THE CAR SHOW

Nicolae Sfetcu

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Cuprins

1 Automobile

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An *automobile* is a wheeled vehicle that carries its own motor. Different types of automobiles include cars, buses, trucks, vans, and motorcycles, with cars being the most popular. The term is derived from Greek 'autos' (self) and Latin 'movére' (move), referring to the fact that it 'moves by itself'. Earlier terms for automobile include 'horseless carriage' and 'motor car'. As of 2005 there are 600 million cars worldwide (0.074 per capita).

The automobile was hailed as an environmental improvement over horses when it was first introduced. Before its introduction, in New York City, over 10,000 tons of manure had to be removed from the streets daily. However, in 2006 the automobile is one of the primary sources of worldwide air pollution and cause of substantial noise and health effects.

History

Main article: **History of the automobile**

The automobile powered by the Otto gasoline engine was invented in Germany by Karl Benz in 1885. Even though Karl Benz is credited with the invention of the modern automobile, several German engineers worked on building automobiles at the same time. These inventors are: Karl Benz, who was granted a patent dated January 29, 1886 in Mannheim for the automobile he built in 1885, Gottlieb Daimler and Wilhelm Maybach in Stuttgart in 1886 (also inventors of the first motor bike), and in 1888/89 German-Austrian inventor Siegfried Marcus in Vienna, although Marcus didn't go beyond the experimental stage.

Automobile history eras

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<tr><td>1890s</td><td>1900s</td><td>1910s</td><td>1920s</td><td>1930s</td><td>1940s</td><td>1950s</td><td>1960s</td><td>1970s</td><td>1980s</td><td>1990s</td><td>2000s</td></tr>
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Steam powered vehicles

Steam-powered self-propelled cars were devised in the late 18th century. The first self-propelled car was built by Nicolas-Joseph Cugnot in 1769, it could attain speeds of up to 6 km/h (3.7 mi/h). In 1771 he designed another steam-driven car, which ran so fast that it rammed into a wall, producing the world's first car accident.

Internal combustion engine powered vehicles

In 1806 Fransois Isaac de Rivaz, a Swiss, designed the first internal combustion engine (sometimes abbreviated "ICE" today). He subsequently used it to develop the world's first vehicle to run on such an engine that used a mixture of hydrogen and oxygen to generate energy. The design was not very successful, as was the case with the British inventor, Samuel Brown, and the American inventor, Samuel Morey, who produced vehicles powered by clumsy internal combustion engines about 1826.

Etienne Lenoir produced the first successful stationary internal combustion engine in 1860, and within a few years, about four hundred were in operation in Paris. About 1863, Lenoir installed his engine in a vehicle. It seems to have been powered by city lighting-gas in bottles, and was said by Lenoir to have "travelled more slowly than a man could walk, with breakdowns being frequent." Lenoir, in his patent of 1860, included the provision of a carburettor, so liquid fuel could be substituted for gas, particularly for mobile purposes in vehicles. Lenoir is said to have tested liquid fuel, such as alcohol, in his stationary engines; but it doesn't appear that he used them in his own vehicle. If he did, he most certainly didn't use gasoline, as this was not well-known and was considered a waste product.

The next innovation occurred in the late 1860s, with Siegfried Marcus, a German working in Vienna, Austria. He developed the idea of using gasoline as a fuel in a two-stroke internal combustion engine. In 1870, using a simple handcart, he built a crude vehicle with no seats, steering, or brakes, but it was remarkable for one reason: it was the world's first internal-combustion-engine-powered vehicle fueled by gasoline. It was tested in Vienna in September of 1870 and put aside. In 1888 or 1889, he built a second automobile, this one with seats, brakes, and steering, and included a four-stroke engine of his own design. That design may have been tested in 1890. Although he held patents for many inventions, he never applied for patents for either design in this category.

The four-stroke engine already had been documented and a patent was applied for in 1862 by the Frenchman Beau de Rochas in a long-winded and rambling pamphlet. He printed about three hundred copies of his pamphlet and they were distributed in Paris, but nothing came of this, with the patent application expiring soon afterward—and the pamphlet disappearing into total obscurity. In fact, its existence mostly was unknown and Beau de Rochas never built a single engine.

Most historians agree that Nikolaus Otto of Germany built the world's first four-stroke engine although his patent was voided. He knew nothing of Beau de Rochas's patent or idea, and came upon the idea entirely on his own. In fact, he began thinking about the concept in 1861, but abandoned the concept until the mid-1870s.

There is some evidence, although not conclusive, that Christian Reithmann, an Austrian living in Germany, had built a four-stroke engine entirely on his own by 1873. Reithmann had been experimenting with internal combustion engines as early as 1852.

In 1883, Edouard Delamare-Deboutteville and Leon Malandin of France installed an internal combustion engine powered by a tank of city gas on a tricycle. As they tested the vehicle, the tank hose came loose, resulting in an explosion. In 1884, Delamare-Deboutteville and Malandin built and patented a second vehicle. This one consisted of two four-stroke, liquid-fueled engines mounted on an old four-wheeled horse cart. The patent, and presumably the vehicle, contained many innovations, some of which wouldn't be used for decades. However, during the vehicle's first test, the frame broke apart, the vehicle literally "shaking itself to pieces," in Malandin's own words. No more vehicles were built by the two men. Their venture went completely unnoticed and their patent unexploited. Knowledge the vehicles and their experiments was obscured until years later.

Supposedly in the late 1870s, an Italian named Murnigotti patented the idea of installing an internal combustion engine on a vehicle, although there is no evidence that one was built. In 1884, Enrico Bernardi, another Italian, installed an internal combustion engine on his son's tricycle. Although merely a toy, it is said to have operated somewhat successfully in one source, but another says the engine's power was too feeble to make the vehicle move.

If all of the above experiments hadn't taken place, however, the development of the automobile wouldn't have been retarded by so much as a moment, since they were unknown experiments that never advanced beyond the testing stage. The internal-combustion-engine automobile really can be said to have begun in Germany with Karl Benz in 1885, and Gottlieb Daimler in 1889, for their vehicles were successful, they went into series-production, and they inspired others.

Karl Benz began to work on new engine patents in 1878. First, he concentrated all his efforts on creating a reliable two-stroke gas engine, based on Nikolaus Otto's design of the four-stroke engine. A patent on the design by Otto had been declared void. Karl Benz finished his engine on New Year's Eve and was granted a patent for it in 1879. Karl Benz built his first three-wheeled automobile in 1885 and it was granted a patent in Mannheim, dated January of 1886. This was—*the first automobile designed and built as such*—rather than a converted carriage, boat, or cart. Among other items Karl Benz invented for the automobile are the carburetor, the speed regulation system known also as an accelerator, ignition using sparks from a battery, the spark plug, the clutch, the gear shift, and the water radiator. He built improved versions in 1886 and 1887 and—went into production in 1888—the world's first automobile put into production. Approximately twenty-five were built before 1893, when his first four-wheeler was introduced. They were powered with four-stroke engines of his own design. Emile Roger of France, already producing Benz engines under license, now added the Benz automobile to his line of products. Because France was more open to the early automobiles, in general, more were built and sold in France through Roger, than Benz sold initially from his own factory in Germany.

Gottlieb Daimler, in 1886, fitted a horse carriage with his four-stroke engine in Stuttgart. In 1889, he built two vehicles from scratch as automobiles, with several innovations. From 1890 to 1895 about thirty vehicles were built by Daimler and his innovative assistant, Wilhelm Maybach, either at the Daimler works or in the Hotel Hermann, where they set up shop after having a falling out with their backers. These two Germans, Benz and Daimler, seem to have been unaware of the early work of each other and worked independently. Daimler died in 1900. During the First World War, Benz suggested a co-operative effort between the companies the two founded, but it was not until 1926 that the companies united under the name of Daimler-Benz with a commitment to remain together under that name until the year 2000.

In 1890, Emile Levassor and Armand Peugeot of France began series-producing vehicles with Daimler engines, and so laid the foundation of the motor industry in France. They were inspired by Daimler's Stahlradwagen of 1889, which was exhibited in Paris in 1889.

The first American automobile with gasoline-powered internal combustion engines supposedly was designed in 1877 by George Baldwin Selden of Rochester, New York, who applied for a patent on an automobile in 1879. Selden didn't build a single automobile until 1905, when he was forced to do so, due to a lawsuit. Selden received his patent and later sued the Ford Motor Company for infringing his patent. Henry Ford was notorious for opposing the American patent system and Selden's case against Ford went all the way to the Supreme Court, which ruled that Ford, and anyone else, was free to build automobiles without paying royalties to Selden, since automobile technology had improved significantly since Selden's patent and no one was building according to his earlier designs.

Meanwhile, notable advances in steam power evolved in Birmingham, England by the Lunar Society. It was here that the term horsepower was first used. It also was in Birmingham that the first British four-wheel petrol-driven automobiles were built in 1895 by Frederick William Lanchester. Lanchester also patented the disc brake in that city. Electric vehicles were produced by a small number of manufacturers.

Innovation

The first automobile patent in the United States was granted to Oliver Evans in 1789 for his "Amphibious Digger". It was a harbor dredge scow designed to be powered by a steam engine and he built wheels to attach to the bow. In 1804 Evans demonstrated his first successful self-propelled vehicle, which not only was the first automobile in the US but was also the first amphibious vehicle, as his steam-powered vehicle was able to travel on wheels on land as he domonstrated once, and via a paddle wheel in the water. It was not successful and eventually was sold as spare parts.

The Benz Motorwagen, built in 1885, was patented on January 29, 1886 by Karl Benz as the first automobile powered by an internal combustion engine. In 1888, a major breakthrough came with the historic drive of Bertha Benz. She drove an automobile that her husband had built for a distance of more than 106 km or fifty miles. This event demonstrated the practical usefulness of the automobile and gained wide publicity, which was the promotion she thought was needed to advance the invention. The Benz vehicle was the first automobile put into production and sold commercially. Bertha Benz's historic drive is celebrated as an annual holiday in Germany with rallies of antique automobiles.

On 5 November 1895, George B. Selden was granted a United States patent for a two-stroke automobile engine (U.S. Patent 549160). This patent did more to hinder than encourage development of autos in the USA. Steam, electric, and gasoline powered autos competed for decades, with gasoline internal combustion engines achieving dominance in the 1910s.

The large-scale, production-line manufacturing of affordable automobiles was debuted by Oldsmobile in 1902, then greatly expanded by Henry Ford in the 1910s. Development of automotive technology was rapid, due in part to the hundreds of small manufacturers competing to gain the world's attention. Key developments included electric ignition and the electric self-starter (both by Charles Kettering, for the Cadillac Motor Company in 1910-1911), independent suspension, and four-wheel brakes.

Model changeover and design change

Cars are not merely continually perfected mechanical contrivances; since the 1920s nearly all have been mass-produced to meet a market, so marketing plans and manufacture to meet them have often dominated automobile design. It was Alfred P. Sloan who established the idea of different makes of cars produced by one firm, so that buyers could "move up" as their fortunes improved. The makes shared parts with one another so that the larger production volume resulted in lower costs for each price range. For example, in the 1950s, Chevrolet shared hood, doors, roof, and windows with Pontiac; the LaSalle of the 1930s, sold by Cadillac, used the cheaper mechanical parts made by the Oldsmobile division.

Alternative fuels and batteries

Main article: **Alternative fuel cars**

With heavy taxes on fuel, particularly in Europe and tightening environmental laws, particularly in California, and the possibility of further restrictions on greenhouse gas emissions, work on alternative power systems for vehicles continues.

Diesel-powered cars can run with little or no modification on 100% pure biodiesel, a fuel that can be made from vegetable oils but require modifications if you drive in cold weather countries. The main plus of Diesel combustion engines is its 50% fuel burn advantage over 23% in the best gasoline engines. This makes Diesel engines capable of achieving an average of 17 kilometers per liter fuel efficiency. Many cars that currently use gasoline can run on ethanol, a fuel made from plant sugars. Most cars that are designed to run on gasoline are capable of running with up to 15% ethanol mixed in. With a small amount of redesign, gasoline-powered vehicles can run on ethanol concentrations as high as 85%. All petrol fuelled cars can run on LPG. There has been some concern that the ethanol-gasoline mixtures prematurely wear down seals and gaskets. Theoretically, the lower energy content of alcohol should lead to considerably reduced efficiency and range when compared with gasoline. However, EPA testing has actually shown only a 20-30% reduction in range. Therefore, if your vehicle is capable of doing 750 kilometers on a 50 liter tank (15 kilometers per liter), its range would be reduced to approximately 600 kilometers (12 kilometers per liter). Of course, certain measures are available to increase this efficiency, such as different camshaft configurations, altering the timing/spark output of the ignition, increasing compression, or simply using a larger fuel tank.

In the United States, alcohol fuel was produced in corn-alcohol stills until Prohibition criminalized the production of alcohol in 1919. Brazil is the only country which produces pure ethanol powered cars, called Flex, since the late 1970s.

Attempts at building viable battery-powered electric vehicles continued throughout the 1990s (notably General Motors with the EV1), but cost, speed and inadequate driving range made them uneconomical. Battery powered cars have primarily used lead-acid batteries and NiMH batteries. Lead-acid batteries' recharge capacity is considerably reduced if they're discharged beyond 75% on a regular basis, making them a less-than-ideal solution. NiMH batteries are a better choice, but are considerably more expensive than lead-acid.

Current research and development is centered on "hybrid" vehicles that use both electric power and internal combustion. The first hybrid vehicle available for sale in the USA was the Honda Insight. As of 2005, The car is still in production and achieves around 25.5 kilometers per liter.

Other R&D efforts in alternative forms of power focus on developing fuel cells, alternative forms of combustion such as GDI and HCCI, and even the stored energy of compressed air .

Accidents seem as old as automobile vehicles themselves. Joseph Cugnot crashed his steam-powered "Fardier" against a wall in 1771. The first recorded automobile fatality was Bridget Driscoll on 1896-08-17 in London and the first in the United States was Henry Bliss on 1899-09-13 in New York City, NY.

Cars have two basic safety problems: They have human drivers who make mistakes, and the wheels lose traction near a half gravity of deceleration. Automated control has been seriously proposed and successfully prototyped. Shoulder-belted passengers could tolerate a 32G emergency stop (reducing the safe intervehicle gap 64-fold) if high-speed roads incorporated a steel rail for emergency braking. Both safety modifications of the roadway are thought to be too expensive by most funding authorities, although these modifications could dramatically increase the number of vehicles that could safely use a high-speed highway.

Early safety research focused on increasing the reliability of brakes and reducing the flammability of fuel systems. For example, modern engine compartments are open at the bottom so that fuel vapors, which are heavier than air, vent to the open air. Brakes are hydraulic so that failures are slow leaks, rather than abrupt cable breaks. Systematic research on crash safety started in 1958 at Ford Motor Company. Since then, most research has focused on absorbing external crash energy with crushable panels and reducing the motion of human bodies in the passenger compartment.

There are standard tests for safety in new automobiles, like the EuroNCAP and the US NCAP tests. There are also tests run by organizations such as IIHS and backed by the insurance industry.

Despite technological advances, there is still significant loss of life from car accidents: About 40,000 people die every year in the U.S., with similar figures in Europe. This figure increases annually in step with rising population and increasing travel if no measures are taken, but the rate per capita and per mile travelled decreases steadily. The death toll is expected to nearly double worldwide by 2020. A much higher number of accidents result in injury or permanent disability. The highest accident figures are reported in China and India. The European Union has a rigid program to cut the death toll in the EU in half by 2010 and member states have started implementing measures.

Current Production

In 2005 63 million cars and light trucks were produced worldwide. The world's biggest car producer (including light trucks) is the European Union with 29% of the world's production. In non-EU Eastern Europe another 4% are produced. The second largest manufacturer is NAFTA with 25.8%, followed by Japan with 16.7%, China with 8.1%, MERCOSUR with 3.9%, India with 2.4% and the rest of the world with 10.1%. (vda-link)

Large free trade areas like EU, NAFTA and MERCOSUR attract manufacturers worldwide to produce their products within them and without currency risks or customs, additionally to being close to customers. Thus the production figures do not show the technological ability or business skill of the areas. In fact much if not most of the Third World car production is used western technology and car models (and sometimes even complete obsolete western factories shipped to the country), which is reflected in the patent statistic as well as the locations of the r&d centers.

The automobile industry is dominated by relatively few large corporations (not to be confused with the much more numerous brands), the biggest of which (by numbers of produced cars) are currently General Motors, Toyota and Ford Motor Company. It is expected, that Toyota will reach the No.1 position in 2006. The most profitable per-unit car-maker of recent years has been Porsche due to its premium price tag.

The automotive industry at large still suffers from high under-utilization of its manufacturing potential.

Future of the car

In order to limit deaths, there has been a push for self-driving automobiles. There have been many notable efforts funded by the NHTSA, including the many efforts by the NavLab group at Carnegie Mellon University. Recent efforts include the highly publicized DARPA Grand Challenge race.

A current invention is ESP by Bosch that is claimed to reduce deaths by about 30% and is recommended by many lawmakers and carmakers to be a standard feature in all cars sold in the EU. ESP recognizes dangerous situations and corrects the drivers input for a short moment to stabilize the car.

The biggest threat to automobiles is the declining supply of oil, which does not completely stop car usage but makes it significantly more expensive. Beginning of 2006 1 liter of gas costs approx. 1.6 US$ in Germany and other European countries. If no cheap solution can be found in the relatively near future individual mobility might suffer a major setback. Nevertheless, individual mobility is highly prized in modern societies so the demand for automobiles is inelastic. Alternative individual modes of transport, such as Personal rapid transit, could make the automobile obsolete if they prove to be cheaper and more energy efficient.

Hydrogen cars, driven either by a combination of fuel cells and an electric motor, or alternatively, a conventional combustion engine, are thought to replace fossil fuel powered cars in a few decades. The biggest obstacle for a mass market of hydrogen cars is the cost of hydrogen production by electrolysis, which is inefficient and requires a comparatively expensive source of electrical energy. However Hydrogen produces 5 times as much energy than 93 octane gasoline and promises to be cheaper with mass production and none CO_2, but steam H_2O emissions as result of the combustion. BMW's engineering team promises a high horsepower hydrogen fuel engine in it's 7-series sedan before the next generation of the car makes it's debut.

The electric car in general appears to be a way forward in principle; electric motors are far more efficient than internal combustion engines and have a much greater power to weight ratio. They also operate efficiently across the full speed range of the vehicle and develop a lot of torque at zero speed, so are ideal for cars. A complex drivetrain and transmission would not be needed. However, despite this the electric car is held back by battery technology - so far a cell with comparable energy density to a tank of liquid fuel is a long way off, and there is no infrastructure in place to support it. A more practical approach may be to use a smaller internal combustion engine to drive a generator- this approach can be much more efficient since the IC engine can be run at a single speed, use cheaper fuel such as diesel, and drop the heavy, power wasting drivetrain. Such an approach has worked very well for railway locomotives, but so far has not been scaled down for car use.

Recently the automobile industry has determined that the biggest potential growth market (in terms of both revenue and profit), is software. Cars are now equipped with a stunning array of software; from voice recognition and vehicle navigation systems to in-vehicle distributed entertainment systems (DVD/Games), to telematics systems such as GMs Onstar not to mention the control subsystems. Software now accounts for 35% of a cars value, and this percentage is only going to get larger. The theory behind this is that the mechanical systems of automobiles are now essentially a commodity, and the real product differentiation occurs in the software systems. Many cars are equipped with full blown 32bit real-time memory protected operating systems such as QNX.

- engine
  - carburetor or fuel injection

fuel pump
engine configuration: Wankel or reciprocating (V, inline, flat).
engine management systems
exhaust system
ignition system
self starter
emissions control devices
turbochargers and superchargers
front engine
rear engine
mid engine

Automobile ancillary power

- Ancillary power — mechanical, electrical, hydraulic, vacuum, air
- drivetrain
  - transmission (gearbox)
    - manual transmission

semi-automatic transmission
fully-automatic transmission

  - Layout
    - FF layout

FR layout
MR layout
MF layout
RR layout

  - Drive Wheels

- Two-wheel drive

Four-wheel drive
Front-wheel drive
Rear-wheel drive
All-wheel drive

- differential
    - limited slip differential

locking differential

- axle

Live axle

- brakes
    - disc brakes

drum brakes
anti-lock braking systems (ABS)

- wheels and tires
    - custom wheels
- steering
    - rack and pinion

Ackermann steering geometry
Caster angle
Camber angle
Kingpin

- suspension
    - MacPherson strut

wishbone
double wishbone
multi-link
torsion beam
semi-trailing arm
axle

- body
    - crumple zones

monocoque (or unibody) construction
doors
headlight styling
spoiler
Japan Black (fore-runner of modern automotive finishes)

- interior equipment
    - passive safety
        - seat belts

airbags
child safety locks

- dashboard

shifter for selecting gear ratios

ancillary equipment such as stereos, air conditioning, cruise control, car phones, positioning systems, cup holders, etc.

- exterior equipment
    - windows
        - Power window

windshield
Daytime running lamps

Automobile platforms

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An *automobile platform* is a shared set of components common to a number of different automobiles. Many vendors refer to this as a *vehicle architecture*. Originally, a platform was a literally shared chassis from a previously-engineered vehicle, as in the case for the Volkswagen Beetle frame under the Volkswagen Karmann Ghia. The first generic platform to be shared among a number of vehicles was the Ford Fox platform of the 1970s. In the 1980s, Chrysler's K-cars all wore a badge with the letter, "K", to indicate their shared platform.

Today, platform sharing is much less noticeable. Vehicle architectures consist of "under the skin" components only, and shared platforms can show up in unusual places like the Nissan FM platform-mates Nissan 350Z sports car and Infiniti FX SUV. Volkswagen A platform-mates like the Audi TT and Volkswagen Golf also share much of their mechanical components but seem entirely different. Ford Motor Company has had much success building many well differentiated vehicles from many marques off the same platforms.

Automobiles

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Here is a structured list of automobiles:

Drivetrain

- List of car companies that do not make FWD models

Military

- List of vehicle models used in the military

Slangs

- List of slang terms for automobiles
- List of slang terms for police vehicles

Uncategorized

- List of 6-passenger sedans
- List of automobile manufacturers
- List of automobile model and marque oddities
- List of automobile model nameplates with a discontiguous timeline
- List of automotive superlatives
- List of bestselling vehicle nameplates
- List of cars
- List of famous automobiles
- List of fictional vehicles
- List of international Formula One colors
- List of supercars
- List of unrelated vehicles with identical nameplates

See also

- List of songs about automobiles

Car companies that do not make FWD models

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Here is a list of car companies whose lineup does not contain any front wheel drive models:

Excluded from list is:

- Companies that make vehicles in classes that are clearly expected to be RWD (e.g. trucks, construction equipment, etc.); however, sports cars expected to be RWD are an exception to the exclusion rule.

Aston Martin
BMW
Rolls-Royce
Bentley
Porsche
American Motors Corporation (defunct); however, it's replacement spinoff Eagle made some FWD models.
Ferrari
Lamborghini
Packard
Panoz
Maybach
Jeep (2007 Compass will be available with FWD)
Hummer
Land Rover

Though vehicles by Jeep, Land Rover and Hummer are technically trucks, any sport utility vehicle with a fully enclosed cargo bed and multiple rows of seating are titled as automobiles (or station wagons) in many countries. None of these manufacturers/divisions produces a front-drive vehicle.

Vehicle models used in the military

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Here is a list of vehicle nameplates used in the military environment:

Great Britain

- Land Rover

USA and Canada

- Chevrolet Blazer
- General Motors C/K Trucks
- Humvee

Slang terms for automobiles

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Here is a list of slang terms for automobiles:

Generic

- Auto
- Hooptie
- Car
- Economy car
- Horseless carriage
- Motorized carriage
- Luxury car
- Passenger car
- Beater (used to describe a car in particularly bad condition)
- Shit-box
- Bomber
- Pig

Pop culture terms:

- Whip
- Ride
- Wheels

Coupe

- 2-door (car)
- Convertible
- Coupe de Ville
- Sports car

Sedan

- 4-door (car)
- Family car
- Luxury sedan
- Saloon

Limousine

- Limo
- Long luxury car
- Luxury bus
- Prom bus
- Stretch (Limo)

- Wedding carriage

RV

- Camping bus
- Camping truck
- Conversion van
- Motorhome
- Pickup truck camper shell
- Winnebago
- Campervan (EN-GB)

SUV/Station wagon

- 4X4
- 4WD
- Hatchback
- Hatchback coupe
- Hatchback sedan
- Hatchback wagon
- Jeep
- Jungle cruiser
- Rock climber
- Soccer Mover
- Sport Utility Vehicle
- Sport Utility Truck
- Sports Utility Van (SUVan) cars such as the Dodge Durango that are technically Sports Utility Vehicles but are very big so they are called SUVans
- Shaggin' Wagon (also refers to vans)

Semi-truck

The whole thing

- 18-wheeler
- Big rig
- Freight hauler
- Fat boy
- Semi-Trailer
- Articulated Lorry
- Artic (EN-GB)

Tractor

- Bobtail
- Bull
- Loud horn
- Prime Mover

Trailer

- Cargo unit
- Freight unit
- Chassis Tail (Tractor unit and empty trailer, term notably used in connection with containerisation)

Taxicab

- Cab
- Checker cab
- Taxi
- Medallion
- Hack

Truck

- Pickup truck (Texas Cadillac)
- Sport Utility Truck
- Utility vehicle

Van

- Cargo van
- Conversion van
- Family van
- Family wagon
- Full-size van
- Minivan
- Passenger van
- Sports Utility Van (SUVan) cars such as the Dodge Durango that are technically Sports Utility Vehicles but are very big so they are called SUVans

See also

- List of slang terms for police vehicles

- Lists of automobiles for a structured list

Hooptie

Home | Up | Hooptie | Luxury vehicles | Coupe | Sedan | Sport utility vehicle | Station wagon | Hatchback | Semi-trailer | Taxicab

A *hooptie* is typically a large car popular with the "gangsta" and hip-hop culture. The cars are usually old 1970s or 1980s model cars outfitted with hydraulics or other "gangsta" apparel (Houston rapper Paul Wall refers to these vehicles as slabs - usually Cadillacs).

More recently, hoopties have moved along with the spinner (wheel) fad. Hoopties are popular in movies that seriously portray life in the ghetto and movies that poke fun at various people of other races acting as if they were blacks in the ghetto.

Usually, Buick Electras were common as entry-level hoopties (in response to Sir Mix-A-Lot's 1990 hit "My Hooptie"); usual hoopties include beaters covered with house paint or rust buckets.

Hoopties have several meanings in Los Angeles, Miami, Houston, and New York City. For example, the Miami scene emphasizes on 1971-76 Chevrolet Impalas, while in Houston, the 'slabs' refer to any pre-1980 General Motors luxury car regardless of the division. In the Houston Metro area, hoopties with the elbow rims (common to 1983 and 1984 Cadillacs) are a rare find.

The term may be related to a much earlier usage (1930's-1940's) for an old or beat-up car, "hoopie" or "hoopy", in the Southwest and California.

Semi-trailer

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A semi-trailer is a trailer without a front axle. A large proportion of its weight is supported either by a tractor or by a detachable front axle assembly known as a dolly. A semi-trailer is normally equipped with legs which can be lowered to support it when it is uncoupled.

A *semi-trailer truck* or *tractor-trailer* (colloquially known as an *18-wheeler*, *semi*, or *big-rig* in the US, as a *semi* in Australia, US, and Canada, and as an *articulated lorry*, *artic*, or *truck and trailer* in the UK, Ireland, and New Zealand) is an articulated truck or lorry consisting of a towing engine (tractor in the US, prime mover in Australia, "truck" in the UK and New Zealand), and a trailer that carries the freight. In the UK, the term *juggernaut* is sometimes used for especially large articulated lorries.

Regional Configurations

United States

In United States, semi tractors usually have 3 axles, the front, or "steer" axle having two wheels, and each of the two rear "drive" axles having a pair of "dual" (double) wheels on each side. Thus, the most common configuration of tractor has 10 wheels. The cargo trailer usually has two "tandem" axles at the rear, each of which has dual wheels, or 8 wheels on the trailer.

Although dual wheels are most common, use of a single, wider tire on each axle is becoming popular, particularly among bulk cargo carriers and other weight-sensitive operators. The advantages of this configuration are two: the lighter weight allows a truck to be loaded with more weight, and the single wheel covers less of the brake unit, which allows faster cooling. The biggest disadvantage is that when a tire becomes deflated or destroyed, it is not possible to drive the vehicle to a service location without risking damage to the rim, as it is with dual wheels.

However, the United States also allows 2-axle tractors to tow two 1-axle 28-foot (8.5 m) semi-trailers known colloquially as *doubles*, *a set*, or *a set of joints*.Some states, especially on the East Coast, allow for two 40-48-foot trailers known as *turnpike doubles*. Some states also allow towing up to three 28-foot trailers known colloquially as *triples* or *road trains*. A 2-axle full-sized semi-trailer pulling a 28-foot "pup" trailer known as a *Rocky Mountain Double* is also permitted in some regions. Very few states allow two full-sized semi trailers which are similar to the Australian road trains. Reasons for limiting the legal trailer configurations include both safety concerns and the impracticality of designing and constructing roads that can accommodate the larger wheelbase of these vehicles and the larger minimum turning radii associated with them.

Overall lengths range from 50 to 70 ft (15 to 25 m) in the U.S., and most U.S. states limit the overall weight to 80,000 lb (36 tonnes) The long-haul towing engines used in interstate travel are often equipped with a "sleeper" behind the driver's cab, which can be anything from a small bunk to a rather elaborate miniature apartment.

Europe in general

In continental Europe, most semi tractors have 2 axles, again with the front, steer, having two wheels, and rear, drive, having twin wheels on each side. Thus, the most common configuration has 6 wheels. The cargo trailer usually has three axles at the rear, with single wheels, or 6 wheels in total. The entire vehicle thus usually has 5 axles and 12 wheels in total, although the trailers can vary in number of wheels.

In the UK, both tractor and semi-trailers must have 3 or more axles each, to carry the maximum permitted gross weight of 44 tonnes. [1] No heavier vehicles are permitted on the UK road network, except for indivisible loads which would be classed as abnormal (or oversize).

The noticeable difference between trucks in the US and Europe is that most European models are cabovers (or *forward control*), while most US trucks are *conventional* (or *normal control*). In European design, the driver's cab is normally positioned above the engine. For repairs, the entire cab hinges forward to allow maintenance access. European trucks, whether small or fully articulated, have a sheer face on the front. This allows greater manoeuvrability, as the driver need only gauge distances behind his seating point, and this allows for shorter trucks with longer trailers (with larger freight capacity) within the legal maximum total length. In Europe the entire length of the vehicle is measured as total length, while in US the cabin of the truck is normally not part of the measurement.

Sweden and Finland

In Sweden the allowed length is 24 meters for all vehicles and 25.25 meters for trucks with two trailers. In 1997 the rules were changed, under pressure from the EU, allowing trucks to pull two trailers with a total length of 25.25 meters, assuming certain conditions were met, like ABS on all vehicles. In Finland most trucks can tow trailer as long as total length stays within 25.25 meters. The exception to this is a tractor unit pulling semi-trailer, which can be only 16.5 meters long. The allowed gross weight in both countries is up to 60 metric tons depending on the distance between the first and last axle. In Sweden the old style tractor-trailer is still the most common, but in some areas, especially container haulage, 25.25 meter vehicles are available. In Finland most new trucks and trailers are built with 25.25 meter in mind.

Using a dolly, which has to be equipped with lights and a license plate, rigid trucks can be used to pull semitrailers. The dolly is equipped with fifth wheel to which the trailer is coupled. The dolly and trailer together act like a regular trailer, so driving it and backing up is usually no different.

The truck-trailer configuration is almost the only style used on timber trucks. There are at least two big advantages with this, one is the weight of the load on the drive wheels, and two, that the crane used to lift the logs from the ground can be mounted on the rear of the truck behind the load, instead of behind the cab which would make it difficult to reach to the end of the trailer.

Australia

Australia road transport has a reputation of using very large trucks (road trains). This is reflected in the most popular configurations of trucks generally having axles in groupings of 3 rather than 2, with either 4 or 6 tires on each axle. This means that Australian semi-trailers will often have 26 or even 32 wheels which is generally more than their counterparts in other countries. In total, the maximum length that any articulated vehicle may be is 53.5 metres, its maximum load may be up to 115.5 tonnes gross and may have up to 4 trailers. However heavy restrictions apply to the areas where such a vehicle may travel in many of the more densely populated states. In less remote areas a truck is generally limited to two trailers to 26 metres long and in urban areas this length limit is further reduced to 19 metres. 25 metre, 62 tonne B-doubles are very common in all parts of Australia including state capitals and on certain roads actually outnumber single trailer configurations, however these vehicles typically travel at night and by law stay on main roads so are not encountered as often by passenger vehicle drivers. In remote areas such as the Northern Territory great care must be taken when sharing the road with longer articulated vehicles that often travel during the day time, especially 4 trailer road trains.

In Australia, both conventional tractors and cabovers are common, however cabovers are most often seen on B-Doubles on the south east coast where the reduction in total length allows the vehicle to pull longer trailers and thus more cargo than it would otherwise.

Construction

The cargo trailer is hooked to a horseshoe-shaped coupling device called a fifth wheel at the rear of the towing engine that allows easy hook up and release. The trailer cannot move by itself because it only has wheels at the rear end, hence the name *semi-trailer*: it only carries half its own weight. The vehicle has a tendency to fold at the pivot point between the semi and the trailer when braking hard at high speeds. Such a truck accident is called a jack-knife, or jack-knifing.

Semi trucks use air pressure, rather than hydraulic fluid, to actuate the brakes. This allows for ease of coupling and uncoupling of trailers from the tractor unit, as well as reducing the potential for problems common to hydraulic systems, such as leakage or "brake-fade" caused when overheated brake fluid vaporizes in the hydraulic lines. (Brake fade may also occur when the lining of the braking unit becomes severely overheated. This has no connection to the fluid lines.)

The "parking brake" of the tractor unit and the "emergency brake" of the trailer are applied when air pressure is released, and disengaged when air pressure is supplied. This is an emergency feature which ensures that if air pressure to either unit is lost, that unit will not lose all braking capacity and become uncontrollable.

The trailer controls are coupled to the tractor through two "glad-hand" connectors, which provide air pressure, and an electrical cable, which provides power to the lights and any specialized features of the trailer.

"Glad-hand" connectors (also known as "palm couplings") are air couplers, each of which has a flat engaging face and retaining tabs. The faces are placed together, and the units are rotated so that the tabs engage each other to hold the connectors together. This arrangement provides a secure connection, but allows the couplers to break away without damaging the equipment when they are pulled, as may happen when the tractor and trailer are separated without first uncoupling the air lines.

Two air lines control the trailer unit. An "emergency" or main air supply line pressurizes the trailer's air tank and disengages the emergency brake, and a second "service" line controls the brake application.

Another braking feature of semi-trucks is the *engine brake*, or "Jacobs brake". This feature uses the engine to slow the vehicle, which allows trucks to travel down long grades without overheating their wheel brakes. Owing to noise concerns, some locales have prohibited or restricted the use of engine brake systems inside their jurisdictions

Because of the wide variety of loads the semi may carry, they usually have a manual transmission to allow the driver to have as much control as possible.

In most countries a trailer or semi-trailer must have minimum

- 2 rear lights (red)
- 2 stop lights (red)

- 2 turning lights; one for right and one for left, flashing (yellow, orange or red)
- 2 marking lights behind if wider than certain specifications (red)
- 2 marking lights front if wider than the truck or wider than certain specifications (white)

Drivers license

A special driver's license is required to operate a semi-trailer in most countries. This license in the US would be called a (State you are applying in..)CDL -- Class A is needed for gross weight being more than 26,500 lbs. Class B if between 15,000 and 26,499 and Endorsements like HazMat (Gasoline, Oxygen)Double, Triple Trailers (must pass driving test with trailers..)

Road trains

In Australia, semi-trailers with more than one trailer are known as road trains. In certain areas "B-doubles" are permitted. These include a modified trailer with a turntable at the rear to allow a second trailer to be tightly coupled to the rig without the extra cost and handling problems of a dolly.

On some interstate highways in the US, long-haul semi-trailer trucks can tow another full trailer at the end, which makes the vehicle look like a two-car small train. Some of the second cars are full trailers with wheels on both ends, while others are just regular semi-trailer cars hooked to the standard coupling device on another set of wheels in tow (known as a dolly). Some states further allow a third trailer to be added to the vehicle, against the objections of some car drivers who must share the highways with these longer trucks.

Role in Industry

Modern day semi-trailer trucks often operate as a part of an international transport infrastructure to support containerized cargo shipment. Some flat bed train cars are modified to hold the cargo trailer with wheels and all. This is called "piggy-back". The system allows the cargo to switch from the highway to railway or vice versa with ease.

The large trailers pulled by a semi come in many styles, lengths, and shapes. Some common types are: vans, reefers, flatbeds, containerlifts and tankers. These trailers may be refrigerated, heated, ventilated, or pressurized, depending on climate and cargo. Some trailers have movable wheel axles that can be adjusted by moving them on a track underneath the trailer body and securing them in place with large pins. The purpose of this is to help adjust weight distribution over the various axles, to comply with local laws.

Television

The best known semi-trailer appearance in television is in the 1980s hit cartoon The Transformers as the great Autobots leader Optimus Prime (Convoy in Japan.

Taxicab

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A *taxicab* (sometimes called *taxi*, *cab*, or *hack*) is a vehicle for hire which conveys passengers between locations of their choice. (In most other modes of public transport, the pick-up and drop-off locations are determined by the service provider, not by the passenger, and are usually less expensive than hiring a taxicab.) Although types of vehicles and methods of regulation, hiring, dispatching, and negotiating payment differ significantly from country to country, some common characteristics exist.

History and etymology

Horse-drawn for-hire hackney carriage services began operating in both Paris and London in the early 17th century. Royal proclamations in both cities regulated the number of carriages--the first example of taxicab regulation. In the 19th century, Hansom cabs largely replaced the older designs because of their improved speed and safety.

Although battery-powered vehicles enjoyed a brief success in Paris, London, and New York in the 1890s, the 1891 invention by German Wilhelm Bruhn of the taximeter (the familiar mechanical and now often electronic device that calculates the fare in most taxis) ushered in the modern taxi. (The "taxi" in "taximeter" is related to the word "tax," or "rate.") The first modern meter-equipped taxi was the Daimler Victoria, built by Gottlieb Daimler in 1897; the first motorized taxi company began operating in Stuttgart the same year.

Petrol powered taxis began operating in Paris in 1899, in London in 1903, and in New York in 1907. The New York taxis were imported from France by businessperson Harry N. Allen, who adapted the French word taxi-mètre and coined the word "taxicab" to describe the vehicles he was importing. In time, the shortened term "taxi" came into common usage. (Allen was also the first person to paint his taxis yellow, after learning that yellow is the colour most easily seen from a distance.)

Taxis proliferated around the world in the early 20th century. The first major innovation after the invention of the taximeter occurred in the late 1940s, when two-way radios first appeared in taxicabs. Radios enabled taxis and dispatch offices to communicate and serve customers more efficiently than previous methods, such as using callboxes. The next major innovation occurred in the 1980s, when computer assisted dispatching was first introduced.

There has generally been a legal struggle concerning the certification of motor vehicles to be taxis, which take much more wear than a private car does. In Britain, they were additionally required to meet stringent specifications, for example, as concerns turn radius, which resulted for a time in having only one make legally usable. In the US, in the 1930s the cabs were often DeSotos or Packards. General Motors offered a specialized vehicle for a time, named the General. The firm Checker came into existence then, and went out of business in the 1970s. Its cars were specially built to carry "double dates." But now New York City requires that all taxicabs be ordinary cars. They are usually large Fords. In the 1960s in

Europe, Mercedes Benz and Peugeot offered diesel taxicabs. This form of engine is now quite common there.

(Sources:** BBC America: Ask a Cabby**;** The New York City Taxicab Fact Book (2003), p. 22**;** Today in Science History**).

Vehicles

Taxi service is typically provided by automobiles, but various human powered vehicles (such as the rickshaw) and animal powered vehicles (such as the Hansom cab) or even boats (such as water taxis or gondolas) are also used or have been used historically. In Western Europe it is not uncommon for expensive cars such as Mercedes-Benz to be the taxi of choice. Often this decision is based upon the perceived reliability of, and warranty offered with these vehicles. These taxi-service vehicles are often equipped with four-cylinder turbo-diesel engines and low levels of equipment, and are not considered luxury cars. (This often surprises Americans, who are used to seeing only the upmarket trims and associate Mercedes-Benz cars with luxury.)

Taxis in less developed places can be a completely different experience, such as the ancient French cars typically found in Cairo, however starting March, 2006 new yellow modern taxi entered the service operated by various private companies. Taxis differ in other ways as well: London's black cabs have a large compartment beside the driver for storing bags, while many fleets of regular taxis also include wheelchair accessible taxis among their numbers (see below). Although taxis have traditionally been sedans, minivan and even SUV taxis are becoming increasingly common. In many cities, limousines operate as well, usually in competition with taxis and at higher fares.

See also

- Cabriolet

Slang terms for police vehicles

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Here is a list of slang terms for law enforcement vehicles and other emergency vehicles:

Generic

- Black and white
- Boxer shorts (in greek slang) because there are always 2 testicles inside
- Bubblegum Machine
- Cherry top
- Civic Cruiser (coined in the game Need for Speed: Most Wanted)
- Cop car

    - Cruiser
    - Donut Cruiser
    - Emergency vehicle
    - Five-O
    - Fuzzmobile
    - Ghost car (unmarked police car)
- Jam sandwich
    - One time
- Panda car
    - Patrol car
    - Pigmobile
    - Po
    - PoPo (shortened form of *P*issed-*O*ff *P*olice *O*fficer)
    - Polar Bear (Coined in the movie "Smokey and the Bandit" refers to CHP)
    - Police cruiser
    - Police car
    - Police interceptor
    - Police vehicle
    - RMP
    - Rollers
    - Slick top
    - Squad car
    - Twelve

Ambulance

- Box
- Bus
- Meat Wagon (US)
- Medical transport unit
- Paramedic station wagon
- Paramedic truck
- Paramedic van (vanbulance)
- Rig
- White car (Hong Kong)

Police bicycle

- Police bike
- Police motorcycle
- Bike Gods
- Bacon on a bicycle

Police SUV

- K-9 unit
- Police Emergency Wagon
- Police 4X4
- Rural police car
- Rhino (coined in the game Need for Speed: Most Wanted)

Police van

- Paddywagon
- Prison bus
- Divvie van (short for Divisional van)
- Meat Wagon (UK)
- Pig-pen vehicle (Hong Kong)

SWAT van

- Black Maria
- SWAT bus
- SWAT truck

Jam sandwich

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In British slang, a *jam sandwich* (or 'jam butty') is a police traffic or fast response car (as opposed to an ordinary panda car or patrol car).

The term came into common use in the 1970s, when such cars changed from the traditional blue and white colour scheme to white with a broad fluorescent orange stripe along the side. This colour scheme is reminiscent of jam sandwiched between two slices of white bread, hence the name. The slang was popularised on such TV shows as The Sweeney and Minder, as well as spreading through the use of CB radio. It is still in common use, although most forces now use different colour schemes with fluorescent stripes and panels of various colours.

It can also have its literal meaning of a sandwich with jam in it.

See also

- Panda car

Panda car

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A *panda car* is a small or medium-sized police car operated by British police forces. They are used for ordinary patrol work, with larger and more powerful vehicles being used for emergency response, traffic patrol and special services.

Description

Panda cars were named after pandas because they were originally painted in large panels of black and white, or blue (usually light blue) and white. This may have been influenced by the black-and-white vehicle colour scheme favoured by North American police forces, which allowed the unambiguous recognition of patrol units as such from a significant distance. In the 1980s police cars in the U.K. began to be painted predominantly white to save acquisition costs, usually with reflective red or yellow stripes. The Dunbartonshire force found an enterprising way round this, however, buying two Hillman Imps (subsequently nicknamed 'Pinky and Perky'); one blue and one white. The boot lids, bonnets and doors were then swapped to create a panda car style scheme. Today, patrol cars are painted in a variety of different colours, often with multicoloured panels or stripes, although many forces still use a mainly white colour scheme. The name panda car or panda is still often used, however.

History

In many areas the panda car replaced the traditional "bobby on the beat" when it was seen that larger suburban or rural areas could be more effectively patrolled by officers in cars, as opposed to on foot, bicycles or motorcycles. The provision of shelter from the notoriously unpredictable British weather and a two-way radio were also benefits.

The panda is distinct from the "area car", a larger and more powerful vehicle which acts as support to the beat constables, usually carrying two officers.

Models of car used

Many models of panda car have been or are used by British police forces. Among the most popular are:

Austin Maestro
Austin/Rover Metro
Ford Escort
Ford Fiesta
Ford Focus
Hillman Imp
Mini
Morris Traveller

Vauxhall Astra
Vauxhall Vectra

See also

- Jam sandwich

Ambulance

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An *ambulance* is a vehicle designated for the transport of sick or injured people. The first ambulances called by that name were horse ambulances used in the American Civil War. The first practical ambulances were created by Dominique Jean Larrey, a French surgeon (1766–1842), for use in the Napoleonic Wars. Modern-day ambulances are typically large automobiles on a van or light truck chassis.

However, an ambulance can be any vehicle, including a bus, helicopter, or even a hospital ship. During the 1960s and 1970s, station wagons were used in some American cities (despite their limited space) and can be seen in motion pictures from that period.

In some countries civilian ambulances may use the symbol referred to as the "Star of Life," a blue six point star, originally designed and governed by the U.S. National Highway Traffic Safety Administration (NHTSA). Any unit displaying this star is said to be qualified to render its specific level of emergency care.

Under the laws of war, an ambulance marked by a red cross is not to be fired on and is to be permitted to carry out its duties in spite of the fighting. An ambulance may not mount weapons, although the Israeli EMS has produced a "tankbulance" that combines a Merkava main battle tank with ambulance features (see below).

Ambulances in North America

Ambulance types

Ambulances in both the United States and Canada are defined by KKK-1822E requirements which defines several categories of ambulances.

- Type I Ambulances are based on the chassis-cabs of light duty pickup-trucks,
- Type II Ambulances are based in modern passenger/cargo vans,
- Type III Ambulances are based on chassis-cabs of light duty vans,
- Extreme Duty versions of both Type I and Type III are also now authorized based on the chassis-cabs of medium duty truck chassis.

Note that Type I's and Type III's are often called boxes by their crews with Type II's being called vanbulances; ambulances are also referred to as buses (which some EMTs and paramedics consider to be derogatory), mods or modulars (if type I or III), rigs etc.

- There are also fly-cars, which are large cars or SUVs. These units cannot provide patient transport, but are used variously by supervisors or as a source of additional personnel.
- A new and emerging industry, specifically in the Province of Ontario, is non-emergency patient transfers. Many companies who specialize in these transfers are creating their own vehicles with ambulance type equipment, but without emergency lights and sirens. One example is from Voyageur Transportation, based on the Dodge Sprinter Cargo Chassis. Aboutown Medical Transfer, has several varieties based on GMC/Chevy passenger chassis.

Ambulance Providers

Ambulance service providers come in several types in the USA:

1. Volunteer Ambulance Corps (VAC) or services - function similar to Volunteer Fire Companies. St. John Ambulance is the most common, providing world-wide service in locations ranging from New York City **Sorry, this is incorrect. There is a hospital in Elmhurst, Queens, NYC, called SVCMC St. John's Queens Hospital, which has an ambulance department which provides several units to the NYC 911 EMS system, however it has no relation to the UK's St. John Ambulance organization.** to small rural communites, but many VACs are independent corporations. VACs may be community owned or privately owned, but are typically organised as non-profit organizations. VACs may also be part of Volunteer Fire Companies; in some of these cases, EMTs and drivers are also firefighters. Up until recently, Harbor City Volunteer Ambulance Squad (HCVAS) in Melbourne, Florida was the largest volunteer ambulance squad in the United States.
2. Private Ambulance Service - Normal commercial companies with paid employees, of which the largest is AMR (American Medical Response). While many private companies provide inter-facility patient transfer, many communities' 911 needs are served by private services.
3. Municipal Third Service - Operate as a third service alongside fire and police departments. These are more likely to be found in areas with a high population density, such as a city or metropolitan area.
4. Municipal - Usually fire department owned and operated, though some systems are police department owned and operated.
5. Combined - these are full service emergency service agencies such as airport and college public safety offices. Some smaller towns and cities may also have them. Generally all personnel are crosstrained as EMT's/Firefighter/peace officer.
6. Hospital Based - Ambulance service such as ALS, BLS and CCT are offered by profit and non profit hospitals as a service to the community. Often these services do not support themselves and are funded by the hospital. Such as Enloe Medical Center out of Chico, Ca.

Ambulances in France

In France, the most general term is "vehicle adapted to patient transport", the term "ambulance" only applies for some categories of patient transport vehicles.

The word "ambulance" is reserved to transportation on medical prescription, including oral prescription in case of emergency. It does not apply to first responders vehicles (most of times firefighters), although they also transport casualties; their vehicles are called VSAV–véhicule de secours et d'assistance aux victimes (rescue and assistance to casualties vehicle), or VPS–véhicules de premiers secours (first responders vehicles) in case of volunteers from associations. The VSAV and VPS are considered as vectors that bring rescue workers and devices onsite, the evacuation being only the logical following of this intervention but not their main duty.

There are therefore two kinds of ambulance providers: hospitals and private companies.

The reglementation classifies the patient transport vehicles in four types:

- A-type : ambulance for rescue and emergency care (ambulance de secours et de soins d'urgence–Assu) : in these ambulances, the personnel can stand; only these vehicles can be used for emergency (sanitary duty and H-MICU, see below) ;
- B-type : rescue and assistance to casualty vehicles (VSAV), i.e. first responders vehicles, very close to the A-type ;
- C-type : ambulance : the personnel cannot stand, it only allows the transport of a lying patient and of a sitting ambulance technician besides ; due to the lack of room, cares cannot be performed during the transport (these vehicles tend to disappear) ;
- D -type: light vehicle (véhicule sanitaire léger–VSL) : normal car without any specific equipment, for patient who can sit.

The A, B and C-types are called "specially equipped" vehicles, and must follow the NF EN 1789 standard (December 1999).

First responders vehicles

A VSAV has three professional[1] CFR onboard, a VPS has five volunteer CFR.

The first responders of the VSAV and VPS are called secouristes and have 60 hours of initial education (plus additional continuous education) and perform non-medical, non-invasive acts. They use splints (including cervical collars, long spine boards and vacuum mattresses), oxygen first aid, and make the casualty lifting.

Note

1. some firefighters are not full-time professionals; they are called "pompiers volontaires", but they are paid for their work, whereas the volunteers from CFR associations (secouristes bénévoles) are not paid.

Hospital ambulances

There are two kind of hospital ambulances:

- internal ambulances, which drive the patients from a building to the other; these are sometimes simple vehicles without any medical equipment when the transport do not require any care (these are always very short transportations).

- the UMH–unité mobile hospitalière (H-MICU–hospital medical intensive care unit) from the SMURr–service mobile d'urgence et de réanimation (mobile emergency resuscitation service) : an ambulance with an MD, a nurse and an ambulance technician that do pre-hospital intervention and interhospital transportation under intensive care.

The H-MICU is often a light rapid-intervention vehicle, i.e. a car carrying the personnel and the material to the casualty; the transport itself is made with a VSAV or a private ambulance equipped with the medical unit.

Special warning devices and traffic law

The H-MICU (A-type) and VSAV (B-type) have a blue rotating light and a two-tones siren (high-low-high-low-high-low...). When these special warning devices are on and when the emergency of the mission justifies it and as long as they do not endanger the life of other people, the traffic law allow them to get rid of certain limitations such as speed limits, direction of driving, priorities and traffic light. In most states, this allows ambulances to travel no more than 5 miles per hour above the posted speed limit. Also, when approaching a red light, the ambulance must first stop, determine the intersection is clear, and then may proceed regardless of what color the light is.

The ambulance of private companies (A- and C-type) have a blue flashing light and a three-tones siren (high-low-high...high-low-high...). When these special warning devices are on and when the emergency of the mission justifies it and as long as they do not endanger the life of other people, traffic laws allow them to get rid of certain limitations such as speed limits while respecting lane priorities and traffic lights.

Ambulances in the UK

In the UK, ambulance services are provided under the National Health Service through local ambulance 'trusts'. Each trust is specific to a county or area, and so the country is divided across a number of ambulance trusts, in a similar way to the British Police are. There are 31 ambulance trusts in England but there are likely to be several mergers in 2006 which will result in fewer trusts.

Most trusts offer three levels of personnel for service: care assistants, technicians and paramedics. Care assistants operate PTS (Patient Transport Services), which is largely concerned with the moving of patients between hospital and home. Technicians and paramedics crew the emergency ambulances, providing more urgent transport and also paramedical care of casualties. Occasionally, when not attending emergency incidents, technicians and paramedics may help out with PTS duties. Ambulance Trust's performance is measured. The Governments targets are to reach 75% of Category A (life threatening) calls within 8 minutes. A number of initiatives have been introduced to assist meeting these targets, including Rapid Responders and Community Responders.

Ambulance crews work a shift rota, and working nights and public holidays is seen as part of the job. Many people start out in a PTS role to gain experience of patient care, and then progress onto additional technician training at a later date. This has always been the classic method of entry into the ambulance service, although more recently some Universities have started to offer paramedicine degrees, with guaranteed direct entry into technician status on completion. These courses are somewhat controversial, with some more experienced ambulance staff arguing that such a fast-track approach misses the experience of PTS where recruits learn vital interpersonal skills. Direct entry to paramedic is not available, and can only be achieved via the technician route. Many trusts receive several hundred applicants per place, and this allows them to be very discriminating.

Technician training in many trusts is a 10 week course, usually residential. The IHCD division of Edexcel provides the qualifications for ambulance technicians and paramedics, and qualifiers become known as "state registered" or "IHCD registered". Without this registration, crewing of emergency vehicles or administration of certain medical techniques is forbidden.

Private ambulance services are becoming more common in the UK, along with the traditional voluntary sectors, such as the Red Cross and St. John Ambulance. However both the voluntary and private services tend to be concerned with PTS, and it is rare (although not unheard of) to find an emergency being attended by a non-NHS ambulance. The relevant UK legislation applies to all ambulances with no discrimination as to who owns or operates them. The majority of UK Private Ambulance Services are members of the British Ambulance Association.

In the UK, a minority of NHS ambulance staff are highly critical of the voluntary and private services, and there may exist an elitist attitude within some trusts. This may stem from hatred incurred during the various ambulance strike actions, where private, voluntary and military ambulance services have stepped in to provide cover, being referred to as "scabs". Most trusts are more positive about the additional services, even welcoming them as a means to reduce their own workload.

Ambulances is Germany and Austria

In the german-speaking countries of Germany and Austria preclinical care is not only provided by non-physician staff (Rettungssanitäter or Retttungassistent), but also by specially trained emergency phyicians (called "Notarzt"). Therefore there are different types of ambulances. A few years ago, an ambulance that was sent to a potential life-threatening situation (e.g. cardiac arrest), was usually staffed with two paramedics and one physician. This system's disadvantage was that if the situation wasn't that life-threatening at all (and therefore no emergency physician would be needed) the ambulance staff had to treat the patient and wasn't therefore able to respond to situations where they really would be needed. In the last few year the so-called "Rendezvous-System" took over, where the emergency physician is driven to the scene by a separate car (usually a SUV) and the paramedics with the ambulance. Therefore, if there is not physician needed, the doctor can leave and let the paramedics take care of the patient or - in the opposite situation - if an ambulance is deployed to a situation which didn't sound that serious to the operator, the paramedics can call for reinforcements and the emergency physician could respond. Also, the driver of the emergency phycician's car is usually a trained EMT too, so in case there is a very serios situation (resuscitation, heavy trauma), there are more trained people on the scene.

Military ambulances

Military ambulances include both regular ambulances painted in olive (though some may be white, like civil ones. The British Army Medical Corps has a fleet of white ambulances, based on production trucks) and armed ambulances based upon AFVs. Military helicopters often function as aerial ambulances, since they are extremely useful for MEDEVAC.

Due to the high level of danger in battle-fields, military ambulances are often armored, or based upon armored fighting vehicles (AFV). Since laws of war demand ambulances not to mount any weapon, an ambulance AFV is disarmed and marked by a red cross or another accepted medical marking.

Recently, Israel has modified some of its Merkava main battle tanks with ambulance features in order to allow rescue operations to take place under heavy fire in urban warfare. The modifications were made following a failed rescue attempt in which Palestinian gunmen killed two soldiers who aided a Palestinian woman in Rafah. Since M-113 armoured personnel carriers and regular up-armored ambulances are not protected enough against anti-tank weapons and improvised explosive devices, commonly used by Palestinian militants against both military and civilian Israeli vehicles, it was decided to use the Merkava tank, because it features heavy armor and a rear door enabling the evacuation of critically wounded soldiers. Though ambulances may not carry weapons, Israel did not remove the Merkava's weaponry, claiming that Palestinian militants do not adhere to international law by firing on ambulances. Therefore, it becomes necessary to protect troops that come to aid the wounded.

References

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Police car

Home | Up

A *police car*, *police cruiser*, *squad car*, *radio car* or *patrol car* is a vehicle used by police forces around the world to patrol, temporarily detain and transport individual criminal suspects. Use of the police car has largely replaced the tradition of officers or constables "walking a beat" in most jurisdictions. A police car is also sometimes called a *cop car* or *cherry top*.

Advocates of community policing have asked police departments to encourage constables to spend less time in their vehicles and more time walking the streets and interacting with the community.

Characteristics

Police cars are usually normal cars which are upgraded with a *police package* provided by the manufacturer. The police package often modifies the car for higher durability, speed and capability for high mileage driving and to accommodate the use of the electronic equipment used by police officers on patrol (laptop database, strobe lights/siren, radio etc.). This is usually accomplished by heavy duty suspensions, brakes, tires, transmission and cooling systems, and also sometimes includes slight modifications to the car's stock engine. Additional special equipment may include modified electrical wiring, inoperable rear door locks and rear windows, and other heavier-duty components. These components not only increase performance but also increase the car's longevity, usually lasting from 7 to 12 years. It is for this reason that many taxis and fire chiefs' vehicles are based very closely on police cars.

With the advent of highways and motorways, special patrols have been established to monitor traffic offenses as well as engage suspects in flight. The latter often results in police chases, which have been criticized (and even outlawed in some places) for putting uninvolved motorists and pedestrians at risk, and have also been dramatized in television programs and movies.

Police cars may either be marked or unmarked, to catch suspects unaware. Marked cars have reflective decals and the word "police" on them to clearly mark them as police cars. Most, but not all, marked vehicles have a light bar on top with red and/or blue light beacons and sirens. Unmarked cars are devoid of any visible markings or equipment which can identify it as a police vehicle, making it appear identical to a regular car of the same model. The siren is hidden and the police lights are placed behind the either the windshield or grill and back window.

On film and television, police cars are almost always portrayed as containing a team of two police officers so that they may converse and interact on screen. In reality, most districts have only one police officer per vehicle, although at night this may increase to two.

In the United States, most police departments currently use the Ford Crown Victoria Police Interceptor as the standard patrol car. Other manufacturers provide police cars as well, and a few jurisdictions use these vehicles.

Markings and paint schemes

The markings and paint schemes on police cars vary by country. North American police cars have a reputation for being painted black and white; usually the car doors and roof are painted white, while the trunk, hood, front fenders and rear quarter panels are painted black. However, in the United States, the paint scheme for each fleet is determined by each agency. Cars may range from being all white to completely black. Blues and greens are also frequently used.

In Japan and China, a variation of black and white scheme is used, except that the top half of the car is painted white, and the bottom half is black. Similar color schemes are also used by departments in Taiwan and Greece. Germany and Sweden use a similar paint scheme configuration, although Germany uses bright green instead of black, and Sweden have changed from black paint to light blue stickers. In Ireland, the United Kingdom, South Africa, Australia, and a few other countries in Europe, police cars are often painted predominantly white, with a fluorescent checkered strip running along the sides of the car, usually silver, blue, orange or yellow, or combinations of these colors.

Official markings also vary by jurisdiction. The side doors and sometimes the hood of a marked police car usually bear the police force's badge or the city seal, often in reflective finish. Markings such as emergency telephone numbers are also common. Some agencies such as the California Highway Patrol also have identification numbers printed on the roofs of patrol cars for identification from aircraft.

Deterrence

Just the presence of a police car, without active enforcement, can be a visual reminder of traffic laws. At high speeds, motorists may not even notice whether or not an officer is inside. In 2005, Virginia's legislature considered a bill which provided, in part[1]:

Whenever any law-enforcement vehicle is permanently taken out of service . . . such vehicle shall be placed at a conspicuous location within a highway median in order to deter violations of motor vehicle laws at that location. Such vehicles shall . . . be rotated from one location to another as needed to maintain their deterrent effect.

See also

- Panda car
- SWAT van
- Jam sandwich (slang)
- List of slang terms for police vehicles

Police Emergency Wagon

Home | Up | Police Emergency Wagon

Police Emergency Wagon is a North American term for a station wagon put into police use with police car variants. They are usually used as K-9 units, Bomb Squad units, patrol units, emergency units, or assistance units. By the 1980s, Police Emergency Wagons had begun to be phased out by most police forces by the arrival of the Police SUV and special service packages. Some police forces, such as the New York City Police Department and the Chicago Police Department, still use Police Emergency Wagons. With the arrival of the Dodge Magnum Police Package in 2006, Police Emergency Wagons may be put back into standard use into the Future.

Paddywagon

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A *paddywagon* is a vehicle used by police to transport large groups of people who have been arrested.

"Paddy" (a common Irish shortening of Patrick) was used as a pejorative with which to insult Irish people. Irishmen made up a large percentage of the officers of early police forces in many American cities. This concentration of Irish in the police forces could have led to the term "paddy wagon" being created.

Some theorize that the backs of these vehicles were often filled with rowdy, fighting drunkards. Irish people have also been stereotyped in this regard, which may have also contributed to the term.

These vehicles were usually painted black. Archaically in the United States and the United Kingdom, they were also called Black Mariahs ("ma-RYE-ahs"). The origin of the term is uncertain. The OED lists the first usage as the Boston Evening Traveller from 1847 which mentions them as a new type of wagon. Brewer's Dictionary of Phrase and Fable suggests the name came from Maria Lee a large and fearsome black madam who the police would call on for help with difficult prisoners. The term is still used today in parts of Britain for the vehicle that transports prisoners from jail to court, appearing in the song "Guns of Brixton" by The Clash. Frequently, screened-in buses are also used for the same purpose.

The term is often used in some areas of Australia, specifically New South Wales[2] and Queensland[3] to refer to a general duties vehicle with a prisoner cage on the back. Australian 'paddywagons' are typically based on small utility vehicles such as the Holden Rodeo or Toyota Hilux.

SWAT van

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A *SWAT van* or *SWAT truck* is a vehicle used to transport heavily-armed Special Weapons and Tactics (SWAT) team members. These vehicles are often armored and can also be used to transport heavy-duty equipment (for example, rubber bullet guns, machine guns, and battering rams). Sometimes, SWAT vans are used as paddywagons. Used school buses and ambulances can also be converted into SWAT vans or trucks.

See also

- Police car

Automobile manufacturers

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The following *automobile manufacturers* produce or have produced automobiles. Note that these are automobile makers rather than individual types. Some of these have never been independent companies but are sub-brands established by a parent company.

Companies by Country

Argentina

- Andino

Armenia

- ErAZ

Australia

- Alpha Sports
Amuza
Australian Kitcar
Bavariacars
Birchfield
Bolwell
Bomac
Bullet
Carbontech
Chrysler Australia (produced the Valiant)
Classic Glass
Classic Revival
Cobra Craft
Daktari
Daytona (car)
Deuce Customs
Devaux
DRB Sports Cars
Elfin Cars
Evans
Finch
Ford Australia

Ford Performance Vehicles (FPV)
G-Force
Hartnett
Holden Special Vehicles (HSV)
Holden
Homebush
Kraftwerkz
Lightburn
Mitsubishi Motors Australia Limited
NASENBAER Sports
Nota
Piper
PRB
Python
RCM
RMC
Roaring Forties
Robnell
Sharpbuilt
West Coast Motors
White Pointer

Austria

- Achleitner

Austro-Daimler
Denzel
Grofri
Magna Steyr
ÖAF
Puch
Steyr
Steyr-Daimler-Puch
Tomaszo

Belarus

- Minsk Tractor Plant

BelAZ
MAZ

Belgium

- ABC (B)
Apal (before 1995, now Germany)
Edran
Excelsior
FN
Germain
Gillet
L&B
Métallurgique
Miesse
Minerva
Nagant
Springuel (1907-1914)
Vivinus

Brazil

- Brasinca
Bugre
Chamonix
Dardo
Envemo
FNM
Gurgel
Hofstetter
JPX
Lobini
Miura
Puma
Sta. Matilde
Troller

Bulgaria

- Bulgar Renault
Chavdar

Canada

A-E

- Acadian
Allard Canada

Barrie Bell (Barrie Carriage Company Ltd)
Bricklin
Brock Motors
Chatham Motors Company
Colonial Motors
Chalmers Motor Car of Canada
Chrysler Canada Ltd.
Desoto
Dodge Brothers of Canada
Dominion Motors Ltd.
Durant Motors
E-M-F

F-I

- Ford Motor Company of Canada Ltd.

Fargo
Fisher Motor Company. Ltd.
Frontenac
Galt Motor Company of Canada
General Motors of Canada Ltd.
Graham-Paige Motors Ltd.
Gray-Dort Motors Ltd.
Hudson Motors Car Company of Canada, Ltd.
Hupmobile of Canada
International Harvester

L-R

- Leroy

Maple Leaf
Maxwell Motor Company of Canada Ltd.
McLaughlin
McLaughlin Buick
Mercury (Canada)
Meteor
Monarch
National Cycle and Motors of Canada
Pontiac
Russell (automobile)

S-Z

- Studebaker Canada Ltd.
Two-in-One
Tudhope
Renault
Timmis-Ford
Vauxhall

China

- BYD Auto
Brilliance China Auto (also Jinbei(Ño)/Zhonghua)
Chang'an Auto
Chang'an Ford
Chang'an Suzuki
Changhe(³)
Chery(G^)
Dadi Auto
Dongfeng
First Automotive Works (FAW)/Hongqi (¢×)/Huali(N))
Geely (also Huapu(Nn)/Haoqing(jÅ)
Great Wall(Î)
Guangzhou Automotive
Guizhou Auto/Yunque(‘À)
Hafei Motor
Jiangling (also Landwind)
Lifan
Nanjing Automobile Group
Shanghai Automotive (also GM Shanghai/Wuling)
Soueast Motors
Tianjin Xiali

Czech Republic

- Aero
AVIA
Jawa Motors
Laurin & Klement
MTX
Praga
Škoda
Tatra
Walter

Denmark

- Anglo-Dane
Thrige
Kewet

Egypt

- Arab American Vehicles
El Nasr Automotive Manufacturing Company
The Ghabbour Group
WAMCO — the Watania Automotive Manufacturing Company

Estonia

- ESTfield

Finland

- Elcat
RaceAbout
SISU
Valmet

France

A-H

- Aixam-Mega
Alcyon
Alda
Alma
Alpine/Alpine-Renault
Amilcar
Amédée Bollée
Ardex
Avions Voisin
Bonnet
Ballot
Bédélia
Berliet
Bignan
Brasier

Bucciali
Bugatti
Chaigneau-Brasier
CD
CG
Chenard-Walcker
Citroën
Clément-Bayard
Dangel
Darlmat
Darracq
DB
De Dion-Bouton
Delage
Delahaye
Delaunay-Belleville
Facel Vega
Farman
Ford (France)
Georges Irat
Georges Richard
Gordini
Hispano-Suiza
Hommell
Hotchkiss
Hurtu

J-V

- Jidé

Léon Bollée
Ligier
Lorraine-Dietrich
Major
Marcadier
Mathis
Matford
Matra
Monica
Mors
Mega
Motobloc
Panhard & Levassor
Peugeot

Peugeot and Mors
Renault
Richard-Brasier
Rolland-Pilain
Rosengart
Salmson
Scora
Simca
Sizaire-Naudin
Stimula
Talbot
Talbot-Lago
Tracta
Unic
VELAM
Venturi
Voisin

Germany

Major Current German Automobile Manufacturers

- Volkswagen Group VAG
  - Volkswagen

  Audi
  Skoda *formerly Czech (Europe and Middle East only)
  SEAT *formerly Spanish (Europe, Middle East and Latin America only)
  Lamborghini *formerly Italian
  Bentley *formerly British
  Bugatti *formerly French
- Daimler-Chrysler
  - Mercedes-Benz

  Maybach
  Chrysler *formerly American
  Dodge *formerly American
  Jeep *formerly American
  Smart (Europe, Middle East and Canada only)
- BMW
  - BMW

  Rolls-Royce *formerly British
  MINI *formerly British

Other German Manufacturers

A-G

- Adler

AFM
AGA
Alpina
Amphicar
Apal (formerly Belgium)
Apollo
Arimofa
Audi
Auto Union
AWS
Benz
Bitter Cars
Borgward
BMW
Bugatti (later in France)
Daimler
Deutz
DKW
EMW
Fendt
Ford Deutschland
Glas
Goggomobil
Gumpert
Gutbrod

H-R

- Heinkel

Horch
Isdera
Karmann
Käsbohrer-Setra
Kleinschnittger
Lloyd
MAN
Magirus
Maybach
Melkus
Mercedes-Benz
Merkur

Messerschmitt
Neckar
Neoplan
NSU
Opel
Pluto
Porsche
Robur
Ruf

S-W

- Selve

Smart
Standard Superior
Stoewer
Titan
Trabant
Volkswagen (VW)
Wartburg
Wanderer
Wiesmann

Greece

- Agricola (trucks)

AK Hellas
Alta
Attica
AutoDiana (trucks)
Automeccanica
Balkania
B.E.T.
Biamax
DIM
EBIAM
ELBO
Malkotsis
MAVA-Renault
MEBEA
Motoemil
MotorCar
Namco

Neorion
Pan-Car
Petropoulos (trucks, tractors)
Ros
SAM
Saracakis
Scavas
Sfakianakis
Styl Kar
Theologou
Tzen

Hungary

- Balaton

Helix
Méray
Puli
Rába
Unitas

India

- Ashok Leyland

Force Motors
HeroHonda
Hindustan
Mahindra
Maruti
Premier
Reva
San Storm
Sipani
Tata Motors

Iran

- IAPMA

Iran Khodro/Paykan/Samand
Iran Vanet
Kerman Khodro
Morattab
Pars Khodro
Saipa

Ireland

- Dundalk
Shamrock
Thomond

Israel

- AIL
Sabra

Italy

A-H

- Abarth
Alfa Romeo
Aquila
Amilcar Italiana
Ansaldo
Arcadia (caravans)
ASA
ATS
Autobianchi
Bandini
Bertone
Bianchi (lorry manufacturer)
Bizzarrini
Bonetti
Bremach
Brixia-Zust
Bugatti Automobili SpA
Carletti
Casalini
Chiribiri
Cisitalia
CityCat
Cizeta-Moroder
CMC
Colli
Conrero
De Tomaso
Diatto

Ecoiniziative
Edonis
Effedi
Ermini
FATA
Feab
Ferrari
Fissore
Fiat
FLAG
FOD
Fornasari
Garage Italia
Ghia
Grecav

I-Z

- Iso

Innocenti
Isotta-Fraschini
Itala
Italauto
Iveco
Laiza
Lamberti
Lamborghini
Lancia
Maserati
Mazzieri
Minonzio
Mobilvetta
Moretti
MyCar
Officine Meccaniche
OSCA
Pagani
Piaggio
Qvale
Serenissima
Siata
SLC
SPA
Start Lab

Stanguellini
Tasso
TechnoLab
Town Life
Valentini
Vespa
Viotti
Vignale
Zagato
Zust

Japan

- Autobacs
Daihatsu
Honda (also Acura)
Isuzu
Mazda (also Autozam/Eunos/Efini)
Mitsubishi
Mitsuoka
Nissan (formerly Datsun, also Infiniti)
Prince Motor Company
Subaru (Fuji Heavy Industries)
Suzuki Motor
Tommy Kaira
Toyota Motor Corporation (also Lexus/Scion)

Latvia

- RAF
Russo-Balt
Ford-Vairogs
VEF

Liechtenstein

- Jehle

Lithuania

- KAG

Malaysia

- Bufori
Inokom
Naza
Perodua
Proton
TD2000

Morocco

- Laraki

Namibia

- URI

Netherlands

- Altena
Burton
Bij 't Vuur
Carver (Vandenbrink)
Charon
DAF
Donkervoort
Eysink
Ford (In Amsterdam there was a Ford factory, up until 1981. Their last product was the ill-fated Trans Continental, presumably a Dutch only truck)
FTF (truck)
Ginaf (truck)
H.A.M.
Le Patron
Kromhout (truck)
Max
RAM (truck)
Rizovari
Ruska
Terberg (truck)
Spyker
Spyker Cars
Startwin
Waaijenberg

North Korea

- Pyonghwa
Tokchon

Norway

- Kewet
Think Nordic, also known as Pivco
Troll

Philippines

- Francisco Motors Corporation
Norkis
Nexus
Pasajero
Sarao

Poland

- Autosan
FSM
FSO
FSR
HONKER
JELCZ
Leopard car
Polski Fiat
STAR
INTRALL

Portugal

- Entreposto
Portaro
UMM

Romania

- ARO
Aurel Persu
Dacia

Dimitrie Vasescu
IMS (part of ARO)
Iustin Capra
Lastun
M.R.
Malaxa
Oltcit/Rodae
ROMLOC
Uzinele Brasov

Russia

- GAZ/Volga (also Chaika/Pobeda/ZIM)

IZH
KamAZ
KAvZ
KrAZ
AZLK/Moskvitch
PAZ
SeAZ
UAZ
TagAZ
VAZ/Lada/Zhiguli
ZIL/ZIS

Serbia

- Zastava/Yugo

Zastava Trucks
FAP

Slovenia

- IMV

TAM/TVM

South Korea

- Asia Motors (1965-1999; merged with Kia in 1999)

Daewoo Bus Corporation
GM DAT/Daewoo
Hyundai
Kia Motors
Proto Motors

Renault Samsung Motors
SsangYong

Spain

- Abadal

Anglada
Barreiros
Biscuter
Comarth
David
Hispano-Suiza
Hisparo
Pegaso
Santana Motor
SEAT
Uro

Sweden

- Allvelo

AMG
ANA
AS Special
Berglund & Laurin
BHB
Dala7
Design by Ulf
Gemo
Gin1
Gun-Ger
Esther
Evo Special
Häcklefjäll
Husqvarna
Ilestam-Special
Jösse
Koenigsegg
MS Special
Nilsson
Nordic Uhr
Pilot
Racing Plast Burträsk
Saab

S.A.M.
Scania
Thulin
Tidaholm
Tjorven/Kalmar
Vabis
Volvo Cars
Wahrendorfsbilen
Wiba

Switzerland

- Ajax

Albar
Felber
Monteverdi
Pic-Pic
Rapid
Rinspeed
Sbarro
Turicum

Taiwan

- China Motor Corporation

Formosa
Yulon/Yueloong

Thailand

- Thai Rung Union Car

Turkey

- Devrim

Anadol
BMC
TOFA^ — FIAT
OTOSAN — Ford
OYAK — Renault
ASSAN — Hyundai
Otokar
Otoyol

Temsa
Karsan

Ukraine

- KrAZ

LAZ
LuAZ
ZAZ

United Arab Emirates

- Al-Dhabi

United Kingdom

A-E

- AC

Adamson
Albion
Allard
Alvis Cars 1919-1967
Ariel
Arkley
Armstrong Siddeley 1922 — 1959
Arrol-Johnston
Ascari
Ashley
Aston Martin
Atalanta
Austin
Austin-Healey
AV
Barnes
Bean cars
Belsize Motors
Bentley
Berkeley cars
Bond
BMC
BSA
Bristol 1945 — present

British Leyland
British Salmson
Calthorpe
Caterham
Clan
Clyno
Coventry-Victor
Crossley Motors
Crouch Cars
Daimler 1896 — 2002
Dawson Car Company
Dellow
De Lorean
Elva
Excelsior Motor Company Ltd.

F-L

- Fairthorpe

Ford
Frazer Nash
Gilbern
Ginetta Cars
Gordon-Keeble
Grinnall Specialist Cars
Healey Motor Company
Hillman-Coatalen
Hillman
HRG
Humber
Invicta
Jaguar
James and Browne
Jenson
Jowett
Kieft Cars
Lagonda
Lammas
Lanchester
Land Rover
Lea-Francis
Lister
Locost

Lotus
Lloyd cars

M-R

- MacNeillie

Marauder Cars
Marcos
Marendaz
McLaren
Metrocab
MG
MINI
Morgan
Morris
Noble
Ogle
Panther
Paramount Cars
Peerless/Warwick
Peel
Piper
Railton
Range Rover — sub-marque of Land Rover
Reliant
Riley
Rochdale
Rolls-Royce
Rover

S-W

- Siddeley-Deasy

Singer 1905 — 1970
Standard
Sterling
Streamline Cars Ltd
Sunbeam
Swallow
Swallow Doretti
Swift Motor Company
Talbot
Tiny

Tornado
Trident
Triumph
Trojan
Turner
TVR
Unipower
Vanden Plas
Vauxhall
Westfield Cars
Willys Overland Crossley
Wolseley

United States

There were over 1800 automobile manufacturers in the United States from 1896 to 1930. Very few survived and only a few new ones were started after that period.

Major current US automakers

With their various brand-names, many of which earlier had been independent companies:

- AM General (not sold to private individuals; similar vehicles are sold to ordinary consumers as Hummers)
- DaimlerChrysler (Though headquartered in Stuttgart, Germany, DaimlerChrysler is sometimes seen as an American car manufacturer.)
  - Jeep
  - Chrysler
  - Dodge
- General Motors
  - Buick
  - Cadillac
  - Chevrolet
  - GMC
  - Hummer
  - Pontiac
  - Saturn
- Ford
  - Lincoln
  - Mercury
- Panoz

Saleen
Vector Supercars

Defunct US automakers

A

- Abbott (automobile) (Cleveland based automobile manufacturer)

Abbott-Detroit (1909)
A.B.C. High-Wheeler (1905)
A Car Without A Name (1909) renamed F.A.L.
Ace Motor Corp (1920)
Acme (1904)
AC Propulsion
Adams-Farwell (1905)
Adelphia (1920)
Adria (1921)
Aerocar (1906)
Aero Willys
Ajax (1901 and 1925)
Akron (1900)
Albany (1907)
Alpena (1911)
Alsace (1920)
Alco (1909)
Allen-Kingston (1908)
Allen
Allstate
Alter (1915)
Altman (automobile) (Cleveland based automobile manufacturer)
Amco (1917)
Ambassador (1921)
Ambler (automobile)(Cleveland based automobile manufacturer)
American Austin (later American Bantam)
American Chocolate (1902)
American De Dion (1900)
American Electric
American Fiat (1910)
American Gas (Cleveland based automobile manufacturer)
American Locomotive Company (ALCO) (1909)
American Mercedes (1905)
American Mors (1906)
American Motors
American Napier (1904)
American Piedmont (1917)
American Simplex (1906)
American Steamer (1922)

American Underslung (1906)
American Voiturette Company
Ames (1910)
Amplex (1910)
Amstutz-Osborn (Cleveland based automobile manufacturer)
Anchor (1910)
Anderson (1907 and 1916)
Anderson Electric Car Company (later Detroit Electric)
Anhut Motor Car Company (1910)
Apperson (1902) (see also Haynes-Apperson)
ArBenz (1911)
Ardsley (1905)
Argo Electric (1912)
Argonne Four (1919)
Ariel (1905)
Armstrong Electric
Arnolt
Arter (Cleveland based automobile manufacturer)
Atlas (1907)
Atlas-Knight (1912)
Atterbury (1911)
Auburn (1900)
Auburn-Moore (Cleveland based automobile manufacturer)
Aultman (Canton Ohio based automobile manufacturer)
Aurora (1905, 1907)
Austin (1903)
American Motors Corporation
Autocar (1901)
Autocycle (Vandegriff) (1906)
Automatic Electric (1921)
Automobile Fore-Carriage (1900)
Automotor (1901)
Avanti

B

- B&H (automobile) (Cleveland Ohio based manufacturer of automobiles)

Babcock (1909)
Babcock Electric (1906)
Bailey Electric (1907)
Baker Electric (1899) (Cleveland Ohio based manufacturer of automobiles)
Balboa (1924)
Baldner (1902)

Baldwin Steam (1899)
Banker (1905)
Barbarino (1925)
Barley (1923)
Bantam
Barnes (1907)
Bates (1903)
Bauer (taxi) (1925)
Bay State (1907 and 1922)
Beaver
Beggs (1920)
Belden (1907)
Bell (1916)
Bendix (1908)
Benham (1914)
Ben Hur (1917)
Benner (1908)
Benson (automobile) (Cleveland Ohio based manufacturer of automobiles)
Berg (1903) (Cleveland Ohio based manufacturer of automobiles)
Bergdoll (1910)
Berkshire (1905)
Bertolet (1908)
Beverly (1904)
Biddle (1915)
Bingham (automobile) (Cleveland Ohio based manufacturer of automobiles)
Binney & Burnham Steam (1902)
Birch (1916)
Birmingham (1921)
Black (1908)
Black Crow (1909)
Black Diamond (1904)
Blackhawk (1903 and 1929)
Blakeslee (automobile) (Cleveland Ohio based manufacturer of automobiles)
Blakeslee Electric (Cleveland Ohio based manufacturer of automobiles)
Bliss (1906)
B.L.M. (1906)
Blomstrom (1902)
Bobbi-Kar
Bolte (1900)
Borland Electric (1910)
Boss (1905)
Boston (steam) (1900)
Bour-Davis (1916)
Bowman (1921)
Bradley (1920)

Brazier (1902)
Brecht (1901)
Breese & Lawrence (1905)
Brew-Hatcher (1904)(Cleveland Ohio based manufacturer of automobiles)
Brewster
Brewster-Knight (1916)
Briggs-Detroiter
Briggs & Stratton (1919)
Briggs & Stratton Flyer (1918)
Briscoe Motor Company (1914)
Bristol (1902)
Broc Electric (1909) (Cleveland Ohio based manufacturer of automobiles)
Brooks Steamer (1927)
Browniekar (1908)
Brunn (1906)
Brush Motor Car Company (1907) (Cleveland Ohio based manufacturer of automobiles)
Buckeye (1901)
Buckboard (automobile) (Cleveland Ohio based manufacturer of automobiles)
Buckeye (automobile) (Cleveland Ohio based manufacturer of automobiles)
Buckmobile (1903)
Buffalo (1900)
Buffalo Electric (1901)
Buffum (1901)
Bugmobile (1907)
Burg (1910)
Bush (1916)
Byrider (automobile) (Cleveland Ohio based manufacturer of automobiles)

C

- Caddy(automoble) Canasota NY (1900)

Calvert (1927)
Cameron (1903)
Canda (1900)
Cantono Electric (1904)
Canzol Cleveland Ohio based automobile producer
Cardway (1923)
Carhartt (1911)
Car-Nation (cyclecar) (1912)
Carroll Six (1921)
Cartercar (1905)
Cavalier (1926)
Case (1911)

Central (automobile)Cleveland Ohio based automobile producer
Centaur (1902)
Century (electric and steam) (1901)
C-F (Cornish-Friedberg) (1907)
Chadwick (1904)
Chalfant (1906)
Chalmers
Chalmers-Detroit (1908)
Champion (1919) Cleveland Ohio based automobile producer
Chandler (1913) Cleveland Ohio based automobile producer
Chaparral (1961)
Chase (1907)
Checker Cab (1921)
Cheetah 1962
Chevrolet (1911)
Chicago Electric (1899 and 1912)
Chicago Motor Buggy (1908)
Chief (1908)
Christie (1904)
Chrysler (1924)
Church
Church-Field Electric (1912)
Cincinnati Steam (1903)
Clark-Hatfield (1908)
Clark Norwalk Cleveland Ohio based automobile producer
Clarkmobile (1903)
Clark Steam (1900)
Cleveland (1918) (a small Chandler)
Cleveland Electric Cleveland Ohio based automobile producer
Clenet
Climber (1919)
Clipper 1956 only
Cloughley (1902)
Clymer (highwheeler) (1908)
Coates-Goshen (1909)
Coats Steam Car (1922)
Coey (1913)
Colburn (1906)
Colby (1911)
Cole (1909)
Collins Electric (1900)
Colonial (1921)
Colt (1907)
Columbia Electric
Columbia Motors (1916)

Columbus Electric (1903)
Comet (1917)
Commander (1922)
Commerce
Commercial Electric (1903)
Commodore (1921)
Commonwealth (1917)
Compound (E.H.V.) (1904)
Conover (1907)
Conrad (steam) (1901)
Consolidated Motor Company
Continental (1907 and 1910 and 1940)
Corbin (1905)
Corbitt (1907)
Cord Automobile (1929)
Corinthian (1922)
Correja (1909)
Cosmopolitan (highwheeler) (1907)
Cotta Steam (1901)
Country Club (1903)
Courier (1904 and 1923)
Courier Car Co (1909/10)
Covert (1902)
Craig-Toledo (1907)
Crane (1912)
Crane-Simplex (1915 and 1922)
Crawford Automobile (1905)
Crawford-Hough Cleveland Ohio based automobile producer
Crescent (1907)
Crest (1900)
Crestmobile (1901)
Crosley
Crowdus Electric (1900)
Crow-Elkhart (1911)
Crown (highwheeler) (1908)
Croxton (automobile) Cleveland Ohio based automobile producer
Croxton-Keeton (1909)
Cruiser (1917)
Culver (1905)
Cunningham (1907)
Curtis (1921)
Cutting (1909)
Cuyhoga Electric Cleveland Ohio based automobile producer
C.V.I. (1907)
Cyclomobile (1920)

D

- D.A.C (Detroit Air Cooled) (1922)

Dagmar (1922)
Dalton (1911)
Daniels (1916)
Darling (1901)
Dawson (1904)
Davenport Steam (1902)
Davis (1908)
Day Automobile Company
Dayton Electric
Davis
Deal (1908)
Decker (1902)
Deemster (1923)
DeKalb (1915)
Delling Steamer (1923)
Del Mar
De Lorean
Demot (1910)
Demotcar
De Motte (1904)
Desberon (1901)
DeSchaum (1908)
DeSoto (cyclecar) (1913)
DeSoto (automobile) (1929–1961)
De Tamble (1908)
De Vaux
De Vaux Continental
Detroit (1904)
Detroit Air Cooled (1922)
Detroit Automobile (1899-1901)
Detroit-Dearborn (1909)
Detroit Electric (1907)
Detroiter (1912)
Detroit Steamer (1923)
Diamond T (1907)
Diana (1925)
Dile (1914)
Dingfelder
Disbrow (1917)
Dispatch (1910)
Dixie Flyer (1916)

Doble Steamer (1914)
Dodge (1914)
Dodo (cyclecar) (1912)
Dolson (1904)
Dorris Motors Company
Dort (1915)
Dragon (1906)
Drake (1921)
Driggs (1921)
Drummond (1916)
Dual-Ghia
Duer (highwheeler) (1907)
Duplex (1908)
DuPont (1918-32)
Duquesne (1904)
Durant (1921)
Durocar (1907)
Duryea (1895)
Duesenberg (1920)
Dyke (1899)

E

- Eagle (1923)

Eagle Air Cooled (1905)
Eagle-Macomber Rotary (1917)
Earl (1907 and 1922)
Eclipse Steamer (1900)
Economy (1916)
Economy (highwheeler) (1908)
Economy-Vogue (1920)
Edsel
Edwards-Knight (1912)
Elcar (1916)
Eldredge (1903)
Electrakar
Electric Carriage and Wagon Company (1896-1897) becomes Electric Vehicle Company
Electric Vehicle Company (1897-1909) becomes Columbia
Elgin (1916)
Emancipator (1909)
E-M-F Company (1908)
Empire (automobile) Empire Amsterdam NY (1898-1904)1901 Empire Stateman 1 Cylinder Gas,Alamo

Empire (1909)
Empire Steamer (1899-1901)
Enger (1909)
Erskine (1927)
Eshelman (1953-1961)
Essex (1901-1902), (1906) (1919)
Essex Steam (1906)
Euclid (1907)
Eureka (1907)
Everitt (1909 and 1910)
Everybody's (1907)
Excelsior
Excalibur

F

- Fageol (1917)

Fairbanks-Morse (1908)
F.A.L. (1909)
Falcon (1907 and 1922)
Falcon-Knight (1927)
Famous (1908)
Fanning (1901)
Fargo (1929)
Farmac (1915)
Farner (1922)
Fee-American (1907)
Fergus (1916)
Ferris (1920) (Cleveland Ohio Based Automobile Manufacturer)
Firestone-Columbus (1909)
Flanders (1910)
Flint Motor Company (1923)
Flint Steam (1902)
Ford Motor Company (1903)
Forest City (1905)(Cleveland Ohio Based Automobile Manufacturer)
Foster (1901)
Fostoria (1906)
Four Traction (Kato) (1907)
Four Wheel Drive (1904)
Fox (1921)
Franklin (1902)
Frayer-Miller (1904)
Frazer
Frazier

Fredonia (1902)
Fremont (1921)
Friedman (1900)
Friend (1921)
Fritchle Electric (1905)
Frontenac (1906, 1922 and 1960)
F.R.P. (1914)
Fuller (1908)
FWD Truck (1910)

G

- Gaethmobile (1902)

Gale (1905)
Gardner (1920)
Gardnier
Garford (1908)
Gasmobile (1900)
Gas-Au-Lec (1905)
Gaylord (1911)
Gearless (1907)
Gearless Steam (1920)
General (1902)
Geneva Steam (1901)
Geo
Geronimo (1917)
Ghent (1917)
Gibbs Electric (1904)
Gifford-Pettitt (1907)
G.J.G. (1909)
Glide (1903)
Globe (1920)
Goodspeed (1922)
Graham
Graham Electric (1903)
Graham Motorette (1902)
Graham-Paige
Grant (1913)
Gray (1922)
Great Eagle (1910)
Great Smith (1907)
Great Southern (1912)
Great Western (1910)
Greeley (1903)

Gregory (1922)
Grinnell Electric (1912)
Griswold (1907)
Grout (1899)
Gurley (1899)

H

- Hackett (1917)

H.A.L. (1916)
Hall (1903)
Halladay (1905)
Halsey Steam (1901)
Hamlin-Holmes (1921)
Hammer (1905)
Hammer-Sommer (1903)
Handley-Knight (1921)
Hanover (1921)
Harper (1907)
Harrigan (1922)
Harris Six (1923)
Harrison (1906)
Harroun (1917)
Harvard (1915)
Hasbrouck (1900)
Hatfield (1907 and 1916)
Havers (1911)
Hawley (1906)
Hay-Berg (1907)
Haydock (1907)
Haynes-Apperson (see also Apperson)
H.C.S. (1920)
Heine-Velox (1906 and 1921)
Henderson (1912)
Henney (1921)
Henry (1910)
Henry J
Hercules (1914)
Herff-Brooks Corporation (1915)
Herreshoff (1909)
Hertz (1926)
Hewitt (1906)
Hewitt-Lindstrom (1900)
Highlander (1919)

Hill (1904)
Hobbie (1908)
Hoffman (steam) (1901)
Holley (1900)
Hollier (1915)
Holly (1913)
Holsman (1902)
Holyoke (1899)
Homer-Laughlin (1916)
Hoppenstand
Howard (1903 and 1913)
Huber
Hudson (1909)
Hudson Steamer (1901)
Huffman (1920)
Hupmobile (1908-1941)
Hupp-Yeats (1911)

I-J

- Ideal (1902 and 1907)

Illinois (1909)
Imp (cyclecar) (1913)
Imperial (1900 and 1908 and 1955)
Innes (1920)
International (1900)
International (highwheeler) (1907)
International Harvester
Inter-State (1909)
Iroquois (1903)
Jackson Automobile Company (1903)
Jaxon Steam (1903)
Jeannin (1908)
Jeffery (1914)
Jenkins (1907)
Jerrery
Jewell (1906)
Jewett (1922)
Johnson (1905)
Johnson Service Company
Jones (1914)
Jones-Corbin (1903)
Jonz (1909)

Jordan (1916)(Cleveland Ohio Based Automobile Manufacturer)
Julian (1925)

K

- Kaiser

Kansas City (1906)
Kauffman (Advance) (1909)
Kearns (1909)
Keene Steamobile (1900)
Keller
Kelsey (1920)
Kenmore (1910)
Kensington (1899)
Kent (1916)
Kenworthy (1920)
Kermath (1907)
Kessler (1920)
Keystone (1900 and 1909)
Kiblinger (highwheeler) (1907)
Kidder (1899)
Kimball Electric (1910)
King Motor Car Company (1911)
Kingston (1907)
Kissel Motor Car Company (1906)
Kleiber (1924)
Kline Kar (1910)
Klink (1907)
Klock (1900)
Knox (1900)
Kobusch (1906)
K-R-I-T Motor Car Company (1910)
Kurtz Automatic (1920)
Kunz (1902)
Kurtis Kraft

L

- LaFayette (1921)

LaMarne (1920)
Lambert (1906)
Lane Steam (1900)
La Petite (1905)

La Salle (1927)
Laurel (1916)
Lauth-Juergens (1907)
Leach-Builtwell (1920)
Leach Steamer (1899)
Leader (1905)
Lenox (1911)
Leon Rubay (1923)
Lexington Motor (1909)
Lewis (1901 and 1914)
Liberty (1916)
Lincoln (1908 and 1921)
Lion Motor Car Company (1910)
Little (1912)
Locomobile (1899)
Logan (1904)
Lone Star (1919)
Long Distance (1901)
Lorraine (1907 and 1920)
Lozier (1905)
Luverne (1904)
Luxor (1924)
Lyman & Burnham (1903)
Lyons-Knight (1913)

M

- MacDonald (1923)

Mackle-Thompson (1903)
MacNaughton (electric) (1906)
Madison (1915)
Mahoning (1904)
Maibohm (1916)
Majestic (taxi) (1925)
Manexall (1920)
Marathon Motor Works (1908)
Marble-Swift (1903)
Marion (1904)
Marion-Handley (1916)
Marlboro (steam) (1900)
Marmon (1904)
Marquette (1912)
Marquette (1929-1930)
Marr (1903)

Marshall (1920)
Martin
Marvel (1907)
Maryland (1907)
Mason (1906)
Matheson (1903)
Maumee (1906)
Maxwell (1905)
Maxwell-Briscoe
Mayfair (1925)
McCue (1909)
McCurdy (1922)
McFarlan (1910)
McGill (4WD) (1921)
McIntire (1909)
McIntyre
Mecca (cyclecar) (1915)
Mecca (standard-size) (1916)
Media (1899)
Menominee Electric (1915)
Mercer (1910)
Mercury (1903)
Merit (1921)
Merkur
Meteor (1915, 1919)
Metropolitan (1922)
Metz (1909)
Metzger Motor Car Company
Michigan (1904)
Michigan Automobile Company
Michigan Motor Car Manufacturing Company
Midland (1908)
Mier (1908)
Mighty Michigan (1911)
Milburn Electric (1914)
Miller (1907)
Milwaukee (steam) (1900)
Mitchell Motors (1903)
Model (1902)
Modoc (1912)
Mohawk (1903)
Moline (1904)
Moline-Knight (1914)
Moller (1920)
Monarch (1903 and 1905 and 1907 and 1913)

Moncrief Steam (1901)
Monitor (1915)
Monroe (1914)
Moon Motor Car (1905)
Moore (1906 and 1916)
Mora (1906)
Morse (1910)
Morse Steam (1905)
Mosler (originally named Consulier)
Motorette (1911)
Moyea (1903)
Munson Company
Muntz Car Company
Murdaugh (1901)
Murray (1902 and 1916)
Murray-Mac Six (1921)

N

- Napoleon (1917)

Nash (1917)
National Electric (1901)
National
Nelson (1917)
New Era (1916)
New York Six (1927) with "Parkmobile" device
Niagara (1903)
Nielson (1906)
Noma (1919)
Northern (1902)
Northern Manufacturing Company
Northway (1921)
Norton (1901)
Norwalk (1910)
Nyberg (1911)

O

- Oakland (1907)

Oakman-Hertel (1899)
Ogren (1915)
Ohio (1909)
Ohio Electric (1910)

Oldsmobile
Olympian (1917)
Omaha (1912)
Orient (1899)
Ormond Steam (1904)
Otto (1910)
Owen (1910)
Owen Magnetic (1915)
Owen-Thomas (1908)
Overland (1903)
Oxford (1905)

P-Q

- Packard (1899)

Page (1906)
Paige
Paige-Detroit (1909)
Palmer (highwheeler) (1906)
Palmer-Singer (1908)
Pan (1919)
Pan-American (1917)
Panoz
Paragon (1906)
Parenti (1920)
Parkin (1903)
Parry Auto Company (1910)
Parsons Electric (1905)
Partin-Palmer (1913)
W.A. Paterson Company (1908)
Pathfinder (1912)
Pawtucket Steam (1901)
Peerless (1900)
Penn (1911)
Pennsy (1917)
Pennsylvania (1907)
People's (1900)
Perfection (1907)
Perfex (1912)
Peters (1921)
Petrel (1909)
Pickard (1909)
Pierce-Arrow
Pierce-Racine (1904)

Pilgrim (1915)
Pilliod (1915)
Pittsburgh (1908)
Phelps (1903)
Phianna (1917)
Pilot (1909)
Planche (1909)
Playboy
Plymouth (1910)
Plymouth (Chrysler Division) (1928-2001)
Pomeroy (1902)
Pontiac (1906) A Division of GM and is still manufacturing
Pope-Hartford (1904)
Pope-Robinson (1903)
Pope-Toledo (late 1903 as 1904 model)
Pope-Tribune (1904)
Pope-Waverley Electric (1904)
Porter (1919)
Postal (highwheeler) (1906)
Powell
Pratt (1912)
Pratt-Elkhart (1909)
Premier (1903)
Premocar (1920)
Prescott Steam (1901)
Princeton (1923)
Publix
Pullman (1905)
Pungs-Finch (1904)
Pup
Queen (1904)
Quinlan (1904)

R

- Rainier (1905)

Raleigh (1921)
Rambler (1902 and 1950)
Randall Three-Wheeler (1903)
Ranger (1907 and 1920)
Rapid (1903)
Rauch & Lang (1905)
R&V Knight (1920)
Rayfield (1911)

R.C.H. (1912)
Read (1913)
Reading Steamer (1901)
Reber (1902)
Rees (1921)
Reese Aero-Car (1921)
Reeves (1905)
Regal (1907)
Regas (1903)
Reliable Dayton (1906)
Reliance (1904)
Remington (1900)
Republic (1910)
Reo (1905)
Richard (1915)
Richelieu (1922)
Richmond (1904)
Rickenbacker (1922)
Ricketts (1909)
Riddle (1916)
Rider-Lewis (1908)
Riker Motor Vehicle (1898-1901) absorbed by Electric Vehicle
Roader (1911)
Roamer (1916)
Roberts (1904)
Robinson (1900)
Rockaway (1902)
Rocket
Rock Falls (1919)
Rockne
Rodgers (1921)
Roebling (1909)
Rogers (1911)
Rogers & Hanford (1901)
Rollin Motors (1923)
Rolls-Royce (1921)
Romer (1921)
Roosevelt (1929)
Ross (1915)
Rotary (1903)
Royal Electric (1904)
Royal Princess (1904)
Royal Tourist (1904)
Russell (1903)

Russell
Ruxton (1929)

S

- Saf-T-Cab (taxi) (1926)

Salter (1909)
Sampson
Sandusky (1902)
Santos-Dumont (1902)
Saxon Motor Car Company (1914)
Sayers (1917)
Schacht (1904)
Schuler (1924)
Scripps-Booth (1915)
Searchmont (1900)
Sears, Roebuck Company
Sears (highwheeler) (1908)
Sebring (1910)
Sekine (1923)
Selden (defunct before 1919)
Sellers (1909)
Senator (1907)
Seneca (1917)
Severin (1920)
S.G.V. (1911)
Sharp Arrow (1908)
Shaw (Colonial) (1920)
Shawmut (1906)
Shelby (1903)
Shelby-American
Sheridan (1921)
Shoemaker (1906)
Sibley (defunct before 1919)
Simms (1920)
Simplex (1907)
Simplicity (1907)
Singer (1914)
Single Center (1906)
Smith (1903)
Skelton (1920)
S&M Simplex (1904)
Sommer (defunct before 1919)
Southern (defunct before 1919)

Southern Six (1920)
Spacke (1919)
Spaulding (1910)
Speedway (1905)
Speedwell (1907)
Spencer (1921)
Sperling (1921)
Sphinx (1915)
Spoerer (1909)
Springer (1903)
Springfield Steam (1900)
S&S (1924)
Stafford (1908)
Standard Motor Company
Standard (New Jersey) (1904)
Standard Electric (1911)
Stanley
Stanwood (1920)
Star (1903 and 1922)
States (1917)
Staver (1907)
Steamobile (1901)
Stearns (1901)
Steel Swallow (1906)
Stephens (1917)
Sterling (1909)
Sterling-Knight (1923)
Stevens-Duryea (1904)
Stilson (1907)
St. Joe (1908)
St. Louis (1899 and 1922)
Stoddard-Dayton (1904)
Stoddard-Dayton Knight (1912)
Storck Steam (1901)
Stout-Scarab
Strathmore (1899)
Stratton-Bliss (1922)
Strong & Rogers Electric (1900)
Studebaker (1902 first Car/ Wagons 1852)
Studebaker Electric (1902)
Studebaker Motor Company (The Modern Company)
Sturtevant (1904)
Stutz (1911)
Stuyvesant (1911)
Suburban (defunct before 1919)

Success Auto Buggy (1906)
Sultan (1908)
Sun (1916)
Synnestvedt Electric (1904)

T-V

- Tarkington (1922)

Taunton Steam (1901)
Texan (1920)
Thomas (1903)
Thomas-Detroit (1906)
Thompson (steam) (1901)
Thompson Electric (1901)
Tincher (1903)
Toledo (1909)
Toledo (gas) (1902)
Toledo (steam) (1901)
Touraine (1912)
Tourist (1902)
Towne Shopper
Trask Steam (1922)
Traveler (1924)
Trebert (1907)
Tribune (1913)
Triumph (steam or electric) (1900)
Triumph (1907)
Tucker
Tulsa (1918)
Twombly (cyclecar) (1913)
Twombly (1910-1911)
Union (1902)
United States Motor Company
Upton (1902)
Valiant
Velie (1909-29)
Vector Aeromotive
Victor (1905)
Victor Steam (1899)
Viking (1908 and 1929)
Virginian (1911)
Vixen (1914)
Vulcan (1913)

W-Z

- Waco (1916)

Wagenhals (defunct before 1919)
Wahl (1913)
Waldron (1908)
Walker (1905)
Wall (1901)
Walter (1902) (also known as American Chocolate)
Waltham (1922)
Waltham-Orient (defunct before 1919)
Waltham Steam (1899)
Walworth (1904)
Warner (Muncie) (1903)
Warwick (1901)
Warren-Detroit (1910)
Washington (1909, 1921)
Wasp (1920)
Waterloo (1903)
Watrous (1905)
Waverley Electric
Wayne (1904)
Webb Jay (steam) (1908)
Welch Motor Car Company
Welch Tourist (1903)
Welch-Detroit (defunct before 1919)
Welch-Marquette (defunct before 1919)
Welch-Pontiac (defunct before 1919)
Wescott (1909)
W.F.S. (1911)
Wharton (1922)
White (1903)
White (1910)
White Steamer (1900)
Wick (1902)
Whiting (defunct before 1919)
Wilcox (1910)
Wildman (1902)
Wills Sainte Claire (1921-1926)
Wills and Company
Willys
Willys-Knight (1914)
Willys-Overland
Windsor (1929)

Winther (1921)
Winton
Wizard (1921)
Whippet (1926)
Wolfe (1907)
Wolverine (1904 and 1927)
Woods Dual Power (1917)
Woods Electric (1899)
Woodworth (defunct before 1919)
Yale (1902 and 1916)
Yellow Cab Manufacturing Company (1915)
Zentmobile (1903)
Zimmer
Zimmerman (1908)
Zip (defunct before 1919)

Vietnam

- Song Cong Diesel

Automobile model and marque oddities

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Single-vehicle marques

Automobile manufacturers generally attempt to have a family of vehicles sold under a single marque. Occasionally, however, manufacturers have deemed it important to sell a single vehicle under its own marque. Sometimes this is done because the vehicle is thought of as inappropriate for the other marques of the manufacturer, as was the case with the Dino from Ferrari. Other times, the single-vehicle marque is created as a fashion statement, as is the case with the new MINI. These sometimes develop into full-fledged marques of their own, but just as often disappear as the vehicle is merged with another marque or sales cease entirely. Of course, some manufacturers never make it past selling a single vehicle.

Many marques never made it past their first vehicle model. This list contains just those marques that were never intended to have a full roster of different models.

- Surprisingly, only one vehicle was ever offered under the General Motors marque: the *EV1*. The "GM" badge had previously been used sporadically in the 1960s in addition to the marque. In 2005, the company decided to add the badge to all GM vehicles, beginning with the Pontiac G6.

Eponymous marques

This list is only for those special single-vehicle marques which are eponymous, that is named for their only intended vehicle.

Ford: After the Ford Model T became popular, and for decades after Model T production ended, many Americans called full-size Ford models "the Ford," whether or not they had model names [1].

The Hummer H1 was retroactively given that designation when AM General introduced the H2. Previously, the car was simply known as Hummer or Humvee.

Imperial was a separate marque off and on. The vehicle has just as often been sold as a Chrysler.

The modern MINI car is its own marque of BMW; The Cooper name is a trim level. BMW reportedly plans to expand MINI into a full marque in the future, but it is currently the only eponymous marque sold in the United States.

Saturn sold coupé (SC), sedan (SL), and station wagon (SW) versions of a single vehicle. Though they did have model names, the company encouraged calling them "Saturns" and considered them a single eponymous model. All three were virtually identical. Today, Saturn is a much more traditional marque.

Smart was a separate marque with just its one eponymous microcar. Later, the marque was expanded and the initial car renamed the Fortwo to make room for the Forfour and Formore.

Valiant was a separate marque for 1960 before the vehicle was reassigned to Plymouth. For many years after, it teetered between model name and marque in Australia. The same goes for Oldsmobile's Cutlass and Aurora, and Ford's Thunderbird.

In the 1970s, the top Chrysler model in Australia was called The Chrysler by Chrysler.

The Portuguese Portaro and Spanish Hisparo had no model names, being Daihatsu-powered export versions of the Aro 24 Series.

Smaller manufacturers sometimes have no need to give other names to their models. That is the case of the original Venturi range, the Hommel and the Gillet Vertigo, which is simply known as Vertigo.

With the rebadging of GM Daewoo models as Chevrolets in most of the world, Corvette becomes a single-vehicle marque outside the United States.

Range Rover has been used as a separate single-model marque under the Land Rover company in some markets.

AC Cars sold its Ace and Aceca without any marque at all. In fact, the correct pronunciation of these cars, according to a 1959 issue of Road & Track is "A-See" and "A-See-Ka", meaning the Ace would be pronounced the same as the builder, AC.

Multi-marque models

Models are often sold under different marques in different markets, and are sometimes moved from marque to marque, especially when the former marque disappears. But the case of the same vehicle (with the same model name) being sold under multiple marques in the same market and model year is much more unusual.

The Colt was both a Dodge and Plymouth, though Plymouth previously used the name, Champ. Mitsubishi Motors, maker of the Colt, previously used this name for the entire marque, making the Colt an eponymous model as well. Colt continues to be the name for Mitsubishi's operations in many countries, including the United Kingdom.

The Neon was available from Dodge and Plymouth, and outside the USA, as a Chrysler.

The Conquest was a rebadged Mitsubishi Starion sold from 1983 to 1989 by the Chrysler Corporation. From 1983 to 1986, the Conquest was sold under both the Dodge and Plymouth names, until 1987 when it was only sold as a Chrysler.

DaimlerChrysler sells the Sprinter van under the Freightliner, Dodge, and Mercedes-Benz brands in many markets.

The original Suburban from General Motors was sold under both the Chevrolet and GMC marques. In the 1990s, it was also sold as a Holden.

The original Mini was sold at the same time as Morris Mini and Austin Mini in the European market.

The Russian Oka minicar is sold by both Lada and Kamaz, as well as a special version for handicapped drivers marketed by SeAZ.

The BMC "1100" (and later 1300) was sold under the Austin, Morris, MG, Riley and Wolseley marques.

In general most British Motor Corporation vehicle had a common chassis and mechanics and only badges or slight bodywork/engine differences. This carried over into the British Leyland period to some extent.

Both the Austin and Morris versions of the BMC "landcrab" were known as the "1800".

Unrelated models

Sometimes, automakers use the same marque and model name on two unrelated models in the same market and model year.

The best current example is the current Chrysler Sebring. The coupé is based on the Mitsubishi Galant while the sedan and convertible are based on Chrysler platforms. Despite the name, they share very few components.

Oldsmobile sold four quite different vehicles in the late 1980s under the Cutlass name - the Cutlass Calais, Cutlass Ciera, the Cutlass Cruiser wagon and the Cutlass Supreme.

The Jeep Cherokee and Grand Cherokee of the late 1990s shared very few parts. This was a repeat of the marque's use of Wagoneer and Grand Wagoneer in the previous decade.

The Mitsubishi Pajero/Montero and Pajero/Montero Sport are entirely different vehicles, and unrelated to the Pajero Mini and Pajero Pinin/Montero iO.

There is little in common between the Nissan Pathfinder and Pathfinder Armada. Nissan decided to drop the Pathfinder name from the Armada shortly after the vehicle's launch, but the Pathfinder badge remained for model year 2004.

The Ford Transit Connect has nothing in common with the Ford Transit apart from the name.

It is common for a previous special model (especially a convertible or other low-volume style) to continue in production even after the rest of the line has been converted to a new platform. Examples include the Cabrio version of the VW Golf, the 2004 Ford F-150 Heritage, and the 1983 Toyota Corolla Levin.

Likewise, a derivation has preceded the base model's release and was sold alongside its predecessor, case of the Ford Focus C-MAX mini-MPV, sold alongside the Focus' first generation for a year.

In Australasia, the Japanese/European Honda Accord sedan is sold alongside its American Accord sedan "cousin", although both have different platforms. The former is called the Accord Euro.

There is not much in common between the Japanese Suzuki Wagon-R and Wagon-R Solio (this one the Wagon-R proper in other markets). The same happened to the Suzuki Jimny and the Suzuki Jimny Sierra SUV (the last one using the Jimny name in Europe).

In most markets, Toyota uses the Land Cruiser name for two distinct models, the KZJ120 (the "regular" Land Cruiser or sometimes Land Cruiser Prado) and the HDJ100 (usually called the Land Cruiser 100 or Land Cruiser Amazon, equivalent to the American Land Cruiser).

In 1976, Dodge marketed two intermediate coupés with different bodies under the Charger badge, one of which had previously been the Dodge Coronet coupe.

The Ford Motor Company has used the "Zephyr" nameplate on different vehicles in all three domestic lines of cars — as a Ford in the 1930s, a Lincoln, and Mercury as well as in the UK from 1950 to 1971 with the Ford Zephyr.

The 2006 Land Rover Range Rover Sport shares its platform with the Discovery/LR3 rather than the Range Rover as might be expected from the name.

Production of the Chevrolet Vega station wagon continued for 1978 and 1979 after the demise of the rest of the model line, rebadged as the Chevrolet Monza wagon but unrelated to the rest of the Monza line.

Identical models

Other times, automakers will use two (or more) different model names for the same vehicle.

In the 1990s, after changing the name twice in a decade, Oldsmobile sold one vehicle as three different models - the 88, LSS, and Regency.

At the same time, Buick sold one vehicle with two names, Regal and Century.

The 1970½ Ford Falcon and 1970 Fairlane and Torino were versions of the same car.

Cadillac's Fleetwood and DeVille were two badges for the same vehicle from 1987 through 1992.

In South Korea, the Kia Optima is sold both as Optima and Regal. The same happens to the Kia Carens, also sold as X-Trek.

In Japan, the Toyota Corolla RunX differs from the Toyota Allex on minimal design aspects. The same happens (or happened) to the Japanese company's Allion/Premio, Noah/Voxy, Progres/Brevis, Tercel/Corsa/Corolla II and Cressida/Mark II/Cresta/Chaser. For some years in the 1990s, the Toyota Corolla and Sprinter were identical, too, though in most years there were body differences.

In Australia, there were only trim differences between the Holden Belmont, Kingswood and Premier (and before that, the Holden Standard and Special). The same applied to its rivals, the Ford Falcon and Ford Fairmont, there. Today, Holden officially badges its Commodore, Berlina and Calais as separate models.

Nissan, and its predecessor Prince, sold its large car as both the Cedric and the Gloria in Japan.

In the 1980s, the Pulsar, Langley and Liberta Villa were practically the same car.

The second generations of the Audi 80 and Audi 100 had identical models (with different engines) called Audi 90 and Audi 200.

Racing homologation specials

Some manufacturers have occasionally built limited editions of a few models in order to obtain a minimum production requirement for motor racing.

Alfa Romeo produced a Turbodelta version of the Alfetta for FIA Group 4.

Audi developed the Audi Quattro model for the Group B class in the World Rally Championship.

BMW created a limited run of the BMW M3 Sport Evo with a 2.5 L engine for the Group A rules in the European Touring Car Championship.

Citroën created the limited-production BX 4TC for Group B rallying.

Fiat created a coupé version of the Fiat 131 powered by a 2.0 L DOHC engine for FIA Group 4.

Ford] is widely considered to be an expert on homologation specials, starting with the Escort RS1600 Mk.I powered by a 1601 cc Ford BDA engine, small enough so it could be enlarged to 2.0 L in Groups 2 and 4 and retain low weight. In the 1980s, Ford was one of the makers that created a Group B-specific car, in this case the RS200. Later, both Ford Sierra Cosworth (the Mk.I RS500 and the Mk.II RS 4x4) were produced so the company could be competitive in FIA Group A touring car racing and world rallying. Likewise, the same happened to the Escort Cosworth, which had nothing to do with the Escort at all.

Lancia also had some expertise in this department. Both the Lancia Stratos and 037 Rally were created to win rallies in FIA Group 4. The italian make would also create the Delta S4 for Group B, and, to replace this outlawed class, the Delta Integrale.

Mercedes-Benz came up with the AMG Evolution II version of the 190 E to have a 2.5 L car that could go up against the BMW M3. The low-production Mercedes-Benz CLK-GTR was developed specifically to race in the FIA GT Championship even though the 25 road cars were delivered only after the 1998 season when the series was discontinued due to lack of remaining competitors

MG Rover started early, in its BMC days, with the powerful Cooper versions of the Mini. Later, in an attempt at returning to world rallying, the PRV-powered MG Metro 6R4 would appear... and flop.

Mitsubishi is no stranger to the world of homologation specials. Starting with the Starion 4WD, moving on to the Galant VR-4, and finally, every incarnation of the Mitsubishi Lancer Evolution, were created, sales success nonwithstanding, to keep Mitsubishi going on in the WRC.

Nissan succumbed as well to the attraction of the WRC, with the 4WD turbocharged Sunny GTi-R. The first two generations of the Skyline GT-R were also homologated to create an unbeatable car in Group A touring cars. And finally, Tom Walkinshaw Racing once developed the prototype-like R390 in the permissive GT1 regulations in the FIA, racing even though the car never actually achieved the required production minimums.

Opel has created a variety of versions, including the Cosworth-powered versions of the Ascona 400 and Manta 400 for world rallying, the limited-edition Omega Evo.500 for the DTM, and the Astra OPC, for FIA Group N 2000 rules.

Peugeot was another one to run in Group B, with the successful 205 T16 which would later be converted to Dakar-spec. More recently, in order to obey minimum length regulations for the WRC, the french automaker created the awkward 206 GT with enlarged bumpers.

Porsche's history with homologation specials begins with the 934, a special version of the 911 Turbo for Group 4 racing, followed by the Group B 959. The 924 Carrera GT was developed with the IMSA Championship in mind. More recently, the German company came up with the 911 GT1 (closer to the 962 than to the road-going 911), and the stripped-down 996 GT3-RS, both for FIA GT.

Renault's most famous endeavor in the homologation specials is the 5 Maxi Turbo, a mid-engined 160 hp beast created for FIA Group 4. In the early 1990s, Renault produced a limited edition of the Clio Williams, with a 2.0 L engine, for the then new Formula 2 category in the WRC.

Subaru has assumed the position of Mitsubishi's main competitor in the Group N rallying arena, with the WRX and WRX STi versions of the Impreza.

Toyota concentrated its efforts on the World Rallying Championships, with three GT-4 generations of the Toyota Celica.

Volkswagen is best known for a special version of the Golf G60, called G60 Rallye, with 4WD and engine capacity reduced to 1763 cc (to fit within the 3000 cc weight limit, while most other Group A cars had to run in the 3500 cc class).

Not for sale

Some car models have been produced but never offered for retail sale:

The American Chevrolet Classic is only sold for rental car fleets. The Chevrolet Beretta was also a rental-only model for its first year of production. The General Motors EV1 was only ever leased, and all have been removed from consumer hands.

The London Taxis International TX series is sold to London cabbies, and in limited exports to Japan, but is not offered for retail sale. Its predecessors, the LTI Fairway/Austin FX4, the Austin FX3 and others were also not offered for retail sale but there was a retail version of each called the FL1 and FL2. The direct competitors, the Beardmore Paramount and the Winchester taxi were also restricted to the licenced taxi market.

The Metrocab, formerly the MCW Metrocab, is not offered for retail sale.

Grumman Long Life Vehicle, the right-hand drive U.S. Post Office vehicle

Ford Flexible Fuel Vehicle, U.S. Post Office replacement for the LLV

The Dodge Neon supplied to automobile rental fleets has a three speed automatic transmission unobtainable in the model for retail sale, which is equipped with a four speed automatic.

See also

- Lists of automobiles
    - List of unrelated vehicles with identical nameplates for autonomous companies sharing identical nameplates.

Automobile model nameplates with a discontiguous timeline

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Here is a* list of automobile model nameplates that have a discontiguous timeline of production*:

An italicized X will denote that the X means various affixes rather than the X being part of the title.

BMW 6 Series
Buick Century
Buick Roadmaster
Chevrolet Camaro
Chevrolet El Camino
Chevrolet Impala
Chevrolet Malibu
Chevrolet Monte Carlo
Chevrolet Nova
Chrysler 300x
Chrysler Imperial
Chrysler Town & Country
Dodge Challenger
Dodge Charger
Dodge Lancer
Dodge Magnum
Dodge Monaco
Fiat Croma
Ford Fairlane (1950s, 2008)
Ford Thunderbird
Kia Pride
Kia Sportage
Lincoln Continental
Lincoln Zephyr (1936, 2006)
Mercury Capri
Mercury Cougar
Mercury Montego
Mercury Monterey
Nissan Z-car
Opel Tigra

Plymouth Duster
Pontiac LeMans
Pontiac Grand Am
Pontiac GTO
Pontiac Tempest
Volkswagen Beetle/Volkswagen New Beetle (see notes)

Near-miss

These vehicles may be made by the same parent/contract company and use the same nameplate but may have a different brand name.

Dodge Aspen, Chrysler Aspen
Dodge Raider, Mitsubishi Raider
Dodge Neon, Chrysler Neon, Plymouth Neon

Notes

The Volkswagen Beetle/New Beetle: discontinuous in major markets, though the "legacy" Beetle continued production for sale in Mexico. Not a true discontiguious name because the original model was never officially sold as a "Beetle."

The Mercury Monterey was reincarnated as a minivan.

The Chrysler Town and Country was reincarnated as a station wagon in 1965, then as a minivan in 1990.

Nissan's Z-car was discontinued during the late 1990s, and resumed production with the 2003 350Z.

Chevrolet is the current champion of this list.

Automotive superlatives

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This page lists superlatives of the automobile industry - that is, the smallest, largest, fastest, lightest, best-selling, and other such topics.

In order to keep the entries relevant, the list (except for the Firsts section) will be limited to automobiles built after World War II. Many odd vehicles emerged in the early days of the automobile industry.

The list will also be limited to production road cars that meet the following conditions:

1. 20 or more examples must have been made by the original vehicle manufacturer and offered for commercial sale to the public in new condition - cars modified by either professional tuners or individuals are not eligible
2. They must be street-legal in their intended markets and capable of passing any tests or inspections required to be granted this status
3. They must have been built for retail sale to consumers for their personal use on public roads - no commercial or industrial vehicles are eligible

Some notes about units of measurement used herein

Engine capacity/displacement

- 1 L = 1,000 cubic centimeters = 61.0237 cubic inches
- 1 in^3 = 16.3871 cubic centimeters

Engine output

Power

- 1 horsepower (hp) = 1 brake hp (hp) = 1.0139 metric hp (PS) = 0.7457 kilowatts (kW)
- 1 metric hp = 0.9863 hp = 0.7355 kilowatts
- 1 kilowatt = 1.3410 hp = 1.3596 metric hp

Torque

- 1 pound-foot of torque (ft·lbf) = 1.3558 newton-meter (N·m)
- 1 newton-meter = 0.7376 pound-feet

Fuel economy

- 1 mile per US gallon = 1.2009 miles per imperial gallon = 0.4252 kilometers per L = 235.208 liters per 100 kilometers
- 1 mile per imperial gallon = 0.8327 miles per US gallon = 0.3540 kilometers per L = 282.4731 liters per 100 kilometers
- 1 kilometer per L = 2.3521 miles per US gallon = 2.8247 miles per imperial gallon
- 1 L per 100 kilometers = 235.208 miles per US gallon = 282.4731 miles per imperial gallon

Power to weight or weight to power

- 1 hp per short ton = 1.12 hp per long ton = 0.82199 kilowatt per metric ton
- 1 hp per long ton = 0.89286 hp per short ton = 0.76890 kilowatt per metric ton
- 1 kilowatt per metric ton = 1.2166 hp per short ton = 1.3625 hp per long ton
- 1 pound per hp = 0.60828 kilogram per kilowatt

Engine capacity

- Straight-3 (I3)

- Smallest I3 engine (gasoline) - 0.36 L (357 cc/22 in^3) - 1967 Suzuki Fronte
- Smallest I3 engine (Diesel) - 0.8 L (799 cc/48.8 in^3) - 2000 Smart Fortwo cdi
- Largest I3 engine (gasoline) - 1.2 L (1198 cc/73 in^3) - 2002 Volkswagen Polo/Seat Ibiza 1.2
- Largest I3 engine (Diesel) - 1.8 L (1779 cc/109 in^3) - 1984 Alfa Romeo 33 1.8 TD

* Straight-4 (I4)
  - Smallest I4 engine (gasoline) - 0.36 L (356 cc/21.7 in^3) - 1963 Honda T360 AS250E
  - Smallest I4 engine (Diesel) - 1.25 L (1248 cc/65 in^3) - 2003 Fiat Panda Multijet
  - Largest I4 engine (gasoline) - 3.2 L (3188 cc/194.5 in^3) - 1961 Pontiac Tempest 195
  - Largest I4 engine (Diesel) - 4.3 L (4334 cc/278 in^3) - Isuzu NKR 4HF1
* V4 engine
  - Smallest V4 engine - 0.9 L (903 cc/55 in^3) - 1939 Lancia Ardea V4
  - Largest V4 engine - 2.6 L (2568 cc/157 in^3) - 1930 Lancia Lambda V4
* Straight-5 (I5)
  - Smallest I5 engine (gasoline) - 1.9 L (1921 cc/117 in^3) - 1981 Audi 100 1.9 E
  - Smallest I5 engine (Diesel) - 2.0 L (1986 cc/121 in^3) - 1978 Audi 100 2.0 D
  - Largest I5 engine (gasoline) - 3.5 L (3464 cc/211 in^3) - 2004 GM Atlas L52 3500
  - Largest I5 engine (Diesel) - 3.5 L (3469 cc/212 in^3) - 1990 Land Cruiser 1PZ Diesel
* Straight-6 (I6)
  - Smallest I6 engine (gasoline) - 1.5 L (1488 cc/91 in^3) - 1948 Maserati A6G
  - Smallest I6 engine (Diesel) - 2.4 L (2383 cc/145 in^3) - 1979 Volvo 240 D24
  - Largest I6 engine (gasoline) - 4.9 L (4917 cc/300 in^3) - 1965 Ford] 300
  - Largest I6 engine (Diesel) - 5.9 L (5883 cc/359 in^3) - 1989 Dodge Ram 250/350 Cummins B series turbodiesel
* V6 engine
  - Smallest V6 engine (gasoline) - 1.6 L (1597 cc/97 in^3) - 1992 Mitsubishi Lancer 6A10
  - Smallest V6 engine (Diesel) - 2.5 L (2496 cc/152 in^3) - 1996 Audi/VW 2.5 TDI (in multiple cars)
  - Largest V6 engine (gasoline) - 5.8 L (5755 cc/351 in^3) - 1966 GMC 1000-3500 series 351E 60° V6
  - Largest V6 engine (Diesel) - 4.3 L (4304 cc/262 in^3) - 1982 GM LT6

- V8 engine
  - Smallest V8 engine (gasoline) - 2.0 L (1990 cc/121 in^3) - 1975 Ferrari 208 GT4
    - Others: ATS/BRM/Coventry Climax and Ferrari Formula One 1.5 L V8 engines (none of them used in a road car)
  - Smallest V8 engine (Diesel) - 3.3 L (3328 cc/203 in^3) - 2000 Audi A8 3.3 TDI
  - Largest V8 engine (gasoline) - 8.1 L (8194 cc/500 in^3) - 1970 Cadillac Eldorado 500
    - Honorable mention: 9.3 L (9373cc/572in^3) - (2003 Chevrolet crate motor)
  - Largest V8 engine (Diesel) - 7.3 L (7275 cc/444 in^3) - 1997 Ford F250 Power Stroke
    - Smallest American V8 engine - 3.4 L (3391 cc/207 in^3) - 1996 Ford Taurus SHO V8
    - Largest small-block V8 engine - 7.0 L (7008 cc/428 in^3) - 2006 Chevrolet Corvette Z06
- V10 engine
  - Smallest V10 engine - 4.9 L (4921 cc/301 in^3) - Volkswagen Touareg V10 TDI
  - Largest V10 engine - 8.3 L (8277 cc/505 in^3) - 2003 Dodge Viper
- V12 engine
  - Smallest V12 engine - 2.0 L (1995 cc/122 in^3) - 1948 Ferrari 166 Inter Colombo
  - Largest V12 engine - 7.3 L (7291c cc/445 in^3)- 2002 Pagani Zonda C12S AMG-Mercedes
    - Honorable mention: The TVR Cerbera Speed 12 prototype had 7730 cc but the car never entered production.
- W12 engine
  - Largest W12 engine - 6.0 L (6000 cc/366 cu in^3) 2005 Audi A8
- V16 engine
  - Largest V16 engine - 7.4 L (7406 cc/452 in^3)- 1930 Cadillac V16
    - Honorable mention: 6.0 L (6000 cc/366 cu in^3) 1995 Cizeta-Moroder V16T (This motor was 2 V8's end-to-end that shared the same timing chain)
    - Honorable mention: 13.6L (13600 cc/829 cu in^3) 2003 Cadillac Sixteen (Concept Car)
- W16 engine
  - Largest W16 engine - 8.0 L (7993 cc) - 2005 Bugatti Veyron 16.4

Dimensions

Overall

- Shortest (3 wheels) - 1340 mm (52.8 in) - 1962 Peel P50
- Shortest (4 wheels) - 2286 mm (90 in) - 1956 Isetta
- Longest
  - Overall - 6342 mm (249.7 in) - 2005 Dodge Ram Quad Cab
    - Honorable mention - 6680 mm (263.0 in) - 2005 Dodge Sprinter High Roof (Not a consumer vehicle)
  - Passenger car - 6,426 mm (253 in) - 1975 Cadillac Fleetwood Seventy-Five
    - Honorable mention - 6852 mm (269.8 in) - Checker Aerocar (Not a consumer vehicle)
    - Honorable mention - 6.4 m (21 ft) Bugatti Royale (Few produced)
- Lowest - 102 cm (40 in) - 1966 Ford GT40
  - Honorable mention - 37 in (940 mm) - Concept Centaur GT (Not a production car)
- Highest - 79.4 in (2017 mm) - 2005 Chevrolet Express/GMC Savana 1500 passenger van
  - Honorable mention - 103.6 in (2631 mm) - 2005 Dodge Sprinter High Roof (Not a consumer vehicle)

Wheelbase

- Shortest wheelbase - 1500 mm (59.1 in) - 1956 Isetta
  - Others:
    - 1800 mm (70.9 in) - 2003 Suzuki Twin
- Longest wheelbase - 4140 mm (163.0 in) - 2005 Ford F-150 SuperCab
  - Honorable mention - 3880 mm (153 in) - ZIL-41047 (Longest-wheelbase car)
  - Honorable mention - 4475 mm (176.2 in) - 2005 Ford F-350 Super Duty Chassis Crew Cab (Not a passenger vehicle)
  - Honorable mention - 4800 mm (189 in) - Checker Aerocar (Not a consumer vehicle)

Track

- Widest - 71.0 in (1803 mm) - 2005 GMC Sierra Denali (rear)
  - Honorable mention - 66.7 in (1694 mm) - 2005 Maybach 57 and 62 (rear)
- Narrowest - 52.2 in (1326 mm) - 2005 Honda Insight (rear)

Weight

- Lightest passenger vehicle (3 wheels) - 59 kg (132 lb) DIN - 1962 Peel P50

- Lightest passenger vehicle (4 wheels) - 350 kg (770 lb) DIN - 1956 Isetta
  - Honorable mention - 370 kg (816 lb) DIN - 1992 LCC Rocket
- Heaviest passenger vehicle - 3550 kg (7825 lb) curb weight - ZIL-41047

Other

- Largest brake disc - 405 mm (16 in) - 2004 Bentley Continental GT

Power

Most power

- Petrol/gasoline - (naturally-aspirated) - 485 kW (660 PS/651 hp) - 2003 Ferrari Enzo V12 engine
  - Honorable mention: The TVR Cerbera Speed 12 prototype produced an estimated 701 kW (953 PS/940 hp) (the central shaft of TVR's dynamometer snapped before they could complete the test) but the car never entered production
  - Front-wheel drive: 226 kW (307 PS/303 hp) - GM LS4, 2005 Chevrolet Impala SS and Monte Carlo SS
    - Honorable mention: 287 kW (385 hp) (gross) 1966 Oldsmobile Toronado, less net power than Impala/Monte Carlo
- Petrol/Gasoline - (forced-induction) - 736 kW (1001 PS/987 hp) - 2005 Bugatti Veyron 16.4 turbocharged W16 engine.
- Diesel 243 kW (330 PS/326 hp) - BMW M67, 2006 BMW 745d

Most torque

- Petrol (naturally-aspirated) - 760 N·m (561 ft·lbf), 2005 Pagani Zonda F 7.3 L (445 in^3) V12 engine.
- Petrol (forced-induction) - 1250 N·m (922 ft·lbf), 2005 Bugatti Veyron 8.0 L (488 in^3) turbocharged W16 engine.
- Diesel - 826 N·m (609 ft·lbf), 2005 Dodge Ram 5.9 L Cummins 610 turbocharged I6 engine

Most specific power (power to weight ratio)

- 100–200 hp — 288.75 hp/metric ton (7.635 lb/hp) — Lotus 340R, 190 hp (142 kW) and 658 kg (1451 lb)
- 200–300 hp — 657 hp/short ton (3.04 lb/hp) — Ariel Atom 2 supercharged 300 hp (224 kW) and 456 kg (1005 lb)

- 300–400 hp — 381 hp/metric ton (5.79 lb/hp) — 2003 TVR Tuscan S 400 hp (298 kW) and 1050 kg (2315 lb)
- 400+ hp — 620 hp/short ton (3.2 lb/hp) — 2004 Koenigsegg ccR supercharged V8 engine 806 hp (468 kW) and 1180 kg (2513 lb)

Most specific engine output (power per unit volume)

- Naturally-aspirated rotary engine - 140.5 kW (191.1 PS/188.8 hp) /liter - Mazda RX-8 Renesis (184 kW (250 PS/247 hp) JIS 1.3 L)
- Forced-induction rotary engine - 157.4 kW (214.1 PS/212.3 hp)/liter - 2003 Mazda RX-7 13B-REW (206 kW (280 PS/276 hp JIS 1.3 L)
- Petrol/Gasoline (naturally-aspirated) piston engine - 92.1 kW (125.2 PS/123.7 hp)/litre - 2000 Honda S2000 F20C (184 kW (250 PS/247 hp) JIS 2.0 L I4)

  Note: This output is available in the Japanese market only
- Honorable mention: 168 hp (125.3 kW)/litre - 2002 Radical Motorsport SR3 (252 hp (184 kW) 1.5 L I4 engine) - (Note: The Radical's status as a production car is disputed, and numbers refer to the competition version, there is no official data for the road version)
- Petrol/Gasoline (forced-induction) piston engine - 149 kW (203 PS/200 hp)/litre 400hp - 2005 Mitsubishi Lancer Evolution VIII FQ400 (298 kW (405 PS/400 hp) 2.0 L I4 (Note: the FQ400's status as a "production car" is disputed)
  - Honorable Mention: 126 kW (171.4 PS/169.7 hp)/litre (441 kW (600 PS/594 hp) DIN 3.5 L V12 quad-turbo) - Bugatti EB110 Super Sport
  - Honorable mention: 179.3 kW (243.8 PS/240,5 kW)/litre (537 kW (730 PS/720 hp) 3.0 L flat-6 twin-turbo) - Dauer 962 LeMans (this is a road version of the Group C Porsche 962)
- Diesel (naturally-aspirated) - 33.4 kW (45.4 PS/44.7 hp)/litre (100 kW (136 PS/134 hp) DIN 3.0 L I6) - 1995 Mercedes E 300 D
- Diesel (forced-induction) - 66.8 kW (90.9 PS/89.5 hp)/litre (200 kW (272 PS/268 hp) DIN 3.0 L I6 twin-turbo) - 2005 BMW 535d
  - Honorable Mention: 81.6 kW (111 PS/109.5 hp)/litre (156 kW (212 PS/209 hp) 1.9 L I4 twin-turbo) - 2003 Opel Vectra OPC Concept

Most specific torque (torque per unit displacement)

- Petrol (naturally-aspirated) - 114 N·m (84 ft·lbf)/litre (370 N·m (273 ft·lbf)) - 2003 BMW M3 CSL
- Petrol (forced-induction) - 216.6 N·m (159.5 ft·lbf)/litre (432 N·m (318 ft·lbf)) - 2005 Subaru Impreza S204 (japanese market)
  - Honorable mention: 233.6 N·m (172.3 ft·lbf)/litre - 700 N·m/516 ft·lbf Dauer 962 LeMans, road-going versin of the Group C Porsche 962

- Petrol (naturally-aspirated rotary engine) - 170.8 N·m (126.0 ft·lbf)/litre (222 N·m (164 ft·lbf)) - 2005 Mazda RX-8
- Petrol (forced-induction rotary engine) - 226.3 N·m (166.9 ft·lbf)/litre (294 N·m (217 ft·lbf)) - 1995 Mazda RX-7 Turbo
- Diesel - 187.1 N·m (138 ft·lbf)/litre (560 N·m (413 ft·lbf)) - 2005 BMW 535d
  - Honorable mention: 210.5 N·m (154.8 ft·lbf)/litre (400N·m (294 ft·lbf)) - 2003 Opel Vectra OPC Concept

Least specific engine output (power per unit volume)

- Petrol - 22.5 hp (16.8 kW)/litre, 1973 Chevrolet 307 5.1 L V8, 115 hp (85.8 kW)
- Diesel - 18.4 hp (13.7 kW)/litre, 1980 Oldsmobile LF9 engine 5.7 L V8, 105 hp (78.3 kW)

Performance

- Highest USA EPA mileage - 61/66 mpg (3.9/3.6 L/100 km) - 2005 Honda Insight 5-speed
- Lowest EU average fuel consumption - 2.99 L/100 km (78.6 mpg (US)) - 2002 VW Lupo 1.2 TDI 5-speed
  - Honorable mention: 2.5 L/100 km (94 mpg (US)) - 2002 Opel Eco Speedster Concept (Note: the Eco Speedster is not a "production car")
- Quickest 0-60 mph (roughly equal to 0-100 km/h):
  - 2.5 s - 2006 Bugatti Veyron
  - Sports car (4 seat) - 3.8 s - 2000 TVR Cerbera (4.5 L version)
  - 4-door car - 3.5 s - 2005 Mitsubishi Lancer Evolution VIII FQ400 2.0 L (Note: the FQ400's status as a "production car" is disputed)
  - Pickup truck - 4.9 s - 2004 Dodge Ram SRT-10
    - Honorable mention: 1991 GMC Syclone - most reliable sources suggest 5.0-5.5 seconds, but 4.6 seconds is often quoted
- Quickest 0-100-0 mph:
  - Sports car (2 seat) - 11.5 sec - McLaren F1 LM (Note: this is the best 0-100-0 time for an undisputed production car)
    - Honorable mention: 9.8 seconds - 2005 Ultima GTR-640**[1]** - (Note: production numbers for GTR-640 are not available and the GTR's status as a "production car" is disputed)
    - Honorable mention: 10.73 sec - 2004 Caterham 500 - (Note: the Caterham's status as a "production car" is disputed)
    - Honorable mention: 10.88 sec - Ariel Atom 2 300 Supercharged - (Note: in a 2005 issue of the car magazine, Autocar, the Ariel Atom 2 was tested and completed the 0-100-0 run in the time shown)
- Highest top speed:

- Sports car - 407 km/h (253 mph) - Bugatti Veyron 16.4[2]
- 4-door car - 312 km/h (195 mph) - 2005 Bentley Continental Flying Spur
- Pickup truck - 249 km/h (154.6 mph) - 2004 Dodge Ram SRT-10

Sales

See also **List of bestselling vehicle nameplates**

- Best-selling models:
  - Best-selling car nameplate - Toyota Corolla (more than 32,000,000 sold in nine generations since 1966)
  - Best-selling vehicle nameplate - Toyota Corolla (more than 32,000,000 sold in nine generations since 1966)
  - Best-selling single model - Volkswagen Beetle (more than 21,000,000 of the same basic design sold worldwide between 1947 and 2003)
  - Best-selling sports car - Ford Mustang (more than 7,800,000 of five generations sold between 1964 and 2004)
  - Best-selling 2-seat car - Mazda Roadster/MX-5/Miata (more than 700,000 of two generations sold between 1989 and 2004)
  - Best single-year sales - 9,395,118 - 2004 Ford F-150 (23 years in a row as the top-selling single vehicle, 28 years as the best-selling truck in the USA)
  - Best-selling American Sedan - Ford Taurus (more than 7,000,000 sold in 4.5 generations sold between 1986 and 2006)
  - Best Selling Minivan - Dodge Caravan, over 11,000,000 sold.
- Lowest-production models: (excluding limited-production vehicles)
  - Pickup truck - avg. 223 per month, Lincoln Blackwood (3,356 sold in 15 months)
  - Sports car - avg. 6 per month, Toyota 2000GT (337 sold in 5 years)
    - Honorable mention: avg. 79 per month, Bricklin SV-1 (2,857 sold in 3 years)
  - SUV - avg. 4 per month, Lamborghini LM002 (301 sold in 6 years)
    - Honorable mention: avg. 200 per month, Suzuki X-90 (7,205 sold in 3 years)
- Marques and manufacturers:
  - World's top-selling manufacturer, 2005 - Toyota*, General Motors, and Ford Motor Company
  - United States top-selling marque, 2005 - Chevrolet Total numbers stated to be just below 400,000 units

For first ten months of 2005.*

Firsts

Full-production vehicles are listed here. Many were preceded by racing-only cars.

- First automobile manufacturer - Panhard et Levassor (1889) (followed by Peugeot in 1891)
- First standardized automobile - Benz Velo (1894) or Duryea Motor Wagon (1893)
- First mass-produced automobile - Oldsmobile Curved Dash (1901)
    - Honorable Mention - Ford Model T, first car produced on a moving assembly line.

Engine types

- V4 engine
    - First V4 - 1922 Lancia Lambda
        - Honorable mention - 1903 Marmon (few produced)
- Straight-6
    - First 6-cylinder - 1903 Napier
- V6 engine
    - First V6 - 1950 Lancia Aurelia
        - Honorable mention - 1904 Marmon (few produced)
    - First American V6 - 1962 Buick Special
- Straight-8
    - First I8 - 1919 Isotta-Fraschini
        - Honorable mention - 1920 Duesenberg
- V8 engine
    - First V8 - 1910 De Dion-Bouton
        - Honorable mention - 1904 Marmon (few produced)
    - First mass-produced V8 - 1914 Cadillac Type 51
    - First mass-produced monobloc V8 - 1932 Ford Model B
    - First OHV V8 - 1949 Oldsmobile/Cadillac (Not the same engine, but both released the same year)
- V10 engine
    - First V10 - 1992 Dodge Viper
    - First V10 sedan - 2002 Volkswagen Phaeton
- V12 engine
    - First V12 - 1916 Packard "Double-Six"
- W12 engine
    - First W12 - 2002 Volkswagen Phaeton (5998cc W12 engine - four banks of three cylinders)
- V16 engine
    - First V16 - 1930 Cadillac V-16
        - Honorable mention - 1931 Marmon and 1932 Peerless
- W16 engine
    - The Bugatti Veyron is expected to be the first production car from a major manufacturer to use a W16 engine, however, several smaller firms have either developed prototyped or produced small numbers of cars - including

the Jimenez Novia which used a 4.1 L W16 based on four I4 Yamaha motorcycle engines.

- W18 engine
    - No production cars yet are known to use a W-18 configuration, however Bugatti has experimented with both three-bank and four-bank designed for various concept cars.

Engine technologies

- First carburetor - 1896 Daimler
- First overhead cam engine - 1898 Wilkinson
- First DOHC engine - 1925 Alfa Romeo 6C (Peugeot had a DOHC multivalve Grand Prix car in 1913)
- First variable displacement engine - 1905 Sturtevant 38/45 six
    - Honorable mention - 1917 Enger Twin-Unit Twelve
- First twin-spark engine - 1921 Bentley 3 Litre
- Multi-valve engines
    - First 3-valve engine - 1924 Bugatti Type 35 (Type 18 had a 3-valve in 1912, but only 6 or 7 were made. Type 35 used the engine from the 1922 Type 29 racing car.)
    - First 4-valve engine - 1921 Bentley 3 Litre
        - Honorable mentions - 1931 Bugatti Type 51 DOHC. An SOHC 4-valve engine appeared in 1910's Type 13 racing car, while a 4-valve straight-4 was also developed by Bugatti in 1914. The Linthwaite-Hussey Motor Company of Los Angeles manufactured and advertized a four-valve straight-4 engine in 1916.
    - First 5-valve engine - 1991 tie Bugatti EB110 3.5 L V12, Mitsubishi Minica Dangan ZZ .7L I4 and Toyota 4A-GE I4
    - First 6-valve engine - 1985 Maserati 2.0L V6 36V 261HP
    - First 3-valve Diesel - 1989 Citroën XM
    - First 4-valve Diesel - 1994 Mercedes-Benz E-Class
    - First multi-valve turbocharged engine - 1984 Saab 900 B202
- First carburetor air filter - 1915 Packard Twin Six
    - Honorable mention - 1922 Rickenbacker had a modern dry element
- First crankcase ventilation - 1926 Cadillac V8 engine
- First automatic choke - 1932 Oldsmobile
- First four-barrel carburetor - 1941 Buick
- Fuel injection
    - First FI engine - 1910 Adams Farwell Diesel
    - First non-Diesel FI engine - 1952 Gutbrod Superior
    - First gasoline direct injection - 1955 Mercedes-Benz 300SL
    - First electronic fuel injection - 1968 Bosch D-Jetronic - Volkswagen Type 3/Type 4
    - First Diesel direct injection engine - 1986 Fiat Croma TD

- First electronic gasoline direct injection - August 1996 Mitsubishi Galant/Legnum 4G93 GDI I4
- First turbocharged car - 1962 Oldsmobile F-85 Turbo Jetfire
  - Honorable mention - 1962 Chevrolet Corvair flat-6
- First variable-nozzle turbocharger - 1989 Shelby CSX
- First point ignition - 1910 Cadillac Model Thirty/Delco
- First electronic ignition - 1960 General Motors Delco
- First alternator - 1960 Chrysler Corporation, Plymouth Valiant
- First flat-engine - 1905 Knox
- First square engine - 1906 Premier
- First monobloc engine with removable cylinder head - 1908 Ford Model T
- First counterbalanced crankshaft - 1908 Mercer Type 35
- First split-plane crankshaft - 1923 Cadillac V8 engine
- First gas turbine car - 1950 Rover JET 1 (Experimental only; no gas turbine car ever reached real production)
  - Wankel engines
    - First Wankel engine - 1964 NSU Spider
    - First 2-rotor Wankel engine - 1965 Mazda Cosmo (60 preproduction examples were produced and registered)
      - Honorable mention - 1966 NSU Ro 80
    - First front-wheel drive Wankel engine - 1969 Mazda R130 Luce (Only FWD rotary vehicle ever produced)
    - First 3-rotor Wankel engine - 1991 Mazda Cosmo
      - Honorable mentions - 1969 Mercedes-Benz C111 and 1970 Felix Wankel-refitted Mercedes-Benz 300SL (Not production cars)
    - First turbo Wankel engine - 1982 Mazda Luce/Cosmo
  - First Miller cycle engine - 1996 Mazda Millenia
  - First Atkinson cycle engine - 2004 Toyota Prius
  - First Hydrogen vehicle - 2006 Mazda RX-8 (Japan commercial leases only)

Hybrid vehicles

- First gas-electric hybrid - 1899 Lohner-Porsche Mixte (about 300 produced)
- First modern hybrid car - 1997 Toyota Prius NHW10 (Japan)
- First hybrid bus - 1997 Hino (Japan)
- First all-wheel drive hybrid, first hybrid SUV - 2004 Ford Escape Hybrid
- First hybrid luxury car - 2005 Lexus RX 400h (introduced January 2004)
- First hybrid pickup truck - 2005 Chevrolet Silverado/GMC Sierra Hybrid (debated)

- First rear-wheel drive hybrid car - 2007 Lexus GS450h (on sale March 16, 2006 in Japan)
- First three-cylinder hybrid - 1999 Honda Insight
- First four-cylinder hybrid - 1997 Toyota Prius NHW10 (Japan)
- First six-cylinder hybrid - 2005 Lexus RX 400h (introduced January 2004)

Body

- First production closed-body car - 1910 Cadillac Model Thirty
- First monocoque - 1924 Lancia Lambda
  - Honorable mentions - 1917 Ruler Four (few produced), 1934 Citroën Traction Avant
- First coupé convertible - 1934 Peugeot 401 D Eclipse
- First safety windshield - 1948 Tucker Torpedo (popout safety glass) [3]
- First fiberglass body - 1953 Chevrolet Corvette and Kaiser Darrin
- First MPV - 1956 Fiat 600 Multipla
- First retractable hardtop - 1930s Lancia
  - Honorable mention - 1957 Ford Skyliner
- First hatchback - 1953 Aston Martin DB2/4
  - Honorable mentions - 1958 Austin A40 Farina, 1962 Innocenti Combinata, and 1965 Renault 16
- First fiberglass monocoque - 1959 Lotus Elite
- First SUV - 1942 Dodge Carryall
  - Honorable mention - 1957 Moskvitch 410 (first crossover SUV/XUV)
  - Honorable mention - 1980 AMC Eagle (popularised the crossover SUV/XUV)
- First carbon fiber monocoque - 1991 McLaren F1
- First aerodynamic design - Tie: 1934 Chrysler Airflow and 1934 Tatra T77

Transmission

- Manual transmissions
  - First synchronized transmission - 1929 Cadillac
  - First overdrive - 1934 Chrysler Airflow
  - First modern cone synchromesh transmission - 1952 Porsche 356
  - First 5-speed manual - 1953 Ferrari 212
  - First 6-speed manual - 1986 Honda Civic Wagon 4WD
    - Honorable mention - 1986 Porsche 959 (introduced at 1985 Frankfurt Motor Show but first customer deliveries were delayed until 1987)[4]
      - Honorable mention - 1957 Moskvitch 410/411
  - First 8-speed manual - 1960 Moskvitch 410/411
  - First 16-speed manual - 1913 David

- Automatic transmissions
    - First automatic transmission - May 1939 Oldsmobile Hydra-Matic (also the first 4-speed automatic)
        - Honorable mention - 1934 REO (a pair of self-shifting manuals)
        - Honorable mention - 1937 Oldsmobile Automatic Safety Transmission
    - First torque converter automatic - 1948 Buick Dynaflow
        - Honorable mention - 1949 Packard Ultramatic (torque converter automatic)
        - Honorable mention - 1946 Chrysler Presto-Matic (torque converter manual)
    - First non-planetary automatic - 1968 Honda Hondamatic
    - First 5-speed automatic - 1991 BMW E34 5-Series and E36 320i/325i ZF 5HP18
    - First 6-speed automatic - 2002 BMW E65 7-Series ZF 6HP26
        - Honorable mention - 1999 Jeep Grand Cherokee 45RFE had an automatic transmission with 3 planetary gearsets capable of six speeds, but only 5 were used, and the company advertized it as a 4-speed.
    - First 7-speed automatic - 2003 Mercedes-Benz 7G-TRONIC
    - First 8-speed automatic - 2007 Lexus LS 460
- First limited slip differential - 1956 Studebaker
- First continuously variable transmission - 1958 DAF 600 "A-Type"

Layout

- First RR car - 1896 Hertel
- First front-wheel drive - 1929 Cord L29
    - Honorable mention - 1900 Pennington and 1928 Alvis (did not sell more than 150 units)
    - Honorable mention - 1934 Citroën Traction Avant
- First transverse front-wheel drive - 1949 Saab 92
    - Honorable mention - 1959 Mini
    - First transverse FWD I5 - 1993 Volvo 850
    - First transverse FWD I6 - 1970 Austin Kimberley & Austin Tasman
        - Honorable mention - 1959 Saab Monster (Not a production vehicle)
    - First transverse FWD V8 - 1985 Cadillac DeVille
- First four-wheel drive vehicle - 1910 Caldwell Vale or 1911 Four Wheel Drive
- First all-wheel drive car - 1966 Jensen FF
    - Honorable mention - 1901 Lohner-Porsche (One produced), electric 4WD
    - Honorable mention - 1902 Jacobus Spyker (One produced), first mechanical 4WD

    - Honorable mention - 1932 Type 53 (Three produced)
    - Honorable mention - 1958 Citroën 2CV Sahara (Dual-engine all wheel drive)
- First FR transaxle - 1950 Lancia Aurelia (the 1914 Stutz Bearcat featured a primitive transaxle)
- First MR car - 1957 Zündapp Janus (or possibly the 1923 Benz Drop-Shaped racer)
- First MR AWD car - 1990 Panther Solo 2
    - Honorable mention - 1985 Ford RS200 (Homologation special, only 200 road cars produced for Group B regulations.)
    - Honorable mention - 1985 Peugeot 205 Turbo-16 (Homologation special, only 200 road cars produced for Group B regulations.)
    - Honorable mention - 1985 Lancia Delta S4 (Homologation special, only 200 road cars produced for Group B regulations.)
    - Honorable mention - 1985 Rover Metro 6R4 (Homologation special, only 200 road cars produced for Group B regulations.)
- First four wheel steering - 1985 Nissan Skyline HICAS
    - Honorable mention - 1970s Daimler-Benz offroad trucks
    - Honorable mention - April 1987 Honda Prelude 4WS
    - Honorable mentioned - 2002 Chevrolet Silverado

Suspension

- First torsion bar suspension - 1921 Leyland
- First front independent suspension - 1924 Lancia Lambda
- First hydraulic shock absorbers - 1933 Hudson (Monroe)
- First coil spring/shock absorber suspension - 1934 Cadillac, Chrysler, and Hudson
- First MacPherson strut suspension - 1949 Ford Vedette
- First Chapman strut suspension - 1958 Lotus Elite
- First air suspension - 1958 Cadillac Brougham
    - Honorable mentions - 1909 Cowley and 1933 Stout-Scarab (Firestone)
- First self-levelling suspension - 1955 Citroën DS
    - Honorable mention - 1954 Citroën Traction Avant 15HHydropneumatic
- First electronically-controlled suspension - 1985 Nissan Maxima (Japan-market model)
- First fully active suspension - 1991 Infiniti Q45 (renamed Q45a for 1992)
- First active anti-roll bars - 2002 BMW 7-Series (Active Roll Stabilization)

Brakes

First power brakes - 1919 Hispano-Suiza H6 (mechanically assisted)
Honorable mention - 1921 Duesenberg Model A
First vacuum-assist power brakes - 1928 Pierce-Arrow
First standard disc brakes - 1955 Citroën DS
Honorable mentions - 1956 (HRG twincam) used helicopter disc brakes Triumph TR3, Girling (Jaguar pioneered disc brakes at Le Mans in 1953)
First antilock braking system - 1966 Jensen FF (Dunlop Maxaret system, previously used in aviation)
First electrical antilock braking system - 1969 Lincoln Continental Mark III
Honorable mention - 1970 Cadillac (rear only)
First electronic antilock braking system - 1986 Lincoln Mark VII/Continental and Chevrolet Corvette
First Electric parking brake - 2003 Lincoln LS
First diagonally split, dual brake circuits - 1962 Saab 95/96
First asbestos-free brake pads - 1983 Saab Automobile
First electro-hydraulic brakes - 2003 Mercedes-Benz SL-Class
First regenerative brakes - 1994 Toyota Prius

Driver-aids

First standard rear-view mirror - 1912 Marmon
First power steering - 1951 Imperial
First cruise control - 1957 Imperial
Honorable mention - Peerless had a centrifugal governor speed control system in the 1910s
First traction control - 1987 Bosch Mercedes-Benz S-Class/BMW 7-Series
First dynamic stability control system/Electronic Stability Program - 1996 BMW 7-Series/Mercedes-Benz CL-Class
First adaptive cruise control - 1997 Toyota Celsior
First night vision - 2000 Cadillac DeVille
First integrated car dynamics control system: 2005 Toyota Crown Majesta (Vehicle Dynamics Integrated Management)

Passive-restraint

First airbags - 1974 Oldsmobile Toronado
First head airbags - 1998 BMW 7-Series

Tires

First use of pneumatic tires - 1895 Peugeot L'Eclair (Michelin)
First standard pneumatic tires - 1896 Bollee Voiturette
First radial-ply tires - 1949 Michelin "X" (patented in 1946)
First self-repairing tires - 1950 Goodyear
First run-flat tires - Porsche 959 (Dunlop Denloc; with special wheels)
Honorable mention - 1994 Chevrolet Corvette C4 (Goodyear SST; optional; with regular wheels)
Honorable mention - 1997 Chevrolet Corvette C5 (standard)

Lighting

First electrical lighting - 1898 Columbia electric
First standard lights - 1904 "Prest-O-Lite" acetylene
First standard electrical lights - 1908 Peerless
First integrated electrical and lighting system - 1912 Cadillac Model 1912 Delco
First "dipping" headlights - 1915 Guide Lamp Company
First dual-beam headlight - 1924 Bilux
First swivel headlights - 1948 [[Tucker(car)] Tucker Torpedo
First fog lights - 1938 Cadillac
First auto-dimming headlights - 1952 Cadillac Autronic Eye
First auto-on/off headlights - 1964 Cadillac Twilight Sentinel
First halogen headlights - 1965 Hella
First headlight wipers - 1970 Saab Automobile
First modern U.S.-market car with sealed beam headlights - 1984 Lincoln Mark VII
First AC HID lights - 1991 BMW 7-series
First DC HID lights - 1997 Lincoln Mark VIII
First neon lights - 1997 Lincoln Mark VIII
First all-LED tail lights - 1998 Maserati 3200 GT
First Bi-Xenon HID lights - 2000 Mercedes-Benz CL-Class

Electrical system

First electric windows - 1938 Buick Y
First combination key and ignition switch - 1949 Chrysler
First AC alternator - 1960 Valiant
First sealed battery - 1971 Pontiac "Freedom Battery"

First multiplexed wiring - 1987 Cadillac Allanté
First integrated car systems control - 1991 Mazda Eunos Cosmo (Car Control System)

Climate control

First windshield defroster - 1928 Studebaker
First windshield washer - 1937 Studebaker
First air conditioning - 1938 Studebaker Commander
Honorable mention - 1939 Packard and 1941 Cadillac
First rear window defogger - 1948 Cadillac
First heated seats - 1966 Cadillac
Honorable mention (first electrically heated) - 1972 Saab 99
First automatic climate control - 1964 Cadillac
First digital climate control - 1975 Rolls-Royce Camargue
First ventilated seats - 1997 Saab 9-5

In-car electronics and entertainment

First original-equipment radio - 1923 Springfield
First navigation system - August 1981 Honda Accord (analog, dealer-installed) [5]
First digital navigation system - 1990 Acura Legend
First GPS navigation system - 1995 Oldsmobile Eighty Eight Guidestar[6]
Honorable mention - 1996 tie 1997-model BMW 5-Series and Acura RL
Honorable mention - 1990 Pioneer Electronics/Trimble (aftermarket)
Honorable mention - 1992 Mazda (dealer-installed)
First telematics assist system - 1996 tie 1997-model Cadillac Seville (OnStar) and Lincoln Continental (Motorola RESCU)
First DVD navigation system - 1996 Matsushita/Pioneer Electronics (aftermarket)
First in-car PC - 1997 Microsoft Auto PC (aftermarket)
First Bluetooth-capable audio system - 2000 Chrysler
First THX-certified stereo system - 2003 Lincoln LS
First in-car karaoke machine - 2003 Geely BL
First active noise cancellation - 2005 Acura RL

Other

First steering wheel - 1899 Packard
First speedometer - 1901 Oldsmobile
First tilt-away steering wheel - 1912 Peerless
First dash-mounted fuel tank gauge - 1914 Studebaker
First turn signals - 1939 Buick
First split folding rear seats - 1961 Renault 4 (Fiat patented the system in 1978)
First tilt/telescope steering wheel - 1965 Cadillac
First composite wheels - 1989 Shelby CSX

First active differential - 1997 Honda Prelude Type SH
Honorable mention - 2005 Ferrari F430 and Acura RL feature the first fully-integrated electronic differentials

American types

First standardized American automobile - Duryea Motor Wagon (1896)
First American electric car - Detroit Electric (1907)
First American hybrid SUV - Ford Escape Hybrid

Pre-War

Best-selling pre-war vehicle - Ford Model-T (15,000,000 sold between 1908 and 1928)
Least-expensive full-featured automobile - 1927 Ford Model-T ($300 is about $3500 in inflation-adjusted 2005 dollars)
Largest vehicle - Bugatti Royale - 21 ft (6.4 m) long, 180 in (4.57 m) or 170 in (4.32 m) wheelbase depending on model
Largest pre-war Straight-4 - 21.5 L (21495 cc) - 1912 Benz 82/200
Largest pre-war Straight-6 - 21.1 L (21112 cc) - 1905 Panhard et Levassor 50 CV
Largest pre-war Straight-8 - 12.8 L (12763 cc/778 in^3) - 1929 Bugatti Royale

See also

- Classic Auto Prints' Automobile History Timeline

Bestselling vehicle nameplates

Home | Up

Toyota Corolla — 35,000,000 sold in nine generations since 1966.
Ford F-Series — more than 29,000,000 sold in eleven generations since 1948.
Volkswagen Golf — over 24,000,000[1] in five generations, overtaking Beetle in 2002.
Volkswagen Beetle — 21,529,464 — the best-selling single car design in history.
Ford Model T — 16,500,000 — (Ford estimate - the second best-selling single car design).
Lada Riva — 13,500,000.
Chrysler Minivans — over 11,000,000 sold.
Renault 4 — 8,000,000 of one generation sold from 1961 to 1992
Ford Mustang — more than 7,800,000 of five generations sold between 1964 and 2004.
Ford Taurus — over 7,000,000 as of 2004.
Fiat Uno-- over 6,000,000 (estimated).
Mini -- over 5,300,000 and the best selling British-made car ever. 1959 to 2000.
Ford Crown Victoria — over 5,000,000 (estimated).
Ford Econoline — over 5,000,000 (estimated).

Ford Escort — over 5,000,000 (estimated).
Ford Explorer — over 5,000,000 (estimated).
Ford Ranger — over 5,000,000 (estimated).
Ford Falcon — over 4,000,000 sold in Australia since 1960.
Toyota Prius — over 1,000,000 units and a six-month waiting list for people wanting one of these vehicles.
Citroen 2CV — 3,872,583.
Dodge Aries/Plymouth Reliant
Dodge Omni/Plymouth Horizon

See also

- List of automotive superlatives
- Lists of automobiles

Diesel automobiles

Home | Up

The following is a list of automobiles (including pickup trucks, SUVs, and vans) made with diesel engines.

Alfa Romeo

- Alfa 147
- Alfa Sportwagon

AM General

- Hummer
Hummer H1

Audi

- 80
90
100
4000
5000
Allroad
A2
A3
A4

A6
A8

Buick

- Century

Electra
LeSabre
Regal
Riviera

BMW

- 1 Series:
  - 118D
  - 120D
- 3 Series:
  - 320D
  - 330D
- 5 Series:
  - 524TD
  - 525D
  - 530D
  - 535D
- 7 Series:
  - 730D
  - 740D
  - 745D
- X3

X5

Cadillac

- DeVille

Eldorado
Fleetwood
Seville

Chevrolet

- Bel Air

Blazer
C10 Pickup
C1500

C20 Pickup
C2500
C30 Pickup
C3500
Caprice
Celebrity
Chevette
El Camino
E Series (2006)
G20 Van
G2500 Van
G30 Van
G3500 Van
Impala
K10 Pickup
K1500
K20 Pickup
K2500
K30 Pickup
K3500
Kodiak (2005)
Luv
Malibu
Monte Carlo
P20 Van
P30 Van
R10 Pickup
R20 Pickup
R2500
R30 Pickup
R3500
Silverado (2006)
Suburban
Tahoe
V10 Pickup
V30 Pickup
V3500 Pickup

Chrysler

- Grand Voyager

PT Cruiser
Voyager

Citroën

- Berlingo
C1
C2
C3
C4
C5
C8
Xsara

DaimlerChrysler

- Smart (automobile)

Dodge

- Ram
Sprinter

Fiat

- Ducato
- Idea
- Stilo
- Punto MultiJet

Ford

- E-Series
Escort (1984-1987)
Excursion
Fiesta
Fusion
Galaxy
Lion VLE
Mondeo
Focus
Focus C-Max
Ranger
Tempo (1984-1986)
Ford Tourneo

International

- Scout II (1980)

GMC

- Savana (2006)
Sierra (2005)
Topkick (2005)

Honda

- CR-V
- Civic

Hyundai

- Elantra
Getz
Santa Fe
Terracan
Trajet
Tucson

Jaguar

- S-Type
- X-Type
- XJ

Jeep

- Cherokee
Cherokee Limited
Grand Cherokee Laredo
Grand Cherokee Limited
Grand Cherokee Overland
Liberty (2005)
Mitsubishi Built Jeeps - Diesel

Kia

- Carens
- Sportage
- Sorento

Land Rover

- Defender
- Discovery
- Freelander
- Range Rover

Lincoln

- Continental

Mark VII

Mazda

- Mazda2
- Mazda3
- Mazda6
- MPV

Mercedes-Benz

- 170D

170Da
170Db
170Ds
180D
180Db
180Dc
190D
190D 2.2
190D 2.5
190D 2.5T
190Db
190Dc
200D
200TD
220D
240D/8
240D
240TD
240D Lang
250D
250TD
300CD

300d
300D
300D 2.5
300D 4MATIC
300D Lang
300SD
300SDL
300TD
300TD 4MATIC
350SD
350SDL
C220D
E220D
E250 D Turbo
E270D
E300D
E300D 4MATIC
E300DT
E320 CDI
G300D
ML350 (2006)
ML500 (2006)

Mercury

- Lynx

Topaz

Nissan

- Almera
- Primera
- Terrano
- X-Trail
- Sentra
- Maxima
- Patrol
- Pathfinder (Turbo Diesel)

Opel

- Astra
- Combo Tour
- Corsa

- Meriva
- Signum
- Vectra
- Vivaro

Peugeot

- 206

306
307
407
504
505
604
807
1007
Boxer
Partner

Renault

- Clio
- Grand Espace
- Grand Sc
- Kangoo
- Laguna
- Mégane
- Scénic

Rover

- 100

200
25
400
45
620
75
800
Metro
SD1

SAAB

- 9-3
- 9-5

Seat

- Altea
- Cordoba
- Ibiza
- Leon
- Toledo

Skoda

- Fabia
- Octavia
- Superb

Suzuki

- Grand Vitara

TATA

- Safari Dicor - SUV
- Victa - MUV
- Sumo - MUV
- Spacio - MUV
- Telcoline Pickup
- Ace
- 207DI Pickup
- 407 SFC Truck
- 709 SFC Truck
- 1512, 1613 Series of Trucks
- Novus

Toyota

- Avensis

Camry
Corolla
Hiace
Land Cruiser

RAV4
Yaris

Vauxhall

- Carlton

Volkswagen

- Bora
Caddy
Caravelle
Golf (2000-2005)
Jetta (2000-2005)
Jetta Wagon (2000-2005)
Lupo
Multivan
New Beetle (2000-2005)
Volkswagen 1-litre car 2002
Passat (2004-2005)
Passat Wagon (2004-2005)
Phaeton
Polo
Rabbit
Sharan
Touareg (2004-2005)
Touran
Transporter
Vanagon

Volvo

- S40
S60
S80
V50
V70
XC70
XC90

Famous automobiles

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Below is a list of famous automobiles:

Real

Historical

The Oscar Mayer Wienermobile
"La Jamais Contente" - The first car that reached 100 km/h.
The Blue Flame - World land speed record holding rocket car.
The Bluebird - Used for world land speed attempts by Sir Malcolm Campbell
Thrust2 - Former holder of the world land speed record.
ThrustSSC - The world's first supersonic land vehicle.
Bigfoot - The first monster truck.

Racing

Ford GT40, winner of LeMans race 1967 and 1968.
Swamp Rat, name of a series of dragsters built and raced by Don Garlits.
Moby Dick, nickname for Porsche 935 (racing model of 1978).
Stanley, first robot car to win the DARPA Grand Challenge
Grave Digger, name of a series of popular monster trucks.

From fiction

Literature

Chitty Chitty Bang Bang from the book by Ian Fleming
Christine from the Stephen King novel of the same name
Rocinante, the modified camper driven by John Steinbeck in Travels with Charley
The Betsy from the Harold Robbins novel of the same name

Movies

Bond Cars as driven by 007
Christine (a 1958 Plymouth Fury) from the movie of the same name (based upon the novel by Stephen King)
The Mirthmobile from Wayne's World
Chitty Chitty Bang Bang from the film of the same name (based on the Ian Fleming novel)
Genevieve (film) from the 1953 film of the same name.
http://www.donbrockway.com/Genevieve%27s%20History.htm
Herbie from The Love Bug and four sequels
De Lorean time machine from the Back to the Future series
The Ectomobile from Ghostbusters

Pursuit Special, the Interceptor from Mad Max
The Bluesmobile (a 1974 Dodge Monaco police car) from The Blues Brothers
Il Tempo Gigante from Pinchcliffe Grand Prix. [1]
Peugeot 406 Taxi from the 1998 film Taxi, the 2000 film Taxi 2 and the 2003 film Taxi 3.
Ford Crown Victoria taxi and her enemy, BMW 7 Series from the 2004 film Taxi
The Corvette from Corvette Summer

The original 1966 Batmobile was built by George Barris from a Lincoln Futura concept car.

Television

1928 Porter from My Mother the Car
Al's Dodge, from Married... with Children
The Batmobile from Batman
Ford Torino in Starsky and Hutch
Bessie from Doctor Who
The Black Beauty from The Green Hornet
Car 54 from Car 54, Where Are You?
The Compact Pussycat driven by Penelope Pitstop in Wacky Races
The Mean Machine driven by Dick Dastardly in Wacky Races
The General Lee (Dodge Charger) from The Dukes of Hazzard
The Mach Five from the anime Mach Go Go Go (also known as Speed Racer).
The Peugeot 403 cabriolet from Columbo
Gladys Crabtree from My Mother the Car
The Grey Ghost from Baretta
The Homer, Homer's ugly car from The Simpsons
KITT, the talking car (Pontiac Trans Am) from Knight Rider
Del Boy's yellow Reliant Regal Supervan in Only Fools and Horses. Later buys a 1978 Ford Capri Ghia, which Rodney nicknames 'The PratMobile'.
The Monkeemobile, from The Monkees
The Mystery Machine from Scooby Doo
The Flintstones' car, from The Flintstones
The Supercar was a children's TV show produced by Gerry Anderson's AP Films.
The FAB 1, Lady Penelope Creighton-Ward's pink six-wheeled Rolls-Royce in the Thunderbirds TV series by Gerry Anderson's AP Films.
Ray's black 1965 Corvette Stingray from the series Stingray
The GMC van from the series The A-Team
The Dodge Viper RT/10 roadster and Viper GTS coupe from the series Viper.
The Green & Black Mini Minor featured in Mr. Bean TV Series.
The Blue Bubble Car featured in the Mr. Bean TV Series.
The Thunderhawk, a 1985 Chevrolet IROC-Z Camaro featured in the M.A.S.K. cartoon series

Song

Rocket 88 by Ike Turner and the Kings of Rhythm - purportedly the first rock and roll song
409 by the Beach Boys
Little Deuce Coupe by the Beach Boys
Little GTO by Ronnie and the Daytonas
Little Red Corvette by Prince
The Eliminator from the videos by ZZ Top
Red Barchetta by Rush

Comics

The "313," Donald Duck's 1934 "Belchfire Runabout," from the Donald Duck comic books.
Grandma Duck's Detroit Electric, also from the Donald Duck comics.
The Batmobile, Batman's specialized vehicle.
Shelby Cobra GT500, Rally Vincent's car from the manga Gunsmith Cats

See also

- List of fictional vehicles
- Lists of automobiles

Unrelated vehicles with identical nameplates

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Here is a *list of unrelated vehicles with identical nameplates*. Sometimes, the same nameplate can have different makes, whether it is simultaneous, overlapping or discontiguous in timeframe (i.e. none of the models have any inspiration between each other).

Excluded from list are vehicle nameplates with the same make and discontiguous timeline and vehicle nameplates that undergo design changes (by the same make)
130 (BMW, Fiat)
145 (Alfa Romeo, Honda)
147 (Alfa Romeo, Fiat)
164 (Alfa Romeo, Volvo)
240 (Mercedes Benz, Volvo)
244 (ARO, Volvo)
310 (Datsun, Lorraine-Dietrich)
323 (BMW, Mazda)
403 (Bristol, Peugeot)

404 (Bristol, Peugeot)
405 (Bristol, Peugeot)
406 (Bristol, Peugeot)
407 (Bristol, Peugeot)
500 (Fiat, Ford, Mercedes-Benz)
600 (Dodge, Fiat, Saab, Mercedes-Benz)
700 (BMW, Bond)
740 (BMW, Volvo)
760 (BMW, Volvo)
850 (BMW, Volvo)
1100 (Cisitalia, Fiat)
A3 (Audi, Auverland)
Acclaim (Holden, Plymouth, Triumph)
Accord (Honda (North and South America, South Africa, Asia and Oceania), Honda (Europe and Japan))
Ambassador (AMC, Hindustan, Nash)
Armada (Mahindra, Nissan)
Atlantic (Bugatti, Volkswagen)
Avenger (Dodge, Hillman)
B-Series (Mazda (North America), Mazda (outside North America))
Barchetta (Fiat, Maserati)
Bora (Volkswagen, Maserati)
Brava (Bedford, Fiat)
C3 (Citroën, Cunningham, Voisin)
C4 (Citroën, Cunningham)
C5 (Citroën, Sinclair)
C6 (Amilcar, Citroën)
C8 (Citroën, Spyker)
Calais (Cadillac, Holden)
Caravelle (Plymouth, Renault, Volkswagen)
Century (Buick, Toyota)
Challenger (Dodge, Mitsubishi)
Commander (Dutton, Jeep, Mahindra, Studebaker)
Commodore (Holden, Hudson)
Conquest (Chrysler, Daimler, Toyota)
Contessa (Hindustan, Hino)
Continental (Bentley, Lincoln)
Cordoba (Chrysler, SEAT)
Corsa (Opel, Toyota)
Courier (Elva, Ford)
Dauphine (Berliet, Renault)
Delta (Daihatsu, Lancia)
Diplomat (Adler, Dodge, Opel)
Durango (Dodge, Ford)
Dyna (Panhard et Levassor, Toyota)

Dynasty (Dodge, Hyundai)
Express (Chevrolet, Mitsubishi, Renault)
Europa (Lotus, Neckar)
Firenza (Oldsmobile, Vauxhall)
Fusion (Ford (Europe and India), Ford (North America))
G20 (Ginetta, Infiniti
GS (Buick, Chrysler, Citroën)
GTO (Ferrari, Mitsubishi, Pontiac)
Lancer (Dodge, Mitsubishi)
Le Mans (DB, Pontiac)
Liberty (Jeep, Subaru)
LS (Lexus, Lincoln)
Magnum (Dodge, Rayton Fissore, Renault, Vauxhall)
Marathon (Checker, UAZ)
Matador (AMC, Dodge)
Matrix (Hyundai, Toyota)
Metro (Geo, Rover)
Minx (Hillman, Isuzu)
Montana (Chevrolet, Pontiac)
Monte Carlo (Chevrolet, Lancia, Mega)
Nova (Chevrolet, Dacia, Lada, Vauxhall)
Omega (Oldsmobile, Opel)
Omni (Dodge, Maruti, Studebaker)
Orion (Doninvest, Ford)
Pacer (AMC, Valiant)
Pathfinder (Nissan, Riley)
Phoenix (Dodge, Pontiac)
Popular (Ford, Skoda)
Raider (Dodge, Mitsubishi)
Ranger (Ford (North America), Ford (outside North America))
Regal (Buick, Kia, Valiant)
Rodeo (Isuzu, Renault)
Royale (Bugatti, Daewoo, Ford, Vauxhall)
Safari (GMC, Nissan, Tata, Volkswagen)
Satellite (Hyundai, Plymouth)
Scorpio (Ford, Mahindra)
Sebring (Chrysler, Maserati)
Sierra (Ford, GMC, Monteverdi, Suzuki, Tata)
SM (Citroën, Sta. Matilde)
Solara (Talbot, Toyota)
Speedster (Auburn, Opel, Studebaker)
Spirit (AMC, Dodge)
Storm (Geo, Lister, San)
Suburban (Chevrolet, Plymouth, Studebaker)
Sunfire (Asuna, Pontiac)

TC (Chrysler, MG, Scion)
TF (Isuzu, MG)
Toledo (SEAT, Triumph)
TT (Audi, NSU)
Venture (Chevrolet, Toyota)
Versa (Maruti, Nissan)
Versailles (Ford, Lincoln)
Viva (Holden, Vauxhall)
Zephyr (Ford, Lincoln, Mercury)

Songs about automobiles

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0-9

"105" by Fred Eaglesmith
"24's" by T.I.
"409" by The Beach Boys
"`69 El Camino" by Southern Culture on the Skids
"455 Rocket" by Kathy Mattea

A

"Accelerator" by Therapy?
"Act a Fool" by Ludacris
"Airbag" by Radiohead
"Autobahn" by Kraftwerk

B

"Baby You Can Drive" by Trisha Yearwood
"Back Seat of My Car" by Paul McCartney
"Ballad of Ole Betsy" by The Beach Boys
"Beep Beep" by The Playmates
"Bench Seat Baby" by Fred Eaglesmith
"Big Boys Toys" by Aaron Tippin
"Big Ol' Truck" by Toby Keith
"Bitchin' Camaro" by The Dead Milkmen
"Black Devil Car" by Jamiroquai
"Black Sunshine" by White Zombie
"Bloodstains (Speed Kills)" by Agent Orange
"Born To Be Wild" by Steppenwolf (Covered by Slayer and Blue Öyster Cult)

"Born Too Slow" by The Crystal Method
"Brand New Cadillac" by Vince Taylor & his Playboys
"Bucket T" by Jan & Dean
"Burn Rubber" by Gap Band
"Bus Stop" by The Hollies
"Buzzbomb" by Dead Kennedys

C

"Cadillac" by Bo Diddley
"Cadillac Ranch" by Bruce Springsteen
"Car Car" by Woody Guthrie
"Car Crazy Cutie" by The Beach Boys
"Car Song" by Elastica
"Car Wash" by Rose Royce
"Caralho Voador" by Faith No More
"Carbon Monoxide" by Cake
"Cars" by Gary Numan (Note: there is also a cover of this song by Fear Factory, called "Cars (MPH Mix)".)
"Cars & Parties" by Edith Frost
"Cars And Girls" by Prefab Sprout
"Cars Hiss by My Window" by The Doors
"Cherry Cherry Coupe" by The Beach Boys
"Circles" by Nonpoint
"Counting Blue Cars" by Dishwalla
"Cowboy Cadillac" by Garth Brooks
"Crawling from the Wreckage" by Graham Parker (covered by Dave Edmunds)
"Crazy Bout an Automobile" by Al Vance, & Ry Cooder
"Cross The Line" by Tantric
"Crosstown Traffic" by Jimi Hendrix (Note: there is also a cover of this song by (hed) p.e..)
"Custom Machine" by Beach Boys

D

"Dad, Give Me The Car (Tonight)" by The Violent Femmes
"Daytona" by Chris Rea
"Dead Man's Curve" by Jan and Dean
"Demon Speeding" by Rob Zombie
"Dodge Veg-o-matic" by The Modern Lovers
"Drag City" by Jan & Dean
"Drag Strip Girl" by Jan & Dean
"Dragula" by Rob Zombie
"Drive" by Alan Jackson
"Drive" by Blind Iris
"Drive" by R.E.M.

"Drive" by Steve Wariner
"Drive" by The Cars
"Drive In" by Beach Boys
"Drive it All Over Me" by My Bloody Valentine
"Drive it Like I Stole It" by Apathy
"Drive My Car" by The Beatles
"Driver's seat" by Sniff 'n' the Tears
"Drivin' Rain" by Gov't Mule
"Driving in My Car" by Madness
"Driving Lesson" by Garbage

E

"Elvis' Rolls Royce" by Was (Not Was)

F

"Fast Car" by Tracy Chapman (Note: There is also a cover of this song by Darwins Waiting Room.)
"Freeway Flyer" by Jan & Dean
"Fried Chicken and Gasoline" by Southern Culture on the Skids
"Fuel" by Metallica
"Fun, Fun, Fun" by The Beach Boys

G

"Geronimos Cadillac" by Modern Talking
"Get out of my dreams, get into my car" by Billy Ocean (Note: There is also a cover of this song by Fenix*TX.)
"Getaway Car" by Smash Mouth
"Gimme the Car" by The Violent Femmes
"Going Mobile" by The Who

H

"Heaven and Hot Rods" by Dry Cell
"Hell on Wheels" by Fu Manchu
"Hey Little Cobra" by the Rip Chords
"Highway Star" by Deep Purple (Note: There is also a cover of this song by Type O Negative.)
"Hot Ride" by Prodigy
"Hot Rod Lincoln" by Charlie Ryan and his Timerlone Riders, Les Claypool & Commander Cody & His Lost Planet Airmen

I

"I Ain't Got You" by Jimmy Reed & the Yardbirds
"I Can't Drive 55/65" by Sammy Hagar (The song was officially changed in 2001 to 65.)
"I Get Around" by Beach Boys
"I Gotta Drive" by Jan & Dean
"I'd Rather Ride Around With You" by Reba McEntire
"I'm in Love With My Car" by Queen
"I'm Truckin'" by Spirit
"In My Merry Oldsmobile" by Billy Murray
"In the Parking Lot" by The Beach Boys
"I like driving in my car" by madness
"I Am The Highway" by Audioslave

J

"Jaguar" by The Who

K

"K Car" by The Relient K
"Katie Wants A Fast One" by Garth Brooks and Steve Wariner
"Killer Cars" by Radiohead

L

"Let Me Ride" by Dr. Dre
"Life In The Fast Lane" by The Eagles
"Little Deuce Coupe" by The Beach Boys
"Little Deuce Coupe" by James House
"Little GTO" by Ronnie & the Daytonas
"Little Honda" by The Hondelles
"Little Red Corvette" by Prince
"Little Red Rodeo" by Colin Raye
"Long May You Run" by Neil Young
"Low Rider" by Cypress Hill
"Low Rider" by War

M

"Magic Bus" by The Who
"Maybelline" by Chuck Berry
"Mercedes Benz" by Janis Joplin
"MFC" by Pearl Jam
"MGB-GT" by Richard Thompson
"Mighty Big Car" by Fred Eaglesmith
"Motor Breath" by Metallica

"Motoring" by The Who
"Move Out Little Mustang" by Jan & Dean
"Mustang Sally" by Wilson Pickett
"My Car" by The Gin Blossoms

N

"Need for Speed" by Petey Pablo
"Nitrous Oxide" by The Crystal Method
"No-Go Showboat" by The Beach Boys
"No Money Down" by Chuck Berry
"No Particular Place to Go" by Chuck Berry
"Nothin' But The Taillights" by Clint Black

O

"Ode To My Car" by Adam Sandler
"On The Road Again" by Willie Nelson (also covered by Buckcherry)
"One Piece At A Time" by Johnny Cash
"Our Car Club" by The Beach Boys

P

"Pickup Man" by Joe Diffie
"Pink Cadillac" by Bruce Springsteen
"Police Truck" by Dead Kennedys
"Pontiac" by Fred Eaglesmith
"Popsicle Truck" by Jan & Dean
"Prep for Victory" by Niels Bye Nielsen

Q

"Quarter" by Fuel

R

"Race Car Ya-Yas" by Cake
"Radar Gun" by the Bottle Rockets
"Ramrod" by Bruce Springsteen
"Rapid Roy" by Jim Croce
"Ray's Dad's Cadillac" by Joni Mitchell
"Rearviewmirror" by Pearl Jam
"Red Barchetta" by Rush
"Red Cadillac & a Black Moustache" by Warren Smith
"Riding Along in my Automobile" by Chuck Berry

"Road Trippin'" by Red Hot Chili Peppers
"Road Trippin" by Steve Wariner
"Rocket 88" by Jackie Brenston and his Delta Cats
"Rollin" by Limp Bizkit
"Road to hell" by chris rea

S

"She Drives Like Crazy" by "Weird Al" Yankovic
"She Loves My Automobile" by ZZ Top
"Shlock Rod Pts 1 & 2" by Jan & Dean
"Shut Down" by Beach Boys
"Shut Up And Drive" by Chely Wright
"Silver Machine" by Hawkwind
"Smashing the Gas" by Mystikal
"Speedway" by Static-X
"Spirit of America" by Beach Boys
"Start The Car" by Travis Tritt
"Stupid Car" by Radiohead
"Supercharger (Let Freedom Ring Mix)" by Machine Head
"Super-charger Heaven" by Rob Zombie
"Surfin' Hearse" by Jan & Dean

T

"The Big 3 Killed My Baby" by The White Stripes
"The One I Loved Back Then" by George Jones
"The Passenger" by Iggy Pop
"This Car of Mine" by Beach Boys
"Three Window Coupe" by Jan & Dean
"Thunder Express" by MC5
"Trampled Underfoot" by Led Zeppelin
"A Transport of Delight" by Flanders and Swann
"Truckin'" by The Grateful Dead
"Turbo Lover" by Judas Priest
"Two Lane Blacktop" by Rob Zombie
"The race" by yellow

U

"'Ullo John! Got a New Motor?" by Alexei Sayle
"Understanding in a Car Crash" by Thursday
"Under my Hood" by Gluecifer
"Used Cars" by Bruce Springsteen

V

"Vehicle" by The Ides of March
"Voodoo Cadillac" by Southern Culture on the Skids

W

"Waiting for the Bus" by The Violent Femmes
"Warm Leatherette" by The Normal

Y

"You Can't Catch Me" by Chuck Berry

See also

- Lists of automobiles

Automotive flops

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The automotive industry has seen its fair share of flops, from models to management people, to entire brands. While some cars flopped for being unreliable (Yugo), others flopped for design defects plaguing the car (Pontiac Fiero), missing their target audience (Edsel, Buick Reatta), poor design (Pontiac Aztek, Acura Vigor), while others don't really have a reason for flopping, but instead they had poor sales (Suzuki X90).

Vehicles

Acura Vigor

The Vigor was a mid-size sedan introduced in 1992 that fit between the Integra sedan and the Legend in Acura's lineup. Sales were slow due to the car's 5-cylinder engine, small size, and poor interior design. It was cancelled after only 3 years in production.

Bricklin SV-1

This safety/sports car from Canada suffered from quality problems. Just 2,857 were sold in 3 years.

Buick Reatta

The Reatta was an aerodynamically-styled car originally made by Buick to attract "mature" buyers. But the car's controversial styling and heavy amount of computerized features worked against the car in its intended market. The car was mostly handbuilt and the Reatta sold just 21,751 units in a 4 year run from 1988 to 1991.

Cadillac V8-6-4 variable cylinder engine

Poor reliability and dubious benefit doomed the variable displacement concept for a decade.

Cadillac Allante

Cadillac's first convertible for almost 20 years. The Allante was introduced for the 1987 model year and was by far Cadillac's most expensive vehicle. All parts for manufacture were shipped from Italy to the US where the vehicle was assembled by hand. The relatively high price alongside the lack of an engine as powerful as those commonly found in the price range at the time caused sales to be only 21,000 units over a 4 year run. The Allante also was no help to Cadillac's reputation since it was hacked up due to the Cimarron debacle just before the Allante entered production. Cadillac successfully relaunched the idea of an upmarket convertible with the Cadillac XLR.

Cadillac Cimarron

The first compact Cadillac, was developed as part of GM's mid 1980s downsizing. GM rushed the Cimarron into production about three years ahead of schedule, denying Cadillac time to develop a more refined car and requiring the use of a four-cylinder engine as the V6 would not be ready for a few more years. It was initially sold as "Cimarron by Cadillac", implying a lack of confidence on Cadillac's part. Sales were disappointing as its size and styling did not prove popular with Cadillac buyers. Not only was the vehicle perceived as being too small for a Cadillac, it shared many design components with its much cheaper Chevrolet cousin. Though the Cimarron was eventually improved to the point of complete competence, sales never improved and its initial impression on the public continued to hurt Cadillac's reputation as builder or luxury cars in the important 35-45 demographic segment. After seven years, the Cimarron was discontinued.

Caterham 21

Intended as a modern, more practical alternative to the Caterham/Lotus Seven. Unfortunately, Lotus successfully reinvented the Seven themselves at the same time with the Lotus Elise.

Chevrolet Corvair

While the Corvair was an early sales success, design flaws highlighted by Ralph Nader's Unsafe at Any Speed proved to be the car's downfall. Despite fixing the problem that Nader detailed in his book, and the successful 1965 redesign, General Motors halted future development of the car and sales declined for the Corvair for the rest of its lifetime.

Chrysler Airflow

The Airflow's advanced aerodynamic design made the mistake of being too far ahead of its mid-1930s era; in the depths of the Great Depression, consumers avoided the car because of its odd appearance and falsly rumored unsafe conditions. The failure of the Airflow pushed Chrysler design the conservative extreme, resulting in the "three-box" designs launched in 1949.

Chrysler Crossfire

DaimlerChrysler reportedly paid Karmann to reduce production with sales running 1/3 of predicted levels.

De Lorean

Roughly 9,000 were built before John De Lorean's arrest on charges of cocaine-smuggling (which he was later acquitted for) closed the factory two years after its launch.

Dodge Dakota convertible

In 1989, Dodge created a convertible version of its popular Dakota pickup truck, with a ragtop in place of a cab with a small rollbar installed. The general public thought that the design was too awkward and that the idea of a convertible pickup was absurd. Only 2,000 units were sold in two years.

Dodge Rampage

The Dodge Rampage was a mixture of a car and a pickup truck; it was based upon the Dodge Omni. The Rampage was a front-wheel drive truck, which is not normally used for trucks because a heavy load on the rear of the truck can cause traction problems. This is mainly considered to be the downfall of the Rampage, along with a weak engine. Its Plymouth Scamp twin only sold around 2,000 units, making it one of the rarest Plymouths ever created.

Buckminster Fuller's 1933 Dymaxion car

Original and innovative, but a fatal crash and safety issues with rear-wheel steering aborted investor interest and further development. A total of three were built.

Dodge Charger Daytona/Plymouth Superbird

The Charger Daytona and the Superbird were built to be the best at NASCAR, and they were. Because of this, street versions were built. Unfortunately, they were criticized for their radical styling, and the rounded front noses led to the car overheating easily. NASCAR later banned the design, and production ceased, with 500 Charger Daytonas and 2,000 Superbirds being built. This has meant that they are very collectible, with an all original Superbird recently being sold at over US$200,000 on eBay.

Ford Ranger EV

Ford's only electric-powered pickup truck. There were numerous problems with the NiMH battery-equipped Rangers associated with an inability to accept a charge in hot environmental conditions, and some other problems requiring replacement of major components, but Ford successfully addressed these problems early in the vehicle's life cycle. There were some range issues around the 25,000 mile service life with the NiMH batteries, and due to the great expense of these batteries, Ford elected not to fix this range problem (a valid response under the lease terms). Some leases elected to continue the lease despite the shorter range.

Ford Taurus Ghia

Since its introduction in 1986, the Ford Taurus has been one of Ford's most successful models. But when Ford tried to push the slightly modified Taurus on European and Australian buyers, renamed the "Taurus Ghia", it learned the hard way that just because a car is successful in one market doesn't mean that it will be successful in another.

GMC Envoy XUV

Despite the grondbreaking retractable roof feature first seen on the 1963 Wagonaire, the XUV failed to sell like in sufficient volume to justify the expense to General Motors to continue marketing the vehicle. This vehicle was discontinued after only 2 years since introduction.

Hudson Jet

With its race proven step-down bodied full-size cars in their sixth year, Hudson gambled almost everything that it had into the development of the Hudson Jet, a compact car designed by committee. While Hudson sold more than 40,000 units, the impact to the bottomline was so negative that the company was forced to merge with rival Nash in 1954 to form American Motors. (See 1956 Hudson)

Hudson 1956-1957

Following a poor showing in 1955 when Hudson's nameplate was applied to modified Nash bodied cars, AMC hired designer Richard Arbib to create a unique personality for Hudson. The designer christened his design motif as the V-Line Style, which applied liberal amounts of chrome in "V" patterns from front to fin and everything in between. The resulting cars were both grotesque and a burlesque of design gone awry. The public reacted by shunning Hudson, which saw its sales drop to 10,671 units (92% off its 1949 production) for 1956 and just 4,108 in 1957.

Jaguar XJ220

The XJ220 concept car was unveiled to great response. Because of this, Jaguar put it into production to compete with Lamborghini and Ferrari. Many potential buyers were disappointed by the fact that it didn't come with a V12 or four wheel drive, like the concept, and sales were poor.

Leyland P76

Infamous in Australia as a commercial flop.

Lincoln Blackwood

The Blackwood was intended to be a luxurious version of the Ford F-150, much like the Lincoln Navigator was to the Ford Expedition. A velvet-lined bed, low towing capability, and a single exterior color led to the cancellation of this model after 15 months with 3,356 sold. Lincoln has reintroduced a more practical luxury pick-up under the Lincoln Mark LT nameplate.

Lincoln Versailles

The Versailles was introduced for the 1977 model year as Lincoln's new mid-size sports sedan, meant to compete with the Cadillac Seville. The vehicle failed however, due to its many similarties in terms of exterior and interior design with its lesser Ford Granada and Mercury Monarch cousins. The Versailles featured the same dashboard and exterior contour as the much cheaper Ford Granada and failed to meet the standards of Lincoln buyers. Lincoln slightly modified the rear sail panels hoping that the modification would reduce the visual relationship to the Grenada and Monarch, however the change failed to attract consumers. The produciton of the Versailles ended for the 1981 model year.

Mazda Navajo

The *Mazda Navajo* was a two-door badged engineered SUV that was abased on the Ford Explorer Sport. Even though four-door Explorer sales soared the day it was introduced and became the best selling SUV, the two-door Sport sales were not eqaully as good, and the Navajo sold poorly. When the Explorer was redesigned in 1995, the Navajo was discontinued and the capacity given over to producing the new Mercury Mountaineer, in 1997.

Mercury Marauder

The Marauder was introduced in 2003 as a modern day muscle car. However the Marauder suffered from lackluster sales, blamed by some on bland styling, gutless performance, and incorrect target audience. It didn't return for the 2005 model year.

Mitsubishi Raider

The Dodge Dakota clone sold so poorly that Mitsubishi has reportedly stopped production after just four months.

NSU Ro 80

A stylish and advanced car that was plagued by early reliability problems with its revolutionary Wankel engine. The resulting financial crisis lead to the company being acquired by Volkswagen.

Oldsmobile 5.7 L diesel engine

Also marketed as the Olds 350 Diesel, it was offered in General Motors automobiles between 1978 and 1985. Because it was a modified gasoline engine rather than a proper diesel design, the unit had a tendency to tear itself apart. So poor was this engine's reliability record that small diesel engines were shunned by U.S. consumers for a generation.

Pontiac Aztek

Controversial styling resulted in just over 27,000 sales per year instead of an expected 50,000 to 70,000. GM Vice President Robert Lutz regularly referred to the Aztec as looking like "an agry appliance" and a symptom of what was wrong with GM's vehicle styling programs. Discontinued in 2005.

Pontiac Fiero

Originally conceived as a commuter car, the Fiero was initially a sales success. However the car received negative reviews by Car & Driver and Motor Trend magazines for not having enough power in acelleration tests. In mid-course, Pontiac began to remarket the car as a mid-engine sports car. A design defect in the car's 4-cylinder engine caused it to catch fire. While the V6 version didn't suffer from this problem, the Fiero's reputation was damaged, and even after GM worked out all the flaws, sales fell to an unprofitiable level. GM discontinued it in 1988.

Renault Avantime

Renault teamed up with Matra to build the next modern European MPV. Many buyers didn't like its strange styling which sacrificed passenger room. Matra later went bankrupt, and Renault scrapped the Avantime after two years in production. Only 8,450 Avantimes were produced.

Sinclair C5

A battery-powered tricycle designed by Sir Clive Sinclair.

Subaru SVX

The Subaru SVX was the only production car to date to have an all around glass canopy. The car failed in every market it was sold in due to lack of marketing dollars, concerns of safety in a rollover and radical styling; the car's introduction also came at a time when American consumers were beginning their love affair with SUVs. It was also plagued with known reliability problems due to its heavy weight. Worldwide production of the SVX never topped 40,000 units through a 6 year run.

Suzuki X-90

This 2-seater sporty mini-SUV was not welcomed in the market. Just 7,205 were sold in 3 years, making it among the slowest-selling full-production vehicles in history.

Toyota Project Genesis

A series of three automobiles born in the late-1990s/2000 - which included the Toyota Echo, Toyota MR2 Spyder, and redesigned Toyota Celica - intented to make inroads to the younger Gen Y market segment. All three models failed to meet sales expectations and have been discontinued in favor of the separate Scion line.

Toyota T-100

Japan's first entry into the large American pickup truck market fell far short due to its weak towing capacity, mid-sized frame, and engine choices of either a large I4 or a small V6.

Vauxhall Firenza hpF

Just 204 built instead of the projected 30,000+. Killed by the fuel crisis, its rarity has at least assured it classic status in modern times.

Volkswagen 412

Volkswagen's last rear-engine, air-cooled car. Although it had interesting and novel technologies at the time (MacPherson struts in front, independent rear suspension, fuel injection, a supplemental heater powered by gasoline), the car was only produced from 1969 until July 1974.

Yugo

This Yugoslavian car was sold in the United States from 1986 to 1990, and quickly gained a reputation for being as unreliable as it was cheap. It was featured in the movie Dragnet as a punishment for Dan Aykroyd's character's repeated crashing of his cars, and was referred to as "the latest in Serbo-Croatian technology". Yugo has become to cheapness as Lexus has become to quality.

Brands

Asuna

General Motors launched this brand in Canada to accompany its Geo brand, and to give Buick and GMC dealers low cost cars. Sales were extremely poor, mostly because Asuna's 2 models were also available as Geos, and as a result, Asuna dissappeared after juat a year.

Daewoo

This Korean marque flopped badly in some markets, especially the United States. When Daewoo made its U.S. debut for the 1999 model year, it sold cars through independent contractors on college campuses rather than at conventional dealerships. U.S. sales ended in 2002 when *Daewoo Motor America* went bankrupt. New owner General Motors has dropped the Daewoo name outside Asia in favor of its Chevrolet brand. However, Daewoo sales have been moderately successful in some regions, such as the UK and Ireland. Daewoo cars are currently being sold in the U.S. as Suzukis and Chevrolets.

Eagle

The Eagle brand was formed by Chrysler from the remains of AMC. Aimed at the enthusiast driver, sales of the badge engineered cars faltered and the marque was folded after 11 years. Only the Eagle Talon sports car was an sales success, due in part to the fact that it was the same vehicle as the Mitsubishi Eclipse and Plymouth Laser.

Edsel

One of the biggest and most lavish new car line launches in history quickly became a legendary flop. Just over 100,000 were built in four years. In 1960, Edsel's final model year, only a few thousand were built, enough to use up the parts backstock. It was named after Henry Ford's son.

Liberty

In May 1985, hot on the heals of General Motors announced partnership with Toyota (NUMMI) and the launch of the Geo nameplate, Lee Iacocca announced the formation of the "Liberty" a new Chrysler marque targeting younger, import-loyal car buyers. Before the Liberty could get to the formation stage, Chrysler acquired American Motors for the rights to Jeep, and Liberty quietly disappeared, when Chrysler decieded to launch Eagle as it's youth targeted brand.

Merkur

This U.S. marque, which consisted of two rebadged European Ford models, lasted only four years.

Sterling

This American version of the British Rover 800 suffered from poor build quality, feeble performance and a lack of brand recognition. Sales dropped from 15,000 in 1988 to fewer than 2,000 in 1991.

Tucker

Preston Tucker's streamlined automobile with a rear engine and then-innovative safety features. Tucker's attempt to launch a major automobile company failed, either due to conspiracy by the major manufacturers, shady financial maneuvers by Tucker or both. A total of 51 were built.

Management

Jacques Nasser's position as head of Ford

When Nasser became head of Ford, he made pointless investments in small companies in order "To make Ford the number one provider of automobiles and automotive services". His tough business practices alienated Ford employees, suppliers, and dealerships, and the Ford family was also alienated by his poor handling of the controversy over camshaft failure on the Ford Taurus SHO. When he nearly ruined Ford's reputation with the Firestone Tire Controversy, the Ford family had seen enough, and they replaced him with William Clay Ford, Jr. Nasser was the head of Ford for only 3 years.

Mini based cars

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The British Motor Corporation *Mini* has been used as the basis for numerous Kit Cars and Specials.

Below is a partial list. There could also be some duplications as many cars emerged more than once under different ownership.

Australia

- Pellandini

Italy

- Innocenti 90L and 120L

United Kingdom

- ABC Tricar
- AC Donington and Grand Prix
- Alto Duo
- Andersen
- ASP 1300S
- Autocars Marcos
- Autocom Minibuggy
- Banshee
- Beauford
- Berkeley
- Biota
- Birchall Mccoy
- Blitz
- Bobcat
- Boxer
- Broadspeed GT
- Brooklands Swallow
- Brookwell Triffid
- Bulanti
- Butterfield Musketeer
- Camarotta
- Camber GT
- Capricorn
- Cavallo Estivo
- Cirrus
- Coldwell GT
- Crayford
- Cub
- Curley trike
- D.A.R.T.
- Davenport
- Davrian
- Deep Sanderson 301
- De Joux

- Domino
- Fletcher GT
- FRA
- Freestyle
- Gecko
- Gitane
- Gnat
- Goa
- GTM (was Cox GTM)
- Hobo
- Jimini
- Kingfisher Sprint
- Lambert
- Landar
- Lenham Le Mans
- Leonhardt Tiger
- Lynx
- Macintosh M1
- Magenta
- Maguire
- Many Mego
- Maya GT
- McCoy
- Micron GT
- Midas
- Mincia
- Minette
- Mini Beach
- Mini Bug
- Mini Cord
- Mini CS
- Mini Daly Runabout
- Mini Dart
- Mini DB6
- Mini Jem
- Minim
- Mini Michelotti
- Mini Marcos
- Mini Scamp
- Mini Sprint
- Mini Warrior
- Mini Zagato
- Minissima

- Minnow GT
- Minus
- Moko
- Mosquito
- Nautica
- Navajo
- Nifty
- Nimbus
- Nimrod
- Nomad
- Nota Fang
- Ogle SX1000
- Peel Viking
- Phoenix
- Pimlico
- Pulsar
- Quasar-Unipower
- Ranger
- Sabot
- Sabre
- Scamp
- Scarab
- Scout
- Seagull
- Siva
- Skip 1000
- Sprint
- Status Minipower and 365
- Stewart & Ardern
- Stimson
- Tici Mini
- TMC Scout
- Tomcat
- Towns Hustler
- Towns Minissima
- Tracer
- Trek
- Triad
- Trimini
- Trio
- Twini
- Ultimini
- Unipower

- Viking Hornet Sport
- VW90
- Westfield TRZ
- Whitby Warrior
- Yak

Automotive packages

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An *automotive package* is a collection of cosmetic or functional additions to a vehicle that are marketed and sold as a group. Such packages often represent a substantial portion of the profit on a vehicle. Over time, many of the features in a package may be incorporated into the base vehicle as costs are driven down through manufacturing experience, design refinement, materials substition, and economies of scale.

List of automotive packages(edit)

- Convenience package
- Handling package
- Navigation package
- Performance package
- Safety package
- Sports package
- Trim package (sometimes as appearance package)

Convenience package

Home | Up | Convenience package | Handling package | Navigation package | Performance package | Safety package | Sports package | Trim package

A *convenience package* is a set of minor functional enhancements to a vehicle, sold and priced as a unit. Many of these items are now included as standard equipment in a "step up" model of a particular vehicle line. As vehicles imported to the United States do not generally include the lowest "stripper" model, many of these features are standard on such imports. For domestic manufactures, vehicles will often use a common wiring harness regardless of features installed and so the marginal cost of adding these enhancements can be quite low for the manufacture and so enhance profitablility. This use of a standard wiring harness can make it relatively easy to upgrade an older car using components from salvage vehicles. Many of the features now taken as standard, such as the passenger compartment dome light were once extra cost or features or only seen in higher end models. Some features listed below may not be available on lower priced vehicles.

Typical convenience package enhancements include:

- Automatic headlight dimmer (may be part of a safety package)

- Automatic central rear view mirror dimmer (may be part of a safety package)
- Bluetooth cellphone link
- Glove compartment light
- Ground light on lower edge of door
- Passenger assist strap or handhold
- Vanity mirror on sun visor
- Vanity mirror light
- Map light
- Umbrella holder in door pillar.

Convenience items now generally included as standard include:

- Passenger compartment dome light
- Trunk light

Convenience items that are sometimes in favor include:

- Carriage side light (a white light on the *B* or *C* pillars to assist passengers during entry and exit)
- Swiveling front seat - the seat rotates toward the door opening so that one can sit in the seat before bringing one's legs inside of the vehicle.

Convenience items not generally included on modern cars include:

- Engine compartment light
- Automobile camping package:
  - Window screens
  - Fold up rear seat back
  - Added cushions or pads
  - Hatchback tent extension
  - Fitted luggage for touring (usually for use with a sports or grand touring car)

Obsolete items appearing only in antique cars

- Rumble seat
- Rumble seat entrance step
- Trunk rack
- Removable exterior trunk

See also

- *Convenience package*
- Handling package
- Navigation package
- Performance package
- Safety package
- Sports package
- Trim package (sometimes as appearance package)

Handling package

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A *handling package* is a set of functional enhancements to the suspension of a vehicle, sold and priced as a unit.

This package may contain one or more of the following enhancements

- Harder suspension bushings
- Enhanced shock absorber, which will usually have stiffer valving which may be locally or remotely adjustable
- Stiffer front anti-roll bar
- Rear anti-roll bar
- Special wheels and tires, typically with lightweight wheels of increased diameter and low profile tires offering greater resistance to side forces

See also

- Convenience package
- *Handling package*
- Navigation package
- Performance package
- Safety package
- Sports package
- Trim package (sometimes as appearance package)

Navigation package

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A *Navigation package* is a set of functional enhancements to assist in the operation of a vehicle, sold and priced as a unit.

This package may contain one or more of the following enhancements:

- GPS receiver to determine the location of the vehicle
- Enhanced odometer sensing by computer
- Electronic compass, usually presented on or near the central rear-view mirror
- CD-ROM drive or other computer storage of mapping information
- LCD display device for presentation of maps and navaigation information
- Voice synthesizer for the acoustic presentation of turning instructions to the driver
- Accident detection and notification - see OnStar for an example

- Satellite telephone service for emergency or casual use

See also

- Convenience package
- Handling package
- *Navigation package*
- Performance package
- Safety package
- Sports package
- Trim package (sometimes as appearance package)

Performance package

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A *performance package* is a set of functional enhancements to the driveline of a vehicle, sold and priced as a unit.

This package may contain one or more of the following enhancements

- Greater engine torque
- Greater engine power
- Lower ratio gears for enhance low end performance
- A greater number of speeds in the gearbox, manual or automatic
- Clutchless manual transmission
- Turbocharger or supercharger, perhaps with intercooling
- Cold air induction
- Dual exhaust system
- Special low back pressure mufflers, often with a distinctive sound
- Special cosmetic badging, hood scoop, or grille color, not usually related to performance but making the presence of the package obvious

See also

- Convenience package
- Handling package
- Navigation package
- *Performance package*
- Safety package
- Sports package
- Trim package (sometimes as appearance package)

Safety package

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A *safety package* is a set of functional features of a vehicle that are intended to reduce the likelihood of a crash or enhance surviveablity or injury reduction. Many items once included at extra cost are now standard items, being mandated by legislation or rule.

Some elements that may be included in a modern safety package:

- Acoustic back-up alarm
- Heads up instrumentation
- Heads up infra-red video vision augmentation
- Seat belt tensioners (pyrotechnic)
- Side curtain air bags
- Swiveling headlights that respond to the steering wheel input.
- Video imaging to the rear for assisting in vehicle back-up

Safety components once considered enhancements that are now standard:

- Air bags
- Backup lights
- Brake lights
- Central stop light
- Padded dashboard (many of these were actually more dangerous due to soft padding masking hard corners)
- Padded sun visors
- Seat belts
- Turn signals

See also

- Convenience package
- Handling package
- Navigation package
- Performance package
- *Safety package*
- Sports package
- Trim package (sometimes as appearance package)

Sports package

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A *sports package* is a set of cosmetic and functional enhancements to a vehicle, sold and priced as a unit.

In an SUV or light truck this may include special racks or tiedowns for transport of off road recreational vehicles and other equipment.

For a sedan or coupe the package combines elements of the following packages:

- Performance package - a more powerful motor, perhaps including increased displacement, higher compression, or a turbocharger or supercharger and may include special wheels of light weight
- Handling package - Harder suspension bushings, enhanced shock absorber, and anti-roll bar. Modern versions typically include special wheels and tires tires
- Trim package - often with bold graphics or special paint colors
- Special aerodynamic bodywork, often with a chin spoiler, side skirts, and a fixed rear foil or powered flap or spoiler to increase downforce at high speed

See also

- Convenience package
- Handling package
- Navigation package
- Performance package
- Safety package
- *Sports package*
- Trim package (sometimes as appearance package)

Trim package

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A *trim package* is a set of cosmetic (mostly non-functional) embellishments to a vehicle. In some cases the trim package may include a specific model name. Such packages may be characterized by the use of a famous designer's name.

Typical elements that may be included in a trim package include

- Special paint, some with the appearance of pearl, others showing color variations depending upon light angle.
- Paint patterns using multiple colors - two tone or three tone (out of current favor).
- Aluminum, plastic, or stainless steel trim to divide paint regions (out of current favor).
- Applied graphics on printed plastic sheeting with adhesive backing, usually rather gaudy.
- Pin striping - usually applied as a dealer add-on using special plastic tape and a removable backing.
- Plastic bumpers painted the same color as the vehicle body, rather than a matte black (now mostly included in the base level vehicle)

- Plastic rub strips to reduce paint and metalwork damage from adjacent car doors that are carelessly opened.
- Interior upholstery materials specific to the package. Leather in whole or part is often used in high end trim packages.
- Wood patterned plastic or applied surfaces in the interior or exterior. Applied surfaces out of current favor as they require careful design and application and lack translucency.
- Genuine wood trim - rare but used in some high end applications.
- Exterior cloth roof covers, simulating the appearance of a convertible (out of current favor).
- Padded plastic top additions to simulate a removable top portion - a landau top (out of current favor).

See also

- Convenience package
- Handling package
- Navigation package
- Performance package
- Safety package
- Sports package
- **Trim package** (sometimes as appearance package)

Most expensive cars

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This is the list of the most expensive cars as of the last decade (01.2006), The Price Is In NIS (Shekels Plus Taxes) — (for dollar divide by 12)

http://www.bmwparkville.com

Gemballa-Porsche Mirage EVO 23,500,000
Ferrari FXX 21,330,000
Mercedes-Benz CLK GTR 18,200,000 1999
Mercedes-Benz CLK GTR Roadster 17,625,000
Bugatti Veyron 16.4 15,500,000
Mercedes-Benz CLK GTR SuperSport14,688,000
B Engineering Edonis 10,900,000
McLaren F1 10,457,000 1998
Brabus SLR McLaren 9,270,000
Ferrari 575 GTC 9,220,000
Maserati MC12 9,050,000
Project 1221 MF1 8,900,000
Pagani Zonda C12F 8,890,000

a.d. Tramontana 7,750,000
Ferrari Enzo 7,700,000
-Lotus Elise GT1 7,570,000
Mercedes-Benz SLR AMG 7,000,000
Saleen S7 Twin Turbo 6,560,000
Leblanc Mirabeau 6,197,000
BMW E46 GTR (M3 SE) 5,520,000
Honda (Acura) NSX-R GT 5,520,000
Leblanc Caroline 5,510,000
Mercedes Benz SLR McLaren 5,319,000
Porsche Carrera GT 5,204,000
Rolls-Royce Phantom S 5,140,000
Brabus S V12 4,880,000
Saleen S7 4,700,000
Bentley Continental T Mulliner 4,510,000
Maybach 62 4,439,000
Bentley Azure Mulliner 4,420,000
Picchio DP2 4,400,000
Bristol Fighter S 4,300,000
Rolls-Royce Corniche 4,270,000
Spyker C8 double 12S 4,171,000
Pagani Zonda C12S 7.3 Monza 4,112,000
Pagani Zonda C12S 7.0 4,112,000
Koenigsegg ccR 4,112,000
Koenigsegg cc8S 4,112,000
Lister Storm GT 4,110,000
Bentley Continental T 4,000,000
Bentley Azure Convertible 3,960,000
Bentley Azure 3,940,000 1998
Rolls-Royce Phantom 3,900,000
Brabus E V12 3,870,000
Bentley Continental R Mulliner 3,865,000
Maybach 57 3,850,000
Bristol Fighter 3,850,000
Pagani Zonda C12S 7.3 Roadster 3,819,000
Techart GT — XL 3,818,000
Spyker C12 spyder 3,760,000
Spyker C12 laturbie 3,760,000
Pagani Zonda C12 6.0 3,760,000
Ascari KZ1-R 3,720,000
Lamborghini Diablo GTR 3,642,000 1999
Lamborghini Diablo GT 3,630,000 1999
Techart GT — S 3,525,000
Mercedes-Benz Renntech CLK-GTX 3,524,000
Mercedes-Benz Renntech E320 EV12 3,521,000 1999

-Auto China Hongqi 3,500,000?
Bentley Continental R 3,430,000
Lamborghini Diablo VT Roadster 3,360,500 1999
Lamborghini Murciélago 3,300,000
Lamborghini Diablo VT 6.0 Roadste3,290,000
Porsche 911 GT3 RSR 3,278,500
Bentley Arnage T Mulliner 3,256,000
Lamborghini Diablo VT 6.0 3,236,000
Koenigsegg cc 3,157,000
Hamann Porsche 911 Gullwing 3,100,000
Bentley Arnage RL Mulliner 3,060,000
Aston Martin DB RS9 3,030,000
Aston Martin V12 Vanquish S 3,012,000
Ferrari 575 SuperAmerica 3,000,000?
Ferrari 612 Scaglietti F1 2,988,000
Lamborghini Murciélago Roadster 2,963,000
Spyker C8 Spyder T 2,955,000
Aston Martin DB7 Vantage Zagato 2,937,000
Mercedes-Benz Renntech SL600 7.4 2,936,500
Gemballa Porsche GTR 750 EVO 2,935,000
Lamborghini Diablo VT 2,914,000 1999
Bentley Arnage T 2,890,000
TVR Carbera Speed 12 2,879,000
Ferrari 612 Scaglietti 2,870,000
Ferrari 360 Challenge Stardale 2,820,000
Shelby Super Cars Aero SC/8T 2,807,000
Lamborghini Diablo SV 2,796,000 1999
Techart Magnum 2,790,000
Ferrari 575M Maranello F1 2,750,000
Hamann Ferrari 360 Spider 2,737,000
Hamann Las Vegas Wings F1 2,723,000
Bentley Arnage R 2,720,000
BMW E46 (M3) GTR Short 2,690,000
Aston Martin Vanquish 2,679,000
Aston Martin DB Ameri Roadster 1 2,660,000
Rolls-Royce Silver Seraph 2,650,000
Ferrari 575M Maranello 2,644,000
Brabus SL 2,580,000
Mosler MT900S Photon 2,573,000
Bristol Blenheim 3S 2,560,000
Bristol Blenheim Speedster 2,510,000
Bentley Continental GT v12 2,470,000
Bristol Blenheim 3G 2,435,000
Techart GT2 ClubSport 2,390,000
Dodge Viper GTS-R 2,350,000 1998

Italdesign Volkswagen W12 Nardo 2,350,000
Bristol Blenheim 3 2,350,000
Brabus SL 55 K8 2,290,000
Hamann BMW E63 (645ci) 2,286,000
Mercedes-Benz Renntech sL65 2,262,000
Porsche 911 GT2 2,252,500
Ferrari F430 Spider F1 2,244,000
Mosler MT900S 2,220,000
Mercedes-Benz Renntech cL65 2,200,000
Brabus M V12 2,200,000
Mercedes-Benz SL65 AMG 2,183,000
Vector M12 2,160,000 1999
Ferrari F430 Spider 2,140,000
Techart turboblock 2,138,000
Mercedes-Benz CL65 AMG 2,119,000
Ferrari F430 F1 2,100,000

Automobile awards

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Car of the Year is a phrase usually considered to have been invented by Motor Trend magazine in the 1950s for their annual award for best automobile. The magazine still gives this award.

It also refers to an award given yearly to the new automobile selected best by a jury of journalists for motor magazines in Europe.

Although other similar awards exist in other parts of the world like Australia from the Australian automobile magazine Wheels and the AJAC in Canada, these two are the major ones that use the phrase, which is sometimes abbreviated COTY.

World Car of the Year
European Car of the Year
North American Car of the Year
Canadian Car of the Year
Motor Trend magazine's Car of the Year
Wheels magazine's Car of the Year
Car and Driver magazine's Ten Best
Road & Track magazine's Ten Best
MotorWeek Driver's Choice Awards
Top Gear magazine's Car of the Year Awards
Green Car Journal Green Car of the Year
International Car of the Year

European Car of the Year

Home | Up | European Car of the Year | North American Car of the Year | World Car of the Year

The European Car of the Year award was established in 1964 by a collective of motoring magazines from different countries in Europe. The current organisers of the award are Auto (Italy), Autocar (UK), Autopista (Spain), Autovisie (Netherlands), L'Automobile Magazine (France), Stern (Germany) and Vi Bilägare (Sweden).

The voting jury consists of motoring journalists from publications throughout Europe. Representation from each country is based on the size of the country's car market and car manufacturing industry. The jury for 2006 consisted of 58 members from 22 countries.

There are no categories or class winners — the stated objective is to find a "single, decisive winner" among all competing cars.

Current rules

Eligible cars are new models released in the twelve months prior to the award. The award is not restricted to European cars, but nominees must be available in at least five European countries, and have expected sales of 5,000 a year.

Nominees are judged on the following criteria: design, comfort, safety, economy, handling, performance, functionality, environmental requirements, driver satisfaction, and price.

A shortlist of seven cars is selected by a simple vote. For the final round of voting, each jury member has 25 points to distribute among the finalists. The points must be distributed to at least five cars, with no more than ten to any one car, and no joint top marks. The voting is open, and each jury member provides published justification for their vote distribution.

Under these rules, the decisiveness of the victory has varied greatly. For example, in 2005, the Toyota Prius won by a clear 139 points, received maximum points from twelve jurors, and was the top choice of 37. The next year, the Renault Clio won by a mere 5 points, received maximum points from only one juror, and was the top choice of 11.

Comments on each winner

Rover P6 (1964)

As the last new Rover before the creation of the British Leyland group, the distinctive looking P6 was a massive hit with wealthier buyers in the British market thanks to its excellent ride and handling, upmarket image and an excellent top-of-the-range 3.5 V8 engine. Comfort and value for money were good too.

Austin 1800 (1965)

After the success of the Mini and Austin 1100/1300, BMC launched another successful family car in the form of the large 1800 saloon. It won plaudits for its practicality and comfort, and was a strong competitor for the likes of the Ford Cortina.

Renault 16 (1966)

Renault went out on its own limb by launching the world's first-ever production hatchback - the Renault 16. It would be very popular — especially in its homeland of France — for many years, thanks largely to its versatility, comfort, ride quality and equipment levels.

Fiat 124 (1967)

Fiat's rejuvenation began with the launch of the medium sized 124 saloon. This practical range of saloons and estates had cavernous boot space and a roomy interior which contributed to its position as one of Europe's most popular family cars in the late 1960s.

NSU Ro80 (1968)

The slick styling of this German saloon housed an innovative 115bhp rotary engine with a three-speed semi-automatic gearbox driving the rear wheels. But the car was ultimately plagued by numerous engine problems and NSU eventually disappeared following a merger with Volkswagen.

Peugeot 504 (1969)

Despite a lack of technical innovation, Peugeot's 504 won praise all over the world. It was a stylish, comfortable, spacious and sturdy family car which offered superb ride and handling. The full range eventually included saloon, estate, coupe and cabriolet bodystyles.

Fiat 128 (1970)

Fiat's rejuvenation continued with the launch of the entirely new 128, which was nothing special to look at but on its launch was easily the best-handling family car in Europe. Its saloon and estate bodystyles were practical and the range was later completed with the arrival of a stylish coupe.

Citroën GS (1971)

Citroën broke into the medium family car sector with the aerodynamic GS hatchback and estate range. It was instant hit on the continent. Roadholding was excellent, but relatively small engines meant that performance was restricted.

Fiat 127 (1972)

Fiat completed its rejuvenation with the compact 127, which slotted into its range between the tiny 500 and the medium sized 128. It was one of Europe's first compact hatchbacks and for the first few years of its life was probably the most practical small car in the world.

Audi 80 (1973)

Following the merger with Volkswagen, Audi was fast becoming one of the most acclaimed car makers in Europe and the award winning 80 showed just how far the German marque had progressed in terms of quality, refinement and style. A light body ensured that its 1.3 and 1.6 engines gave strong performance.

Mercedes-Benz S-Class (1974)

The original Mercedes-Benz S-Class was an extremely stylish and luxurious saloon on its launch and its new 4.5 V8 engine was one of the most refined drivetrains of the decade. It was first of many S-Class models which have helped Mercedes-Benz maintain their position as one of the biggest 'image' car makers in the world.

Citroën CX (1975)

After nearly 20 years in production, the legendary DS/ID was finally replaced by the ultra-modern aerodynamically styled CX. A wide range of engines were all refined and economical, but the real star of the range was the 2.4 130bhp GTi version which could top 120mph. Hydropneumatic suspension ensured high levels of ride comfort and kept market demand high throughout the CX's long production life.

Chrysler Alpine/Simca 1307-1308 (1976)

Chrysler Europe's first all-new car was badged as the Chrysler Alpine in Britain and the Simca 1307-1308 in France. It had a stylish and practical hatchback body, a spacious interior, decent equipment levels and good handling. But it was let down by outdated 1.3 and 1.4 pushrod engines which were simply too short of power for cars in the Ford Cortina sector.

Rover SD1 (1977)

After the heavily criticised Austin Allegro and Morris Marina, BL finally got it right with its range topping Rover SD1. Its Chrysler-sourced 3.5 V8 was swift, refined and reliable, and its ultra-modern hatchback body was the most modern on a big car to be seen on Europe's roads during the 1970s.

Porsche 928 (1978)

Porsche spent heavily on an all-new supercar to replace the ageing 911, and the 928 was indeed a great looking and great handling masterpiece. Its 4.5 V8 power unit gave superb performance. But the 911 refused to die, and Porsche eventually dropped the 928.

Chrysler/Simca Horizon (1979)

Chrysler Europe's second award winning model, the Horizon was its manufacturer's first intended world car. On its arrival things were looking good — a practical, sturdy five-door hatchback with excellent roadholding. It was soon rebadged as a Talbot due to Chrysler Europe's sale to Peugeot, but was unable to establish itself as a successful world car.

Lancia Delta (1980)

Lancia entered the 1980s with an ultra-modern family hatchback which had been penned by world renowned designer Giugiaro. The four-wheel drive Integrale version would go on to enjoy a long and successful rally career, but smaller-engined versions were heavily criticised for their sluggishness and unreliability.

Ford Escort (1981)

Ford stuck with an established nameplate to completely upgrade its small family car for the 1980s, with rear-wheel drive and saloon bodystyle being discontinued in favour of front-wheel drive and hatchback bodystyle. With a wide range of engines and trim levels, the Escort was ideal for those looking for reliable motoring on a tight budget to enthusiasts wanting an exciting yet affordable driving tool. It was a huge success all over the world throughout the decade.

Renault 9 (1982)

Renault's answer to the Ford Escort and Opel Kadett (Vauxhall Astra) was the Renault 9 four-box saloon. Although not the most attractive or innovative car on the market, it was still relatively successful thanks to its superb roadholding and high levels of comfort and space. It was soon joined by the Renault 11 hatchback.

Audi 100 (1983)

The third incarnation of the Audi 100 went straight to the top of the large saloon sector and grabbed a host of honours, and for good reason. On its launch, it was hard to find another large saloon in Europe — if not the world — that offered more in the way of quality, engine refinement and technical innovation.

Fiat Uno (1984)

Fiat replaced the ageing 127 with the all-new Giugiaro-styled Uno. The contemporary-looking exterior housed a surprisingly spacious and practical interior, as well as having (some) power provided by its frugal engines. Quickly established itself as one of Europe's most popular cars and its popularity continued into the 1990s.

Opel Kadett/Vauxhall Astra (1985)

The second generation of Opel's front-drive Kadett (Vauxhall Astra in the UK) was voted Car of the Year thanks to its modern aerodynamic styling and wide range of engines, ranging from the veteran but economical 1.2 unit all the way up to the swift 1.8 GSi — and soon afterwards the road-burning 2.0 GTE 8v and 16v versions. Its wide range guaranteed the Kadett/Astra success virtually everywhere it was sold.

Ford Granada Scorpio (1986)

Ford scored a winner with the distinctive-looking Granada Scorpio, which was based on the mechanicals of the smaller rear-drive Sierra but stood out from the compact luxury car crowd thanks to its unusual but practical hatchback bodystyle, well-appointed interior and superb range-topping 2.9 V6 engine. It was also Europe's first volume production model to have antilock brakes as standard equipment across the range.

Opel Omega/Vauxhall Carlton (1987)

General Motors responded to the success of Ford's Granada Scorpio by introducing the all-new Opel Omega as replacement for the Rekord, although the British version was still sold as the Vauxhall Carlton. Its plus points were a massive boot, comfortable interior and an impressively powerful top-of-the-range 3.0 V6 engine with 177bhp.

Peugeot 405 (1988)

The Pininfarina-penned 405 saloon and estate range won the award by a wide margin. And it wasn't just the car's looks which sealed it. A comfortable interior, excellent ride and handling and an advanced turbo-diesel engine were years ahead of the competition on the 405's launch. It proved popular in Europe and just about everywhere else it went for the entirity of its production life.

Fiat Tipo (1989)

Fiat replaced the much-maligned Ritmo (Strada) with the all-new Tipo, finally lifting the rusting curse thanks to galvanised body panels. But the real key to the Tipo's success was its ultra practical tall body which housed a spacious, well-equipped and comfortable interior. Value for money and ride comfort were also very good.

Citroën XM (1990)

The quirky Citroën XM was one of the most unique offerings in the executive car market for the 1990s, with its Bertone-penned exterior well in keeping with Citroën's tradition for innovation, running skin deep through to the oleo pneumatic suspension. But earlier cars were plagued with electrical faults and within a few years demand had reduced to a trickle outside France.

Renault Clio (1991)

As an eventual replacement for the elderly Renault 5, the Clio won praise all over Europe by moving the supermini game on to a higher level thanks to its attractive styling, comfortable interior, solid build quality and excellent road behaviour. It went on to be a massive hit all over Europe.

Volkswagen Golf (1992)

It was third time lucky for the Golf as the third incarnation of this world famous family car finally lifted the Car of the Year award. It earned praise for its solid build quality, reliable engines, comfortable interior and superb performance from the 1.8 GTI and 2.8 VR6 sports models.

Nissan Micra (1993)

The Micra was the first Japanese car to win the Car of the Year award, although it was made at Nissan's Sunderland plant in the UK. Ease of driving, solid build quality, faultless reliability and lively 16-valve engines were the main reasons for most jurors giving the Micra top marks.

Ford Mondeo (1994)

Ford replaced the rear-drive Sierra with the front-drive Mondeo, and its new model was an instant success all over Europe thanks to its modern looks, impressive handling, comfortable interior and refined range of Zetec petrol engines. The only major criticism of the car was the lack of refinement of its diesel engine in comparison to the oil-burners from Peugeot and Citroen.

Fiat Punto (1995)

Fiat replaced the long-running Uno with the Punto. Like its predecessor, the Punto was a stylish product from the Giugiaro studios, but there was more to its success than its dramatic looks. Competitive prices, low running costs and spacious interior saw it pip the all-new Volkswagen Polo to the big prize. The Punto was an instant success all over Europe.

Fiat Brava/Bravo (1996)

The Car of the Year award went to Fiat for the second year running. This time the winner was two separate cars — the three-door Bravo hatchback and five-door Brava fastback. Both cars were distinctively styled, spacious, well equipped and good to drive, and strengthened Fiat's position in the European family car market.

Renault Scénic (1997)

Renault became the first European manufacturer to churn out a compact people carrier, with its Scénic being sourced from the chassis of the successful Mégane hatchback. It was a huge success wherever it went, thanks to its ultra practicality and good range of engines. Within a few short years, most other manufacturers had come up with an answer to the Scénic but few of them could match its superb versatility.

Alfa Romeo 156 (1998)

Alfa Romeo's first serious BMW 3-Series competitor grabbed the Car of the Year award thanks to its sleek looks, appealing interior, superb handling and strong performance, as well as much-improved build quality which looked to end the marque's reputation for lacklusture build quality.

Ford Focus (1999)

After trying the distinctive 'New Edge' style in less popular models, Ford adopted its distinctive styling for the all-new Focus which would be competing in the small family car sector - the most competitive sector in Europe. It was an instant success all over Europe thanks not only to its distinctive looks, but its excellent ride and handling, good equipment levels and spacious interior also drew praise from those who bought the car.

Toyota Yaris (2000)

As only the second Japanese car to be voted European Car of the Year, Toyota's new supermini was a winner with the jurors thanks to its technical innovation, spacious interior, clever styling and impressively powerful 1.0 engine. It also maintained Toyota's reputation for building solid and faultlessly reliable cars.

Alfa Romeo 147 (2001)

Taking its chassis from the larger 156, the 147 hatchback was arguably the most stylish car in its sector and won the Car of the Year award by a one-point margin. It also offered a smooth ride, sharp handling and a clever Selespeed semi automatic gearchange as an option on some models. Its 1.9 litre JTD turbo diesel unit was also an ultra refined oil burner which helped Alfa Romeo rejuventate itself further.

Peugeot 307 (2002)

The Peugeot 307 was voted European Car of the Year thanks to its appealing looks, spacious interior, good equipment levels and impressive handling. Its 2.0 HDi turbo-diesel was a benchmark for oil-burners in terms of economy, performance and environmental friendliness. Most European markets took to it straight away, although some concerns about build quality and reliability dented its reputation.

Renault Mégane (2003)

The second-generation Renault Mégane ran away with the European Car of the Year award thanks to its distinctive looks, excellent safety rating, good equipment levels, solid build quality and an ultra-refined 1.9 dCi diesel engine. A wide range included a hatchback (with three or five doors), an estate (badged SportTourer), a saloon and a clever coupe-cabriolet. Sales all over Europe were high, silencing any critics who suggested that the car's quirky looks would ruin its chances of success.

Fiat Panda (2004)

Fiat's all-new city car was given top marks by most of the jurors thanks to its surprsingly high levels of space and comfort, as well as its excellent 1.3 Multijet diesel engine. It helped revive Fiat's fortunes after a slight fall in market share across Europe, and set the benchmark for others to match in the subcompact market.

Toyota Prius (2005)

The quirky-looking Prius was an award winner mainly due to its environmentally friendly petrol-electric hybrid motor which also gave good performance. A slightly high price tag was partly justified by high levels of interior space, comfort and equipment. Handling was good too, and being a Toyota it should establish itself as a reliable and well built vehicle.

Renault Clio (2006)

With the third generation Clio, Renault strengthened its position as one of the world's top car manufacturers. The Clio was the first model to have won the award twice, the original Clio having received the award 15 years earlier. The main factors in its success were excellent safety ratings, a spacious interior, high equipment levels and a good driving experience which justified its slightly steep asking price.

North American Car of the Year

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The *North American Car of the Year* is an automobile award voted annually in January at the North American International Auto Show in Detroit. The jury consists of 48 automotive journalists.

World Car of the Year

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The *World Car of the Year* is an automobile award selected by a jury of 48 international automotive journalists. Cars considered must be sold in at least five countries on at least two continents prior to January 1 of the year of the award. The contest is a new one, inaugurated in 2005 as a unified award similar to many of the continent- and nation-specific Car of the Year awards already given.

2006

The winner will be selected at the New York Auto Show in April.

BMW 3-Series (winner)
Mazda MX-5 (finalist)
Porsche Cayman S (finalist)
Honda Civic and Honda Civic Hybrid
Land Rover Range Rover Sport
Lexus IS
Mercedes-Benz M-Class
Mercedes-Benz S-Class
Suzuki Swift
Volkswagen Passat

World Performance Car

Porsche Cayman S (winner)
Audi RS4 (finalist)
BMW M5 (finalist)

World Green Car

Honda Civic Hybrid (winner)
Citroën C1 1.4 Hdi Diesel (finalist)
Lexus RX 400h/Toyota Harrier Hybrid (finalist)

World Car Design of the Year

Citroën C4 (winner)
BMW 3-Series (finalist)
Honda Civic / Civic Hybrid European version (finalist)

2005

Ten finalists were reduced to three before the winner was selected at the Canadian International Auto Show in Toronto.
Audi A6 (winner)
Porsche 911
Volvo S40

Fictional automobiles

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The following is a list of fictional vehicles:

Automobiles

- 6000 SUX - car from film RoboCop
- Abarth 2000 – driven by Heinrich Von Schnellfahren in the Norwegian puppet film Flåklypa Grand Prix (English title "Pinchcliffe Grand Prix").
- ARGO - the all terrain vehicle employed by the Enterprise in Star Trek:Nemesis.
- Batmobile - The primary transportation of the DC Comics superhero Batman. Note: The Batmobile has taken on many different forms from the 1930s to today and has evolved along with the character in TV, films, and comics. Notable examples include:
    - The original 1930s Batmobile, which automotive experts believe resembles the DeSoto coupe of that era.
    - The muscle car Batmobile used in the campy 1960s TV series.
    - The sleek, aerodynamic Batmobiles of the 1990s cartoons and the Movie Batman Forever
    - The flying Batmobile used in the futuristic Batman Beyond cartoon series.
    - The hulking, tank-like Batmobile of the newest Batman film, Batman Begins
- Belchfire - name of the make of huge, overpowered cars in Grin and Bear it cartoons by George Lichty

- Bertone Carabo - driven by Rufino Gasolinis, the Devil from Torino, in the Norwegian puppet film Flåklypa Grand Prix (English title "Pinchcliffe Grand Prix").
- The Betsy - Harold Robbins novel (and movie) The Betsy
- Bormann 6 - car from the US film Putney Swope
- Bulgemobile - name of the make of huge, overdecorated cars illustrated by Bruce McCall in National Lampoon
- Boomerang Rapido – designed and driven by Rudolf Blodstrupmoen (English name "Rudolph Gore-Slimey") who has completely dominated auto racing the past three years. It features a 12 cylinder engine, active spoiler and a super retometer distributor (the design of which was stolen from Reodor Felgen). From the Norwegian puppet film Flåklypa Grand Prix (English title "Pinchcliffe Grand Prix").
- C.A.R.R. - Stroker & Hoop
- Canyonero - a parody of typical SUVs, The Simpsons Also available in F-Series, for the ladies.
- The Catillac - Shape-shifting Cadillac convertible (Red body wth a white hood, trunk, and interior, no tires or rims, a trophy for a hood ornament, and a fan where the spare tire should be), which can shift into an air boat, a mobile home, or a submarine in the Catillac Cats cartoons (paired with DIC Entertainment's Heathcliff cartoons) — despite looking like a junker, this car is really a hotrod capable of beating most other cars in any race
- Deling City bus - from Final Fantasy VIII, most notable for running 1 every 30 seconds
- Durango 95 - sports car, from the film A Clockwork Orange
- Dragster of Doom - Beetlejuice animated series. Created from spare parts like Frankenstein, but with a Jekyll & Hyde personality. Known as Doomie, for short. Created by Lydia Deetz and Beetlejuice.
- The Flintstones' car from The Flintstones
- Helen Wheels - a Land Rover from the Paul McCartney song of the same name
- Herkimer Battlejitney - "the best nonlethal military vehicle ever made" from the movie, Mystery Men
- Heron sedan car - Nero Wolfe
- Hirondel - the unpretentious make of car driven by Simon Templar, Leslie Charteris's character The Saint
- The Homer - car designed by Homer Simpson, The Simpsons
- IT - codename for a superfast gyroscopic unicycle designed by Mr. Garrison to combat airlines, South Park
- The Jupiter 8 - a Roman car on an episode of the original Star Trek series
- KARR - Knight Rider
- KITT - Knight Rider
- La Tourra - from Futurama
- Mach Five - the racing car driven by Speed Racer

- Maibatsu Thunder - Sendup of SUV ads in Grand Theft Auto
- Melmoth - Humbert Humbert's car in Lolita
- Nike One 2022 - from the Gran Turismo 4 video game
- Paragon Panther - make of the car from Chitty Chitty Bang Bang of which the one with the license plate GEN11 happened to be magical
- Porter - a "1928 Porter" was the vehicle in My Mother the Car; a firm of this name once existed, but failed before that year
- Rolls-Royce FAB 1 - a pink, James Bond-like amphibious limousine driven by Aloysius "Nosey" Parker and ridden by Lady Penelope Creighton-Ward in the Thunderbirds television series
- Rolls Royce Shadowshark - driven by 1930s pulp magazine character Dr Shade and yuppie Dark Lord Rex Leech in Kim Newman's fiction
- Schlep car - the dilapitated green dune buggy that became Wonder Bug, a sparkling red buggy when fitted with a magic horn.
- Shinra truck - Final Fantasy VII, a 3 wheeled pickup (single wheel at the rear), presumably with a Mako engine
- The Silver Hornet - a Citroen 2CV, driven by Inspector Clouseau in Revenge of the Pink Panther with extensive cosmetic modifications prone to falling apart
- Takuro Spirit - Popular car in an alternate Earth from Stephen King's Dark Tower series
- Il Tempo Gigante - designed and driven by Reodor Felgen (English name "Theodore Rimspoke") in the Norwegian puppet film Flåklypa Grand Prix (English title "Pinchcliffe Grand Prix")
- Thundercougarfalconbird - From Futurama A car that is marketed to men who really do care what other people think about their masculinity.
- Trovare - expensive but unreliable sports car from 'Europa', from the 1988 US movie It Takes Two
- Wagon Queen Family Truckster (in Metallic Pea) - National Lampoon's Vacation
- Wario Car - driven by Wario, first seen in Wario Land 4
- Wasabi - a badly designed Japanese car driven by Newton Pulsifer in Good Omens
- Yamura - the series of race cars in the 1966 movie Grand Prix

Recreational Vehicles

- Klassy Krib, a "fully-loaded" RV - The Simpsons

Flying cars/personal spacecraft

- Beta Romeo - flying car, Futurama
- Ford Thundercougarfalconbird - flying car, Futurama
- Plymouth V'ger - flying car, Futurama

- Scooty-Puff Jr. - short-range single-person spacecraft for children, Futurama
- Scooty-Puff Sr. - short-range single-person spacecraft for adults, Futurama
- General Products - Spaceship hulls, Known Space
- The Jetsons' car from The Jetsons

Railroads and trains

- Wrath of Conrail - Futurama
- Unnamed truck-train hybrid - Mad Max Beyond Thunderdome
- Blaine, a suicidal high-tech locomotive that will only reconsider self-destruction if its passengers can stump the CPU with a riddle - Stephen King's The Dark Tower: Wastelands

See also

- List of famous automobiles

Auto racing

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Auto racing (also known as *automobile racing*, *autosport* or *motorsport*) is a sport involving racing automobiles. *Motor racing* or *motorsport* may also mean motorcycle racing, and it can further include motorboat racing and air racing. It is one of the world's most popular spectator sports and perhaps the most thoroughly commercialized.

History

The start

Auto racing began almost immediately after the construction of the first successful petrol-fuelled autos. In 1894, the first contest was organized by Paris magazine Le Petit Journal, a reliability test to determine best performance.

A year later the first real race was staged in France, from Paris to Bordeaux. First over the line was Émile Levassor but he was disqualified because his car was not a required four-seater.

An international competition began with the Gordon Bennett Cup in auto racing.

The first auto race in the United States, over a 54.36 mile (87.48 km) course, took place in Chicago, Illinois on November 2, 1895, Frank Duryea winning in 10 h and 23 min, beating three petrol-fuelled cars and two electric. The first trophy awarded was the Vanderbilt Cup.

City to city racing

With auto construction and racing dominated by France, the French automobile club ACF staged a number of major international races, usually from or to Paris, connecting with another major city in Europe or France.

These very successful races ended in 1903 when Marcel Renault was involved in a fatal accident near Angouleme in the Paris-Madrid race. Eight fatalities caused the French government to stop the race in Bordeaux and ban open-road racing.

1910-1950

The 1930s saw the radical differentiation of racing vehicles from high-priced road cars, with Delage, Auto Union, Mercedes-Benz, Delahaye and Bugatti constructing streamlined vehicles with engines producing up to 450 kW(612HP) with the aid of multiple superchargers. From 1928-1930 and again in 1934-1936, the maximum weight permitted was 750 kg(1654Lbs), a rule diametrically opposed to current racing regulations. Extensive use of aluminium alloys was required to achieve light weight, and in the case of the Mercedes, the paint was removed to satisfy the weight limitation, producing the famous Silver Arrows.

Categories

There are many categories of auto racing.

Single-seater racing

Single-seater (open-wheel) racing is perhaps the most well-known form of motorsport, with cars designed specifically for high-speed racing. The wheels are not covered, and the cars often have aerofoil wings front and rear to produce downforce and enhance adhesion to the track.

Single-seater races are held on specially designed closed circuits or street circuits closed for the event. Many single-seater races in North America are held on "oval" circuits and the Indy Racing League races mostly on ovals.

The best-known variety of single-seater racing is the Formula One World Championship, which involves an annual championship featuring major international car and engine manufacturers in an ongoing battle of technology and driver skill. Formula One is, by any measure, the most expensive sport in the world, with some teams spending in excess of 200 million US dollars per year. Formula One is widely considered to be the pinnacle of motorsports, and a seat in a Formula One car is undoubtedly the peak of any driver's racing career. In North America, the cars used in the National Championship (currently Champcars and the Indy Racing League) have traditionally been similar to F1 cars but with more restrictions on technology aimed at helping to control costs.

Other single-seater racing series are GP2 (formerly known as Formula 3000 and Formula Two), Formula Nippon, Formula Renault 3.5 (also known as the World Series by Renault, succession series of World Series by Nissan), Formula Three, Formula Atlantic, and A1 Grand Prix.

There are other categories of single-seater racing, including kart racing, which employs a small, low-cost machine on small tracks. Many of today's top drivers started their careers in karts.

Rallying

Main article: Rallying

Rallying, or rally racing, involves highly modified production cars on (closed) public roads or off-road areas run on a point-to-point format where participants and their co-drivers “rally” to a set of points, leaving in regular intervals from start points. A rally is typically conducted over a number of stages of any terrain, which entrants are often allowed to scout beforehand. The co-driver uses the "pacenotes" to help the driver complete each stage as fast as possible, reading the detailed shorthand aloud over an in-car intercom system. Competition is based on lowest total elasped time over the course of an event.

The top series is the World Rally Championship (WRC), but there also regional championships and many countries have their own national championships. Some famous rallies include the Monte Carlo Rally and Rally Argentina. Another famous event (actually best described as a "rally raid") is the Paris-Dakar Rally. There are also many smaller, club level, categories of rallies which are popular with amateurs, making up the "grass roots" of motorsports.

Touring car racing

Touring car racing is a style of road racing that is run with production derived race cars. It often features exciting, full-contact racing due to the small speed differentials and large grids.

The V8 Supercars originally from Australia, Deutsche Tourenwagen Masters originally from Germany, and the World Touring Car Championship held with 2 non-European races (previously the European Touring Car Championship) are the major touring car championships conducted worldwide.

The Sports Car Club of America's SPEED World Challenge Touring Car and GT championships are dominant in North America while the venerable British Touring Car Championship continues in Great Britain. America's historic Trans-Am Series is undergoing a period of transition, but is still the longest-running road racing series in the U.S. The National Auto Sport Association also provides a venue for amateurs to compete in home-built factory derived vehicles on various local circuits.

Stock car racing

Stock car racing is the American variant of touring car racing. Usually conducted on ovals, the cars look like production cars but are in fact purpose-built racing machines which are all very similar in specifications. Early stock cars were much closer to production vehicles; the car to be raced was often driven from track to track.

The main stock car racing series is NASCAR and among the most famous races in the series are the Daytona 500 and Allstate 400 at The Brickyard. NASCAR also runs the Busch Series (a junior stock car league) and the Craftsman Truck Series (pickup trucks).

NASCAR also runs the Featherlite series of "modified" cars which are heavily modified from stock form. With powerful engines, large tires, and light bodies. NASCAR's oldest series is considered by many to be its most exciting.

There are also other stock car series like IROC in the United States and CASCAR in Canada.

British Stock car racing is a form of Short Oval Racing This takes place on shale or tarmac tracks in either clockwise or anti-clockwise direction depending on the class, some of which allow contact.

Races are organised by local promoters and all drivers are registered with BRISCA and have their own race number.

What classes exist depends on the promoters, so events in Scotland at Cowdenbeath can be very different from an event at Wimbledon Stadium in London.

Formula Cars

- F1 - Cars built to Specification normally utilising 5,6 or 7 Litre V8 engines
- F2 - Specification built cars similar to F1 with 2 Litre Engines

These are the two main National forms of British Stock Car Racing, there are World Championships organised by the governing body [1]

There are also local variants raced in some smaller tracks, they are usually similar to F2 Stock Cars.

F1's race (in the UK) at the following venues:

Belle Vue Stadium (Manchester), Owlerton Stadium (Sheffield), Skegness Stadium, Buxton, Hednesford, Birmingham, Northampton, Coventry, Kings Lynn, Ipswich, Cowdenbeath, Knockhill.

They also race in Holland.

Hot Rods

- Local Variations on the concept of fibreglass cars that look like production models Non Contact

Production Models

- Modified Road cars, classes range from Non-Contact 2 Litre Hot Rods to Contact Banger Racing.

Contact Classes can be identified by the inclusion of external side impact bars and large bumpers at either end made out of square section steel.

Drag racing

In drag racing, the objective is to complete a certain distance, traditionally 1/4 mile, (400 m), in the shortest possible time. The vehicles range from the everyday car to the purpose-built dragster. Speeds and elapsed time differ from class to class. A street car can cover the 1/4 mile (400 m) in 15 s whereas a top fuel dragster can cover the same distance in 4.5 s and reach 330 mph (530 km/h). Drag racing was organised as a sport by Wally Parks in the early 1950s through the NHRA (National Hot Rod Association) which is the largest sanctioning motor sports body in the world. The NHRA was formed to prevent people from street racing. Illegal street racing is not drag racing.

Launching its run to 330 mph (530 km/h), a top fuel dragster will accelerate at 4.5 g (44 m/s^2), and when braking and parachutes are deployed, the driver experiences deceleration of 4 g (39 m/s^2), more than space shuttle occupants. A single top fuel car can be heard over eight miles (13 km) away and can generate a reading of 1.5 to 2 on the Richter scale. (NHRA Mile High Nationals 2001, and 2002 testing from the National Seismology Center.)

Drag racing is often head-to-head where two cars battle each other, the winner proceeding to the next round. Professional classes are all first to the finish line wins. Sportsman racing is handicapped (slower car getting a head start) using an index, and cars running faster than their index "break out" and lose.

Drag racing is mostly popular in the United States.

Sports car racing

In sports car racing, production versions of sports cars and purpose-built prototype cars compete with each other on closed circuits. The races are usually conducted over long distances, at least 1000 km, and cars are driven by teams of two or three drivers (and sometimes more in the US), switching every now and then. Due to the performance difference between production based sports cars and sports racing prototypes, one race usually involves many racing classes. In the US the American Le Mans Series was organized in 1999, featuring GT, GTS, and two prototype classes. Another series based on Le Mans began in 2004, the Le Mans Endurance Series, which included four 1000 km races at tracks in Europe. A competing body, Grand-Am, which began in 2000, sanctions its own set of endurance series, the Rolex Sports Car Series and the Grand-Am Cup. Grand-Am events typically feature many more cars and much closer competition than American Le Mans.

Famous sports car races include the 24 Hours of Le Mans, the 24 Hours of Daytona and the 12 Hours of Sebring.

Offroad racing

In offroad racing, various classes of specially modified vehicles, including cars, compete in races through off-road environments. In North America these races often take place in the desert, such as the famous Baja 1000. In Europe, "offroad" refers to events such as autocross or rallycross, while desert races and rally-raids such as the Paris-Dakar, Master Rallye or European "bajas" are called Cross-Country Rallies.

Kart racing

Although often seen as the entry point for serious racers into the sport, kart racing, or karting, can be an economic way to try your luck at motorsport and is also a fully fledged international sport in its own right. World-famous F1-drivers like Michael and Ralf Schumacher and most of the typical starting grid of a modern Grand Prix took up the sport at around the age of eight, with some testing from age three. Several former motorcycle champions have also taken up the sport, notably Wayne Rainey, who was paralysed in a racing accident and now races a hand-controlled kart. As one of the cheapest ways to go racing, karting is seeing its popularity grow worldwide.

Go-karts, or just "karts" - seem very distant from normal road cars, with dimunitive frames and wheels, but a small engine combined with very light weight make for a quick machine. The tracks are also on a much smaller scale, making kart racing more accessible to the people.

Other categories

Autocrossing
Autograss
Demolition Derby
Dirt speedway racing
Dirt track racing
Drifting
Grand Prix Truck Racing
Road racing
Short track motor racing
Slalom
Solo
Street racing
Rallycross
Folkrace

Use of flags

In open-wheel, stock-car and other types of circuit auto races, flags are displayed to indicate the general status of a race and to communicate instructions to competitors in a race. While the flags have changed from the first years (e.g. red used to start a race), these are generally accepted for today.

Flag | Displayed from start tower | Displayed from observation post

The race has started or resumed after a full caution or stop, or the race is proceeding normally. End of hazardous section of track.

Full course caution condition for ovals. On road courses, it means a local area of caution. Depending on the type of racing, either two yellow flags will be used for a full course caution or a sign with 'SC' (Safety car) will be used as the field follows the pace/safety car on track and no cars may pass. Local caution condition — no cars may pass at the particular corner where being displayed.

Debris or slippery patches on the track.

The car with the indicated number must pit. The session is halted; all cars on course must return to pit lane.

The car with the indicated number has mechanical trouble.

The driver of the car with the indicated number has been penalized for misbehaviour.

The driver of the car with the indicated number is disqualified or will not be scored until they report to the pits.

A car must allow another car to pass if the flag is blue only. With an orange or yellow stripe, it simply serves as a warning that faster traffic is behind. A car is being advised to give way to faster traffic approaching.

The race is stopped—all cars must halt on the track or return to pit lane. One lap remains. A slow vehicle is on the track.

The race has concluded.

Accidents

For the worst accident in racing history see Pierre Levegh

Formula One

Home | Up | Formula One | Rallying

Formula One, abbreviated to *F1* and also known as Grand Prix racing, is the highest class of single-seat open-wheel formula auto racing. The "formula" in the name is a set of rules which all participants and cars must meet. The F1 season consists of a series of races, known as Grands Prix, held in most cases on purpose-built circuits, in a few cases on closed city streets, whose results determine two annual World Championships, one for drivers and one for constructors. The cars race at speeds often in excess of 320 km/h (200 mph). The cars must meet a number of specifications, designed amongst other things to restrict maximum speeds in the interests of safety. For 2006[1] engines were reduced to normally-aspirated V8s with a displacement (capacity) of 2.4 litres (providing around 750 bhp at nearly 20,000 rpm). The rules place special emphasis on electronics, aerodynamics, suspension and tyres. The formula has seen many evolutions and changes through the history of the sport: engines have ranged from normally-aspirated straight-4 engines to supercharged V12 engines, displacements have ranged from 1.5 litres to 4.5 litres, and the maximum power achieved in the history of the series has been around 1200 bhp, during the turbo era.

Europe is Formula One's traditional centre and remains its leading market; however, Grands Prix have been held all over the world, and with new races in Bahrain, China, Malaysia and Turkey, its scope is continually expanding. As the world's most expensive sport, its economic impact is significant, and its financial and political battles are widely observed. Its high profile and popularity makes it an obvious merchandising environment which leads to very high investments from sponsors translating into extremely high monetary budgets for the constructor teams, however, in recent years several teams have gone bankrupt.

The sport is regulated by the Fédération Internationale de l'Automobile, with its headquarters in Place de la Concorde, Paris. Its President is Max Mosley. Formula One's commercial rights are vested in the Formula One Group, now owned by Alpha Prema.

Although now a minority shareholder, the sport is still generally promoted and controlled by Bernie Ecclestone.

History

The Formula One series has its roots in the European Grand Prix motor racing (q.v. for pre-1947 history) of the 1920s and 1930s. A number of Grand Prix racing organisations laid out rules for a World Championship before World War II, but due to the suspension of racing during the war, the World Drivers Championship was not formalised until 1947, and was first run in 1950. A championship for constructors followed in 1958. National championships existed in South Africa and the UK in the 1960s and 1970s. Non-championship Formula One races were held for many years but due to the rising cost of competition, the last of these occurred in 1983.

The sport's title, Formula One, indicates that it is intended to be the most advanced and most competitive of the many racing formulae.

Formative years

The inaugural Formula One World Championship was won by Italian Giuseppe Farina in his Alfa Romeo in 1950, barely defeating his Argentine teammate Juan Manuel Fangio. However, Fangio won the title in 1951 and four more in the next six years, his streak interrupted by two-time champion Alberto Ascari of Ferrari. Though Britain's Stirling Moss was able to compete regularly, he was never able to win the World Championship. Fangio is remembered for dominating Formula One's first decade and has long been considered the "grand master" of Formula One.

The first major technological development, Cooper's re-introduction of mid-engined cars (following Porsche's pioneering and all-conquering Auto Unions of the 1930s), which evolved from the company's successful Formula 3 designs, occurred in the 1950s. Jack Brabham, champion in 1959 and 1960, soon proved the new design's superiority. By 1961, all competitors had switched to mid-engined cars.

The first British World Champion was Mike Hawthorn, who drove a Ferrari to the title in 1958. However, when Colin Chapman entered F1 as a chassis designer and later founder of Lotus, British racing green came to dominate the field for the next decade. Between Jim Clark, Jackie Stewart, Jack Brabham, Graham Hill, and Denny Hulme, British teams and Commonwealth drivers won twelve world championships between 1962 and 1973.

In 1962, Lotus introduced a car with an aluminium sheet monocoque chassis instead of the traditional spaceframe design. This proved to be the greatest technological breakthrough since the introduction of mid-engined cars. In 1968, Lotus painted Imperial Tobacco livery on their cars, thus introducing sponsorship to the sport.

Aerodynamic downforce slowly gained importance in car design from the appearance of aerofoils in the late 1960s. In the late 1970s Lotus introduced ground effect aerodynamics that provided enormous downforce and greatly increased cornering speeds (though the concept had previously been tested by Jim Hall's Chaparral IndyCar team in the 1960s).

The formation of the Federation Internationale du Sport Automobile in 1979 set off the FISA-FOCA War, during which FISA and its president Jean Marie Balestre clashed repeatedly with the Formula One Constructors Association over television profits and technical regulations.

Rise in popularity

1981 saw the signing of the first Concorde Agreement, a contract which bound the teams to compete until its expiration and assured them a share of the profits from the sale of television rights, bringing an end to the FISA-FOCA War and contributing to Bernie Ecclestone's eventual complete financial control of the sport, after much negotiation.

The FIA imposed a ban on ground effect aerodynamics in 1983. By then, however, turbocharged engines, which Renault had pioneered in 1977, were producing over 700 bhp (520 kW) and were essential to be competitive. In later years, notably 1987, the Formula One turbo cars produced in excess of 1,000 bhp in racing trim (and perhaps as much as 1,250 bhp in qualifying trim). These cars were the most powerful open-wheel circuit racing cars ever. To reduce engine power output and thus speeds, the FIA limited fuel tank capacity in 1984 and boost pressures in 1988 before banning turbocharged engines in 1989.

In the early 1990s, teams started introducing electronic driver aids such as active suspension, semi-automatic gearboxes and traction control. Some were borrowed from contemporary road cars. Some, like active suspension, were primarily developed for the track and later made their way to the showroom. The FIA, due to complaints that technology was determining the outcome of races more than driver skill, banned many such aids in 1994. However, many observers felt that the ban on driver aids was a ban in name only as the FIA did not have the technology or the methods to eliminate these features from competition.

The teams signed a second Concorde Agreement in 1992 and a third in 1997, which is due to expire on the last day of 2007.

On the track, the McLaren and Williams teams dominated the 1980s and 1990s. Honda and McLaren dominated much of the 1980s, whilst Renault-powered Williams drivers won several world championships in the mid 1990s, with a McLaren comeback in the late 1990s. The rivalry between racing legends Senna and Prost became F1's central focus in 1988, and continued until Prost retired at the end of 1993. Tragically, Ayrton Senna died in a crash at the 1994 San Marino Grand Prix having taken over Prost's lead drive at Williams that year. The FIA vowed to improve the sport's safety standards; since that weekend, no driver has died on the track during a race.

Drivers from McLaren, Williams, Renault (formerly Benetton) and Ferrari, dubbed the "Big Four", have won every World Championship from 1984 to the present day. Due to the technological advances of the 1990s, the cost of competing in Formula One rose dramatically. This increased financial burden, combined with four teams' dominance (largely funded by big car manufacturers such as DaimlerChrysler), caused the poorer independent teams to struggle not only to remain competitive, but to stay in business. Financial troubles forced several teams to withdraw. Since 1990, 28 teams have pulled out of Formula One. This has prompted former Jordan owner Eddie Jordan to say that the days of competitive privateers are over.[2]

Modern F1

Many records were broken in the first few years of the 21st century by German Michael Schumacher and a resurgent Ferrari. Fernando Alonso became the youngest ever crowned champion in 2005. In 2001, Schumacher set the new record for the most Grands Prix ever won; the earlier record holder was Alain Prost, with 51 wins to his name. In 2002, Schumacher also set a new record by winning the championship earlier in the season than any previous driver by winning the French Grand Prix in July that year.[3] In 2003, Schumacher won his sixth championship title, beating the earlier record-holder, Juan Manuel Fangio with five championships. His record in 2006 stood at 7 championships. In 2003 Fernando Alonso became the youngest ever pole sitter by qualifying first at Malaysia. Later that year he became the youngest ever winner of a Grand Prix when he took the chequered flag in Hungary.

Despite Ferrari's dominance, Kimi Räikkönen driving for McLaren had a theoretical chance of claiming the championship in 2003 right until the end of the season at the Japanese Grand Prix. Juan Pablo Montoya driving for Williams also came close in 2003. Ferrari's championship streak finally came to an end on September 25, 2005 when Fernando Alonso clinched the 2005 championship with a third place finish at the Brazilian Grand Prix to become the youngest champion to date, replacing previous record holder Emerson Fittipaldi of Brazil. Michael Schumacher had been world champion for more than 1,800 days.

In the rulebook, several driver aids returned due in part to developments that allowed teams to evade the FIA "restrictions". Meanwhile, several changes to the rules were made[4] with the intention of improving the on-track action and cutting ever-increasing costs. Most notably, the qualifying format changed several times between 2003 and 2006. Another new regulation made drivers start each race with the same level of fuel they had during qualifying, introducing a new tactical element to each team's strategy. Other new restrictions included one making it mandatory for each engine to last two races; a driver who had to have his engine replaced would be penalised by starting ten places lower than his actual qualifying position in the starting grid of the race. In 2005, drivers were not allowed to change tires during the race, unless the tires were dangerously worn. This rule was removed for the 2006 season. Slick tyres(tyres without treads) are required for the 2007 season.

The first few years of the 21st century in F1 also saw some controversies and scandals. At the Austrian Grand Prix in 2002, Rubens Barrichello, Schumacher's teammate at Ferrari who was leading the race, was ordered by Ferrari to allow Schumacher to overtake him under "team orders". The ensuing scandal saw Ferrari slapped with a fine by the FIA, who also banned any further use of team orders in the new rules and regulations. [5] In 2005, the United States Grand Prix at Indianapolis saw only three out of ten teams race in a bizarre mishap when it turned out that the Michelin tyres for the other seven teams could not be safely used on the surface of the track, causing them to withdraw from the race [6] when the FIA refused a change for safety reasons, insisting on keeping to the letter of the regulations. Michelin has since announced that they will stop supplying tyres to F1 teams in 2007, sparking debate on whether this new system would make all F1 racing teams compete on a more equal ground.

During the early 2000s, Bernie Ecclestone's Formula One Administration created a number of trademarks, an official logo, and an official website for the sport in an attempt to give it a corporate identity. Ecclestone experimented with a digital television package (known colloquially as Bernievision), which was launched at the 1996 German Grand Prix in cooperation with German digital television service "DF1". Bernievision offered the viewer several simultaneous feeds (such as super signal, on-board, top of field, backfield, highlights, pit lane, timing), which were produced with cameras, technical equipment and staff different from those used for the conventional coverage. It was introduced in many countries over the years, but was shut down after the 2002 season for financial reasons.

The year 2005 marked the end of the era of the 10-cylinder engines, in which both normally-aspirated and turbocharged engines were used in F1 cars for more than two decades. At the end the statistics show a raw supremacy of the Renault engines having clinched several championships as engine suppliers and their first ever Drivers and Constructors Championships in a 100% Renault car in 2005. Renault was innovative during this period producing out of the standard designs as the 111° 10 cylinder engine for the 2003 RS23. But not only Renault was successful, Ferrari and especially Honda enjoyed great success with multiple championships with several teams, most notable McLaren and by a lesser extent Williams with whom Honda engines reached the highest levels of power in F1 history in the late 80's exceeding, in some circumstances, the 1200 bhp limit in qualifying. Other Championship winning engines are those from Mercedes Benz, BMW, Porsche and Ford Cosworth.

Racing and strategy

A Formula One Grand Prix event spans an entire weekend, beginning with two free practices on Friday, and one free practice on Saturday. Third drivers are allowed to run on Fridays for teams that finished the preceding season in 5th place or lower. After these practice sessions, a qualifying session is held.

The format of this qualifying session has been through several iterations since 2003. Attempts were made to reinvigorate interest in the qualifying session by using a "one-shot" system in which each driver would take turns on an empty track to set their one and only time. This has been changed for 2006 with a new "knockout" system.

The qualifying session is divided up into three phases lasting fifteen, fifteen and twenty minutes respectively. In the first phase, all 22 cars take to the track, doing as many laps as they wish. Only their fastest time will be recorded. At the end of the phase, the slowest six cars are eliminated from the session and are assigned the back six slots on the starting grid. The second phase is the same, leaving only ten cars to battle it out in the final phase for the top ten grid slots. The drivers can do as many laps as they wish during qualifying. During the first two 15 minute qualifying sessions, drivers may run on any fuel load they wish. This allows drivers to produce their fastest times possible on very light loads. The cars that have been "knocked out" are allowed to refuel to any level before the start of the race, even completely if they choose. This gives the drivers at the back the option for the possible advantage of a longer or even one pit stop strategy.

The ten remaining cars must declare the amount of fuel that they plan to start the race before they begin the final 20 minute phase. They will be allowed to replace the amount of fuel used in this session using a 2.5 kilograms of fuel per lap equation as long as the lap times produced during the session comply with the 110% rule. This forces the drivers onto the track to burn off their fuel load before they are able to set their fastest times with a lighter car. The 110% rule states that any lap times produced by a driver in the final session must be within 110% of their fastest time or it will not be recognised for fuel replacement. This applies to the drivers using their personal times. For example, during the final qualifying session at the 2006 season opener in Bahrain, Michael Schumacher set the fastest time of 1 min 31.431 s, for which he was awarded the pole position. According to the 110% rule any of his lap times during this session must not exceed 1 min 40.574 s, which is 110% of his fastest. Unfortunately, due to traffic he did exceed this limit and was penalized the 2.5 kg of fuel for that lap, causing Michael to pit sooner than planned and arguably to lose the race.

The race begins with a warm-up formation lap, after which the cars assemble on the starting grid in the order they qualified. If a driver stalls before the parade lap, and the rest of the field passes him, then he must start from the back of the grid. As long as he moves off and at least one car is behind him, he can retake his original position. A racer may also elect to start from pit-lane if he has any last minute problems with the car. If they choose to do this, they must wait for all cars to pass pit-lane before they may begin the race.

A light system above the track then signals the start of the race. Races are a little over 305 kilometres (180 miles) long and are limited to two hours, though in practice they usually last about ninety minutes. Throughout the race, drivers may make one or more pit stops in order to refuel and change tyres.

The FIA awards points to the top eight drivers and their respective teams of a grand prix on a 10-8-6-5-4-3-2-1 basis (the race winner receives ten points, the first runner-up eight, and so on). The winner of the two annual championships are the driver and the team who have accumulated the most points at the end of the season. If any drivers and/or teams have the exact amount of points and are both competing for the driver and/or team championships, the driver and/or team who has won more Grand Prix races during the course of the season is declared the winner.

Drivers and constructors

Formula One teams must build the chassis in which they compete, and consequently the terms "team" and "constructor" are more or less interchangeable. This requirement distinguishes the sport from series such as IRL, Champ Cars, and NASCAR, which allow teams to purchase chassis, and "spec series" such as GP2, which require all cars be kept to an identical specification. In its early years, Formula One teams sometimes also built their engines, though this became less common with the increased involvement of major car manufacturers such as BMW, DaimlerChrysler, Renault, Toyota, and Honda, whose large budgets rendered privately built engines less competitive (and redundant).

Early manufacturer involvement came in the form of a "factory team" (that is, one owned and staffed by a major car company), such as those of Alfa Romeo, Ferrari (FIAT) or Renault. Companies such as Climax, Repco, Cosworth, Hart, Judd and Supertec, which had no direct team affiliation, often sold engines to teams who could not afford to manufacture them. As the manufacturers' deep pockets and engineering ability took over, almost all engines are now produced by major manufacturers.

After having virtually disappeared by the early 1980s, factory teams made a comeback in the 1990s and 2000s, and now form half the grid with Toyota, Ferrari (FIAT), Honda, Renault and BMW either setting up their own teams or buying out existing ones. Mercedes-Benz (DaimlerChrysler) owns 40% of the McLaren team. The remaining teams buy engines from the factory teams or from Cosworth, currently the only commercial engine manufacturer.

The sport's 1950 debut season saw eighteen teams compete, but due to high costs many dropped out quickly. In fact, such was the scarcity of competitive cars for much of the first decade of Formula One that Formula Two cars were admitted to fill the grids. Ferrari is the only still-active team which competed in 1950, and as of 2006 eleven teams remain on the grid, each fielding two cars. Although teams rarely disclose information about their budgets, it is estimated that they range from US$75 million to US$500 million each.

Entering a new team in the Formula One World Championship requires a £25 million (about US$50 million) up-front payment to the FIA, which is then repaid to the team over the course of the season. As a consequence, constructors desiring to enter Formula One often prefer to buy an existing team: B.A.R.'s purchase of Tyrrell and Midland's purchase of Jordan allowed both of these teams to sidestep the large deposit.

Each car is assigned a number. The previous season's World Drivers' Champion is designated number 1, with his teammate given number 2. Numbers are then assigned according to each team's position in the previous season's World Constructors' Championship. There have been exceptions to this rule, such as in 1993 and 1994, when the current World Drivers' Champion (Nigel Mansell and Alain Prost, respectively) was no longer competing in Formula One. In this case the drivers for the team of the previous year's champion are given numbers 0 and 2. The number 13 has not been used since 1974, before which it was occasionally assigned at the discretion of individual race organizers. Before 1996, only the world championship winning driver and his team generally swapped numbers with the previous champion – the remainder held their numbers from prior years, as they had been originally set at the start of the 1974 season. For many years, for example, Ferrari held numbers 27 & 28, regardless of their finishing position in the world championship. As privateer teams quickly folded in the early 1990s, numbers were frequently shuffled around, until the current system was adopted in 1996.

Michael Schumacher holds the record for having won the most Drivers' Championships (seven) and Ferrari holds the record for having won the most Constructors' Championships (fourteen). Jochen Rindt has the distinction of having been the only posthumous World Champion.

Grands Prix

The number of Grands Prix held in a season has varied over the years. Only seven races comprised the inaugural 1950 season; over the years the calendar has almost tripled in size. Though the number of races had stayed at sixteen or seventeen since the 1980s, it reached nineteen in 2005.

Six of the original seven races took place in Europe; the only non-European race that counted towards the World Championship in 1950 was the Indianapolis 500, which, due to lack of participation by F1 teams, since it required cars with different specifications from the other races, was later replaced by the United States Grand Prix. The F1 championship gradually expanded to other non-European countries as well. Argentina hosted the first South American grand prix in 1953, and Morocco hosted the first African World Championship race in 1958. Asia (Japan in 1976) and Oceania (Australia in 1985) followed. The current nineteen races are spread over the continents of Europe, Asia, Oceania, North America, and South America.

Traditionally, each nation has hosted a single grand prix that carries the name of the country. If a single country hosts multiple grands prix in a year, they receive different names. For example, every year two grands prix take place in Germany, one of which is known as the European Grand Prix.

The grands prix, some of which have a history that predates the Formula One World Championship, are not always held on the same circuit every year. The British Grand Prix, for example, though held every year since 1950, alternated between Brands Hatch and Silverstone from 1963 to 1986. The only other race to have been included in every World Championship season is the Italian Grand Prix. It has always taken place at Monza, with one exception in 1980 when it took place at Imola (which now hosts the San Marino Grand Prix).

One of the newest races on the Grand Prix, held in Bahrain, represents Formula One's first penetration into the Middle East with a high tech purpose-built desert track. The Bahrain Grand Prix, along with other new races in China and Turkey, present new opportunities for the growth and evolution of the Formula One Grand Prix franchise whilst new facilities also raise the bar for other Formula One racing venues around the world.

Circuits

A typical circuit usually features a stretch of straight road on which the starting grid is situated. The pit lane, where the drivers stop for fuel during the race, and where the teams work on the cars before the race, is normally located next to the starting grid. The layout of the rest of the circuit varies widely, although in most cases the circuit runs in a clockwise direction. Those few circuits that run anticlockwise (and therefore have predominantly left handed corners) can cause drivers neck problems due to the enormous lateral forces generated by F1 cars pulling their heads in the opposite direction to normal. Many corners have become well known in their own right, such as the high-speed Eau Rouge at Spa-Francorchamps, and before the addition of chicanes to tame it, the Tamburello corner at Imola and the Curva Grande at Monza. Others, like thirteenth turn at Indianapolis (road course configuration), are simply straights for the drivers, even having taken in consideration the G-forces acting on the suspension. Also particularly lamented are the circuits at Zandvoort in the Netherlands and Kyalami in South Africa, neither of which are now used by F1.

Most of the circuits currently in use are specially constructed for competition. The only real street circuit is the Circuit de Monaco, used for the Monaco Grand Prix, although races in other urban locations come and go (Las Vegas and Detroit, for example) and proposals for such races are often discussed – most recently for London and Beirut. Several other circuits are also completely or partially laid out on public roads, such as Spa-Francorchamps. The glamour and history of the Monaco race are the primary reasons why the circuit is still in use, since it is thought not to meet the strict safety requirements imposed on other tracks. Three-time World champion Nelson Piquet famously described racing in Monaco as "riding a bicycle around your living room."

Circuit design to protect the safety of drivers is becoming increasingly sophisticated, as exemplified by the new track in Bahrain, designed – like most of F1's new circuits – by Hermann Tilke. Whereas in the 1950s a driver was lucky to find a strategically placed bale of straw to absorb an impact, modern Formula One circuits feature large run-off areas, gravel traps and tire barriers to reduce the risk of injury in crashes. This is an ongoing task – after the deaths of Ayrton Senna and Roland Ratzenberger at Imola during the 1994 season, the FIA mandated further changes to circuits. These were mostly aimed at better matching the speed of a car with both the available space to slow down in before reaching a barrier and the ability of those barriers to safely absorb the energy of a crash. An ongoing complaint of long time F1 fans is the emasculation of the world's greatest circuits in order to satisfy sometimes arbitrary demands from the FIA. Whilst circuit safety is of prime importance, this can often be achieved without the reduction of the modern circuit to parade route status.

The future of Formula One

Formula One went through a difficult period in the early 2000s. Viewing figures dropped, and fans expressed their loss of interest due to the dominance of Michael Schumacher and Ferrari. However, viewing figures are seeing some signs of recovery due to the varied 2005 season, with the Canadian Grand Prix attracting the third largest global TV audience of any sporting event in 2005, behind only the Super Bowl and the UEFA Champions League final.[7]

At present, the FIA has been taxed with the responsibility of making rules to combat the spiralling costs which affect the smaller teams and to ensure that the sport remains as safe as possible. The sport's rapid expansion into new areas of the globe also leaves some question as to which races will be cut.

As of the 2005 Formula 1 season, Ferrari dominance disapated as Renault and McLaren both became the top two teams in Formula 1, with Fernando Alonso becoming the new World Champion. This has since seen an insurgence of interest in the sport, with 22 teams applying for the 12 team spots available for the 2008 season.

Venue changes

In the interest of making the sport truer to its designation as a World Championship, FOM president Bernie Ecclestone has initiated and organized a number of Grands Prix in new countries and continues to discuss new future races. As of 2005, this expansion has resulted in the disappearance of only one race, the Austrian Grand Prix, which was last held in 2003; however, several teams have expressed their preference for a shorter calendar[8], and the future of such races as the British, European and San Marino Grands Prix has recently fallen into doubt.

The inaugural Turkish Grand Prix took place in 2005 in Istanbul Park, and Ecclestone has asserted publicly that F1 will return to South Africa within five years.[9] He has also expressed interest in a Russian Grand Prix in Moscow or St Petersburg in the near future.[10] The European Union's ratification of laws prohibiting tobacco advertising went into effect on July 31, 2005, providing another incentive for the heavily tobacco-sponsored sport to find venues outside of Europe.[11]

The future of the United States Grand Prix at Indianapolis Motor Speedway is also in doubt after only six cars started the 2005 race due to concerns about the safety of the supplied Michelin tyres. The US Grand Prix has been officially scheduled to occur again at the Indianapolis Motor Speedway on July 2, 2006.

Several of the new circuits in F1, especially those designed by Herman Tilke, have been criticized as lacking the "flow" of such classics as Spa-Francorchamps and Imola. His redesign of the Hockenheim circuit in Germany for example, while providing more capacity for grandstands and eliminating extremely long and dangerous straights, has been frowned upon by many who argue that part of the character of the Hockenheim circuits were the long and blinding straights into the Black Forest. These newer circuits, however are generally agreed upon to meet the safety standards of modern Formula One better than the older ones.

Rule changes

In the interests of safety and competition due to spending, the FIA instituted a number of rule changes at the start of the 2005 season. New tyre restrictions, multi-race engines, and reductions on downforce took effect. These two issues, safety and cost, are paramount in all rule-change discussions, and the FIA has made public its intention to continue to modify the rules with these goals in mind.

2005

The most significant of the new rules to save money required an engine to be used for two consecutive races. Drivers had the same unit for practice, qualifying, and race day as in previous years, and a team changing out an engine for any reason was penalized half the grid (10 spots) on race day. This reduced the number of engines each team produced by a significant amount, and the subsequent man hours required in constructing and maintaining the most expensive part of the car. The switch to a single set of tires went into effect: one set was to be used for qualifying, then set aside as spares, while only one set was used for the entire race, along with wets and intermediates for rain when allowed by officials, and spares for punctures only. After Raikkonen destroyed his Mercedes due to a flat spot, the rule was modified to allow dangerous non-puncture officially inspected changes in the interest of safety. While tire rules usually are implemented primarily for safety and/or cost reduction, some detractors felt that this rule was an attempt to mix the grid up due to Ferrari/Schumacher's dominance on Bridgestones over the past five years; Ferrari did, in fact, lose out as Michelin found itself better able to cope with the rule changes. The new downforce rules were continuations of the previous years to decrease overall downforce and ease breakaway speed safety, while at the same time optimizing advertising space on wings and body.

New qualifying rules were enacted as well. The then current qualifying format, a single flying lap on race fuel, replaced one which was used for the first part of the 2005 season (until the 2005 European Grand Prix) which involved two separate sessions, one on Saturday and a second on Sunday morning, with the starting grid drawn up according to the fastest aggregate time of each driver. This was ditched after complaints from spectators, who felt that the Saturday session was meaningless, and broadcasters, who did not want to broadcast so much Formula One on a Sunday.

2006

Beginning with the 2006 season, engine displacement will be decreased, a 2.4L V8 replacing the current 3.0L V10. With similar engine speeds, the change is expected to cut peak power by around 200 bhp, which in turn is likely to add around three to five seconds to lap times at most circuits. The FIA has permitted Scuderia Toro Rosso to use a rev-limited and air restricted V10 engine. In its previous incarnation as Minardi last year it seemed unlikely to be able to source a V8 engine and this measure was intended to permit it to continue operations. In the long run, the FIA intends to introduce greater restrictions on testing and the introduction of standardised electronic units and tires.

Over the coming years, radical changes will be made to the rules. In October 2005, the FIA proposal of enhancing overtaking won the support of the teams by agreeing about the new rear wing concept that would eliminate the current single rear wing and replace it with two box-like wings, one behind each rear wheel. These changes are due in 2007. **[12]**

A switch to the "KO" qualifying system for 2006 was announced in October 2005. All cars are permitted on the track. At the end of the first 15-minute period the clocks are stopped immediately. Drivers on a timed lap will not have their time registered once the 15 minutes are up. The slowest six cars can take no further part in qualifying, these cars will make up the last six grid positions in the order of their times. The times for the sixteen remaining cars are reset for the next session. At the end of the second 15-minute period, the clocks are stopped immediately. Drivers on a timed lap will not have their time registered once the 15 minutes are up. The slowest six cars can take no further part in qualifying, these cars will make up the grid in positions eleven to sixteen in the order of their times. The times for the ten remaining cars will be reset for the next session. For the final period, lasting 20 minutes, the cars will be arranged on the grid in positions one to ten in the order of their times. In the first two 15-minute sessions, cars may run any fuel load and drivers knocked out after those sessions may refuel ahead of the race. However, the top-ten drivers must begin the final 20-minute session with the fuel load on which they plan to start the race. They will be weighed before they leave the pits. Whatever fuel they use in the 20 minutes may be replaced at the end of the session provided that the laps they complete are all within 110% of their best session time. Any fuel for a lap outside of the 110% time will not be replaced. Unlike the first two 15 minute sessions, if a driver starts a timed lap before the checkered flag falls for the 20 minute session, their time will count even if they cross the finish line after the session has ended. **[13]**

Also, the 2006 season sees the return of the tyre changes during the pitstops. The thinking behind this is that the reduced engine size will offset any performance gain. Drivers also have access to slightly more tyres than in 2005 - seven sets of dry-weather, four sets of wet-weather and three sets of extreme-weather. Drivers must make a final choice of dry-weather compound ahead of qualifying as opposed to ahead of saturday practice as in years gone by.

Small teams

The Ford Motor Company's decision to pull out of Formula One at the end of 2004 exposed the vulnerabilities of some small teams. Jaguar Racing was sold to Red Bull and is now known as Red Bull Racing.

Jordan and Minardi both relied on Ford's Cosworth engines. Jordan then signed deal to use Toyota engines, while Minardi continued to use Cosworth engines under Cosworth's new owners.

Jordan was bought by Russo-Canadian company Midland in 2005 and from 2006 will be rebadged as Midland F1. In June 2005, BMW bought a majority stake in Sauber and intends to run the team as a factory entry in 2006. The Williams team will cease their partnership with BMW as a result, instead opting to run Cosworth engines for 2006. Arguably, the final small team disappeared with the September 2005 purchase of Minardi by Red Bull. In 2006, the Faenza-based team will be run as a junior team named Scuderia Toro Rosso (initially known as Squadra Toro Rosso), although technically the team is a separate entity to Red Bull Racing.

BAR-Honda's former driver Takuma Sato has found a home with new team Super Aguri F1 (headed by Japanese former F1 racer Aguri Suzuki). The team will start the year with 2002 Arrows chassis bought from former Minardi chief Paul Stoddart powered by Honda engines. The team plans to introduce a new car later in the season. [14]

Notes

1. ‘ Jordan: Privateer era is over
2. ‘ Schumacher makes history
3. ‘ It was Ferrari all the way
4. ‘ Seven teams boycott US Grand Prix
5. ‘ F1 third biggest global TV draw referenced from ITV-F1, published 31 December 2005
6. ‘ Sauber: 19 races is too many
7. ‘ Bernie in South Africa pledge
8. ‘ Bernie promises Russian race
9. ‘ Confusion over tobacco laws
10. ‘ F-1 Plans to Reshape Cars, Have Knockout Qualifying
11. ‘ 2006 season changes from the Official Formula 1 Website

- ‘ F1 gives Super Aguri green light from BBC Sport, published 21 December 2005

Constructors and drivers competing in the 2006 Formula One championship

Renault	*McLaren*	*Ferrari*	*Toyota*	*Williams*	*Honda*	*Red Bull*	*BMW*	*MF1*	*Toro Rosso*	*Super Aguri*
1 Alonso 2 Fisichella	*3 Räikkönen 4 Montoya*	*5 M Schumacher 6 Massa*	*7 R Schumacher 8 Trulli*	*9 Webber 10 Rosberg*	*11 Barrichello 12 Button*	*14 Coulthard 15 Klien*	*16 Heidfeld 17 Villeneuve*	*18 Monteiro 19 Albers*	*20 Liuzzi 21 Speed*	*22 Sato 23 Ide*

Rallying

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Rallying (international) or *rally racing* (US) is a form of automobile racing that takes place on public roads with modified production or specially built road cars. This unique motorsport is distinguished by running not on a circuit, but instead in a point-to-point format where participants and their co-drivers "rally" to a set of points, leaving in regular intervals from start points. The entertaining and unpredictable nature of the stages, and the fact that the vehicles are in some cases closely related to road cars, draws massive spectator interest, especially in Europe, Asia and Oceania.

History

While it is almost certain that similar competitions took place almost as early as there were cars, modern rallying originated in Europe in the early 20th century, and gained a modest foothold in car-crazy Europe. Not blind to the growing popularity, auto manufacturers began to support "works" or "factory" cars and sometimes entire teams in the events scattered around Europe throughout the year, and eventually a European Championship series was arranged, awarding points to the top finishers of the various respective events and standardizing rules. Later to become the World Rally Championship, this was a large step forward for rallying. There were negatives, however, as countries with multiple rallies were ultimately forced to nominate a single event for the regional and later world championship to the detriment to the other rounds. The movement truly hit its stride after the Second World War, reaching its romantic "Golden Age" in the 1960's as the Post-WW2 baby boom generation began to grow up. Soon after, sponsors' advertisements began to pock the paint of the rally cars, and the commercialization that permeates the modern sporting world began to change rallying forever. Drivers became paid professionals and technology advanced at shocking speeds, almost totally unhindered until the mid-eighties. The World Rally Championship now visits nearly all continents, taking its stylish sideways driving style and specialized cars to a vast global market, estimated by some to be second only to the Formula One juggernaut. This has produced unprecedented levels of visibility in recent years, but in many ways removed the motorsport from its "grassroots" past. For better or worse, rally has become a lucrative business.

Rally cars

In the industry-leading FIA World Rally Championship, the cars used are built to current World Rally Car specification. Previously Group A and Group B specification machines (very powerful turbocharged engines in lightweight bodies) were used. Group B cars were banned in 1986 because of an unacceptable number of deaths and injuries among drivers and spectators. It is worth noting, though, that due to advances in technology today's WRC rally cars are actually much faster than those in the Group B era, due mainly to superior braking technologies; not one Group B record stage time stands on the world circuit. Deaths are now very rare thanks to modern safety regulations including the HANS device and improved spectator control policies, but rallying retains its own particular dangers, as shown by the death in 2005 of co-driver Michael Park (admittedly the first fatality at the top level in over a decade).

Rally courses

Rally is also unique in its choice of where and when to race. Rallys take place on all surfaces and in all conditions, asphalt (tarmac), gravel, or snow and ice, sometimes more than one in a single rally, depending on the course and event. Rallies are also run every month of the year, in every climate, bitter cold to monsoon rain. This contributes to the notion top rally drivers are some of the best car control experts in the world. Because the drivers don't know exactly what's ahead, the lower traction available on dirt roads, and the driving characteristics of small cars, the drivers are much less visibly smooth than circuit racers, regularly sending the car literally flying over bumps, and sliding the cars out of corners.

A typical rally course consists of a sequence of relatively short (up to about 50km {30mi}) timed "special stages" where the actual competition takes place, and untimed "transport stages" where the rally cars must be driven under their own power to the next competitive stage within a generous time limit. Rally cars are thus unlike virtually any other top-line racing cars in that they retain the ability to run at normal driving speeds, and indeed are registered for street travel. Some events contain "super special stages" where two competing cars set off on two parallel tracks (often small enough to fit in a football stadium), giving the illusion they are circuit racing head to head. These stages, ridiculed by many purists, seem increasingly popular with event organizers. Run over a day, a weekend, or more, the winner of the event has the lowest combined special and super special stage times. Given the short distances of super special stages compared to the regular special stages and consequent near-identical times for the frontrunning cars, it is very rare for these spectator-oriented stages to decide rally results, though it is a well-known axiom that a team can't win the rally at the super special, but they can certainly lose it.

Reconnaissance drives

In most rallies, including those of the World Rally Championship (WRC), drivers are allowed to run on the tracks of the course before competition. In these reconnaissance drives, the co-drivers, who sit next to the drivers, write down shorthand notes on how to best drive the stage. Usually the drivers call out the turns and road conditions for the co-drivers to write down. These pacenotes are read aloud through an internal intercom system during the actual race, allowing the driver to anticipate the upcoming terrain and thus take the course as fast as possible.

In the past—and until recently in North America—most rally courses were not allowed to be scanned prior to the race, and the co-drivers used maps supplied by the organization. The exact route of the rally often remained secret until race day. This is changing though, as rallies throughout North America are now switching to either organizer supplied "route notes" or to full reconnaissance or "recce". This change has been brought on in large part due to competitor demand. Recce makes the competition experience faster, safer, and more satisfying for the entrant.

Notable rallies

Acropolis Rally in Greece
Expedition Trophy [1] in Russia from Minsk to Vladivostok
Junior World Rally Championship (JWRC)
Monte Carlo Rally to Monte Carlo, Monaco
Neste Rally Finland in Finland
Corona Rally Mexico in Mexico
Olympus Rally
Paris Dakar Rally (which is actually an offroad endurance race rather than a rally as described here)
RAC Rally in the UK
Rally of Poland
Rallye des Pharaons in Egypt
Safari Rally
San Remo Rally San Remo
Swedish Rally
Canadian Rally Championship
Targa Newfoundland
Targa Tasmania
World Rally Championship

Rallying is a very popular sport at the "grass roots" of motorsport—that is, motor clubs. Individuals interested in becoming involved in rallying are encouraged to join their local clubs. Club rallies (e.g. Road rallies) are usually run on public roads with an emphasis on navigation and teamwork. These skills are important fundamentals required for anyone who wishes to progress to higher-level events. Additional information about the jargon and rules of rally racing are available through the following links:

Rally principles and definitions
Rally navigation techniques, tips and tricks
Categories of rallies

Auto show

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An *auto show* or *motor show* is a public gathering of automobile manufacturers which includes demonstrations of current automobile models, new debuts, and concept cars. Most auto shows are regular annual or biennial occurrences. A few of the shows have become very important to the industry for their publicity value, while others are more important to local dealers wanting to bring consumers into their showrooms.

The Organisation Internationale des Constructeurs d'Automobiles, schedules many major international auto shows.

List of Auto Shows

With days, month and/or place, if they are fixed for all the years.

Australian International Motor Show
AutoRAI (Amsterdam)
Bangkok International Motor Show
Beijing Auto Show
Belgrade International Motor Show
Bologna Motor Show
British Motor Show
Brno Auto Show
European Motor Show (Brussels)
Canadian International AutoShow
Chicago Auto Show
Cairo International Motor Show
Copenhague International Motor Show
Salon International de l'Auto (Geneva)
Greater Los Angeles Auto Show
Greater Minneapolis and Saint Paul International Auto Show
Hannover Motor Show
Hot Import Nights
Internationale Automobil-Ausstellung (IAA - Frankfurt)

Kiev International Motor Show
Los Angeles Auto Show (January)
Lisbonne International Automobile Motor Show
Melbourne International Motor Show
Middle East International Motor Show, Dubai Website
Mondial de l'Automobile (Paris)
MOTORTEC (Madrid, May)
Nashville International Auto and Truck Show
New York International Auto Show
North American International Auto Show (Detroit, January)
Paris Motor Show (September-October)
Pebble Beach Concours d'Elegance
Scarsdale Concours d'Elegance (Scarsdale, New York)
Seattle International Auto Show
Seoul International Motor Show
South Florida Auto Show (Miami, Florida)
Tallinn Motorshow
Tokyo International Motor Show
TourdeSol Green Car Show (Westchester County, New York), May
Washington Auto Show (January)
Zagreb International Motor Show

2 Maintenance

Home | Auto mechanic | Tire rotation | Wheel alignment

Auto mechanic

An *auto mechanic* is a mechanic who specializes in automobile maintenance, repair, and sometimes modification and design. Education is usually post-secondary or secondary vocational education, although apprenticeship under a master mechanic is also an accepted method of learning the trade. A good mechanic must be proficient in mathematics, physics, electronics and computer science as well as logical processes used for diagnosing problems. Most reputable mechanics are ASE certified, which is a standardized method of testing skill level. The technology used in automobiles changes very rapidly and the mechanic must be prepared to learn these new technologies and systems. The auto mechanic has a physically demanding job, often exposed to temperature extremes and well as lifting heavy objects and staying in uncomfortable positions for extended periods as well as exposure to gasoline, solvents and other toxic chemicals. Related jobs include motorcycle repair and small engine repair.

Auto 'mechanics' are today professionally referred to as 'technicians', due to the level of technological competency now required to diagnose and perform needed repairs. Fading quickly is the day of the 'shadetree mechanic', who needed little knowledge of todays computerized systems. Today's technician must have knowledge of these systems, as well as more basic mechanical principles.

Due to the increasingly labyrinthine nature of the technology that is now incorporated into automobiles, most automobile dealerships now provide sophisticated diagnostic computers to each technician, without which they would be unable to diagnose or repair a multitude of common failures.

Tire rotation

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Tire rotation or *rotating tires* is the practice of moving automobile tires from one wheel to another to ensure even tire wear. Tire wear is uneven for any number of reasons. Even tire wear is desirable to maintain consistent performance in the vehicle.

By design, the weight on the front and rear axles differs which causes uneven wear. As the engine is in the front, the front axle typically has more of the weight. For rear wheel drive vehicles, the weight distribution between front and back approaches 50:50. Front wheel drive vehicles also have the differential in front, adding to the weight with a typical weight distribution of no better than 60:40. This means, all else being equal, the front tires wear out at almost twice the rate of the rear wheels, especially when factoring the additional stress that braking puts on the front tires. Thus, tire rotation needs to occur more frequently for front-wheel drive vehicles.

Turning the vehicle will cause uneven tire wear. The outside, front tire is worn disproportionately. Cloverleaf interchanges and parking ramps turn right in right hand drive countries, causing the left front tire to be worn faster than the right front. Furthermore, right turns are tighter than left turns, also causing more tire wear. Conversely the sidewalls on the right tire tends to be bumped and rubbed against the curb while parking the vehicle, causing asymmetric sidewall wear. The symmetric opposite occurs in countries that drive on the left.

In additional, mechanical problems in the vehicle may cause uneven tire wear. The wheels need to be aligned with each other and the vehicle. The wheel that is out of alignment will tend to be dragged along by the other wheels, causing uneven wear in that tire. If the alignment is such that the vehicle tends to turn, the driver will correct by steering against the tendency. In effect the vehicle is constantly turning, causing uneven tire wear. Also, if a tire is under or over-inflated, it will wear differently than the other tires on the vehicle. Rotating will not help in this case and the inflation needs to be corrected.

Manufacturers will recommend tire rotation frequency and pattern. Depending on the specifics of the vehicle tire rotation may be recommended every 12,000 km (7,500 mi). The rotation pattern is typically moving the back wheels to the front and the front to the back but crossing them when moving to the back. If the tires are unidirectional, the rotation can only be rotated front to back on the same side of the vehicle to preserve the rotational direction of the tires. Most unidirectional tires can be moved from side to side if they are remounted; tires with asymmetric rims are a rare exception. More complex rotation patterns are required if the vehicle has a full-size spare tire that is part of the rotation or if there are snow tires.

In rare cases, automobile manufacturers may recommend performing no tire rotation at all (eg BMW MINI).

Wheel alignment

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A *wheel alignment* is part of automobile maintenance.

In its most basic form, an alignment consists of adjusting the angles of the wheels so that they are set to the car maker's specification. Most people assume they simply need to be adjusted so to be perpendicular to the ground and parallel to each other, but this is not true at all. The purpose of these adjustments is maximum tire life and a vehicle that tracks straight and true when driving along a straight and level road, as well as correct tracking when driving on turns.

While wheel alignment is often confused with wheel balancing, the two have nothing to do with each other except for the fact that they affect ride and handling. If a wheel is out of balance, it will cause a vibration at highway speeds that can be felt in the steering wheel and/or the seat. If the alignment is out, it can cause excessive tire wear and steering or tracking problems.

What is Wheel Alignment? Wheel alignment is an adjustment an auto shop can make on your vehicle to ensure the tires are calibrated to 'point' straight ahead. Proper wheel alignment makes a vehicle steer easily and allows tires to wear evenly. When wheels are not aligned various problems result.

See also

- Tire rotation

3 Styling Features

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Hidden headlights

Hidden headlights are an automotive styling feature that conceals an automobile's headlights when not in use. Depending on the design, the headlights may rotate to sit flush with the front end (as with the Porsche 928), may retract into the hood and/or fenders (as with the Chevrolet Corvette from 1963 to 2004), or may be concealed behind retractable or rotating grille panels (as on the 1966 Dodge Charger or 1967 Mercury Cougar).

Hidden headlights first appeared on the Cord 810 in 1936. These units had to be manually opened when the headlights needed to be used.

Powered hidden headlights were pioneered in GM's Buick Y-Job concept car of 1938 and were used briefly on the 1942 production DeSoto, but their popularity has waxed and waned during the ensuing decades. While the arrangement was again popular in the 1980s, in large part because the retracted headlamps had less aerodynamic drag, it has fallen out of favor, owing in large part to the added cost, weight, and complexity, and the dubious reliability of the mechanisms in older cars.

Partial list of cars with hidden headlights

1985-1989 Acura/Honda Integra
1990-2002 Acura/Honda NSX
1976-1989 Aston Martin Lagonda
1989-1999 BMW 8 Series
1978-1981 BMW M1
1988-1991 Buick Reatta
1965-1969 Buick Riviera
1967-1968 Cadillac Eldorado
1967-1969 Chevrolet Camaro (optional)
1968-1969 Chevrolet Caprice (optional and very rare)
1963-2004 Chevrolet Corvette
1968-1971 Chrysler 300
1990-1993 Chrysler Imperial
1987-1992 Chrysler LeBaron (coupe & converible only)
1976-1981, 1988-1993 Chrysler New Yorker
1990-1993 Chrysler New Yorker Fifth Avenue
1942 DeSoto

1966-1970 Dodge Charger (optional from 1971 to 1972)
1987-1991 Dodge Daytona
1978-1979 Dodge Magnum (clear covers)
1972-1973 Dodge Monaco
1976-1978 Dodge Royal Monaco
1979-1981 Dodge St. Regis (clear covers)
1973-1988 Fiat X1/9
1968-1970 Ford LTD (including Country Squire wagon)
1975-1978 Ford LTD Landau (including Country Squire wagon)
1989-1997 Ford Probe
1970 Ford Ranchero (GT only)
1967-1969 and 1977-1982 Ford Thunderbird
1970 Ford Torino Brougham
1986-1989 Honda Accord
1982-1991 Honda Prelude
1969-1975, 1981-1983 Imperial
1975-1979 Lancia Montecarlo
1970-1979 Lincoln Continental
1968-1983 Lincoln Mark series
1962-1975 Lotus Elan 2+2
1978-2004 Lotus Esprit
1989-1995 Lotus Elan
1989-1997 Mazda MX-5
1978-2002 Mazda RX-7
1967-1970 Mercury Cougar
1969-1978 Mercury Marquis
1970 Mercury Montego (some models)
1991-1993 Mitsubishi 3000GT
1990-1992 Mitsubishi Eclipse
1989-1998 Nissan 180SX
1989-1994 Nissan 240SX/Silvia
1966-1969 and 1986-1992 Oldsmobile Toronado
1968-1973 Opel GT
1970-1971 Plymouth Fury (Gran Coupe & Sport Fury, Sport Suburban wagon for 1971)
1972 Plymouth Fury III (optional)
1984-1988 Pontiac Fiero
1982-2002 Pontiac Firebird
1968-1969 Pontiac GTO
1967-1968 Pontiac Grand Prix
1976-1988 Porsche 924
1982-1991 Porsche 944
1991-1994 Porsche 968
1985-1989 Porsche 911 Turbo SE 'Slantnose'
1994 Porsche 911 Turbo 3.6S 'Flatnose'
1967-1970 Toyota 2000GT

1986-1993 Toyota Celica
1983-1987 Toyota AE86 Sprinter Trueno/Toyota Corolla GT-S
1987-1991 Toyota Corolla AE92 SR5/GT-S coupe's
1984-1999 Toyota MR2
1982-1992 Toyota Supra
1975-1982 Triumph TR7 & TR8

Personal luxury car

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A *personal luxury car* is a highly styled, luxurious automobile intended for the comfort and satisfaction of its owner/driver, sacrificing passenger space, cargo capacity, and other practical concerns for the sake of style. The personal luxury car has often been a lucrative market segment of the post-World War Two automotive market.

Definition

Personal luxury cars are usually, though not necessarily, two-door coupes or convertibles with two-passenger or 2+2 seating capacity. They are distinguished from GT cars or sports cars by their greater emphasis on comfort and convenience than on performance, although the distinction between a luxury GT and a personal luxury car is often hazy. Personal luxury cars are typically mass producted (rather than custom-bodied), sharing their mechanical components with more prosaic sedans to reduce production costs and increase profitability.

Origins

The antecedents of the personal luxury car are the expensive, often custom-bodied sporting luxury cars of the 1920s and 1930s, some of the most famous of which were built by Bugatti, Delage, Delahaye, Duesenberg, and Mercedes-Benz. Two well-known examples were the Duesenberg SJ and Mercedes SSK: tremendously fast and stratospherically expensive automobiles eschewing the comfort of pure luxury cars while being too large and heavy to be true sports cars. They nonetheless offered distinctive style, impeccable craftsmanship, and strong performance for wealthy buyers (including film and music stars, kings, and gangsters) who wanted to project a dashing image. The Great Depression and World War Two eroded the market for these expensive, bespoke cars, but the postwar era still produced noteworthy examples like the Bentley Continental R Type with its fine two-door body built by H.J. Mulliner. A related, primarily postwar phenomenon was the grand tourer (GT), a relatively comfortable, high-performance car intended for high-speed, long-distance travel. Italy became a major producer of GTs, with marques like Ferrari and Maserati offering distinctive, often custom-bodied models of considerable performance.

Both the bespoke luxury car and the GT were beyond the reach of all but the wealthiest buyers, and the 1950s saw a growing trend in both the United States and Europe towards mass-market "specialty cars" catering to drivers who coveted the image of the bespoke machinery, but who could not afford the cost -- and to wealthier buyers who could afford the genuine article, but disliked the inconvenience and complexity of servicing and repairing it, especially outside of a major urban area. Buyers were also interested in automatic transmission, air conditioning, power steering, and other convenience options not generally offered on GTs or sports cars of the day.

The result was a burdgeoning market for "factory customs," models using standard or mostly standard engines and other mechanical components, but with unique styling. A prominent early example was the 1953 Cadillac Eldorado convertible, whose customized styling gave it a price tag nearly twice that of a standard Cadillac ragtop despite nearly identical underpinnings.

The personal luxury car market segment in the United States was largely defined by the Ford Thunderbird. The first Thunderbird, launched in 1955 and sold through 1957, was a two-seat convertible, but despite its compact size and respectable performance, Ford made no claims that the softly sprung T-bird was a true sports car, calling it a "personal car." Although some Thunderbirds were quite fast for their time, and some successfully competed in various forms of competition, it was more of a compact luxury car than a GT.

In 1958 Ford transformed the Thunderbird into a bulkier, four-seat model with a large array of comfort features and styling gimmicks and found it a tremendous success, outselling any of the earlier, two-seat T-birds. While the four-seat Thunderbirds had only average performance and mediocre handling, their airplane and rocketship-inspired design cues found a receptive audience.

The personal luxury market emerges

Curiously, other U.S. automakers were slow to react to the success of the Thunderbird. It was not until 1962 when Pontiac offered the Pontiac Grand Prix and Buick offered the Wildcat, followed the next year by the Buick Riviera, that the T-Bird had serious competition. By 1970 the segment was growing, and would achieve even greater success in the later 1970s.

While Europe's slower economic recovery meant that it did not venture as much into this market until the 1960s, there were exceptions like the DKW 1000Sp, the custom-bodied Alfa Romeo 1900 Sprint, BMW 507, and Mercedes 190SL, none of which were true sports cars or GTs, but did cultivate a similar image to the U.S. personal luxury market, albeit on a smaller scale. By the 1960s models like the Jaguar E-Type,BMW CS coupes, Citroen SM, and Mercedes SL roadsters, while more expensive and somewhat smaller than their U.S. equivalents, were very much aimed at the same type of market. Indeed, the initial 6-series BMWs of 1977 were very comparable to models like the Riviera: they shared most of their mechanical components with contemporary sedans, offering very similar (and even slightly inferior) performance and less practicality at a higher price, but their distinctive style and image made them desirable automobiles.

The decline of the muscle car in the early 1970s coincided with a strong upswing in the personal luxury segment, as buyers shifted emphasis from performance to comfort. The models of that time, including the Lincoln Continental Mark series, Cadillac Eldorado, and Ford Thunderbird, largely abandoned any pretense of sport for a more intimate, luxury-oriented feel, with plush interiors and vintage styling cues like Rolls Royce-style radiator grilles, opera windows, and vinyl tops. They were mechanically uninspired other than the occasional gimmick, but despite high prices and poor fuel economy, they sold well.

Decline

American 'personal luxury' cars began to die out in the late 1980s as younger buyers moved towards imported European and Japanese cars, or towards sport utility vehicles. After years of steadily declining sales, the Buick Riviera died after 1999, the Oldsmobile Toronado after 1991, the Cadillac Eldorado after 2002, and the Lincoln Mark after 1998.

Nevertheless, conceptually similar imports from Japanese manufacturers like Lexus SC and Infiniti and European marques like BMW and Mercedes continue to sell well, even though their vehicles tend to be higher priced than their former American counterparts.

Partial list

While the vast majority of personal luxury cars came from the United States in the past, most of today's personal luxury cars are sold under German nameplates.

American vehicles

American made cars that can be included in the Personal Luxury Car sector include the following. Note that not all model years with cars bearing these names count, since automobile manufacturers often re-use names, sometimes on very different types of car:

Ford Thunderbird - The original personal luxury car, and always one of the best sellers

Ford Elite - The company's first intermediate personal luxury car, obsoleted when the Thunderbird was downsized in 1977

Oldsmobile Starfire - Until the arrival of the Toronado in 1966

Oldsmobile Toronado - The first modern American front wheel drive car

Buick Riviera - Considered as one of the most beautiful American cars of the 1960s

Buick Regal - Was originally a personal luxury car until 1988

Pontiac Grand Prix - Introduced in 1962, early models are similar to the Pontiac Catalina in looks but they were always more luxurious. From 1969 through 1973, it shared a platform with the Pontiac GTO.

Chrysler Cordoba - Late to market in 1975, but for several years phenomenally successful

Mercury Cougar - Originally based on the Ford Mustang, then became related to the Ford Thunderbird

Chevrolet Monte Carlo - Introduced in 1970, and related to the Chevrolet Chevelle; again, a much more luxurious car than its stablemate, but considerably smaller and cheaper than the following cars from luxury car brands, which fitted in at the very top end of the personal luxury car market:

Cadillac Eldorado - From 1967 onwards, it shared the front wheel drive drivetrain and other characteristics of the Oldsmobile Toronado

Lincoln Continental Mark Series - From 1969, usually sharing the chassis, drivetrain and other parts of the Ford Thunderbird

Imperial - In 1981, this venerable name was briefly resurrected to compete in the personal luxury car market

European vehicles

Aston Martin Vanquish
Audi A8 coupe
Bentley Continental GT
Bentley Azure
BMW 6-Series
BMW 8-Series
Maserati Coupe
Mercedes-Benz CLK
Mercedes-Benz CLS
Mercedes-Benz CL

Streetfighter

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The term *Streetfighter* is used for a non-stock Superbike that is customized by removing the fairing and other changes, resulting in a more aggressive look.

Modifications are commonly made to Streetfighter:

- Clip-on handlebars replaced with motocross-style handlebars
- Raised rear subframes
- Most fairings removed
- Distinctive paint schemes
- Loud aftermarket exhaust systems
- Aftermarket headlights to replace often heavy headlight setups
- Large rear sprockets to sacrifice top speed for more torque
- Larger brake discs than stock
- Improved brake calipers
- Improved springs, shock absorbers and various other parts to improve the chassis
- Various performance improvements to the engine: turbochargers, nitrous oxide injection, etc.

Hand made frames

The most extreme motorcycles are those with hand made frames, the most famous of which are made by

- Bakker (NL)
- Harris **(GB)**
- Martek (D)
- Moko **(D)**
- PSS-Rau (D) central-tube frame like Egli
- Spondon(GB) Aluminium frames in different views

Building one of these with an extremely highly modified engine ensures you truly are driving a Streetfighter.

Controversy

Some people associate streetfighters with gross neglect of traffic regulations, and it's true that some streetfighter riders occasionally do perform stunts in traffic, but it's disputed as to whether streetfighter riders cause more problems than riders of stock sportbikes. One explanation to their reputation of "traffic troublemakers" could be their distinctive visual appearance, which makes them more easily noticed in all situations, whether they are breaking the law or not.

Tailfin

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The *tailfin era* of automobile styling encompassed the 1950s and 1960s, peaking between 1958 and 1960. It was a style developed in the United States but spread its influence worldwide, as cars designed in all parts of the world picked up styling trends from the American automobile industry. General Motors design chief Harley Earl is generally credited for the automobile tailfin, introducing small fins on the 1948 Cadillac. Harley credited the look of World War II fighter aircraft for his inspiration, particularly the twin-tailed P-38 Lightning.

The style was incredibly popular and its use spread to other models in the General Motors family of brands. Soon it was adopted by other manufacturers; Chrysler's Virgil Exner in particular took the tailfin idea on board. As confidence grew in the styling trend, the fins grew larger and bolder as manufacturers competed to have the best-looking, most striking vehicle.

The most extreme tailfins appeared in the late 1950s. Many consider the fins on the 1959 Cadillac Eldorado to be the largest and most outrageous ever fitted. Those fins were too much for many customers, however, and the tailfins shrank after that point. Within a couple of years, tailfins had become much less prominent, and by the mid 1960s, they were gone on many models. However, vestigial tailfins remained on American cars until very recently, with the sides of the quarter panels often being raised above the trunk lid and the corner sharp-edged. Mercedes used something similar to fintails (nicknamed "heckflosse" in German), but they claimed it wasn't fintails but "sight lines" to make it easier to determine the corners of the vehicle.

Examples of Tailfin Styling:

Cadillac Eldorado, 1948-1966
Chrysler Imperial, 1955-1963
Lincoln Capri

Vinyl roof

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Vinyl roof refers to a vinyl covering for an automobile's top. This covering was originally designed to give something of the appearance of a convertible to models with a fixed roof, but eventually it evolved into a styling statement in its own right. Vinyl roofs were most popular in the American market, and they are considered one of the period hallmarks of 1970s Detroit cars. Vinyl roofs were also very popular on European- (especially UK-) and Japanese-built cars during the 1970s, and tended to be applied to sporting or luxury trim versions of standard saloon (sedan) models by pretty much the whole gamut of manufacturers.

History

The first use of this technique goes back into the 1920s, when leather and canvas were sometimes used along with landau bars, to give a fairly accurate reproduction of a horse-drawn carriage's movable top. The technique fell out of favor in the 1930s and 1940s, when smoother, "envelope" bodies began to be fashionable; for these designs, the look of the modern, integrated metal roof was important.

Lincoln used the convertible look on some of its Cosmopolitan coupes in the 1950s, as did the Kaiser firm on its Manhattan sedans, although the material was still canvas. In the very late 50s, Chrysler's Imperial made a limited use of true vinyl on some models. Probably the first modern vinyl roof as it would later be accepted, though, appeared as an option on the 1962 Ford Thunderbird, a car which also re-introduced landau bars as a styling touch. The vinyl covering proved popular, and some form of vinyl trim would be commonly be seen on Thunderbird roofs for the next two decades.

Other manufacturers noticed immediately that the new look could be profitable – it didn't cost very much to add, but many buyers willingly paid a premium for it. Vinyl appeared on some coupe models in GM's 1962 full-size line. Chrysler took the first step toward moving the look out of the higher-price class, however, when they made a partial vinyl roof available on the compact 1963 Dodge Dart. Ford soon offered it on the first Mustang as well. By mid-decade, four-doors as well as coupes could be topped with a number of colorful vinyls.

From that point on, vinyl proliferated rapidly and became very common in most car classes by the late 60s, even appearing on some station wagons. Vinyls were produced that mimicked other materials such as (ironically) canvas, and even alligator hide. Chrysler briefly produced some very bizarre " " patterns, with paisley or floral designs – this was called the "Mod Top" option. The Mercury Cougar briefly offered a houndstooth pattern. There was even an aftermarket spray-on product that claimed to add that factory vinyl look, but mostly it just added the spray-on look. By 1972, even the humble Ford Pinto sported a vinyl roof option, and a Ford sales brochure of the time conceded that vinyl was mostly for looks, but gamely averred that a small case could be made for its sound insulating qualities. In a hailstorm, that might have been true.

At about that same time, the modern opera window first appeared, and it went so well with a vinyl surround that the two together became emblematic of American body design in the 1970s. During this period, vinyl with padding under it was sometimes used, allowing the top to somewhat mimic the feel as well as the look of a genuine convertible.

European and Japanese manufacturers were not immune to this trend. Chrysler used it on upmarket models of its Hunter and Avenger saloons; Ford had vinyl roofs on Escorts, Cortinas, Tauntuses and Granadas into the early [1980s]]. British Leyland had vinyl roofs on the last Wolseley and top-end Leyland Princess models. Toyota adopted vinyl roofs for its Corona sedans in the mid-1970s, and they could be found on Nissan Laurels and Cedrics.

Vinyl continued to appear in many car lines through the 1980s, but the coming of the "aero look," first introduced to the US market by the 1983 Thunderbird, tended to militate against both opera windows and vinyl roofs, as their more formal style did not go well with the sleek profile designers were beginning to emphasize. During this final phase, canvas-look tops, often called cabriolet roofs, with simulated convertible top bows under the fabric, gained some popularity. The availability of all vinyl styles dwindled in the 1990s, until the 1998 Cadillac Fleetwood Limited offered one of the very last ones.

Hearse and limousine bodies almost universally still have vinyl tops. Not only are they part of the expected style of those vehicles, but they have a practical advantage in covering up the welded body seams that result when standard sedans are stretched to greater length. Aftermarket customizers also continue to install vinyl roofs of various types for drivers who want them. These are usually seen on Cadillacs and Lincolns, but can be fitted to virtually any kind of car.

Styles

Four major styles of vinyl roof evolved during the 1960s and 1970s, with a couple of odd variants thrown in:

- *FULL* - this is the most commonly seen style, in which the vinyl simply covers the whole top of the car, including the rear quarter panels. The windshield pillars may or may not be covered. If a center sedan pillar exists, it is usually not covered, but exceptions to this rule were made. This is the type that was almost always used on four-door models.
- *HALO* - this type is similar to the above, but the vinyl stops just short of the tops of the side windows and windshield, allowing a "halo" of painted sheet metal to appear between the vinyl and the glass area.
- *CANOPY* - in this style, the vinyl covering is applied only to the front half or two thirds of the roof, usually ending at the trailing edge of the rear side

windows. The windshield pillars are very commonly covered in this style, but the quarter panels never are.

- *LANDAU* - this is almost the opposite of the canopy, as the vinyl covers the rear quarter or third of the roof, including the quarter panels, coming as far forward as the trailing edge of either the rear or front side window. In common parlance, this was often called the "half roof," although logically that term could apply to the canopy as well.

The above styles were all used by more than one manufacturer. Two others were unique to one company or nearly so:

- Chrysler had a design for its large and intermediate coupes in the mid to late 70s that was often called *"up and over."* These cars all had opera windows, and the vinyl extended to only a couple of inches behind the opera window rather than all the way to the rear window as with a full vinyl treatment. The line of the vinyl then turned upward to run over the top of the car, leaving a margin of sheet metal almost like a roll bar sticking up at the very back of the roof. No one else used this style.
- Ford in the late '70s managed to install both the *landau and canopy* styles on one vehicle. On vinyl-equipped '77-'79 Thunderbirds, two separate vinyl areas existed, one starting at the base of the windshield pillars and extending back to the trailing edge of the front side windows, and another starting at the base of the rear window and coming forward as far as the leading edge of the rear side window. These were separated by a targa band of sheet metal in the middle of the roof, which swept down at the sides to form a thick sedan-like pillar on the sides. The opera window was mounted in this pillar and was surrounded by sheet metal, not touching either vinyl area. Three pieces of glass were mounted on each side of these cars; the Fairmont Futura had a very similar style, differing only in not using the center opera window. Although it is rare, a comparable two-piece roof was available on the AMC Pacer.

See also: *Car body styles*

Issues for Collectors

Many 60s and 80s cars will have vinyl, and most 70's ones. Unfortunately, vinyl surfaces are not as durable as sheet metal and are particularly prone to sun damage, so faded, cracked, or actually ragged tops are commonly seen. Even where this is not the case, the trim around the tops often trapped water and caused rust, and this could percolate under the vinyl itself, where rusting even to the point of sheet metal perforation could rapidly occur. The only real exceptions would likely be cars from a dry climate which were well maintained and kept garaged. Replacement of a vinyl top can be costly, even leaving aside repair of any rust damage. For unusual vinyl grains and patterns, an exact replacement could be impossible to find.

Whitewall tire

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Whitewall tires are tires that have a stripe of white rubber on the outer sidewalls. The original whitewalls featured an entirely white sidewall. Modern whitewall tires often just have a thin white stripe, or white raised lettering identifying the tire manufacturer and tire model. Such tires were still made with a full strip of white rubber under the black. The raised white letters were revealed by buffing the cured tire sidewall. It was also necessary to use expensive non-staining antioxidents in the sidewall and carcass compounds to avoid staining the white compound brown. The black covering strip was made of Neoprene (polychloroprene), again to avoid staining.

Classic vehicles have usually been optioned with wide whitewalls - it was a fad during the pre and post-war era, only to resurface in the 1970s within the pimpmobile culture. Although wide whitewalls are a rare find these days, they are either sold brand new through tire specialty outlets and/or classic car restoration companies. Some companies manufacture wide whitewall inserts - the Portawall inserts are usually sold through VW Beetle restoration companies.

Whitewalls were popular on classic cars, lowrider and Cadillacs. In recent years they have fallen out of vogue because of the maintenance required to keep whitewalls bright and white. Additionally the current trend is to use larger wheels and lower profile tires, so the side walls often aren’t wide enough to have a white wall.

4 Car body style

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Cars can come in a large variety of different *body styles*. Some are still in production, while others are of historical interest only. These styles are largely (though not completely) independent of a car's classification in terms of price, size and intended broad market; the same car model might be available in multiple body styles.

Plese note that while each body style has a historical and technical definition, in common usage such definitions are often blurred. Over time, the common usage of each term evolves. For example, people often call 4-passenger sport coupes a 'sports car', while purists will insist that a sports car by definition is limited to two-place vehicles.

Styles in current use

Cabrio coach or *Semi-convertible*

Style of automobile roof. A car that has a retractable textile cover for what amounts to a large sunroof. Used on several older cars such as Citroën 2CV and Fuldamobil.

Cabriolet

Another term for a convertible, rarely used in North America.

Convertible

Style of automobile roof. A body style with a removable or retractable roof and rear window. The convertible has roll-up side windows as contrasted with the roadster, which does not.

Coupé (UK/EU) or *coupe* (US)

A 2-door, 2- or 4-seat car with a fixed roof. Its doors are longer than those of a sedan, and the rear passenger area smaller. In cases where the rear seats are very small and not intended for regular use it is called a 2+2.

Coupé convertible

A type of convertible with a rigid roof (as opposed to a fabric or vinyl roof) that retracts into the lower bodywork.

Coupe Utility (ute)

the Coupe Utility is a passenger-car derived light truck with coupe passenger cabin lines and an integral cargo bed. See Coupe Utility for more details.

Crossover SUV *(or XUV)*

A type of Sport Utility Vehicle (SUV)which is based on a car platform rather than truck chassis. This also refers to a vehicle which is marketed as neither an SUV, a minivan nor a wagon, but combines design elements of those types.

Estate car

A British English term for what North Americans call a station wagon.

Fastback

A design where the roof slopes at a smooth angle to the tail of the car, but the rear window does not open as a separate door.

Hardtop

A style of automobile roof. Originally referred to a removable solid roof on a convertible; later, also a fixed-roof car whose doors have no fixed window frames, which is designed to resemble such a convertible. A pillarless hardtop (the most common kind) is completely open on the sides with the windows down.

Hatchback

Identified by a rear door including the back window that opens vertically to access a storage area not separated from the rest of the passenger compartment. May be 2 or 4 door and 2 or 4 seat, but generally called in British English 3 door, 5 door.

Liftback

A style of coupe with a hatchback; this name is generally used when the opening area is very sloped (and is thus lifted up to open).

Limousine

By definition, a chauffeur-driven car with a (normally glass-windowed) division between the front seats and the rear. In German, the term simply means a sedan.

Minivan

A boxy wagon-type of car usually containing three or four rows of seats, with a capacity of six or more passengers. Often with extra luggage space also. As opposed to the larger van, the minivan was developed primarily as a passenger vehicle, though is more van-like than a station wagon. In Britain, these are generally referred to as People carriers.

MPV

Multi-purpose vehicle, a large car or small bus designed to be used on and off-road and easily convertible to facilitate loading of goods from facilitating carrying people.

Notchback

A cross between the smooth fastback and angled sedan look. It is a sedan type with a separate trunk compartment.

Pickup truck aka pick-up

Small or medium sized truck. Not based on a passenger car, but of similar size. This light commercial vehicle features a separate cabin and rear load area (separate cargo bed).

Ragtop

An open car like a Roadster, but with a soft top (cloth top) that can be raised or lowered. Unlike a convertible, it has no roll-up side windows.

Roadster

Originally a two-seat open car with minimal weather protection — no top was provided, neither any side glass. In some cases an optional hard or soft top might be offered, along with side curtains, but there was no side glass. In modern usage, the term is often used mean simply a convertible two-seat sports car, similarly to spyder.

Saloon

The British English term for a sedan.

Sedan

A car seating four or more with a fixed roof that is full-height up to the rear window. Normally a 4 door; 2 door is rarer in the US but they do occur (more so historically). This is the most common body style. In the U.S., this term has been used to denote a car with fixed window frames, as opposed to the hardtop style where the sash, if any, winds down with the glass. As hardtops have become rarer, this distinction is no longer so important.

Sport utility vehicle ***(SUV)***

Derivative of off-road or four-wheel drive vehicles but with car-like levels of interior comfort and drivability. Also sometimes called a "soft-roader".

Spyder (or *Spider*)

Similar to a roadster but originally with even less weather protection. Nowadays means simply a convertible sports car.

Shooting brake

A two-door estate car/station wagon in (somewhat antiquated) British usage. Often based on a higher-end luxury coupés, they were vehicles for the well-off shooter and hunter, giving space to carry shotguns and other equipment and are usually made to order by coachbuilders.

Station wagon

A car with an full-height body all the way to the rear; the load-carrying space created is accessed via a rear door or doors.

Surrey top

Similar to the Porsche Targa top, the surrey top was developed by Triumph in 1962 for the TR4.

T-top

A derivative of the Targa top, called a T-bar roof, this fixed-roof design has two removable panels and retains a central narrow roof section along the front to back axis of the car (e.g. Toyota MR2 Mk 1.)

Targa top

A semi-convertible style used on some sports cars, featuring a fully removable hard top roof panel which leaves the A and B pillars in place on the car body. (e.g. Fiat X1/9). Strictly, the term originated from and is trademarked by Porsche for a derivate of its 911 series, the Porsche 911 Targa, itself named after the famous Targa Florio rally. A related styling motif is the Targa band, sometimes called a wrapover band which is a single piece of chrome or other trim extending over the roof of the vehicle and down the sides to the bottom of the windows. It was probably named because the original Porche Targa had such a band behind its removable roof panel in the late 60's.

Ute

Australian English term for the Coupe Utility body style (see above). Sometimes used informally to refer to any utility vehicle, particularly light trucks such as a pickup truck. In American English, *ute* infrequently is used to refer to an SUV (see above).

Van

In North America 'van' refers to a truck-based commercial vehicle of the wagon style, whether used for passenger or commercial use. Usually a van has no windows at the side rear (panel van), although for passenger use, side windows are included. In other parts of the world, 'van' denotes a passenger-based wagon with no rear side windows.

Non-English terms

Some non-English language terms are familiar from their use on imported vehicles in English-speaking nations even though the terms have not been adopted into English.

Barchetta

Italian term for a roadster. The name means, roughly, "small boat".

Berlina

Italian term for a sedan.

Berline

French term for a sedan.

Berlinetta

Italian term for a sport coupé.

Break

French term for a station wagon.

Jeep

German and Greek term for a sport utility vehicle. Not to be confused with the english-language jeep, which originated from the WWII 'GP' (general purpose) military vehicle.

Kombi

Swedish term for a station wagon, also used in Germany as abbreviation of "Kombinationswagen" (Combination Car).

Turismo

Spanish term for a sedan. Literally means tourism, used mostly in Latin American countries.

Alternative names

Car manufacturers sometimes invent names for the body styles of their cars for the purpose of differentiating themselves from other manufacturers. These names are often, but not always, adaptations of other words and terms. The body styles themselves correlate closely to those listed above.

Avant

A name used by German maker Audi for their station wagon/estate car models.

Bakkie

A generic South African term for light pickup truck.

Combi coupé

A name used by Saab for a cross between a saloon and an estate car, essentially a hatchback. Called "Waggon Back" in the U.S..

Coupe Roadster

The Mercedes-Benz name for their convertibles with a removable hardtop.

El Camino

A trademark of Chevrolet, the 1959 El Camino was a half-car (front) and half-truck (back) with low walls surrounding the bed. In other words, it used the Coupe Utility body style. El Camino is used by some in the US as a generic term for any passenger car with an integral cargo bed. While the 1957 Ford Ranchero with similary body style debuted before the El Camino, it did not have the success of its Chevrolet counterpart.

Caravan

Used by Opel for its station wagon/estate car models.

Fordor and *Tudor*

These names were coined by Ford Motor Company in the 1950s to describe four-door and two-door bodystyles respectively. These terms were used sporadically into the 1960s.

Giardinetta

Name used in Italy in the 70s and early 80s in models for an Autobianchi three-door station wagon based on Fiat 600, as well as a similar version of the Alfa Romeo Alfasud.

Hardtop Convertible

The 1958 Ford whose solid roof retracted into the trunk (boot) and which would class as a coupé convertible above was advertised under this name.

HPE

Short for High Performance Estate, a name used by Lancia for a station wagon version of their Beta model.

Kammback

Originally, a car with a tapered rear that cuts off abruptly, after that shape's inventor Wunibald Kamm, commonly seen especially on sports cars. However, this usage is rare nowadays. In North America during the 1970s this style was used General Motors Vega wagon and AMC Hornet wagon, and so many think of it as another word for "station wagon" or "hatchback" respectively even though it refers to the very specific aerodynamic design of the back of the car.

Nevada

Very popular station wagon version of the Renault 21, so much that people dropped the 21 when referring to it.

Panorama

Used by Fiat for station wagons during the late 70s and early 80s, notably the 127, 128 and 131. Replaced by the Weekend designation in the mid 80s.

Pillared Hardtop

This name was used by Ford in the 1970s to describe its bodies which had frameless door glass like a hardtop, but retained a center pillar like a sedan. The '72-'76 Torino sedans and wagons were of this type, as were the '75-'79 Lincoln Town Cars. When GM introduced a similar style on their intermediates for '73-'77, they called the two-doors Colonnade Hardtop Coupe and the four-doors, in a triumph of ad agency gibberish, Colonnade Hardtop Sedan. The '76 Buick Century sedan used this configuration.

Prairie

a high roofed station wagon.

Sport Activity Vehicle (SAV)

This name is used by BMW for their sport utility vehicle models. It was first used on the X5 and later on the X3.

Sportshatch

This term, which has been used by General Motors for several European models, has been applied to a number of body styles: A sporty liftback or hatchback (e.g. Opel Manta), and a sporty variant of a 2-door estate car (e.g. Vauxhall Magnum Sportshatch).

Sports Wagon

A term used by a number of manufacturers in the North American market for their station wagon models, an example of the Sports Wagon would be the Dodge Magnum. Auto manufacturers in recent years perceive a stigma attached to the term 'station wagon', and attempt to make these models sound more exciting. In Europe, a few manufacturers, notably Alfa Romeo, have used the name Sport Wagon.

Touring

Used by BMW in Europe for its station wagon/estate car models. In North America, 'Sports Wagon' is used instead.

Turnier

Used by Ford in Europe for its station wagon/estate car models.

Variant

Used by Volkswagen for its station wagon/estate car models.

Verso

Used by Toyota for MPV versions of the Yaris/Vitz, Corolla and Avensis.

Weekend

Used by Fiat for station wagons since the mid 80s, introduced in the Regata and later used by its replacements Tempra and Marea, as well as the Brazilian small estates Duna and Palio.

Historical body styles

Most early body styles were derived from those available in horse-drawn carriages and used the coachbuilding terms for them, although often their application in the automobile differed from the carriage use. Other types were soon invented, and either used modifications of earlier terminology or wholly new terms to describe them. Some of these terms are occasionally used in modern model designations, but almost always inaccurately with respect to their historical meaning (e.g. Lincoln Town Car, Volkswagen Phaeton).

Brougham

Generally equivalent to a sedan, but more likely to have closed rear quarters and sometimes more luxuriously trimmed.

Close-coupled sedan

A four-windowed sedan with a trunk that from front to rear was almost as thin as an upright suitcase. The rear-seat passengers sat a little bit forward of the differential. Ford Motor Company called its version a "Victoria" in the 1930s.

Coupé convertible

A coupé with a convertible top, naturally. Fully enclosed with the top up and side windows up. Called a drophead coupé in the United Kingdom.

Drophead coupe

As a coupé, but with a full convertible top. British terminology, and dropping out of use for most modern cars, though luxury British makes occasionally still use it. Compare American use of coupe convertible; contrast with fixed-head coupé.

Fixed-head coupé

British term for a standard coupé with a fixed solid roof, as opposed to a drophead coupé.

Hansom

A fixed-roof car with a mostly-enclosed cabin in front and a high-mounted open drivers seat in the rear.

Landau

In automobiles, generally (inaccurately) synonymous with landaulet; also used for a car with a simulated folding top and false landau bars. This latter usage is still current.

Landaulet (Landaulette)

A car in which there is a roof over the front seats and the rear doors (possibly with a center row of seats) but with a folding convertible roof over the rear quarters.

Phaeton

An open car, normally describing a double or triple-row phaeton. There is often a folding fabric top but no side weather protection. Early Phaetons had a high-mounted rear seat for the driver. The modern VW Phaeton derives its name, but nothing else, from this style.

Roi des Belges

Named after King Leopold II of Belgium who ordered the first example. A large open car with high built seats and the rear seat usually set higher than the front seat. Also know more rarely as a Tulip Phaeton because of the side profile of the rear of the car resembling the shape of a tulip flower head..

Runabout

A popular open light body style, normally with a single bench seat but sometimes with a rear tonneau. Most cars in the first decade of the 20th century were either runabouts or touring cars.

Stanhope

A car with a single bench seat mounted at the center, a folding cloth top, and only a buckboard at the front.

Tonneau

A car in which the rear compartment passengers enter through a rear, rather than side, door. Often completely open (no top).

Touring car

A larger car, normally with two rows of seats (with a tonneau) and a large compartment at the front.

Town brougham

Equivalent to a town car, but, as with the brougham, more likely to have closed rear quarters.

Town car

A car in which the front seats were open and the rear compartment closed, normally with a removable top to cover the front chauffeur's compartment. The modern Lincoln Town Car derives its name, but nothing else, from this style.

Town landaulet, Town landau

Combining the town car and landaulet, this car is open over the driver's compartment, closed over the rear doors, and with an opening convertible top over the rear quarters.

See also

- vinyl roof
- woodie

- Car classification

A-pillar

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An *A pillar* is a name applied by car stylists and enthusiasts to the shaft of material that supports the windshield (windscreen) on either of the windshield frame sides. By denoting this structural member as the "A" pillar, and each successive vertical support is named after a successive letter in the alphabet (B pillar, C pillar etc.) the name allows those interested in car design to have a point of reference when discussing design elements.

When looking at the side of a vehicle, the A-pillar is the pillar that attaches to the windshield and supports the roof. The *B-pillar* is the second post supporting the roof, and so on towards the rear of the vehicle. In the most usual configuration, the *C-pillar* attaches to the rear window, however, depending on configuration, the final pillar can be B, D, or even higher in more extreme examples.

Bangle-butt

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Bangle-butt is a derogatory term for the current rear-end styling paradigm among high-end automobiles. The name comes from controversial designer Chris Bangle. Although all of Bangle's designs have been the subject of heated debate, no element has been more discussed and copied than his two-level rear end styling. It features separate rear fenders with a "bustle-back" trunk (boot) lid.

Although named for Bangle, the two-level rear end styling has spread beyond BMW, and may not have even been invented there. The Maybach 57 and 62 came out the same year as Bangle's 2002 7-Series and also features this design element. Since then it has been adopted by Mercedes-Benz and others.

Vehicles with a "Bangle-butt" include:

2002-present BMW E65/E66 7-Series
2002-present Maybach 57 and 62
2004-present BMW E63/E64 6-Series
2006-present Mercedes-Benz W221 S-Class
2006-present Toyota Majesta
2007-present Toyota Camry
2004-present Toyota Mark X
2004-present Toyota Solara Coupe

Brougham

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Invented by Henry Brougham, 1st Baron Brougham and Vaux, Lord Chancellor of Great Britain, a brougham was a four-wheeled horse-drawn carriage of the 1800s. It had a low body with a box seat in front for the driver. In the rear was seating for two or four with two doors.

In the 1930s, a brougham was a car with an open seat in front for the chauffeur and an enclosed cabin behind for the passengers.

Cadillac used the name on their Cadillac Brougham in 1916, and it would later be used on their top models throughout the 20th century.

Over the years, Chevrolet, Pontiac and Plymouth have also used the Brougham name to differentiate the more comfortably-appointed versions of a given model; Chevrolet Caprice Classic Brougham, Pontiac Parisienne Brougham and Plymouth Valiant Brougham have all been produced.

Ford used the Brougham name on its 1970s-era LTD line and some later models of vans.

Cab forward

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In passenger vehicle design, the term refers to a collection of styling tropes commonly used by Chrysler since the early 1990s in which the passenger cabin is "pushed forward" so that the front wheelwell directly abuts the leading edge of the front doors, and the windscreen extends forward near the front axle, while the rear wheels are "shifted" towards the back corners of the vehicle.

In the case of vehicles other than passenger cars the term refers to a design in which the steering wheel is placed forward of the front axle, which, typically, is located directly beneath the driver's seat. This arrangement is perhaps better known as forward control.

Cabrio coach

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A *cabrio coach* or *semi-convertible* is a type of car that has a retractable textile roof. It is used on several older cars such as the Saab 92, Citroën 2CV, Fiat 500 and the Fuldamobil, but some modern cars also have it. It is an inexpensive alternative to a full convertible, especially on cars with unibody designs since little or no redesign of the body is necessary.

Coupe

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A *coupé* (from the French for cut) or *coupe* is a car body style with a close-coupled interior offering either two seats or 2+2 seating (space for two passengers up front and for two occasional passengers in the rear). Through the 1950s convertible models were sometimes called convertible coupés, but since the 1960s the term coupé has generally been applied exclusively to fixed-roof models. Coupés generally, but not necessarily, have two doors, although automobile makers have offered four-door coupés and three- and five-door hatchback coupés, as well.

A coupé is distinguished from a sedan primarily by interior volume; SAE standard J1100 defines a coupé as a fixed-roof automobile with less than 33 ft^3 (0.93 m^3, 934.6 L) of rear interior volume. A car with a greater interior volume is technically a two-door sedan, not a coupé, even if it has only two doors. Some automakers may nonetheless choose to use the word coupé to describe such a model, e.g., the Cadillac Coupe de Ville.

Pronunciation

Speakers of American English pronounce coupe as coop (IPA: /kuĐp/) and spell it without an accent. In Europe and the UK, the original French spelling, coupé, and a semi-French pronunciation, koo-pay, are often used (/'kuĐpej/).

History

In the 19th century a coupé was a short carriage with a single row of passenger seating behind the driver. During the 20th century the term was applied to various close-coupled automobiles. Through the 1950s many automakers offered several varieties of coupé

Club coupé

a coupé with a larger rear seat, which would today be called a two-door sedan.

Business coupé

a coupé with no rear seat or a removable rear seat, intended for traveling salesmen and other vendors who would be carrying their wares with them.

Sport coupé *or* berlinetta

a uniquely styled model with a sloping roof, sometimes sloping downward gradually in the rear in the style known as fastback.

With the growing popularity of the pillarless hardtop during the 1950s some automakers used the term coupé to refer to hardtop (rigid, rather than canvas, automobile roof) models and reserved the term sedan for pillared models. This definition was by no means universal, and has largely fallen out of use with near-demise of the hardtop.

Coupe de Ville

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The *Coupe de Ville* (sometimes spelled Coupe Deville or Coupe DeVille) was a model of Cadillac from 1949 through 1993. The name has become famous through pop culture, with references in pop songs, movies, and other media.

Model History

The *Coupe de Ville* was introduced by Cadillac late in the 1949 model year. Part of the Cadillac Series 62 line, it was a closed, two-door coupé, Cadillac's first pillarless hardtop. Intended as a prestige model, at $3,497 it was one of the most expensive models of the Series 62 line. It was luxuriously trimmed, with leather upholstery and chrome 'bows' in the headliner to simulate the ribs of a convertible top. The first-year Coupe de Ville sold 2,150 units, but 1950 sales were more than double, and 1951 more than doubled those of the previous year. By 1961 it was one of the company's most popular models, with annual sales above 20,000.

In 1956 the Coupe de Ville was joined by the *Sedan de Ville*, a four-door hardtop sedan. The Sedan de Ville would ultimately outlive its two-door predecessor. In 1959 the de Ville line was separated in a distinct *Series 63*.

The Coupe de Ville, like other Cadillacs, grew substantially larger and more powerful from 1949 through the early 1970s. By 1973 it was 4 in. (101.6 mm) longer in wheelbase, 17 inches (431.8 mm) longer overall, and more than 900 lb (408 kg) heavier, and its standard V8 engine had grown from 331 cu. in. (5.4 L) to 472 cu. in. (7.7 L).

The Coupe de Ville remained a pillarless hardtop through the 1973 model year, but for 1974 was restyled as a pillared two-door with then-fashionable opera windows behind the side windows. The Sedan de Ville remained a pillarless four-door through 1976.

When General Motors initiated the redesign of the B-body and C-body for the 1977 model year the De Ville (and all other full-size GMs) shrank by 9.8 in (249 mm) and about 750 lb (340 kg). The new standard engine was a 425 cu. in. (6.9 L) V8.

In 1985 the De Ville was downsized again, this time dropping some 26.2 in (665.5 mm) in length and another 800 lb (363 kg). It also adopted front-wheel drive.

The declining popularity of full-size coupes eventually led to the discontinuation of the model in 1993. For 1994, The DeVille (now identified on the car with a capital " D") series was comprised of the four-door Sedan DeVille and (Sedan) DeVille Concours. Starting in 1997, it was known simply as the Cadillac DeVille for several years, although the Concours version was available through 1999. Subsequently, Cadillac added a 'DTS' model to the Deville series, an abbreviation for Deville Touring Sedan.

Popular culture

50's models with their extravagant fins are probably the best known versions of the car. Models from this era have commonly appeared in movies and music videos and also on postage stamps.

A movie of this name directed by Joe Roth appeared in the early 1990s.

It sometimes seems that songwriters know no other kind of car. The Coupe de Ville (and more widely: "Cadillac") is simply pre-eminent among cars referenced in American popular music, whether rap, country, pop or blues, and this process is still going on some ten years after the model was discontinued.

Coupe de Ville songs

Neil Young has a song of that title, and the car figures in songs by:

Joe Nichols Brokensheartsville
Suzy Bogguss The Other Side of the Hill
Steve Earle Cadillac Lyrics
Colt 45 The Good Times
OutKast We Luv Deez Hoez
Bachman Turner Overdrive Just for You
Robert Plunkett Sweet Tooth
Meat Loaf Two out of Three Ain't Bad
Ludacris What's Your Fantasy?
Chuck Berry Maybelline
Ice Cube A Gangsta's Fairytale
Beastie Boys Hey Ladies

Combi coupé

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Combi coupé is a name used by Saab for a specific car body style. It is essentially a hatchback that is more of a saloon (sedan) than an estate car (station wagon) or typical hatchback. The bodystyle was first introduced in the 1974 Saab 99, but Saab also discussed making it available for the Saab 96 and went so far as to create the prototype Saab 98.

On the Saab 900 the three door combi coupé is, despite having larger loading space than the sedan, often seen as sportier than the sedan. This may be due to that the look is reminding of a fastback.

Other vehicles exhibiting this form, though not the name, include Volkswagen Passat, Renault 30, Citroën BX, the mid-1980s Mazda 626 and the Saab 9000 hatchback.

For the USA market this body style was called a "Waggon Back".

Coupe Utility

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The *Coupe Utility* car body style has a passenger-car derived cabin of "coupe" style but with an integral cargo bed behind the cabin. An example of this is the 1957 Ford Ranchero. The vehicle that uses this style is significantly different than a pickup truck, which has a cargo area separate from the cab.

Features

A Coupe Utility style has these features:

- Body style with coupé lines, especially using a fixed roof, but like a truck it has an integral open cargo area at rear
- Like a passenger car, it can be built as a unibody, or as a separate body (body-on-chassis construction)
- Derived from existing passenger car in most cases and not from a truck

Origins

Holden coach works of Australia was the first to integrate a cargo area with the bodywork of a passenger vehicle. Starting in 1924 Holden produced these bodies for Chevrolet and Dodge cars (Holden later became a subsidiary of General Motors). These "roadster utilities" were essentially an extention of the open top roadster design, but with a 'well' type cargo area instead of the roadster turtledeck. These were known as roadster utilities. Barsby and other coach builders also built roadster utilities**[1]**. Later, in 1934**[2]**, as the result of a request from a Victorian farmer's wife, Ford Australia combined the cab of its newly released Ford Coupe body with the well-type load area of their roadster utility, producing the first 'Coupe Utilities'**[3]**. Holden also claims to have built the first production-based Coupe Utility in 1934**[4]**. Both types of vehicles were called "utilities" or "utes" for short. This basic design quickly gained in popularity & became available as either a standard offering, or special order body from a number of car makers in Australia by 1929.

Both the Coupe Utility and the Roadster Utility continued in production, but the improving economy of the mid to late '30s and the desire for a little comfort saw coupe utility sales climb at the expense of the roadster ute until by 1939, the roadster ute was all but a fading memory. No car maker offered a roadster ute when car production restarted after World War II.

The pickup truck, on the other hand, started its life a little earlier and is defined by its separate, removeable, well-type 'pickup bed'. This pickup bed does not contact the cabin part of the vehicle, while the ute bed is an integral part of the whole body. Both the Coupe Utility and Closed Cab pickup designs migrated to light truck chassis & these are correctly known respectively as Utility trucks & Pickup trucks. Eventually the pickup design found a natural home on the smaller truck chassis while the ute became entrenched as a passenger car derivitave, so that no modern manufacturer today offers a pickup derived from a a passenger car, nor a Coupe Utility derived from a truck model.

The Term "Ute"

The original makers of roadster utilities and coupe utilities called these vehicles "utilities". As Australians are wont to do, the term was quickly shorted to "ute".

Today some Australians define a "ute" as any commercial vehicle that has an open cargo carying space, but requires only a passenger car licence to drive. This includes both coupe utilities, pickup trucks and traybacks (flatbed pickup trucks). In popular usage "ute" in Australia has been further genericized to refer to any light commercial vehicle.

Vehicles of This Style

Since readers in many parts of the world may be unfamilar with the formal term 'Coupe Utility', here follows some examples of vehicles using this body style.

Modern Coupe Utilities

Modern vehicles of the Coupe Utilty style include, among others:

- 2006 Subaru Baja
- 2006 Ford Bantam
- 2006 Nissan 1400 LDV

Famous Coupe Utilities of the Past

- 1956 Ford V8 Mainline Star (Ford of Australia)
- 1957 Ford Ranchero
- 1959 Chevrolet El Camino (General Motors)

References

- According to a Holden press release in 2001.**[5]**, the coupe utility "is based on a sedan equivalent and has a load bed integral with the cabin"
- Car Exchange magazine article 'Ford V8 Mainline Star', June 1981 pp 76-77
- ABC Austrialia interview with automotive historian Adrian Ryan**[6]**
- The Good Ole Aussie Ute, Larry O'Toole, ISBN 0949398268
- Ford R5 press release**[7]**

Coupe roadster

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A *coupe roadster* is a convertible automobile equipped with a removable hardtop.

Mercedes-Benz uses the term *Coupe Roadster* (note capitalization) to denote cars so equipped. These models always have a folding textile or vinyl soft top in addition.

The hardtop usually includes the rear back glass and side quarter windows. It can usually be lifted on or off the car by two people, although typically a block and tackle garage mounted hoist is used. The soft top need not be deployed, nor can it be, when the hardtop is in place.

Crew cab

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Crew Cabs are an extended cab bodystyle commonly found on utes or pickup trucks.

Nissan was the first[1] to have the extended cab bodystyle after the release the first crew cab pickup truck called the Frontier in 2000. Similar to King cab, with 4 doors and more space for seating in the back (the seats are normal and face forward in direction).

References

1. ^ **PickupTruck.com Nissan Frontier Review**. URL accessed on 2006-04-08.

Dune buggy

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A *dune buggy* is a recreational vehicle having big wheels and tires designed for use on sand dunes or beaches, especially a light vehicle with a modified engine mounted on an open chassis. Also called *beach buggy* or a *sand rail*.

Design

Dune buggies are created using two different methods. The first involves alteration of an existing vehicle, most notable the older Volkswagen Type One (Beetle, or Bug). The VW Bug was preferred for a variety of reasons. Most notable are that the rear mounted engine and removal of bodywork transfers a high proportion of the remaining weight to the rear drive wheels for extra traction, the engine is air cooled simplifying engine modification and the elimination of the radiator as a source of engine failure, the extremely cheap price, and the sizable quantity of spare parts from other VW Bugs and buses. This is a likely candidate for where the term "buggy" originated.

The second method involves construction of a vehicle frame from steel tubing bent and welded together. The advantage of this method is the fabricator can change various fundamental parts of the vehicle (usually the suspension and a built-in roll cage). However, the cost is the extra time taken. Buggies of this type are typically called *sand rails* because of the rail frame. Rails, like the VW bug typically have the engine located behind the driver and engine sizes vary depending on the intended function (see below). Sizes can vary from a one seat ATV sized go-cart to a 4 seat, 8+ cylinder sedan sized vehicle. Rail type buggies can have panels or custom shaped body coverings over the rails and tubing that compose the vehicle, though many are left bare.

Some dune buggies represent mixes of the two design philosophies above. This is typical when a converted vehicle sustains damage from age, hard use, or accidents and spare parts are not available or affordable.

Function

Initially dune buggies were designed for navigating desert or beaches (hence the word "dune"). However, dune buggies have become more diversified in terms of the terrain they can handle. Dune buggies are being built for more generic off road tasks, such as CORR / SCORE indoor track racing. Some are even built for and used as on-road vehicles. Typically the function is determined before the buggy is created in order to maximize the comfort or abilities of the vehicle.

History

Belgian thief, playboy and notorious dune buggy aficionado Tomas Van Der Heijden used a purpose built Renault dune buggy to steal seven Renoir paintings from the Louvre in 1961.

Military buggy's

Because of the obvious advantages a buggy can affor on certain terrain, they are also used by the military. The buggy's built for the US military are adressed as Desert Patrol Vehicle's (or DPV) or by their previous name of Fast Attack Vehicle]]or FAV. They are generally used by US Navy Seals in this particular army. The DPV's are built by Chenowth Racing Products Inc., witch is a company, based in San Diego. Like most military material, it is not sold to people outside the army.

Tube Framed Buggies

Over time Buggies have been altered to allow maximum recreational use. They are now available in varying sizes to compensate for lack of large amounts of land. The most common form of non-racing buggy consists of a 'tube frame'. This design is simple to construct and sturdy. If the frame bends or breaks then it is very simple to fix. Most Mechanics will have the equipment to fix the broken parts. Steel tubing is preferred to "pipe". The distinction is that pipe is rolled and welded, tubing is mandrel drawn, making it stronger and closer to consistent tolerences.

The engine size varies depending on the suspension, frame strength, requirements and performance needs. Most buggies are equipped with a 4-stroke engine to allow large amounts of torque to propel the heavy frames. Very few are equipped with 2-stroke engines because they can not produce large amounts of torque. Dune buggies may be equipped with automatic or manual transmissions, but manual transmissions are the norm in the buggy world.

Engine sizes vary anywhere between 50 cc for small light buggies to 2.4 L subaru WRX engines designed to race professionaly at 250 km/h.

Fastback

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Fastback is a form of automobile body characterised by a smoothly sloped back. Fastbacks can be two-door coupés or four-door sedans. There is no separate volume for the trunk area of the car.

The fastback can be visually confused with the hatchback or combi coupé, which has a rear door, instead of the fixed window and separate trunk of a fastback.

Fastbacks are often designed for dramatic impact, but the form is also an advantage in developing aerodynamic vehicles with a low drag coefficient.

Examples of two-door fastback cars

1966-1970 Oldsmobile Toronado
1966-1967 Dodge Charger
1965-1973 Ford Mustang GT (several generations)
Nissan 240SX
1968-1972 Oldsmobile Cutlass S
1970-1977 Toyota Celica
1970-1977 Ford Maverick
1964-1969 Plymouth Barracuda

Examples of four-door fastback cars

1970-1979 Citroën GS
1974-1990 Citroën CX
1973-1981 Volkswagen Passat
2005 Mercedes-Benz CLS-Class

See also

- Car body styles
- Notchback
- Hatchback

Hackney carriage

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In the United Kingdom, the name *hackney carriage* refers to a taxicab licensed by the Public Carriage Office in London (for the area within the M25 motorway) or by the local authority (shire district councils or authorities) in other parts of England and Wales, by the Scottish Executive in Scotland, or by the Department of the Environment in Northern Ireland.

Hackney carriages originated in the 17th century as horse-drawn carriages, later modernized as hansom cabs (1834), that operated as vehicles for hire. Electric hackney carriages appeared before the introduction of the internal combustion engine to vehicles for hire in 1901. Today the regulations define a hackney carriage as a taxicab allowed to ply the streets looking for passengers to pick up, as opposed to private hire vehicles (sometimes called minicabs), which may only pick up passengers who have previously booked or who visit the taxi operator's office.

At the beginning of 2004, the UK Government had started consulting local councils and taxi operators on abolishing the distinction between the two types of taxi, with a view to issuing only hackney licences.

Black cabs

Motorised hackney cabs, traditionally all black in colour, have the popular name of black cabs, although other colours also appear, most frequently when advertising campaigns call for the respraying of large groups of cabs in vivid brand liveries.

In most of the United Kingdom hackney-carriage operators use conventional four-door saloon cars, but London (and some other cities like Glasgow and Edinburgh) use specially-designed hackney carriages manufactured by a small number of companies. These vehicles allow up to 5 passengers in the back. Luggage usually goes in the passenger compartment, but travel in the front next to the driver — these vehicles have no front passenger-seat, although a door has replaced the original open side. Some modern designs can also accommodate wheelchairs in the back. Black cabs have a turning circle of only 25 feet.

Some proposals exist to use "people carrier"-type vehicles as hackney carriages.

In London, hackney-carriage drivers have to pass a test called The Knowledge to demonstrate they have an intimate knowledge of London streets.

London Taxi drivers will only pick up passengers if they are travelling no further than six miles from Charing Cross in central London. This restriction has long been resented by Londoners who live outside this zone.

History

The first hackney-carriages licenses date from 1662, and applied literally to horse-drawn carriages. During the 20th century cars generally replaced horse-drawn models, and the last horse-drawn hackney carriage ceased service in 1947.

Note the distinction between a generic hackney carriage and a hackney coach, a hireable vehicle with specifically four wheels, two horses and six seats.

The name hackney derives not from the borough of Hackney in London, but from the French word haquenée (an ambling horse or hack) referring to the horses which pulled the original carriages. The word hackney came subsequently to denote "for hire".

The New York terms "hackstand" (taxi stand) and "hack license" (taxi license) likely derive from "hackney carriage".

City of Boston

The City of Boston in the United States of America also issues hackney carriage licenses. The Boston Police Hackney Carriage Unit handles the regulation of the city's taxis.

Hardtop

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A *hardtop* is a term for a rigid, rather than canvas, automobile roof. It has been used in several contexts: *detachable hardtops*, *retractable hardtop roofs*, and the so-called *convertible hardtop* body style.

Detachable hardtops

Before the mid-1920s 90% of automobiles had open tops, with rudimentary (if any) weather protection provided by a convertible-type canvas top and celluloid or isinglass side curtains. Some automobile bodies had roofs that could be removed during the summer and reattached during the winter, although it was a cumbersome and laborious job. By the time of World War One some automakers offered a lift-off roof, typically with a wood frame, canvas or leather covering, and glass windows. These removable roofs, sometimes called a *California top*, were the forerunners of the detachable hardtop, offering security and weather protection comparable to a fixed-roof model when installed.

Following the ascendancy of steel tops for closed bodies in the 1930s, detachable hardtops with metal roofs began to appear. After World War Two, the availability of new types of plastic and fiberglass allowed lighter, easier to handle hardtops with much of the strength of a metal top.

In the 1950s and 1960s detachable hardtops were offered for various convertible sports cars and roadsters, including the 1955-1957 Ford Thunderbird and the Chevrolet Corvette. Because the convertible top mechanism is itself expensive, the hardtop is customarily offered as an additional, extra-cost option. On early Thunderbirds (and Corvettes through 1967), buyers could choose between a detachable hardtop and a folding canvas top at no additional cost, but paid extra for both.

Improvements in canvas tops have rendered the detachable hardtop less common in recent years, in part because the top cannot be stored in the vehicle when not in use, requiring a garage or other storage facility. Nonetheless, some open cars continue to offer it as an option.

Retractable hardtop

Since the 1930s the appeal of a solid roof that can be lowered or retracted at will has been obvious. Perhaps the first such "*retrac*" was the 1934 Peugeot Cabriolet 301 Eclipse, which had a one-piece metal roof that could be stowed beneath the clamshell rear deck. The operation was manual, not automatic; while the designers had originally intended the roof to be electrically operated, period motors and wiring proved inadequate for the task.

The first production car with a power-operated retractable hardtop was the 1957 Ford Skyliner. Its top merchanism used seven electric motors, 10 power relays, eight circuit breakers, and more than 600 feet (183 meters) of wiring to raise the decklid and lower the top beneath it. The process took about 40 seconds if everything was working properly. The "Retrac" was an impressive showpiece, but the top mechanism and its stowage space eliminated most luggage space with the top down, the system was heavy and quite complex, and the price was some US $437 above a conventional convertible and nearly twice that of a baseline Ford sedan. It was eliminated after 1959, although elements of its design were used in several later convertibles.

Mitsubishi revived the retractable hardtop in 1995 with the Mitsubishi 3000GT Spyder. Impressively engineered, the Spyder nevertheless cost nearly twice the price of comparable fixed-roof models, and only 1,618 were sold.

In recent years, however, European manufacturers have increasingly turned to the retractable hardtop, including Ford Focus, Mercedes SLK & new SL, Nissan Micra, Peugeot 206 cc and 307 cc, Renault Megane cc and Volkswagen Eos.

Pillarless hardtops

The other automotive usage of the term "hardtop" is a body style known as the *hardtop convertible*. A hardtop convertible is a fixed-roof model designed to look like a convertible with the top raised. While some early models retained side window frames and B-pillars, by the 1950s most were *pillarless hardtops*, omitting the B-pillar (the roof support behind the front doors) and configuring the window frames, if any, to retract with the glass when lowered. Some hardtops took the convertible look even further, including such details as simulating a convertible-top framework in the interior headliner and shaping the roof to resemble a raised canvas top. By the late 1960s such modifications were often superseded by a simple vinyl roof.

A pillarless hardtop is inherently less rigid than a pillared body, requiring extra underbody strength to prevent shake. Production hardtops commonly shared the frame or reinforced body structure of the contemporary convertible model, which was already reinforced to compensate for the lack of a fixed roof. With such a reinforced frame, a hardtop was stronger and stiffer than a convertible, but both weaker and (because of the reinforcements) heavier than a pillared body.

There were a variety of hardtop-like body styles dating back to at least the 1920s, but the trend-setter for mass-production hardtops was General Motors, which launched two-door, pillarless hardtops in 1949 as the Buick Riviera, Oldsmobile Holiday, and Cadillac Coupe de Ville. They were purportedly inspired by the wife of a Buick executive who always drove convertibles, but never lowered the top. The hardtop became extremely popular in the 1950s, and by 1956 automakers offered hardtop coupés, four-door hardtop sedans, and even station wagons.

Throughout the 1960s the two-door pillarless hardtop was by far the most popular body style in most lines where such a model was offered. Even on family vehicles like the Chevrolet Impala, the two-door hardtop regularly outsold four-door sedans.

The hardtop began to disappear along with convertibles in the mid-1970s, partly out of a concern that U.S. federal safety regulations would be difficult for pillarless models to pass. The ascendancy of monocoque construction also made the pillarless design less practical. Some models adopted modified roof styling, placing the B pillars behind tinted side window glass and painting or molding the outer side of each pillar in black to make them less visible, creating a hardtop look without actually omitting the pillar. Some mid to late 1970s models continued their previous two-door hardtop bodies, but with fixed rear windows or a variety of vinyl roof and opera window treatments. The U.S. industry's last true two-door and four-door hardtops were in the 1978 Chrysler Newport line.

Since then, no U.S. manufacturer has offfered a true hardtop in regular production, although some German manufacturers, including BMW and Mercedes have offered upscale pillarless hardtops. The body style may be due to return, however, as concept versions of the Dodge Challenger and Chevrolet Camaro shown in 2006 were both two-door hardtops.

See also

- Car body styles

Hearse

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A *hearse* is a funeral vehicle, a conveyance for the coffin from e.g. a church to a cemetery, a similar burial site, or a crematorium. In the funeral trade, they are often called *funeral coaches*.

The name, supposedly, derives from the Anglo-Saxon word harrow, describing the temporary framework on which candles were placed above the bier. This also held banners and armorial bearings and other heraldic devices. Verses or epitaphs were often attached to the hearse.

Hearses were originally horse-drawn, but motorised examples began to be produced from 1909 in the United States, and became more widely accepted in the 1920s. The vast majority of hearses since then have been based on larger, more powerful car chassis, generally retaining the front end up to and possibly including the front doors but with custom bodywork to the rear to contain the coffin. Normally more luxurious brands of car are used as a base; the vast majority of hearses in the United States are Cadillacs and Lincolns. In Europe, Mercedes-Benz, Jaguar, Opel, Ford and Volvo are common contemporary bases, and in the past, even Rolls-Royce limosuines were converted, though their cost is generally considered prohibitive.

Cadillac produced what it termed a "commercial chassis". This was a strengthened version of the long-wheelbase Fleetwood limousine frame to carry the extra weight of bodywork, rear deck and cargo. Designed for professional car use, the rear of the Cadillac commercial chassis was considerably lower than the passenger car frame, thereby lowering the rear deck height as well for ease of loading and unloading. They were shipped as incomplete cars to coachbuilders for final assembly. A commercial chassis Cadillac was little more than a complete rolling chassis, front end sheet metal with lighting and trim, dashboard and controls. Rear quarter panels and sometimes the front door shells were shipped with the chassis for use in the finished coachwork. Today, most hearses are made from converted sedans on stretched wheelbases. The fleet division of Ford Motor Company sells a Lincoln Town Car with a special "hearse package" strictly to coachbuilders. Shipped without rear seat, rear interior trim, rear window or decklid, the hearse package also features a heavy-duty suspension, brakes, charging system and tires and was once offered on a modified Ford Expedition SUV chassis with the Triton V10 truck engine. Since the working life of a hearse is generally one of light duty and short, sedate drives, hearses remain serviceable for a long time; hearses 30 years old or more may still be in service, although some funeral homes replace them at least once a decade. As of 2004, a new hearse in the USA usually costs in the range of $40,000 to $65,000.

Two styles of hearse bodywork are common. The older style is the limousine style; these have narrow pillars and lots of glass. These are more popular in the United Kingdom, among others. More popular in the United States is the landau style, with a heavily-padded leather or (later) vinyl roof, and long blind rear quarters, similarly covered, and decorated with large metal S-shaped bars designed to resemble those used to lower the tops on some horse-drawn coaches. It is common practise in the USA for the windows to be curtained, while in the UK the windows are normally left unobscured. Hearses resemble station wagons strictly because of the shape of the rear ends of conventional ones.

In Japan, hearses can come in two styles: "Foreign" style, which is similar in build and style to an American hearse, or a Japanese style, in which the rear area of the vehicle is modified to resemble a small, ornate Buddhist temple. Foreign style hearses are mostly similar in appearance to their US counterparts, although their exterior dimensions and interiors reflect the Japanese preference for smaller, less ornate caskets (this in light of the national preference for cremation). This means that, in contrast to American hearses, the rear quarter panels require less, and sometimes no, alteration. These are generally built from station wagons such as the Nissan Stagea, or from executive sedans such as the Toyota Celsior (Lexus LS430 in the US) and Nissan Cima (Infiniti Q45 in the US). Interestingly, American market vehicles such as the Lincoln Town Car and Cadillac DeVille, which are otherwise fairly uncommon in Japan, are often converted to hearses in both styles.

In recent times, the Motorcycle hearse has become more popular. This type of hearse is a motorcycle with a special sidecar built to carry a casket or an urn. These hearses are often used during the funeral of motorcycle enthusiasts.

Until the late 1970s, it was common for hearses in the USA to be combination coaches which also could serve in the ambulance role; these were common in rural areas. Car-based ambulances and combination coaches were unable to meet stricter Federal specifications for such vehicles and were discontinued after 1979.

Perhaps owing to the morbid nature of the hearse, its luxurious accommodations for the driver, or both, the hearse has a number of enthusiasts who own and drive retired hearses. Celebrity hearse enthusiasts include rock singer Neil Young and double NASCAR Nextel Cup Champion Tony Stewart, who had his hearse customised for a television show into a play toy.

Cultural references

- The 1971 film "Harold and Maude features a unique Jaguar E-Type, converted to a hearse by it's owner, Harold.
- The 1984 film Ghostbusters famously features the "Ectomobile", a white 1959 Cadillac Miller-Meteor hearse.

See also

- car body style
-

High Wheeler

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The *High Wheeler* was a body style virtually unique to the United States. It is typified by large diameter slender wheels, frequently with solid tyres, to allow for use on the primitive tracks in much of the country at the turn of the 20th century. The last ones were built around 1910.

Kammback

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A *Kammback* is a car body style influenced by the research of the German aerodynamicist Wunibald Kamm in the 1930s. Kamm showed that a better drag-reducing tail end design for a car is one that tapers until its cross-sectional area is approximately 50% of the car's maximum cross-section. At that point, the tail should cut off abruptly. Prior to this, a teardrop shape that tapered smoothly to a point was considered optimal. Kamm showed that an abbreviated teardrop actually worked better; the air still flowed as if the entire teardrop were still there, but without the surface drag of the long point.

Many cars since then have had a Kammback tail, especially sports cars. Usage of the term has fallen off as Kamm's principles have become more generally accepted.

American car manufacturers have described certain models as Kammbacks with greater or lesser degrees of accuracy. In many cases, it has simply been used as a substitute for "station wagon" or "hatchback".

General Motors produced a 2-door station wagon version of the Chevrolet Vega in the 1970s that was called a Kammback, although it lacked appreciable rear-end taper before the cut-off rear and thus cannot accurately be said to follow Kamm's design.

In 1978, a Kammback version of the Pontiac Firebird was seriously considered, and prototypes were built and shown. In many respects similar to what the British would call a shooting brake (a station wagon version of a sporting coupé), this "Type K" did not have a tailgate but rather lifting side windows for access to the cargo area. Costs eventually killed the project, but from 1980 replica aftermarket conversions were available for a short time from an independent manufacturer. In 1986 Chevrolet built two similar Camaros, but again the concept did not reach production.

AMC stylist Richard A. Teague became a fan of this truncated somewhat-"Kammback" style in the late 1960s as he considered simple ways of adding to AMC's model range. He came up with the idea of truncating a larger car to make a smaller, enabling the two cars to share a lot of common tooling. This concept first came to the public as the AMX, a cut-down 2-seat version of the 4-seat Javelin coupé, although this shared the Javelin's rear and was not a Kammback. A still further cut-down concept car with a Kammback tail, the AMX GT, was shown in 1968, but never entered production. Instead, Teague adapted the concept to AMC's next car, the compact Hornet, to produce the Gremlin subcompact. The same concept was later continued as the AMC Eagle Kammback.

In 1985, the Fiat Group introduced a rather luxurious small town car named the Y10, initially under the Autobianchi brand and later badged as a Lancia, featuring a Kammback, which, combined with its clean lines and clever bodywork detailing, gave a drag coefficient of 0.30, resulting in excellent fuel economy.

Other Kammback cars have included the Alfa Romeo GTV, the Maserati Khamsin, and the Volvo S60. The feature is also visible on hybrid cars designed for extremely high gas mileage, such as the third-generation Toyota Prius (see photo above) and the Honda Insight.

Landau

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Coachbuilding

A *landau* is a lightweight open carriage on elliptical springs, invented in the 18th century (first noted in English in 1743 [1]), and named after the city of Landau in the Rhenish Palatinate, French at the time, where they were first produced. Lord, Hopkinson, coachmakers of Holborn London, produced the first English landaus in the 1830s (Museum Victoria). A landau, drawn by a pair or four-in-hand, is similar to a vis-à-vis, a social carriage with facing seats over a dropped footwell (illustration), which was perfected by mid-19th century in the form of a swept base that flowed in a single curve. Double soft folding tops at front and rear ordinarily lie perfectly flat but in a pinch can completely cover the passengers, latched at the center, with some loss of a graceful line [2], [3].

The landau's center section might contain a fixed full-height glazed door, or more usually a low half-door. There would usually be a separate raised open driver's upholstered bench-seat, but a landau could be postilion-driven, and there was ordinarily a separate groom's seat, sprung above and behind the rear axle, saving the groom from having to stand on a running board.

The landau reached its full development by the mid-19th century [4] It was purely a city carriage of luxury type. The low shell of the landau made for maximum visibility of the occupants and their clothing, a feature that makes a landau still a popular choice for Lords Mayor on ceremonial occasions.

A distinguishing characteristic of the landau carriage is the external hinged supporting bars mounted on the outside of the folding top. When the top was up, these bars would lock into place, forming an elegant shallow 'S' shape. The bars are variously known as landau bars, landau bows, landau irons or S-bars.

Automobiles

Many coachbuilding terms transferred over to automobile usage, since coachbuilders began making motor car bodies instead, and because customers were familiar with coachbuilding terms. The landau, however, was not a style that transferred well to the automobile. A forward view was generally insisted upon by passengers, and so the half-landau *landaulet* style, instead of the landau, became a more popular choice. The landaulet opens over the rear seats, but not the front. Some of these vehicles were inaccurately described as "landaus".

In the 1920s and 1930s, especially in the United States, the term "landau" became used for a simulated convertible, in which a fixed roof of a sedan with solid rear quarters was covered with fabric or leather and fitted with side landau bars in order to appear like a convertible top. This became the commonly accepted definition of 'landau' in North American usage thereafter.

Postwar, the term fell into disuse, only to be revived during the 1960s as the trend for such "fake convertibles" with vinyl roofs established itself. Some of these vehicles were called "landaus" by their manufacturers, and many were fitted with landau bars on the rear quarters. Some use the term "Town Landau", and this generally means a wider rear pillar with no rear quarter windows, or a vinyl roof that only covers the rear seat area (and is thus reminiscent of a town car).

A landau roof is also commonly used on the North American hearse; very long closed rear quarters, a vinyl roof and huge, polished landau bars have been the preferred hearse style since before World War II.

Reference

- Richardson, C., Driving : The Development and Use of Horse-Drawn Vehicles, London, 1985.

Notchback

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Notchback is a form of automobile body that is characterized by a sharp vertical drop-off from roof to trunk, as opposed to hatchback or fastback. The notchback is usually a synonym for sedan, although many coupé cars are notchbacks as well.

Examples

Plymouth Barracuda
Pontiac Trans Am
Chevrolet Vega
Volkswagen Notchback
Ford Mustang
Pontiac Fiero
Oldsmobile Cutlass Supreme

See also

- car body styles

Panel van

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A *panel van* (or *panelvan*) is a form of van, usually one based on a family car chassis. They were especially popular with younger car buyers in Australia during the 1970s.

Australian panel vans

In Australia, panel vans were a development of the Australian ute (a variety of pickup also based on a car chassis). By the late 1980s, they began to slowly disappear from Australian roads as demand fell and major manufacturers slowly ceased building them.

Most utes usually had an option of metal, then later rigid plastic, shells that would fit over the back of the tray of the ute, thereby extending the vertical space drivers could store in the tray, usually to just above the existing roofline of the passenger cab. Later shells offered plastic windows for ventilation along the sides and even pop-out or swing-out windows at the rear to aid the driver's rear vision. These were eventually integrated into the body of the ute itself to form a hybrid vehicle that, while based on a ute body, offered more rear space than a conventional station wagon with its rear seats folded down. These became known to the Australian public essentially as panel vans.

Initial models were fitted at the rear with swing-down and -up doors (like utes), but later models came equipped with "barn-door" configurations that opened out to the sides of the vehicle, rather than down, aiding the loading of bulky freight into the vehicle without (as badly) damaging the body. Passengers could climb from the interior passenger cab into the cargo bay behind them easily. Later the installation of safety cages which segregated passengers from the cargo area became popular to prevent freight from the back sliding into the passenger cab (and potentially injuring the driver).

The first panel vans were manufactured by Holden and Ford in the late 1950s, but didn't become popular until the mid-1960s. By the early 1970s, usually when based on the Holden Kingswood and Ford Falcon model of the time, panel vans had become Australian cultural icons. The Holden Sandman is probably the best-remembered of these: for example, one of the vehicles driven by Mel Gibson in the 1979 movie Mad Max was a Sandman (apparently a 1975 "HJ" model in this case)(The panelvan in Mad Max was not a Sandman, But a customised HJ Kingswood panel van). Ford panel vans (known briefly as Sundowners) were also popular, to a lesser degree. Chrysler also came to the party in 1976, offering a CL-model Valiant panel van dubbed the Chrysler Drifter, but these could not compete with the popularity of Ford and particularly Holden, and were axed in 1978.

Younger drivers were especially attracted to panel vans, for reasons such as the ease with which a mattress could be installed within the cargo bay. Consequently, panel vans also attracted nicknames such as "sin bins", "shaggin' wagons", and "fuck-trucks". During the 1970s it also became fashionable to decorate the exterior sides with murals painted with intricate detail.

Australian police forces also purchased fleets of panel vans to use in a black maria, or paddy wagon, role. In Melbourne, panel vans were known in police terminology as divisional vans, giving rise to the localised slang term divvy van (and the drinking chant, "we're going home in the back of a divvy van!").

Painters, electricians, and general labourers also found panel vans ideal for their trades, as the cargo bay offering extended capacity otherwise wasted in passenger space, and a highly customisable interior, without the bulk or extended dimensions of other longer-base vans.

The popularity of panel vans has waned however the last 20 years: Holden's last release was their "WB" model, in 1983. Subsequently, Ford became the sole manufacturer of them until 1997, when the "XH" model was released; this was to prove the last entry in the history of the Australian panelvan. In 2003, Holden released a new Sandman, based on their "VU" model Holden Commodore of the time. These Sandmans were a limited edition release, and while they were identified (and marketed) as panel vans, they still retained the rear window and firewall of the ute they were ultimately based on, preventing movement between the cargo bay and the passenger cab, as offered by traditional panel vans.

See also

- Car body styles

Phaeton body

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A *Phaeton* is a car body style in which the passengers sit in one to three rows of open seats. Early Phaetons had a high-mounted driver's seat at the rear, as in a Hansom.

Retractable hardtop

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A *Retractable Hardtop* refers to a car with a movable roof for a convertible that is made of plastic or metal. This results in a car with the flexibility of an optional roof yet the rigid roof of a coupé.

History

In the first years of the 2000s, car makers started building articulated retractable rigid roofs allowing the automobiles using this configuration to go seamlessly from convertible to coupé and back. Usually, the roof is made of two metal parts that fold and store themselves in the trunk when in convertible position. More recently, cars have started to appear where all parts of the roof are transparent. These cars' rooves are made out of glass, giving the car, a sunroof when the top is up. This idea is not new, having been used by Peugeot before World War II and the Ford Motor Company in the 1950s with the Ford Skyliner. The car was sold for 3 years in the United States. However, unreliability and expense doomed those earlier efforts. In America, the next car to follow suit with an automatic hardtop was the Mitsubishi 3000GT Spyder in 1995 and 1996. However, similar to the Ford Fairlane 500 Skyliner, the 3000GT didn't prove to be a high volume seller. Next in line was the 1998 Mercedes-Benz SLK 230 (R170). This car is admittedly the first successful hardtop convertible in the United States. This car's chassis lasted until the 2005 version (R171) was released. This approach, despite its obvious mechanical costs, is considered much more convenient in day-to-day use than the more traditional removable hardtop used by some convertibles to replace the textile roof during rainy or winter months. In 2006, the first four-door coupe convertible, the Peugeot 407 Macarena concept car is presented.

List of cars with retractable hardtops

Cars with a retractable hardtop:

Cadillac XLR (2004)
Chevrolet SSR (2003)
Daihatsu Copen (2002)
Ford Focus (2006)

Lexus SC 430/Toyota Soarer (2001)
Mercedes-Benz SLK-Class (R170 & R171) (1998)
Mercedes-Benz SL-Class (R230) (2003)
Mitsubishi 3000GT Spyder Mk.2 (1995-1996)
Mitsubishi Colt 2+2 (2006)
Nissan Micra C+C (2005)
Opel Tigra Twin Top (2005)
Opel Astra Twin Top (2006)
Peugeot 206 CC (2001)
Peugeot 307 CC (2003)
Pontiac G6 (2006)
Renault Mégane CC glass-roofed (2003)
Volvo C70 Mk.2 (2006)
Volkswagen Eos (2006)

References

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Roadster

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Roadster is the North American term for a two-seat, open car, traditionally without side windows (possibly with pluggable doortops), so that even with the lightweight convertible top raised the driver and passenger remain exposed to the elements. In modern times, the word is often used to describe a two-seat convertible without fixed window frames, especially a light-weight sports car. Here, the use of the name roadster is more a marketing than a technical one, invoking the feeling of an open-top machine for enjoyment, like those of the past.

Old roadsters

Traditionally, roadster bodies were used on anything from a Ford Model T to a Cadillac V-16. It was a body style favored by those who preferred enjoyment to practicality. Roadster-bodied cars are popular with collectors, and are often valued higher than even other open styles.

Hot Rod Roadsters

The American Hot Rod is largely based on Ford roadsters and coupes. Late Model T Fords, and 1932 Fords are by far,the most

Modern roadsters

The roadster name experienced a resurgence in 1990 with the introduction of the Mazda Miata/MX-5. Though not roadsters in the traditional open sense, many manufacturers today offer "roadsters". They can be described as "convertible sports cars" because they stress driving rather than practicality - like sports cars, modern roadsters are two-seaters or 2+2.

While some makes prefer the word *Spyder* for a completely open-topped vehicle, Italian makes favor the term *Barchetta*, which means "small boat". The term "Spyder" originated from a small two-seat horse-cart with a folding sunshade made of four bows. With its black cloth top and exposed sides for air circulation, it resembled an eight-legged spider.

Notable modern roadsters are:

Audi TT
BMW Z3/Z4
Fiat Barchetta
Honda S2000
Mazda Miata
Mercedes SLK
Pontiac Solstice
Porsche Boxster
Toyota MR-Spyder

See also

- Sports car
- Convertible
- Spyder
- Cabriolet

Runabout

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Runabouts were a popular car body style at the beginning of the 20th Century. They were small, inexpensive, open cars. Most runabouts had just a single row of seats, providing seating for two passengers. Many also had a tonneau at the rear to provide optional seating for four or five. In the vintage vehicle era, nearly half of all car models, and the majority of cars produced, were classified as runabouts.

Shooting-brake

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Shooting-brake is a car body style indicating luxury estate cars built for being used by wealthy hunters.

The body is usually custom built. An early manufacturer of shooting brakes was Albion Motors of Scotland. There are existing examples of custom-built Bentley S2 and Mercedes 300 cars.

VG, a small US coachbuilder, actually offers a model named VGD Shooting Brake.

Some modern manufacturers, such as Audi, have recently referred to some concept cars as shooting brakes.

Softtop

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A *softtop* is a convertible top which is made out of flexible materials like PVC or textile.

Sportwagon

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A *Sportwagon* is the Alfa Romeo model name for a long-bodied estate type vehicle. It is one which has an extended storage compartment (boot) over the rear wheels, with the roof at the same height as the passenger compartment.

Common cars available in the Sportwagon name are the Alfa Romeo 33 and Alfa Romeo 156.

Spyder

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Spyder or *Spider* is a term for a convertible car body style. In paintball, the Spyder is a line of Paintball markers by Kingman Group

The term derives from horse-drawn carriages, as do other automotive terms. A spider phaeton was a lighter version of a phaeton, having narrower, spindly wheels and two-seat accommodation. This term was subsequently applied to cars.

The first car to be officially called a "spyder" was the Porsche 550 Spyder — the name implied an extremely rudimentary top mechanism. Other later spyders include the Fiat 850, numerous Ferraris, later Porsches, the Chevrolet Corvair, and the Triumph TR7 Spider.

In more recent times, the term has been used by many automakers as a synonym for convertible. Examples include the Toyota MR2, Mitsubishi Eclipse, Lamborghini Gallardo, and the Mitsubishi 3000GT.

See also

- convertible
- roadster

Stanhope body

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Stanhope is an archaic car body style characterized by its single bench seat mounted at the center, folding cloth top, and buckboard at the front. All Stanhopes featured tiller steering, either in the center or at the side. The body style disappeared by the vintage vehicle era.

T-bucket

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A *T-bucket* (or *Bucket T*) is a specific style of hot rod car, based on a Ford Model T but extensively modified, or alternatively built with replica components to resemble a Model T. Since the last Model T was built over three-quarters of a century ago as of 2004, modern T-buckets are generally replicas as there are few real Model Ts left in scrapyards to build upon.

A genuine T-bucket has the very small and light two seater body of a Model T roadster pickup (with or without the small pickup box), this "bucket"-shaped bodyshell giving the cars their name. A Model T style radiator is always fitted, and these can sometimes be barely up to the task of cooling the large engines fitted. There is never any kind of engine cowling on a T-bucket. Windshields, when fitted, are vertical glass like the original Model T.

Model Ts were being hot-rodded and customized from the 1930s on, but the T-bucket specifically was created and given that name by Norman Grabowski in the 1950s.

Today, T-buckets are still a very common hot rod style. They generally feature an enormous engine for the size and weight of the car, generally a V8 of some form, along with tough drivetrains to handle the power and big, fat rear tires to apply that power to the road. Front wheels, in a nod to the Model T hot rod's drag racing past, are often very small.

Most are actually built purely for street or display use, and the big engines are more for show than for need — many are more powerful than the vehicles can actually make use of. Although the bodyshell is a Ford (in appearance, at least), engines of a wide variety of makes can be found on T-buckets. The small-block Chevrolet 350 V8 is a common choice, since it is relatively small, light, easy to obtain and to improve, and performs well. Many people also tend to equip blowers (superchargers) on their motors, and some people even run modern fuel injected motors.

T-top

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A *T-top* is a kind of semi-convertible automobile body style, similar to the targa top, but with a solid, non-removeable bar running between the passenger and driver sides of the car. It is called a T-top due to the design looking roughly like the letter *T*.

See also

- convertible
- targa top

Targa top

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Targa top, *targa* for short, is a semi-convertible car body style with a removable roof section and a full width roll bar behind the seats. The rear window can be fixed or removable, making it a convertible. In common usage, any piece of metal or trim which rises up from the side of a car and continues in an uninterrupted line over the roof and down the other side may be called a targa band, or sometimes a wrapover band. Targa tops are different from *T-top* or known as *T Bar roof*, which has a solid, non-removable bar running between the passenger and driver sides of the car. It is called a T-top due to the design looking roughly like the letter T.

The word targa first came into use from the 1966 Porsche 911 Targa, though the first production car with this system as an option was actually released five years before, namely the 1961 Triumph TR4. The name was first adopted by Porsche after the Targa Florio road race in which they entered, used type of body style to allow a quicker entry and exit to the car by drivers in 1962 and many race cars adopted it especially Ford and its bitter rival at the time, Ferrari in the '60s and early 70's for twistier road courses.

This body style became popular in the 1970's, when the DoT in the United States, attempted to ban convertibles, due to concerns when the car is overturned, as a result manufacturers adopted Targa tops or T bars. As Porsche helped to popularise this body style, they took out a copyright for the Targa name and manufacturers sought to look for alternative names for their removable roof.

1996 and saw the debut of a retractable glass roof, a design continued on the 996 Targa. The glass roof would retract underneath the rear window revealing a large opening. A shade was there to help prevent the greenhouse effect of the closed roof. This system was a complete redesign, as previous Targa models had a removable roof section and a wide B-pillar functioning as a roll bar. The new glass roof design allowed the 993 Targa to retain the same side-on profile as the other 911 Carrera variants and finished with the inconvenience of storing the removed top of the old system. The Targa has the body of the Cabriolet with the Targa glass roof replacing the fabric roof.

With the introduction of the Mazda Miata in 1989, saw a revival of convertibles as recent models had roll bar incorporated into the front windscreen, Targas and T-top saw a slow decline as manufacturers discountinued them one by one, putting convertibles into favor, but will continue to produce them when it is not possible to incorporate convertible styles.

Examples of the Targa car and T-bar top body style include:

Chevrolet Camaro (1978 - 2002)
Chevrolet Corvette coupe (1968 - current)
Datsun 280ZX
Ferrari 250P / 250LM / 330P / 330P2 / 330P3 / 330P4 / 412P / 312P
Ferrari 512S/512M
Ferrari Dino
Ferrari 308 GTB
Ferrari F355
Fiat X1/9
Ford GTX-1 (1966 12 Hours of Sebring winner)
Ford GTX-1 Roadster (2005)
Honda del sol
Honda NSX - T
Lotus Elise
Matra 530
Nissan 100NX
Nissan 300ZX
Porsche 904
Porsche 906
Porsche 911 Targa (1966-1992)
Porsche 914
Pontiac Firebird (1978 - 2002)
Saab Catherina prototype
Suzuki Cappucino (has an optional solid roof which can be converted into a Targa top)
Toyota MR2 (AW11 and SW20 models)
Toyota Supra (MK 4)
Triumph TR4
Triumph TR7

Three window coupe

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The *three window coupe* is a style of hot rod, based on the 1932 to 1934 Ford three window coupe (one window in each door, plus the backlight, as distinct from the five window coupe with an additional window on each side). It is one of the classic variations on the hot rod theme.

Tonneau

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Tonneau (pronounced ta’-no) is an archaic term for an open rear passenger compartment on an automobile and, by extension, a body style incorporating such a compartment. Most tonneaus were fixed in place as an optional element at purchase, but some could be removed as on the Crestmobile. Early tonneaus had a rear-facing hinged door as a rule, but single- or dual side doors were soon introduced. The first side-door tonneau was made by Peerless, but others quickly followed suit. This led to the development of the modern sedan/saloon, with Cadillac manufacturing the first production closed-body four-door car in 1910.

In the post-WW2 era the term has come to refer to the area behind the front seats of an open car (a convertible or roadster). The term *tonneau cover* is sometimes used for a hard or soft cover that encloses the well for the convertible top and/or the rear seating/storage area. It is also used to describe a similar cover for a pickup truck bed.

Touring car

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A *touring car* was a popular car body style in the early 20th century, being a larger alternative to the runabout and the roadster. They were open cars, often fitted with convertible tops. Most early touring cars had a tonneau at the rear giving seating for four or more. Engines on early models were either in the front, or in a mid-body position. Touring cars evolved into the modern sedan/saloon body style.

By the mid-teens in the United States, the touring car body had evolved into a varity of types, with the four door touring car, equipped with a convertible top, being the most popular body style offered.

The majority of Model T's produced by Ford between 1908 and 1927 were four and then three-door models (with drivers sliding behind the wheel from passenger seat) touring cars, accounting for 6,519,643 cars sold out of the 15,000,000 estimated Model T's built. In terms of percentage, the 5-passenger touring car model was Ford most popular body type and accounted for 44% of all Model T's (cars, trucks and chassis) sold over the model's eighteen-plus year life span; Ford's second most popular body style during the same period was its Model T based truck.

Side curtains, when available for a particular model, could be installed to protect passengers from weather elements by snapping or zipping them into place, otherwise, drivers and passengers braved the elements. When the top was folded down, it formed a bulky mass known as the "fan" behind the back seat: "fan covers" were made to protect the top and its wooden ribs while in the down position.

The popularity of the touring car began to wane in the early 1920s when cars with enclosed passenger compartments became more affordable, and began to consistently out-sell the open cars.

Van

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A *van* is a vehicle used for transporting goods or groups of people. It is generally a rather box-shaped vehicle on four wheels, about the same width and length as a large automobile, but taller and usually higher off the ground. It can either be a specially designed vehicle or be based on a saloon/sedan car, the latter type often including derivatives with open backs (pick-ups etc). Some vans can be really small, like the van versions of the Mini or can be really large like some Mercedes-Benz vans. Larger vehicles are classified as trucks or lorries.

Word usage and etymology

The word van is a shortened version of the word caravan which originally meant a covered vehicle. In British English, this now has a similar meaning to the U.S. terms travel trailer or recreational vehicle (RV).

The word van has slightly different, but overlapping, meanings in different forms of English. While the word always applies to boxy cargo vans, the most major differences in usage are found between the different English-speaking countries.

United Kingdom and Australia

British English speakers will generally refer to a passenger minivan as a people-carrier or MPV (multi-purpose vehicle), and a larger passenger van as a minibus. British people, mostly older ones, will also sometimes call a pickup truck a van, something Americans would not do. Similarly, in Australia, panel vans, RVs popular among young people in the 1970s, were based on locally-manufactured utes (short for utility, the local name for pickup).

United States

In the United States, a van can also refer to a box-shaped trailer or semi-trailer used to carry goods. In this case there is a differentiation between a dry van, used to carry most goods, and a refrigerated van (a reefer) used for cold goods. A railway car used to carry baggage is also called a van. Occasionally the term van is also used to refer to a minivan. However, minivans are usually distinguished by their smaller size, unibody architecture, and front wheel drive powertrains.

Examples

The standard or full size vans in the United States were originally manufactured by the "big three": Dodge, Ford and General Motors. The frame and drive train are identical or similar to the full-sized pickups made by the each manufacturer but with a snub front, resulting in most of the engine protruding under a console between the front seats, often called a dog house. They have been sold as both cargo and passenger models to the general public and as cutaway van chassis versions for second stage manufacturers to make box vans, ambulances, campers and other vehicles. Second stage manufacturers also modify the original manufacturer's body to create custom vans for the general public. Dodge, now part of Daimler-Chrysler quit making their model in June of 2002 and replaced it with the Dodge Sprinter which may be due to roll-over concerns.

Usage

In urban areas of the United States full-size vans have been used as commuter vans since 1977, when Dodge introduced a van that could transport up to 15 passengers. Commuter vans are used as an alternative to carpooling and other ride sharing arrangements.

Many mobile businesses use a van to carry almost their entire business to various places where they work. For instance, there are those who come to homes or places of business to perform services or to install or repair appliances.

Vans are also used to shuttle people and their luggage between hotels and airports, to transport commuters between parking lots and their places of work, and along established routes as minibuses.

Criticism

Recently, the passenger versions have been criticized for having a tendency to roll over. The van body is taller than the cab and bed of the pickup that uses the same style frame and powertrain resulting in the basic van having a higher center of gravity than a similarly loaded pickup from which it is derived. The seats in the passenger version raise the load, passengers, above the floor, further increasing the center of gravity. The bench seats allow passengers to slide if safety belts are not used (in the United States it is common for only the front seat passengers to use their safety belts) and belted passengers can still lean and shift a large amount. The result is a high center of gravity and a shifting load, particularly in passenger versions. In addition, many of the drivers of passenger vans drive them infrequently. Apart from safety issues, it seems inefficient to have a high cross-sectional area and a high mass when only transporting one to two persons on average. Average heights are for:

- Minivans 70.2 in
- Family sedans 57.3 in
- SUVs 70.7 in

This leads to increased energy demand and thus fuel consumption and more consumption of other resources like steel, brake blocks, oil, etc. Modular vehicle concepts and Low-energy vehicles are in preparation of avoiding those problems.

Alternatives

For business and private in most cases the usage of trailers gives the possibility to transport bulky goods without the need to propel a heavy vehicles all the time. Utility cycling is a more extreme form of transporting goods. Here also trailer are seen. Apart from bicycle couriers, window cleaners are employing bicycles. For craftsmen in cities its also possible to use a transport service i.e. the specialists may arrive via public transport and bulky or heavy material is transported by courier services either from the same company or using courier express or parcel services. Thus parking fees and city tolling may be avoided.

See also

- recreational vehicle
- SUV

Makes of van

Full-size vans

Chevrolet

Chevrolet Beauville
Chevrolet Corvair 95 Greenbriar
Chevrolet Express
Chevrolet G Series G10, G20, G30
Chevrolet Nomad Van
Chevrolet Sport Van

Citroën

Citroën Jumpy
Citroën Jumper/Citroën Relay

Dodge

Dodge A Series A100, A200, A300
Dodge B Series B100, B150, B200, B250, B350
Dodge Coachman
Dodge MB Series MB-250, MB-350
Dodge Sportsman
Dodge Sprinter

Dodge Tradesman
Dodge Ram Van

Fiat

Fiat Scudo
Fiat Ducato

Ford

Ford Econoline E-100, E150, E250, E350, E450
Ford Club Wagon
Ford Transit

GAZ

- Gazelle

GMC

GMC Gypsy
GMC Rally Rally Wagon, Rally STX
GMC Savana
GMC Vandura 1500, 2500, 3500

Mazda

- Mazda Bongo

Mercedes-Benz

Mercedes-Benz Sprinter
Mercedes-Benz Vario
Mercedes-Benz V-Class

Nissan

Nissan Caravan
Nissan Elgrand
Nissan Interstar
Nissan Primastar
Nissan Silkroad
Nissan Vanette

Opel

Opel Movano
Opel Vivaro

Peugeot

Peugeot Boxer
Peugeot Expert

Plymouth

- Plymouth PB Series PB-100, PB-200, PB-350

Renault

Renault Master
Renault Trafic

Toyota

Toyota Dyna
Toyota Hiace

Toyota Regius Ace
Toyota Toyoace
Volkswagen
Volkswagen Transporter
Volkswagen LT

Mid-size vans

Chevrolet
- Chevrolet Astro

GMC
- GMC Safari

Minivans

British Leyland, United Kingdom
Bedford: Rascal, Midi
DaimlerChrysler: Dodge, United States
FSC, Poland
Iveco
LDV
Nissan, Japan
Saab automobile: Saab 95 (certain markets)
Holden: Combo

Woodie

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A *woodie* is a type of car, more specifically an early station wagon (US) or estate car/shooting brake (UK), in which the rear portion of the car's bodywork is made of wood. Frequently this wood is visible, since it is covered in a clear finish, either over the entire wooden area or sometimes just on the framework with the interior panels painted.

The vast majority of woodies were produced before the end of the 1950s at which time safety regulations and changing automotive fashions meant the effective end of the style. Woodies were generally not produced by the original car manufacturer, but were third-party conversions of regular vehicles. Some were done by large, reputable coachbuilding firms, while others were built by local carpenters and craftsmen for individual customers.

It is a derivative of the body-on-frame method of car construction. Earlier cars generally had aluminium or steel panels bolted on top of the wood framing. Woodies were originally cheaper because they didn't need these panels and their fitment and painting. So railway stations used them for hackwork of luggage and petty shipments; hence the name, station wagon. The tradition of the woodie remains in the woodgrain decals and plastic beams attached to a structural steel body of many station wagons. These imitations are considered deceitful for the same reasons that modern architects maintain Adolf Loos's statement, "Ornament is Crime."

This car body style was popular both in the United States and the United Kingdom. Woodies were produced from all kinds of cars, from basic to luxury, but the most popular conversions were large, powerful but not highly luxurious models.

In the 1960s and to some degree the 1970s woodies were considered undesirable, unfashionable old vehicles. California surfers, among others, realised the potential of these cars; they were cheap, large enough to carry a good number of people, surfboards and equipment, and could be fixed up with woodworking skills. Thus, the woodie became the archetypal vehicle of the surfer; there is probably a higher population of surviving woodies in California than anywhere else, aided by the area's ideal climate for preserving the vehicles; warm, dry but not desiccating, with rare rainfall.

These days, woodies are highly collectible antique cars and a good example can fetch a very large amount of money. The wooden bodywork has often not survived all that well, increasing the rarity.

5 Car classifications

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Car classification is a somewhat subjective subject, as many vehicles fall between classes or even outside all of them. Not all car types are sold in all countries and names differ in some cases between British and American English. The following are commonly used classifications within the Wikipedia. Where applicable, the relevant EuroNCAP classifications are shown.

United States	EuroNCAP	Euro size	Example
Microcar	-	Microcar	Smart Fortwo
-	Supermini	A class	Fiat Panda
Subcompact		B class	Ford Fiesta
Compact	Small family car	C class	Ford Focus
Mid-size	Large family car	D class	Volkswagen Passat
Full-size		E class	Chrysler 300
Luxury	Executive car	F class	Mercedes-Benz S-Class
Sports	-	Sports	Porsche 911
Convertible	-	Cabriolet	BMW 3-Series
Roadster	Roadster	Roadster	BMW Z4
-	Small MPV	MIni MPV	Opel Meriva
-		Compact MPV	Renault Scénic
Minivan	MPV	Large MPV	Toyota Previa
Crossover SUV	Small Off-Roader	-	Honda CR-V
SUV	Large Off-Roader	-	Jeep Grand Cherokee

Microcar

See main article: Microcar

Straddling the boundary between car and motorbike, these vehicles have engines of only a few hundred ccs, typically seat only 2 people, and are generally unorthodox in construction. Many only have three wheels. They are especially associated with post-war Europe, where their appearance led them to called *Bubble cars*. A contrast to the traditional microcar is the modern Smart.

Examples of microcars

CLEVER
Copen
Fend Flitzer
Messerschmitt microcar
Isetta
Goggomobil
Heinkel microcar
Trojan (automobile)
Electric Sparrow

Hatchback

See main article: Hatchback

City car

See main article: City car

A city car is a small car intended for use in urban areas. Unlike microcars, city car's greater speed and occupant protection allow relative safety in mixed traffic environments and in all weather conditions. While it may be capable of freeway speeds this is not the main purpose of the car.

In Japan, a specially restricted type of these (under 3.40m long) are called the keicar, where taxes and insurance are lower.

Examples of city cars

Daihatsu Mira
Fiat Cinquecento
Fiat Seicento
Smart Fortwo
Mazda Carol
Mitsubishi Minica
Peugeot 107
Renault Twingo
Suzuki Alto

Supermini / Subcompact car

See main article: Supermini car
See main article: Subcompact car

This class, known as *superminis* in Europe and *subcompact cars* in North America, covers the not-so-small hatchbacks and the smallest sedans. These vehicles are the smallest cars widely sold in the North American market. They have usually three, four or five doors and are designed to seat comfortably four adults and a child, but can take five adults. Current supermini hatchbacks are around 3.90m long and sedans 4.20m long.

In Europe, the first superminis were the Fiat 500 of 1957 and the Austin Mini of 1959. Today, superminis are some of the biggest selling cars in Europe.

Examples of superminis / subcompact cars

Austin Metro
Austin Mini
BMW MINI
Citroën AX
Dacia Logan
Fiat Punto
Fiat Palio
Fiat Uno
Ford Fiesta
Kia Rio
Mercedes-Benz A-Class
Nissan Micra/March
Opel Corsa
Peugeot 205
Renault 5
Renault Clio
Rover Metro
Volkswagen Polo

This category is equivalent to the EuroNCAP class 'Superminis'.

Small family car / Compact car

See main article: Family car
See main article: Compact car

Compact cars are usually referred to the longest hatchbacks or the smallest family cars. Nowadays they are about 4.25 metres long, have room for five adults and their engines are usually around 1.6 L to 2.0 L.

Examples of hatchback small family cars / subcompact cars

Citroën Xsara
Citroën ZX
Ford Escort
Ford Focus
Honda Civic
Opel Astra
Peugeot 306
Peugeot 307
Renault Mégane
Toyota Corolla
Volkswagen Golf

This category is equivalent to the EuroNCAP class 'Small Family Cars'.

Sedan/saloon and station wagon / estate

See main article: Sedan (car)
See main article: Saloon
See main article: Station wagon
See main article: Estate

Family car

See main article: Family car

Longer than hatchbacks, they have room for five adults and a larger boot, depending on the size. The most popular layouts are sedan/saloon and station wagon / estate. This class makes up the largest percentage of vehicles in most developed countries.

Examples of sedan/estate small family cars / compact cars

Ford Focus
Honda Civic
Opel Astra
Toyota Corolla
Volvo S40
Volkswagen Jetta

This category is equivalent to the EuroNCAP class 'Small Family Cars'.

Examples of large family cars / mid-size cars

Ford Taurus
Ford Mondeo
Honda Accord
Nissan Primera
Opel Vectra
Peugeot 406
Renault Laguna
Toyota Camry
Volkswagen Passat

This category is equivalent to the EuroNCAP class 'Large Family Cars'.

Executive car / Luxury car

See main article: Luxury car

An executive car or luxury car are typically four-door sedan/saloon cars. They are usually very roomy, powerful and luxurious, which is highly estimated by most of the people. This is why they are much more expensive than "standard" sedans.

Examples of mid-size executive cars / mid-size luxury cars

Audi A6
BMW 5-Series
Infiniti Q45
Lexus GS
Mercedes-Benz E-Class
Jaguar S-Type
Volvo S80

Examples of large executive cars / full-size luxury cars

Audi A8
Bentley Arnage
BMW 7-Series
Cadillac DeVille
Jaguar XJ
Holden Commodore
Lexus LS
Lincoln Town Car
Maybach
Mercedes-Benz S-Class
Rolls-Royce Phantom

This category is equivalent to the EuroNCAP class 'Executive Cars'.

Sportive cars

Hot hatch

See main article: Hot hatch

A *hot hatch* is a performance hatchback based on standard superminis or small family cars, with improved straight line performance, handling and styling. Hot hatches make up a large section of the market for hatchbacks.

Examples of hot hatches

Ford Focus RS
Ford Escort RS Cosworth
Peugeot 205 GTI
Renault 5 Turbo
Renault Clio 182
SEAT León Cupra R
Vauxhall Astra VXR
VW Golf GTI

Sports saloon

Thess are high performance versions of saloon cars. Originally homologated for production based motorsports and like saloon cars, seats four people.

Examples of sports saloons

BMW M3
BMW M5
Lotus Cortina
Mitsubishi Lancer Evolution
Nissan Skyline GT-R
Subaru Impreza

Sports car

See main article: Sports car

This small lightweight class combines performance and handling. Often inspired by racing vehicles. This class ranges from sporty vehicles such as the MX-5 to derivatives of true racing thoroughbreds such as the Lotus Elise.

Examples of sports cars

Jaguar E-type
Lotus Elise
Chevrolet Corvette
Honda S2000
Mazda Miata/MX-5
Toyota MR2

Grand tourer

See main article: Grand tourer

Larger, more powerful and heavier than sports cars, these vehicles typically have a FR layout and seating for four or 2+2. They are more expensive than sports cars but not than supercars, and often combine modern technology with hand-built construction.

Examples of grand tourers

Aston Martin DB9
Ferrari 612 Scaglietti
Jaguar XK8
BMW 6-Series

Supercar

See main article: Supercar

They are ultra-high performance cars, typically very expensive, luxurious and exceptionally fast. Supercars typically contain cutting-edge technology, and can be assembled partly or completely by hand.

Examples of supercars

See also: *List of supercars*
Aston Martin Vanquish
Dodge Viper
Ferrari Enzo
Ford GT
Lamborghini Murciélago
McLaren F1
Plymouth Superbird
Porsche 959

Muscle car

See main article: Muscle car

The *Muscle car* is a peculiarly American type of sports car, popular from the 1960s until a combination of spiralling insurance costs and the 1973 energy crisis largely killed off the category. A smaller offshoot, the *pony car*, still exists in the form of the Ford Mustang. The epitome of brute-force power, these cars shoe-horned giant engines into mid-sized cars (by the then US standard) which were often, from the factory, inadequate to handle the power and performance; handling was subordinate to straight-line acceleration.

Examples of muscle cars

Chevrolet Camaro
Chevrolet Chevelle
Dodge Charger
Holden Monaro
Mercury Cougar
Plymouth Barracuda
Plymouth Road Runner
Plymouth Superbird
Pontiac GTO

Cabriolet / convertible

See main article: Cabriolet
See main article: Convertible

Also called an open saloon, roadster or drop-head coupe, this type of car has a roof (fabric, vinyl, metal or glass) which can be folded away. Convertibles were very popular in hotter places before the advent of automotive air-conditioning. They remain popular in certain countries, paradoxically including the UK with its relatively wet climate. Many models are small sports cars with two seats, but there are also popular convertible versions of larger cars such as the Saab 9-3 and the BMW 3-Series.

Examples of cabriolets / convertibles

Mazda MX-5/Miata/Eunos Roadster
Fiat Barchetta
MGF
Toyota MR2
Saab 9-3
BMW 3-Series

4x4

See main article: 4x4

Also know as off-roaders, there are two general trends among them: *SUVs* and *crossover SUVs*.

SUVs

See main article: SUV

SUVs are off-road vehicles with a truck chassis, all-wheel-drive and true offroad capability. SUVs have severe problems with crash incompatibility, and are typically of more primitive design than smaller cars. Combined with serious handling issues in some vehicles due to the high centre of gravity, this makes them a dangerous vehicle in inexperienced hands.

Examples of 4x4s / SUVs

Cadillac Escalade
Humvee
Jeep Cherokee
Jeep Wrangler
Land Rover Defender
Range Rover
Nissan Patrol
Suzuki Sidekick
Suzuki Samurai
Toyota Land Cruiser

This category is equivalent to the EuroNCAP class 'Large Off-Roaders'.

Crossover SUV

See main article: Crossover SUV

Crossover SUVs have a monocoque chassis and low ground clearance. Some of them use electronic systems like traction control and pneumatic/hydraulic suspension, which give them good capability in many offroad situations, particularly sand and graded roads.

Examples of crossover SUVs

BMW X5
Ford Escape
Mercedes-Benz M-Class
Suzuki SX4

Toyota RAV4
Volvo XC90

This category is equivalent to the EuroNCAP class 'Small Off-Roaders'.

Minivan / MPV

See main article: Minivan

See main article: **Multi-purpose vehicle**

Also known as people carriers, this class of cars resemble family cars but are taller with a shorter hood/bonnet and are designed for maximum practicality. The larger minivans may have seating for seven or eight people.

The increased height of these vehicles above a family car improves visibility for the driver (while reducing visibility for other road users) and may help access for the elderly or disabled. They also offer more seats and increased load capacity over their similar low-roof models.

Examples of mini MPVs

Fiat Idea
Hyundai Matrix
Opel Meriva
Peugeot 1007
Renault Modus

Examples of compact MPVs

Chrysler PT Cruiser
Citroën Picasso
Ford Focus C-Max
Opel Zafira - also Chevrolet, Holden, Subaru or Vauxhall
Renault Scénic
Volkswagen Touran

Both categories are equivalent to the EuroNCAP class 'Small MPVs'.

Examples of large MPVs / minivans

Chevrolet Venture
Chrysler Minivans such as Caravan, Voyager, and Town & Country
Ford Galaxy
Hyundai Trajet
KIA Sedona
Mitsubishi Space Wagon

Peugeot 807
Renault Espace
Toyota Previa
Pontiac Montana
This category is equivalent to the EuroNCAP class 'MPVs'.

Other

Brass Era car

Personal luxury car

Recreational vehicle

Vintage car

See also

- Automobile
- car safety **and** road safety
- Car body style

- List of recent automobile models by type

List of cars

Home | List of cars | Vehicle size class | Microcars | Hatchback | Sedan | Station wagon | Sportive cars | Cabriolet | Convertible | Four-wheel drive | Minivan | Brass Era car | Personal luxury car | Recreational vehicle | Vintage car | Full-size vehicles | Keicars | Hybrid vehicles | Luxury vehicles | Mid-size car | Pickup trucks | Prestige vehicles | Production Electric vehicles | 2 plus 2 | Air car | Compact SUV | Concept cars | Cyclecar | Leisure activity vehicle | Limousine | Personal luxury car | Pony car | Professional car | Safety car | Show car | Sport compact | Voiturette | Green vehicles | Off-road vehicles | Steam automobiles

This page tries to show every car ever made by country and then manufacturer.

Argentina

- Andino

Armenia

- ErAZ

Australia

- Alpha Sports

Amuza
Australian Kitcar
Bavariacars
Birchfield
Bolwell
Nagari
Bomac
Bullet
Carbontech
Chrysler Australia
Valiant
Valiant Charger
Classic Glass
Classic Revival
Cobra Craft
Daktari
Daytona (car)
Deuce Customs
Devaux
DRB Sports Cars
Elfin Cars
Evans
Finch
Ford Australia
Ford Fairlane (Australian)
Ford Falcon
Ford Performance Vehicles (FPV)
G-Force
Hartnett
Holden Special Vehicles (HSV)
Holden
Holden Adventra
Holden Apollo
Holden Astra
Holden Barina
Holden Belmont
Holden Brougham
Holden Camira
Holden Commodore
Holden GTS 300
Holden Gemini

Holden Kingswood
Holden Monaro
Holden Nova
Holden Premier
Holden Sandman
Holden Statesman
Holden Suburban
Holden Sunbird
Holden Torana
Homebush
Kraftwerkz
Lightburn
Zeta
Mitsubishi Motors Australia Limited
Mitsubishi 380
Mitsubishi Magna
NASENBAER Sports
Nota
Piper
PRB
Python
RCM
RMC
Roaring Forties
Robnell
Sharpbuilt
West Coast Motors
White Pointer

Austria

- Achleitner

Austro-Daimler
Grofri
Magna Steyr
ÖAF
Puch
Steyr
Steyr-Daimler-Puch
Tomaszo

Belarus

- BelAZ

GomSelMash

Lidagroprommash
MAZ
MTZ
MZKT

Belgium

- ABC (B)

Apal (before 1995, now Germany)
Edran
FN
Germain
Gillet
L&B
Métallurgique
Miesse
Minerva
Nagant
Springuel (1907-1914)
Vivinus

Brazil

- Bugre

Chamonix
Dardo
FNM
Gurgel
Hofstetter
JPX
Puma
Sta. Matilde
Troller

Bulgaria

- Bulgar Renault

Chavdar

Canada

A-E

- Acadian
Allard Canada
Bricklin
Brock Motors
Chatham Motors Company
Colonial Motors
Chalmers Motor Car of Canada
Chrysler Canada Ltd.
Desoto
Dodge Brothers of Canada
Dominion Motors Ltd.
Durant Motors
E-M-F

F-I

- Ford Motor Company of Canada Ltd.
Fargo
Fisher Motor Company. Ltd.
Frontenac
Galt Motor Company of Canada
General Motors of Canada Ltd.
Graham-Paige Motors Ltd.
Gray-Dort Motors Ltd.
Hudson Motors Car Company of Canada, Ltd.
Hupmobile of Canada
International Harvester

L-R

- Leroy
Maple Leaf
Maxwell Motor Company of Canada Ltd.
McLaughlin
McLaughlin Buick
Mercury (Canada)
Meteor
Monarch
National Cycle and Motors of Canada

Pontiac
Russell (automobile)

S-Z

- Studebaker Canada Ltd.

Two-in-One
Tudpole
Renault
Timmis-Ford
Vauxhall

China

- BYD Auto

Brilliance China Auto (also Jinbei(Ño)/Zhonghua
Changan Ford
Changhe
CheryG^
China Motor Corporation (Taiwan)
Dongfeng
First Automotive Works (FAW)/ Hongqi (¢×)/Huali(N))
Formosa (Taiwan)
Geely (also Huapu(Nn)/Haoqing(jÅ)
Great Wall(Î)
Guangzhou Automotive
Guizhou Auto/Yunque(‘À)
Hafei Motor
Jiangling (also Landwind)
Nanjing Automobile Corporation
Shanghai Automotive (also GM Shanghai/Wuling)
Soueast Motors
Yulon/Yueloong (Taiwan)

Czech Republic

- Aero

AVIA
Jawa Motors
Laurin & Klement
MTX
Praga
Škoda

Tatra
Walter

Denmark

- Anglo-Dane

Thrige
Kewet

Estonia

- ESTfield

Finland

- Elcat

RaceAbout
SISU
Valmet

France

Current Major French Manufacturers

- Peugeot (only Europe)
  - Citroën (only Europe)
- Renault (only Europe)
  - Dacia formerly Romanian (only Europe)

Other French Manufacturers

A-H

- Aixam-Mega

Alcyon
Alda
Alma
Amilcar
Alpine/Alpine-Renault
Ardex
Arola
Bonnet
Ballot

Bédélia
Berliet
Bignan
Brasier
Bucciali
Bugatti
Chaigneau-Brasier
CD
CG
Chenard-Walcker
Citroën
Clément-Bayard
Dangel
Darracq
DB
De Dion-Bouton
Delage
Delahaye
Delaunay-Belleville
Facel Vega
Ford (France)
Georges Richard
Gordini
Hispano-Suiza
Hommell
Hotchkiss

J-V

- Jidé

Léon Bollée
Ligier
Lorraine-Dietrich
Major
Marcadier
Mathis
Matford
Matra
Mochet
Mom
Monet
Monica
Montier
Morisse

Mors
Mega
Motobloc
Panhard
Peugeot
Renault
Richard-Brasier
Rolland-Pilain
Rosengart
Salmson
Scora
Simca
Sizaire-Naudin
Stimula
Talbot
Talbot-Lago
Tracta
Unic
VELAM
Venturi
Voisin

Germany

Major Current German Manufacturers

- Daimler-Chrysler
  - Chrysler *formerly American

  Dodge *formerly American
  Jeep *formerly American
  Maybach
  Mercedes-Benz
  Smart (Europe only)
- BMW
  - Rolls-Royce *formerly British

  Rover *formerly British (Europe only)
- Volkswagen
  - Audi

  Bentley *formerly British
  Bugatti *formerly Italian
  Lamborghini *formerly Italian
  Seat (Europe only)
  Skoda *formerly Chezch (Europe only)

Other German Manufacturers

A-G

- Adler
AFM
AGA
Alpina
Amphicar
Apal (formerly Belgium)
Apollo
Arimofa
Audi
Auto Union
AWS
Benz
Bitter Cars
Borgward
BMW
Daimler
Deutz
DKW
EMW
Fendt
Ford
Glas
Goggomobil
Gutbrod

H-R

- Heinkel
Horch
Isdera
Karmann Ghia
Käsbohrer-Setra
Kleinschnittger
Lloyd
MAN
Magirus
Maybach
Mercedes-Benz
Merkur

Messerschmitt
Neoplan
NSU
Opel
Pluto
Porsche
Robur
Ruf

S-W

- Smart

Standard Superior
Stoewer
Titan
Trabant
Volkswagen (VW)
Wartburg
Wanderer
Wiesmann

Greece

- Agricola (trucks)

AK Hellas
Alta
Attica
AutoDiana (trucks)
Automeccanica
Balkania
B.E.T.
Biamax
DIM
EBIAM
ELBO
Malkotsis
MAVA-Renault
MEBEA
Motoemil
MotorCar
Namco
Neorion
Pan-Car
Petropoulos (trucks, tractors)

Ros
SAM
Saracakis
Scavas
Sfakianakis
Styl Kar
Theologou
Tzen

Hungary

- Balaton

Helix
Mavag
Méray
Puli
Rába
Unitas

India

- Force Motors

HeroHonda
Hindustan
Mahindra
Maruti
Premier
Reva
San Storm
Sipani
Tata

Iran

- IAPMA

Iran Khodro/Paykan/Samand
Iran Vanet
Kerman Khodro
Morattab
Pars Khodro
Saipa

Ireland

- Dundalk

Shamrock
Thomond

Israel

- AIL

Autocars of Haifa
Carmel-Susita
Suffa

Italy

A-H

- Abarth
- Alfa Romeo
  - 147

  156
  159
  166
  Brera
  Spider
  GT
  GTV
- Amilcar Italiana

Arcadia (caravans)
ASA
ATS
Autobianchi
Bertone
Bizzarrini
Bremach
Brixia-Zust
Bugatti Automobili SpA
  - Veyron

  EB110
  Type 57
- Casalini
  - Ydea
- Cisitalia

Cizeta-Moroder

Conrero
De Tomaso
- Mangusta

Pantera
- Diatto

Effedi
- Maranello4cycle

Gasolone
- Ferrari
  - F40

F50
Enzo
360
F430
355
Testarossa
412
612 Scagletti
575M Marenello
456
- Fissore

Fiat
- Palio

Siena
Albea
Sedici
Panda
Punto
Seicento
Brava
Bravo
Marea
Stilo
Ulysse
Multipla
Barchetta
Idea
- Fornasari

I-Z

- Iso

Innocenti
Isotta-Fraschini

Itala
Italauto
Iveco
Laiza
Lamborghini
- Gallardo

Espada
Countach
Murcielago
Diablo
Miura
Jalpa
350GT
400GT
LM002
Islero
Jarama
- Lancia
  - Delta

Fulvia
Stratos
Ypsilon
Musa
Lybra
Thesis
Thema
- Maserati
  - Quattroporte

Spyder
4200
3200
Bora
Ghibli
- Mobilvetta

Moretti
Officine Meccaniche
OSCA
Pagani
- Zonda
- Piaggio

Qvale
Siata
SPA
Stanguellini

Vespa
Vignale
Zagato
Zust

Japan

- Autobacs
Daihatsu
Honda (also Acura)
Isuzu
Mazda (also Autozam/Eunos/Efini)
Mitsubishi
Mitsuoka
Nissan (formerly Datsun, also Infiniti)
Prince Motor Company
Subaru (Fuji Heavy Industries)
Suzuki Motor
Tommy Kaira
Toyota Motor Corporation (also Lexus/Scion)

Latvia

- RAF
Russo-Balt
Ford-Vairogs
VEF

Liechtenstein

- Jehle

Lithuania

- KAG

Malaysia

- Bufori
Inokom
Naza
Perodua
Proton
TD2000

Namibia

- URI

Netherlands

- Burton
Carver (Vandenbrink)
Charon
DAF
Donkervoort
Le Patron
Ruska
Spyker
Startwin
Waaijenberg

North Korea

- Pyonghwa
Tokchon

Norway

- Kewet
Think Nordic, also known as Pivco
Troll

Philippines

- Sarao
- Sakbayan
- Francisco Motors Corp.

Poland

- FSM
FSO
FSR

Portugal

- Entreposto
Portaro
UMM

Romania

- ARO
Dacia
Dimitrie Vasescu
IMS (part of ARO)
Iustin Capra
Lastun
M.R.
Malaxa
Oltcit/Rodae
ROMLOC
Uzinele Brasov

Russia

- GAZ/Volga (also Chaika/Pobeda/ZIM
IZH
KamAZ
KAvZ
KrAZ
AZLK/Moskvitch
PAZ
SeAZ
UAZ
TagAZ
VAZ/Lada/Zhiguli
ZIL/ZIS

Serbia

- FAP
Zastava/Yugo

Slovenia

- IMV
TAM/TVM

South Korea

- Asia Motors
Daewoo Bus Corporation
GM DAT/Daewoo
Hyundai
Kia Motors
Proto Motors
Renault Samsung Motors
SsangYong

Spain

- Abadal
Anglada
Barreiros
Biscuter
Comarth
David (car)
Hispano-Suiza
Hisparo
Pegaso
Santana Motor
SEAT
Uro

Sweden

- Allvelo
AMG
ANA
AS Special
Berglund & Laurin
BHB
Design by Ulf
Gemo
Gin1
Gun-Ger
Evo Special
Häcklefjäll
Husqvarna
Ilestam-Special
Jösse
Koenigsegg

MS Special
Nilsson
Nordic Uhr
Pilot
Racing Plast Burträsk
Saab
S.A.M.
Scania
Thulin
Tidaholm
Tjorven/Kalmar
Vabis
Volvo Cars
Wahrendorfsbilen
Warg
Wiba
Woodstar

Switzerland

- Ajax

Albar
Felber
Minelli
Monteverdi
Pic-Pic
Rapid
Rinspeed
Sbarro
Turicum

Turkey

- Devrim

Anadol
Tofas
Bocek
Oyak-Renault
Otokar
Ozaltin
Türk Traktör

Ukraine

- KrAZ
LAZ
LuAZ
ZAZ

United Arab Emirates

- Al-Dhabi

United Kingdom

A-E

- AC
  - Ace
  Cobra
- Adamson
AJS
Albion
Allard
Alvis Cars
Argyll
Ariel
Arkley
Armstrong Siddeley
Arrol-Johnston
Ashley
Aston Martin *Now American — Ford Motor
  - DB4
  DB5
  DB6
  DB7
  DB9
  V8 Vantage
  Vanquish
- Austin
  - Seven
  Mini *Now American — Ford Motor
- Austin-Healey
AV
Barnes
Bentley *Now German — Volkswagen

- Continental GT

Bentley Arnage

- Berkeley cars

Bond
BMC
BSA
Bristol
British Leyland
British Salmson
Calthorpe
Caterham
Clan
Clyno
Crossley Motors
Crouch
Dawson
Dellow
De Lorean

- DMC-12

- Elva

Rolls-Royce *Now German — BMW

F-L

- Fairthorpe Cars

Ford

- Escort

Fiesta
Focus
Mondeo
Scorpio
Sierra
Ka
Cortina
Granada
Galaxy

- Frazer Nash

Gilbern
Ginetta Cars
Gordon-Keeble
Healey
Hillman
HRG

Humber
Invicta

- S1

- Jaguar

- XJ Series

XK Series
XJ220
X-Type
S-Type
E-type

- James and Browne

Jensen
Jowett
Kieft Cars
Lagonda
Lammas Limited
Lanchester
Land Rover

- Series 1

Range Rover
Discovery
Defender
Freelander

- Lea-Francis

Lister
Locost
Lotus

- Elise

Elan
Esprit
Seven
Europa
Elite

- Lloyd cars

M-R

- MacNeillie

Marauder Cars
Marcos
Marendaz
McLaren

- F1

- Mercer Automobile Co.

Metrocab
MG

  - F

  ZR
  ZS
  ZT
  X-Power

- Morgan

Morris
Mini
Noble

  - M10

  M12
  M14
  M400

- Ogle

Panther
Paramount Cars
Peel
Peerless/Warwick
Piper
Railton
Range Rover — sub-marque of Land Rover
Reliant
Riley

  - Elf

- Rochdale

Rolls-Royce

  - Silver Spirit

  Phantom

- Rover

  - 25

  45
  75
  100
  200
  400
  600
  800

S-W

- Siddeley-Deasy
- Singer
- Standard
- Sterling
- Streamline Cars Ltd
- Sunbeam
- Swallow
- Swallow Doretti
- Swift
- Talbot
- Tiny
- Tornado
- Trident
- Triumph
- Trojan
- Turner
- TVR
- Vanden Plas
- Vauxhall
    - Agila
    - Astra
    - Belmont
    - Calibra
    - Carlton
    - Cavalier
    - Chevette
    - Combo
    - Corsa
    - Cresta
    - Equus design concept (1978)
    - E-type
    - Firenza
    - Frontera
    - Prince Henry
    - Magnum
    - Manta (Vauxhall/Opel comarketed)
    - Monaro
    - Movano
    - Meriva
    - Nova (see also Corsa)
    - Omega
    - Signum

Silver Aero Styling prototype based on Cavalier (1983)
Silver Bullet Styling prototype based on Magnum Sportshatch (1976)
SRV Styling Research Vehicle — design concept (1970)
Tigra
Vectra
Velox
Ventora
Victor
Viscount
Viva
Vivaro
VX4/90
VX 220
VX Lightning
Wyvern
Zafira

- Westfield Cars

Willys Overland Crossley
Wolseley

United States

There were over 1800 automobile manufacturers in the United States from 1896 to 1930. Very few survived and only a few new ones were started after that period.

Major current US automakers

With their various brand-names, many of which earlier had been independent companies:

- DaimlerChrysler*Despite actually being a German car manufacturer, many still see Chryler as an American Marque; thus justifying this listing
    - American Motors (no longer sold)
        - Nash (no longer sold)

Hudson (no longer sold}
Rambler (no longer sold)
Eagle (no longer sold)
Jeep

- Willys-Overland (no longer sold)

    - Chrysler
        - Imperial (no longer sold)

Maxwell (no longer sold)
Chalmers (no longer sold)

    - Dodge

Mercedes-Benz *Since Daimler-Benz bought Chrysler

Plymouth (no longer sold)
Smart *Since Daimler-Benz bought Chrysler
DeSoto (no longer sold)

- General Motors
  - AM General (not sold to private individuals; similar vehicles are sold to ordinary consumers as Hummers)

Buick
Cadillac
Chevrolet

- Geo (no longer sold)

  - GMC

GM DAT/Daewoo
Hummer
LaSalle (no longer sold)
Marquette (no longer sold)
Oakland (no longer sold)
Oldsmobile (no longer sold)
Opel (Germany)
Pontiac
Saab formerly Swedish
Saturn
Vauxhall (Great Britain]]
Viking (no longer sold)

- Ford
  - Aston Martin formerly British

Continental
Edsel (no longer sold)
Jaguar formerly British
Land Rover formerly British
Lincoln
Mazda formerly Japanese
Mercury
Merkur (no longer sold)
Volvo formerly Swedish

Other US automakers

A

- Ace Motor Corp

AC Propulsion
Aerocar
Ajax
Allen

Allstate
American Austin (later American Bantam)
American Electric
American Locomotive Company (ALCO)
American Motors
American Voiturette Company
Anderson Electric Car Company (later Detroit Electric)
Anhut Motor Car Company
Apperson (see also Haynes-Apperson)
Armstrong Electric
Arnolt
Auburn
American Motors Corporation
Autocar
Avanti

B

- Baker Electric

Bantam
Beaver
Bobbie Kar
Brewster
Briscoe Motor Company
Briggs-Detroiter
Brush Motor Car Company
Buffalo Electric

C

- Chalmers

Chandler
Chaparral
Checker Cab
Church
Cleveland Electric
Clenet
Clipper 1956 only
Cole
Colonial
Columbia Electric
Columbia Motors
Commerce

Continental (automobile) Division of Ford Motor Company 1955-1956
Consolidated Motor Company
Cord Automobile
Courier Car Co
Crane-Simplex
Crawford Automobile
Crosley
Crow-Elkhart
Cunningham

D

- Day Automobile Company

Dayton Electric
Davis
Del Mar
De Lorean
Demotcar
De Vaux
De Vaux Continental
Detroit Automobile (1899-1901)
Detroit-Dearborn
Detroit Electric
Diplomat (Canadian model)
Dingfelder
Doble
Dorris Motors Company
Dort (automobile)
Dual-Ghia
DuPont
Durant (automobile)
Duryea
Duesenberg

E-G

- Edsel (short-lived Ford subsidiary)

Elcar
Electrakar
Electric Carriage and Wagon Company (1896-1897) becomes Electric Vehicle Company
Electric Vehicle Company (1897-1909) becomes Columbia
Electrobat

E-M-F Company
Erskine
Essex
Everitt
Excelsior
Excalibur
Flint Motor Company
Franklin
Frazier
Gardnier
Graham
Graham-Paige
Gregory

H-K

- Harrison

Haynes-Apperson (see also Apperson)
Herff-Brooks Corporation
Herreshoff
Hollier
Hoppenstand
Huber
Hudson
Hupmobile
International Harvester
Jackson Automobile Company
Jerrery
Jeannin
Jewett
Johnson Service Company
Jordan
Kaiser
Kaiser-Frazer Corporation
Keller
King Motor Car Company
Kissel Motor Car Company
K-R-I-T Motor Car Company
Kurtis Kraft

L-N

- LaFayette

La Salle
Lexington Motor
Liberty
Lion Motor Car Company
Locomobile
Marathon Motor Works
Marmon
Martin
Maxwell
Maxwell-Briscoe
McIntyre
Mercer (automobile)
Metzger Motor Car Company
Michigan Automobile Company
Michigan Motor Car Manufacturing Company
Mitchell Motors
Moon Motor Car
Mosler (originally named Consulier)
Munson Company
Muntz Car Company
National
Nash
Northern Manufacturing Company
Northway

O-R

- Oakland

Owen Magnetic
Overland
Packard
Paige
Panoz
Parry Auto Company
W.A. Paterson Company
Peerless
Pierce-Arrow
Playboy
Pope-Hartford
Pope-Robinson

Pope-Toledo
Pope-Tribune
Pope-Waverley
Powell (automobile)
Publix
Pup
Queen
Rambler
Republic
Reo
Rickenbacker
Riker Electric
Rocket
Rockne
Rollin Motors
Roosevelt (automobile)
Russell-Knight

S-V

- Saleen

Sampson
Saxon Motor Car Company
Scripps Booth
Sears, Roebuck Company
Shelby-American
Standard Motor Company
Stanley
Stearns
Stevens-Duryea
Stoddard-Dayton
Stout-Scarab
Studebaker
Stutz
Thomas-Detroit
Towne Shopper
Twombly (cyclecar)
Twombly (1910-1911)
Tucker
United States Motor Company
Valiant
Velie
Vector Aeromotive

W-Z

- Wagenhals
Warren-Detroit
Waverley Electric
Wayne Automobile
Welch Motor Car Company
Wescott (automobile)
White
Wills Sainte Claire
Wills and Company
Willys
Willys Knight
Winton
Whippet
Woods Electric
Yellow Cab Manufacturing Company
Zimmer

Vietnam

- Song Cong Diesel

See also

- List of most expensive cars

Vehicle size class

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There are many ways of classifying cars. The common North American parlance is word-based (eg, compact car) while European writers typically use letters for sizes.

United States	EuroNCAP	Euro size	Example
Microcar	-	Microcar	Smart Fortwo
-	Supermini	A class	Fiat Panda
Subcompact		B class	Ford Fiesta
Compact	Small family car	C class	Ford Focus
Mid-size	Large family car	D class	Volkswagen Passat
Full-size		E class	Chrysler 300
Luxury	Executive car	F class	Mercedes-Benz S-Class
Sports	-	Sports	Porsche 911
Convertible	-	Cabriolet	BMW 3-Series
Roadster	Roadster	Roadster	BMW Z4
-	Small MPV	MIni MPV	Opel Meriva
-		Compact MPV	Renault Scénic
Minivan	MPV	Large MPV	Toyota Previa
Crossover SUV	Small Off-Roader	-	Honda CR-V
SUV	Large Off-Roader	-	Jeep Grand Cherokee

North America

Vehicle size classes in use in North America categorize automobiles by their relative lengths and volumes. Widely used vehicle size classes include:

Car Class	Interior Volume		Modern example
	ft^3	L	
Microcar/supermini/minicompact	< 85	<2400	Smart
Subcompact car	85-99	2400-2800	Hyundai Accent
Compact car	100-109	2800-3000	Ford Focus
Mid-size car	110-119	3000-3300	Chevrolet Malibu
Full-size car	>120	>3300	Lincoln Town Car

Europe

Vehicle segments in Europe don't have formal characterization or regulations. Models are attributed a segment based on comparison to generalist brands models. For example, a car the size of a Volkswagen Golf would be its competitor. The VW Polo is smaller, so it belongs one segment below the Golf, while the bigger Passat is one segment above.

Generally:

- The *A* segment, or *city cars*, describes hatchbacks about 330-360 cm in length, such as the Chevrolet Matiz or Fiat Panda.
- The *B* segment is for the cars generally known as *superminis*, like the Opel Corsa or Renault Clio, with size around 370-400 cm, although recent models have broken the 4 metre psychological barrier.
- The *C* segment, for *small family cars*, is the most competitive in Europe, absorbing the bulk of the sales, with cars measuring around 410-440 cm, and examples such as the Ford Focus, Opel Astra or Renault Megane.
- The *D* segment are the cars usually called *large family cars*, with length around 450-470 cm, the best examples being the Ford Mondeo and VW Passat, as well as more premium cars such as the Audi A4 and BMW 3-Series.
- The *E* segment cars, usually known as *executives*, measure around 480-500 cm, with the Lexus GS and Mercedes-Benz E-Class as examples. There are also "non-executive" cars in this category (sometimes dubbed "upper-medium class"), such as the Renault Vel Satis and Peugeot 607.
- The *F* segment is reserved for *luxury cars* over 5 meters in length, such as the BMW 7-Series and Mercedes-Benz S-Class.

MPVs are usually atributed to the B, C and D segments, according to the models they are based on. For example, the Opel Meriva belongs to the B segment (called mini MPVs), the Ford Focus C-MAX] is a C-segment car (a Compact MPV), and the Renault Espace corresponds to the D segment (large MPVs).

Off-road vehicles and SUVs are considered a segment apart from normal, as are light commercial vehicles. While classification is more confusing in this case, reporters use to compare different 4x4s the size, off-road capabilities and engine power.

High-performance sports cars and supercars are not part of a normal classification, due to their nature as overpriced exotic vehicles, although some coupés and cabriolets are based on regular models and included in the same segment as the base model.

For safety ratings, the EuroNCAP uses nine categories:

- Superminis (it includes city cars)
- Small family cars (also for stand-alone saloon superminis, like the Dacia Logan)
- Large family cars
- Executive cars (for expensive cars over 4.80m long)
- Roadsters
- Small off-roaders (similar to the Northmerican crossover SUV category)
- Large off-roaders (similar to the Northmerican SUV category)
- Small MPVs (both mini MPVs and compact MPVs)

- Large MPVs

Microcars

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A *microcar* is an extremely small automobile. Various definitions are used, including "less than 3 metres in length" and "less than 85 cubic feet/2400 litres interior volume". Typically, microcars seat only the driver and a single passenger, and many have only three wheels. Microcars are usually designed and produced for economic purposes when materials and heavy equipment are scarce or fuel is scarce and expensive. Many microcar designs flourished in post-World War II Europe, particularly in Germany, where former military aircraft manufacturers such as Messerschmitt and Heinkel were prominent microcar makers. The Messerschmitt KR175, KR200 and TG500 even had aircraft-style bubble canopies, giving rise to the term *bubble car* to refer to all these post-war microcars. Isettas and others also had bubble-like appearance.

France also produced large numbers of similar tiny vehicles called voiturettes, but unlike the German makes, these were rarely sold abroad. Very small cars have also been popular in Japan, where again they attract various tax and insurance benefits when compared to other vehicles. These are known as keicars and differ from most of the European microcars in that they are typically designed and built as scaled-down versions of very traditional car configurations, while European microcar designs tend to be unorthodox and sometimes bizarre.

The *Smart* or "smart" (now called *Fortwo*) launched in 1998 could be seen as a successful re-invention of the microcar principle. Like the Japanese keicars, it is of relatively conventional design. Microcars built in Europe after World War I were often motorcycle based and referred to as "cycle cars".

Another name for microcar is *Station Car*, where the intended use is to travel from a suburban home to an interurban transit station or Park and Ride lot where the vehicle remains until the operator returns from the commute to and from the workplace. In some locations electric vehicle recharging is provided to encourage the use of electric vehicles. NEVs may also be used as station cars where the roadway speed limits permit such use.

Reasons for microcars

The economy of operating such a small car (mostly in fuel and tires) has often been helped by three-wheeled microcars or cars with very small engines being treated as motorcycles for tax and insurance purposes. In some countries (e.g. Austria) three-wheelers with a certain maximum weight were considered as motorcycles with side car and therefore no car drivers license was needed. This was assuring a certain market for elder people who did not want to pass a car drivers license. Three wheelers are a separate class of their own in Britain. In Germany, what could be driven with a motorcycle license depended only on engine displacement, so many of the microcars had four wheels. The Corbin Sparrow is licensed as a motorcycle and parked in motorcycle spaces in California, and probably in other places.

In some European countries, taxes used to depend on engine displacement and/or insurance on power. This has given rise to names of such cars as Citroën 2CV and Renault 4CV. This favorable treatment by governments is based on the benefits to a society of reducing use of such resources as minerals, parking space and foreign exchange, reduced noise and chemical pollution, reduced hazard to others and etc. Reduced global warming from carbon dioxide emission has now been added to this list.

Although microcars use much less fuel than the more common sizes do, they are still far from record and competition fuel economy, which is measured in thousands of miles per gallon (or in ml./100 km.).

Another advantage is the ease of parking. Some microcars can be parked perpendicular, where other cars park parallel, or be lifted by hand, like a motor scooter, to get into a tight spot. The Isetta and some others had forward entry, to facilitate perpendicular parking close to other vehicles.

The small size improves handling by reducing the angular inertia. The Messerschmitt and Spatz have been described as much better than ordinary cars on snow and ice. Spare room on the road and ease of missing obstacles are also improved. For the performance oriented, who prefer more than two wheels or a roof, the scaling laws show that one need not give up acceleration until the curb weight comes down to around the driver's weight, because power per weight of the car itself improves with small size, in an otherwise similar design. Top speed is lost with small scale, due to the decreased Reynolds number, but this is a small effect. The Messerschmitt TG500 had about a 90 mph (125 km/h) top speed with 20 horsepower (15 kW) and intuitive aerodynamics.

Microcars by countries

Austria

Felber Autoroller
Möve
Libelle

Brazil

Dacon
Obvio!
Romi Isetta

France

Aixam
Ardex
Bugatti supercharged 375 cc (half the size of a Bébé). Canceled when Ettore Bugatti died.

Early small engined Citroën 2CVs, in spite of passenger space and comfort.
Citroën Prototype C
Ligier BeUp
Microcar
Mochet 100 (1948) This was a revival of the 1924 Mochet cycle car or vélocar
Smart
Valle Chantecler, 1956, 125 cc.
VELAM Isetta, 1954-1958
Vespa designed in Italy, made in France 1957-1961
Willam

Germany

BMW Isetta
Brütsch Mopetta
Fend Flitzer
Fuldamobil N2, (1952–1955)Also made under licence in Chile (as the Bambi), Netherlands (as the Bambino), South Africa, Sweden (as the Fram King Fulda), Greece (as the Attica and also the Alta , India (as the Hans Vahaar) and United Kingdom (as the Nobel).
Glas Goggomobil
Goliath Pioneer (1934, three wheels)
Heinkel Kabine See also Trojan (UK)
Kleinschnittger (notably the Kleinschnittger F125 roadster)
Some Lloyds, made by Borgward, the Lloyd LP300s, of 1950, may have been small enough to be micros
Messerschmitt KR175
Messerschmitt KR200
Messerschmitt TG500 (Four wheeler)
Meyra 55, (1950)
Opelit Mopetta
Spatz
Trabant
Zündapp Janus

Greece

Alta
Attica
B.E.T.

Hungary

Balaton
Puli

Italy

Autobianchi Bianchina (Fiat 500 based)
Fiat Topolino
Fiat 500
Fiat 500 Zagato (1970)
Fiat Abarth Zagato, 750 cc, exotic sports car
Iso Isetta, 1953-1955
Lawil
Vespa 400
Zagato Zele 1000 (1976)

India

REVA

Japan

Fuji Cabin
Honda Canopy
Honda S600 sports car
Honda N360 K car
Mitsuoka K-1
Subaru 360 (This was imported to the US in considerable numbers.)

Poland

Mikrus MR-300

Portugal

- The *Sado 550* was a Portuguese microcar. Around 500 were produced from 1982 to 1984. Only a few dozen still circulate today.

Spain

Biscúter
David
Kapi

United Kingdom

AC Clipper
Austin Seven (1922. Early post-war A30s and some early Minis were also called "Austin Seven".)
Berkeley Caravan manufacturers. Design by Laurie Bond.
Bond Bug 700cc four cylinder engine. Made by Reliant, Tamworth, Staffordshire.
Bond Minicar Villiers two-stroke engines. 1949-1965 Made by Sharps Comercials of Preston. Designed by Laurie Bond.
Cleco 1936-1940 Electric microcar. Also vans.
Frisky Wolverhampton.
Isetta Assembled in Brighton under license from BMW.
The high performance Morgan three wheeler, Triking Cyclecar and perhaps Lotus Seven should be mentioned, in spite of their larger engines.
Opperman 1956-1959
Peel
Peel P50 (Made on the Isle of Man)
Peel Trident (Made by the same company as the Peel P50)
Power-Drive
Raleigh 1933-1936
Reliant Robin
Rodley 1954-1955
Russon 1951-1952
Rytecraft 1934-1940 Originally 98 cc later 250 cc. One was actually driven round the world in 1960.
Scootacar 1957-1965 Made by Hunslet in Leeds
Tourette 1956-1957
Trojan (Licence built version of the Heinkel)
Unique Motor Company QPod

United States

American Bantam
Commuter Cars Tango
Corbin Sparrow
Crosley, various models
King Midget, three models

USSR

ZAZ-965

Electric microcars

Some examples of battery electric microcars are:

- The Th!nk City, imported to the USA by Ford Motor Company to satisfy California Zero-emissions vehicle (ZEV) requirements in the state of California. Removed from the market by Ford in a bargain with the California Air Resources Board. See PZEV for more information.
- The REVA electric vehicle as used in its home environment, India. This may soon be exported to the USA with speed electronically limited and sold as an NEV.
- The obstacle to adaptation of such vehicles in the United States is less technical than cultural and political. The mandates by regulatory powers that such vehicles to meet full U.S. safety regulations ensures the unavailability of vehicles suitable for use in mixed traffic conditions that predominate in U.S. suburban areas. To supporters of electric vehicles this appears not to be an accident.

See also

- Vehicle size class
- Car classification
- Keicar

References

- Bugatti, The Man and the Marque - by Jonathan Wood, 1992
- Kleinwagen, Small Cars, Petites Voitures - by Hans-Ulrich von Mende and Matthias Dietz, Benedikt Taschen, 1994

Hatchback

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A *hatchback* is an automobile design, consisting of a passenger cabin which includes an integrated cargo space, accessed from behind by a hatch or flip-up window. Hatchbacks are also often called three-doors (two entry doors and the hatch) or five-doors (four entry doors and the hatch) cars. Small cars often incorporate a hatchback to make the best use of available space. Especially in smaller models, hatchbacks are often truncated, with the hatch nearly vertical, to reduce the car's footprint. This is an important consideration in countries where small streets and traffic congestion are factors. Hatchbacks frequently include fold-down rear seats, which enable a substantial portion of the interior space to be used as a cargo area to accommodate with the current transportation needs. Usually, the rear seat can be folded partially (for instance 1/2, 1/3 or 2/3) or completely to expand the cargo space.

Technically speaking, SUVs, station wagons and minivans can also be classified as hatchbacks. However, the term hatchback, especially in the U.S., is typically used in reference to small cars, with a smaller trunk than other vehicles. There are larger hatchbacks (i.e. Rover SD1), which have fastback rear windows.

Hatchbacks typically have a parcel shelf: a rigid shelf covering the cargo space that is hinged behind the rear seats and lifts with the hatch. An alternative is a flexible roll-up tonneau cover.

High performance variants of typical family hatchbacks are now common, known as "hot hatches".

History

The credit for the first hatchback is claimed by several manufacturers. Holden of Australia fitted what could be described as hatchbacks onto its cars in the late 1940s. The 1953 Aston Martin DB2/4 featured a top-hinged rear hatch. Its successor, the 1958 DB Mark III, even offered a folding rear seat. However, since less than 700 DB2/4 and Mark III hatches were built, the Aston Martin is not universally considered the first mass-produced hatchback car. The 1954 AC Aceca and later Aceca-Bristol from AC Cars had a similar hatch at the back, though just 320 were built.

The first car which could genuinely be called a hatchback and produced in masses was the Renault 4 of 1961. This is controversial however, and some argue that the Austin A40 which predated the Renault 4 by three years was the first. However, that car had a split tailgate quite unlike what is generally accepted to be a hatchback. The Renault 4 also came with a folding rear seat. Another car often credited with being the first hatchback is the Renault 16, which was voted European Car of the Year on its launch in the autumn of 1965. The first Italian hatchback was the Fiat 127, which went into production during 1971. The first German hatchback was the Volkswagen Passat (Dasher in North America) of 1973.

By the early 1980s, most family cars produced in Europe were hatchbacks. Hatchbacks quickly became regular winners of the European Car of the Year award. However in some countries, especially with larger cars where a sedan and (usually liftback-type) hatchback is available for the same model, the sedans are often preferred. Same is true also in certain regions like Southern and Eastern Europe, where some manufacturers have been forced to offer a local sedan version of smaller cars that are sold only as hatchbacks elsewhere to comply with the preferences of local clients.

US backlash

Despite, or perhaps because of, the hatchback design's space efficiency, relatively few cars with this layout are available in the United States. Some Americans view the hatchback design elements as an "econobox" and consider this negatively in purchase decisions. Others view hatchbacks as representing support for "green" movements which some consider "un-American", although the recent commercial success of hybrid models belies this. Interestingly enough, many of the minivans and SUVs which are quite popular in the United States have hatchback design elements and car companies frequently market hatchback cars with euphemisms such as "Liftback", "Sportback", or "Sportwagon".

Similar body styles

Many sports and mid-sized cars are also designed using a variation of hatchback design, sometimes called a 'liftback. Here, the hatchback is angled down over the rear seats, and smoothly integrated into the tail of the car, resembling a fastback or sedan overall. This often improves aerodynamic performance, resulting in a reduced drag coefficient. Some of these cars are the Opel Vectra, the Ford Mondeo and the Renault Laguna.

Saab often used the term combi coupé (or 'Wagonback' in the US) for their take on the concept. Even some typical-looking sedans (saloons) have hatchbacks, such as the Mazda6, Hyundai Elantra, Kia Spectra and the Saab 9000.

See also

- **List of** car body styles
- Subcompact car
- Compact car
- Sedan
- Hatchmania forum

Other body styles

- Sedan
- Coupe
- Convertible
- Minivan
- Combi coupé
- Notchback
- Fastback
- SUV
- Station wagon

City car

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A *City Car* is a small, moderately powered vehicle (sometimes battery electric powered) intended for use in urban areas. It is more substantial and faster than a Neigborhood Electric Vehicle (NEV). Unlike the NEV, the City Car's greater speed and occupant protection allow relatively safe operation in mixed traffic environments and in all weather conditions. While it may be capable of freeway speeds and may be legal to operate on high speed roadways this is not intended to be its primary operating environment.

Another name for city car is *Station Car*, where the intended use is to travel from a suburban home to an interurban transit station or Park and Ride lot where the vehicle remains until the operator returns from the commute to and from the workplace. In some locations electric vehicle recharging is provided to encourage the use of electric vehicles. NEVs may also be used as station cars where the roadway speed limits permit such use.

Internal combustion engine (ICE) city cars

Early superminis can be considered city cars because of their size, but even in the late 70s superminis were the second smallest available cars (after the two-seater microcars). But in the late 80s they had grown so much that peple desired smaller cars, which still had to have seating for four.

Early ages

The first city car is probably the 1980 *Fiat/SEAT Panda*. With a length under 3.50 metres and low-cost design, a new car category was created. The Panda remplacement, the 1991 *Fiat Cinquecento* is unarguably a city car. With only 3.20 meters long, it had room for four and true entry-level prices.

Renault followed in 1993 with the *Renault Twingo*, which featured a MPV-like design and interior room, despite its size and height (3.43 x 1.42 m). Combined with an original exterior and interior design, it became the best-selling city car quickly.

Korean vs. European city cars

The Korean brands Daewoo, Hyundai and Kia introduced in the late 90s their own city cars, both for the Asian and European markets. The *Hyundai Atos*, launched in 1997, was 3.50 m long and 1.60 m tall, which was much more than any European models (usually under 1.45 m) and provided an inmense interior room. However, its boxy styling prevented the Atos from becoming a best-seller.

The *Daewoo Matiz* followed in 1998 with a Giorgetto Giugiaro design and a mid-size heigth (1.50 m), which proved more eye-catching. Hyundai tried to revert this with the rounder *Atos Prime* but without much success.

These Korean city cars were much cheaper than most of the European models, specially the 2000 *Opel Agila* and 1999 *Volkswagen Lupo*, and showed decent reliability. Still, sales were dominated by the Renault Twingo and *Ford Ka*.

Luxury city cars

Mercedes-Benz launched in 1996 the first luxury city car, the Mercedes-Benz A-Class. Despite its true qualities, it was extremely expensive (it could be compared with the small family car Volkswagen Golf) and was not very successful. However BMW decided to compete against its eternal rival by launching an all-new MINI in 2001. It was powered by 1.6 engines and the cheapest model in the range cost €16,000.

City car / supermini crossovers

While family cars and superminis grew considerably from the 90s to the 2000s, so happened with city cars. After some new superminis were over 3.90 m long (like the Ford Fiesta, the SEAT Ibiza and the Volkswagen Polo) some many makers designed models between 3.65 and 3.75 m.

The first of these models was the 2002 Nissan Micra, which is 3.72 m long and smaller that many superminis of the late 90s. Other cars are the Citroën C2, Suzuki Swift, Smart Forfour, Toyota Yaris and Peugeot 1007 (the last one which can also be labelled as "mini MPV").

These vehicles are hard to classify, since their size does not fit the "city car" and "supermini" categories. A possiblity is to compare the price and interior room with superminis: the Yaris is definitely a supermini, whereas the Tata Indica is closer to a city car.

In addition, there are new "true" city cars, like the 2004 *Kia Picanto* and the *Citroën C1*/*Peugeot 107*/*Toyota Aygo* trio.

Battery electric city cars

The Th!nk City, imported to the USA by Ford Motor Company to satisfy California Zero-emissions vehicle (ZEV) requirements in the state of California. Removed from the market by Ford in a bargain with the California Air Resources Board..

The REVA electric vehicle as used in its home environment, India. This may soon be exported to the USA with speed electronically limited and sold as an NEV.

The obstacle to adaptation of such vehicles in the United States is less technical than cultural and political. The mandates by regulatory powers that such vehicles to meet full U.S. safety regulations, as high-speed roadways exist in most urban and suburban areas, ensures the unavailability of vehicles suitable for use in mixed traffic conditions that predominate in U.S. suburban areas. To supporters of electric vehicles this appears not to be an accident.

See also

- Battery electric vehicle
- Car classification
- Electric vehicle conversion
    - List of recent city cars
- Supermini car
- Vehicle size class

Supermini car

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A *supermini* is a European hatchback car category. In the United States these are more often known as subcompacts. To be a supermini, the length of the car should be around 3.90 metres (12.8 ft) and have seating for four adults and a child. The first superminis were the 1957 Fiat 500 and the 1959 Austin Mini. In 2004, the best selling cars in Belgium, the Czech Republic, Denmark, France, Greece, Italy, the Netherlands and Portugal were all superminis. Overall in 2005, of the fifteen best selling types of car in Europe, six were superminis.

History

50s and 60s

In Europe, the first supermini is considered to be the Italian Fiat 500 of 1957. The design was further popularized by the British Austin Mini two years later (from which the class takes its name).

The Mini was the first successful mass production mini-car in Europe, going on sale in 1959 as the Austin Seven or Morris Mini Minor. It was the only major choice in the mini-car sector until the Rootes Group launched its rear-engined Hillman Imp four years later. Around the same time, an Italian rival - the Fiat 500 - was also launched. Throughout the 1960s and 1970s, the Mini was a huge successful for the BMC and later BL combines which produced it. The Fiat 500 remained hugely popular in Italy until production finally halted in 1974. Mini sales began to fall after 1980 following the launch of the Austin Metro, a larger and more modern alternative to the Mini, but it actually outlived its 'replacement' and remained on sale until it was finally replaced by the totally redesigned BMW MINI in 2001. During that time the Mini took its place as one of the most iconic cars of all time.

70s - oil crisis

By the 1970s, small cars were getting bigger and hatchback bodystyles were favoured over the traditional saloon. The 1973 oil crisis forced buyers to choose more economical, less powerful, lighter cars, The first successful compact hatchback in Europe was the 1971 Fiat 127, which was a strong seller in Italy but struggled to find homes elsewhere because it had such a notorious reputation for being rust-prone. Other successful superminis from the 1970s included the Volkswagen Polo, Ford Fiesta, Opel Kadett City (Vauxhall Chevette in the UK) and Peugeot 104.

Autobianchi A112
Austin/Morris Mini
Datsun/Nissan Cherry
Fiat 600
Fiat 127
Hillman Imp
Renault 5
Vauxhall Chevette

80s

The 1980s saw the compact hatchback market reach its peak. British Leyland began the decade by introducing the revolutionary Austin Metro, which was sold as a more practical alternative to the ageing Mini. 1983 saw two major mini-car launches on the continent: the stylish Pininfarina-penned Peugeot 205 and the Giugiaro-styled, spacious Fiat Uno. Both cars lasted well into the 1990s and were hugely popular all over Europe. Vauxhall/Opel replaced the Chevette/Kadett City with the all-new Corsa.

Citroën Visa
Citroën AX
Fiat Uno
Ford Fiesta
Lancia Y10
MG Metro
Mitsubishi Colt
Opel Corsa/Vauxhall Nova
Peugeot 205
Renault 5
Volkswagen Gol/Fox
VW Polo

90s

The first major compact hatchback launch of the 1990s was the Renault Clio, which arrived in 1990 as successor to the long-running R5. The R5 continued until 1995 but its sales slumped after the launch of the Clio, which shot straight to the top of the supermini class and set the benchmark for style, build quality, comfort and driver appeal. Peugeot launched two major mini-cars during the 1990s: the compact 106 in 1991 and the larger 206 in 1998. The 106 was Peugeot's first step in phasing out the hugely popular 205 range, which was finally superceded seven years later when the larger 206 went on sale. Nissan launched a curvy all-new Micra in 1992 and the new car, built at its Sunderland plant, was the first Japanese car to be voted European Car of the Year. The Fiat Punto replaced in 1994 the long-running Uno, and the new car set class-leading standards of style and economy. At the same time, the third generation Volkswagen Polo was launched.

Citroën AX
Citroën Saxo
Daihatsu Charade
Fiat Punto
Mitsubishi Colt
Opel/Vauxhall Corsa
Peugeot 106
Renault Clio
Rover Metro
Seat Ibiza
Suzuki Baleno
Suzuki Swift
Toyota Starlet
Volkswagen Gol
Volkswagen Polo

2000s

The 21st century has seen several major supermini launches. In the year 2000, Volkswagen completed the transformation of the once-maligned Skoda company by launching the well-built, comfortable and economical Škoda Fabia. Within two years, the Fabia's chassis had spawned all-new versions of the Volkswagen Polo and Seat Ibiza. 2000 also saw Vauxhall/Opel launch the completely new Corsa which became hugely popular largely thanks to its spacious and comfortable interior which gave it a big-car feel. In 2001 BMW released the new MINI "retro" version of the classic Mini. Citroën replaced the Peugeot 106-derived Saxo with the five-door C3 in 2002 and the three-door C2 in 2003. Both cars were strong sellers thanks to their competitive asking price, low running costs, distinctive styling and spacious interiors. Renault launched its third-generation Clio in 2005, and 2006 will see new versions of the Vauxhall/Opel Corsa and Fiat Punto.

See also List of recent superminis

See also

- Subcompact car
- Vehicle size class
- Car classification

Subcompact cars

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A *subcompact car* is a car in a vehicle size class smaller than a compact car but larger than a city car (see supermini for European small cars). Such cars usually have four or more seats (whereas microcars such as the Smart tend to have two) and in North America, subcompacts are usually considered to be those cars that have a wheelbase of 2.54 metres (100 inches) or less or between 85 ft^3 (2400 L) and 99 ft^3 (2800 L) of interior volume (though popular usage of the term frequently ignores these boundaries). Subcompacts/superminis are most commonly sold in Europe and Japan where they enjoy enormous popularity, and are reasonably popular in North America.

This type of car was first seen in North America in the 1950s with the introduction of the Nash Metropolitan and a number of imported models, although the subcompact did not see wider adoption until the 1970s with such cars as the Ford Pinto and Chevrolet Vega. Today numerous models of subcompacts are sold, including the Toyota Vitz (also sold as the Toyota Echo & Yaris), the Scion xA, the Kia Rio, the Chevrolet Aveo, and the Hyundai Accent.

In 1971, Ford and GM introduced their subcompact models, with AMC's Gremlin having been the first introduced in April 1970. Of the four large American companies that were making cars at that point, only Chrysler did not develop a domestic subcompact car, electing instead to import models produced by its British and Japanese affiliates (the Plymouth Cricket and Dodge Colt respectively). Although they were all strong sellers in their time, none of the early subcompacts are well thought of today, with the AMC Gremlin, Ford Pinto and Chevrolet Vega placing 4th, 3rd and 2nd, respectively, in Car Talk's Worst Car of the Millennium contest. The 'winner' was another subcompact, the Yugo.

See also

- List of recent subcompact cars
- Vehicle size class
- Car classification

Family car

Home | Up | Mini SUV

A *family car* is a car classification used in Europe to describe larger cars. The name refers to the fact that these cars are suitable for a family to go shopping or on vacations. Most family cars are hatchbacks or saloons, although there are MPVs, station wagon and cabriolets with the same structure as with the other body style. The term covers three types of family cars.

Small family cars

Current small family cars are between 4.20m and 4.35m long. Examples: Ford Focus, Opel Astra, Renault Mégane, Volkswagen Golf.

The first successful small family hatchback in Europe was the Volkswagen Golf, which first went on sale in 1974. By the end of the decade, several other manufacturers had followed Volkswagen's suit by launching the likes of the following - Fiat Ritmo (Strada), Renault 14 and Opel Kadett (Vauxhall Astra). But the Volkswagen Golf remained the most popular small family hatchback in Europe and its successors have followed suit over the last 30 years.

The 1980's began with the launch of two revolutionary front-wheel drive hatchbacks: the Ford Escort and Lancia Delta. More similar cars followed over the decade, including the updated Opel Kadett (Vauxhall Astra), Renault 19, Fiat Tipo and second generation Rover 200. Alfa Romeo's venture into this market, the Nissan-based Arna, was one of the few unsuccessful European small family hatchbacks of the 1980's.

The 1990's saw small family hatchbacks firmly pitch themselves as the most popular sector of car in Europe. The third generation Volkswagen Golf was launched in 1991 and elected European Car of the Year, shortly after Citroen finally broke into the market with its ZX. The ZX's chassis spawned the Peugeot 306 in 1993. Fiat replaced the successful Tipo with the distinctive Bravo (three-door) and Brava (five-door) in 1995. Ford replaced the long-running Escort with the dramatically-styled and all-new Focus in 1998.

Some family hatchbacks have spawned *compact MPVs*, the first of which was the 1996 Renault Mégane Scenic. The Volkswagen Touran (based on the Golf), Fiat Multipla

(Brava/Bravo platform) and Citroën Picasso (with Xsara components) are all a similar concept.

Large family cars

Around 4.50m in the early 90s, now shifting to 4.70m or more. Examples: Ford Mondeo, Opel Vectra, Renault Laguna, Volkswagen Passat.

Full-size family cars

Not as popular as the other two, usually used in official fleet. Examples: Citroën C6, Peugeot 607, Skoda Superb.

Compact car

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Compact car is a largely North American term denoting an automobile smaller than a mid-size car, but larger than a subcompact car. Compact cars usually have wheelbases between 2.54 metres (100 inches) and 2.67 metres (105 inches). Another definition specifies between 100 ft^3 (2800 L) and 109 ft^3 (3000 L) of interior volume.

Although compact cars had been made in the United States before, the modern compact class is considered to have begun between 1958 and 1960, when the Rambler American, Studebaker Lark, Chevrolet Corvair, Ford Falcon, and Plymouth Valiant all appeared in rapid succession. Within a few years after that, the compacts had given rise to a new class called the pony car, named after the Ford Mustang, which was built on the Falcon chassis. At that time, there was a distinct difference in size between compact and full-size models, and an early definition of the compact was a vehicle with an overall length of less than 200".

During the 1960s, compacts were the smallest class, but in the early 1970s, automakers introduced even smaller models, the subcompact, such as the Ford Pinto and Chevrolet Vega.

Today, although the general downsizing of all vehicles has somewhat blurred size class distinctions, the compact segment is still discernible as a class smaller than the average car but larger than the smallest models on the market. The Chevrolet Cobalt would be an example. The term has also been adopted to describe small SUVs, such as the Ford Escape. Compact SUVs are sometimes called "cute-utes" or "soft-roaders".

This term is not commonly used in Europe, where the classification system is different (the term *small family car* is used for compact cars).

See also

- Vehicle size class
- Family car
- Sport compact

Economy car

Home | Up | Economy car

An *economy car* is an automobile that is designed for low-cost operation. They are designed for those who drive their car from point A to point B without using too much gas. Typical economy cars are small, light weight, and inexpensive to buy. The Oil crisis of the 1970s caused a great deal of emphasis on economy, leading to a shift to smaller cars such as the Volkswagen Beetle and front wheel drive cars like the Honda Civic. Some economy cars can go relatively fast because of their light weight while simultaneously saving a lot of gas. Today, economy cars are becoming more expensive. For example, the Scion xB starts with a base MSRP of around $14,000.

Economy cars from the early days tended to focus more on fuel economy than performance. Some from the 80's and early 90's take more than 11 seconds to go from 0 to 60 mph.

Fortunately, most of the automakers today have addressed that issue and are now producing economy cars that can perform and save gas at the same time by installing fuel saving devices such as variable valve timing in the vehicles that they produce.

Small compact cars tend to do worse than midsize or fullsize cars in crash tests. For example, the Toyota Echo received a below average rating in side impact crash testing.

A car that does as well as midsize and fullsize cars in crash tests is the 2006 Honda Civic. Unlike many cars in its class, it offers side curtain airbags as a standard feature.

Among the most popular economy cars (at least in the U.S.) are:

Toyota Corolla Honda Civic Volkswagen Golf Volkswagen Beetle Toyota Tercel Scion xA Scion xB Ford Focus Dodge Neon MINI Cooper (base) Chevrolet Cavalier Chevrolet Cobalt Mazda 3 Mazda Protege Toyota Prius Toyota Echo Kia Rio

The Civic Si is technically a "Sport Compact".

Sedan

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A *sedan* car, American English terminology (*saloon* in British English), is one of the most common body styles of the modern automobile. At its most basic, the sedan is a passenger car with a separate hood covering the engine in the front, and a separate trunk for luggage at the rear—the archetypical "3-box" car.

Historically, the usage of the term sedan has changed over time. Several versions of the body style exist, including four-door, two-door and fastback models.

Description

A sedan seats four or more and has a fixed roof that is full-height up to the rear window. Most commonly it is a four-door; two-door is rarer but they do occur (more so historically). In the U.S., this term has been used to denote a car with fixed window frames, as opposed to the hardtop style where the sash, if any, winds down with the glass. As hardtops have become rarer, this distinction is no longer so important.

Types of sedan

Two-door sedan

A two-door sedan is defined by the SAE as any two-door model with rear accommodation greater than or equal to 33 cubic feet (0.934 m^3) in volume (a calculation made by multiplying the legroom, shoulder room, and headroom). By this standard, the Chevrolet Monte Carlo, Ferrari 612 Scaglietti, and Mercedes-Benz CL-Class coupes are all two-door sedans. Only a few sources, however (including the magazine Car and Driver), use the two-door sedan label in this manner.

In the popular vernacular, a two-door sedan is defined by appearance and not by volume—vehicles with a so-called formal roofline are called two-door sedans, while those with the more common sloping backlight are called coupes. This has led to the so-called four-door coupe, which is a sedan with classic coupe-like proportions. The designation was first applied by Rover to a variant of its P5 from 1962 until 1973. It has more recently been adopted by DaimlerChrysler for the Mercedes-Benz CLS-Class, which the Mercedes marketing department has erroneously called the first four-door coupe. Other companies are leaping into the segment as well, but the term four-door coupe is entirely aesthetical, and not the product of any formal definition. To make matters even more clouded, the Mazda RX-8 meets the volume requirement to be called a sedan, but it has vestigial rear-hinged rear doors, making it a 2+2-door sedan.

Hardtop and fastback sedans

Sometimes a particular fastback or hardtop car body style is referred to as a sedan. Both have the classic trunk (boot) at the rear of the vehicle. Classically a sedan will have a frame around the door windows, while the hardtop has frameless door glass. The hardtop design can be considered separately (i.e., a vehicle can be simply called a four-door hardtop), or it can be called a hardtop sedan. During the 1970s, hardtop sedans were often sold as sport sedans by American manufacturers. The more contemporary four-door sedans with B-pillars were called pillared hardtops or pillared sedans during this period. The sport sedan term has since been appropriated for other uses. A fastback sedan is simply a four-door sedan with a sloping rear deck, but still a separate trunk. An example is the 1978–80 Buick Century. In a way, the discussion is entirely academic, since no fastback or hardtop four-door sedans are built today.

Hatchback sedan

Hatchback (a.k.a. liftback) sedans are often described as well. Here, the car has fastback profile but instead of a trunk lid, the entire back of the vehicle lifts up (using a liftgate or hatch). A vehicle with four passenger doors and a liftgate at the rear can be called a four-door hatchback, four-door hatchback sedan, or five-door sedan. There can also be two-door hatchback sedans (three-door sedans), by the same technical explanation for two-door sedans. An example of this type is the Volkswagen GTI. Whether this is recognized by the SAE, or whether hatchbacks are not sedans by technical definition, is not known at this time of writing.

Small sedans

Sedan bodystyles on smaller cars are now less popular after the hatchback revolution during the 1970s, although many hatchbacks also form the basis of sedans. The first major European manufacturer to phase out sedans in favour of hatchbacks was Renault, who invented the hatchback (Renault 4) in 1965. The 3-box sedan bodystyle is still used on almost all large and luxury cars, excluding the Renault Vel Satis—which has not been especially successful.

Terminology

Origin

The word sedan is possibly derived from a southern Italian dialect derivative of Italian sede "chair" (the first sedan was said to have been introduced from Naples). The derivation from the town of Sedan in France, where it was said to have been made or first used, lacks historical evidence, according to OED. The word sedan was later used to refer to a litter or windowed box containing a passenger seat carried by two or more bearers.

International terminology

In British English the configuration is called a *saloon* and has its engine under the bonnet at the front, and a boot for luggage at the rear. The British English term is sometimes used by British car manufacturers in the United States: the Rolls-Royce Park Ward was sold as a saloon in the United States, while the smaller Silver Seraph was called a sedan.

In Australia and New Zealand, the American term is now used, albeit with the British terms of boot and bonnet being retained. In other languages, sedans are known as Limousine (German), *Berline* (French), *Berlina* (Spanish and Italian), although these terms also may include hatchbacks. These terms, besides sedan, derive from types of horse-drawn carriages.

Sports sedan

Home | Up | Sports sedan | 6 passenger Sedans | Family car | Luxury car

A *sports sedan* is a type of sedan automobile that is designed to look and feel "sporty". They often have a manual transmission and tachometer in order to provide that "sports feel". Traditionally sports sedans are rear wheel drive, have good handling characteristics, and adequate power. But because there is no designation for sporty front wheel drive sedans, front wheel drive sporty sedans can also be considered to be sports sedans (Ex. Acura TSX, Acura TL). The BMW 3-series is often considered the bench mark car in this segment. Examples of sports sedans are the BMW 3 Series, Audi A4, Cadillac CTS, Mazdaspeed 6, Jetta GLI, and the Infiniti G35.

6 passenger Sedans

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Here is a list of 6-passenger sedans. However, some of them may have 5-passenger versions of themselves. This does *not* include truck-based vehicles, nor vehicles that have a 2-2-2 seating arrangement (ex. Chrysler Pacifica) as opposed to the conventional 3-3 arrangement.

A * will denote a vehicle where 6-passenger seating is only optional.

Dodge Aries, Plymouth Reliant (198?-1988)
Dodge Spirit, Plymouth Acclaim (1989-1995)
Dodge Intrepid*, Chrysler Concorde (1993-2004)
Buick Century, (1936-2005)
Buick LaCrosse*, (2005-present)
Buick Le Sabre (1959-2005)
Buick Lucerne* (2006-present)
Buick Roadmaster (1938-1996)
Cadillac DeVille (1949-2005)
Chevrolet Caprice (1966-1996)
Chevrolet Impala (1958-1980s), (2000-present)
Ford Crown Victoria, aka Ford LTD (1955-present)
Ford Taurus, Mercury Sable (1986-2005)
Mercury Grand Marquis
Lincoln Continental*
Lincoln Town Car
Oldsmobile Cutlass (1961-1996)
Pontiac Bonneville (1958-2005)
Pontiac 6000 (1982-1991)

Station wagon

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A *station wagon* (United States usage), *wagon* (Australian usage, though station wagon is widely used) or *estate car* (United Kingdom usage) is a car body style similar to a sedan, but with an extended rear cargo area.

The station wagon as it is known to popular culture is a passenger vehicle, similar to a sedan, with an enclosed cargo area added onto the passenger compartment. Various cultures have their own nomenclature for the vehicle.

- Station wagon – North America
- Wagon – Australian
- Estate – United Kingdom

Most station wagons are modified sedan-type car bodies, having the passenger area extended to the rear window (over the normal trunk area of the vehicle). Unlike a hatchback car, which otherwise meets this description, a station wagon is the full height of the passenger cabin all the way to the back; the rear glass is not sloped too far from vertical. Two exceptions to this rule include Rambler (automobile) station wagons (1952-1962]] on which the roof line subtly dipped down over the cargo area, and GM's Oldsmobile Vista Cruiser (1964-1972) and Buick Sportwagon (1964-1969) on which the rear roof section was slightly elevated and combined with four skylights.

A station wagon is distinguished from a minivan (MPV) or SUV by still being a car, sharing its forward bodywork with other cars in a manufacturer's range. The popularity of the minivan in the 1980s and early 1990s is credited with the decline of the traditional station wagon.

History

The first station wagons were a product of the age of train travel. They were originally called 'depot hacks' because they worked around train depots as hacks (short for hackney carriage, an old name for taxis). They also came to be known as 'carryalls' and 'suburbans'. The name 'station wagon' is a derivative of 'depot hack'; it was a wagon that carried people and luggage from the train station to various local destinations.

Prior to mid 1930s, hardwoods were used by most automotive makes in framing the passenger compartments of their passenger vehicles. In automobiles, the framing was sheathed in steel which was then covered in colored lacquers for protection. Eventually, all steel bodies were adapted because of their strength, cost and durability.

Early station wagons, however, evolved from trucks and were viewed as Commercial Vehicles, not consumer automobiles. The framing of the early station wagons were left unsheathed because of the commercial nature of the vehicles. Early station wagons were fixed roof vehicles, but lacked the glass that would enclose the passenger compartment. In lieu of glass, side curtains of canvas could be unrolled. More rigid curtains could be snapped in place to protect passengers from the elements outside.

In 1922 Essex introduced the first affordable enclosed automobile, which shifted the auto industry away from open vehicles towards meeting consumer demand for enclosed automobiles. Station Wagons too, began to be enclosed, especially in higher price categories from up market automobile companies. Windows in these early enclosed models were either retractable, or sliding in nature.

With the exception of Ford which owned its own hardwood forest and mills specifically for the purpose of building woodie wagons, manufacture of the passenger compartments was outsourced to custom body builders because of the slower nature of the production of the all wood bodies. Companies that were major producers of wood bodied station wagons included Mitchell Bentley, Hercules, USB&F and Cantrell and other custom builders. The roofs of woodie wagons were usual made of stretched canvas that was treated with a water proofing dressing.

While commercial in its origins, by the mid-1930s, wood bodied station wagons, also known as "Woodies", began to take on a prestige aura. The vehicles were priced higher than regular cars, but were popular in affluent communities, especially among the Country Club social set. The vehicles gained in "snob appeal" when mating the ultility of the hard wood bodies to better makes of automobiles such as Buick and Packard and Pierce-Arrow.

Cachet aside, woodie wagons required constant maintenance; bodies were finished in varnishes that required recoating, bolts and screws required tightening as wood expanded and contracted throughout the seasons.

All-steel wagons

Following World War II, automobile production from preexisting manufactures resumed using tooling left over from 1942. However, advancement in production techniques learned over the course of World War II made all-steel station wagons practical when automobile manufacturers switched over to new designs.

The first all-steel station wagon type vehicle in North America was the 1946 Jeep Station Wagon, based upon the rugged Jeep produced by Willys-Overland during the war effort. The Willys was a two-door vehicle, and in premium trim had its passenger compartment exterior painted in a style that evoked the light framing/darker panel design of wagons from the woodie era.

In 1949, Plymouth introduced the first all-steel station wagon, the two-door Suburban, that was based on an automotive platform. In 1950, Plymouth discontinued the woody station wagon in its line and converted to all steel bodies. Buick was the last automobile manufacturer to produce a station wagon with a true wooden structure in 1953.

By 1955, only Ford and Mercury offered a woody-like model; however the look was accomplished with steel, plastics and various materials, such as DiNoc (a vinyl product) to simulate broad expanses of wood. Known as the Ford Country Squire, this heavily-trimmed full-size wagon was a staple of the Ford line from the 1940s to the 1990s.

Reintroduction of woody decorated station wagons by other makers in America began in 1966 when Dodge offered the look for the first time in fifteen years. By 1967, simulated "wood" decoration was used exclusively on top line models, with unadorned vehicles denoting lower price and status models.

In many suburban communities, owning a current year woody station wagon was a sign of affluence and good taste. In the 1980s and early 1990s, the idea of "fake wood" became archaic and manufacturers dropped the option. With the introduction of the retro-styled Chrysler PT Cruiser, aftermarket firms began selling faux woodie kits designed to invoke a sense of nostalgia.

Station wagons enjoyed their greatest popularity and highest production levels in the United States during from the 1950s through the 1970s. The late 1950s through the mid 1960s was also the period of greatest variation in bodystyles, with pillared two and four-door models marketed alongside hardtop (no B-pillar) four door models. AMC's Rambler was the first to enter into this body style in 1956, followed by Mercury, Oldsmobile, Buick in 1957; Chrysler entered the market in 1960. Expensive to produce and buy, the hardtop wagon sold in limited numbers. GM was the first to eliminate the hardtop wagon from its lineup in 1959, and AMC and Ford exited the field beginning with their 1960 and 1961 vehicles, leaving Chrysler and Dodge with the body style through the 1964 model year.

Full-size wagons

Traditionally, full-sized American station wagons were usually configured for 6 (three passengers in the front and three passengers in the rear seat) or 9 seats, which added a passenger seat in the rear cargo area that faced either forward or rearward. In Ford and Mercury wagons built after 1964, the configuration was changed to two seats facing each other, which according to the manufacturer accommodated four people.

Newer models are usually built on smaller platforms and accommodate four or five passengers. Because of size and safety concerns, seating is no longer permitted in the rear of new passenger car-based station wagons, except in the now-discontinued Ford Taurus and Mercury Sable, which had a small jump-seat that had room for two children.

Two-door wagons

Between 1955 and 1957, Chevrolet produced the Nomad, and Pontiac the sibling Safari, both of which were sporty two-door wagons. Limited demand for the style and their costly production resulted in cancellation after three model years. For 1958, both model names were applied to pillared four-door wagon models. Chevrolet dropped the Nomad name at the end of the 1961 model year while Pontiac continued to use the Safari name into the 1980s. Mercury, a division of the Ford Motor Company, produced a two-door hardtop wagon from 1957 to 1960. When Mercury lost its unique body designs in 1961,the marque lost its hardtop wagons and instead fielded pillared models.

More utilitarian two-door wagons were known as "sedan delivery" cars, often with solid panels where the rear side windows would be. These were produced in the United States into the 1970s.

A special variety of the two-door wagon is the shooting break. These are wagon-back sports cars, sometimes built by custom coachworks, and originally intended for well-heeled English hunters to have a car suited to their station that can accommodate their gear (the word "break" is the French word for station wagon).

Declining popularity in North America

Sales of station wagons in the United States and Canada remained strong until 1984, when the Chrysler Corporation introduced the first minivans, derived from the K platform, which, ironically, also was the platform for the Plymouth Reliant and Dodge Aries station wagon models which the minivan would soon eclipse.

The ripple effect of the 1973 Arab Oil Embargo led to the demise of the station wagon where CAFE legislation dethroned the rear wheel drive layout for efficient front wheel drive vehicles. Station wagons were the victims of Detroit's downsizing trend after 1976, and vehicle choice was limited to which SUVs like the Chevrolet Suburban and van conversions (GMC Vandura) filled the void of station wagon sales. This, indeed, led to the station wagon's demise.

The emergence and popularity of SUVs which closely approximate the traditional wagon bodystyle was a further blow. After struggling sales, the last full-size wagons (the Chevrolet Caprice and the Buick Roadmaster) in U.S. production (until 2005 with the Dodge Magnum) were discontinued in 1996.

Since then, small wagons (such as the Subaru Outback) have enjoyed an increase in popularity in the U.S., as safer, sportier and (in most cases) much less expensive alternatives to SUVs and minivans. Domestic wagons also remained in the Ford, Mercury, and Saturn lines until 2004 when the bodies began a phase-out, replaced by car-based "crossover SUVs" and minivans designed to look like station wagons.

Station wagons around the world

In Europe, Australasia and South Africa, these vehicles remain popular and in volume production, although minivans (MPVs) and the like have had some impact. Indeed, the absence of a station wagon in a model range is considered detrimental to its success by manufacturers in Australasia. Station wagons are lower in profile than a minivan or SUV and thus have less air resistance when driving on the highway.

As in North America, early station wagons were aftermarket conversions and had their new bodywork built with a wooden frame, sometimes with wooden panels, sometimes steel. Station wagons were the originators of fold down seats to accommodate passengers or cargo.

In the United Kingdom, a very specific type, rare these days, is known as a shooting brake. These are modifications of luxury coupés with an estate car-like back fitted. They generally remain with two side doors. The purpose of them, historically, is obvious from the name; they were vehicles for the well-off shooter and hunter, giving space to carry shotguns and other equipment. They have rarely been made by the factory and are generally aftermarket conversions; some are still made. Up through the early 1960s many of them were built as woodies, making them some of the most exclusive and luxurious woodies ever built.

In the 1950s, the British companies Rover and Austin produced 4x4 vehicles (the Land-Rover and the Gypsy respectively). Apart from the standard canvas-topped utility vehicles, both these 4x4s were available in estate car bodystyles that were sold as 'Station Wagons'. These bodystyles incorportated more comfortable seating, trim and options such as heaters that made the vehicles more attractive to private buyers. The name was alien in the UK, but was probably chosen because of the high number of these vehicles that went to export markets such as Africa and Australia, where the name was understood. The current Land Rover Defender range still incorporates a series of Station Wagon-named types.

European manufacturers often built two-door station wagons in the post-war period for the compact class, and not four-door models, a practice that continued at Ford with its Escort Mk III in the early 1980s. Usually, by that time, manufacturers created four-door models.

Japanese manufacturers did not value station wagons highly until very recently. For many years, models sold as well-appointed station wagons in export markets were sold as utilitarian "van" models in the home market. This explains why station wagons were not updated for consecutive generations in a model's life in Japan: for instance, while a sedan might have a model life of four years, the wagon was expected to serve eight — the 1979 Toyota Corolla wagon is an example (it was built until 1987). The Nissan Avenir is an example of a model that began its life as a utility vehicle, and became a well equipped passenger car in the 1990s.

Australian station wagons, such as the Ford Falcon and Holden Commodore, are usually built on a longer wheelbase compared to their sedan counterparts, though they share the same door skins. This leads to a slightly unusual appearance with the rear door not reaching all the way to the rear wheel arch.

Tailgate evolution

The vast majority of modern station wagons have an upward-swinging, full-width, full-height rear door supported on gas struts, and a few also have a rear window that can be swung upward independently to load small items without opening the whole liftgate. Historically, however, many different designs have been used for access to the rear of car; the following summary concentrates on American models.

- The earliest common style was an upward-swinging window combined with a downward swinging tailgate. Both were manually operated. This configuration generally prevailed from the earliest origins of the wagon bodystyle in the 1920s through the 1940s. It remained in use through 1960 on several models offered by Ford.
- In the early 1950s, tailgates with hand-cranked roll-down rear windows began to appear. Chrysler is generally credited with the first of these in 1950. Later in the decade, electric power was applied to the tailgate window - it could be operated from the driver's seat, as well as by the keyhole in the rear door. By the early 1960s, this arrangement was becoming common on both full-size and compact wagons.
- The Studebaker Wagonaire station wagon had a unique retractable rear roof section as well as a conventional rear tailgate which folded down. This allowed it to carry tall objects that would not fit otherwise. Water leaks, body flex and noise prevented the innovation from being adopted by other manufacturers. The concept was reintroduced in 2003 on GMC's mid-size Envoy XUV SUV, but did not last long on that vehicle either.

- Ford's full-size wagons for 1965 took the conventional tailgate and disappearing window a step further. The rear section was made to open either downwards like a regular tailgate, or like a door, outward from the curb side. The window had to be retracted for either operation. This was called the "Magic Doorgate". For 1969, Ford made another innovation by allowing the glass to stay up when the door was opened sideways, thus creating the "Three-Way Magic Doorgate". This versatile style quickly caught on and became a fixture on full-size and intermediate wagons from GM, Ford, and Chrysler. GM, however, added a notch in the rear bumper that acted as a step plate; to fill the gap, a small portion of bumper was attached to the doorgate. When opened as a swinging door, this part of the bumper moved away, allowing the depression in the bumper to provide a "step" to ease entry; when the gate was opened by being lowered or raised to a closed position, the chrome section remained in place making the bumper "whole".
- Full-size GM wagons (Buick, Chevrolet, Oldsmobile, and Pontiac) built between model years 1971 and 1976 brought a completely new design to market. They had a rear window that would slide upwards into the roof as the tailgate dropped down below the load floor. This was referred to as a "clamshell" arrangement. On all full-size GM wagons, the window for the clamshell door was power operated, however the gate door itself could be had in either manual on Chevrolet models or power assist in Pontiac, Oldsmobile or Buick cars. The manual style door quickly lost favor because of the effort required to lift and swing the heavy door up from is storage area; sales tapered off after the 1972 model year and electric assist all but became standard. This was the first power tailgate in station wagon history. This system was large, heavy, and complex, and was never adopted for any other car manufacturer. After that, GM reverted to the doorgate style for its full-size wagons.
- As the 1970s progressed, the need for lighter weight to meet fuel economy standards led to a simplified, one-piece liftgate on several models, particularly smaller wagons, such as is commonly seen on SUVs today. On the same principle, and quite ironically, the last generation of GM's full-size wagons returned to the upward-lifting rear window as had been used in the 1940s.

See also

- SUV
- Hatchback
- Van
- Minivan

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Sportive cars

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Hot hatch

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A *hot hatch* is an informal or slang term for a performance derivative of a European hatchback (in the US, Asian sports hatches are sometimes called Sport Compacts). Vehicles of this class are typically based on a budget, family-oriented automobile, and equipped with improved suspension and a more powerful engine. Front mounted engines and front wheel drive is the most common layout.

Development of the hot hatch

The design most often considered to have started the hot hatch genre is the 1977 Volkswagen Golf GTI, although this is a matter of debate in some circles. The original 1974 version of the Golf was in mass production at this point, and the addition of a 1.6 litre fuel injected engine, sharp handling, and sharper marketing found a huge market for enjoyable yet practical cars.

The Golf GTI enjoyed a short run of almost unparalleled success, but by the early 1980s car manufacturers worldwide were racing to market with their own alternatives. Notable big-sellers in the early days were the Ford Escort XR3 and Vauxhall Astra GTE.

By the end of the 1980s the hot hatch had taken its place across Europe, and was pushing into other worldwide markets. The brief heyday of Group B rallying pushed the hot hatch genre to its limits, and small numbers of ultra-high performance variants were manufactured to comply with the rally rules. These enthusiasts vehicles represented a brief, extreme branch of the hot hatch, and included such notable vehicles as the Peugeot 205 T-16 and MG Metro 6R4.

Pre-History: Hot hatches and compacts before 1980

Until 1980 the VW Golf had the market largely to itself. Competition was limited to non-hatchbacks such as the Mini, and race-inspired enthusiasts' vehicles such as the Vauxhall Chevette HS. However, sub-compacts and superminis had adopted a two-box design ever since the Mini, and, in spite of their small engines, had been adopted by young racing enthusiasts with little money because of their low weight. Thus, even though the Golf was one of the few cars with engines larger than 1.4 L and with more than 100 hp (75 kW), other hatches were on their way to becoming "hot". Also, cars such as the Hillman Imp or the Simca Rallye, while having sedan bodies, were small enough to be considered direct ancestors of the hot hatch.

Alfa Romeo Alfasud TI
Autobianchi A112 Abarth
Austin/Morris Mini Cooper/Cooper S/1275 GT
Datsun/Nissan Cherry 120A
Datsun/Nissan Sunny/B110 1200 SSS
Fiat 600 Abarth
Fiat 127 Sport
Hillman Imp
Renault 8 Gordini
Renault 5 Alpine/Gordini/Alpine Turbo
Simca Rallye /2
Vauxhall Chevette HS
Volkswagen Golf GTI

1980–1990—The first generation

The first generation of hot hatches included the following notable models:

Citroën Visa Crono/GT/GTi/1000 Pistes
Citroën AX GT/Sport
Daihatsu Charade GTti
Fiat Uno Turbo
Fiat Ritmo/Strada 130 TC
Ford Escort XR3/XR3i/RS Turbo
Ford Fiesta XR2/XR2i/RS
Lancia Y10 Turbo/GT i.e.
Lancia Delta HF Turbo/Integrale
MG Metro GTA/Turbo
Mitsubishi Colt GTi
Opel Corsa/Vauxhall Nova SR/GT/GSi/GTE
Opel Kadett/Vauxhall Astra GT/GSi/GTE
Peugeot 205 Rallye/GTi 1.6/GTi 1.9
Peugeot 309 GTi/GTi 16V
Renault 5 Turbo/Turbo II/GT Turbo
Renault 11 Turbo
Talbot Sunbeam Lotus
Toyota Corolla Twin Cam
VW Polo G40
VW Golf GTI/GTI 16v/G60
Volvo 480 ES Turbo

1990–2000—The second generation

With the Golf getting slower, heavier and more expensive to match its target market, space opened for a new breed of hot hatches in the 1990s:

Citroën AX GTi
Citroën Saxo VTR/VTS
Citroën ZX Volcane/16s
Daihatsu Charade GTti
Fiat Punto GT
Ford Escort RS 2000/Cosworth
Honda Civic VTEC/VTi/SiR-II
Mazda 323 GTX 4WD
Mitsubishi Colt GTi
Nissan Sunny/Pulsar GTi/GTi-R
Opel/Vauxhall Corsa GSi 16v
Opel/Vauxhall Astra GSi 16v
Peugeot 106 Rallye/XSi/GTi
Peugeot 306 S16/GTi
Renault Clio 16V/Williams
Renault 19 16V/16S
Renault Megane Coupe 16S
Rover Metro/114 GTi
Rover 220 GTi/1.8 VVC
Seat Ibiza GTi/GT 16v/Cupra
Suzuki Baleno GTi
Suzuki Cultus/Swift GTi
Toyota Starlet Turbo
Toyota Corolla GTi
Volkswagen Polo GTI
Volkswagen Golf GTI/VR6

Hot hatches since 2000

The late 90s to today has seen a volley of criticism leveled at the warm and hot hatch market. The so-called "Max Power" culture, similar to American "Import Tuners", has overtaken the lower priced slower models. The higher-end models are also becoming more expensive and heavy. Radical new designs are called for if the hot hatch market wants to avoid blurring into a mass of over-priced, over-stylised modern vehicles. Fortunately, the car manufacturers are feeling the threat, and the future promises new, exciting designs. However in most of Europe the traditional 'hot hatch' is still under threat, with turbo diesel and 8v petrol engined 'warm' hatches becoming more and more popular. This is due to rising petrol and insurance costs. Recent warm and hot hatches include the following models:

Alfa Romeo 147 2.0 TS/GTA
Audi S3

BMW 130i
Citroën C2 VTR/VTS
Citroën Xsara VTS
Citroën C4 VTS
Fiat Punto HGT
Fiat Bravo HGT
Fiat Stilo Abarth
Ford Fiesta ST
Ford Focus ST170/SVT/RS Turbo/ST Turbo
Honda Civic Si/Type-R
Mazda 3/Axela SP23
MG ZR 160
MINI Cooper/Cooper S
Mitsubishi Colt CZT 1.5 Turbo
Nissan Micra 160 SR
Opel/Vauxhall Corsa GSi 16v
Opel/Vauxhall Astra OPC/OPC Turbo/VXR (Also Holden Astra SRi Turbo in Australia)
Peugeot 206 S16/GTi 138/RC/GTi 180
Renault Clio RS 2.0/V6
Renault Megane RS
SEAT Ibiza Cupra R / Cupra Diesel
SEAT Leon Cupra R
Skoda Fabia vRS
Skoda Octavia vRS
Suzuki Swift GTI 1600
Toyota Vitz/Yaris T Sport
Toyota Corolla T Sport
Volkswagen Lupo GTI
Volkswagen Polo GTI 1.8T
Volkswagen Golf R32/GTI/TDI 150

See also

- Sport compact

Sports car

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A *sports car* is a type of automobile designed for sporting performance.

While opinions differ as to the exact definition, most sports cars have two seats and two doors, and are designed to provide excellent handling, acceleration, top speed, and good looks.

A sports car is a car whose dominant design consideration is driving pleasure. The ideal sports car (only the Bugatti Type 35 is a clear example) is capable of both transportation and racing service. A sports car's compromise between road holding, braking, maneuverability, low weight, power, reliability, comfort, passenger space, economy and etc. is intermediate between that of a sedan and that of a racing car. A car is generally considered a sports car if it gives up comfort and passenger space for handling, by having a low roof. This definition has the advantage that a sports car can be identified simply by seeing how high it is. A sports car will not usually turn over when driven hard with racing tires, while a sedan or "truck" usually will. On the other hand, (at least the original) Ford Thunderbird, though low, is not generally considered a sports car because its suspension emphasizes comfort above handling. Sports cars can be fairly luxurious or spartan, but neither comfort nor cost may be achieved at the expense of driving pleasure. Customers regard racing experience (Ferrari, Porsche, Lotus, etc.) as an important indication of sporting quality, but brands such as Lamborghini, who do not race or build cars exclusively for racing, may also be highly regarded.

Great emphasis is often placed on handling—the ability of the driver to remain in control of the car under challenging conditions such as when the car's tires begin to lose their grip on corners.

A car may be sporting without being a sports car. Performance modifications of regular cars, such as muscle cars, hot hatches and the like do not generally fall in the pure sports car territory.

A large, powerful engine is not required; many of the early British sports cars lacked a powerful engine and did not accelerate as quickly as, say, muscle cars, but were known for having exceptional handling characteristics due to their combination of light weight, carefully engineered/balanced chassis and innovative suspension designs. Lotus is often cited as an example of this approach. On tight, twisting roads, such a car has higher effective performance than a heavier, more powerful car with less cornering ability.

In many situations, the term "sports car" is used to refer to any car with more power or performance than is typical for cars in general. Often vehicles in the muscle car, performance sedan/saloon or grand tourer (GT) category are referred to as sports cars even though they tend to lack the light weight and excellent handling characteristics of a true sports car.

Due to bureaucratic restrictions in the North American market, many sports cars are not available for sale or use in the United States and Canada. In Britain and Europe, a more flexible attitude towards small-volume specialist manufacturers has allowed companies like TVR, Noble, Pagani, etc. to succeed.

Prices on sports car have risen due to emissions requirements, more luxerious interior, more powerful engines and so on. Apart from some small British firms the idea of an affordable sports car vanished until the introduction of the Mazda Miata. The Miata had a rather modest price tag and a not that powerful engine 120 bhp. Since the success of the Miata others have followed.

Layout

The layout of drive train and engine influences the handling characteristics of a car and is the focus of more attention in a sports car.

Most modern cars use front wheel drive (FF) where the engine is in the front and drives the front wheels. Some sports cars have this layout (e.g. Lotus Elan M100, Fiat Coupé, Fiat Barchetta, Saab Sonett...), but due to its conservative effect on handling, it is not typical in higher-performance models. However the FF layout is quite common in small Japanese sport cars such as Honda CR-X, Subaru Alcyone SVX, Toyota Celica, Mitsubishi Eclipse... The FF layout has some advantages in small sport cars since it allows you to reduce weight (no need for gearing and propshaft) and size (no intrusion from the transmission tunnel).

Previously FR, front engine driving rear wheels, was common. The designation is deceptive as the engine is often mounted behind the front wheels, so it should be called a mid engine. This form has survived longer in sports cars than in the mainstream and is declared by some to be the "classic" layout for sports cars. The lighter rear-end and rear drive increases the ability of a car to "drift" around corners without losing control.

In search of improved handling and weight distribution other formats have been tried. mid engine, rear drive (MR) is a layout commonly found only in sports cars—the engine is mounted towards the centre of the chassis, close behind the driver, and powers the rear wheels.

Porsche are the sole remaining users of the RR layout, a rear engine driving the rear wheels. The qualities of their cars are often said to have come about despite rather than because of this layout. The weight distribution across the wheels in a Porsche 911 provides excellent traction, but cannot be seen as ideal as the weight of the engine is outside the car's wheelbase. This would usually lead to extremely unpredictable handling and, indeed, many of their early Porsches did suffer from this. However, Porsche have continuously refined the design and, in the recent years, combined their modifications with electronic driving aids like computerized traction and stability control which do much to counteract the inherent flaws of the design. Many of Porsche's techniques have been applied to other cars with success.

One option for transferring the power from the engine to the car's wheels is all wheel drive or AWD. Although some early passenger cars used this technique (e.g. 1966 Jensen FF) it did not gain widespread acceptance until the 1980s, when Audi upgraded their FF design to a turbocharged Quattro. Their great initial rally racing success in the early 1980s was soon bettered by even more sophisticated mid-engine cars, eg. from Peugeot or Lancia, who was later continued with the front-engine Lancia Delta Integrale.

Japanese manufacturers like Mitsubishi and Subaru use AWD in performance cars that serve as a basis for rallying, so they can be considered real sports cars. Many of the top-performing cars from marques like Audi, Porsche and Lamborghini have AWD in order to allow less skilled customers to take advantage of the power, which has to be considered the exact opposite of sporting.

In touring car racing like the 1990s German DTM, Opel and Alfa Romeo needed to add AWD to their FF designs in order to keep up with the Mercedes-Benz standard FR. After having been beaten once even in the wet by the inferior concept, these two brands pulled out of the DTM/ITC because they couldn't afford the high costs anymore. When the DTM serie resumed in 2000, AWD was banned to save costs, which was eventually accepted even by Audi.

Seating

Some sports cars have small emergency back seats that are really only suitable for luggage or small children. Such a configuration is often referred to as a 2+2 (two full seats + two "occasional" seats). Often these seats are only included to lower insurance premiums. When no other form of transportation is available, people have even been known to get into the backs of cars without even these vestigial seats.

Over the years, some manufacturers of sports cars have sought to increase the practicality of their vehicles by increasing the seating room.

One method is to place the driver's seat in the center of the car which allows two full-sized passenger seats on each side and slightly behind the driver. The arrangement was originally considered for the Lamborghini Miura but abandoned as impractical because of the difficulty for the driver to enter/exit the vehicle. McLaren used the design in their limited-edition supercar the F1 whose performance was so extraordinary that the inconvenience of getting in and out of the car was dismissed by many owners as a minor complaint.

Another British manufacturer, TVR, took a different approach in their Cerbera model. The interior was designed in such a way that the dashboard on the passenger side swept toward the front of the car which allowed the passenger to sit farther forward than the driver. This gave the rear seat passenger extra room and made the arrangement suitable for three adult passengers and one child seated behind the driver. The arrangement has been referred to by the company as a 3+1.

Some Matra sports cars even had three seats squeezed next to each other.

The tiny Messerschmitt TG500 had only one front seat, reminding one of a high performance airplane cockpit or of a motorcycle, with the passenger sitting in the rear. (The model name of the three wheeled Messerschmitt KR200 version was Kabinenroller, which means enclosed motor scooter.) The TG500, naturally, was not a commercial success. The romance of a sports car is lost without the possibility of having one's favorite person beside one. Perhaps it would have sold in a country where the women walk behind the men.

The Morgan Four Seater may be the only true four seat sports car, ever. It has no luggage space at all when the rear seats are occupied, and, aside from the number of seats, it is among the most spartan of sports cars, making it impossible to call it a sedan or convertible.

Safety

Unfortunately, sports cars are often charged more for insurance, because, naturally, people who drive far and fast prefer them, but they are the foremost examples of active safety. Excluding their tending to tempt their drivers, they are safer than other cars because they are capable of avoiding accidents that would be inevitable for other vehicles and because they stimulate their drivers to improve their driving skills and to pay attention.

Examples

Well known specialist brands or marques, new and old, are:

AC
Alfa Romeo
Alpine
Aston Martin
Audi
Austin-Healey
BMW M
Bricklin
Bugatti
Caterham
Darrian Cars
Davrian
De Lorean
Ferrari
Fisker
Jaguar
Koenigsegg
Lamborghini
Ligier
Lotus
Marcos
McLaren
Maserati
MG
Morgan
Noble
Pagani
Panoz
Porsche
Spyker
Triumph
TVR
Vector

Almost all major car manufacturers also make some form of high performance car, sometimes very successfully such as Ford with the GT40, Mazda with the MX-5/Miata, RX-7/RX-8, Chevrolet with the Corvette and Nissan with the Z-car and Skyline GT-R.

Most major manufacturers have a sports car that serves as the 'flagship' image car of the company. For example,

BMW M6
Chevrolet Corvette
Dodge Viper
Ford GT
Honda NSX
Mazda RX-7, RX-8
Mitsubishi Lancer Evolution

Nissan Skyline GT-R, Z-car
Renault Sport Clio V6
Subaru Impreza WRX STi
Toyota Supra

(Note, some of these cars, such as the Clio, Impreza, Lancer, M6, and Skyline may not fit the definition of a sports car, nevertheless, they serve as a sympol of a company's performance orientation.)

See also

- Roadster
- Muscle car
- Car safety

Grand tourers

A *grand tourer* (Italian: Gran Turismo), sometimes initialised *GT*, is a high-performance automobile designed for long distance driving. Any such car could be considered to be a grand tourer, but the traditional and most common body style is a two door coupe with either a two seat or a 2+2 seat arrangement. Example cars include the BMW 6-Series, Bentley Continental GT and the Aston Martin DB9.

Grand tourers differ from sports cars in that they are usually larger, heavier and tend to make less compromise in comfort for the sake of driving ability. For this reason they mostly have front-mounted engines that leave more space for the cabin than mid-mounted engines. They also tend to have softer suspension to provide good ride quality. However, grand tourers do have similarities with sports cars, such as the fact they mainly use rear or four wheel drive, and the term sports car may be used to describe a car with grand touring qualities. Very high-performance grand tourers, such as the Ferrari 612 Scaglietti, may be considered to be supercars.

Supercars

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A *supercar* is a term used for a sports car, typically an exotic or rare one, whose performance is highly superlative to its contemporary sports cars. The proper application of this term is subjective and disputed, especially among enthusiasts. In addition, the use of the term is dependent on the era; a vehicle that is considered to be a supercar at one time may not retain its superiority in the future. Nonetheless, the automotive press frequently calls new exotic cars "supercars". Also see the list of supercars to help understand the term subjectively.

Performance criteria

- *High power-to-weight ratio* — most supercars have high engine power and low vehicle weight, for the sake of high acceleration (see Newton's Second Law) and top speed. For example, the 2004 Porsche Carrera GT carries just five pounds per horsepower (3 kg/kW or 438 hp/Mg) — compare this to the Porsche Boxster which hauls nearly 12 pounds per horsepower (7.1 kg/kW or 193 bhp/Mg). The McLaren F1, introduced in 1991 and widely considered as one of the fastest supercars of the 20th century, produced 627.1 hp (467.6 kW) against a weight of 2513 pounds (1140 kg), translating to 550 hp per 1000 kilograms or 4 pounds per horsepower. Certain vehicles have a high power-to-weight ratio despite having a heavy weight, due to a powerful engine output. For example, the Bugatti Veyron carries 4.3 pounds per horsepower despite weighing 4299 pounds (1950 kg, including fuel[1]), due to its 1001 PS (987 SAE hp/736kW) engine.
- *High Acceleration* — supercars, by the usual definition, have extremely quick acceleration compared to most vehicles, including ordinary sports cars. Some current expectations are as follow:
  - 0 to 60 mph (96.56 km/h): Under 4 seconds for virtually all supercars today. The McLaren F1 has a 0 to 60 mph time of about 3.2 seconds. The Bugatti Veyron has a 0-60 time of 2.5 seconds.
  - 0 to 100 mph (160.9 km/h): Under 10 seconds is generally called for, with undisputed supercars being significantly faster. The Ferrari Enzo, introduced in 2002, has a 0 to 100 mph time of about 6.5 seconds. McLaren F1 could do it in 6.3 seconds.
  - Standing Quarter-Mile (402.3 meters): Under 13 seconds is arguably a requirement, as is a trap or terminal speed of at least 110 mph (177 km/h).
    - The Ferrari Enzo completes the quarter mile from a stop in about 11.1 seconds at 133 mph (214 km/h).
    - The Koenigsegg CCR, introduced in 2004, is officially claimed to run the quarter mile in "9 seconds, end speed 235 km/h (146 mph)" [2]

It should be noted here, however, that the term supercar usually refers to particular models of factory-built, street-legal sports cars, which tend to be perceived as unmodified; heavily modified and potentially street-illegal vehicles can often accelerate faster than any production car, requiring well under 10 seconds in the quarter mile. Because supercars are usually designed for road use as opposed to drag racing or straight-line racing alone, their standard equipment often do not include roll cages and other mandatory requirements for fast cars on a dragstrip.

- *High Top Speed* — Today, undisputed supercars can exceed at least 200 mph. The fastest models today have speeds exceeding 250 mph (400 km/h).
  - On February 28, 2005, the Koenigsegg CCR with 806 hp (601 kW) achieved a top speed of 387.87 km/h (241.01 mph) on default settings. The car was driven on Italy's Nardo Prototipo proving ground, a circular track with a circumference of 12.5 km. This exceeded the McLaren's record.[3]
  - On May 20, 2005, the Bugatti Veyron 16.4 achieved a two-way average speed of 400 km/h (248.5 mph)(limited) at parent company Volkswagen's Ehra-Lessien test track. This exceeded the Koenigsegg's record. The Veyron can do 0-200mph in just under 14 seconds which is quicker than the Mclaren F1 can even do 120-200mph[4]
- *Superb Handling* — In contrast to a sports car which simply has a more 'sporty' or involving handling than a normal hatchback or saloon, a supercar is usually built for maximum cornering and road gripping ability in order to achieve superior racing times.

Other criteria

In addition to performance, the following criteria are also cited in determining if a particular sports car or exotic car deserves the supercar moniker:

- *Styling* — Supercars often feature groundbreaking styling elements. The Formula One-inspired Enzo Ferrari, for example, set a new styling direction for that company.
- *Focused design* — Supercars are not designed to be practical transportation devices, with functionality varying widely between different examples. Many car body styles (including 2+2 coupe, station wagon, and pickup truck) make inherent tradeoffs of performance potential for utility. By this measure, extreme vehicles like the Dodge Ram SRT-10 are not normally called supercars (in the case of Dodge Ram SRT-10, it is classified as a truck, not car, so the car-based description would not fit anyway). While one undisputed supercar, the McLaren F1, featured seating for three (and had a number of useful storage spaces), performance was not sacrificed, but instead improved by the seating design: the driver's central position lowered the vehicle's moment of inertia and increased its turning ability.
- *Technology* — All supercars feature cutting edge contemporary racing car technology. This has included the use of carbon fibre and ceramics, ground effects and wings, and novel layouts like mid-engine. The use of turbochargers

has fallen out of favor in many recent supercars, though the Bugatti Veyron uses four. All wheel drive is also used in some modern supercars, reflecting the success of the Audi Quattro rally car. Rear wheel drive is still used most often.

- *Production* — Most commentators would not include one-off concept cars or self-built kit cars under this category. Although no objective metric has been agreed on, homologation often makes the case for a supercar. Similarly, the term is never applied to a pure racing car — supercars must be legal for use on the street. Although their makers often promise to produce dozens of examples, some supercars never reach these production targets. For example, while 400 Enzos were built, just two Mosler Photons have been sold.
    - *Special Orders* — Some manufacturers have programs for car dealers, which allow dealers to order and sell specialized street vehicles that would otherwise be left unbuilt. Those cars are built by the automobile manufacturers, and may come with factory warranty. Special programs such as COPO were used by dealers in the muscle car era to sell supercars with unequal performance, even by standards of the era.
- *Spirit* — An extremely difficult aspect to objectively discuss is the "spirit" or "soul" many supercar buyers search for. This is often more a reflection of the manufacturer's reputation, especially on the race track, than the absolute qualities of the vehicle in question. This factor is often cited in disqualifying cars like the Honda/Acura NSX and Dodge/Chrysler Viper and including even the lesser V12-powered Ferraris.

See also

- List of supercars
- List of automotive superlatives
- Supercars.net

List of supercars

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This page is a list of cars generally regarded as supercars. However, the category is a subjective one and the inclusion of some of the vehicles listed may be more or less controversial, depending upon the opinions of the reader.

While there is no objective definition of a supercar, they are generally considered to have characterics like cutting-edge technology, extreme power, exclusivity/rarity and extravagant styling. For this reason, some cars that may have one or another of these attributes but be notably lacking in others may not be considered "supercars" by some people.

Supercars

The following is a list of vehicles that are widely considered to be "supercars" for their era. Vehicles are listed in the era of the base model's initial year of production, then sorted alphabetically.

===1950's Supercars

Mercedes-Benz 300SL
Porsche 550 Spyder

1960's Supercars

Ferrari 250 GTO
Ferrari P3/4
Ford GT40
Lamborghini Miura

1970's Supercars

Aston Martin V8 Vantage (1977)
BMW M1
De Tomaso Pantera
Ferrari 512BB
Lamborghini Countach
Maserati Bora

1980's Supercars

Ferrari 288 GTO
Ferrari Testarossa
Ferrari F40
Porsche 959

1990's Supercars

Aston Martin Vantage V600 LE MANS
Bugatti EB-110/EB-110 SuperSport
Cizeta Moroder
Ferrari F50
Isdera Commendatore 112i
Jaguar XJ220
Jaguar XJR-15
Lamborghini Diablo
Lister Storm
McLaren F1
Mega Track
Mercedes-Benz CLK-GTR

Nazca C2
Nissan R390
Pagani Zonda
Porsche 911 GT1 model
Schuppan 962CR
Spectre R42
Venturi Atlantique

2000's Supercars

Aston Martin V12 Vanquish
Ascari KZ1
Bugatti Veyron 16.4
BMW M3 GTR
B Engineering Edonis
Ferrari Enzo
Ferrari FXX
Ford GT
Gumpert Apollo
Koenigsegg CC8S
Koenigsegg CCR
Lamborghini Murciélago
Maserati MC12
Mercedes-Benz CLK DTM AMG
Mercedes-Benz SLR McLaren
Mosler MT900
Nismo GT-R Z-Tune
Pagani Zonda C12 S 7.3
Pagani Zonda F "C12 F"
Porsche Carrera GT
Saleen S7
SSC Aero

Unproduced supercars

Audi Avus Quattro
Bentley Hunaudieres
Bizzarrini BZ-2001
BMW Nazca M12
Cadillac Cien
Chrysler ME Four-Twelve
Holden Hurricane
Italdesign Cala
Italdesign Schigera

Jiotto Caspita
Joss Supercar
MCV CH4
MG XPower SV (900bhp+ model never entered production)
Mitsuoka Orochi
Monteverdi Hai 650 F1
TVR Cerbera Speed 12 (never went into production, however one of the prototypes was recently rebuilt, registered, MoT'd and sold)
Peugeot 907
Vector WX-3
Vector WX-3R

Planned supercars

Jaguar XK-RS (production being considered)
Joss Supercar (production is planned)
Laraki Fulgara (production is planned)
McLaren P8 (development restarted)
Volkswagen W12 (production being considered)
Audi Le Mans Quattro (production approved)

Disputed/questionable supercars

Acura NSX
BMW 8-Series
Buick Reatta
Chevrolet Corvette
De Tomaso Deauville
De Tomaso Guara
De Tomaso Longchamps
De Tomaso Mangusta
Dodge Viper
Dodge Daytona (1969)
Ferrari Dino
Ferrari 308
Ferrari 328
Ferrari 348
Ferrari F355
Ferrari 360
Jehle Super Saphier
Lamborghini Gallardo
Lamborghini Jalpa
Lotus Carlton
Lotus Esprit
Panther Solo

Plymouth Superbird
Porsche 911 Turbo, GT2 and GT3 models
Porsche 928
Porsche 930
Vector M12
Vector W8

See also

- Car classification

Muscle cars

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Muscle car is a term for high-performance automobiles, principally referring to American models produced between 1964 to 1971. During the period these vehicles were interchangeably (and more commonly) described as *supercars*.

Definition

The term *muscle car* generally describes a mid-size car with a large, powerful engine (typically, although not universally, a V8 engine) and special trim, intended for maximum acceleration on the street or in drag racing competition. It is distinguished from sports cars, which were customarily considered smaller, two-seat cars, or GTs, two-seat or 2+2 cars intended for high-speed touring and possibly road racing. High-performance full-size or compact cars are arguably excluded from this category, as are the breed of compact sports coupes inspired by the Ford Mustang and typically known as pony cars, although few would dispute a big-block pony car's credentials as a muscle car.

An alternate definition is based on power-to-weight ratio, defining a muscle car as an automobile with (for example) fewer than 12 pounds per rated hp. Such definitions are inexact, thanks to a wide variation in curb weight depending on options and to the questionable nature of the SAE gross hp ratings in use before 1972, which were often deliberately overstated or underrated for various reasons..

Origins

Although auto makers such as Chrysler had occasionally experimented with placing a high performance V-8 in a lighter mid-size platform, and full-size cars such as the Ford Galaxie and Chevrolet Impala offered high-performance models, Pontiac is usually credited for starting the muscle car trend with its 1964 Pontiac GTO, based on the rather more pedestrian Pontiac Tempest. For 1964 and 1965, the GTO was an option package that included Pontiac's 389 cu. in. (6.5L) V8 engine, floor-shifted transmission with Hurst shift linkage, and special trim. In 1966, the Pontiac GTO was no longer an option, and became its own model. The project, spearheaded by Pontiac division president John De Lorean, was technically a violation of General Motors policy limiting its smaller cars to 330 cu. in. (5.4L) displacement, but it proved far more popular than expected, and inspired a host of imitations, both at GM and its competitors.

It marked a general trend towards factory performance, which reflected the importance of the youth market. A key appeal of the muscle cars was that they offered the burgeoning American car culture an array of relatively affordable vehicles with strong street performance that could also be used for racing. The affordability aspect was quickly compromised by increases in size, optional equipment, and plushness, forcing the addition of more and more powerful engines just to keep pace with performance. A backlash against this cost and weight growth led in 1967 and 1968 to a secondary trend of "budget muscle" in the form of the Plymouth Road Runner, Dodge Super Bee, and other stripped, lower-cost variants.

Although the sales of true muscle cars were relatively modest by total Detroit standards, they had considerable value in publicity and bragging rights, serving to bring young buyers into showrooms. The fierce competition led to an escalation in power that peaked in 1970, with some models offering as much as 450 hp (and others likely producing as much actual power, whatever their rating).

Another related type of car is the car-based pickup. Examples of these are the Ford Ranchero, GMC Sprint, GMC Caballero, and one of the most famous examples, the Chevrolet El Camino.

Politics of the Muscle Car

The muscle cars' performance soon became a liability during this period. The automotive safety lobby, which had been spearheaded by Ralph Nader, decried the irresponsibility of offering such powerful cars for public sale, particularly targeted to young buyers. The high power of the muscle cars also underlined the marginal handling and braking capacity of many contemporary American cars, as well as the severe limitations of their tires. In response, the automobile insurance industry began levying punitive surcharges on all high-powered models, soon pushing many muscle cars out of the price range of their intended buyers. Simultaneously, efforts to combat air pollution led to a shift in Detroit's attention from power to emissions control — a problem that grew more complicated in 1973 when the OPEC oil embargo led to gasoline rationing.

With all these forces against it, the market for muscle cars rapidly evaporated. Power began to drop in 1971 as engine compression ratios were reduced, high-performance engines like Chrysler's 426 Hemi were discontinued, and all but a handful of performance models were discontinued or transformed into soft personal luxury cars. One of the last hold-outs, which Car and Driver dubbed "The Last of the Fast Ones," was Pontiac's Trans Am SD455 model of 1973-1974, which had performance to rival most any other muscle car of the era. The Trans Am remained in production through 2002, but after 1974 its performance, like those of its predecessors and rivals, entered the doldrums.

While performance cars began to make a return in the 1980s, spiraling costs and complexity seem to have made the low-cost traditional muscle car a thing of the past.

Surviving models are now prized collectibles, some carrying prices to rival exotic European sports cars.

Outside the US

Australia developed its own muscle car tradition around the same period, though many were modified four-door sedans rather than two-door coupes. The most famous were the Holden Monaro, the Ford Falcon GTHO Phase III of 1971, the Valiant Charger, and the two highest performance Holden Toranas, the SLR 5000 and the XU-1.

Holden Special Vehicles currently produces high-performance versions of various rear-drive Holden Commodore sedans and Monaro coupes, fitted with highly modified American V8 engines, and are perhaps one of the closest contemporary equivalents to the classic American muscle car — fast, exciting, but relatively crude automobiles (though with far more attention to handling, suspension, safety and exceptional brakes). Ford Australia has an equivalent operation, Ford Performance Vehicles, turning out similarly uprated special versions of the Ford Falcon Sedan.

In the UK, the muscle car itself never gained a significant market, but it certainly influenced British manufacturers, with models such as the Ford Capri and Vauxhall Firenza directly inspired by American designs. Later, both Ford and Vauxhall continued the tradition of producing high performance variants of its family cars, though often these had more subtle styling than the traditional muscle car, though with some notable exceptions. The more European influenced hot hatch has largely occupied this segment of the market since the early 1980s.

In Germany Opel, which belongs to GM and is the non-british version of Vauxhall produced the Opel Manta. A muscle car that quickly became a pop-cult item and made its appearance in several German movies and TV shows.

Modern muscle cars

In the US, General Motors discontinued its Camaro and Trans Am models in 2002 (along with the short-lived 1994-1996 Chevrolet Impala SS), leaving the Ford Mustang as the last surviving semi-muscle car built in the states, Chrysler having discontinued its musclecars after 1974.

In 2004 the Pontiac GTO returned to the market as a rebadged Holden Monaro, imported from Australia. In the spring of 2004 Chrysler introduced their LX platform, which serves as the base for a new line of rear-wheel drive, V8-powered cars (using the new Hemi®-engine), including a four-door version of the Dodge Charger. While purists would not consider a four-door sedan or station wagon a muscle car, the performance of the new models is the equal of many of the vintage muscle cars of legend. Dodge has also been developing a new performance vehicle under the Challenger badge, which borrows styling cues from its older namesake. The prototype will be making its debut at the 2006 North American International Auto Show.

For 2003, Mercury revived its old Marauder nameplate, as a modified Ford Crown Victoria or Mercury Grand Marquis. Sales were poor, just like those of its 1970s predecessor, and it was discontinued after two years.

However, the last three years has seen an enormous increase of interest in The American Muscle Car. This has been greatly influenced by Hollywood. Movies like Gone In 60 Seconds (the recent re-make); The Fast and The Furious; Starsky & Hutch and The Dukes of Hazzard has re awoken the image of power when we think of Dodge; Ford and Chevrolet.

This recent increase in popularity of the Muscle Car has been reflected in their price. A vintage '65 - '72 Muscle car can now cost as much as $100,000 and possibly more depending on availability, demand, and condition of the vehicle.

Detroit was quick enough to catch on to this phenonemom. In 2004 Ford the 'New' Mustang went on sale - this model very distinctly being a re-engineered '67/'68 edition. The other big names weren't long about jumping on the band wagon: Dodge has already un-veiled its new Dodge Charger and also the Dodge Challenger Concept Car has been given the 'Green Light' for production. Similarly Chevrolet recently un-veiled their Camaro Concept. All these vehicles have distinct resemblance to the 1960's design but thankfully have introduced 21st century technology to their platforms.

American muscle cars

Road & Track identified the following models as "musclecars" in 1965:

1964-1965 Pontiac Tempest Le Mans GTO
1965-1975 Buick Riviera Gran Sport
1965-1969 Buick Skylark Gran Sport
1965-1970 Dodge Coronet/Plymouth Belvedere 426-S
1965 Chevrolet Chevelle Malibu SS
1965-1967 Oldsmobile Cutlass 442

Other later muscle cars include the following:

1968-1974 AMC AMX
1970-1974 Buick GSX
1967-2002 Chevrolet Camaro
1965-1972 Chevrolet Chevelle SS
1970-1972 Chevrolet Monte Carlo SS454
1963-1974 Chevrolet Nova SS
1970-1971 Dodge Challenger
1966-1974 Dodge Charger
1968-1976 Dodge Dart GTS and Demon
1969-1970 Dodge Daytona
1968-1971 Dodge Super Bee
1966-1969 Ford Fairlane GT, GTA, and Cobra
1964-1973 Ford Mustang
1968-1974 Ford Torino (GT & Cobra)
1967-1973 Mercury Cougar
1968-1971 Oldsmobile 442
1964-1974 Plymouth Barracuda
1970-1976 Plymouth Duster
1967-1971 Plymouth GTX
1968-1974 Plymouth Road Runner

1970 Plymouth Superbird
1966-1971 Pontiac GTO
1967-2002 Pontiac Firebird

See also

- Pony car
- Personal luxury car

Cabriolet

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A *cabriolet* (or *cabrio*) is a car body style that has a removable or retracting roof and rear window, known in America more commonly as "convertible". Soft tops are usually made of vinyl or canvas, and folding plastic rear windows are common. Owing to the issue of body flex, cabriolets almost always have only two doors.

See also

- taxicab
- convertible

Convertible

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A *convertible* is a car body style with a folding or retracting roof. The collapsible roof section is typically made from flexible canvas or vinyl, although plastic, aluminium and steel have occasionally been used in elaborate folding designs. When the top is made of a rigid material such as steel it is often referred to as a "retractable hardtop" instead of a convertible.

Unlike a roadster, which may also have a soft folding top, a convertible has roll-up glass windows in the sides, and so the entire vehicle is "convertible" to an enclosed coupé.

Convertibles are usually 2 door models, only a few 4 door models exist e.g. the 1960s Lincoln Continental.

In Europe this body style is frequently called cabriolet or cabrio. When the model has a rigid folding top, the body style is called Coupé Cabriolet ("CC") or coupé convertible.

In the vintage car era, the convertible was the default body style. It was not until 1910 that Cadillac introduced the first closed-body car. A combination of weak engines and public expectation that a car was analogous to a wagon meant that steel roofs were not in demand until then. Later, convertibles were made less often, possibly due in part to an unfulfilled threat made in the mid-1970s by the United States government to increase rollover safety requirements that may have made auto manufacturers hesitant to manufacture cars that would be unsalable under those new restrictions. By the 1970s they had almost disappeared and in 1976 the Cadillac Eldorado was advertised as "The last convertible in America". During this period of very low convertible production, T-tops became a popular alternative to convertibles, especially in muscle cars. It was not until the 1980s and cars like the Chrysler LeBaron and Saab 900 convertibles that the body style made a comeback. Also in the 1980s, small sporty family cars such as the Escort xr3i and Golf gti were selling a high amount of cabriolets, and in the 1990s, the Mazda MX-5 again cemented the convertible as the sports car body style of choice. Today, there are scores of convertible cars offered by nearly every manufacturer.

Notable convertibles

Audi TT
BMW 3-series
BMW Z3
Buick Reatta
Cadillac Sixty Special
Cadillac XLR
1976 Cadillac Eldorado, advertised as "the last American convertible."
Chevrolet Corvette
Dodge 400, the first Chrysler convertible in the 1980s, revived interest in convertibles
Chrysler LeBaron
Chrysler Sebring Convertible
Ford Mustang
Honda S2000
Lincoln Continental
Mazda MX-5/Miata
Mercedes-Benz SL
MINI
Porsche Boxster
Saab 900
TVR Chimaera
Ford Escort Cabriolet
Volkswagen Beetle Cabriolet
Volkswagen (Golf) Cabriolet
Volvo C70

See also

- coupe convertible
- roadster
- spyder

Four-wheel drive

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Four-wheel drive, *4WD*, *4x4* ("four by four"), *all wheel drive*, and *AWD* are terms used to describe a four-wheeled vehicle with a drivetrain that allows all four wheels to receive power from the engine simultaneously. While many people think exclusively of off-road vehicles, powering all four wheels provides better control on slick ice and is an important part of rally racing on mostly-paved roads.

Four-wheel drive (4WD or 4x4 for short) was the original term, often used to describe truck-like vehicles that required the driver to manually switch between a two wheel drive mode for streets and a four-wheel drive mode for low traction conditions such as ice, mud, or loose gravel. The "all wheel drive" term (AWD for short) was invented to distinguish vehicles that are capable of driving all four wheels on normal roads without causing poor control and excessive tire and drivetrain wear. The AWD term is now being used to market vehicles which do not continuously drive all four wheels, but instead switch from two wheel drive to four-wheel drive automatically as needed. The terms are thus quite vague in modern usage, with AWD being used to describe vehicles with a wide variety of very different drivetrains.

The buyer must be wary. It is common for identical drivetrain systems to be marketed under different names for upmarket and downmarket branding, and also common for very different drivetrain systems to be marketed under the same name for brand uniformity. For example, both Quattro and 4motion can mean either an automatically engaging system with a Haldex clutch or a continuously operating system with a Torsen differential.

Design

When powering two wheels simultaneously, something must be done to allow the wheels to rotate at different speeds as the vehicle goes around curves. When driving all four wheels, the problem is much worse. A design that fails to account for this will cause the vehicle to handle poorly on turns, fighting the driver as the tires slip and skid from the mismatched speeds.

A differential allows one input shaft to drive two output shafts with different speeds. The differential distributes torque (angular force) evenly, while distributing angular velocity (turning speed) such that the average for the two output shafts is equal to that of the input shaft. Each powered axle requires a differential to distribute power between the left and right sides. If all four wheels are to be driven, a third differential can be used to distribute power between the front and rear axles.

Such a design would handle very well. It distributes power evenly and smoothly, making it unlikely to start slipping. Once it does slip though, recovery will be difficult. Suppose that the left front wheel (of a design that drives all four wheels) slips. Because of the way a differential works, the slipping wheel will spin twice as fast as desired while the wheel on the other side stops moving. (the average speed remains unchanged, and neither wheel gets any torque) Since this example is a vehicle that drives all four wheels, a similar problem occurs between the front and rear axles via the center differential. The average speed between front and rear will not change, torque will be matched, torque goes to zero, speed at the rear goes to zero, and the speed at the front goes to double what it should be... making the left front wheel actually turn *four* times as fast as it should be turning. This problem can happen in both 2WD and 4WD vehicles, whenever a driven wheel is placed on a patch of slick ice or raised off the ground. The simplistic design works acceptably well for a 2WD vehicle. Since a 4WD is twice as likely to have a driven wheel on an icy patch, the simplistic design is usually considered unacceptable.

Traction control was invented to solve this problem for 2WD vehicles. When one wheel spins out of control, the brake can be automatically applied to that wheel. The torque will then be matched, causing power to be divided between the pavement (for the non-slipping wheel) and the brake. This is effective, though it does cause brake wear and a sudden jolt that can make handling less predictable. By extending traction control to act on all four wheels, the simple 4WD vehicle design based on three differentials can now recover from wheel spin. One nice feature of this design, is that it is traction control, and thus will not work against traction control. This design is commonly seen on luxury crossover SUVs.

Another way to solve the problem is to temporarily lock together the differential's output shafts, usually just for the center differential that distributes power between front and rear. Recall that a drivetrain without differentials will fight the driver, causing tire wear and handling problems. This is of little concern when the wheels are already slipping. One very common design joins the output shafts together via a multi-plate clutch under computer control. This design causes a small jolt when it activates, which can disturb the driver or cause more wheels to lose traction. Another common design uses a viscous coupling unit. A dilatant fluid inside the viscous coupling unit acts like a solid when under shear stress caused by high shaft speed differences, causing the two shafts to become connected. This design suffers from fluid degradation with age and exponential locking (joining) behavior. It can also waste fuel, because it requires that there be a slight shaft speed difference under normal driving conditions (via gearing) to prepare the fluid for operation. Older designs used manually operated locking devices.

Yet another way to solve the problem is via a Torsen differential. When a normal differential is replaced with a Torsen differential, it is possible to drive the output shafts with different amounts of torque. While this is useless in a zero-torque situation, it will help greatly when the slippage is not so extreme. As the slipping side begins to spin out of control, more power is delivered to the other side. A typical Torsen differential can deliver up to twice as much power to the non-slipping side as it delivers to the slipping side. Most Audi Quattro cars, notably excluding the A3 and TT, use a center Torsen differential. For a time, the Volkswagen Passat 4motion shared this design. The HMMWV uses front and rear Torsen differentials, but only has a normal differential in the center. Torsen differentials generally work very well, though they are expensive and heavy.

Many lower-cost vehicles entirely eliminate the center differential. These vehicles behave as 2WD vehicles under normal conditions. When the drive wheels begin to slip, one of the locking mechanisms discussed above will join the front and rear axles. Such systems distribute power unevenly under normal conditions, and thus do not help prevent loss of traction; they only enable recovery once traction has been lost. Most minivan 4WD/AWD systems are of this type, usually with the front wheels powered during normal driving conditions and the rear wheels served via a viscous coupling unit. Such systems may be described as having a 95%/5% or 90%/10% power split. Light trucks and SUVs tend to use multi-plate clutches under computer control, often with 100% of the power going to the *rear* axle under normal conditions. Sports cars using this type of system always drive only the rear under normal conditions. For example, Lamborghini uses a viscous coupling unit to drive the front, and the Nissan Skyline GT-R uses a clutch. The Audi TT normally powers the front, and has a multi-plate clutch to power the rear.

History

The first-ever four-wheel drive car (as well as hill-climb racer), the so-called Spyker 60 HP, was built in 1903 by Dutch brothers Jacobus and Hendrik-Jan Spijker of Amsterdam. Designs for four-wheel drive in the US, came from the Twyford company of Brookville, PA in 1905. The first US four-wheel drive vehicle was built in 1911 by the Four-Wheel Drive auto company (FWD) of Wisconsin. FWD would later produce over 20,000 of its four-wheel drive Model B trucks for the British and American armies during World War I. It was not until "go-anywhere" vehicles were needed for the military that four-wheel drive found its place. The Jeep, originally developed by American Bantam but mass-produced by Willys and Ford, became the best-known four-wheel drive vehicle in the world during World War II. Willys (since 1950 owner of the Jeep name) introduced the CJ-2A in 1945 as the first full-production four-wheel drive passenger vehicle. Possibly beaten by the 1941 GAZ-61.

It was in 1948 that the vehicle whose name is synonymous with Four Wheel Drive in many countries was introduced. The Land Rover appeared at the Amsterdam Motor Show, originally conceived as a stop-gap product for the struggling Rover car company, and despite chronic underinvestment succeeded far better than the passenger cars. Land Rover pioneered the luxury 4WD with the Range Rover in the 70's, which unlike most subsequent offerings from other manufacturers, was genuinely capable of serious off-road use. Indeed, once a few years of depreciation had brought its price tag into the realm of the possible, many Range Rovers enjoy a new life as off-road competition vehicles. One startling snippet testifying to the durability of Land Rovers was when it was noted on the occasion of the marque's 50th anniversary in 1998 that over 70% of all Land Rovers ever built were still in use.

However, it was not until Jensen applied the Formula Ferguson four-wheel drive system to their 1966 Jensen FF that the system was used in a production sports car, but with a total of 320 build units this did not sell in appreciable numbers. The first manufacturer to develop four-wheel drive for road-going cars was Subaru, who introduced the mass-produced 4WD Leone in 1972. This model eventually became the best-selling 4WD car in the world. Audi introduced the first permanently all-wheel driven high volume road-going car, the Audi Quattro, in 1980. Audi's chassis engineer, Jörg Bensinger, had noticed in winter tests in Scandinavia that a vehicle used by the German Army, the Volkswagen Iltis, could beat any high performance Audi. He proposed developing a four-wheel drive car, soon used for ***rallying*** to improve Audi's conservative image, the resulting rally bred Audi Quattro was a famous and historically significant Rally car. This feature was also extended to Audi's production cars and is still available nowadays.

Some of the earliest mid-engined four-wheel drive cars were the various road-legal rally cars made for Group B homologation, such as the Ford RS200 made from 1984-1986. In 1989 niche maker Panther Westwinds created a mid-engined four-wheel drive, the Panther Solo 2. Today, sophisticated all wheel drive systems are found in many passenger vehicles and most exotic sports cars and supercars.

4WD in road racing

Bugatti created a total of three four-wheel drive racers, the Type 53, in 1932, but the cars were legendary for having poor handling. Ferguson Research Ltd. built the front-engined P99 Formula One car that actually won a non-WC race with Stirling Moss in 1961. In 1969, Team Lotus raced cars in F1 and the Indy 500 that had both turbine-engines and 4WD, as well as the 4WD-Lotus 63 that had the standard Cosworth-engine. Matra also raced a similar MS84, while Team McLaren tested its design only. All these F1 cars were considered inferior to their RWD counterparts and the idea was discontinued, even though Lotus tried repeatedly.

Terminology

Although in the strictest sense, the term "four-wheel drive" refers to a capability that a vehicle may have, it is also used to denote the entire vehicle itself. In Australia, vehicles without significant offroad capabilities are often referred to as All-Wheel Drives (AWD) or SUVs, while those with offroad capabilities are referred to as "four-wheel drives". This term is sometimes also used in North America, somewhat interchangeably for SUVs and pickup trucks and is sometimes erroneously applied to two-wheel-drive variants of these vehicles.

The term *4x4* (read either four by four or full times four) is used to denote the total number of wheels on a vehicle and the number of driven wheels; it is often applied to vehicles equipped with either full-time or part-time four-wheel-drive. The term *4x4* is common in North America and is generally used when marketing a new or used vehicle, and is sometimes applied as badging on a vehicle equipped with four-wheel drive. Similarly, a *4x2* would be appropriate for most two-wheel-drive vehicles, although this is rarely used in the USA in practice. In Australia the term is often used to describe Utes that sit very high on their suspension. This is to avoid the confusion that the vehicle might be a 4x4 because it appears to be otherwise suited to off-road applications. A *2×4*, however, is unambiguously a piece of lumber.

Large American trucks with dual tires on the rear axles (also called duallys or duallies) and two driven axles are officially badged as 4x4s, despite having six driven wheels because the 'dual' wheels behave as a single wheel for traction purposes and are not individually powered. True *6x6* vehicles with three powered axles such as the famous "Deuce and a Half" truck used by the U.S. Army has three axles (two rear, one front), all of them driven. This vehicle is a true *6x6*, as is the Pinzgauer, which is popular with defence forces around the globe.

Another related term is 4-wheeler (or four-wheeler). This generally refers to all-terrain vehicles with four wheels and does not indicate the number of driven wheels; a "four wheeler" may have two or four-wheel drive.

In the UK, the derogatory nickname "Chelsea tractor"[1] is sometimes used to describe large privately owned four-wheel drive vehicles. The term originally applies mostly to Range Rovers but may also be applied to any similar large four-wheel-drive vehicle.

Four wheel drives in Australia

There are two main players in the Australian market: Toyota and Nissan. The typically more massive American four-wheel drive trucks and SUVs are generally not as popular among Australian consumers because they are not well suited to the Australian outback. They are often not rugged enough for the harsh conditions, and with their typically larger size they are too wide to fit on the existing wheel tracks created by previous cars (so the driver ends up attempting to carve out his own track). As in other countries, four-wheel drives have become popular with city-dwelling people, who by and large will never actually drive "off road". This is commonly referred to as driving a Toorak Tractor.

Many Australian Utes are also 4x4. They are more often used by farmers and others who dwell in the country's remote regions than tradesmen in the cities. Some examples are the Holden Rodeo and the Toyota Hi-lux.

Unusual four-wheel drive systems

Prompted by a perceived need for a simple, inexpensive all-terrain vehicle for oil exploration in North Africa, the French motor manufacturer Citroën developed the 2CV Sahara. Unlike other 4x4 vehicles which use a conventional transfer case to drive the front and rear axle, the Sahara had two engines, each independently driving a separate axle, with the rear engine facing backwards. The two throttles, clutches and gearchange mechanisms could be linked, so both 12 bhp 425 cc engines could run together, or they could be split and the car driven solely by either engine. Combined with twin fuel tanks and twin batteries (which could be set up to run either or both engines), the redundancy of two separate drive trains meant that they could make it back to civilization even after major mechanical failures. Only around 700 of these cars were built, and there are no clear records of how many still exist. Enthusiasts have built their own "new" Saharas, by rebuilding a 2CV and fitting the modified engine, gearbox and axle onto a new, strengthened chassis.

BMC experimented with a twin-engined Mini Moke in the mid-1960s, but never put it into production.

Suzuki Motors introduced the Suzuki Escudo Pikes Peak Edition in 1996. Though actually numbers were never released, this twin-engined vehicle is believed to weigh less than 2000 pounds and produce nearly 1000bhp. Each engine is twin-turbo charged 2.0L V6 mated to a sequential 6-speed manual transmission.

Most recently DaimlerChrysler's Jeep Division debuted the twin engine, 670hp Jeep Hurricane concept at the 2005 North American International Auto Show in Detroit. Unique to this vehicle is it's "crab crawl" cability, which allows it to rotate in 360 degrees in place and it's dual Hemi V8s.

See also

- Sport Utility Vehicle

Sport utility vehicle

Home | Up | Sport utility vehicle | Crossover SUV

A *sport utility vehicle*, or *SUV*, is a type of passenger vehicle which combines passenger-carrying and load-hauling abilities with the versatility of a pickup truck. Most SUVs are designed with a roughly square cross-section, an engine compartment, a combined passenger and cargo compartment, and no dedicated trunk. Most mid-size and full-size SUVs have 5 or more seats, and a cargo area directly behind the last row of seats. Mini SUVs, such as the Jeep Wrangler, may have fewer seats.

It is known in some countries as an *off-roader* or *four wheel drive*, often abbreviated to *4WD* or *4x4*, and pronounced "four-by-four". More recently, SUVs designed primarily for driving on roads have grown in popularity. A new category, the crossover SUV uses car components for lighter weight and better fuel economy.

Design characteristics

SUVs were traditionally derived from light truck platforms, but have developed to have the general shape of a station wagon. SUVs are typically taller, though, with a roughly square cross-section.

SUVs typically have higher seating than a station wagon and can be equipped with four wheel drive, providing an advantage in low traction environments. The design also allows for a large engine compartment, and many SUVs have large V-6 or V-8 engines. In countries where fuel is more expensive, buyers often opt for diesel engines, which have better fuel efficiency, and given that diesel fuel itself is often much cheaper than gasoline.

History

Sport utility vehicles were originall descended from commercial and military vehicles such as the Jeep and Land Rover. In fact, that many SUVs have a squarish design is partially due to the Jeep, which was manufactured that way. **[1]** SUVs have been popular for many years with rural buyers due to their off-road capabilities. In the last 25 years, and even more in the last decade, they have become popular with urban buyers. Consequently, more modern SUVs often come with more luxury features and some crossover SUVs, such as the BMW X5, the Acura MDX, and the Toyota RAV4, have adopted lower ride heights and car chassis to better accommodate their use for on-road driving.

Popularity

SUVs became popular in the United States, Canada, and Australia, especially in the 1990s and early 2000s, for a variety of reasons. Buyers became drawn to their large cabins, higher ride height, and perceived safety when in the market for a new vehicle. Additionally, most full-size SUVs have far greater towing capacities than conventional cars, allowing owners to tow RVs, trailers, and boats with relative ease, adding to the utilitarian image.

A large growth in SUV popularity and sales is due to advertisement targeted towards women. Women constitute more than half of SUV drivers, and SUVs are the most popular vehicle choice of women in the United States.

The most common reason for SUV popularity cited by owners was their safety advantage in a collision with regular cars. Some of their success is also due to their image, a substantial factor for many buyers. In the late 1990s and early 2000s, vehicle manufacturers sold the image of SUVs very effectively, with per-vehicle profits substantially higher than other automobiles. Historically, their simple designs and often outdated technology (by passenger car standards) often made the vehicles cheaper to make than comparably-priced cars. Still, SUVs are more expensive than sedans of similar quality and features.

In the mid 2000s, however, their popularity has waned, due to higher gasoline prices after a period of low prices when SUVs became popular. Current model SUVs take into account that 98% of SUV owners never offroad. As such, SUVs now have lower ground clearance and suspension designed primarily for paved road usage.

SUVs in remote areas

SUVs are often used in places such as the Australian Outback, Africa, the Middle East, and most of Asia, which have limited paved roads and require the vehicle to have all-terrain handling, increased range, and storage capacity. The low availablity of spare parts and the need to carry out repairs quickly allow model vehicles with the bare minimum of electric and hydraulic systems to predominate. Typical examples are the Land Rover, the Toyota Land Cruiser and the Lada Niva.

SUVs targeted for use in civilization have traditionally originated from their more rugged all-terrain counterparts. For example the Hummer H1 is derived from the HMMWV developed for the US Armed Forces.

Other names

Outside of North America and India, these vehicles are known simply as four-wheel-drives, often abbreviated to "4WD" or "4x4". They are classified as cars in countries such as the UK where the U.S. distinction between cars and 'light trucks' is not used. In Australia, the automotive industry and press have recently adopted the term SUV in place of four wheel drive in the description of vehicles and market segments. "Utility" or "ute" refers to an automobile with a flatbed rear or pick-up, typically seating two passengers and is often used by tradesmen, and is typically not a 4WD vehicle.

Hybrid technology

The 2005 Ford Escape Hybrid is the first hybrid SUV, with a hybrid version of the Lexus RX 330 (known as the RX 400h) also available. Shortly after the Escape Hybrid's introduction, Mercury introduced a hybrid version of its Mariner, which is a lightly restyled Ford Escape. A hybrid version of the Toyota Highlander is available, and hybrids of the Mazda Tribute and Saturn VUE are in the pipeline. While some manufacturers (most notably Toyota in the Lexus RX 400h) are using added power generated from the hybrid systems primarily to give vehicles added performance, these hybrid SUVs still offer equal or better fuel efficiency than their conventionally-powered counterparts.

SUVs in recreation and motorsport

SUVs are also used to explore off-road places otherwise unreachable by vehicle or for the sheer enjoyment of the driving. In Australia, China, Europe, South Africa and the U.S. at least, many 4WD clubs have been formed for this purpose. Modified SUVs also take part in races, most famously in the Paris-Dakar Rally, and the Australian Safari.

Criticism

The explosive growth in SUV ownership has attracted a large amount of criticism, mainly of the risks to other road users and the environment, but also on the basis that the perceived benefits to the vehicle owner are illusory or exaggerated.

Safety

Safety is a common point of criticism. The majority of modern automobiles are constructed by a method called unibody or monocoque construction, whereby a steel body shell absorbs the impacts of collisions in crumple zones. Many SUVs, on the other hand, are constructed in the traditional manner of light trucks: body-on-frame, which, when negligently designed can provide a comparatively lower level of safety. However, some SUVs have designs based on unibody construction: the Ford Escape/Mazda Tribute, Lexus RX 330 and RX 400h, Hyundai Santa Fe, and Acura MDX are some examples. In fact, the Jeep Cherokee/Liberty (1984 on) and Grand Cherokee (1993 on) have used unibody construction from the start.

Risk to other drivers

Because of SUVs' greater height and weight, and often usage of body-of-frame constructions, it is documented many SUVs hurt overall public road safety by slightly reducing risk for people inside the SUV, but substantially increasing risk for those outside the SUV (in other vehicles or on foot). This is due to the SUVs' weight and height advantage in multi-vehicle accidents (resulting in much fewer deaths in the vehicle, but increasing risks for others) being counterbalanced by their raised center of gravity, which increases the potential for rollover.

In 2004, the National Highway Traffic Safety Administration released figures showing that drivers of SUVs were 11 percent more likely to die in an accident than people in cars. [1] These figures may be confounded by variables other than the vehicles' inherent safety, for example the documented tendency for SUVs to be driven more recklessly (most sensationally perhaps, the 1996 finding that SUV drivers are more likely to drive drunk [2]). SUV drivers are also statistically less likely to wear their seatbelts. [3]

The considerable weight of full-size SUVs (such as the Chevrolet Suburban and the Ford Excursion) makes collisions with other, smaller cars much less dangerous for the SUV and much more dangerous for the car. The higher ride and other design characteristics of many SUVs may also lead to greater damage to smaller crash partner cars. These mass and design dangers are known as crash incompatibility issues in the crash testing industry, and are a topic of active research. The most notable statistic in SUV design crash incompatibility is an increase in fatalities when an SUV strikes the head of a passenger or driver in a side-impact collision. This is one of the motivations for the development of side-curtain airbags in standard autos.

The high center of gravity of SUVs makes them more prone to rollover accidents (especially if the vehicle leaves the road or in emergency manoeuvres) than lower vehicles. In recent years, Consumer Reports has found a few SUVs unacceptable due to their rollover risk. This was also dramatically demonstrated in one Fifth Gear show using a Range Rover. Modern SUVs are usually designed to prevent rollovers on flat surfaces. Average heights for:

- Minivans 70.2 in
- Family sedans 57.3 in
- SUVs 70.7 in

SUV safety concerns are compounded by a perception among some consumers that SUVs are safer for their drivers than standard autos. This perception is generally incorrect, although SUVs might provide more safety in a few situations. According to G. C. Rapaille, a psychological consultant to automakers (as cited in Gladwell, 2004), many consumers feel safer in SUVs simply because their ride height makes "[their passengers] higher and dominate and look down (sic). That you can look down [on other people] is psychologically a very powerful notion." This and the massive size and weight of SUVs may lead to consumers' false perception of safety (Gladwell, 2004). [4].

Similarly, a related perceived benefit for SUV drivers is that their higher seating enables them to have a better overview on the road, possibly enabling the driver to react sooner to crossing pedestrians or hazards ahead. However, this advantage is only relative to other vehicles: a higher vehicle, while affording a better view for its own driver, will tend to obscure the view for all other road users, thus decreasing general road safety, and possibly frustrating other drivers.

In Europe, effective 2006, the fitting of bull bars, also known as grill guards to vehicles such as 4x4s and SUVs is illegal.

Risk to pedestrians

An SUV hitting a pedestrian is about twice as likely to kill as a car at equal speed. This is in part because the collision of an SUV with a pedestrian tends to impact the chest, while the collision of a car with a pedestrian tends to impact the knees.

The size and design of SUVs leads to a restricted driver's view of the area immediately surrounding the vehicle. The back view is particularly restricted. Young children and cars behind the SUV may be completely invisible. While this is a non-issue on the road, it makes backing out of a stall or a driveway more difficult and dangerous. Quite a few manufacturers try to remedy the problem by offering rear-view cameras or simple sensors that sound the alarm if the car is about to hit something. This is still rather new technology and is not fool-proof. Unfortunately, those tend to be pricey options and only a fraction of SUVs have them installed. Aftermarket offerings also exist for interested buyers.

Recent improvements

Manufacturers have added car-level bumpers to reduce the possibility of the other vehicle(s) sliding under the SUV in a collision. SUVs have therefore become somewhat safer for other road users in recent years.

Tax benefits

In the United States, the so-called 'SUV subsidy' allows small-business owners to deduct up to $25,000 of the cost of a vehicle with a gross vehicle weight rating of over 6000 lb (2722 kg) from their income tax calculation. Small-business owners may deduct $10,610 of the cost of a passenger automobile. This provides a slight tax incentive for businesses to purchase an SUV. However, the cost of both SUVs and automobiles is fully deductible over future years using normal depreciation. In previous years, this deduction reached $120,000 and was the subject of much criticism.

Fuel economy

The recent popularity of SUVs is one reason the U.S. population consumes more gasoline than in previous years. SUVs are as a class much less fuel efficient than comparable passenger vehicles. The main reason is that SUVs are classified by the U.S. government as light trucks, and thus are subject to the less strict light truck standard under the Corporate Average Fuel Economy (CAFE) regulations. The CAFE requirement for light trucks is an average of 20.7 mpg (US), versus 27.5 mpg (US) for passenger cars (11.4 and 8.6 L/100 km, respectively).

As there is little incentive to change the design, SUVs have numerous fuel-inefficient features. The high profile of SUVs increases wind resistance. The heavy suspension and large engines increase vehicle weight. SUVs also often come with tires designed for off-road traction rather than low rolling resistance. The more car-like SUVs tend to have somewhat lower profiles and better road performance tires, but often still have several disadvantages, such as large, fuel-inefficient engines, greater mass, and poorer aerodynamics.

The low fuel economy is caused by

- high parasitic masses (compared to the average load) causing high energy demand in transitional operation (in the cities) $P_{accel} = m_{vehicle} \cdot a \cdot v$ where P stands for power, m*vehicle* for the vehicle mass, a for acceleration and v for the vehicle velocity.
- high cross-sectional area causing very high drag losses especially when driven at high speed $F_{drag} = A_{cross} \cdot cw_{vehicle} \cdot \frac{v_{air}^2 \rho_{air}}{2}$ where F stands for the force, A*cross* for the cross-sectional area of the vehicle, Á*air* for the density of the air and v*air* for the relative velocity of the air (incl. wind)
- high rolling resistance due to all-terrain tires (even worse if low pressure is needed offroad) and high vehicle mass driving the rolling resistance $F_{roll} = \mu_{roll} \cdot m_{vehicle}$ where ¼*roll* stands for the rolling resistance factor and m*vehicle* for the vehicle mass.

Diesel-engined versions tend to show better fuel economy figures than gasoline-burning versions: some official figures show that a small diesel 4x4 has better touring economy than the supercharged Mini Cooper S or many large saloon cars. Note though that gasoline contains about 15% less energy than diesel fuel per unit of volume, so direct comparison of fuel economy numbers can be misleading. Bear in mind also that high-sulfur diesel (soon to be forbidden in the United States) is much more polluting than gasoline, so direct comparisons of miles-per-gallon or litres-per-kilometre figures can be misleading.

Although SUVs have the image of being fuel hogs, compared to sport editions of standard cars, luxury cars, and minivans, SUVs are not always worse. Minivans, luxury cars, diesel-engined sedans, can weigh as much as, or more, than an SUV. However, SUVs and sedans of the same weight do not always have the same fuel efficiency, because SUVs tend to have more drag. Sport editions and tuned cars can have poor fuel economy. Luxury cars and limousines often have larger engines than an SUV. The smallest consumer gasoline cars average from 16 km/L to 20 km/L (40-50 mpg). Average gasoline cars average from 8 km/L to 15 km/L (20-35 mpg). Most gasoline luxury cars, limousines, SUVs, sport editions and tuned cars vary from 6 km/L to 12 km/L(15-30 mpg).

Weight

The high gross vehicle weight rating of some full-size SUVs (like the Ford Excursion and Hummer H2) technically limits their use on certain roads. Rural bridges often have a 6000 lb (2700 kg) weight limit, and some full-size SUVs surpass this limit when loaded. These laws are rarely enforced for SUVs, however, since these vehicles are seen as passenger vehicles instead of commercial trucks. Other vehicles can weigh as much as an SUV: the Dodge Grand Caravan exceeds the 6000 lb mark by 650 lb (295 kg), and the Honda Odyssey, at 5952 lb (2700 kg), and Kia Sedona, at 5959 lb (2703 kg), are close. For comparison, a mid-size sedan such as the Honda Accord weighs 4080 lb (1851 kg) fully loaded. These weights are all for vehicles fully loaded to GVWR, and most owners rarely load their vehicles to full capacity. However sometimes, SUVs may look heavier than they actually are. For instance, a 1999 Jeep

Cherokee has a curb (empty) weight of 3300 lb (1500 kg), while a smaller car like the 2005 Volkswagen Golf diesel has a curb weight of 3100 lb (1400 kg).

Handling and braking

Because of the its great weight and high center of mass, an SUV generally performs poorly in emergency manoeuvres. In braking, the high center of mass directs an excessive loading shift to the front tires, which results in poor traction.

Image

Some criticism of SUVs is based purely on their image as expensive, upscale status symbols for the (relatively) wealthy and their stereotypically yuppie owners/drivers as arrogant, rude, and wasteful show-offs.

Protests

Anti-SUV vandalism

In April 2005, William Cottrell, a 24-year-old American postgraduate student at Caltech was sentenced to more than eight years in federal prison and $3.5 million in fines for firebombing or vandalizing 125 SUVs at dealerships and a few homes in 2003.[5] Two of his associates fled the country to avoid prosecution. [6]

Slang

In southern England, SUVs, excluding farm vehicles such as Land Rovers, are often referred to in derogatory terms as "Soft-Roaders" or "Chelsea tractors", coined by London Mayor, Ken Livingstone.In the UK they are occasionally known as jeeps or Land Rovers no matter what make they actually are, although the increasing prevalence of these vehicles in recent years has decreased this colloquial usage. In New Zealand they are occasionally called "Fendalton tractors" or "Remuera tractors" after the higher priced suburbs in Christchurch and Auckland respectively. In Australia, particularly Victoria, they are referred to as "Toorak Tractors". In The Netherlands they are often called "PC Hooft-tractoren" after Amsterdam's most exclusive shopping street. SUVs are also criticized in the Netherlands for similar reasons, and some environmentalists are pushing local governments to deny SUV users parking spaces.

See also

- Four wheel drive
- Car classification
- Compact SUV

- Crossover SUV
- Mini SUV
- Station wagon

Notes and references

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- Motor Trend. (Complete information on the Motor Trend reference is unavailable. However, the article was Motor Trend's announcement of the Lexus RX 300 as the 1999 SUV of the Year.)

1. ' Keith Bradsher. High and Mighty: SUVs--The World's Most Dangerous Vehicles and How They Got That Way. Published by PublicAffairs. ISBN 1586482033

Additional reading

- Keith Bradsher. High and Mighty: SUVs--The World's Most Dangerous Vehicles and How They Got That Way. Published by PublicAffairs. ISBN 1586482033
- Adam Penenberg. Tragic Indifference : One Man's Battle with the Auto Industry over the Dangers of SUVs. Published by HarperBusiness. ISBN 0060090588

Mini SUV

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Mini SUV is a class of small sport utility vehicles which are more or less under 4,15 m long. Early mini SUVs were specially designed for off-road conditions (such as the Jeep Wrangler); however, current mini SUVs usually have unibody chassis and few off-road capabilities. They feature instead off-road apperance, such as large black bumpers and slightly increased ground clearance; therefore, they fall into the crossover SUV category. Mini SUVs have become popular in some countries because of fashion trends: for example, wealthy young people buy them just to have a "different-looking" car.

In Japan, as cars under 3.40 meter in length are classified as keicars and pay less taxes, some manufacturers build these cars with off-road looks (such as the Mitsubishi Pajero Mini).

List of mini SUVs

Mini offroaders

Jeep Wrangler
Geo Tracker/Suzuki Sidekick
Suzuki Samurai

Mini crossover SUVs

Chevrolet HHR
Daihatsu Terios
Fiat Sedici/Suzuki SX4
Ford EcoSport
Honda Element
Honda HR-V
Jeep Compass
Mitsubishi Pajero Mini
Scion xB
Volkswagen CrossFox

Crossover SUV

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A *crossover SUV* (also called CUV for Crossover Utility Vehicule) or *XUV* (not to be confused with GMC's Envoy XUV) is an automobile with a sport utility vehicle appearance but is built upon a more economical and fuel-efficient car-based platform.

History

The first of this class of vehicles was the 1957 Moskvitch 410, but a more well-known example is the AMC Eagle, which debuted in 1980. The Eagle combined Jeep 4×4 off-road functionality with the AMC Concord car-based platform and bodywork. However, the Eagle suffered from poor sales throughout its production, and it was discontinued in 1988.

In the 1990s, an SUV and light truck craze took hold of the North American vehicle market, catapulting what once was a small piece of the market that was originally dedicated to farmers and outdoorsmen to vehicles that were being used as family cars, to the extent that by the end of the decade, light trucks accounted for almost 50% of all new vehicle sales, and overwhelmingly the popularity of the SUV segment was responsible for this shift in buying patterns.

Traditionally, SUVs were heavy-duty truck-based appliances, with body-on-frame construction. In response to market demands, automakers had been continually making each successive generation of their SUVs more and more "car-like" but the inherent limitations of this configuration made them poorly suited for their new primary function as family haulers.

Research showed that a vast majority of SUV owners never took their vehicles off-pavement, much less used them for fording streams or climbing boulders, which was their original raison d'etre. An opportunity to provide what this new type of SUV owner actually wanted was seized.

Customers liked the idea of all-weather traction provided by four wheel drive, the ability to haul large items or a good number of people, and enjoyed the "commanding" seating position and sense of security that they believed the mass of an SUV provided, but mostly they liked the implication of an active, outdoorsy lifestyle that an SUV suggested, and that minivans and station wagons implicitly did not.

The Toyota Camry-based Lexus RX300 was introduced in 1999 and was an instant success. It provided all of the aforementioned attributes that customers were looking for in an SUV, but additionally provided car-like attributes such as a smooth ride, (relatively) good handling, low step-in height and decent gas mileage, all while providing the desired SUV psychological imagery.

The term "Cross-Over" was applied to the Lexus RX300 to indicate its indeterminate status and was retroactively applied to progenitor models such as the AMC Eagle and Subaru Outback. Given the inherent fuzziness of the "Crossover" designation, and automakers' desire to introduce vehicles into this currently "hot" segment, any number of improbable vehicles that are far removed from the original SUV concept are grouped in this category. The designation now signifies almost any non-truck based model that carries some form of SUV styling cues or attributes.

Advantages

Car-based crossover SUVs vehicles have three primary advantages over truck-based SUVs:

1. *Handling* - The unsafe handling characteristics of trucks with respect to sudden, evasive maneuvers has been demonstrated and accepted. Their high center of gravity, tall tire sidewalls, and long-travel suspensions (designed for heavy cargo and off-road use) make designing a truck-based SUV to be resistant to rollovers extremely difficult. Car-based crossovers ride lower and feature more road-appropriate suspension designs, that while limiting their ultimate off-road utility makes them much more stable and responsive.
2. *Economy* - Car-based crossovers are much lighter than their heavy-duty truck-based cousins. They also feature light-duty all wheel drive or even just two wheel drive rather than less-efficient and heavy four wheel drive, and use lighter unibody construction as well as coming equipped with more practical "on-road"-oriented tires. As a result, most crossovers get only slightly worse fuel economy than station wagons and sedans based on the same platform owing primarily to the fundamentally less efficient aerodynamics of the SUV shape.
3. *Cost* - Light-duty car components can be cheaper to build and in fact, many modern crossovers are based on small economy cars, driving underlying costs lower still.

Continuing proliferation

Given the market's demonstrated insatiable appetite for SUVs and SUV-like vehicles, automakers have been scrambling to imbue the desired characteristics (with varying success) to a wide range of disparate products from station wagons such as the Subaru Outback and the Audi Allroad to minivans like the Pontiac Montana SV6, and the Mazda MPV All Sport, extending even to sedans like the Subaru Outback SUS and Ford Five Hundred and running the gamut from entry-level, inexpensive models like the Honda CRV to the luxurious and pricey Cadillac SRX.

Almost every automaker participating in the North American market has a "crossover" vehicle, and the selection of choices has exploded. A short list of current crossovers with their platform genealogy follows (similar vehicles are grouped together):

Model(s) - Platform

Acura MDX and Honda Pilot - Honda Accord

BMW X3 - BMW 3-Series

BMW X5 - BMW 5-Series

Buick Rendezvous/Pontiac Aztek - U platform (GM minivans)

Cadillac SRX - Sigma platform (Cadillac CTS & STS)

Chrysler Pacifica - Chrysler CS platform (Chrysler Town and Country/Dodge Caravan)

Ford Escape/Mazda Tribute/Mercury Mariner - Ford CD3 platform

Ford Ecosport - Ford Mk6 platform (Ford Fiesta)

Ford Freestyle - Ford D3 platform (Volvo S80)

Ford Territory - Ford Falcon

Holden Adventra/HSV Avalanche - Holden Commodore

Holden Crewman/HSV Avalanche XUV - Holden Commodore

Honda CR-V and Honda Element - Honda Civic

Hyundai Tucson/Kia Sportage - Hyundai Elantra

Hyundai Santa Fe - Hyundai Sonata

Infiniti FX - Nissan FM platform (Infiniti G35)

Lincoln MKX - Ford CD3 platform (Lincoln Zephyr/MKZ)

Toyota Harrier/Lexus RX and Toyota Kluger/Highlander - Toyota Camry

Mitsubishi Endeavor - Mitsubishi Galant

Mitsubishi Outlander - Mitsubishi Lancer

Nissan Murano - Nissan Altima

Subaru Forester - Subaru Impreza

Toyota RAV4 - Toyota Corolla

Volvo XC90 - Volvo P2 platform (Volvo S80)

See also

- Sport utility vehicle
- Station wagon
- Car classification
    - List of recent crossover SUVs

Minivan

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A *minivan*, *people carrier*, *multi utility vehicle* (MUV),or *multi purpose vehicle (MPV)* is a type of vehicle which has a body that resembles a van, but which has rear side doors, rear side windows, and interior fittings to accommodate passengers similar to a station wagon. Minivans are higher than normal sedans, compacts and station wagons, and are designed for maximum interior room; minivans often feature three seat rows and can seat 7 people or more.

The original "Minivan" was developed by Volkswagen in about 1950 with the Volkswagen Type 2 "Minibus" and varients. The VW Type 2 had a rear engine and rear-wheel drive. VW currently makes a modern varient with a front engine and front-wheel drive which is very similar to the vehicles discussed below. In 1952 the Lloyd Motoren Werke, Bremen (a brand of the Borgward Group) introduced their Lloyd LT (Picture), that was, in retrospect, even closer to the minivan of nowadays.

The modern revision design was developed simultaneously in the late 1970s and early 1980s by Chrysler UK/Matra (launched by Renault as the Espace) and the Chrysler Corporation. Minivan is the more usual term in North American English whilst the other two terms predominate elsewhere in the English speaking world. In India, however, the acronym used is MUV, in line with a similar acronym, SUV.

History

Minivans were launched to the market almost simultaneously by Chrysler (Dodge Caravan) in late 1983 and by Renault (Renault Espace) in 1984. Though these two cars were developed almost entirely separately, they can each trace their roots back to the same point: the minivan design was originally conceived in the late-1970's by Chrysler UK in partnership with the French manufacturer Matra (who were also affiliated with Simca, the former French subsidiary of the Chrysler Corporation, who were sold in 1977 to the PSA Group (Peugeot-Citroën). The Chrysler-UK/Matra design was originally intended to be sold as a Talbot, and to be a replacement for the Talbot-Matra-Simca Rancho station wagon. Early prototypes were designed to use Simca parts, and hence featured a grille reminiscent of the Simca 1307. However, after acquiring all of Chrysler's European assets, PSA decided the design was too expensive and risky to put into production, and Matra took their idea to Renault, who agreed (PSA finally ventured into the minivan sector 11 years later with the Citroën Evasion/Peugeot 806). The Matra concept became the Renault Espace. However, Chrysler, under whom Matra had originally conceived the Espace, had also been developing the minivan concept themselves, and managed to release their own Dodge Caravan a year earlier than the Espace in 1983. The term "minivan" derived from the fact that cars such as the Dodge Caravan were considerably smaller than traditional North American passenger vans such as the Ford E-Series.

The target market for the minivan was families living in suburban areas. This vehicle was a cross between the station wagon and the large work vans that people would customize for passenger travel. In North America, it came at a time when families wanted a different vehicle that didn't have the stigma of the station wagon era of their parents, and also wanted better fuel economy than that of the previously popular V8-powered station wagons/vans.

The minivan also offered another change from the large van or the station wagon: front-wheel drive, usually found only on smaller automobiles. This made for easier assembly of the vehicle, and allowed for more cargo/passenger area along the floor with the absence of the drive shaft hump. Minivans typically have removable seats and with the seats removed, the cargo area in the larger minivans can hold a 4'x8' sheet of drywall or plywood flat.

In the USA, in order for the style of minivan to circumvent the 1980s emission standards, the minivan had to be classified as a truck and could not have four doors like a car. Early US minivans such as the Dodge Caravan were three door configurations with a sliding curbside door.

Early minivans came with four-cylinder motors, which although they were more efficient, were not able to meet the life span of bigger engines. It was common to require major engine repairs on the four cylinder motors. The vehicles were also extremely sluggish when these small engines were paired with hydraulic automatic transmissions. Later six cylinder motors were offered and have become a standard choice by purchasers who plan to operate the vehicle for many years. Minivans are also notorious for having problems with their transaxles.

Current models

Modern minivans are now very similar to station wagons except they have a higher profile. Also, their hood is shorter, as they have more vertical room. Current models have two sliding doors, or normal doors if they are compact minivans. All minivans sold in North America have sliding doors, with the exception of the first-generation Mazda MPV, Honda Odyssey and Isuzu Oasis.

Today, many minivan manufacturers, including Ford, GM, and DaimlerChrysler also offer their minivans as cargo vans rather than passenger vans. These cargo vans are usually available only through fleet sales.

The trend for compact MPVs and mini MPVs began in Europe in the late 1990s with the launch of the Renault Scénic. Compact minivans were usually cars with tall bodies but based on the chassis and engines of a small family car (in the case of the Scénic, the Renault Mégane). The runaway success of the Scénic saw the car spawn a multitude of similar vehicles, including the General Motors Zafira, the Citroën Xsara Picasso, the Volkswagen Touran and the Nissan Almera Tino. By the mid-2000s, virtually all mainstream automakers in Europe had a compact MPV in their range. Also in the mid-2000s, manufacturers began to use MPV-style designs on supermini-based chassis, in cars such as the Opel Meriva, based on the Corsa, and the Fiat Idea, derived from the Punto chassis. Such models enjoyed some popularity in the United States in the late 1980s and early 1990s (for example, the Mitsubishi Expo (Mitsubishi Chariot in other markets) and Nissan Axxess. For 2006, the lone compact minivan available in the United States is the Mazda5.

In the ASEAN nations and India, because of the wide geography of the region, MUVs tend to be smaller cars that can cope with uneven terrain. Among these MUVs are the Chevrolet Tavera/Isuzu Panther, Ford Fusion, Hindustan Pushpak and Toyota Qualis (replaced by the Toyota Innova).

Public image in the USA

Minivans have a mixed image. They have a reputation for poor maneuverability and performance in comparison with other types of vehicles. However, they are also the vehicle of choice for large suburban families, and are frequently associated with "soccer moms". Perhaps because of these associations, minivan are often seen as dowdy or boring. Many buyers who need a car with a large amount of luggage and passenger space prefer the rugged, go-anywhere image of SUVs or the sporty, upscale image of European station wagons like the BMW 3 Series or the Volvo V70 provide. Whether large SUVs such as the Chevrolet Suburban and Ford Expedition are affected by similar stigmas as their designers attempt to compete with minivan comfort and convenience remains to be seen.

Minivan model prototype oddities

- The concept version of the Pontiac Trans Sport was small, and had a wingflap door on the side similar to the Delorean.

Minivan examples

Anything with *e-* is considered to be part of a mysterious sub-range of MPV.

Chevrolet Lumina APV/Pontiac Trans Sport/Oldsmobile Silhouette
Chevrolet Uplander/Pontiac Montana SV6/Buick Terraza/Saturn Relay
Chevrolet Venture/Pontiac Montana/Oldsmobile Silhouette/Opel/Vauxhall Sintra
Chrysler Town and Country/Dodge Caravan/Plymouth Voyager
Citroën Picasso (e-Type C)
Fiat Idea
Fiat Ulysse/Citroën C8/Peugeot 807
Fiat Multipla

Ford Aerostar
Ford Windstar/Ford Freestar/Mercury Monterey
Ford Galaxy/SEAT Alhambra/Volkswagen Sharan
Honda Odyssey/Isuzu Oasis
Kia Sedona
Mazda 5
Mazda MPV
Mercury Villager/Nissan Quest
Opel/Chevrolet/Vauxhall/Holden Zafira
Opel/Chevrolet/Vauxhall Meriva
Renault Espace (e-Type A)
Renault Scénic (e-Type B)
Toyota Previa
Toyota Sienna
Toyota Van
Toyota Wish
Volkswagen Touran
Volkswagen Vanagon/EuroVan

Recreational vehicle

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In North America the term *recreational vehicle* and its derived acronym, *RV*, are generally used to refer to an enclosed piece of equipment dually used as both a vehicle and temporary travel home. In other parts of the world, particularly Australia, the term may be used to refer to a sport utility vehicle, also known as an SUV. This article discusses the North American usage.

While RVs are intended for brief leisure activities such as vacations and camping, some people, especially retirees, live in their units and are known as fulltimers. RVs can be rented in major U.S. and Canadian cities.

There are different classes of vehicles generally labelled as RVs:

- *Truck Camper* - unit is affixed to the bed or chassis of a pickup truck.
- *Folding Camping Trailer* - also known as a pop-up trailer; a light-weight unit with sides that collapse for towing and storage. Suitable for towing by many vehicles.
- *Travel Trailer* - heavier unit with rigid sides designed to be towed by most larger vehicles by means of a bumper or frame hitch
- *Hybrid Trailer* - a blend between a travel trailer and a folding (tent) trailer. With rigid sides and pull-out tent sections (usually beds)
- *Fifth Wheel Travel Trailer* - designed to be towed by a pickup truck equipped with a special hitch in the truck bed

- *Park Model* - designed for occasional relocation and will require a special tow vehicle and a highway movement permit
- *Motorhome* ("Winnebago", a product of Winnebago Industries that dominated the market for many years, was long a synonym for a motorhome, but this usage has faded in recent years.)

Class A Motorcoach - constructed on either a commercial truck chassis, a specially designed motor vehicle chassis, or a commerical bus chassis. Sizes run from 26 to 45 feet.

Class B Campervan - built using a conventional van, to which either a raised roof has been added or had the back replaced by a low-profile body (compared to a Class C). Sizes run from 19 feet to 24 feet.

Class C Motorhome - built on an truck chassis with an attached cab section, which is usually van based, but may also be pickup truck based or even large truck(freightliner) based. Size can vary from 17 feet to 34 feet.

- *Toterhome*, a motor home built around a semi truck chassis such as a freightliner. This type of motor home allows you to pull large and heavy trailers while having all the conveniences of a large motor home

A minimal RV typically contains beds, a table, food preparation and storage areas. Larger models add full bathrooms, refrigerators, living areas, master bedrooms, etc. Some RVs are very elaborate, with satellite TV and internet access, slide-out sections, and awnings; many RVs can cost (new) from less then $10,000 to $100,000 with some costing over $1 million. These high end RVs typically need to be financed by banks or specialized lenders.

Many RVers stay at RV parks, most of which feature electrical, water and sewer service (full hookups), as well as cable television and wireless Internet. Amenties often include swimming pools, gamerooms and even destination-resort activities such as horseback riding. While others prefer staying at locations in rural, remote areas, called Boondocking and still others at public campgrounds with minimal facilities.

Advantages of RVs include not having to move one's things in and out of motel rooms, not having to rent multiple motel rooms, sleeping in a bed you are comfortable with and the fact that preparing food saves money compared to eating in restaurants. At the same time, an RV provides more organized living space and better protection from the weather than a tent. Children also tend to like RVs.

Disadvantages of RVs include low fuel economy for the motorized RV or tow vehicle, lack of maid service as experienced in motels (maid service is available at a few high-end resorts), and larger RV models can be hard for the novice to drive or tow.

Some people also live in RVs because they lack funds for more conventional housing.

Similarly, RVs — specifically, trailers which strongly resemble travel trailers, but usually with fewer amenities — have been used to temporarily house victims of natural disasters. A notable example is Hurricane Katrina; the federal disaster relief agency FEMA has ordered large numbers of such trailers to house victims of the storm in Louisiana and Mississippi.

Some people craft their own RVs out of cars, vans, or used passenger and school buses.

Elkhart, Indiana, is known as the "RV Capital of the World" because it is home to many RV manufacturers, including, Forest River, Heartland RV, the Damon Corporation, Four Winds, Hy-Line, Keystone, Monaco, Sun Valley, and Travel Supreme. Many other manufacturers, including Dutchman, Gulf Stream, and Jayco, can be found in the nearby towns of Goshen, Middlebury, Nappanee, and Wakarusa. In 2005, these locales experienced a boom because of the large number of trailers ordered to house Hurricane Katrina victims.

Vintage car

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A *vintage car* is commonly defined as a car built between the start of 1919 and the end of 1930. There is little debate about the start date of the Vintage period — the end of World War I is a nicely defined marker there — but the end date is a matter of a little more debate. The British definition is strict about 1930 being the cut-off, while some American sources prefer 1925 since it is the pre-Classic car period as defined by the Classic Car Club of America. Others see the Classic period as overlapping the Vintage period, especially since the Vintage designation covers all vehicles produced in the period while the official Classic definition does not, only including high-end vehicles of the period. Some consider the start of World War II to be the end date of the Vintage period.

The Vintage period in the automotive world was a time of transition. The car started off in 1919 as still something of a rarity, and ended up in 1930 well on the way towards ubiquity; in fact, automobile production at the end of this period was not matched again until the 1950s. During this period, most industrialised nations built a nationwide road system, with the result that towards the end of the period, the ability to negotiate unpaved roads was no longer required.

Cars became much more practical, convenient and comfortable during this period. Car heating was introduced, as was the in-car radio. Antifreeze was introduced, allowing water-cooled cars to be used year-round. Four-wheel braking from a common foot pedal was introduced, as was the use of hydraulically actuated brakes. Power steering was also an innovation of this era. Towards the end of the Vintage era, the system of octane ratings of fuel was introduced, allowing comparison between fuels.

During this period, as well as the car adapting, society began to adapt to the car. Drive-in restaurants were introduced, as well as suburban shopping centers, and motels began lining major roads in the United States.

Full-size vehicles

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A *full-size car* is term a used in North America for an automobile larger than a mid-size car, usually having a wheelbase greater than 2.79 metres (110 inches). Another definition specifies greater than 120 ft^3 (3300 L) of interior volume. The term first appeared in the early 1960's to define what also became known as "standard" size cars from the new compact and intermediate models then being introduced.

Due to the growing length of wheelbases among mid-size luxury sedan, however, the overall length of the vehicles has become another factor to take into account as well. Full-size cars should therefore also feature an overall length of more than 197 in (5000 mm).

A "large car," the equivalent class in Australian terms, is often denoted by width. Therefore, the Ford Falcon and Holden Commodore are considered large cars in the Australian and New Zealand markets. These cars are sometimes referred to as "family cars" in Australia.

In Europe, the terms "executive car" and "luxury car" may refer to cars of this size (which are mostly luxury cars), such as the Audi A8, BMW 7-Series, Mercedes-Benz S-Class and Jaguar XJ.

Decline and renaissance

The sales of full-size vehicles in the United States declined after the early 1970s fuel crisis. By that time, full-size cars had grown to wheelbases of 121" to 127", and overall lengths of around 225". Though most cars throughout the 1970s remianed full-sized, the GM vehicle downsizing of the late 1970s and consumer preference leaning more towards sporty automobiles caused sales to decline well into the 1990s. With the rise of the SUV, fewer and fewer customers whose preferences were still leaning toward full-size cars bought sedans.

It was not until significant gas price increases made SUV usage very expensive that full-size sedan sales recovered. This surge in sales was further fueled by the introduction of popular new models such as the Chrysler 300 and Dodge Magnum.

In Europe, full-size cars have only recently gained in popularity. During the 1980s, full-size cars were rare in Europe, but now they have become a common sight. In Germany, full-size cars make up 15% of the total number of cars (VDA annual report), roughly the same average as in the United States.

List of full-size cars

Current full-size cars

Audi A8
Bentley Arnage
BMW 7 Series
Buick Lucerne
Cadillac DTS
Chevrolet Impala
Chrysler 300
Dodge Charger
Dodge Magnum
Ford Crown Victoria
Ford Five Hundred
Infiniti Q45
Lexus LS 430

Lincoln Town Car
Maybach 57 and 62
Maserati Quattroporte
Mercury Grand Marquis
Mercedes-Benz S-Class
Rolls Royce Phantom
Toyota Century
Toyota Avalon
Volkswagen Phaeton

Past full-size cars

Aston Martin Lagonda
Bentley Brooklands
Buick LeSabre
Buick Park Avenue
Buick Roadmaster
Cadillac Deville
Chevrolet Caprice
Chrysler 300M
Chrysler Concorde
Chrysler LHS
Dodge Intrepid
Eagle Vision
Mitsubishi Diamante
Oldsmobile Aurora
Pontiac Bonneville
Rolls-Royce Silver Seraph
Rolls-Royce Silver Shadow

See also

- Car classification
- Vehicle size class

Keicars

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Keicar (*K-car*), also called *keijidMsha* (in Japanese: ýêÕÊ light motor vehicle), is a Japanese category of small automobiles, including passenger cars as well as vans and pick-up trucks for commercial use. They are mainly designed for sale in Japan, because there are some tax and insurance relaxations and an exemption from the usual requirement of certification that one has adequate parking space at his or her home or has contract for a parking spot.

These relatively relaxed standards came from the post-World War II days when most Japanese were too poor to buy a fullsized car, yet had more than enough money to buy a motorcycle. To promote the growth of car industry as well as to offer an alternative delivery method to small business and shop owners, Keicar standards were created. In Japan, the cars feature yellow licence plates, earning them the name "yellow-plate cars" in English-speaking circles (black numbers on yellow background for private use and yellow numbers on black background for commercial use). The keicar field is very competitive, so that manufacturers are in a constant race to provide better performance, utility, and fun within the keicar regulations, driving the pace of technological innovation, which then spreads to the rest of their automobile line. As a result, keicars are available with turbocharged engines, automatic transmissions, continuously variable transmissions, front wheel drive, rear wheel drive, four wheel drive, hybrid drivetrains, air conditioning systems as well as navigation systems.

History and regulations

- July 8, 1949: first regulations
    - length: up to 2.8 m
    - width: up to 1 m
    - height: up to 2 m
    - engine displacement: up to 150 cc (4-stroke), up to 100 cc; (2-stroke)
- July 26, 1950: major changes
    - length: up to 3 m
    - width: up to 1.3 m
    - displacement: up to 300 cc; (4-stroke), up to 200 cc; (2-stroke)
- August 16, 1951: minor changes
    - displacement up to 360 cc; (4-stroke), up to 240 cc; (2 stroke)
- April 4, 1955: minor changes
    - no further differentiation between 2-stroke and 4-stroke: all up to 360 cc
- January 1, 1976: major changes
    - length: up to 3.2 m
    - width: up to 1.4 m
    - displacement: up to 550 cc
- January 1, 1984: medium changes
    - length: up to 3.4 m
    - displacement: up to 660 cc
- October 1, 1998: today's regulations
    - length: 3.4 m or less
    - width: 1.48 m or less
    - height: 2 m or less
    - displacement: up to 660 cc

Manufacturers of keicars

Daihatsu
Honda
Toyo Kogyo/Mazda
Mitsubishi Motors Corporation
Nissan
Smart (the only non-Japanese company)
Fuji Heavy Industries/Subaru
Suzuki

Famous example cars

For details see the category for keicars.
Autozam AZ-1 (turbocharged sports car with gullwing doors)
Daihatsu Copen (a convertible with a turbocharged engine, now sold in Europe)
Daihatsu Mira, also known as Cuore (sold with some minor changes in Europe)
Honda Beat (a convertible with a mid-mounted engine and rear wheel drive)
Mazda Carol (The Carol's engine was the only four-cylinder in the 360 cc class)
Subaru R1
Suzuki Cappuccino (also a convertible, was also sold in UK)
Suzuki Twin (a hybrid vehicle)
Suzuki Wagon R (sold with larger engines in Europe, also sold as the Opel Agila)

See also

- Microcar

Hybrid vehicles

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A *hybrid vehicle* uses multiple propulsion systems to provide motive power. This most commonly refers to *gasoline-electric hybrid* vehicles, which use gasoline (petrol) or diesel to power internal-combustion engines (ICEs), and electric batteries to power electric motors. Modern mass-produced hybrids, such as the Toyota Prius, recharge their batteries by capturing kinetic energy via regenerative braking. As well, when cruising or idling, some of the output of the combustion engine is fed to a generator (merely the electric motor(s) running in generator mode[1]) which produces electricity to charge the batteries. This contrasts with all-electric cars which use batteries charged by an external source such as the grid, or a range extending trailer. Nearly all hybrids still require gasoline and diesel as their sole fuel source though other fuels such as ethanol or plant based oils have also seen occasional use.

The term hybrid when used in relation with cars also has other uses. Prior to its modern meaning of hybrid propulsion, the word hybrid was used in the United States to mean a vehicle of mixed national origin; generally, a European car fitted with American mechanical components. This meaning has fallen out of use. In the import scene, hybrid was often used to describe an engine swap, such as the common Honda B16 engine into a Honda Civic. Some have also referred to flexible-fuel vehicles as hybrids because they can use a mixture of different fuels — typically gasoline and ethanol alcohol fuel. There are not diesel flexible-fuel vehicles, because nowadays diesel cars can use petroleum and biodiesel at the same time.

A more recent working prototype was built by Herman Wouk's brother Victor Wouk (known as the Godfather of the Hybrid[2]) into a 1972 Buick Skylark provided by GM for the 1970 Federal Clean Car Incentive Program, but the program was killed by the EPA in 1976. Since then, hobbyists have continued to build hybrids but none was put into mass production by a major manufacturer until the waning years of the twentieth century. The Bill Clinton administration initiated the Partnership for a New Generation of Vehicles (PNGV)[3] program in September 29, 1993 that involved Chrysler, Ford, General Motors, USCAR, the DoE, and other various governmental agencies to engineer the next efficient and clean vehicle. The NRC cited automakers' moves to produce hybrid electric vehicles as evidence that technologies developed under PNGV were being rapidly adopted on production lines, as called for under Goal 2. Based on information received from automakers, NRC reviewers questioned whether the "Big Three" would be able to move from the concept phase to cost effective, pre-production prototype vehicles by 2004, as set out in Goal 3. [Review of the Research Program of the Partnership for a New Generation of Vehicles: Seventh Report, National Research Council, (2001), p. 77]. The program was replaced by the hydrogen focused FreedomCAR initiative**[4]** of George W. Bush's administration in 2001. The focus of the FreedomCAR initiative being to fund research too high risk for the private sector to engage in with the long term goal of developing emission / petroleum free vehicles.

In the intervening period, the widest use of hybrid technology was actually in diesel-electric submarines, which operate in essentially the same manner as hybrid electric cars. However, in this case the goal was to allow operation underwater without consuming large amounts of oxygen, rather than economizing on fuel. Since then, many submarines have moved to nuclear power, which can operate underwater indefinitely, though a number of nations continue to rely on diesel-electric fleets.

Automotive hybrid technology became successful in the 1990s when the Honda Insight and Toyota Prius became available. These vehicles have a direct linkage from the internal combustion engine to the driven wheels, so the engine can provide acceleration power. The 2000s saw development of plug-in hybrid electric vehicles (PHEVs), which can be recharged from the electrical power grid and don't require conventional fuel for short trips. The Renault Kangoo was the first production model of this design, released in France in 2003. However, the environmental benefits of plug-in hybrids depend somewhat on the source of the electrical power. In particular, electricity generated with wind would be cleaner than electricity generated with coal, the most polluting source. On the other hand, electricity generated with coal in a central power plant is still much cleaner than pure gasoline propulsion, due to the much greater efficiencies of a central plant. Furthermore, coal is only one source of centrally generated power, and in some places such as California is only a minor contributor, overshadowed by natural gas and other cleaner sources.

The Prius has been in high demand since its introduction. Newer designs have more conventional appearance and are less expensive, often appearing and performing identically to their non-hybrid counterparts while delivering 50% better fuel efficiency. The Honda Civic Hybrid appears identical to the non-hybrid version, for instance, but delivers about 50 US mpg (4.7 L/100km). The redesigned 2004 Toyota Prius improved passenger room, cargo area, and power output, while increasing energy efficiency and reducing emissions. The Honda Insight, while not matching the demand of the Prius, is still being produced and has a devoted base of owners. Honda has also released a hybrid version of the Accord.

2005 saw the first hybrid SUV released, Ford Motor Company's Ford Escape Hybrid. Toyota and Ford entered into a licensing agreement in March 2004 allowing Ford to use 20 patents from Toyota related to hybrid technology, although Ford's engine was independently designed and built. In exchange for the hybrid licences, Ford licensed patents involving their European diesel engines to Toyota. Toyota announced model year 2005 hybrid versions of the Toyota Highlander and Lexus RX 400h with 4WD-i which uses a rear electric motor to power the rear wheels negating the need for a differential. Toyota also plans to add hybrid drivetrains to every model it sells in the coming decade.

For 2007 Lexus is offering a hybrid version of their GS sport sedan dubbed the GS450h with "well in excess of 300hp". The 2007 Camry Hybrid has been announced and is slated to launch in late Spring as a 2007 model. It will be built in Kentucky, USA. Also, Nissan announced the release of the Altima hybrid (technology supplied by Toyota) around 2007.

An R.L. Polk survey of 2003 model year cars showed that hybrid car registrations in the United States rose to 43,435 cars, a 25.8 % increase from 2002 numbers. California, the nation's most populous state at one-eighth of the total population, had the most hybrid cars registered: 11,425. The proportionally high number may be partially due to the state's higher gasoline prices and stricter emissions rules, which hybrids generally have little trouble passing.

Honda, which offers Insight, Civic and Accord hybrids, sold 26,773 hybrids in the first 11 months of 2004. Toyota has sold a cumulative 306,862 hybrids between 1997 and Nov. 2004 and Honda has sold a total of 81,867 hybrids between 1999 and November 2004.[5]

Hybrids currently available

- Ford:
  - Ford Escape Hybrid

  Mercury Mariner Hybrid
- Honda:
  - Honda Insight (International Engine of the Year 2000)

  Honda Civic Hybrid

  Honda Accord Hybrid
- General Motors:
  - Chevrolet Silverado/GMC Sierra Hybrid (debatable, see Mild hybrid)

  New Flyer hybrid buses using Allisons electric drive system

  Opel Astra Diesel Hybrid.
- Mazda:

  - Mazda Demio (Japan-only, debatable)
- Renault:
  - Renault Kangoo

Moped
Power-assisted bicycle
Electric bicycle

- Whispering Wheel Bus
- Toyota
  - Prius

Highlander
Camry

- Lexus
  - Lexus RX400h

Lexus GS450h
Lexus LS600hL

Trains, trucks and buses

In May 2003 JR East started test runs with the so called NE (new energy) train and validated the system's operability (series hybrid with lithium ion battery) in cold regions. In 2004, RailPower Technologies had been running pilots in the US with the so called Green Goats which led to orders by the Union Pacific and Canadian Pacific Railways starting in early 2005.

Also in 2005 GE introduced its hybrid shifters on the market. Toyota claims to have started with the Coaster Hybrid Bus in 1997 on the Japanese market. In May 2003 GM started to tour with hybrid buses developed together with Allison. Several hundreds of those buses have entered into daily operation in the US. The Blue Ribbon City Hybrid bus was presented by Hino, a Toyota affiliate, in January 2005.

In 2003 GM introduced a diesel hybrid military (light) truck, equipped with a diesel electric and a fuel cell auxiliary power unit. Hybrid light trucks were introduced 2004 by Mercedes (Hybrid Sprinter) and Micro-Vett SPA (Daily Bimodale). International Truck and Engine Corp. and Eaton Corp. have been selected to manufacture diesel-electric hybrid trucks for a US pilot program serving the utility industry in 2004. In mid 2005 Isuzu introduced the Elf Diesel Hybrid Truck on the Japanese Market. They claim that approximately 300 vehicles, mostly route buses are using Hinos HIMR (Hybrid Inverter Controlled Motor & Retarder) system.

A promising but as-yet unseen application for hybrid vehicle technology would be in garbage trucks, since these vehicles do stop-start driving and often stand idling.

Taxicabs

In 2005, New York City added six Ford Escape Hybrids to their taxi fleet and city officials said the entire fleet of 13,000 vehicles could be converted within five years.[6]

Types

There are many types of hybrids, differentiated by how the electric and fueled halves of the powertrain connect, and at what times each portion is in operation. Two major categories are *series hybrids* and *parallel hybrids*, though *parallel designs* are most common today. Some hybrid vehicles don't even use electricity for auxiliary energy storage.

Most hybrids, no matter the specific type, use regenerative braking to recover energy when slowing down the vehicle. This simply involves running the motor backwards as a generator.

Many designs also shut off the internal combustion engine when it is not needed in order to save energy. That concept is not unique to hybrids; Subaru pioneered this feature in the early 1980s, and the Volkswagen Lupo 3L is one example of a conventional vehicle that shuts off its engine when at a stop. Some provision must be made, however, for accessories such as air conditioning which are normally driven by the engine. Furthermore, the lubrication systems of internal combustion engines are inherently least effective immediately after the engine starts; since it is upon startup that the majority of engine wear occurs, the frequent starting and stopping such systems cause may reduce the lifespan of the engine considerably. Also, start and stop cycles may reduce the engine's ability to operate at its optimum temperature, thus reducing the engine's efficiency.

Series

In a series design, the internal combustion engine is not directly connected to the drivetrain at all, but powers an electrical generator instead. This is similar to the operation of diesel-electric train locomotives, except that as of [[2006], the overwhelming majority of diesel-electric locomotives do not store auxiliary power in batteries for use in propulsion. A series hybrid is similar to an electric car which is recharged by electricity from a stationary fossil fuel power plant, except that the power plant is carried on board.

Electricity from the generator is fed to the motor or motors that actually move the car, and excess energy can be used to charge batteries. When large amounts of power are required, electricity comes from both the battery pack and the engine-generator section. Because electrical motors can operate quite efficiently over a wide range of speeds, this design removes or reduces the need for a complex transmission. The internal combustion engine can also be finely tuned to operate at its most efficient speed whenever it is running, for a great gain in efficiency. Separate small electric motors installed at each wheel are featured in some prototypes and concept cars; this allows the possibility of easily controlling the power delivered to each wheel, and therefore simplifies traction control, all wheel drive, and similar features.

The advantage of this type of hybrid is the flexibility afforded by the lack of a mechanical link between the internal combustion engine and the wheels. A weakness of a series hybrid system, however, is that series hybrids require separate motor and generator portions, which can be combined in some parallel hybrid designs; the combined efficiency of the motor and generator will be lower than that of a conventional transmission, offsetting the efficiency gains that might otherwise be realized. Still, series hybrids are useful in driving cycles that incorporate many stops and starts, such as for delivery vehicles. It is likely that some fuel cell cars will use a series-style setup, with the fuel cells replacing the engine-generator section; this would eliminate the loss of efficiency inherent in converting the mechanical output of an internal combustion engine to electrical power.

Parallel

Parallel systems, which are most common at present, connect both the electrical and internal combustion systems to the mechanical transmission. They can be subcategorized depending upon how balanced the different portions are at providing motive power. In some cases, the internal combustion engine is the dominant portion and is used for primary power, with the motor turning on only when a boost is needed. Others can run with just the electric system operating alone. Most designs combine a large electrical generator and a motor into one unit, often situated between the internal combustion engine and the transmission, in the location of the flywheel, replacing both the conventional starter motor and the generator or alternator. A large battery pack is required, providing a higher voltage than the normal automotive 12 volts. Accessories such as power steering and air conditioning are powered by electric motors, so that they continue to function when the internal combustion engine is stopped; this offers the possibility of further efficiency gains, by modulating the electrical power delivered to these systems, rather than having them run directly from the engine at a speed which depends on engine speed.

Full hybrid

A *full hybrid*, sometimes also called a *strong hybrid*, is a vehicle that can run on just the engine, just the batteries, or a combination of both. The Prius and Escape Hybrids are examples of this, as both cars can be moved forward on battery power alone. A large, high-capacity battery pack is needed for battery-only operation. These vehicles have a split power path that allows more flexibility in the drivetrain by interconverting mechanical and electrical power, at some cost in complexity. To balance the forces from each portion, the vehicles use a differential-style linkage between the engine and motor connected to the head end of the transmission.

The Toyota brand name for this technology is Hybrid Synergy Drive, which is being used in the Prius and the Highlander sport-utility vehicle (SUV). A computer oversees operation of the entire system, determining which half should be running, or if both should be in use, shutting off the internal combustion engine when the electric motor is sufficient to provide the power. The normal mode of operation is on electrical power alone, with the gasoline engine running only in cases where the extra power is required, or where the batteries are discharged. The hybrid drivetrain of the Prius, in combination with aerodynamics and optimizations in the engine itself to reduce drag, results in 80%–100% gains in fuel economy compared to four-door conventional cars of similar weight and size.

The main principle behind this system is the more-or-less complete decoupling of the power supplied by the engine (or other primary source) from the power demanded by the driver. Thus a smaller, less flexible engine may be used, which is designed for maximum efficiency (often using variations of the conventional Otto cycle, such as the Miller or Atkinson cycle). This contributes significantly to the higher overall efficiency of the vehicle, with regenerative braking playing a much smaller role.

The differing torque vs. rpm characteristics of the internal combustion and electrical motors operate synergistically; an internal combustion engine's torque is minimal at lower RPMs, since the engine must be its own air pump. Thus, the need for reasonably rapid acceleration from a standing start results in an engine which is much larger than required for steady speed cruising. On the other hand, an electrical motor exhibits maximum torque at stall; therefore this engine is well suited to complement the internal combustion engine's torque deficiency at low RPMs, allowing the use of a much smaller and therefore more fuel efficient engine.

General Motors, BMW, and DaimlerChrysler are working together on a so-called Two-Mode Hybrid system which is a full hybrid plus additional efficiency improvements. The technology will be released in 2008 on the Chevrolet Tahoe Hybrid. The system was also featured on the GMC Graphite SUV concept vehicle at the 2005 North American International Auto Show in Detroit.[7]

Assist hybrid

Assist hybrids use the engine for primary power, with a torque-boosting electric motor also connected to a largely conventional powertrain. The electric motor is essentially a very large starter motor, which operates not only when the engine needs to be turned over, but also when the driver "steps on the gas" and requires extra power. Honda's hybrids including the Insight use this design, leveraging their reputation for design of small, efficient gasoline engines; their system is dubbed Integrated Motor Assist (IMA). Assist hybrids differ fundamentally from full hybrids in that they cannot run on electric power alone. However, since the amount of electrical power needed is much smaller, the size of the battery systems is reduced.

A variation on this type is Mazda's e-4WD system, offered on the Mazda Demio sold in Japan. This front-wheel drive vehicle has an electric motor which can drive the rear wheels when extra traction is needed. The system is entirely disengaged in all other driving conditions, so it does not enhance performance or economy.

Ford has dubbed Honda's hybrids "mild" in their advertising for the Escape Hybrid, arguing that the Escape's full hybrid design is more efficient. However, assist hybrids should not be confused with actual mild hybrids like the Chevrolet Silverado Hybrid.

Mild hybrid

Mild hybrids are essentially conventional vehicles with oversized starter motors, allowing the engine to be turned off whenever the car is coasting, braking, or stopped, yet restart quickly and cleanly. Accessories can continue to run on electrical power while the engine is off, and as in other hybrid designs, the motor is used for regenerative braking to recapture energy. The larger motor is used to spin up the engine to operating rpm speeds before injecting any fuel.

Many people do not consider these to be hybrids at all, and these vehicles do not achieve the fuel economy of full hybrid models. A major example is the 2005 Chevrolet Silverado Hybrid, a full-size pickup truck. Chevrolet was able to get a 10% improvement on the Silverado's fuel efficiency by shutting down and restarting the engine on demand. Mild hybrids often use 48 volt systems to supply the power needed for the startup motor, as well as to compensate for the increasing number of electronic accessories on modern vehicles.

General Motors followed the pickup truck hybrid with their Belt alternator starter (BAS) hybrid system, used in the 2006 Saturn VUE Green Line. It operates in much the same manner as the "start-stop" system in the Silverado, but the electric motor can also provide modest assist under acceleration.

Plug-in hybrid

Main article: **Plug-in hybrid electric vehicle**

A *plug-in hybrid electric vehicle* (*PHEV*) is a full hybrid, able to run in electric-only mode, with larger batteries and the ability to recharge from the electric power grid. They are also called *gas-optional*, or *griddable hybrids*. Their main benefit is that they can be gasoline-independent for daily commuting, but also have the extended range of a hybrid for long trips. They can also be multi-fuel, with the electric power supplemented by diesel, biodiesel, or hydrogen. The Electric Power Research Institute's research indicates a lower total cost of ownership for PHEVs due to reduced service costs and gradually improving batteries. The "well-to-wheel" efficiency and emissions of PHEVs compared to gasoline hybrids depends on the energy sources of the grid (the US grid is 50% coal; California's grid is primarily natural gas, hydroelectric power, and wind power). Particular interest in PHEVs is in California where a "million solar homes" initiative is under way, and global warming legislation has been enacted.

Prototypes of plug-in hybrid cars, with larger battery packs that can be recharged from the power grid, have been built in the U.S., notably at Prof. Andy Frank's Hybrid Center**[8]** at UC Davis and one production PHEV, the Renault Kangoo, went on sale in France in 2003. DaimlerChrysler is currently building PHEVs based on the Mercedes-Benz Sprinter van. Light Trucks are also offered by Micro-Vett SPA**[9]** the so called Daily Bimodale.

The California Cars Initiative has converted the '04 and newer Toyota Prius to become a prototype of what it calls the PRIUS+. With the addition of 300 lb of lead-acid batteries, the PRIUS+ achieves roughly double the gasoline mileage of a standard Prius and can make trips of up to 10 miles using only electric power.**[10]**

Car companies are working on plug-in hybrids, but current technology makes do not perform well. According to Dave Hermance, the Executive Engineer for Advanced Technology for Toyota North America, a plug-in hybrid in "electricity mode is only capable of 35 miles an hour top speed. It has fairly glacial acceleration performance and cost 15 to 25 thousand dollars more money."

Hydraulic hybrid

A hydraulic hybrid vehicle uses hydraulic and mechanical components instead of electrical ones. A variable displacement pump replaces the motor/generator, and a hydraulic accumulator replaces the batteries. The hydraulic accumulator, which is essentially a pressure tank, is potentially cheaper and more durable than batteries. Hydraulic hybrid technology was originally developed by Volvo Fly-g-motor and was used experimentally in buses from the early 1980s and is still an active area.

Initial concept involved a giant flywheel for storage connected to a hydrostatic transmission, but it was later changed to a simpler system using a hydraulic accumulator connected to a hydraulic pump/motor. It is also being actively developed by Eaton and several other companies, primarily in heavy vehicles like buses, trucks and military vehicles. An example is the Ford F-350 Mighty Tonka concept truck shown in 2002. It features an Eaton system that can accelerate the truck up to highway speeds.

Pneumatic hybrid

Compressed air can also power a hybrid car with a gasoline compressor to provide the power. MDI in France produces such air cars (See video). An Australian company invented a highly efficient air engine which may make pneumatic hybrid vehicle more competitive.

High-Power Biodiesel Hybrid

The newest hybrid still yet to reach the market is the High-Power Biodiesel Hybrid (HPBH). These cars run on a hybrid engine with a mix of fuels and have excellent fuel efficiency and power. In 2006, Students from Philadelphia created a HPBH car which utilised soybean fuel that could go from 0-60 mph in 4.0 seconds and still achieve 50 MPG.

The different hybrid modes

Engines and fuel sources

Gasoline

Gasoline engines are used in most hybrid designs, and will likely remain dominant for the foreseeable future. While petroleum-derived gasoline is the primary fuel, it is possible to mix in varying levels of ethanol created from renewable energy sources. Like most modern ICE-powered vehicles, hybrids can typically use up to about 15% ethanol. Manufacturers may move to flexible-fuel engines, which would increase allowable ratios, but no plans are in place at present.

Diesel

One particularly interesting hybrid vehicle combination uses a diesel engine for power. Diesels are excellent at delivering constant power for long periods of time, suffering less wear while operating at higher efficiency. The Diesel engine's high torque, combined with hybrid technology, may offer performance in a car of over 100 mpg US (2.35 L per 100 km).

Nowadays most diesel vehicles, and therefore the diesel part of hybrids, have the advantage they can use 100% pure biofuels (biodiesel), so they can use but don't need petroleum at all.

Diesels are not widely used for passenger cars in the United States, as US diesel fuel has long been considered very "dirty", with relatively high levels of sulfur and other contaminants in comparison to the Eurodiesel fuel in Europe, where greater restrictions have been in place for many years. Despite the "legally allowed" dirtier fuel, the US has tough restrictions on exhaust, and it has been difficult for car manufacturers to meet emissions levels given what is put into the engine. However, ultra-low sulfur diesel is set to be mandated in the United States in October 2006.

VW made a prototype diesel-electric hybrid car that achieved 118 mpg US fuel economy (2 liters per 100 km), but has yet to sell a hybrid vehicle.

General Motors has been testing the Opel Astra Diesel Hybrid. So far, hybrid diesels have mostly appeared in mass transit buses, primarily made by General Motors' New Flyer division in the United States, and by Japanese manufacturers (Toyota, Hino, Isuzu) since 1997 for sale in Japan only, a country more sensible to contamination problem than other ones.

Fuel cells

Some fuel cell-powered vehicles currently in development use some hybrid-like technology to store auxiliary energy. Like diesels above and steam power outlined below, fuel cells are best at delivering a fairly constant flow of electricity, so having a secondary system is helpful. In some cases, batteries have been replaced with ultracapacitors, which can store and retrieve energy quickly, but are inappropriate for long-term electrical storage.

Turbines and Steam Engines

At present, no current or announced mass-market car is driven by a gas turbine, but hybrid technology might bring back gas turbines. From the 1950s to the 1970s Chrysler created several turbine-powered vehicles, though only small numbers were produced. They had complex drivetrains and achieved relatively slow starting speeds, with effects reminiscent of "turbo lag," but demonstrated that turbines could be used for automobiles (see Chrysler Turbine engines). Both gas turbines and steam turbines (see below) are lighter than reciprocating steam and internal combustion engines, respectively, and more efficient than the corresponding reciprocating types when operating at their optimum power output. On the other hand, they have very limited optimum power output ranges, and must be used with electric drive or some other sort of transmission. Operation of turbines outside of their optimum power output ranges drastically reduces their efficiency. This is not prohibitive for a ship or aircraft that is mostly operated at very constant power output, or for a power plant containing many turbines that can be put on-line or off-line as needed to match load, but has resulted in near-eradication of turbine engines from land vehicles.

At present, no current or announced mass-market car is driven by a steam engine, but hybrid technology could bring back the steam-powered car. In the early 20th century, cars made by the Stanley Steamer Company with reciprocating steam engines did compete successfully with the internal combustion engine. Reciprocating steam engines have a much larger range of operating speeds than do internal combustion engines, including the ability to produce full torque at stall speed, thus eliminating the need for a transmission; however, they have not been able to compete with internal combustion for land vehicles for several reasons:

- Lower thermal efficiency possible with today's materials — a heat engine such as an internal combustion engine or steam has efficiency limited by its Carnot cycle temperature differential. A steam engine must transfer combustion heat through the material of the boiler, which therefore must be able to withstand the heat, while an internal combustion engine can bypass this limitation by having the piston and cylinder materials always remain at much less than the combustion temperature (at the cost of some loss of efficiency due to unwanted cooling of the combustion gas).
- Longer warm-up time and slow throttle response — this is no great problem for trains and ships which are restricted from quick acceleration by their huge mass and which also generally have predictable demand for power, but is a challenging issue for automobiles, trucks, and buses
- More complex controls — the driver of a Stanley Steamer had to keep a close eye on several pressure and temperature gauges while driving (on the other hand, with modern computers, much of this could be handled automatically)

Gas turbine (or other internal combustion engine), steam turbine, and hybrid technology could be combined to alleviate the disadvantages of gas turbines and steam engines while retaining most of their advantages. In combined cycle power plants, gas turbines drive generators, and their exhaust is used to generate steam for steam turbines, thus recovering some of the energy from the heat of the exhaust that would otherwise be wasted. This principle can be used in vehicles, and is currently in use in ships as COGAS or COGES[4], although the only public proposal for such technology in an automobile uses a conventional internal combustion engine for this purpose instead of a gas turbine[5] (a configuration that has also seen use on ships). A combined cycle gas turbine/steam turbine (or internal combustion engine/steam turbine) set could be combined with hybrid technology to allow the combined cycle system to operate at its most efficient power output. The energy storage system would store energy from the combined cycle system when its output exceeds propulsion requirements and provide energy to the propulsion system when propulsion requirements exceed the combined cycle system output, including combined cycle system startup. The energy storage system would need to have an especially high capacity to work well with a combined cycle system, since the combined cycle system would operate inefficiently during startup and shutdown; therefore, the energy storage system would need to support long intervals between combined cycle startup and shutdown.

Hybrid fuel

In addition to vehicles that use two or more different devices for creating motive power, some also consider vehicles that use distinct energy input types (fuels) to be hybrids, although to avoid confusion with hybrids as described above, these are better described as dual mode vehicles:

- Some electric trolleybuses can switch between an onboard diesel engine and overhead electrical power depending on conditions (see dual mode bus. In principle, this could be combined with a battery subsystem to create a true plug-in hybrid trolleybus, although as of 2006, no such design seems to have been announced.
- Flexible-fuel vehicles can use a mixture of input fuel — typically gasoline and ethanol, though diesel-biodiesel and liquid petroleum gas-natural gas (LPG-NG) vehicles would also qualify.
- Some vehicles have been modified to use another fuel source if it is available, such as cars modified to run on propane and diesels modified to run on waste vegetable oil.
- Power-assist mechanisms for bicycles and other human-powered vehicles are also included.

Human Power

Motorized bicycles use human pedal power and an attached motor. Some bicycle conversion kits aided popularisation of "hybrid" vehicle bicycles that used electric hub motors (such as Bionx[11] and Wilderness Energy[12]), internal combustion engines (such as the 1940s "Pixie" bicycle motor), and pedal power. Such machines include electric bicycles and mopeds, which may often be simultaneously propulsed by human and engine power. More sophisticated constructions are three wheeled and provide at least a windscreen (ZAP EPOD, TWIKE).

Benefits

Benefits of the hybrid design include:

- The internal-combustion engine in a hybrid vehicle is much smaller, lighter, and more efficient than the one in a conventional vehicle, because the engine can be sized for slightly above average power demand rather than peak power demand. The power curve of electric motors is better suited to variable speeds and can provide substantially greater torque at low speeds compared with internal-combustion engines.
- Like many electric cars, but in contrast to conventional vehicles, braking in a hybrid is controlled in part by the electric motor which can recapture part of the kinetic energy of the car to partially recharge the batteries. This is called regenerative braking and one of the reasons for the high efficiency of hybrid cars. In a conventional vehicle, braking is done by mechanical brakes, and the kinetic energy of the car is wasted as heat.
- Hybrids are much more energy efficient than traditional internal combustion engine vehicles because they generally provide greater fuel economy. This statistic has a major implication for the reducing petroleum consumption and vehicle air pollution emissions worldwide**[13]**
- Reduced wear and tear on the gasoline engine.
- Reduced wear on brakes from the regenerative braking system use.
- Reduced noise emissions resulting from substantial use of electric engine at low speeds, leading to roadway noise reduction and beneficial noise health effects.
- Reduced air pollution emissions due to less fuel consumed per travel mile, leading to improved human health with regard to respiratory and other illness. In fact composite driving tests indicate total air pollution of carbon monoxide and reactive hydrocarbons are 80 to 90 percent cleaner for hybrid versus conventional vehicles[6].

Incentives

In order to encourage the purchase of hybrid vehicles, several incentives have been made into law:

- The purchase of hybrid cars qualifies for a $2000 tax deduction on the IRS 1040 form for the year of 2003. The deduction reduces by $500 each year until it reaches zero. HR 1308 Sec. 319 proposed the phasing out of the deduction to put on hold for the year 2004 and 2005 (i.e., hybrid car buyers can enjoy the $2000 deduction before the phasing out resumes at $500 in 2006).
- The Federal tax deduction will turn into a tax credit starting Jan 1, 2006. However only 60,000 new cars sold by each car manufacturer would qualify for such tax credit.
- Many states give tax credits to hybrid car buyers.

- Certain states (e.g., California, Virginia and Florida) allow singly-occupied hybrid vehicles to enter the HOV lanes on the highway. Initially, the Federal Highway Administration ruled that this was a violation of federal statute[14] until August 10, 2005 when George W. Bush signed the Transportation Equity Act of 2005 into law.
- Some states, e.g. California, exempt hybrid cars from the biennial smog inspection, which costs over $50 (as of 2004).
- Hybrid cars can go on certain toll roads for free.
- City of San Jose, CA issues a free parking tag for hybrid cars that were purchased at a San Jose dealership. The qualified owners do not have to pay for parking in any city garage or road side parking meters
- City of Los Angeles, CA offers free parking to all hybrid vehicles starting on October 1, 2004. The experiment is an extension to an existing offer of free parking for all pure electrical vehicles.
- In October, 2005, City of Baltimore, MD started to offer discount on monthly parking in the city parking lots, and is considering free meter parking for hybrid vehicles. On November 3, 2005, the Boston Globe reports that the city council of Boston is considering the same treatment for hybrid cars.
- Annual vehicle registration fees in the District of Columbia are half ($36) that paid for conventionally vehicles ($72).
- Drivers of hybrid vehicles in the United Kingdom benefit from the lowest band of vehicle excise duty (car tax) which is based on CO2 emissions. In London, these vehicles are also exempt from the £8 ($14) daily congestion charge in central London.

Trade-offs

In some cases, manufacturers are producing hybrid vehicles that use the added energy provided by the hybrid systems to give vehicles a power boost, rather than significantly improved fuel efficiency compared to their traditional counterparts.[15] The trade-off between added performance and improved fuel efficiency is mainly something controlled by the software within the hybrid system. In the future, manufacturers may provide hybrid-owners with the ability to set this balance (fuel efficiency vs. added performance) as they wish, through a user-controlled setting.[16] Toyota announced in January, 2006 that it was considering a "high-efficiency" button.

It has been observed that the success of the hybrid systems comes despite the need to carry two complete power systems. In a poorly designed car this might increase the weight and size and therefore greater losses in acceleration and aerodynamic drag, although the Prius is lighter and more aerodynamic than many other cars. In fact, the relative desirability of this concept rests on the deficiencies of the two underlying systems; the unfavorable torque curve of the internal combustion engine, referred to above, and the lack of a system of storing and delivering electrical power with anything near the energy density of combustible liquid fuels, so that a fuel tank, internal combustion engine, and generator together still represent a better source of electrical power than the equivalent weight and volume of batteries. In the event of relatively large leaps forward in battery or fuel cell technology, the internal combustion portion of the hybrid will become superfluous. Somewhat less likely is the possibility of a change in the general popular mode of automobile use largely supplanting short trips by use of mass transportation, so that the majority of automotive operation becomes steady speed cruising rather than stopping and starting; this would eliminate the advantage gained from regenerative braking and the low rpm torque boost of the electrical portion of the hybrid, and allow very small forced induction internal combustion engines to become viable competitors of the heavier hybrid systems.

Skeptics claim that mechanics are not fond of working on hybrid vehicles due to added complexity, but the Toyota mechanics in Atlanta and other U.S. cities say they are delighted by the cars, and hundreds of enthusiastic engineer-owners gather on the Internet and in clubs. The complexity may result in greater repair costs, although Toyota offers regular and extended warranties at the same cost as their other vehicles, so this will not affect the end user. These vehicles have been available for ten years and the lifespan and resale values are good. Hundreds of thousands are in use, but Toyota reports very few problems with battery packs.

Disposal is an additional issue. By its very nature, a battery must be made of highly reactive chemicals; the more power density the battery offers, the more reactive the chemicals it contains. However, all discarded hybrid vehicles will be returned for proper recycling and disposal; dealers and mechanics are trained for this, and rigorous regulations are in effect. Virtually all automobile batteries in the U.S. are recycled, and the environmental effects of leachates from the small number of hybrid battery packs that are not recycled will be no worse than they are from ordinary automobile batteries. (The Prius battery pack is only a little larger than the starter battery.)

Finally, the typical hybrid vehicle is more expensive than corresponding non-hybrids (e.g., Civic vs Civic Hybrid). Although the variables involved are many, those more concerned about economics than the environment might steer away from hybrids in favor of traditional economy vehicles, as they would result in a lower cost in most cases.

Hybrids vs. electric vehicles

All-electric cars are more popular in Europe than in the U.S. The major U.S. automobile manufacturers argue that customer demand for pure electric cars is small. In addition, the long suburban commutes common in the U.S. make range an important criterion for electric vehicle design. However, if advances in battery technology allow increased range at comparable cost to gasoline-powered vehicles, manufacturers will likely mass-market electric vehicles. The relative cost of gasoline to an equivalent amount of electrical energy will also be a critical factor in the electric vehicle market.

For now, car manufacturers are focusing on fuel cell-based cars and hybrids. Toyota intends that all of its vehicles be hybrid electric by 2012.

Other hybrid vehicles

Railpower[17] offers hybrid road switchers, as does GE.[18] Diesel-electric locomotives may not always be considered hybrids, not having energy storage on board, unless they are fed with electricity via a collector for short distances (for example, in tunnels with emission limits), in which case they are better classified as dual mode vehicles.

See also

- Alternative propulsion
- Auto show
- Battery electric vehicle
- Electric vehicle
- Gas-electric hybrid engine
- List of hybrid vehicles

Footnotes & references

1. ' Electric motors can in general also be used as generators, depending on the applied voltage, direction of current flow, and the phase of commutation in the motor. The principal difference between a motor and a generator is one of design optimization only.

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List of hybrid vehicles

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This is a *list of hybrid vehicles* in chronological order of production:

Early designs

- 1907 AL (French car)

1990s

- 1996 AC Propulsion tzero (primarily electric vehicle; 80 mile PbA, 300 mile Li-ion(2003) EV-mode)
1997 Toyota Prius

2000s

- 2000 Honda Insight
2000 Toyota Estima hybrid (Japanese market only)
2002? Mazda Demio e-4WD (Japanese market only, used for traction assistance)
2002 New Flyer DE60LF (diesel-electric hybrid articulated bus)
2003 AC Propulsion tzero (primarily electric; Li-ion, 300 mile EV-mode)
2003 Honda Civic Hybrid
2003 Renault Kangoo (plug-in hybrid electric vehicle)
2003 Toyota Alphard Hybrid
2003 Suzuki Twin
2005 Daihatsu Hijet Cargo Hybrid
2005 Honda Accord Hybrid
2005 Ford Escape/Mercury Mariner Hybrid (released in late summer 2004)
2005 Lexus RX 400h

2005 Toyota Kluger/Highlander Hybrid
2005 Chevrolet Silverado/GMC Sierra Hybrid

Unknown date

- Gillig Hybrid (diesel-electric hybrid buses)

New Flyer DE30LF/DE35LF/DE40LF (diesel-electric hybrid buses)
New Flyer GE40LF (gasoline-electric hybrid bus)
Toyota Sienna
Motorized bicycle (human power and engine)
Whispering Wheel Buss
Aptera hybrid car Prototype planned for April 2006

Planned

- 2005 Daihatsu Hijet Cargo Hybrid a commercial mini car (659 cc) (in Japan)

2007 Toyota Camry Hybrid (expected late Spring 2006, announced May 1, 2005, will be built in Kentucky, USA)
2007 Lexus GS 450h
2008 Dodge Durango Hybrid
2008 Ford Fusion Hybrid

Gas-electric hybrid engine

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A *gas-electric hybrid engine* is a combination of a gasoline/petrol or diesel internal combustion engine with an electric motor to power a vehicle. Various designs exist for how the motor and engine interact with the drive train. Because the engine recharges the battery smaller batteries are required than in an electric vehicle.

A standard combustion engine is required to operate over a range of speed and power, yet its highest efficiency is in a narrow range of operation. Also, an engine designed for a reduced operating range can be more efficient than a standard engine. The battery storage and electric motor allows the engine to operate at its point of maximum efficiency, to be of a higher efficiency design, and to be smaller than non-hybrid applications.

The gas-electric hybrid uses less gasoline than conventional internal combustion engines and does not have the limitations in range that have been a problem for traditional battery electric vehicles. This type of piston engine is used in hybrid electric vehicles which have begun to enter the market as of 1999.

See the more complete discussion of this article in the article hybrid vehicle.

Plug-in hybrid electric vehicle

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A *plug-in hybrid electric vehicle* (PHEV) or gas-electric hybrid fueled vehicle is a hybrid which has additional battery capacity and the ability to be recharged from an external electrical outlet. In addition, modifications are made to the vehicle's control software. The vehicle can be used for short trips of moderate speed without needing the internal combustion engine (ICE) component of the vehicle, thereby saving fuel costs. In this mode of operation the vehicle operates as a pure electric vehicle with a weight penalty (the ICE). The long range and additional power of the ICE power train is available when needed.

PHEVs are commonly called "grid-connected hybrids," "gas-optional hybrids" (GO-HEVs), "full hybrids," and are sometimes called HEV-30 (for instance, to denote a hybrid with a 30-mile (50 km) electric range, compared to a HEV-0 (a non-plug-in hybrid). However, Ford, GM, and Toyota have all used the term "Full Hybrid Technology" to describe configurations that allow electric-only operation at low speeds (yet not PHEVs). Two other PHEV names used by a major U.S. automotive supplier and in a 1999 SAE paper are "energy hybrids" and "true hybrids." PHEVs can also operate in a mixed-mode where both gas and external electricity are used simultaneously to increase gas mileage for a particular range, usually double that of its electric-only range.

Types

Some early non-production plug-in hybrid electric vehicle conversions have been based on the version of Hybrid Synergy Drive (HSD) found in the 2004+ model year Toyota Prius. Early Pba conversions by CalCars have demonstrated 10 miles (15 km) of EV-only and 20 miles (30 km) of double mileage mixed-mode range. A company planning to offer conversions to consumers named EDrive systems will be using Valence Li-ion batteries and have 35 miles (55 km) of electric range. Another company offering a plug-in module for the Toyota Prius is Hymotion. All of these systems leave the existing HSD system mostly unchanged and would be fairly simple to apply to other hybrid configurations. A conversion to plug-in mode involves replacing the stock NiMH battery with a higher capacity battery pack and a higher power charger to recharge the larger pack.

The cost of electricity for for a PHEV is about $0.03/mi ($0.019/km) from standard household outlets. Though the Honda Integrated Motor Assist (IMA) system does not have low-speed electric-only capability, mixed-mode mileage could be greatly enhanced while displacing some of their gasoline consumption with electricity from external sources. The Advanced Hybrid System 2 (AHS2) could be offered with additional battery capacity and charging capabilities as an option, costing about $3000 if offered by the manufacturer. Although the possibility is fairly remote, General Motors or DaimlerChrysler could potentially effect a marketing coup by producing a markedly more versatile and fuel-efficient hybrid; a PHEV.

Current PHEV conversions install a higher capacity battery than common hybrids like the Toyota Prius in order to extend the range. This additional cost is offset by fuel operating cost savings because just $1.00 worth of electricity from the wall (at $0.09/kW·h) will drive you the same distance as a gallon of gasoline. During the year 2006, many government and industry researchers will focus on determining what level of all-electric range is economically optimum for the design.

While PHEV concepts and research have been neglected for many years by industry and government, strong interest is budding in 2006 to such a level that the architecture has even been included as an area of research in President George W. Bush's Advanced Energy Initiative. The "addiction to oil" mentioned in his 2006 State of the Union Address could be largely eliminated by PHEVs and this fact is the most dramatic advantage of the architecture.

Advantages

A 70-mile range HEV-70 will annually require only about 25% as much gasoline as a similarly designed HEV-0. A further advantage of PHEVs is that they have potential to be even more efficient than their HEV-0 cousins because the operation envelope of their IC engine is far more simple. While a Prius is likely to convert fuel to motive energy on average at about 30% efficiency (well below the engine's 38% peak efficiency) the engine of a PHEV-70 would likely operate far more often near its peak efficiency because it is not needed during transient operation conditions. These architectures would be highly likely to employ a parallel hybrid configuration whereby mechanical engine power is allowed to transfer most efficiently directly to the wheels (when the engine is activated).

Another advantage of the PHEV architecture is the synergy it offers with biofuels. It has long been understood that crop production in most countries is not sufficient to supply all of the biofuel needs of society, especially when food production is the obvious primary purpose. However, PHEVs dramatically reduce the requirement for liquid fuel to as little as 20% of an equivalent HEV-0. This produces a synergy between PHEVs and biofuels whereby extreme reductions in petroleum usage are possible. For example, E85 which is composed of 85% ethanol stretches petroleum by a factor of about 2.5 today. Combining E85 as the liquid fuel with a PHEV-70 results in a petroleum stetch factor of 10 (2.5 x 4). If an HEV-0 achieves 50 mpg U.S. (4.7 L/100 km), the similar PHEV-70 would develop 500 mpgp (0.47 L/100 km) (petroleum consumption) if fueled by E85.

Implementations

A number of interesting prototypes have been created, mostly at the UC Davis Hybrid Center by teams led by Prof. Andy Frank, but there are no production vehicles available at this time (2005). Some independent researchers have demonstrated conversions of vehicles such as the Toyota Prius, while leaving the majority of the stock Hybrid Synergy Drive intact and unchanged by simply adding battery capacity and a grid charger.

There has been little interest from the conventional manufactures, although the motorcycle and small car manufacturer Suzuki has produced several prototype light sports cars capable of operation in this mode. The first of these used a 400 cc motorcycle engine to give a primarily electric vehicle a "limp home" capability. A subsequent model was more capable of general operation over a wide range of conditions and ranges.

CalCars, a non-profit advocacy and technology development group in California has converted one 2004 Prius into what it calls a "PRIUS+" as proof of concept. It is now working with EDrive Systems, a new Southern California company that plans to offer installed aftermarket conversions for 2004-2006 Priuses with a target fuel efficiency of 230 mpg (1.0 L/100 km).[1] And the Electric Power Research Institute of Palo Alto, along with a number of utilities and government agencies, is working with DaimlerChrysler to deliver three plug-in hybrids built on the Mercedes Sprinter platform (a 15-passenger van). The Electric Auto Association is sponsoring the EAA-PHEV project, a "Do-It-Yourself" approach to enable those who are comfortable working with high wattage DC systems to do their own conversion.

Hymotion, a canadian company, introduced plug-in hybrid upgrade kits in February 2006. Designed for the Toyota Prius and the Ford Escape and Mariner Hybrids, these kits will be offered to fleet buyers at first and should be available to the general public in 2007.

Battery electric vehicle

A battery electric vehicle with a range extending trailer called pusher trailers or genset trailers might also be considered a plug-in hybrid. About 15 kW of power is required to maintain freeway speeds in a lightweight EV. This is about one third the power output of the Honda Insight's 1 L three cylinder ICE. One advantage of this configuration is that the ICE or other energy conversion device can be tuned to maximize efficiency by running at an ideal constant power level.

Vehicle-to-grid

Another advantage of a gridable vehicle is their potential ability to load balance or help the grid during peak loads. By using excess battery capacity to send power back into the grid and then recharge during off peak using cheaper power such vehicles are actually advantageous to utilities as well as their owners. This is accomplished with what is known as V2G or Vehicle to Grid technology. Even if such vehicles just led to an increase in the use of night time electricity they would even out electricity demand (which is typically higher in the day time) and provide a greater *return on capital* for electricity infastructure.

Luxury vehicles

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A *luxury vehicle* is a vehicle which provides a great abundance of ease and comfort. Although there can be a great range of vehicles that offer luxurious settings, a luxury vehicle will always be categorized as: a car (sedan, coupè, hatchback, station wagon, roadster, etc.), a light truck (light pickup trucks), or an SUV. Luxury vehicles place more emphasis on comfort, appearance, and amenities than on performance, economy, or utility. Furthermore, they usually offer more modern technology, higher quality materials, and are often built in smaller numbers than more affordable mass-market vehicles.

General definition (for American cars)

While a luxury car is difficult to define as it is somewhat subjective, there are certain guidelines by which the luxury cars are defined. Currently, that means its Mean Selling Price (MSP) is excess of roughly US$36,000 or higher. In addition to being relatively expensive, luxury cars also offer a higher degree of comfort than their mainstream counterparts as well as a highly sumptuous interior with a strong emphasis on design and beauty.

A vehicle may still be considered an entry-level luxury vehicle if its base MSP is in the general range of $29,000 and $36,000, it features a strong emphasis on comfort, *and* it is manufactured by a luxury car maker. Luxury car makers are companies which produce cars at approximate price of $36,000. In order for a vehiclemade by a non-luxury marque to be considered a luxury car, it should have a base MSP of roughly $36k.

In addition to featuring a high base price and high levels of comfort luxury, cars typically carry prestige. Although this cannot be measured in finite quantities, "prestige" usually refers to the allure which the car carries. From prestige, people get the idea of "paying for the emblem". For example, because of its prestige, the BMW 3 Series might cost more than if the same car if it was sold under a non-luxury marque. Also, it is important to note, that in no way are all prestige cars actually luxury cars (e.g. the Dodge Viper is certainly not a luxury car).

Non-luxury prestige vehicles

In the car market of the new millennium, it has become rather difficult to determine whether a vehicle is indeed a luxury car or not. Many vehicles such as the GMC Yukon or the Chevrolet Suburban fit the price criteria to be considered luxury vehicles, yet they do not have many of the amenities of other luxury vehicles.

There are quite a few vehicles who have luxury car-like prestige and/or pricing but do not offer the degree of comfort required for them to actually be considered luxury vehicles; these vehicles include the Hummer H1, the Chevrolet Corvette and the Dodge Viper. All three vehicles have base MSPs of above $36,000 and the Hummer H1 is made by a company whose entire lineup, with exception of the Hummer H3, features base MSPs in excess of $50,000. Yet all three lack the comfort needed to make them luxury vehicles. Further, many non-luxury prestige vehicles with extremely high prices, such as the Porsche 911 and many Lamborghinis are often mistaken for luxury vehicles, however, in comparison to the other luxury cars (even in the mid-luxury segment), they are not luxury vehicles.

Other vehicles, such as the Mercury Grand Marquis, are not considered to be luxury vehicles due to their relatively low MSRPs, despite their high degree of comfort.

Luxury market segments (for American cars)

Note that the following classifications of cars does not include certain packages that come with the car that might raise the car into a higher level. For example, the average BMW 3 Series sells in the "entry level" category. But the M3 is certainly part of the mid-level category. Also, vehicles such as the Lincoln Town Car or Cadillac DTS feature interiors as plush and luxurious as those of the Mercedes-Benz S-Class or BMW 7 Series, yet are classified as mid-luxury due to their relatively low MSPs.

Luxury Car Segments, according to MSP

Price	$10k — $20k	$20k — $30k	$30k — $40k	$40k — $50k	$50k — $60k	$60k — $70k	$70k — $80k	$80k — $90k	$90k — $100k	$100k or more
		$29k	$38k	$40k	$60k					
Luxury car manufacturers			Entry-level	Mid-level		High-end				Ultra
Non-luxury car manufacturers			Entry-level	Mid-level		High-end				Ultra

Entry-level luxury

The entry-level luxury forms the beginning classification of the luxury vehicles; competition in this segment is typically fierce. It features vehicles with an MSP approximately between $29,000 and $36,000, a relatively high degree of comfort *and* is manufactured by luxury brand. If the vehicle is manufactured by a non-luxury marque its base MSP should exceed approximately $36k and it must place an emphasis on comfort.

This segment mostly includes the bottom vehicles in the line-up of luxury brands as well as the top-of-the-line models of some non-luxury brands. Vehicles in this segment include the Lincoln Zephyr, BMW 3 Series, Lexus IS, Audi A4, Mercedes C-class, Infiniti G35, Acura TL, and the Jaguar X-Type. It should, however, be considered that some of entry-level luxury vehicles have upgrades which put them into the class above them. For example, while the Lincoln LS V6 is an entry-level luxury vehicle, the LS V8 is due to its pricing a mid-level luxury vehicle.

Mid-luxury segment

In order to be considered part of the middle-luxury segment, a vehicle should feature a base MSP between approximately $36k and $60k[1], have a very high degree of comfort, and should have the latest or near latest technological and safety innovations. Customers in this segment also yield some priority to performance. Therefore, many car manufacturers produce these cars with V8s and some highly sophisticated 6-cylinder engines.

Vehicles in this segment include the mid-range models of several luxury carmakers such as the Mercedes-Benz E-Class, BMW 5 Series, Lexus GS430 or the Jaguar S-Type. There are also some flagship sedans in this segment. The Lincoln Town Car, Cadillac DTS and Acura RL are all considered to be part of the mid-luxury segment due to their relatively low base MSPs despite their rank as a "flagship sedan" and high-end like interiors.

This market is operated under western nameplates with some Japanese representation. It is mainly controlled by mainly Germans (40%), Americans (30%) and Japanese (23%).

High-end luxury segment

This category includes many flagship vehicles of luxury brands such as the Lexus LS 460. Currently, all vehicles priced between the range of $60k and $100k are a part of this exclusive club.[2] The vehicles in this segment offer extremely high levels of quality and latest technological developments, as well as degrees of comfort at least equal to those found in Mid-level luxury vehicles.

Vehicles in this category include some of the models from the flagship lines of luxury car brands. Vehicles in this segement include the Mercedes-Benz S-Class, BMW 7-Series, Audi A8, Jaguar XJ, and Lexus LS. The Volkswagen Phaeton V8 is the only high-end luxury vehicle that is not sold under a luxury nameplate.

This segment is operated under various German, British and Japanese nameplates. It is mainly controlled by Germans (60%), Americans (30%) and Japanese (8%).

Ultra-luxury segment

Currently, all cars in the ultra-luxury segment are priced at approximately $100k or higher.[3] They may or may not be better in quality and refinement than some of the more affordable luxury cars, but due to their high MSP, they guarantee exclusivity and help to get their owners noticed. This segment includes the entire lineup of Rolls Royce, Bentley, Maserati, and Maybach. Many "flagship sedans" from car companies whose average car sells in a lower class are actually in this category. For example, anything more upgraded than the Mercedes-Benz S500, BMW 750, the Porsche Cayenne Turbo, or the Audi A8 can be included in this category. The Volkswagen Phaeton W12 (not V8) and the Toyota Century (only in Japan) are the only ultra luxury vehicles not manufactured by a luxury car manufacturer. Most of the vehicles in this category offer 12-cylinder engines, though some such as Maserati offer only V8s.

This category is operated mostly by European nameplates and controlled mainly by Germans (70%), Americans (10%) and Italians (15%). Some critics have speculated that Asian manufacturers do not have any presence because they fear no one will accept their products in this category.

Luxury SUV (United States)

A luxury SUV much like a luxury car is a relatively expensive vehicle that features a higher emphasis on comfort and quality than its mainstream counterparts. Even though luxury SUVs do not necessarily feature more comfort or a higher quality than sedans, they tend to be more expensive than luxury sedans. The top-of-the-line SUVs of American and Japanese luxury car makers out price their flagship sedans. The flagship SUV Cadillac Escalade, for example, has a base MSP of approximately $57,280, versus $41,991 for the flagship DTS. This scenario, however, does not hold true for European automakers, where the flagship sedans are still priced above the top-of-the-line SUV.

Luxury SUV can be classified into similar segment as luxury cars.

- *Entry-level* luxury SUVs must feature a base MSP of approximately over $38k and offer a high degree of comfort. A vehicle may however still be considered a luxury SUV if its base MSP lies in excess of approximately $29K *and* it is manufactured by a luxury car manufacturer. Vehicles in this category include the Acura MDX and BMW X3.
- *Mid-level* luxury SUVs feature base MSPs ranging approximately between $40K to $60K. Vehicles in this category include the Lincoln Aviator, Lexus GX, Mercedes-Benz M-Class, Land Rover LR3, Lincoln Navigator, Cadillac Escalade, and the Infiniti QX56.
- *High-end* luxury SUVs feature base MSPs from approximately $60k to $100k. Vehicles in this category include the Mercedes-Benz G-Class, Lexus LX, BMW X5, Cadillac Escalade ESV, and the Lincoln Navigator L.

Crossover

Crossover luxury vehicles are between 60-70 inches in height and generally more affordable than traditional luxury SUVs (70 inches and over in height) and feature a base MSP from approximately $30k to $42k. Since they are crossover vehicles, they tend to be smaller than SUVs and feature sedan-like design features. Vehicles in this category include the Lexus RX, Lincoln MKX, and the Infiniti FX35.

Pickup trucks

In the early 2000s, the two main American luxury manufacturers, Lincoln and Cadillac, started the luxury pickup truck segment. The first luxury pickup to enter the scene was the Lincoln Blackwood, first announced in 1999 and put into production in 2002. Less than 4,000 Lincoln Blackwoods were sold, and even those that were sold were sold mainly with the help of heavy incentives. As of 2006, the only two luxury pickup trucks on the market are the Lincoln Mark LT and Cadillac Escalade EXT.

European (German) definition

In Western Europe, different classifications are sometimes used than in the US. While most luxury cars are considered luxury cars in both Europe and the US, the entry-level segment is not. In Germany cars with MSPs of approximately over $20k are classified as "Mittelklasse" or Middle-Class, "Obere Mittelklasse" or Upper-Middle-Class, and "Oberklasse" or Upper-class.

Middle-Class vehicles are the equivalent of entry-level luxury cars in the US such as the BMW 3 Series, Mercedes-Benz C-Class or the Audi A4. These vehicles are not considered to be luxury cars.

Upper-Middle-Class vehicles are the equivalent of mid-level luxury cars in the US. They include vehicles such as the BMW 5 Series, Mercedes-Benz E-Class, and the Audi A6. These vehicles are considered to be luxury vehicles.

Upper-Class vehicles are the equivalent of high-end and ultra luxury vehicles in the US. They include vehicles such as the BMW 7 Series, Mercedes-Benz S-Class, and the Audi A8.

Luxury car manufacturers

Car manufacturers of whom the MSP of all vehicles sold is equal to or greater than $36,000. While this definition is based on American market MSPs, it can be used globally to identify luxury marques.

Current luxury car manufacturers

These are luxury car manufacturers whose models are currently on the market.

Acura
Aston Martin
Audi
Bentley
BMW
Cadillac
Infiniti
Jaguar (includes Daimler)
Land Rover (LR3 and Range Rover)
Lexus
Lincoln
Maserati
Maybach
Mercedes-Benz
Rolls-Royce

Past luxury car manufacturers

These are luxury car brands that used to exist but have since been either bought up or disappeared from the market due to bankruptcy.

Cord
Delage
Delahaye
Delaunay-Belleville
Duesenberg
Horch
Isotta-Fraschini
Minerva
Packard

Peerless
Pierce-Arrow

Near-luxury brands

Semi-luxury, or near-luxury brands are vehicle brands that are not only mistaken for luxury car manufacturers, but also place a relatively high degree of emphasis of comfort in some of the more upscale vehicles in their lineup. Usually the model lineups of these brands include one proper luxury car such as the Chrysler 300 and Volvo S80. But since less than half of the models in their lineup are luxury vehicles, these brands may not be considered to be proper luxury brands.

Buick
Mercury
Saab
Volvo
Alfa Romeo (in Europe)

References

- ‘ High-End and Mid-level Luxury Definition
- ‘ Ultra Luxury Definition

See also

- List of recent automobile models by type
- Personal luxury car
- Prestige vehicles

Mid-size car

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A *mid-size car*, frequently referred to as an *intermediate*, is the North American term for an automobile with a size between that of a compact and a full-size or standard-size car. In Europe, cars of a similar size are often referred to as *family cars* or *large family cars*.

North America

The mid-size class grew out of the compacts of the early 1960s. One of the first, the Ford Fairlane, was referred to at its introduction in 1962 as a compact intermediate. This was true, as it was barely bigger than its close relative the Falcon. General Motors' first entries in the class, such as the Oldsmobile F-85, Pontiac Tempest and Buick Special were not mechanically related to the compact Chevrolet Corvair, but were similar in size. The class began to grow almost immediately, however, and for the next 10 years each expansion in size in the full-size field was followed by a proportionate growth in the mid-sizers. By the mid-1960s, they were as big as full-size cars of the mid-1950s. By the mid-1970s, they were nearly as big as the full-sizers of the mid-1960s. By the 1970's, the intermediate class was generally defined as vehicles with wheelbases between 112" and 118".

A turning point occurred in the late 1970s, when rising fuel costs and government fuel economy regulations caused all car classes to shrink, and in many cases to blur. The situation was complicated by the fact that General Motors began to downsize about two years before everybody else. Consequently, by 1978, there was little difference between the new mid-size Chevrolet Malibu on a 108" wheelbase and the equally new compact Ford Fairmont at 105". From that point on, mid-sizers shrank steadily for the next ten years. Import models, which had often been growing as the domestics shrank, began to be more competitive, and the two essentially came together in the compact and intermediate classes.

Mid-size vehicles today usually have wheelbases between 2.68 meters (105") and 2.79 meters (110"). Another definition specifies between 110 ft^3 (3000 L) and 119 ft^3 (3300 L) of interior volume. This is the most popular size car sold in the United States. Well-known examples include the Toyota Camry and Honda Accord. There is still a tendency for domestic entries to be larger than the imports, however, such as the soon-to-be discontinued Ford Taurus, which has competed well with these models despite (or perhaps because of) its larger size in every dimension.

Europe, Australia & New Zealand

Cars in Europe's equivalent category to North America's mid-size are generally known as *large family cars* (small family cars are North American compacts), whereas Australia and New Zealand also use the mid-size label. European and Australasian mid-size/family cars are usually a little smaller than the North American norm, even from the same manufacturer. For comparison, the 1998 Ford Taurus weighed around 1500 kg, had a 2757 mm wheelbase, and was powered by a 3.0 L V6 engine, whereas a 1998 Ford Mondeo weighed around 1300 kg, had a 2704 mm wheelbase, and was often powered by a 2.0 L I4. European & Australasian mid-size/family cars are also usually offered in sedan and hatchback form, as opposed to the sole sedan form found in the models populating the North American category.

As elsewhere, upsizing has blurred the distinction between types, with models that would be and are compacts in North America, such as the Ford Focus and Opel Astra, approaching the midsize category by growing larger and fitting more powerful engines with every iteration.

Sometimes the definitions of car categories are manipulated to serve marketing ends. In Australia, Toyota had categorized the V6 equipped Camry as a large car and the 4-cylinder Camry as a medium or mid-size car in order to dominate more segments, despite the physical size of the cars being identical. Similarly, the Opel Omega/Cadillac Catera, which had dimensions right on the border between the North American categorizations of full-size and mid-size, was marketed as a luxury full-size car in Europe and a mid-size car in North America.

Japan

In Japan, the term mid-size car probably does not have the intermediate sense that it does in other markets. Due to space restrictions the range of cars available in this market starts from a much smaller size. As such, the models that Japan exports to other markets to compete in mid-size market segments such as the Mazda6 and Subaru Legacy occupy a more exclusive segment in the Japanese marketplace.

An interesting quirk of Japanese automotive tax codes is that width is one of factors determining which category a car is taxed under. Therefore even mid-sized cars destined for export markets from Japan had widths of less than 1700 mm, as manufacturers had to look to domestic consumption as well as export. However, as export markets have become progressively more significant for Japanese car manufacturers, more models have been produced that break this 1700 mm wide limit (around 67 inches).

See also

- Vehicle size class

Pickup trucks

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A *pickup truck* (aka 'pick-up') is a light truck with an open-top rear cargo area. It generally refers to a truck with a rating smaller than 1-ton rating (at least in the US).

In North America, a pickup is small or medium sized truck, not based on a passenger car, but of similar size. This light commercial vehicle features a separate cabin and rear load area (separate cargo bed). Two North American vehicles, the Chevrolet El Camino and Ford Ranchero were passenger car-based vehicles with integrated cargo bed, but were not generally referred to as pickup trucks (see Coupe Utility below).

The basic modern design of the pickup truck first appeared in Geelong, Australia in 1934. Many pickups have short rigid sides and an opening rear gate, while others have a flat tray back. These vehicles are known in Australia and New Zealand as a *ute* or *utility* (from "utility vehicle"), in South Africa as a *bakkie* (pronounced "bucky"), and in Israel as a *tender*. Panel vans, a kind of van, popular in Australia during the 1970s, were based on a ute chassis.

The design details of such vehicles vary significantly, and different nationalities seem to specialise in different style and size of vehicles. For instance, North American pickups come in full-size (large, heavy vehicles often with V8 or six-cylinder engines), mid-size, and compact (smaller trucks generally equipped with inline 4 engines).

Types of pickups

Compact pickups

The *compact pickup* (or simply pickup, without qualifier) is the most widespread form of pickup truck worldwide. It is built like a mini version of a two-axle heavy truck, with a frame providing structure, a conventional cab, a leaf spring suspension on the rear wheels and a small I4 or V6 engine, generally using gasoline.

Until recently, compact trucks were very popular in North America, though mid-size trucks are now dominating the market. Compact trucks sold in the US market in 2006 include:

Ford Ranger
Nissan Frontier

In Europe, compact pickups dominate the pickup market, although they are popular mostly in rural areas. Only Japanese makes such as Toyota (Hi-Lux), Mitsubishi (L200) and Nissan (Navara) have typically built models for this segment, with few entries by European manufacturers, the most notable of which is perhaps the Peugeot 504 Pick-Up, which continued to be sold in Mediterranean Europe and Africa long after the original 504 ceased production. Opel, Ford and VW have occasionally sold rebadged versions of Japanese products, built by Isuzu, Mazda and Toyota, respectively. Eastern European manufacturers such as ARO or UAZ have served their home markets faithfully for decades, but are now disappearing. The near-majority of compact pickups sold in Europe use Diesel engines.

North American full-size pickups

A *full-size pickup* is a large truck suitable for hauling heavy loads and performing other functions. Most full-size trucks can carry at least 1,000 lb (450 kg) in the rear bed, with some capable of twice that much. Most are front-engine and rear-wheel drive with four-wheel drive optional, and most use a live axle with leaf springs in the rear. They are commonly found with V8, V10, or Diesel engines. The largest full-size pickups feature doubled rear tires (two on each side on one axle). These are colloquially referred to as "duallys" (dool-eez), or dual-wheeled pickup trucks, and are often equipped with a fifth wheel for towing heavy trailers.

Full-size trucks are often used in North America for general passenger use, usually those with 1/2 ton ratings. For a number of years, the 1/2 ton full-size Ford F150 was the best-selling vehicle in the United States, outselling all other trucks and all passenger car models.

Until recently, only the "Big Three" American automakers (Ford, GM and Chrysler) built full-size pickups. Toyota introduced the T100 full-size pickup truck in 1993, but sales were poor due to high prices and a lack of a V8 engine. However, the introduction of the Toyota Tundra and Nissan Titan marked the proper entry of Japanese makers in the market. Both of these trucks are assembled in North America.

As of 2005, five pick-ups are sold as full-size in North America:

Chevrolet Silverado/GMC Sierra
Dodge Ram

Ford F-Series
Nissan Titan
Toyota Tundra

Mid-size Pickups

In North America, pickup trucks were commonly used as general purpose passenger cars. They were popular not only with construction workers, but also by housewives and office workers. Thus arose the need for a pickup that was bigger than a compact and smaller and more fuel efficient than the full-size pickup.

The first mid-size pickup was the Dodge Dakota, introduced in 1987 with v6 engine availability to distinguish it from the smaller compact trucks which generally offered only four cylinder engines. Its hallmark was the ability to carry the archetypical 4x8 sheet of plywood (4 feet by 8 feet) flat in the cargo bed, something which compact pickups could only carry at an angle.

In 2006, mid-size and large pickups dominate the US market. Mid-size models include:

Chevrolet Colorado/GMC Canyon
Toyota Tacoma
Dodge Dakota

For 2007, Nissan is up-sizing their small pickup into a mid-size model.

Coupe Utility

The Coupe Utility body style is a passenger-car derived light truck with a passenger cabin of "coupe" style but with an integral cargo bed behind the cabin.

In 1934, as the result of a request from a Victorian farmer, Ford Australia combined the cab of its newly released Ford Coupe body with the well-type load area of their roadster utility, producing the first of the 'Coupe Utilities'.

Both the Coupe Utility and the Roadster Utility continued in production, but the improving economy of the mid to late 30s & the desire for a little comfort saw coupe utility sales climb at the expense of the roadster ute until by 1939, the roadster ute was all but a fading memory. No car maker offered a roadster ute when car production restarted after WW2 until 1957 when Ford began offering the Ranchero; GM followed with the El Camino. In the US however, by the mid-80s the Coupe Utility began to fall out of favor again with the demise of the Ranchero after 1979, the VW Rabbit (Golf) pickup and of the El Camino after 1986. Subaru still offers a Sedan Utility as the Baja.

Both the Coupe utility & Closed Cab pickup designs migrated to light truck chassis & these are correctly known respectively as Utility trucks & Pickup trucks. The Pickup design found a natural home on the smaller truck chassis while the ute became entrenched as a passenger car derivitave, so that only one modern manufacturer offers a pickup [passenger car based] or a utility 'truck' today, and even then the body style will be extinct after 2006.

ute, [pronounced 'yute'] in Australian English and New Zealand English usage, short for " utility", the Australasian alternative to the North American pickup, and pickup truck.

Like the U.S. pickup which was also originally based on a passenger car chassis, the Aussie ute has its origins in the open top passenger car models of the mid 1920's.

The Australian utility started its life as a production model, with its unique one piece body from the rear of the door opening back to the rearmost of the vehicle, in 1924. The pickup, on the other hand, started it's life a little earlier & is defined by its separate, & removeable, well-type 'pickup bed'. This pickup bed does not contact the cabin part of the vehicle, while the ute bed is an integral part of the whole body.

The ute body-type was first available in Chevrolet then Dodge models, the bodies of which were made by Holden under contract, & they were essentially an extention of the open top roadster design, but with a 'well' type cargo area instead of the roadster turtledeck. These were known as roadster utilities. This basic design quickly gained in popularity & became available as either a standard offering, or special order body from a number of car makers in Australia by 1929.

Other pickups

The two Australian-built utilities (the Holden Commodore Ute and the Ford Falcon Ute) currently in production are rebodied versions of large passenger cars, as were the now out of production American Ford Ranchero and Chevrolet El Camino. Consequently, they are much lower-slung and more carlike both in appearance and performance than other pickups. Volkswagen and other European manufacturers have also introduced similar designs at one time or another, but they have not been popular and the designs were typically dropped after a few years. Currently the Subaru Baja and the Honda Ridgeline are the only car-based pickup trucks sold in North America. Another derivative is the Ford Explorer Sporttrac, which is a vehicle similar to the Ridgeline as it is based on an existing sport utility (body on frame construction) though it predates it. The bed is made of a plastic material.

In North America there is a sub-class pickup size known as mid-sized. It includes the Dodge Dakota and it Mitsubishi derivative. The Chevrolet Colorado and GMC twin are also in this class. The compact trucks are slowly growing in dimension into this class.

In Latin America, single cab pickups which are based on supermini cars, are fairly popular. They are called "compact," in contrast with "mid-size" (Ranger, S10, Hilux) and "full-size" (Ram, Avalanche, F150), and also nicknamed "picápinhas" in Brazil. Best-sellers are models such as the Chevrolet Montana/Tornado, Volkswagen Saveiro and Fiat Strada.

In Western Europe, Skoda and Fiat have, on occasion, tried to engage the public's attention to this segment, with little success, as panel vans are more popular as light commercial vehicles in city areas, and Japanese compact pick-ups more capable in rural areas' rough terrains. In Eastern Europe, they were quite popular as commercial vehicles until the turn of the millennium, with makes such as Dacia and IZH offering cars for this segment up to 2004.

One of the smallest pickups to be produced in commercial quantities was the British Austin/Morris Mini Pickup. At a little over 3 meters in length, it was none the less quite popular as a practical, working truck, selling 58,000 vehicles between 1961 and 1983.

Pickup cab styles

Pickup trucks have been produced with a number of different configurations or body styles.

Standard cab

A *standard cab* pickup has a single row of seats and a single set of doors, one on each side. Most pickups have a front bench seat that can be used by three people, however within the last few decades, various manufacturers have begun to offer individual seats as standard equipment.

Extended cab

Extended or *super cab* pickups add an extra space behind the main seat. This is normally accessed by reclining the front bench back, but recent extended cab pickups have featured reverse-hinged doors on one or both sides for access. The original extended cab trucks used simple side-facing "jump seats" that could fold into the walls, but modern super cab trucks usually have a full bench in the back. Ford introduced the SuperCab concept on their 1974 F-100.

Crew cab

A true four-door pickup is a *crew cab* or *double cab*. It features seating for up to five or six people on two full benches and full-size front-hinged doors on both sides. Most crew cab pickups have a shorter bed or box to reduce their overall length.

International was the first to introduced a crew cab pickup in 1957, followed by Ford with their 1965 F-250 (short bed) and F-350 (long bed), Dodge in the same era, and Chevrolet followed with their 1973 C/K. Japanese makes offered crew cab versions of their pick-ups from the mid-80s.

Four-door compact pickup trucks are quite popular outside North America, due to their increased passenger space and versatility in carrying non-rugged cargo. In the United States and Canada, however, four-door compact trucks have been very slow to catch on and are still quite rare. In recent years seat belt laws, requirements of insurance companies and fear of litigation have increased the demand for four door trucks which provide a safety belt for each passenger. Mexican four-door compact pickups are quite popular.

Pickup bed styles

Full-size pickup trucks are generally available with several different types of beds attached. The provided lengths typically specify the distance between the inside of the front end of the bed and the closed tailgate; note that these values are approximate and different manufacturers produce beds of slightly varying length.

Most compact truck beds are approximately 50 in wide, and most full-size are between 60 in and 70 in wide, generally 48 in or slightly over between the wheel wells (minimum width).

Short bed

The *short bed* is by far the most popular type of pickup truck bed. Compact truck short beds are generally 6 ft long and full-size beds are generally 6.5 ft long. These beds offer significant load-hauling versatility, but are not long enough to be difficult to drive or park.

Long bed

The *long bed* is usually a foot or two longer than the short bed and is more popular on trucks of primarily utilitarian employ (for example, commercial work trucks or farm trucks). Compact long beds are generally 7 ft long and full-size long beds are generally 8 ft long. Full-size long beds offer the advantage of carrying a standard-size 4 ft×8 ft sheet of plywood with the tailgate closed. In the United States and Canada, long beds are not very popular on compact trucks because of the easy availability of full-size pickup trucks.

Step-Side

Most pickup truck beds have side panels positioned outside the wheel wells. Conversely, *step-side* truck beds have side panels inside the wheel wells. Pickup trucks were commonly equipped with step-side beds until the 1970s, when most manufacturers switched to a straight bed, which offer slightly more interior space than step-side beds. Step-side beds do have the added advantage of a completely rectangular box, although most modern trucks with a step-side bed are that way purely for styling.

General Motors calls this option sport-side, while Ford Motor Company dubs it flare-side.

Very short bed

As mentioned above, some compact four-door pickup trucks are equipped with *very short beds*. They are usually based on SUVs, and the bed is attached behind the rear seats. The Ford Explorer Sport Trac is an example of this, as is the Ssangyong Musso Sport.

No bed

In some cases, commercial pickup trucks can be purchased without a bed at all; the gas tank and driveline are visible and easily accessible through the top of the frame rails until a proper bed (many times customized to fit a particular business' needs) is attached by the customer. These are called called "Cab & Chassis" models, and are usually finished by the customer to use a flatbed (flat deck) cargo carrier, stake bed, or specialized fitures such as tow rigs, glass sheet carriers or other types. A common type is the "utility body" which in the US is usually of metal and has many lockable cabinet compartments (a type of large tradesmans tool box)

The cultural significance of the pickup

The pickup in American culture

Americans have a special fondness for the pickup truck, and it has developed a mythos that is similar to that of the horse in the American Old West. In the United States, pickups tend to be portrayed as symbols of male virility. They figure prominently in "tough guy" and neo-Western motion pictures, such as Hud, Urban Cowboy, and Every Which Way But Loose. They are also a fixture in American politics, as in the famous campaign speech by Fred Thompson, who explained his opponent's shortcomings by saying "He hasn't spent enough time in a pickup truck." In 2004, Democratic Senate candidate Ken Salazar campaigned with his green pickup truck; Salazar later won the election.[1]

The Australian ute

Since the modern design of the ute first rolled off the assembly line at the Ford factory in Geelong in 1934, which Henry Ford described as the 'kangaroo chaser', Australia has developed a culture around utes. This still manifests itself today, particarly in rural areas with events known as Ute musters that occur nation wide.

In Australia, two common forms of ute exist. The American style Pickup ute which is popular with farmers, etc is usually a Japanese or Australian built ute, such as the Holden Rodeo, Toyota Hilux, etc. These are popular in a variety of forms – two and four-wheel drive, single or dual cab, integrated tray or flatbed. These kinds of vehicles are also common in New Zealand, where they are also referred to as utes. There is an extensive industry in rural areas building a huge variety of different ute backs and trays to fit standard chassis.

The other type of vehicle commonly referred to as a ute is quite different – a 2-seater sporty version of typical saloon cars, featuring a ute-type integrated tray back, comparable to the American Chevrolet El Camino or Ford Ranchero. A typical modern-day example would be the Holden Commodore SS ute. Construction is semi-monocoque, with the front end sharing the unitary construction of the saloon car on which they are based, but featuring a more conventional chassis at the rear. The vehicle is optimised for carrying loads in rural Australia which tend to be very flat, however in other environments the vehicles have somewhat questionable value as most feature very low ground clearance, wide road tyres and so forth. Many young urban drivers often customise their utes, resulting in many not willing to scratch the paintwork on anything useful such as carrying a load.

Pickups in Thailand

As the world's second largest manufacturer of pickup trucks, aided by punitive excise taxes on passenger cars, pickup trucks have long been extremely popular in Thailand: between 1987 and 1996, 58% of all cars sold in the country were pickup trucks. [2] Pickups are used extensively for shipping and transport, notably the converted songthaew (lit. "two row") minibus that forms the backbone of public transportation in and between many smaller cities.

Thailand is also the world's second largest market for pickup trucks, after the United States. 400,000 pickups were sold there in 2005.

Pickups in Europe

In Europe, pickups are considered light commercial vehicles for farmers. Until the 1990s, pickups were preferred mainly as individual vehicles in rural areas, while vans and large trucks were the preferred method of transportation for cargo.

The largest pickup market in Europe is Portugal, where crew cab 4WD pickups have somewhat replaced SUVs as offroad vehicles, after a change in taxation removed light commercial vehicle status from SUVs. The introduction of more powerful engines in pickups, benefitting from variable nozzle turbochargers and common rail direct injection technology, have made these cars interesting prospects in the eyes of the public.

In the United Kingdom, France and Germany, pickups are rarely seen and carry little cultural significance. While British environmentalists tend to object to large cars, their focus is usually aimed at the more common people carriers and especially on the very popular 4x4s (SUVs in American English).

Military use

Pickup trucks have been used as troop carriers in many parts of the world, especially in countries with few civilian roads or areas of very rough terrain. Pickup trucks have also been used as fighting vehicles, often equipped with a machine-gun mounted in the bed. These are known as technicals.

Other uses

Fire chief's vehicle

In the United States pick-up trucks have been used as response vehicles for fire chiefs. These pickup trucks will mount emergency lights and sirens, and sport color shemes similar to the one used by fire trucks in the department.

Law enforcement

Pickup trucks have also been modified for use by local police agencies in areas where a cruiser is ill-suited for terrain requirements, such as in the Pacific Northwest and Southwest of the United States. The United States Border Patrol relies almost entirely on a fleet on SUV's and pickup trucks for use along the United States–Mexico border. Pickup trucks have also found a role in Search and Rescue operations, since they are designed to handle the rugged outdoors.

Miscellaneous

Since about 2001 hybrids of sport utility vehicles and pickups have appeared, which are similar to an SUV except that the 3rd row of seats (or enclosed cargo area) is replaced by a short open truck bed. The Chevrolet Avalanche is the most well-known example of this.

Whilst pickups are commonly used by tradespeople the world over, they are popular as personal transport in Australia, the United States, and Canada, where they share some of the image of the SUV and are commonly criticised on similar grounds.

Many pickup trucks have four-wheel drive, aggressively-treaded tires and high ground clearance, and thus have all-terrain capabilities similar to SUVs.

Prestige vehicles

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Prestige cars are vehicles that enjoy a high degree of esteem among the public, due to their high price and styling. While most prestige vehicles are proper luxury cars, some such as Porsches and Hummers are not. The only attribute common among prestige vehicles are their relatively high price and often sophisticated quality as well as the high amount of esteem they enjoy and project upon the owner.

Guidelines

Prestige vehicles are vehicles whose pricing is either near or equal to that a proper luxury car. In order to meet the pricing criteria of a luxury car, the vehicle must feature a base MSRP of over $38,000 or $29,000 if it is also manufactured by a luxury car manufacturer.

Scarcity is another factor in determining prestige, as prestige decreases the more common a vehicle becomes. This rule mostly applies to classic vehicles whose prices and collection value, thus also prestige, increase with scarcity.

Semi-luxury Prestige vehicles

While most Prestige vehicles feature base MSRP equal to those found on proper luxury cars, some do not. These are vehicles who are often mistaken to be luxury cars but are *not*. The Volvo S60 is an example of such a vehicle. The S60 does not meet the pricing standards of a luxury car since Volvo is *not* a luxury marque and the vehicle's base MSRP is less than the required $38,000. But since prestige is a measurement of esteem and public opinion the S60 can still be considered a prestige vehicle.

The same holds true for some brands such as Acura. Today Acura is no longer a proper luxury car manufacturer anymore, since less than half the vehicles it sells carry a base MSRP below the $38k threshold. Due to its past as a proper luxury car manufacturer, however, many still see Acura as a luxury marque and therefore often mistakenly identify many of its vehicles as luxury cars.

Non-luxury Prestige vehicles

Some vehicles carry high MSRPs as well as a high amount of esteem among the public, yet fail to meet the comfort requirements of a proper luxury vehicles. The cars tend to be performance or utility oriented. Lotus for example sells performance vehicles in the luxury car price brackets, with all its vehicles featuring MSRPs of above $40k. The vehicles are, however not luxury cars since they fail to provide their occupants with sufficient comfort. Many Lotus vehicles do not even feature automatic window levers, a convenience feature standard on many subcompacts. The Hummer H1 is another example of a non-luxury prestige vehicle. The H1 enjoys a large amount of esteem among the public due to its $100k+ price tag, but fails to offer its occupants some of the most basic creature comforts.

Prestige categories

While it is difficult, if not impossible to categorize the prestige enjoyed by the many different types of automobiles it can be easily agreed upon that with the great variety of prestige vehicles come several different types of prestige.

The degree of prestige enjoyed by a vehicle usually depends on the vehicle's pricing as well as its history and position in the manufacturer's line-up. This is why a Mercedes-Benz S-Class or Lincoln Town Car have far more prestige than a Volvo S60 or Acura TSX.

Entry-level This type of prestige is usually enjoyed by some entry-level luxury cars as well as semi-luxury prestige cars and brands. Semi-luxury vehicles such as the Acura TSX, Volvo S60, and proper luxury car such as the Lincoln Zephyr, Mercedes-Benz C-Class coupe, or Lexus IS can be found in this category.

Mid-level This the degree of prestige is mostly enjoyed by the mid-line up vehicles of luxury car manufacturers such as the Mercedes-Benz E-Class, BMW 5-Series, or Cadillac STS. Some non-luxury vehicles such as the Hummer H2, Porsche Boxster, and Chevrolet Corvette fit into this category.

Flagship While many Flagship sedans such as the Lexus LS and the Lincoln Town Car are priced quite a bit below the Mercedes-Benz S-Class or BMW 7-Series, they are nonetheless the flagship models of their luxury manufacturers and enjoy a degree of prestige higher than that of "Mid line-up vehicles" and roughly equal to that of certain Mercedes-Benz S-Class or BMW 7-Series models. Some very high-end non-luxury sport models such as the Porsche Carrera fit into this category as well.

Vehicles in this category include but are not limited to the Lincoln Town Car, Lexus LS, Infiniti Q45, Cadillac DTS as well as the most common models of the Jaguar XJ, Mercedes-Benz S-Class, BMW 7-Series, and Audi A8

Ultra The Ultra luxury segment is probably the only prestige category with roughly the same pricing guidelines as the Ultra Luxury Car Segment, which describes vehicles priced above $90k. This category includes the A8 W12, Mercedes S600, BMW 760, as well as the entire line-up of all marques who exclusively sell vehicles priced in excess of $90k such as Bugatti, Maserati, Lamborghini, Ferrari, as well as Bentley, Rolls-Royce, and Maybach.

The Ford GT and Dodge Viper are the only Ultra prestige vehicles manufactured by neither a luxury car manufacturer nor a marque exclusively selling vehicles which carry a base MSRP of $90k.

List of prestige marques

Acura
Alfa Romeo
Aston Martin
Audi
Bentley
BMW
Bugatti
Buick
Cadillac
Ferrari
Hummer
Infiniti
International Harvester
Jaguar
Koenigsberg
Lamborghini
Land Rover
Lexus
Lincoln
Lotus
Maserati
Maybach
Mercedes-Benz
Mercury
MG
Porsche
Rolls-Royce
Saab
Saleen
Volvo

Production Electric vehicles

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Battery electric vehicles or *BEVs* are electric vehicles whose main energy storage is in the chemical energy of batteries. BEVs are the most common form of what is defined by the California Air Resources Board (CARB) as zero emission (ZEV) passenger automobiles, because they produce no emissions while being driven. The electrical energy carried onboard a BEV to power the motors is obtained from a variety of battery chemistries arranged into battery packs. For additional range genset trailers or pusher trailers are sometimes used, forming a type of hybrid vehicle. Batteries used in electric vehicles include "flooded" lead-acid, absorbed glass mat, NiCd, nickel metal hydride, Li-ion, Li-poly and zinc-air batteries.

While hybrid vehicles apply many of the technical advances first developed for BEVs, they are not considered BEVs. Of interest to BEV developers, however, is the fact that hybrid vehicles are advancing the state of the art (in cost/performance ratios) of batteries, electric motors, chargers, and motor controllers, which may bode well for the future of both pure electric vehicles and the so called "plug-in hybrid".

History

Main article: **History of the electric vehicle**

BEVs were among the earliest automobiles, and before the preeminence of light, powerful internal combustion engines, electric automobiles held many vehicle land speed and distance records in the early 1900s. Most notable was perhaps breaking of the 105.88 km/h (65.79 mph) speed barrier by Camille Jenatzy on 29.4 1899 in his rocket-like EV named La Jamais Contente. This was the first world record over 100 km/h.

BEVs were produced by Anthony Electric, Baker Electric, Detroit Electric, and others and at one point in history out-sold gasoline-powered vehicles.

Some feel that the introduction of the electric starter by Cadillac in 1913, which simplified the difficult and sometimes dangerous task of starting the internal combustion engine, was the downfall of the electric vehicle, as 1912 may have been the pinnacle year for BEVs. Still others point out that it was radiators, in use as early as 1895 by Panhard-Levassor in their Systeme Panhard design, which allowed engines to keep cool enough to run for more than a few minutes, before which they had to stop and cool down at horse troughs along with the steamers to replenish their water supply. The truth may be that EV's had fallen out of favor over the mass produced Ford Model-T which went into production four years earlier in 1908.

Efficiency

Production and conversion battery electric vehicles typically achieve 0.3 to 0.5 kWh per mile (0.2 to 0.3 kWh/km). The U.S. fleet average of 23 mpg of gasoline is equivalent to 1.46 kWh/mi and the 70 mpg Insight gets 0.48 kWh/mi (assuming 33.6 kWh per U.S. gallon of gasoline), so battery electric cars vehicles are relatively efficient. When comparisons are made for the total energy cycle, the efficiency figures for BEVs drop, but such calculations are not commonly offered for ICE vehicles (e.g. the loss of efficiency from energy used to produce specialized fuels such as gasoline as compared to the raw energy available from crude oil or natural gas.

CO_2 emission comparisons are one good indication of the current grid-mix vs gasoline consumption. Such comparisons include production, transmission, charging, and vehicle losses. The CO_2 emissions can improve for BEVs through the use of sustainable grid or local resources but are essentially fixed for gasoline vehicles. Unfortunately the EV1, Ranger EV, EVPlus, and other production vehicles are missing from this site.

- RAV4-EV vs Gas RAV4
    - 2000 Toyota RAV4-EV 4.1 short tons CO_2 (104 mpg)
    - 2000 Toyota RAV4 2wd 7.2 short tons CO_2 (26 mpg)
- Other BEVs
    - 2000 Nissan Altra EV 3.5 short tons CO_2
    - 2000 Nissan Altra EV 3.5 short tons CO_2
    - 2002 Toyota RAV4-EV 3.8 short tons CO_2
    - 2002 Ford Explorer 7.8 short tons CO_2 (USPS)
- Hybrids
    - 2000 Honda Insight 3.0 short tons CO_2
    - 2001 Honda Insight 3.1 short tons CO_2
    - 2005 Toyota Prius 3.5 short tons CO_2
    - 2005 Ford Escape H 2x 5.8 short tons CO_2
    - 2005 Ford Escape H 4x 6.2 short tons CO_2
- Standard ICE vehicles
    - 2005 Dodge Neon 2.0L 6.0 short tons CO_2
    - 2005 Ford Escape 4x 8.0 short tons CO_2
    - 2005 GMC Envoy XUV 4x 11.7 short tons CO_2

It is important to study the full effect of any vehicle design, especially when promoted as better than the status quo. The goal may be to look at overall efficiency only or it may be the total environmental impact, since environmental damage reduction is often the goal behind alternative vehicle efforts. Many factors must be considered when making an overall comparison of total environmental impact. The most comprehensive comparison is known as a cradle-to-grave or lifecycle analysis. The analysis considers all inputs including original production and fuel sources and all outputs and end products including emissions and disposal. The varying amounts and types of outputs and inputs vary in their environmental effects and are difficult to directly compare. For example, are the environmental effects of nickel or cadmium contamination from a battery production facility less than those of hydrocarbon emissions or from petroleum refining? If so, how much, or how much of each would be equivalent? Similar types of questions would need to be resolved for each input and output in order to make a comparison.

A large lifecycle input difference is that the electric vehicle requires electricity instead of a liquid fuel. The advantage of the electric vehicle is that the electricity can be provided by renewable energy. However, if the electricity is produced from fossil fuel sources (as most electricity currently is) the advantage of the electric vehicle is reduced, or nearly eliminated.

Thus utilizing and developing additional renewable energy sources is required for electric vehicles to further reduce their net emissions.

The input for electric vehicle production that differs from internal combustion types is primarily in the large battery. The batteries, however, may not last as long as combustion engines, and needing to be replaced would account for a greater input requirement for their production. However, as BEVs do not require an ICE engine, support systems or related maintenance, they should be more reliable and require less maintenance. Although BEVs are not common, there are related markets which require advances in battery technology, such as mobile phones, laptops, forklifts and hybrid electric vehicles. Improvements to battery technology for any of these other markets will make BEVs more practical too.

Aerodynamic drag has a big impact on efficiency as the speed of the vehicle increases.

Performance

Many of today's electric vehicles are capable of acceleration performance which exceeds that of conventional gasoline powered vehicles. Electric vehicles can utilize a direct motor to wheel configuration which increases the power deliverability to the wheels. Having multiple motors connected directly to the wheels allows for each of the wheels to be used for both propulsion and as braking systems, thereby increasing traction. In some cases, the motor can be housed directly in the wheel, such as in the Whispering Wheel design, which lowers the center of gravity and reduces the number of moving parts. When not fitted with an axle, differential or transmission, many electric vehicles have greater torque availability, which goes directly to accelerating the wheels. A single gear design in some electric vehicles eliminates gear shifting, giving the newer electric vehicles both smoother acceleration and braking. This also allows higher torque at wide rpm levels. Nonetheless, top speed and total possible drivetrain efficiency are severely limited by the lack of a gearbox. For example, the Venturi Fetish delivers supercar acceleration, yet is limited to a top speed of only 100 mph.

Fuels

There are no currently available technologies which can provide all of the energy required for the life of a BEV car. This means that all BEV cars must be refuelled by periodic charging of the batteries.

BEVs most commonly charge from the power grid, which is in turn generated from a variety of domestic resources — primarily coal, natural gas, and nuclear. Home power such as roof top photovoltaic panels, microhydro or wind can also be used. Electricity can also be supplied with traditional fuels via a generator.

Range

The range of a BEV depends greatly on the number and type of batteries used. The weight and type of vehicle also has an impact just as it does on the mileage of traditional vehicles. Conversions usually use lead-acid batteries because they are the most available and inexpensive, such conversions generally have 20 to 50 miles (30 to 80 km) of range and are built to satisfy the drivers' individual needs. Production EVs with lead-acid batteries are capable of up to 80 miles (130 km) per charge. NiMH chemistries have high energy density and can deliver up to 120 miles (200 km) of range. Lithium ion equipped EVs have been claimed in press releases to have 250-300 miles (400-500 km) of range per charge. EVs can also use pusher trailers or genset trailers in order to function as a hybrid vehicle for occasions when unlimited range is desired without the additional weight during normal short range use. The vehicle becomes an internal combustion vehicle when utilizing the trailer, but it allows the greater range that may be needed for limited times while making the advantages of the BEV available for most shorter trips.

In practice most vehicle journeys of all kinds are quite short, the majority being under 30 km (20 mi) per day. Thus, a BEV that can do 60 km (40 mi) in a day is quite practical for most trips for most users, and a substantial additional range can be added for commuters where charging facilities are available at the destination.

Battery charging

The charging time is limited primarily by the capacity of the grid connection. A normal household outlet is between 1.5 kW in the US to 3 kW in countries with 240 V supply. The main connection to a house might be able to sustain 10 kW, and special wiring can be installed to use this. At this higher power level charging even a small, 7 kWh (14–28 mi) pack, would probably require one hour. Compare this to the effective power delivery rate of an average petrol pump, about 5,000 kW. Even if the supply power can be increased, most batteries do not accept charge at greater than their 'charge rate' C1.

Some recent handheld device battery designs by Toshiba are claimed to be capable of accepting an 80% charge in as little as 60 seconds. Scaling this specific power characteristic up to the same 7 kWh EV pack would result in the need for a peak of 336 kW of power from some source for those 60 seconds. It is not clear that such batteries will work directly in BEVs as heat build-up may make them unsafe.

Most people do not require fast recharging because they have enough time (6 to 8 hours) during the work day or overnight to refuel. As the charging does not require attention it takes a few seconds for an owner to plug in and unplug their vehicle. Many BEV drivers prefer refueling at home, avoiding the inconvenience of visiting a petrol station. Some workplaces provide special parking bays for electric vehicles with charging equipment provided.

The charging power can be connected to the car in two ways. The first is a direct electrical connection known as conductive coupling. This might be as simple as a mains lead into a weather proof socket through to special high capacity cables with connectors to protect the user from high voltages. The second approach is known as inductive coupling. A special 'paddle' is inserted into a slot on the car. The paddle is one winding of a transformer, while the other is built into the car. When the paddle is inserted it completes a magnetic circuit which provides power to the battery pack. The major advantage of this approach is that there is no possibility of electrocution as there are no exposed conductors although interlocks can make conductive coupling nearly as safe. Conductive coupling equipment is lower in cost and much more efficient due to a vastly lower component count.

Battery life

Individual batteries are usually arranged into large battery packs of various voltage and ampere-hour capacity products to give the required energy capacities. Battery life must be considered when calculating cost of operation, as all batteries wear out and must be replaced. The rate at which they expire depends on a number of factors.

New scientific and empirical evidence from running individual EV conversions shows that most of these negative factors linked to batteries connected in series for traction application can be mitigated with good DC/DC based Battery Management System, thermo insulation/venting, and proper care. That also includes selecting a well balanced mix of compontents oriented towards specific performance properties, i.e. range, speed. For instance a recombination type of lead-acid battery with C1 hour discharge rate about 120Ah (equals to 220Ah C20 "marketing rating") should be used accordingly. Therefore the EV overall consumption of particular low/mid voltage vehicle should not often exceseed in this example 80-100% of this C1 hours rating — this applies for more advanced battery chemistries like Li-ion with slightly higher discharges C3-C5 as well. In this particular example, longevity of the lead-acid battery pack will be preserved by not discharging it in a prolonged or continuous regime above 120Ah currents.

The depth of discharge (DOD) is the recommended proportion of the total available energy storage for which that battery will achieve its rated cycles. Deep cycle lead-acid batteries generally should not be discharged below 50% capacity. More modern formulations can survive deeper cycles.

In real world use some fleet RAV4-EVs have exceeded 100,000 miles (160,000 km) with little degradation in their daily range. Jay Leno's 1912? Baker Electric still operates on its original edison cells. Battery replacement costs may be partially or fully offset by the lack of regular maintenance such as oil and filter changes and by greater reliability due to fewer moving parts.

Critics claim that batteries pose a serious environmental hazard requiring significant disposal or recycling costs. Some of the chemicals used in the manufacture of advanced batteries such as Li-ion, Li ion polymer and zinc-air are hazardous and potentially environmentally damaging. While these technologies are developed for small markets this is not a concern, but if production was to be scaled to match current car demand the risks might become unacceptable.

Supporters counter with the fact that traditional car batteries are one of the most successful recycling programs and that widespread use of battery electric vehicles would require the implementation of similar recycling regulations. More modern formulations also tend to use lighter, more biologically remediable elements such as iron, lithium, carbon and zinc. In particular, moving away from the heavy metals cadmium and chromium makes disposal less critical.

It is also not clear that batteries pose any greater risk than is currently accepted for fossil fuel based transport. Petrol and diesel powered transportation cause significant environmental damage in the form of spills, smog and distillation byproducts.

Safety

Firefighters and rescue personnel receive special training to deal with the higher voltages encountered in electric and hybrid gas-electric vehicle accidents.

Future

The future of battery electric vehicles depends primarily upon the availability of batteries with high energy densities, power density, long life, and reasonable cost as all other aspects such as motors, motor controllers, and chargers are fairly mature and cost competitive with ICE components.

The most likely future for BEVs currently appears to be the incremental improvements needed for hybrids. Hybrid EVs are a smaller step from purely ICE driven cars, yet share much of the same core technology as true BEVs. As hybrids become more refined, battery life, capacity and energy density will improve and the combustion engine used less (particular with PHEV). At some point it may become economic for hybrids to be sold without their ICE, finally leading to BEVs being commonplace.

Alternatively, if fuel cells make a breakthrough neither BEVs nor hybrids will be required. More likely fuel cells will replace the ICE in hybrid designs, providing a large energy density, whilst a more traditional battery pack provides the required power density.

Li-ion, Li-poly and zinc-air batteries have demonstrated energy densities high enough to deliver range and recharge times comparable to conventional vehicles. Their greater cost has discouraged use in commercial BEVs, but as production increases for other markets BEVs will no doubt use them.

Flywheel energy storage is a completely different form of electrical energy storage. It shares a lot with battery technologies and both batteries and flywheels are used in the same applications. Recent advances in materials and electronic control makes a flywheel 'BEV' a strong possibility. There have been prototype electric locomotives using flywheel storage.

Owners

The greatest fans of BEVs are those who have obtained or built and used them. This is a self-selected group because BEVs have not been promoted by the major manufacturers in the United States, so their enthusiasm may be misleading. Owners of conventional gasoline vehicles, once given the chance to live with an BEV often leave their gasoline cars sitting in the driveway. Spouses, luke warm when the vehicle is purchased often take over the vehicle from the purchaser once they use it. Fans point out the following:

- People can take responsibility for their own energy production with renewables. This will reduce dependence on foreign oil and large scale coal mining. Many electric vehicle owners and operators express great satisfaction in this aspect of electric vehicle use, even while acknowledging that this use can have only little effect on these matters unless adopted more widely and produced in greater quantities.
- Battery electric vehicles are quieter than ICE powered vehicles.
- BEVs do not produce noxious fumes around the car.
- If packs were mass-produced the charging time could be increased by swapping the pack over with the charger. (This is not practical currently as the battery packs are far too heavy to handle without special tools)

Controversy

In the USA, some EV fans have accused the three major domestic manufacturers, General Motors, Chrysler Corporation and Ford Motor Company of deliberately sabotaging their own electric vehicle efforts through several methods: failing to market, failing to produce appropriate vehicles, failing to satisfy demand, and using lease-only programs with prohibitions against end of lease purchase. By these actions they have managed to terminate their BEV development and marketing programs despite operators' offers of purchase and assumption of maintenance liabilities. They also point to the Chrysler "golf cart" program as an insult to the marketplace and to mandates, accusing Chrysler of intentionally failing to produce a vehicle usable in mixed traffic conditions. The manufacturers, in their own defense, have responded that they only make what the public wants. EV fans point out that this response is the same argument used by GM to justify the intensively promoted 11 mpg 6500 lb (2,950 kg) Hummer H2 SUV. Of the various BEVs marketed by the "Big Three", only the General Motors EV1 (manufactured by GM) and the Th!nk City (imported and marketed by Ford) came close to being appropriate configurations for a mass market. However, at the end of their programs GM destroyed its fleet, despite offers to purchase them by their drivers. Ford's Norwegian-built "Th!nk" fleet was covered by a three-year exemption to the standard U.S. Motor Vehicle Safety laws, after which time Ford had planned to dismantle and recycle its fleet; the company was, however, persuaded by activists to not destroy its fleet but return them to Norway and sell them as used vehicles. Ford also sold a few lead-acid battery Ranger EVs, and some fleet purchase Chevrolet S-10 EV pickups are being refurbished and sold on the secondary market.

Major motor companies have also never been able to explain why they promote their electric cars in America, where gas is very cheap, and ignore the European market, where gas is significantly more expensive. Logically, the more expensive fuel is (locally) the more attractive electric cars would be to the consumer.

Educational literature (for children) is still available that teaches that lead-acid batteries cannot store enough energy to make an electric vehicle practical. Though true, this statement is a lie through omission, as it ignores more advanced battery designs.

Both Honda and Toyota also manufactured electric only vehicles. Honda followed the lead of the other majors and terminated their lease-only programs. Toyota offered vehicles for both sale and lease. While Toyota has terminated manufacture of new vehicles it continues to support those manufactured. It is actually possible to see a RAV-4 EV on the road but this is indeed a rare sight.

United States

The United States produced many electric automobiles, such as the Detroit Electric, during the early 20th century, but production dropped to insignificant numbers with the triumph of gasoline powered internal combustion engine vehicles in the 1920s.

In recent years, electric vehicles have been promoted through the use of tax credits. In California, the California Air Resources Board attempted to set a quota for the use of electric cars, but this was withdrawn after complaints by auto manufacturers that the quotas were economically unfeasible due to a lack of consumer demand. However, many believe this complaint to be unwarranted due to the claim that there were thousands waiting to purchase or lease electric cars from companies such as General Motors, Ford, and Chrysler in which these companies refused to meet that demand despite their production capability. Others note that the original electric car leases were at reduced cost and the program could not be expected to draw the high volumes required without selling or renting the cars at a financial loss. Since the California program was designed by the California Air Resources Board to reduce air pollution and not to promote electric vehicles, the zero emissions requirement in California was replaced by a combination requirement of a tiny number of zero-emissions vehicles (to promote research and development) and a much larger number of partial zero-emissions vehicles (PZEVs), which is an administrative designation for an super ultra low emissions vehicle (SULEV), which emits pollution of about ten percent of that of an ordinary low emissions vehicle.

Outside the United States

In London, electrically powered vehicles are one of the categories of vehicle exempted from the congestion charge. This is also true in all of Norway, where zero-emission vehicles are also allowed to use the bus lane. In most cities of the United Kingdom low speed milk floats (milk trucks) are used for the home delivery of fresh milk.

Production vehicles

Recent or current production battery electric vehicles sold or leased to fleets include:

AC Propulsion tzero Very fast two-seat sportster prototype. Four produced.

Anthony Electric

Arton Birdie

Baker Electric

Bertone Blitz

Citicar/CommutaCar/Comuta-Van

Citroën Berlingo Electrique

Chevrolet S10 EV (Some sold to fleets, available on secondary market as refurbished vehicles) S-10 with EV1 powertrain, over 100 produced only 45 sold to private owners and survived. Currently only EVbones in Mesa AZ restores and converts to NiMH battery packs. 2005

Chrysler TEVan (1993-1995) and Second Generation EPIC (1998-200?)

Commuter Cars Tango Narrow, fast two seater (fore and aft.) Now accepting pre-orders in the US.
Corbin Sparrow Three-wheeled, highway capable single-seat vehicle
Detroit Electric (1907-1939)
Elcat (1985-2002, almost all vehicles in second-hand use)
Ford Ranger EV (1998-2003) some sold, most leased.
(Several hundred produced for lease only, almost all recovered and most destroyed)
(Ford has announced reconditioning and sale of a limited quantity to former leaseholders by lottery)
General Motors EV1 Gen 1 (1996-1997), Gen II (1999-2003)
(Over a thousand produced for lease only, all recovered and most destroyed)
Global Electric Motorcars, LLC. GEM Quite common in Davis, California.
Honda EV Plus (199?-1999)
(Several hundred produced for lease only, all recovered and most destroyed)
Hyundai SantaFe EVCurrently testing fast charge in Hawaii 2005
Kewet
Maranello 4cycle — Italiano
Nissan Altra Lithium-powered hatchback; never offered (even by lease) to consumers
Porsche 550 Spyder replica electric conversion
Peugeot 106 EV
Peugeot Partner
Pivco City Bee
Renault EV Kangoo
REVA India-built city car (40 mph top speed,) now also sold in England as the "G-Whiz"
Sebring-Vanguard Citicar
Sinclair C5
Solectria Force (Conversion, not currently in production)
Think City (Norwegian import by Ford, lease only, all recovered and returned to Norway)
Toyota RAV4 EV
(Rare, some leased and sold on U.S. East and west coast, out of production, supported) Toyota agreed to stop crushing
Toyota Force
Twike3 wheeled Swedish EV with peddal assist optiion.
Universal Electric Vehicle Corporation Electrum series Spyder, Com V-3
Venturi Fétish Marketed as the world's first electric sports two-seater. Monaco
Zap[10] Manufactures the Xebra electric car, the U.S. only mass produced enclosed electric vehicle
Zebra Model Z roadster (Formerly Renaissance Tropica)
Zytec Lotus Elise

Prototypes

Recent prototype EVs include:

Eliica (Electric LIthium-Ion Car) designed by a team at Keio University in Tokyo, led by Professor Hiroshi Shimizu.

Cree SAM
Ford E-Ka
Lexus EV (Featured in the film Minority Report)
Pinanfarina Ethos II
Renault EV Racer
Solectria Sunrise
Subaru Zero EV (announcement)
Suzuki EV Sport
Maya-100 Battery: Li-ion "super"-polymer; claimed range: 360 km [11]
Mitsubishi Colt EV (Li-ion battery, in-wheel motors [12])
Volvo 3CC Three seater with lithium ion batteries [13]
Electric Scooter Razor Electric Bikes [14]

Production announcements

- Venturi "Fetish" sports car to use AC propulsion components (Flash animation with music background)
- AC propulsion announces plans to convert Toyota Scion xA and xB vehicles (items 8 and 9).
- Mitsubishi, a Japanese automobile manufacturer, announced on May 11, 2005 that it will mass-produce its MIEV (Mitsubishi In-wheel Electric Vehicle.) Test fleets are to arrive in 2006 and production models should be available in 2008. The first test car, revealed to be Colt EV, is expected to have a range of 93 miles using lithium-ion batteries and in-wheel electric motors. The target price of a MIEV should be around US$19,000. No export decision has yet been made.
- Plug-in hybrid electric vehicle are being developed by calcars, Edrive Systems, and Hymotion. They take a Toyota Prius, add more battery capacity and modify the controller. Then they can get 250 mpg by plugging in at home for a small light charge each night. Edrive and Hymotion recently announced plans to modify other hybrid models, including the Ford Escape.

Hobbyists, research, and racing

There is a minor industry supporting the conversion and building of BEVs by hobbyists. Some designers point out that a specific type of electric vehicle offers comfort, utility and quickness, sacrificing only range. This is called a short range electric vehicle. This type may be built using high performance lead–acid batteries, but of only about half the mass that would be expected to obtain a 60 to 80 mile (100 to 130 km) range. The result is a vehicle with about a thirty mile (50 km) range, but when designed with appropriate weigh distribution (40/60 front to rear) does not require power steering, offers exceptional acceleration in the lower end of its operating range, is freeway capable and legal, and costs less to build and maintain. By including a manual transmission this type of vehicle can obtain both better performance and higher efficiency than the single speed types developed by the major manufactures. Unlike the converted golf carts used for neighborhood electric vehicles, these may be operated on typical suburban throughways (40 to 45 mph or 60 or 70 km/h speed limits are typical) and can keep up with traffic typical to these roads and to the short on and off segments of freeways that are common in suburban areas.

Aside from production electric cars, often hobbyists build their own EVs by converting existing production cars to run solely on electricity. Some even drag race them as members of NEDRA. Universities such as the University of California, Irvine even go so far as to build their own custom electric or hybrid-electric cars from scratch.

A non-profit program "CalCars" at the University of California, Davis, is attempting to convert a hybrid Toyota Prius automobile to operate as a plug-in hybrid electric vehicle (PHEV) through the installation of additional batteries and software modifications. Such a vehicle will operate as would a pure electric for short trips, taking its power from household and workplace rechargers. For longer trips the vehicle will operate as it does at present—as a "strong" hybrid vehicle. A prototype (using sealed lead-acid batteries) is undergoing tests. It is expected that a production conversion would use a more advanced battery. (Advanced batteries are under development and soon for production in the support of hybrid vehicles.) They are currently soliciting donations of additional vehicles and funds for this project.

Battery electric vehicles are also highly popular in quarter mile (400 m) racing. The National Electric Drag Racing Association regularly holds electric car races and often competes them successfully against exotics such as the Dodge Viper.

- Japanese Prof. Dr. Hiroshi Shimizu from Faculty of Environmental Information of the Keio University created the limousine of the future: the *Eliica (Electric Lithium Ion Car)* has 8 wheels with electric 55 kW hub motors (8WD) with an output of 470 kW and zero emissions. With a top speed of 190 km/h and a maximun reach of 320 km provided by lithium-ion-batteries.
- German Umweltbrief want to convert an old-timer car into full electric drive with 4 wheel hub motors; a retro car for the 21th century called *electro4*. This drive is nearly free of abrasion and maintenance and very reliable. Further advantages are optimal capability of acceleration and best traction through individual control of the wheels. Also the power is generated in the place where its used. Gearbox, kardan shaft and drive shaft become unnecessary, which means less weight. Even an old car can get a torque of 1000 N·m. This 4WD is very silent. There is no vibration and no motor cold-running, the full energy is available immediately. Also small cars can get this system. All is combinable with anti-block system, anti-slip system, stability system, etc., climate control with a/c, heating/cabin, pre-conditioning etc.

See also

- Electric vehicle
- Hybrid vehicle

Patents

- U.S. Patent 772571, Hiram Stevens Maxim, Electric motor vehicle
- U.S. Patent 594805**, H. S. Maxim,** Motor vehicle
- U.S. Patent 523354, E. E. Keller, Electrically Propelled Preambulator

2 plus 2

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The term *2 plus 2* (or *2+2*) is a semi-slang phrase used to describe a car with seating for two passengers up front, plus two for occasional passengers in the rear. Technically, many vehicles fall into this definition, but cars called 2+2s are generally of a more sporting nature than the average vehicle (at least in theory). While the "plus two" seats in the back are generally not very spacious, they are effective in bringing down the owner's insurance rate.

Only a few cars have ever been specifically marketed as 2+2s - most prominent are the Lotus Elan +2, the Nissan 300ZX 2+2 and the various Pontiac 2+2 models, including the aerodynamic Grand Prix of NASCAR fame.

See also sports car.

Air car

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The *air car* is a car being developed by MDI, founded by the French inventor Guy Nègre. It is being manufactured by Moteur Développement International (MDI). The air car is powered by the air engine, an engine specifically disigned to be used with the car. This engine is being manufactured by CQFD Air solution, a company closely linked to MDI. The cars MDI will produce, are not being sold just yet (February 2006), but are said to be coming into production soon.

Compact SUV

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Compact SUV (nicknamed "cute-ute") is a class of small sport utility vehicles which are between 4.15 and 4.50 m long. Most of current compact SUVs are crossover SUVs, as they have monocoque chassis and few off-road capabilities.

List of compact SUVs

Compact crossover SUVs

BMW X3
Buick Rendezvous
Ford Escape
Honda CR-V
Honda Element
Hyundai Tucson
Jeep Cherokee/Liberty
Kia Sportage
Land Rover Freelander
Mazda Tribute
Mercury Mariner
Mitsubishi Outlander
Nissan X-Trail
Pontiac Vibe
Subaru Forester
Suzuki Grand Vitara
Tata Safari DICOR
Toyota RAV4
Toyota Matrix

Compact SUVs

Jeep Wrangler
Jeep Cherokee
Mitsubishi Pajero Pinin
Nissan Xterra
Suzuki Jimny

Concept cars

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A *concept car* is a car prototype made to showcase a concept, new styling, technology and more. They are often shown at motor shows to gauge customer reaction to new and radical designs which may or may not have a chance of being produced.

General Motors designer Harley Earl is generally credited with inventing the concept, or show, car, and definitely did much to popularize it through its traveling Motorama shows of the 1950s.

Concept cars rarely go into production directly; most undergo at least some changes before the design is finalized for the sake of practicality and cost. Concept cars are often radical in design. Some use non-traditional, exotic, or expensive materials, ranging from paper to carbon fiber to exotic alloys. Others have unique layouts, such as gullwing doors, 3 or 6 (or more) wheels, or special abilities not usually found on cars.

Because of these often impractical or unprofitable leanings, many concept cars never get past scale models, or even drawings. Other more traditional concepts can be developed into fully drivable vehicles with a working drivetrain and accessories. The state of most concept cars lies somewhere in between and usually does not represent the final product.

If drivable, the drivetrain is often borrowed from another production vehicle from the same company, or may have defects and imperfections in design. They can also be quite refined, such as General Motors' Cadillac Sixteen Concept [1].

Inoperative "mock-ups" are usually made of wax, clay, metal, fiberglass, plastic or a combination thereof.

After a concept car's useful life is over, the cars are usually destroyed. Some survive, however, either in a company's museum or hidden away in storage. One unused but operational concept car that languished for years in the North Hollywood, California shop of car customizer George Barris, Ford Motor Company's "Lincoln Futura" from 1954, received a new lease on life as the Batmobile in the Batman series that debuted in 1966 on the ABC Television Network.

Some concept cars

Audi Avus Quattro.

The Audi TT began life as a concept car.

Buick "Y" Job" - designed in the late 1930s by the famous General Motors designer Harley Earl. Picture. This is considered by most to be the first concept car.

1956 General Motors Firebird - a gas turbine-powered four-seater with a plastic "bubble top" roof. Three versions.

Buick LeSabre - picture.

Bugatti Rinspeed EB110 Cyan - a Bugatti EB110 tuned by the Swiss company Rinspeed.

BMW Z9 Concept - Many people consider the BMW 6-Series the production version of this coupé concept[2].

Cadillac Sixteen [3] [4].

Castagna Imperial Landaulet.

Chrysler Airflite.

Chevrolet Mako Shark.

Chrysler Norseman - a car designed by Ghia of Italy, was lost when the SS Andrea Doria sunk in 1956.

Dodge Copperhead - a small roadster designed to be a "poor man's Viper". It is one of the most well known concepts of all time.

Dodge Kahuna - a minivan/SUV crossover built mainly for the average surfer..

Dodge Sidewinder - a pickup truck unveiled at the SEMA convention in 1997

Eliica - an 8-wheeled electric car.

Ford GT90 - previously a spiritual successor to the Ford GT40, only one GT90 was produced.

Ford MA concept car - a two-seater with a body made out of bamboo.

General Motors Ultralite.

General Motors Hy-wire.

Opel Frogster - a 2002 car capable of transforming into 3 different body styles with a built-in PDA.
TATA Aria - A superb sports utility Vehicle designed by TATA Motors,India.
TATA Indiva - Another big Multi-utility Vehicle designed by TATA Motors,India.
Toyota Sportivo Coupe - The Sportivo Coupe is a concept car that demonstrates new styling, interior dynamics, and a high technology approach to road safety. It was designed with help from [[Australia}Australian]] teenagers. - Pictures at "http://www.mybarina.com/gallery/Toyota-Sportivo-Coupe".
The Massachusetts Institute of Technology Concept Car with Frank Gehry [5].
The upcoming Volkswagen Eos was originally a concept vehicle known as the Volkswagen Concept C.
Volkswagen 1 L car Volkswagen fuel saver concept with 235 MPG(US)
Volkswagen New Beetle Ragster - The possible new design for future New Beetles.
Volkswagen GX3 - A three-wheeled roaster.
Volvo YCC - the first car designed entirely by a team of women.

See also

- Auto show

Cyclecar

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Cyclecars were small, generally inexpensive cars manufactured mainly between 1910 and 1923.

General description

Cyclecars were propelled by single cylinder, V-twin or four cylinder engines, or sometimes motorcycle engines. Several motorcycle-derived components were used. Cyclecars were half way between motorcycles and cars, some historians say. Bodies were lightweight, sometimes in a tandem two-seater configuration. They used various layouts and means of transmitting the engine power to the wheels, such as belt drive or chain drive. Some cyclecars were primitive and offered minimal comfort.

The rise of cyclecars was a direct result of taxation for the registration on cars, because taxation was based on displacement of the engine and weight of the car.

The cyclecars appear

From 1898 to 1910, automobile production quickly expanded. Light cars of that era were commonly known as voiturettes. Cyclecars appeared around 1910. The cyclecar boom began shortly before the outbreak of World War I. The first successful cyclecars were Bédélia of France and G.N. from Britain.

Sporting cars and cyclecar races

There were sporting cyclecars such as Amilcar, Major or Salmson of France.

There were also races dedicated for cyclecars with the first event of this kind organised by the Automobile Club de France in 1913. Memories preserve the Cyclecar GP at Le Mans in 1920. Until the late 1920's, there were races for cyclecars and voiturettes.

The decline of cyclecars

By the early 1920's the days of the cyclecar were numbered. Mass producers, such as Ford, were the extremely successful competitors. The answer of Henry Ford to cyclecars was simple: he introduced a scaled down Model T to bring the price of new Ford cars closer to the price of cyclecars. Similar affordable cars were offered in Europe such as Citroën, Austin 7 or Morris Cowley. The cyclecar boom was over.

The majority of cyclecar manufacturers closed down. Some companies survived, such as Chater-Lea which returned to the manufacture of motorcycles.

After World War II, small, tiny cars were again in demand, but this time they were called microcars by enthusiasts and bubble cars by the general population.

Cyclecars by countries

Austria

- Grofri

Belgium

- SCH

Canada

- Dart Cycle Car Co
- Glen Motor Company
- Gramm

Czechoslovakia

- Vaja

France

Ajams
Alcyon

Amilcar
Ardex
Austral (cyclecar)
Bédélia
Benova
Bignan
Buc
Contal
Grouesy
Huffit
Ipsi
Jack Sport
JG Sport
Jouvie
Laetitia
Major
Marr
Molla
Orial
Roll
Salmson
Sénéchal
SIMA-Violet
Sphinx
Spidos
Super
Vaillant
Villard
Violet-Bogey
Violette
Viratelle
Virus
Weler

Germany

Arimofa
Koco
Pluto
Spinell

Italy

Amilcar Italiana
Anzani

Spain

Alvarez
David
Izaro
JBR
Salvador

Sweden

- Self

United Kingdom

Adamson
Aerocar
Allwyn
Alvechurch
Amazon
Archer
Armstrong
Athmac
Atomette
Autotrix
AV
Baby Blake
Baker & Dale
Bantam
Barnard
Baughan
Bell
Black Prince
Blériot-Whippet
Bound
Bow-V-Car
BPD
Bradwell
Britannia
British Salmson

Broadway
Brough
Buckingham
Cambro
Campion
C & H
Carden
Carlette
Carter
Castle Three
CFB
CFL
Chater-Lea
Coventry Victor
Crescent
Cripps
Crompton
CWS
Dallison
Dennis
DEW
Douglas
Dursley-Pedersen
Economic
Edmond
Edmund
Edwards
EYME
Frazer Nash
GB
Gerald
Gibbons
Gillyard
Glover
G.N.
Gnome
Graham-White
Guildford
G.W.K.
HCE
Heybourn
Hill & Stanier
HMC
Howard
Howett

HP
Imperial
Invicta
Jappic
JBS
Jewel
Jones
Kendall
LAD
La Rapide
Lambert
LEC
Lecoy
Lington
LM
Matchless
Marcus
Menley
Pinnace
Premier
Simplic
Sterling
Tamplin
Tiny
VAL
Vee Gee
Victor
Warne
Westall
Wherwell
Wilbrook
Willis
Winson
Winter
Woodrow

United States

American
Asheville
Comet
Cycle-Car
Cyclops (cyclecar)
Dayton

Delco
Dodo
Dudly Bug
EIM
Falcon
Fenton
Geneva
Greyhound
Hanover
Hawkins
Hoosier Scout
IMP
Kearns LuLu
Keller
La Vigne
Limit
Malcolm Jones
Merz
Michaelson
Mecca
Mercury
O-We-Go
Pioneer
Post
Prigg
Pacific
Real
Scripps-Booth
Twombly
Vixen
Winthur
Wizzard
Woods Mobilette
Xenia

See also

- List of automobile manufacturers

Books

- 'From Cyclecar to Microcar - The Story of the Cyclecar Movement' Author - Michael Worthington-Williams. Publisher Beaulieu Books 1981
- 'Minimal Motoring - From Cyclecar to Microcar' Author - David Thirlby. Publisher Tempus Publishing Ltd ISBN 0752423673 2002.

Leisure activity vehicle

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A *leisure activity vehicle* is a small van, generally related to a supermini, with a second or even a third seat row, and a large, tall boot. They have become popular in Europe in the 1990s as a cheaper and roomier alternative to small family cars. Sales have declined in the late 2000s, partly because of better average incomes and also due to the mini MPVs, which look less "boxy" and closer to compact and large MPVs.

Examples of leisure activity vehicles:

Citroën Berlingo
Fiat Doblò
Mercedes-Benz Vaneo
Peugeot Partner
Renault Kangoo
Volkswagen Caddy

Limousine

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A *limousine* (or *limo*) is a long luxury car, traditionally black in color. Limousines are often driven by chauffeurs.

While some limousines are owned by wealthy individuals, many are owned by governments to transport senior politicians, by large companies to transport executives, or by broadcasters to transport guests. Most limousines, however, operate as livery vehicles, providing upmarket competition to taxicabs.

The word limousine is derived from the name of the French region Limousin, where the inhabitants wore a hood perceived to be similar to the profile of the car.

Limousine ownership and rental

For the most part, only limousine service and rental companies own limousines. Even the wealthy who use limos as their main mode of city transportation usually do not own the limousine — they contract with a limousine service for long term availability through a lease arrangement. Those in need of a limo will usually contact a rental company to provide transportation on a very short term basis. The most common requirements are for transportation to an airport, proms and weddings.

Limousine types

A limousine will have a partition between the driver compartment and the rear passenger compartment. This partition will usually contain a sliding glass window so that conversations between passengers in the rear compartment may be kept private from the chauffeur.

Traditional

Traditionally, the limousine has been an extension of a large sedan. A longer frame and wheelbase allow the rear passenger compartment to contain the usual forward facing passenger seat but with a substantial amount of footroom — more than is actually needed. Usually then two "jump seats" are mounted, facing rearward behind the driver. These seats fold up when not in use. In this way, up to five persons can be carried in the aft compartment in comfort, and up to two additional persons carried in the driver's compartment, for a total capacity of seven passengers in addition to the driver. This type of seat configuration has however become less popular in recent limousines. Newer limousines such as the Maybach 62 and Lincoln Town Car L Edition do not feature such seats since stretch limousines are usually used to transport more than three passengers, excluding the driver. Vehicles of this type in private use may contain expensive audio players, televisions, video players, and bars, often with refrigerators.

Stretch

As shown in several of these illustrations, most modern limousines are extended in length far beyond that required for personal use. These are typically used to transport partygoers to and from events such as dances and weddings. These vehicles are typically based upon cars with body on frame instead of unibody construction easing the conversion into a stretch limousine. Rather than the typical transverse seating these will have benches along the length of the extension, either on one side or on both sides. This allows the travelers to face one another, unlike the traditional "stage" vehicle, which uses multiple doors to access rows of forward facing seats. In addition to the traditional black (considered appropriate for funerals, as it is a mourning color in western societies) many white limousines are now operated (considered appropriate for weddings in western societies).

Stage

Another type of vehicle modified for multiple passenger use is the motorized stage, applied to the same tasks as the earlier stagecoach. It is not considered a true limousine but rather in its design and application is between a sedan and a bus. While a bus will have a central interior aisle for access to seating, a stage has multiple doors that allow access to transverse forward facing seats. This type of vehicle was once rather common in some locations. An example of its typical use was in the transport of travelers arriving by railroad at Merced, California to Glacier National Park and Yosemite National Park in the first half of the 20th century. In Glacier National Park, these were referred to as "Jammers" in reference to the nickname of their gear jamming drivers. In Yosemite, passengers would then stay in rustic platform tent camps or more expensive lodges (both of which are still available) and hike or rent bicycles for movement around the park.

A modern version of the stage is seen in some novelty strech Hummer or Hummer H2 vehicles operated by some limousine companies.

Exotic custom limousines

Sometimes a custom coach builder or custom car designer will develop the "ultimate" stretch limo, adding amenities that are in fact somewhat impractical but which make a significant design statement. One such design includes double rear axles to support the weight of an operational hot tub.

Custom coach builders can perform aftermarket extensions on luxury sedans and SUVs. These extensive limousine conversions have been performed on several luxury marques, including: Audi, Bentley, BMW, Cadillac, Chrysler, Hummer, Infiniti, Jaguar, Lexus, Lincoln, Mercedes-Benz, and Rolls-Royce. In the United States the most popular vehicles for stretch limousines conversion are the Lincoln Town Car, Lincoln Royale Cadillac DTS, Hummer H2, and the Lincoln Navigator.

Most custom coach builders are located in the United States and Europe and cater mainly to celebrities, government officials, and financial executives. Few such vehicles are available for public hire. These custom stretch limousines can cost anywhere from tens of thousands to hundreds of thousands of dollars. In addition to luxuries, safety features such as armoring and bulletproof glass are often available.

Party bus

A Party Bus or Party Ride is a large motor vehicle designed to carry 20 or more passengers. Party buses may offer leather couch seating, surround sound stereo systems, CD/DVD player, plasma televisions, laser, disco or strobe lights, smoke machines and more. They are primarily used for, although not limited to, weddings, proms and bachelor and bachelorette parties as well as round trips to casinos, nights on the town, birthdays and city tours.

See also

- Car body style

Pony car

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The *pony car* is a class of automobile launched and inspired by the Ford Mustang in 1964. It describes an affordable, compact, highly styled car with a sporty or performance-oriented image.

Origins of the breed

The pony car (and of course the Mustang itself) had its beginnings at Ford Motor Company in the late 1950s following the demise of the original, two-seat Ford Thunderbird. While the Thunderbird's transformation into a larger, four-seat personal luxury car, starting with the 1958 model year, proved to be successful in sales terms, dealers and buyers alike lamented the loss of the two-seat 'Bird, which served as an image leader for the company and a traffic-builder in showrooms, attracting buyers who would ultimately purchase more mundane automobiles. For several years Ford explored various plans for reviving some equivalent of the early Thunderbird.

An added impetus came from Chevrolet, with the popularity of the Corvair Monza late in 1960. The initial Corvair had been positioned as an economy car, but it was much more successful with the plusher trim and sportier image of the Monza model, which sold around 144,000 in 1961. Ford responded with sportier Futura and Futura Sprint versions of its Ford Falcon, and Chrysler Corporation with the Plymouth Valiant Signet and Dodge Dart GT.

Some executives, however, principally Ford's Lee Iacocca, believed that sporty versions of mundane compact cars only scratched the surface of the potential market. During this period there was a strong influx of young buyers with disposable income and a taste for vehicles with a younger image than a standard sedan, and Iacocca's marketing studies revealed that if a unique-looking sporty car could be offered at an affordable price, it would find many buyers. Ford's response to this demand was the Mustang, launched on April 17, 1964, which proved to be an enormous success, selling 680,000 cars in its first extended model year.

Defining the class

The Mustang provided the template for the new class of automobiles. Although it was based on the platform of the Falcon, it had a unique body (offered as a hardtop coupé and a convertible) with distinctive, "long hood, short deck" proportions. In basic form it was mechanically mundane, with a 170 cu. in. (2.8L) six-cylinder engine and three-speed manual transmission. It carried an attractive base price of $2,368, and had an extensive option list offering a range of V8 engines, Cruise-O-Matic automatic transmission or four-speed manual, radios, air conditioning, power steering, and other accessories. A V8 Mustang with all available options would cost about 60% more than a basic Six, which made it an extremely profitable model for Ford.

The requirements were therefore set:

- Attractive, sporty styling
- Affordable base price
- Extensive options, including six-cylinder and V8 engines
- Aggressive, youth-oriented marketing and advertising.

While most of the pony cars offered more powerful engines and performance packages, enough to qualify some as muscle cars, a substantial number were sold with six-cylinder engines or mundane, "cooking" V8s, with the high-performance models largely limited to drag racing, road racing, or racing homologation purposes.

Pony car competitors

Despite the immediate success of the Mustang, many (including some within Ford) feared that the bubble would soon burst, and other manufacturers were surprisingly slow to respond. The first competitor was the Plymouth Barracuda, which actually went on sale on April 1, 1964, about two weeks before the Mustang. The Barracuda was not a direct response to the Mustang, which had not yet debuted (although Chrysler was certainly aware of the upcoming model), but a low-cost way to expand the sporty appeal of the Valiant. Chrysler's precarious financial situation meant that the Barracuda was compromised, with insufficient distinction from the Valiant and styling that drew mixed reactions; its sales were a fraction of the Mustang's. Some mentionned then if the Barracuda was successeful, some could had talk of a "Fish car" instead of the pony-car.

Initially General Motors believed that the restyled 1965 Corvair would be an adequate challenger for the Mustang, but when it became clear that the Corvair itself was doomed, the more conventional Chevrolet Camaro was introduced, going on sale for the 1967 model year, at the time the Mustang was entering its second generation. They were presently joined by the Camaro-based Pontiac Firebird, the Mercury Cougar, and, in 1968, the AMC Javelin. Dodge joined the party belatedly with the 1970 Dodge Challenger, an enlarged version of the Barracuda.

The pony car was primarily an American phenomenon, but in 1969 Ford created a highly successful European equivalent in the Ford Capri. Sharing most of its underpinnings and its four- and six-cylinder engines with a mundane model (the Ford Cortina), it had a combination of style and image very much in the spirit of the Mustang. The European Ford Capri (sold in the U.S. as a Mercury Capri through 1978 at Lincoln-Mercury dealerships) was last imported for the 1978 model year, and the nameplate was placed on a rebadged Fox-body Mustang until it survived through 1987.

While sales were strong throughout the end of the 1960s, the greater value of the pony cars was in bringing buyers, particularly the crucial youth market, into the fold. In 1970 Car and Driver reported that while very few pony car drivers bought a second pony car, around 50% moved on to purchase another car of the same make. Nevertheless, even by 1969 sales were beginning to slide, dropping to 9% of the total market from a peak of 13% in 1967.

Expansion and decline

As with most automobile redesigns, each subsequent generation of the pony cars grew somewhat larger, heavier, costlier, and more plush. Big-block engines joined the option list, and both performance and comfort options proliferated. The 1973 Mustang, for example, was 8.5 inches (215.9 mm) longer, 5.9 inches (150 mm) wider, and over 600 lb (272 kg) heavier than the original edition. The Dodge Challenger, meanwhile, was only slightly smaller and lighter than Dodge's intermediate cars. The added bulk left the standard six and V8 engines sorely pressed, while the introduction of powerful big-blocks underscored the limitations of the pony cars' suspension, brakes, and tires.

By 1970 buyers were moving away from the pony cars, either toward smaller compact cars (domestic or imported) or toward larger, more luxurious models. Performance of the hottest pony cars began to erode as a result of emissions controls and the added weight of required safety features. The 1973 Arab Oil Embargo left the bulky pony cars out of step with the marketplace.

The Challenger, Barracuda, and Javelin were cancelled after 1974, and the Camaro and Firebird nearly died at the same time, although they received last-minute stays of execution. The Cougar became an upsale personal luxury twin to the Ford Thunderbird, while the Mustang was reinvented as a luxury compact based on the Ford Pinto.

Later developments

Despite mediocre performance, the GM pony cars experienced a resurgence in popularity in the late 1970s that insured their survival. The Mustang was redesigned with a renewed sporty image in 1979, prompting Mercury to reenter the pony car market with a Mercury Capri twin based on the new Mustang. Chrysler, beset by financial problems, did not revive the pony car, nor did American Motors Corporation, although Chrysler did offer other front-wheel drive performance models with a similar spirit. The Mustang remained strong, although in the 1980s Ford gave serious consideration to replacing it with a front-drive model (which eventually appeared as the Ford Probe instead). Emissions and fuel economy concerns led many of the latter-day pony cars to offer four-cylinder engines (sometimes with turbocharging), although they were never as popular as six-cylinder and V8 models.

Declining sales and the popularity of light trucks and sport utility vehicles led to the demise of the Camaro and Firebird after 2002. As of late 2005 only the original pony car, the Mustang, is still in production, although its popularity following its 2005 redesign means that the Camaro will apparently return for the 2009 model year and Dodge's Challenger could return as soon as 2007.

The dilemma facing automakers in offering pony cars (or their spiritual equivalent) today is that few have suitable platforms that are affordable enough to be viable. Unlike the mid-1960s, the large majority of modern compact cars are front-wheel drive, with four- and six-cylinder engines, and the widespread use of monocoque construction makes engineering a specialized body an expensive proposition. Some would argue that the true modern equivalent of the pony car is the sporty compact, such as the performance models of the Honda Civic and Dodge Neon, although enthusiasts of the traditional, rear-drive, V8-powered cars are skeptical of such comparisons.

Pony cars of the 1964-1974 are highly prized collectibles today, especially the high-performance models.

Professional car

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A *professional car* in modern times is an automobile that has been modified with extensive coachwork for service in livery transportation (i.e., as a limousine) or in funeral home operations (hearses or flower cars).

Up until c. 1980 ambulances were also available on professional car chassis such as Cadillac, as were combination cars that could be utilized either as an ambulance, a first call vehicle, or as a hearse.

Safety car

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In auto racing, a *safety car* (known in America as the *pace car*) is a car which limits the speed of competing cars on a racetrack in the case of a major accident or obstruction on the track. In production automobiles, a safety car is one which highlights safety features.

Formula One

In Formula One or other road racing events, if there is some incident (such as an accident blocking parts of the track, or very heavy rain) meaning that normal racing cannot continue safely, corner workers will call for a full course yellow flag and show boards saying "SC" meaning that the safety car has been deployed. The F1 Safety Car (SC) has both yellow and green lights on it; the green light allows the driver just behind the SC to pass. Once the race leader is right behind the SC, the yellow lights go on. This car is to be operated by a professional driver—currently Bernd Maylander—and must maintain a good speed so that the tires on the racecars can stay at operating temperature.

The first use of the Safety Car in Formula One was at the 1973 Canadian Grand Prix. However, the Safety Car took its place in front of the wrong driver, which placed part of the field incorrectly one lap down. It took several hours after the end of the race to straighten out who the winner actually was.

Formula One did not use the Safety Car again until the 1993 Brazilian Grand Prix.

To date, the 1999 Canadian Grand Prix is the only Formula One race to finish behind the Safety Car.

In Formula One, during the one lap to green, the SC will have the lights on until it is a few turns away from the pits and the lights will go out. That notifies the drivers that they will be racing in a few minutes.

Since the start of the 2004 season, the safety car has been a (tuned) Mercedes-Benz SLK55 AMG. For the 2006 season the new CLK 63 AMG will be used.

The 1973 Canadian Grand Prix was not the only controversy for the Formula One Safety Car. During the 1994 San Marino Grand Prix, the race director decided to order the safety car (Driven by Max Angeletti at the time) out after two cars (J.J. Lehto in the Benneton-Ford and Pedro Lamy in the Lotus-Mugen Honda) wrecked during the start (in a crash that was frighteningly similar to the 1982 crash that killed Riccardo Paletti), rather than put the race under a red flag, and subsequently have the cars restart. This decision caused the temperature in the cars' tires to fall, a circumstance to which the death of Ayrton Senna later in the race was partially attributed.

The use of a safety car has the side effect of pushing all the competitors together, so any time advantage of one car over another that remains on the same lap is virtually eliminated. This "drawing together" effect can make racing more competitive; conversely, it can be viewed as preventing faster drivers and cars from receiving appropriate rewards for their efforts.

Indianapolis 500

The officials at the Indianapolis Motor Speedway have been selecting a pace car and its driver for the Indy 500 each year the race has been held since 1911. The first pace car was a Stoddard-Dayton driven by Carl G. Fisher. Chevrolet models have been chosen as the official pace car numerous times. The pace car is selected two months before the race runs, allowing the manufacturer of the selected pace car to produce replicas of that year's car, which sell at a marked premium to collectors and race fans. Pace car replicas are often seen on the streets of Indianapolis weeks before the race is actually held. For the 2005 Indy 500, the Chevrolet Corvette was chosen as the Official Pace Car yet again, with General Colin Powell driving the pace car for the start.

Automakers compete for the prestige of having one of their models selected as the year's pace car for the publicity. In 1971 it backfired for Chrysler Corporation and local Indianapolis-area Dodge dealers. Eldon Palmer lost control of the Dodge Challenger pace car and crashed into a photography stand, injuring several people. The blame for the crash was never fully determined, as officials realized that an orange cone (or perhaps an orange flag), which was to identify Palmer's braking point, was accidentally removed.

In the last 50 years, the Pontiac Trans Am, Chevrolet Camaro, Chevrolet Corvette, Oldsmobile Cutlass, and Ford Mustang are the only models that have been selected as pace car three or more times.

During the Indy Racing League season, however, Johnny Rutherford is the normal driver of the IRL pace car for all series events. The pace car is deployed for debris, collision, or weather reasons. Since 1993, upon the waving of the yellow flag, pit road is closed until the pace car picks up the leader and he passes the pit entrance the first time, unless track blockage forces the field to drive through pit lane.

NASCAR

In all NASCAR series, if the caution is out for debris, accident, or inclement weather, the flagman will display the yellow caution flag and the pace car will pull out of the pits and turn on the yellow lightbar on the top of the car. NASCAR pace car driver Elmo Langley (August

22, 1929-November 21, 1996) was a frequent "victim" of Dale Earnhardt, who had a reputation for bumping the pace car during cautions "for the fun of it".

Since mid-2004, NASCAR official Brett Bodine drives the vehicle during official race functions during Nextel Cup Series races after a series of controversies over the beneficiary, or "free pass" rule, also known as the "lucky dog" rule.

The beneficiary rule states once the safety car is deployed, the first car not on the lead lap will regain a lap. Initially, the free pass was deployed on the one lap to go signal, then on two laps to go signal, but after controversy, the free pass car will regain his lap once pit road opens. Bodine will signal that car to pass him through radio contact between NASCAR and that team.

Production safety cars

Another use of the term applies to the many car sold with a focus on safety features. The term was coined for the Stutz Motor Company in the 1920s, and was used repeatedly as a marketing differentiator after that. Notable Safety cars included the 1948 Tucker, the 1957 Aurora, the Bricklin SV-1 ("Safety Vehicle-1"), and the De Lorean DMC-12. In modern times, both Volvo and Saturn have used safety as a sales pitch.

Show car

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A *show car*, sometimes called a *dream car*, is a custom-made automobile created specifically for public display, rather than sale. They are shown at auto shows and other exhibitions.

Show cars generally fall into one or more of three categories:

- Cars intended to preview an upcoming new production model or redesigned model, either to assess or to whet the public appetite. Such preview show cars may be thinly disguised or slightly retrimmed versions of the eventual production model, painted in bold or unusual colors or fitted with unusual trim to attract attention.
- Cars intended to assess the public reaction to a type of model, or a particular styling theme or feature. A prominent example was the 1938 Buick Y-Job, a custom-built Buick created by General Motors styling chief Harley Earl for his own use; although it was never produced, it contained features such as hidden headlights that later became GM styling features. Such cars typically are not intended for production themselves, but may become the basis of a production model if demand is high enough. The Dodge Viper is notable example of the latter.
- Styling exercises built to reward successful designers, letting them blow off steam with a design more exciting than workaday, "cooking" sedans and trucks. Such exercises also serve to draw attention to the manufacturer's more ordinary products.

History

The creation of show cars dates back to at least the 1920s, but reached its zenith in the United States in the 1950s, when most of the major U.S. automakers began to exhibit wild, fanciful dream cars. The preeminent dream car maker was GM, which displayed its work at a series of traveling Motorama shows, mounted at tremendous expesne, but with considerable value in publicity. In the 1960s American show cars became substantially more mundane, slight variations on typical production models (with a few exceptions, like Chevrolet's Mako Shark prototype), and the practice of building them fell on hard times during the 1970s, when automotive whimsy was a low priority compared to safety, pollution control, and fuel economy. The practice was revived in the 1980s, and remains strong today both in the U.S. and abroad.

See also

- Concept car

Sport compact

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Sport compact cars are typically front-engine, front wheel drive (FF) compacts or subcompacts driven by a naturally aspirated 4-cylinder engine. Typical sport compacts include the Acura Integra, Honda Civic,Mazda MX-3, Toyota Celica, and more recently, the Chevrolet Cobalt.

The design philosophy of a sport compact sharply contrasts with those of 'true' sports cars. Sports cars are designed with a performance-oriented philosophy, often compromising cargo space, seating, gas mileage, driveability, and reliability. A sport compact is usually designed with a practical design philosophy and profit in mind. This philosophy has led to several compromises when it comes to performance, such as front wheel drive, conservative engine design, and platform sharing. Electronic control units are also programmed for optimal gas mileage.

Performance-oriented sport compacts focus on improving handling and increasing engine efficiency, rather than increasing engine size or conversion to rear-wheel drive. For example, the Celica GT-S and RSX Type-S are both sport compacts that produce 100 hp/ L of displacement, and have handling superior to their stock trims. However, these models are expensive compared to sports cars of similar performance.

Classification & debate

The exact definition of a sport compact remains a subject of debate. Many believe that any 4-cylinder compact car with 130 hp or more falls into this category, so a RWD car such as the Nissan 240SX would be a sport compact. High performance versions of compact cars, such as the Subaru WRX STi or the Mitsubishi Lancer Evolution often make proper categorization ambiguous. Many see the addition of forced induction as the delineation, as that the increased power provided by forced induction can make a 4 cylinder engine produce more power than most six cylinder engines.

Some would venture so far as to place any performance-oriented car with less than 8 cylinders in this category. However, this categorization is very broad, as cars such as the Toyota Supra, Acura NSX, Lotus Elise, and the Nissan Skyline would then fall into the same category as the Honda Civic and Nissan Sentra. This is probably based on the design philosophy of domestic automakers, as they usually produce sports cars driven by eight cylinder engines, reserving six cylinder engines for less competitive models.

Despite this, Sport Compact Car Magazine often contains articles on the Toyota Supra, Nissan 350Z, Honda S2000, Lotus Elise, and the Mitsubishi Lancer Evolution in addition with other sport compacts.

Tuning

It has become fairly popular to modify or customize a sport compact, commonly referred to as tuning. This has given rise to the term "tuner" for the owners of modified sport compacts, and, by extension, their automobiles. There is a large market for bolt-on performance enhancing equipment that fits small cars of this type. This market also includes a lot of equipment that is cosmetic (something that changes the appearance of the vehicle).

Many self-described "tuners" spend more money on spoilers, ground effects, neon lighting, poorly-designed exhausts, loud sound systems, large wheels with low-profile tires and other style/image products than they do on performance enhancing modifications, effectively turning their cars into rice burners. In many cases, these modifications severely hinder the performance of the car either by increasing curb weight or counteracting original design decisions. For example, a large rear spoiler on a FWD car will reduce traction, and larger wheels require more force to move.

This practice is looked down upon by car enthusiasts of all varieties, who often refer to such characters as 'rice boys'. The rapid explosion of ineffective (and disruptive, in the case of buzzing exhausts and rattling subs) modifications has led to a backlash of sorts against all of those who modify their sport compacts. Much to the distress to those participating in the Import Scene, this has led to the term tuner becoming a pejorative in many circles. Many tuners pour thousands of dollars into engine tuning and performance tuning, and are offended when lumped into the same category as rice boys. Many tuners modify their sport compacts to outrun sports cars with double or in some cases, triple the displacment of their engines.

Restoration of a Japanese import to its JDM specifications (or J-Spec) has become a fairly popular modification for many tuners. It is quite common for Japanese automakers to produce or export less powerful versions of their models to the United States. Such modifications usually involve swapping engines and transmissions. Examples include the conversion of a Toyota Celica GT or GT-S into a Celica GT-Four, or a Honda Civic into a Civic Type-R or Si. These modifications can also be cosmetic, such as the replacement of a front bumper or headlights with its JDM counterpart. Many ricers have performed 'modifications' in the same spirit, adding a 'Type-R', 'Type-S', or 'Si' decal to their cars, or in some cases, all three.

Motorsports

Small cars with high power ratings can be formidable racing vehicles, and racing sport compacts has become so popular that the NHRA now has a special class for sport compact racing. Some highly modified sport compact dragsters can accelerate from 0-60 in less than four seconds.

Sport compacts are fairly popular for autocross competitions. The Acura Integra, Toyota Celica, and MINI Cooper are some of the more successful sport compacts within their classes.

Market trends

Sport compacts are one of the fastest growing segments of the performance car market. Manufacturers such as Honda, Toyota, Mazda, and Nissan have begun producing 'pre-tuned' sport compacts, such as the Civic Si, Corolla XRS, Mazda3, and the Sentra SE-R Spec V. These models are often rebadged versions of models previously created for other markets, or simply a trim level that was not available in the United States.

Manufacturers of automobiles in the United States have now begun to respond to the explosion of this market segment. General Motors has responded with a new Ecotec four-cylinder engine, which is designed specifically to be tuned. The engine is offered in the Saturn ION Redline and the Chevrolet Cobalt. Ford now offers many bolt-on performance parts for the Ford Focus.

Toyota has gone so far as to create an entire division dedicated to producing customizable sport compacts, Scion. They place special emphasis on providing aftermarket-style accessories, such as decals, exhaust tips, and a supercharger.

See also

- Compact car
- Hot hatch

Voiturette

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Voiturette has two meanings, depending largely on date. Before World War Two the word applied to light-weight racing cars such as the Bugatti Type 13 and the original ERAs, but in the years following the end of the war it came to refer to a type of small French three-wheeled cyclecar.

In the very late twentieth century the word was revived for a French vehicle designed for use by people not younger than 16 years of age. Its an extremely light car that weighs less than 350 kilograms (770 lb) empty and will take a load (i.e., passengers) of mass not more than 200 kilograms (~440 lb). Further, its top speed is limited to 45 km/h (~30 mph). Such vehicles are also called "motor quadricycles", or, less exactly, "motor tricycles". The driver's licenses that permit their use are those for category "B1". The European Union has decreed that all lands subject to its rule must accept these as alternatives on the market, and could only modify the driver's license requirements to drive them. The British did not like having to accept such a thing on its roads.

Green vehicles

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âA *green vehicle* is a vehicle that is considered to be "environmentally friendly." This is accomplished by reducing consumption of petroleum, or, preferably, by using renewable energy sources for fuel/energy. Examples of green vehicles include electric cars, hybrid cars and hydrogen cars. Solar car races are held on a regular basis in order to promote green vehicles and other "green technology".

A conventional vehicle can become a green vehicle of a sort by mixing in renewable fuels. Typical gasoline cars can handle up to 15% ethanol. There are some places that have built cars that run strictly on ethanol, but another option is a flexible-fuel vehicle, which allows a varying mixture (often up to 85%, sometimes up to 100%[1]). Diesel-powered vehicles can often transition completely to biodiesel, though the fuel is a very strong solvent, which can occasionally damage rubber seals in vehicles built before 1994. More commonly, however, biodiesel causes problems simply because it removes all of the built-up residue in an engine, clogging filters.

The EU is promoting the marketing of greener cars via a combination of binding and non-binding measures

Alternative propulsion

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Alternative propulsion is a term used frequently for power train concepts differing to the standard internal combustion engine concept used in gasoline- or diesel-fueled vehicles.

Definition

The term alternative propulsion or "alternate methods of propulsion" includes both

- alternative fuels used in standard or modified internal combustion engines

- propulsion systems not based on internal combustion, such as those based on electricity (for example, electric vehicles), compressed air, or fuel cells

Motivation

The motivation for the research in alternative propulsion in transport is primarily to achieve more sustainable methods of transportation than those relying on fossil fuels.

Application fields

Most work in alternative propulsion concepts is focused on replacing traditional internal combustion engines in automobiles. Several contests, such as Michelin's Challenge Bibendum and the North American Solar Challenge, are designed to provide motivations for effective concepts utlizing alternative propulsion. Hybrid vehicles, which combine an internal combustion engine with an alternative system, are perhaps the most visible example of alternative propulsion systems in use today.

Alternative propulsion is not limited to automobiles, however; it can also apply to types of spacecraft propulsion beyond solid- or liquid-fueled rockets. Propulsion methods such as the ion thruster and solar sail are examples of alternative propulsion options for spacecraft.

Criteria for successful application of alternative propulsion

In order to supplant traditional propulsion systems, alternative propulsion systems must be able to equal or exceed the performance and convenience of traditional systems in several areas:

- operating radius
- acceleration and top speed
- stability of the stored energy (degradation over time, losses or leakages)
- refueling procedure
- environmental effects (minimizing odor, noise, vibrations, radiation, emission of noxious substances, etc.)

See also

- Low-energy vehicle

Electric vehicles

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An *electric vehicle* is a vehicle whose motion is provided by electric motors. The motion may be provided either by wheels or propellors driven by rotary motors, or in the case of tracked vehicles, by linear motors. The electrical energy used to power the motors may be obtained from a direct connection to land-based generation plants, as is common in electric trains; from chemical energy stored on the vehicle in batteries or diesel fuel; from nuclear energy, on nuclear submarines and aircraft carriers; or more esoteric sources such as flywheels, wind and solar.

The reasons electric motors are used to drive vehicles are their fine control, high efficiency and simple mechanical construction. Electric motors often achieve 90% conversion efficiency over the full range of speeds and power output and can be precisely controlled. Electric motors can provide torque whilst not moving, unlike internal combustion engines, and do not need gears to match power curves. This removes the need for gearboxes and torque convertors. Electric motors also have the unusual ability to convert movement energy back into electricity, through regenerative braking. This can be used to reduce the wear on brake systems, and reduce the total energy requirement of a typical trip.

Most electric transport is directly connected to stationary sources of energy through the grid. Due to the extra infrastructure and difficulty in handling arbitrary travel, most directly connected vehicles are owned publicly or by large companies. These forms of transportation are covered in more detail in maglev trains, metros, trams, trains and trolleybuses. A hypothetical electric vehicle design is Personal rapid transit, a cross between cars and trains optimised for independent travel.

In most systems the motion is provided by a rotary electric motor. However, some trains unroll their motors to drive directly against a special matched track. These are called linear motor trains. Often these are also magnetic levitation trains, floating above the rails through magnetic force. Note that the levitation and the forward motion are independent effects: while the forward motive forces still require external power, Inductrack achieves levitation at low speeds without any.

Chemical energy is the most common independent energy source. Chemical energy is converted to electrical energy, which is then regulated and fed to the drive motors. Chemical energy is usually in the form of diesel or petrol. The fuel is usually converted into electricity by a generator powered by an internal combustion engine or other heat engine. This approach is known as diesel-electric or gas-hybrid locomotion.

Another form of chemical to electrical conversion is electro-chemical. This includes fuel cells and batteries. By avoiding an intermediate mechanical step the conversion efficiency is dramatically improved over the chemical-thermal-mechanical-electrical-mechanical process already discussed. This is due to the higher carnot efficiency through directly oxidising the fuel and by avoiding several unnecessary energy conversions. Furthermore, electro-chemical batteries conversions are easy to reverse, allowing electrical energy to be stored in chemical form.

Despite the higher efficiency, electro-chemical vehicles have many technical issues which prevent them from replacing the more cumbersome heat engines. Heat engines have been easier to scale up, with the largest electrical generators always being driven by heat engines. Fuel cells are fragile, sensitive to contamination, and require external reactants such as hydrogen. Batteries require highly refined and unstable chemicals that could be harmful to the environment and must be recycled to minimize their impact and maximize their sustainability through material reuse. Both have lower energy and power density than heat engines.

For especially large electric vehicles, namely submarines and aircraft carriers, the chemical energy of the diesel-electric can be replaced by a nuclear reactor. The nuclear reactor usually provides heat, which drives a steam turbine, which drives a generator, which is then fed to the propulsion.

There have been a number of experiments using flywheel energy storage in electric vehicles. The flywheels store energy as rotation, which is converted to electricity via a generator, which then drives the wheel motors. It might seem odd to convert rotational energy to electrical energy, only to convert it back, but flywheels need to spin very fast to store enough energy to be useful, and it is easier to use electricity to convert the motion to something suitable for the vehicle.

There are two commonly available electric vehicle designs for automobiles: Battery Electric Vehicles or BEVs, which convert chemical energy to electrical energy in batteries; and Hybrid vehicles, which convert chemical energy to electrical energy via an internal combustion engine and a generator.

Other light personal mobility devices include electric wheelchairs, the Segway HT, electric scooters, motorized bicycles, golf carts and neighborhood electric vehicles. Working electric vehicles include heavy work equipment, fork lifts, and numerous other service and support vehicles. Strictly technology-proving experimental or solar powered vehicles include sun racers, electrathons, the aerial Helios Prototype, and some rocket propulsion systems such as the ion thruster.

History

Main article: **history of the electric vehicle**

Electric motive power started with a small railway operated by a miniature electric motor, built by Thomas Davenport in 1835. In 1838, a Scotsman named Robert Davidson built an electric locomotive that attained a speed of four miles an hour. In England a patent was granted in 1840 for the use of rails as conductors of electric current, and similar American patents were issued to Lilley and Colten in 1847.

Between 1832 and 1839 (the exact year is uncertain), Robert Anderson of Scotland invented the first crude electric carriage, powered by non-rechargable Primary cells.

By the 20th century, electric cars and rail transport were commonplace, with commercial electric automobiles having the majority of the market. Electrified trains were used for coal transport as the motors did not use precious oxygen in the mines. Switzerland's lack of natural fossil resources forced the rapid electrification of their rail network.

Electric vehicles were among the earliest automobiles, and before the preeminence of light, powerful internal combustion engines, electric automobiles held many vehicle land speed and distance records in the early 1900s. They were produced by Anthony Electric, Baker Electric, Detroit Electric, and others and at one point in history out-sold gasoline-powered vehicles.

Future

The future was unclear because of the low range and small lifespan of the batteries. But there are several developments which could bring back electric vehicles outside of their current field of application -- namely operational yards and indoor operation. The first improvement[2] was to decouple the electric motor from the battery through electronic control while employing ultra-capacitors to buffer large but short power demands and recuperable braking energy. The development of new cell types compared with intelligent cell management improved both weak points mentioned above. The cell management is not only able to monitor the health of the cells but by having a redundant cell configuration (one cell more than needed) and a sophisticated switched wiring it is possible to condition one cell after the other while the rest are on duty. Perhaps the most important point is that a monovalent operation (electric only) is no longer considered dogma. The use of fuel cells instead of internal combustion engines can create propulsion systems that are nearly emissions-free (regarding local emissions).

Electric vehicles and the automotive industry

Most major automakers have attempted to postpone or prevent mass production of electric cars. At one time during emissions reductions regulations GM produced over 1,100 of their EV1 models, 800 of which were made available through 3-year leases. Upon the expiration of EV1 leases, GM crushed them. The reason for the crushing is not clear, but has variously been attributed to (1) the auto industry's successful challenge to California law requiring zero emission vehicles or (2) a federal regulation requiring GM to produce and maintain spare parts for the few thousands EV1s. A web site tracks crushing of other electric vehicles.

Patents

- U.S. Patent 772571, Hiram Stevens Maxim, Electric motor vehicle
- U.S. Patent 657046, J. Trier, Multiple motor systme for automobile
- U.S. Patent 594805, **H. S. Maxim,** Motor vehicle
- U.S. Patent 523354, E. E. Keller, Electrically Propelled Preambulator
- U.S. Patent 650014, I. Kitsee, Electric motorcycle
- U.S. Patent 643258, **E. A. Sperry,** Motor vehicle
- U.S. Patent 640968, **E. A. Sperry,** Electric vehicle
- U.S. Patent 849146, **J. Ledwinka,** Automobile
- U.S. Patent 1017198, E. W. Bender, Electric Motor vehicle

See also

- Battery electric vehicle
- Electric vehicle conversion
- Hybrid vehicle
- Hydrogen vehicle
- Steam car

History of the electric vehicle

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Electric vehicles were invented in the mid-1800s and held the vehicular land speed record until around 1900. The high cost and low top speed of electric vehicles compared to later internal combustion vehicles caused a worldwide decline in their use, and only relatively recently have they re-emerged into the public eye.

Flexible-fuel vehicles

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A *flexible-fuel vehicle* or *dual-fuel vehicle* is an automobile that can typically alternate between two sources of fuel. A common example is a vehicle that can accept gasoline mixed with varying levels of ethanol (gasohol). Some cars carry a natural gas tank and one can switch from gasoline to gas.

Flexible-fuel vehicles in the United States

North American vehicles from approximately 1980 onward can run on 10% ethanol/90% gasoline (e.g., E10) with no modifications. Prior to 1980, many cars imported into the United States contained rubber, aluminium, and other materials that were generally non-compatible with any ethanol in their fuel delivery systems, and these cars experienced problems when E10 was first introduced.Cars made in the US from the late 1970's onward can run on E10 with no modifications. E10 fuel is widely available. Going beyond 10% ethanol generally requires special engineering.

In the United States, many flexible-fuel vehicles can accept up to 85% ethanol (E85). The fuel mixture is automatically detected by one or more sensors, and once detected, the ECU tunes the timing of spark plugs and fuel injectors so that the fuel will burn cleanly in the vehicle's internal combustion engine. Originally, sensors in both the fuel-line and in the exhaust system were used for flexible fuel vehicles. In recent years, manufacturers have instead opted to use only sensors in the exhaust manifold, before the catalytic converter, and to eliminate the fuel inline sensor. As E85 is more corrosive, special fuel lines are also required. Some manufacturers also required a different motor oil be used, but even this requirement is now dropped for all but one manufacturer.

In 1998, General Motors Corporation introduced their first light truck (an S10, with 2.2L engine) in a flexible-fuel configuration. In 1999, Ford Motor Company introduced a flexible-fuel option on its Ford Ranger pickup trucks, and it has also been an option on the company's Taurus model. Other manufacturers such as Mercedes-Benz, Chrysler/Dodge (namely certain models of Caravan) also are E85/Flexible fuel vehicles. Flexible fuel vehicles are often identified as such on the driver's side door, on the inside of the fuel fill access door, and by the VIN number.

As of 2005, most existing vehicles that are available to the public with flex-fuel engines are sport-utility vehicles or others in the "light truck" class. Sedans, wagons, and others are usually only available in flexible-fuel configurations as part of fleet vehicle purchases by companies. Starting in 2006, though, more widespread availability is planned for standard models intended for non-fleet sales.

A 1988 federal law provides an incentive for creating flexible fuel vehicles in the form of credits that can be used to relax Corporate Average Fuel Economy fuel efficiency standards. It is alleged that this efficiency relaxation has decreased overall US fleet efficiency, thereby resulting in increased nationwide fuel consumption.

Over 4 million flexible-fuel vehicles are currently operated on the road in America, although a 2002 study found that less than 1% of fuel consumed by these vehicles is E85.

Flexible fuel vehicles as identified by the National Ethanol Vehicle Coalition.

Flexible-fuel vehicles in Brazil

Since the oil crisis in the 70's, Brazil has been selling ethanol as a fuel. Car manufacturers modified gasoline engines so as to better support alcohol characteristics (mainly changes in compression ratio and better robustness to protect from corrosion) and have been selling ethanol powered cars since then, in a lower scale than gas-powered cars. However, flexible fuel technology started to be investigated only in the 1990s. The flexible fuel car is built with an ethanol engine, a lambda probe to measure the mixture of gases that leaves the engine and a controller that regulates the input of fuel and the spark time, so as to correct the quality of the mixture. Those cars can run with arbitrary combinations of gasoline and alcohol (up to 100% of alcohol), but current engines cannot use pure gasoline - they are designed to run on gasoline mixed with 20% to 25% of ethanol, which is obligatory in Brazil.

In May 2003 Volkswagen built for the first time a production flexible fuel car, the Gol 1.6 Total Flex. Chevrolet followed two months later with the Corsa 1.8 Flexpower. The first compact car with flexible fuel engine was the Astra 2.0 Flexpower, and mid-size cars, minivans and pickup trucks followed later. As of 2005, popular manufacturers that build flexible fuel vehicles are Chevrolet, Fiat, Ford, Peugeot, Renault and Volkswagen. Flexible fuel cars were 22% of the car sells in 2004, 53% in 2005, and 75% and 90% rates are estimated for 2006 and 2007.

There's another type of flexible fuel vehicle that is not uncommon in Brazil. Those are the cars able to switch from gasoline to natural gas. The term "flex-fuel", however is never used to describe those cars; instead, they are called bi-fueled vehicles or tri-fueled if they are built with an ethanol-gasoline flexible fuel engine (and tetra-fueled if they can run on pure gasoline). These vehicles are always adapted in specialized houses after they are bought. In many cities, natural gas shares a small part of the fuel market with gasoline and ethanol. It has the advantage of being the cheaper fuel in the country and the disadvantage of having the lowest mileage and taking a lot of space in the trunk.

Trucks are diesel powered and there's no provision to convert them to flexible fuel vehicles. Instead the trend is to slowly replace diesel with bio-diesel. The currently allowed mixture is 98% diesel and 2% bio-diesel. The mixture of 95% diesel and 5% bio-diesel will become a requirement only in 2013.

Flexible-fuel vehicles in Europe

For a long time Ford Taurus was the only flexible-fuel vehicle sold in Sweden. It was later replaced by Ford Focus. In 2005 Saab begun selling its 9-5 Biopower, and Volvo its S40 and V50 with Flexifuel engines. There are also plans of selling E85 fuel, and then some flexible-fuel vehicles, in other European countries.

List of currently-produced flexible fuel vehicles

Europe

Ford Focus, Focus C-MAX
Saab 9-5
Volvo S40, V50

USA

Chrysler Sebring
Dodge Caravan, Durango, Grand Caravan, Ram Pickup, Stratus
Ford Crown Victoria, F-150, Grand Marquis, Taurus
Chevrolet Avalanche, Silverado, Suburban, Tahoe
GMC Sierra, Yukon
Nissan Titan

Brazil

Chevrolet: Celta, Classic, Corsa, Astra, Vectra, Montana, Meriva, Zafira
Citroën: C3
Fiat: Mille, Palio/Siena/Strada, Doblò, Idea, Stilo
Ford: Fiesta, EcoSport
Peugeot: 206
Renault: Clio, Mégane, Scénic
Volkswagen: Gol, Fox, Kombi

See also

- Plug-in hybrid electric vehicle
- Southern Grease - A great beginner's tutorial on using renewable fuel in diesel engines

Hydrogen vehicle

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A *hydrogen vehicle* is an automobile which uses hydrogen as its primary source of power for locomotion. These cars generally use the hydrogen in one of two methods: combustion or fuel-cell conversion. In combustion, the hydrogen is "burned" in engines in fundamentally the same method as traditional gasoline cars. In fuel-cell conversion, the hydrogen is turned into electricity through fuel cells which then powers electric motors. With either method, the only byproduct from the spent hydrogen is water.

Hydrogen can be obtained from decomposition of methane (natural gas) or from water using electricity (electrolysis). A primary benefit of using pure hydrogen as a power source is that it uses oxygen from the air to produce only water vapor as exhaust (and very little nitrogen oxides from the nitrogen in the air when burning at high temperatures, moving the source of atmospheric pollution from many cars back to a single power plant, where it can be more easily dealt with. (The hydrogen car has absolutely nothing to do with fusion of hydrogen.)

Hydrogen is not a pre-existing source of energy like fossil fuels, but a carrier, much like a battery. It is renewable in a realistic time scale, unlike fossil fuels which can take millions of years to replenish. The largest apparent advantages are that it could be produced and consumed continuously as well as cleanly using solar, wind and nuclear power for electrolysis. However, hydrogen production methods currently utilizing hydrocarbons would actually be more pollutive than direct consumption of the fossil fuels. To reduce pollution and reliance on fossil fuels, sustainable methods of hydrogen production would have to be invested in.

Some hydrogen cars currently exist, and a significant amount of research is underway to make the technology more viable. The common internal combustion engine, usually fueled with gasoline (petrol) or diesel liquids, can be converted to run on gaseous hydrogen. However, the most efficient use of hydrogen involves the use of fuel cells and electric motors instead of a traditional engine. Hydrogen reacts with oxygen inside the fuel cells, which produces electricity to power the motors. One primary area of research is hydrogen storage, to try to increase the range of hydrogen vehicles while reducing the weight, energy consumption, and complexity of the storage systems. Two primary methods of storage are metal hydrides and compression.

High speed cars, buses, submarines, and space rockets already run on hydrogen, in various forms. There is even a working toy model car that runs on solar power, using a reversible fuel cell to store energy in the form of hydrogen and oxygen gas. It can then convert the fuel back into water to release the solar energy. **[1]**

Hydrogen fuel cell

While fuel cells are potentially highly efficient, and working prototypes were made by Roger E. Billings in the late 1960s, three major obstacles exist in the development of a fuel cell-powered hydrogen car. The first problem is that hydrogen has a very low density. Even when the fuel is stored as a liquid in a cryogenic tank or in a pressurized tank as a gas, the amount of energy that can be stored in the space available is limited, and hydrogen cars therefore have limited range compared to their conventional counterparts. Some research has been done into using special crystalline materials to store hydrogen at greater densities and with margins.

Instead of storing molecular hydrogen on-board, some have advocated using hydrogen reformers to extract the hydrogen from more traditional fuels including methane, gasoline, and ethanol. Many environmentalists are irked by this idea, as it promotes continued dependence on fossil fuels (at least in the case of gasoline). However, given an efficient reforming process, vehicles using reformed gasoline or ethanol to power fuel cells would still be more efficient than vehicles running internal combustion engines.

The second major problem that used to plague hydrogen fuel cells involves the high cost of making reliable fuel cells that would provide electric power in a hydrogen car. Scientists are also working hard to figure out how to produce inexpensive fuel cells that are also robust enough to survive the bumps and vibrations that all automobiles have to handle. Furthermore freezing conditions have to be handled because fuel cells do produce water and utilise moist air with varying water content. Most fuel cell designs are fragile and can't survive in such environments. Also, many designs require rare substances such as platinum as a catalyst in order to work properly, and the catalyst can be contaminated by impurities in the hydrogen supply. However, within the past few years, a nickel-tin catalyst has been developed which drastically lowers the cost of a hydrogen fuel cell car to make it an economically viable car.

The third "problem" is due to the fact that while hydrogen can be used as an energy carrier, it is not an energy source. It still must be produced from fossil fuels, or from some other energy source, with a net loss of energy (since the conversion from energy to hydrogen storage and back to energy is not 100% efficient). Hydrogen is nearly twice as efficient than traditional combustion engines, which only have an efficiency of 15-25%. Hydrogen has a thermodynamic efficiency of 50-60%. The percentage will never be 100% because of the second law of thermodynamics.

Since all energy sources have drawbacks, a shift into hydrogen powered vehicles may require difficult political decisions on how to produce this energy. The US Energy Department has already announced a plan to produce hydrogen directly from Generation IV reactors. These nuclear powerplants would be capable of producing hydrogen and electricity at the same time. Recently, alternative methods of creating hydrogen directly from sunlight and water through a metallic catalyst have been announced. This may provide a cheap, direct conversion of solar energy into hydrogen, a very clean solution. [2]

Sodium boro hydride ($NaBH_4$) a chemical compound may hold future promise due to the ease at which hydrogen can be stored under normal atmospheric pressures in automobiles that have fuel cells.

United States President George W. Bush is optimistic that these problems could be overcome with research. In his 2006 State of the Union address, he announced the U.S. government's hydrogen fuel initiative, which complements the President's existing FreedomCAR initiative for safe and cheap hydrogen fuel cell vehicles.

Moving the world economy toward the use of alternative (i.e. non-fossil fuel) energy sources, of which creating economically feasible hydrogen vehicles with perfomance comparable to current gasoline powered vehicles is an important part, may help to alleviate a great deal of the world's political problems. For instance, dramatically reducing the United States' dependence on oil would eliminate its main strategic interest in the Middle East allowing it to withdraw both U.S. troops and U.S. aid to repressive regimes in the region (such as Saudi Arabia, Egypt, Pakistan, and Israel) thereby depriving anti-American terrorists of one of their most valuable recruiting tools. Moreover, the economic marginalization of oil that would occur in as the world moved away from oil as its primary fuel would create dramatic changes in the political and economic dynamics of oil producing states. The declining price of oil would help to alleviate the so-called "Dutch Disease" that afflicts major oil exporters in which the oil industry soaks up most of the investment and caused currency appreciation that undermine the competiveness other industries working in tradable goods. The immense oil wealth of these states (think Saudi Arabia or the UAE) also prevents the formation of important political institutions and removes the government's dependence on the people for revenue thereby depriving the people of any ability to hold the government accountable. Without the huge revenues provided by oil the government would have to rely on the people for revenue meaning that the state would likely be forced to make important concessions to the people in the fields of political rights and civil liberties. The bottom line is that the United States may be able to decrease Muslim anti-Americanism, bring home troops, and promote reform in the Muslim world by moving toward alternative energies such as the hydrogen powered vehicle. This may also help to relieve other geopolitical tensions by removing an area over which great powers have traditionally competed and still compete today. (For more information on the corosive effects of oil look for "Dutch Disease" in almost any economics textbook and check out "Saving Iraq From Its Oil" by Nancy Birdsall and Arvind Subramanian in the July/August 2004 issue of Foreign Affairs)

Hydrogen internal combustion

Hydrogen internal combustion engine cars are different from hydrogen fuel cell cars. The hydrogen internal combustion car is a slightly modified version of the traditional gasoline internal combustion engine car. Hydrogen internal combustion cars burn hydrogen directly, with no other fuels and produce pure water vapor exhaust. The problem with these cars is the hydrogen fuel that can be stored in a normal size tank is used up rapidly. A full tank of hydrogen, in the gaseous state, would last only a few miles before the tank is empty. However, methods are being developed to reduce tank space, such as storing condensed (liquid) hydrogen or using metal hydrides in the tank.

In 1807, François Isaac de Rivaz built the first hydrogen-fueled internal combustion vehicle. However, the design was very unsuccessful.

It's estimated that more than a thousand hydrogen powered vehicles were produced in Germany before the end of the WWII prompted by the acute shortage of oil.

BMW's CleanEnergy internal combustion hydrogen car has more power and is faster than hydrogen fuel cell electric cars. A BMW hydrogen car (H2R[3]) broke the speed record for hydrogen cars at 300 km/h (186 mi/h), making automotive history. Mazda has developed Wankel engines to burn hydrogen. The Wankel uses a rotary principle of operation, so the hydrogen burns in a different part of the engine from the intake. This reduces intake backfiring, a risk with hydrogen fueled piston engines.

However the major car companies like DaimlerChrysler and General Motors Corp, are investing in the slower, weaker, but more efficient hydrogen fuel cells instead.

An existing conventional car sleeps in a converter to run on hydrogen, or a mixture of hydrogen and other gasses as produced in a reforming process. Since hydrogen can burn in a very wide range of air/fuel mixtures, a small amount of hydrogen can also be used to ignite various liquid fuels in existing internal combustion engines under extremely lean burning conditions. This process requires a number of modifications to existing engine air/fuel and timing controls. Roy McAlister of the American Hydrogen Association has been demonstrating these conversions. Other renewable energy sources, like biodiesel, are also practical for existing automobile conversions, but come with their own host of problems.

Some claim to have devices that convert water to hydrogen gas directly in the car using the engine's output, making a car that runs only on water and produces water as exhaust. Since this is a closed loop exhibiting net energy output (perpetual motion), it is widely regarded as a hoax.

In 2005 an Israeli company claimed it succeeded in conquering most of the problems related to producing Hydrogen internal combustion engine by using a device called a Metal-Steam combustor that separate Hydrogen out of heated water. A tip of a Magnesium or Aluminum coil is inserted into the small Metal-Steam combustor together with water where it is heated to very high temperatures. The metal atoms bond with the Oxygen from the water, creating metal oxide. As a result, the Hydrogen molecules become free, and are sent into the engine alongside the steam. The solid waste product of the process, in the form of metal oxide, will later be collected in the fuel station and recycled for further use by the metal industry **[4]**

Automobile and bus makers

Many companies are currently researching the feasibility of building hydrogen cars. Funding has come from both private and government sources. In addition to the BMW and Mazda examples cited above, many automobile manufacturers have begun developing cars. These include:

- BMW — 7 series (auxiliary power), based on UTC Power fuel cell technology
- DaimlerChrysler — F-Cell, a hydrogen fuel cell vehicle based on the Mercedes-Benz A-Class.
- Ford Focus FCV — a hydrogen fuel cell modification of the Ford Focus
- General Motors — multiple models of fuel cell vehicles including Hy-wire and the HydroGen3
- Honda is experimenting with a variety of alternative fuels and fuel cells with experimental vehicles based on the Honda EV Plus
- Hyundai — Santa Fe FCEV, based on UTC Power fuel cell technology
- Mazda - RX-8, with a dual-fuel (hydrogen or gasoline) rotary-engine **[5]**
- Nissan — X-TRAIL FCV, based on UTC Power fuel cell technology

- Volkswagen and Toyota also have hydrogen fuel cell cars in development.

A few bus companies are also conducting hydrogen fuel cell research. These include:

- DaimlerChrysler, based on Ballard fuel cell technology
- Thor Industries (the largest maker of buses in the U.S.), based on UTC Power fuel cell technology
- Irisbus, based on UTC Power fuel cell technology

Supporting these automobile and bus manufacturers are fuel cell and hydrogen engine research and manufacturing companies. The largest of these is UTC Power, a division of United Technologies Corporation, currently in joint development with Hyundai, Nissan, and BMW, among other auto companies. Another major supplier is Ballard Power Systems. The Hydrogen Engine Center is a supplier of hydrogen-fueled engines.

Most, but not all, of these vehicles are currently only available in demonstration models and cost a large amount of money. They are not yet ready for general public use.

There are, however, fuel cell powered buses currently active or in production, such as a fleet of Thor buses with UTC Power fuel cells in California, operated by SunLine Transit Agency [6]. Perth is also participating in the trial with three fuel cell powered buses now operating between Perth and the port city of Fremantle. The trial is to be extended to other Australian cities over the next three years.

Mazda leased two dual-fuel RX-8s to commercial customers in Japan in early 2006, becoming the first manufacturer to put a hydrogen vehicle in customer hands. BMW has recently released to the media information of a new car that has been manufactured and uses hydrogen or petrol and is completely clean. BMW also plans to release its first publicly available hydrogen vehicle in 2008.

Fuel stations

Since the turn of the millennium, filling stations offering hydrogen have been opening worldwide and hydrogen stations. Among them:

- Some fuel stations in Germany (among them, Aral), within the Clean Energy Partnership, are offering hydrogen.
- Bus refueling stations in a small number of European cities as part of the Clean Urban Transport for Europe programme.
- Iceland began opening stations in 2003 as part of the country's initiative to implement a hydrogen economy.[7]
- Stations in California opened by the California Fuel Cell Partnership, and under Governor Arnold Schwarzenegger's hydrogen highway program.
- The third hydrogen filling station in the world opened in Dearborn, Michigan in 1999, sponsored by Ford.[8]

Planes

Smartfish is a revolutionary general aviation aircraft technology that is highly innovative in terms of safety, economy and emotion. It uses hydrogen fuel.

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See also

- Electric vehicle
- Future of the car
- Hybrid car
- Alternative fuel cars

Low-energy vehicles

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A *low-energy vehicle* is any type of vehicle that uses less energy than a regular vehicle.

Motivation

Standard for passenger cars in Europe is 175 CO_2 g/km which equals 6.6l diesel resp. 7.5 l gasoline per 100 km. It is not feasible to base transportation in the long run on such high energy consumption without provoking heavy access conflicts to oil reserves and/or environmental damages when trying to produce fuel from natural or other fossile sources. Today's best medium sized cars are consuming 4 l diesel/100 km (59 mpg) which equals 105 g/km. Some newer examples of efficient commercially available ICE-propelled vehicles:

- Citroen C3 Stop & Start 5 l Diesel/100 km
- Honda Civic Hybrid 4.6 l/100 km
- Honda Insight Hybrid 4.3 l/100 km
- Toyota Prius (Hybrid) 4.2 l/100 km

As targets for the development of vehicles propelled by fossil fuels two classes of Low-energy vehicles are proposed:

- Low-energy vehicles LEnV having 18.1-105 g CO_2/km
- Ultra-low-energy vehicles ULEnV below 18 g CO_2/km (approx. 10% of the usual 175 g CO_2/km)

That is a relative standard, of course, and will certainly change in the future. ULEnV will not be feasible with internal combustion engines only working with fossil fuels.

Preconditions

The high fuel economy is caused by

- lower parasitic masses (compared to the average load) causing low energy demand in transitional operation (stop and go operation in the cities) $P_{accel} = m_{vehicle} \cdot a \cdot v$ where P stands for power, *mvehicle* for the total vehicle mass, a for the vehicles acceleration and v for the vehicles velocity. Extreme masses will go down to 300 kg from todays 1100 kg to 1600 kg. 5 seaters of the sixties had 625 kg[1]. Given the high safety standards required nowadays 700 kg will be a minimum.
- low crossectional area and mirrors replaced by cameras causing very low drag losses especially when driven at higher speed $F_{drag} = A_{cross} \cdot cw_{vehicle} \cdot \frac{v_{air}^2 \rho_{air}}{2}$ where F stands for the force, *Across* for the crossectional area of the vehicle, Á*air* for the density of the air and *vair* for the relative velocity of the air (incl. wind). Two places in a back to back or in line arrangement drastically reduce the crossectional area down to 1 m_2. The drag factor may be as low as 1.16.
- low rolling resistance due to smaller and high pressure tires with optimised tread and low vehicle mass driving the rolling resistance $F_{roll} = \mu_{roll} \cdot m_{vehicle}$ where ¼*roll* stands for the rolling resistance factor and *mvehicle* for the vehicle mass. Advanced driver assistance and ABS prevent safety problems caused by the small tires.

It must be added that also the driving style is to be adapted to achieve those low energy consumptions. Energy management becomes possible with hybrid vehicles with the possibility to recuperate braking energy and to operate the internal combustion engine (ICE) at higher efficiency on average. Hybrid power trains of parallel type may also reduce the ICE-engine size thus increasing the average load factor and minimising the part load losses.

Facts

Average data for vehicle types sold in the U.S.A. (source theautochannel.com):

Type	width	height	curb weight	combined fuel economy
Minivans	75.9in 193cm	70.2in 178cm	4275lbs 1939kg	20.36 mpg 11.55 l/100km
Family sedans	70.3in 179cm	57.3in 146	3144lb 1426kg	26.94 mpg 8.73 l/100km
SUVs	73.5in 187cm	70.7in 180cm	4242lb 1924kg	19.19 mpg 12.25 l/100km
Honda Insight	66.7in 169cm	53.3in 135cm	1850b 839kg	63 mpg 3.73 l/100km

Drag resistance for SUVs is at least (same drag coefficient) 30% higher and the acceleration force has to be 35% bigger compared to family sedans. This gives of 40% higher fuel consumptions (even when including parallel hybrid electric SUVs).

See also

- Green vehicle

Off-road vehicles

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An *off-road vehicle* is considered to be any type of vehicle which is capable of driving off paved or gravel surface. It is generally characterized by having caterpillar tracks or large tires with deep, open threads and a flexible suspension. Infrequently, a stricter definition that includes all vehicles that do not travel streets or highways is used, which would include things like forklifts, ships and locomotives.

Off-road vehicles have an enthusiastic following because of their many uses and versatility. Several types of motorsports involve racing off-road vehicles. The three largest "4 wheel vehicle" off-road types of competitions are Rally, Desert Racing, and Rockcrawling. The three largest types of All Terrain Vehicle (ATV) / Motorcycle competitions are Motocross, Enduro, and Desert Racing. These sports are often celebrated in competition events due to public interest. The most common use of these vehicles is for sight seeing in areas distant from pavement. The use of higher clearance, and higher traction vehicles enables access on trails and forest roads that have rough and low traction surfaces.

The Off Road Vehicle industry did over 4.5 billion dollars of business in 2005 alone.

Common off-road vehicles are:

Hummers
LandCruisers
Jeeps
Land Rovers
Rock Crawlers
Broncos
Toyota PickUps
4-Runners
Large 4x4 trucks and some SUV's
Dirt bikes
ATVs, or All Terrain Vehicles
Tractors
Golf carts
Bulldozers

Less common off-road vehicles are:

Haflingers
Pinzgauers
UMMs
Unimogs
Large 4x4 trucks and some SUV's
Dirt bikes

ATVs, or All Terrain Vehicles
Tractors
Golf carts
Bulldozers

Less common off-road vehicles are:

Haflingers
Pinzgauers
UMMs
Unimogs

Jeep

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Jeep is an automobile marque (and registered trademark) of DaimlerChrysler. The marque, like all other Chrysler subsidaries, became part of DaimlerChrysler when Daimler-Benz merged with the Chrysler Corporation in 1998. Jeep, like Band-Aid and Xerox, is a genericized trademark. Unlike Band-Aid and Xerox, however, the name jeep did not start out as a trademark. The term was first applied to a military vehicle, the Bantam BRC, versions of which were produced by Willys-Overland and Ford Motor Company for the Allies during World War II. The term is also used to refer generically to what are now known as SUVs, whether the vehicle in question bears the Jeep nameplate or not.

Roads that are only suitable for off-road vehicles are often called jeep trails. The most famous is the The Rubicon Trail located near Lake Tahoe in central California.

History

The origin of the term jeep

There are many stories about where the name "jeep" came from. The following two although they make for interesting and memorable stories, aren't quite accurate.

Probably the most popular notion has it that the vehicle bore the designation "GP" (for "General Purpose"), which was phonetically slurred into the word jeep. R. Lee Ermey, on his television series Mail Call, disputes this, saying that the vehicle was designed for specific duties, was never referred to as "General Purpose," and that the name may have been derived from Ford's nomenclature referring to the vehicle as GP (G for government-use, and P to designate its 80-inch-wheelbase). "General purpose" does appear in connection with the vehicle in the WW2 TM 9-803 manual, which describes the vehicle as "... a general purpose, personnel, or cargo carrier especially adaptable for reconnaisance or command, and designated as 1/4-ton 4x4 Truck", and the vehicle is designated a "GP" in TM 9-2800, Standard Military Motor Vehicles, 1 September, 1943, but whether the average jeep-driving GI would have been familiar with either of these manuals is open to debate.

Many, including Ermey, claim that the more likely origin is a reference to a character from the Thimble Theater (Popeye) comic strip known as Eugene the Jeep. Eugene the Jeep was a dog-like character who could walk through walls and ceilings, climb trees, fly, and just about go anywhere it wanted; it is thought that soldiers at the time were so impressed with the new vehicle's versatility that they informally named it after the character.

The manuals quoted were published in 1943. The character of "Eugene the Jeep" was created in 1936. The first common use of the term "jeep" predates both of these by roughly 20 years. It was during World War I that soldiers used "jeep" as a slang word for new recruits as well as new, unproven vehicles. This is according to a history of the vehicle for an issue of the U.S. Army magazine, Quartermaster Review, which was written by Maj. E. P. Hogan. He went on to say that the slang word had these definitions as late as the start of World War II.

The term would eventually be used as slang to refer to an airplane, a tractor used for hauling heavy equipment, and an autogyro. When the first models of the jeep came to Camp Holabird for tests, the vehicle didn't have a name yet. Therefore the soldiers on the test project called it a jeep. Civilian engineers and test drivers who were at the camp during this time were not aware of the military slang term. They most likely were familiar with the character of Eugene the Jeep and therefore began to credit Eugene with the name. The vehicle had many other nicknames at this time such as Peep, Pygmy, and Blitz-Buggy although because of the Eugene association, Jeep stuck in people's minds better than any other term.

Words of the Fighting Forces by Clinton A. Sanders, a dictionary of military slang, published in 1942, in the library at The Pentagon gives the following definition:

> *Jeep*: A four-wheel drive car of one-half to one-and-one-half ton capacity for reconnaissance or other army duty. A term applied to the bantam-cars, and occasionally to other motor vehicles (U.S.A.) in the Air Corps, the Link Trainer; in the armored forces, the 1/2 ton command car. Also referred to as "any small plane, helicopter, or gadget."

The term went into widespread public use because of a syndicated news column written by Kathryn Hillyer who was working for the Washington Daily News. Hillyer had been assigned to cover a publicity stunt and Senate photo op where the jeep was presented to the public. The Army brought a jeep to the Capitol in order for it to climb the front steps of the building and show off the vehicle's power. When test driver Irving "Red" Housman was asked by a bystander "What is this thing?" he responded simply with "It's a jeep." Hillyer heard this and used the name in her column which was printed around the country.

The origins of the vehicle: the first jeeps

The first jeep prototype (the Bantam BRC) was built for the Department of the Army by American Bantam, followed by two other competing prototypes produced by Ford and Willys-Overland. The American Bantam Car Company actually built and designed the vehicle that first met the Army's criteria, but the Army felt that the company was too small to supply the number needed and it allowed Willys and Ford to make second attempts on their designs after seeing Bantam's vehicle in action. Some people believe that Ford and Willys also had access to Bantam's technical paperwork. Quantities (1500) of each of the three models were then extensively field tested. During the bidding process for 16,000 "jeeps", Willys-Overland offered the lowest bid and won the initial contract. Willys thus designed what would become the standardized jeep, designating it a model MB military vehicle and building it at their plant in Toledo, Ohio.

Like American Bantam, Willys-Overland was a small company and, likewise, the military was concerned about their ability to produce large quantities of the vehicle. The military was also concerned about Willys-Overland's single manufacturing facility — something that would make the newly-produced military vehicle's factory even more susceptible to sabotage or production stoppages.

Based on these two concerns, the U.S. government required that jeeps also be built by the Ford Motor Company, who designated the vehicle as model GPW (G indicated a governmental vehicle, P indicated the wheelbase, and W referred to the Willys design). Combined production by Willys and Ford, under the direction of Charles E. Sorensen, (Vice-President of Ford during World War II) produced more than 600,000 vehicles.

The jeep was widely copied in countries around the world, including in France by Hotchkiss et Cie, after 1954, Hotchkiss manufactured Jeeps under licence from Willys and by Nekaf in the Netherlands. There were several different versions created, including a railway jeep and an amphibious jeep. As part of the war effort, Jeeps were also supplied to the Soviet Red Army during World War II.

In the United States military, the jeep has been supplanted by a number of vehicles, e.g., Ford's M151, nicknamed the Mutt, of which the latest is the High Mobility Multipurpose Wheeled Vehicle ("Humvee").

The Jeep marque

A division of DaimlerChrysler, the most recent successor company to Willys, now holds trademark status on the word "Jeep" and the distinctive 7 slot front grille design. The original 9 slot grill associated with all WW2 jeeps was designed by Ford for their GPW, and because it weighed less than the original "Slat Grill" of Willys, (an arrangement of flat bars) was incorporated into the "Standardized jeep" design.

The marque has gone through many owners, starting in 1941 with Willys, which produced the first Civilian Jeep (CJ). Willys was sold to Kaiser in 1953, which became Kaiser-Jeep in 1963. American Motors bought the company in 1970. The Chrysler Corporation bought out AMC in 1987, shortly after the Jeep CJ was replaced with the AMC-designed Jeep Wrangler or YJ. Finally, Chrysler merged with Daimler-Benz in 1998 to form DaimlerChrysler.

Jeep vehicles are also produced in Beijing, China, by Beijing Jeep Corporation, Ltd., a joint venture between Beijing Automobile Industry Corporation, DaimlerChrysler and DaimlerChrysler China Invest Corporation, established on January 15, 1984.

Jeep vehicles have "model designations" in addition to their common names. Nearly every civilian Jeep has a 'xJ' designation, though not all are as well-known as the classic CJ.

Historical models

Historical Jeep models:

- *Jeep CJ* (MB — GPW, CJ-2A, -3A, -3B, -4, -5, -6, -7, -8) — All similar to the original Willys' body style. CJ stands for "Civilian Jeep."
  - 1941-1945 Jeep US Army,Military WWII. Willys MA — MB — Ford GP GPW GPA
  1947-1949 CJ-2A
  1949-1953 CJ-3A
  1953-1968 CJ-3B
  1955-1983 CJ-5
  1955-1981 CJ-6 — stretched CJ-5
  1976-1986 CJ-7
  1981-1986 CJ-8
  1981-1985 CJ-10 — pickup truck
- 1963-1970 *Jeep Gladiator* (SJ) — Full-size pickup truck
- 1970s *Jeep Honcho* (SJ) — Full-size pickup truck
- *Jeep Dispatcher* (DJ) — A postal truck for the United States Postal Service
- *Jeep Jeepster* — Passenger vehicle
  - 1948-1950 *VJ* — Willys Jeepster
  - 1966-1971 *C101* — Jeepster Commando
  - 1972-1973 *C104* — Jeep Commando
- 1956-1965 *Jeep Forward Control* — Light truck
  - FC-150
  FC-170
- 1963-1990 *Jeep Wagoneer* — SUV
  - 1963-1983 SJ
  1984-2001 XJ Mid-size Cherokee/Wagoneer
- 1986-1992 *MJ* Comanche Mid-size pickup Cherokee-based
- 1984-1991 *Jeep Grand Wagoneer* — Upscale full-size SUV
  - 1984-1991 Jeep Grand Wagoneer — Continuation of the SJ chassis
  1987-1995 YJ — The original Wrangler -Note- There were no 1996 Model Year Wranglers.
  1993 Jeep Grand Wagoneer — Version of the Grand Cherokee
  1993-1998 ZJ
  1999-2005 WJ

Current models

The Jeep brand currently produces three models:

-
  - TJ — The current Wrangler (includes Rubicon models) First came out as a replacement to the YJ as a 1997 Model.
  LJ — The Unlimited Wrangler, with a 10" longer wheelbase and 15" longer

overall (includes Unlimited Rubicon models).
JK — The upcoming version of the Wrangler, to be released as a 2007 model.
JKL — The long wheelbase, 4-door version of the 2007 Wrangler JK.

- *Jeep Grand Cherokee* — large family-oriented SUV.
  - *WK* — The newest Grand Cherokee, 2006-present ("WK" is the designator for the new Grand Cherokee, it is one of the few non-J-designated Jeeps).
- Jeep Liberty — KJ — A small SUV (called Cherokee outside North America).

Jeep Commander — XK — Newest model in the Jeep line, it is a seven passenger SUV.

Future models

- 2007 Jeep Compass — A small crossover SUV based on the Dodge Caliber.

2007 Jeep Patriot — A small SUV based on the Dodge Caliber.

Concept vehicles

- Concept Jeep Hurricane — A large unconventional SUV with 2 Hemi engines which can rotate 360 degrees.

See also

- SUV **and** Compact SUV

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Steam automobiles

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A *steam car* is a car that is powered by a steam engine. Gasoline and kerosene were used as fuel by the majority of manufacturers, but some crude vehicles did use solid fuels such as coal or coke. The fuel is burned in a firebox, which in automobiles, is generally directly under the boiler. The heat converts water into steam. When the water turns to steam, it tries to expand, but being encased within the boiler, a build up of pressure results. So, the boiler can be thought of a storer of energy. This stored energy, high pressure steam, is used to push a piston back and forth, which, through a linkage of a piston rod and a connecting rod, turns the crank shaft. This in turn is either directly coupled to the driving axle or is indirectly connected via a driveshaft to turn the wheels. No clutch or gearbox is necessary since full power is available even at very low RPMs. This also made high acceleration possible, especially on sportier models, that made steam cars outperform ICE cars.

The steam car was the first logical step in independent transport. Though not generally known, regular intercity bus service in steam driven busses was first founded in England in the 1830's. The horse interests quickly had legislation enacted to kill this new competing form of transport.

A steam engine is an external combustion engine (ECE - the fire is not in the engine), as opposed to an internal combustion engine (ICE - the fire is inside the engine). Gasoline-powered "ICE" cars are more efficient at about 25-28% efficiency. A steam engine car will work at only 5-8% efficiency without addons. With add-ons a steam engine may have efficiencies around 50%, well above ICE´s. A benefit of the ECE is that the fuel burns at atmospheric pressure so it does not produce carbon monoxide and nitrogen oxide

Electric cars and steam-powered cars actually outsold gasoline powered cars in many states prior to the invention of the electric starter for gasoline-powered internal-combustion automobiles. Before the electric starter system from Delco was put into production by General Motors, internal combustion powered cars were started by a hand-crank, which was difficult and occasionally dangerous, as improper cranking could cause a backfire capable of breaking the arm of the operator.

The most well known and best selling steam-powered car was the Stanley Steamer produced from 1896 through 1924. It used a compact fire-tube boiler under the hood to power a simple, double-acting two-piston engine giving four power pushes per revolution of the engine. A normal diesel or gasoline engine has to have eight cylinders to produce four power strokes per revolution. With the smoothness of the steam power and because of its phenomenal torque at only one or two rpm's the steam car's engine was typically connected directly to the rear axle, because no clutch or transmission was needed. Through 1914, the Stanley vented its exhaust steam directly to the atmosphere and its water tank required frequent water re-fills. After 1914, all Stanleys employed a condenser, which improved their water efficiency considerably.

The world's land speed record was dramatically pushed up to 127 mph by a Stanley steam powered car, piloted by Fred Marriot on the sands of Ormond Beach, Florida in 1906. This annual week long "Speed Week" was the genesis of today's Daytona 500.

Early steam cars took a long time to start from cold, but once fully fired-up, could be instantly driven off all day long. Around 1914, Abner Doble and his brothers began producing, on a very small scale, more expensive, upscale steam-powered cars that incorporated a flash-steam generator, which heated a much smaller amount of water into steam as needed. This shortened the start-up time, and lessened the severity of any steam leak, due to the smaller volume of stored steam. By 1923, Abner Doble had developed new automatic boiler and burner controls which allowed his steam cars to be started from cold with the turn of a key and then be driven off in a matter of seconds at speeds up to 70 to 80 mph. The last Doble was produced in 1930. As a historical sideline, the burner and boiler controls developed by the Dobles changed the heating industry. Their systems are used now in almost every home heating boiler and most commercial boilers that burn oil.

As a result of the 1973 oil crisis SAAB in 1974 started a project headed by Dr. Ove Platell that made a steam powered prototype. It used an electronically-controlled 28-lb multi parallel circuit steam generator, 1 mm bore tubing and 16 gph firing rate intended to run an engine at 160 hp. It was about the same size as an ordinary car battery. To avoid long start-up time it used a system where compressed air was stored when the car was running. When starting the car ran on the compressed air until steam pressure built up. The engine used a conical rotary valve made from pure boron nitride. To conserve water is used a hermetically sealed water system.

A company called Enginion AG has since 1996 developed a system they called SteamCell. It makes steam almost instantly and with no open flame. It takes 30 seconds to reach maximum power from a cold start. Their third prototype, ZEE03, was fitted in a VW and a Skoda Fabia. It was a two-stroke displacing 1.0 liters, producing up to 500 N·m of torque. Emissions were far below the SULEV standard. Since the water was recirculated the engine used no oil as a lubricant, but instead used the steam as a lubricant. However, they found that the market was not ready for steam cars so they changed to make power generators based on the same technology.[1][2]

Electric cars had a short range, and could not be charged up on the road if the battery ran low. Gasoline-powered internal combustion automobiles with electric starters rapidly gained in popularity, while electric and steam-powered cars then fell by the wayside. The development of the Doble system with the automatic controls and super fast firing-up came after steam had lost its market share to the gas powered automobile, becoming an ancronism within the automobile world, albeit, a beautiful, powerful, and an absolutely silent one.

See also

- Electric Car

6 Automobile history eras

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Although self-powered vehicles were demonstrated as early as 1769, it was not until 1885 that the history of the automobile truly began. Automotive history is generally divided into a number of eras based on the major design and technology shifts seen over the last century. Although the exact boundaries of each era can be hazy, scholarship has defined them as follows:

Automobile history eras

<table>
<tr><td>1890s</td><td>1900s</td><td>1910s</td><td>1920s</td><td>1930s</td><td>1940s</td><td>1950s</td><td>1960s</td><td>1970s</td><td>1980s</td><td>1990s</td><td>2000s</td></tr>
<tr><td>Veteran</td><td>Brass</td><td colspan="2">Vintage</td><td>Pre-War</td><td colspan="3" rowspan="2">Post-War</td><td colspan="4" rowspan="3">Modern</td></tr>
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<tr><td colspan="8">Classic</td></tr>
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Eras of Invention

Steam-powered self propelled vehicles were devised in the late 17th century. A Flemish priest, Ferdinand Verbiest, demonstrated in 1678 a small steam car. The car was made for the Chinese emperor. Nicolas-Joseph Cugnot successfully demonstrated such a vehicle on a real scale as early as 1769. Cugnot's invention initially saw little application in his native France, and the center of innovation passed to Great Britain, where Richard Trevithick was running a steam-carriage in 1801. Such vehicles were in vogue for a time, and over the next decades such innovations as hand brakes, multi-speed transmissions, and improved speed and steering were developed. Some were commercially successful in providing mass transit, until a backlash against these large speedy vehicles resulted in passing laws that self-propelled vehicles on public roads in the United Kingdom must be preceded by a man on foot waving a red flag and blowing a horn. This effectively killed road auto development in the UK for most of the rest of the 19th century, as inventors and engineers shifted their efforts to improvements in railway locomotives. The red flag law was not repealed until 1896.

The first automobile patent in the United States was granted to Oliver Evans in 1789. Later, in 1804, Evans demonstrated his first successful self-propelled vehicle, which not only was the first automobile in the USA but was also the first amphibious vehicle, as his steam-powered vehicle was able to travel on wheels on land and via a paddle wheel in the water.

Belgian born Etienne Lenoir made a car with an internal combustion engine around 1860, though it was driven by coal-gas. His experiment lasted for 7 miles, but it took him 3 hours; He would have been faster on foot. Lenoir never tried experimenting with cars again. The French claim that a Deboutteville-Delamare was succesfull, and the French celebrated the 100th birthday of the car in 1984.

It is generally acknowledged that the first automobiles with gasoline powered internal combustion engines were completed almost simultaneously by several German inventors working independently: Karl Benz built his first automobile in 1885 in Mannheim. Benz was granted a patent for his automobile on January 29, 1886 and began the first production of autombiles in 1888. Soon thereafter, Gottlieb Daimler and Wilhelm Maybach in Stuttgart in 1889 designed a vehicle from scratch to be an automobile rather than a horse carriage fitted with an engine. They also were inventors of the first motor bike in 1886. Much earlier, an Austrian inventor Siegfried Marcus in Vienna built a crude vehicle by placing an engine on a handcart around 1870, although it is disputed whether it ever ran, and he never applied for a patent for this type of invention. The first four wheel petrol-driven automobiles built in Britain came in Birmingham in 1895 by Frederick William Lanchester who also patented the disc brake.

Veteran era

The first production of automobiles was by Karl Benz in 1888 in Germany and under licence to Benz, in France by Emile Roger. By 1900 mass production of automobiles had begun in France and the United States. The first company to form exclusively to build automobiles was Panhard et Levassor in France. Formed in 1889, they were quickly followed by Peugeot two years later. In the United States, brothers Charles and Frank Duryea founded the Duryea Motor Wagon Company in 1893, becoming the first American automobile manufacturing company. However, it was Oldsmobile who would dominate this era of automobile production. Its large scale production line was running in 1902. Within a year, Cadillac (formed from the Henry Ford Company), Winton, and Ford were producing cars in the thousands.

Within a few years, a dizzying assortment of technologies were being produced by hundreds of producers all over the Western world. Steam, electricity, and gasoline-powered autos competed for decades, with gasoline internal combustion engines achieving dominance in the 1910s. Dual- and even quad-engine cars were designed, and engine displacement ranged to more than a dozen liters. Many modern advances, including gas/electric hybrids, multi-valve engines, overhead camshafts, and four-wheel drive, were attempted and discarded at this time.

Innovation was rapid and rampant, with no clear standards for basic vehicle architectures, body styles, construction materials, or controls. Many veteran cars use a tiller rather than a wheel for steering, for example, and most operated at a single speed. Chain drive was dominant over the modern driveshaft, and closed bodies were extremely rare.

On November 5, 1895, George B. Selden was granted a United States patent for a two-stroke automobile engine (U.S. Patent 549160). This patent did more to hinder than encourage development of autos in the USA. Selden licensed his patent to most major American auto makers, collecting a fee on every car they produced.

Throughout the veteran car era, however, automobiles were seen as more of a novelty than a genuinely useful device. Breakdowns were frequent, fuel was difficult to obtain, and rapid innovation meant that a year-old car was nearly worthless. Major breakthroughs in proving the usefulness of the automobile came with the historic long-distance drive of Berta Benz in 1888 when she traveled more than fifty miles (106 km) from Mannheim to Pforzheim to make people aware of the potential of the vehicles her husband, Karl Benz, manufactured, and after Horatio Nelson Jackson's successful trans-continental drive across the United States in 1903.

Brass era

Main article: Brass Era car

Named for the widespread use of brass in the United States, the Brass or Edwardian era lasted from roughly 1905 through the beginning of World War I in 1914. 1905 was a signal year in the development of the automobile, marking the point when the majority of sales shifted from the hobbyist and enthusiast to the average user.

Within the decade and a half that make up the Brass or Edwardian era, the various experimental designs and alternate power systems would be marginalized. Although the modern touring car had been invented earlier, it was not until Panhard et Levassor's Systeme Panhard was widely licensed and adopted that recognizable and standardized automobiles were created. This system specified front-engined, rear-wheel drive internal combustion cars with a sliding gear transmission. Traditional coach-style vehicles were rapidly abandoned, and buckboard runabouts lost favor with the introduction of tonneaus and other less-expensive touring bodies.

Throughout this era, development of automotive technology was rapid, due in part to a huge number (hundreds) of small manufacturers all competing to gain the world's attention. Key developments included electric ignition and the electric self-starter (both by Charles Kettering, for the Cadillac Motor Company in 1910-1911), independent suspension, and four-wheel brakes. Leaf springs were widely used for suspension, though many other systems were still in use, with angle steel taking over from armored wood as the frame material of choice. Transmissions and throttle controls were widely adopted, allowing a variety of cruising speeds, though vehicles generally still had discrete speed settings rather than the infinitely variable system familiar in cars of later eras.

Exemplary cars of the period included the following:

- 1908–1927 Ford Model T - The most widely produced and available car of the era. It used a planetary transmission and had a pedal-based control system that would be confusing to modern drivers.
- 1910–1920 Bugatti Type 13 - A notable racing and touring model with advanced engineering and design. Similar models were the Types 15, 17, 22, and 23.

Vintage era

Main article: Vintage car

The vintage era lasted from the end of World War I (1919) through the stock market crash at the end of 1929. During this period, the front-engined car came to dominate, with closed bodies and standardized controls the norm. Development of the internal combustion engine continued at a rapid pace, with multi-valve and overhead cam engines produced at the high end, and V8, V12, and even V16 engines conceived for the ultra-rich.

Exemplary vintage vehicles:

- 1922–1939 Austin 7 — The Austin Seven was one of the most widely-copied vehicles ever, effectively initiating the British motor industry as well as serving as a template for cars around the world, from BMW to Nissan.
- 1924–1929 Bugatti Type 35 — The Type 35 was one of the most successful racing cars of all time, with over 1,000 victories in five years.
- 1927–1931 Ford Model A — After keeping the brass era Model T in production for too long, Ford] broke from the past by restarting its model series with the 1927 Model A. More than 4 million were produced, making it the best-selling model of the era.
- 1930 Cadillac V-16 — Developed at the height of the vintage era, the V16-powered Cadillac would join Bugatti's Royale as the most legendary ultra-luxury cars of the era.

Pre-War era

Main article: Classic car

The pre-war part of the classic era began with the Great Depression in 1930 and ended with the recovery after World War II, commonly placed at 1948.

By the 1930s, most of the technology used in automobiles had been invented, although it was often re-invented again at a later date and credited to someone else. For example, front-wheel drive was re-introduced by Andre Citroën with the launch of the Traction Avant in 1934, though it appeared several years earlier in road cars made by Alvis and Cord, and in racing cars by Miller (and may have appeared as early as 1897). After 1930, the number of auto manufacturers declined sharply as the industry consolidated and matured.

Exemplary pre-war automobiles:

- 1934–1940 Bugatti Type 57 — A high-tech and refined automobile for the remaining rich of the time, the Type 57SC has become the singular classic car.
- 1934–1956 Citroën Traction Avant — The first mass-produced front-wheel drive car, built with monocoque techniques, was a technology masterpiece.
- 1936–1955 MG T series — This sports car for the masses came to represent the European motoring experience, especially for American soldiers fighting in the war.
- 1938–2003 Volkswagen Beetle — Perhaps the most-famous automobile of all time, it was a pre-war design that lasted through the modern era.

Post-War era

Main article: Antique car

Automobile design finally emerged from the shadow of World War II in 1949, the year that in the United States saw the introduction of high-compression V8 engines and modern bodies from General Motors' Oldsmobile and Cadillac brands. The unibody/strut-suspended 1951 Ford Consul joined the 1948 Morris Minor and 1949 Rover P4 in waking up the automobile market in the United Kingdom. In Italy, Enzo Ferrari was beginning his 250 series just as Lancia introduced their revolutionary V6-powered Aurelia.

Throughout the 1950s, engine power and vehicle speeds rose, designs became more integrated and artful, and cars spread across the world. Alec Issigonis' Mini and Fiat's 500 mini cars swept Europe, while the similar keicar class put Japan on wheels for the first time. The legendary VW Beetle survived Hitler's Germany to shake up the small car market in the Americas. Ultra luxury, exemplified in America by the Cadillac Eldorado Brougham, reappeared after a long absence, and GT cars, like the Ferrari Americas, swept across Europe.

The market changed somewhat in the 1960s, as Detroit began to worry about foreign competition, the European makers adopted ever higher technology, and Japan appeared as a serious car-producing nation. General Motors, Chrysler, and Ford] tried radical small cars, like the GM A-bodies, but had little success. Captive imports and badge engineering swept through the U.S. and U.K. as conglomerates like the British Motor Corporation consolidated the market. Eventually, this trend reached Italy as niche makers like Maserati, Ferrari, and Lancia were acquired by larger companies. By the end of the decade, the automobile manufacturing world was much smaller.

In America, performance was the hot sell of the 1960s, with pony cars and muscle cars propping up the domestic industry. But everything changed in the 1970s as the 1973 oil crisis, automobile emissions control rules, Japanese and European imports, and stangnant innovation wreaked havoc on the American industry. Throughout the decade, small imported cars outperformed large American ones, and the domestic auto industry began to fail. Small performance cars from BMW, Toyota, and Nissan took the place of big-engined cars from America and Italy.

On the technology front, the biggest developments of the era were the widespread use of independent suspensions, wider application of fuel injection, and an increasing focus on safety in the design of automobiles. The hottest technologies of the 1960s were NSU's Wankel engine, the gas turbine, and the turbocharger. Of these, only the last, pioneered by General Motors but popularized by BMW and Saab, was to see widespread use. Little Mazda had much success with their "Rotary" engines, but was critically affected by its reputation as a polluting gas-guzzler. Other Wankel licensees, including Mercedes-Benz and General Motors, never put their designs into production. Rover and Chrysler both produced experimental turbine cars to no effect.

Exemplary post-war cars:

1948–1971 Morris Minor – A popular and typical post-war car exported around the world.

1949–1968 Oldsmobile 88 — This model introduced the high-compression mass-produced V8 engine to the masses, ushering in the power wars that led to the muscle car era.

1959–2000 Mini — This quintessential small car lasted for four decades and is one of the most famous cars of all time.

1961–1975 Jaguar E-type — The E-type saved Jaguar on the track and in the showroom and set the standard for design and innovation in the 1960s.

1962–1977 BMC ADO16 — This front wheel drive car dominated sales in the United Kingdom, but excessive badge engineering doomed the brands of the British Motor Corporation.

1962–1964 Ferrari 250 GTO — The first supercar, the GTO was dominant in auto racing in the early 1960s.
1964–1973 Ford Mustang — The pony car that became one of the best-selling and most-collected cars of the era.
1964–1974 Pontiac GTO — The architypal muscle car went from being an option package to a high-performance model and back in just 10 years.
1969 Datsun 240Z — One of the first Japanese sports cars to be a smash hit with the North American public, and paved the way for future decades of Japanese strength in the automotive industry. It was affordable, well-built, and had great success both on the track and in the showroom.
1975–1976 Cadillac Fleetwood Seventy-Five — One of the largest cars ever made, with the largest, least-efficient engine in modern times, exemplified the American automobile industry's problems in the 1970s.

Modern era

The modern era is normally defined as the 25 years preceding the current year. However, there are some technical and design aspects that differentiate modern cars from antiques. Without considering the future of the car, the modern era has been one of increasing standardization, platform sharing, and computer-aided design.

Some particularly notable advances in modern times are the wide spread of front-wheel drive and all-wheel drive, the adoption of the V6 engine configuration, and the ubiquity of fuel injection. While all of these advances were first attempted in earlier eras, they so dominate the market today that it is easy to overlook their signifigance. Nearly all modern passenger cars are front wheel drive unibody designs with transversely-mounted engines, but this design was considered radical just 20 years earlier.

Body styles have changed as well in the modern era. Three types, the hatchback, minivan, and sport utility vehicle, dominate today's market yet are relatively recent concepts. All originally emphasized practicality but have mutated into today's high-powered luxury crossover SUV and sports wagon. The rise of pickup trucks in the United States and SUVs worldwide has changed the face of motoring, with these "trucks" coming to command more than half of the world automobile market.

The modern era has also seen rapidly rising fuel efficiency and engine output. Once the automobile emissions concerns of 1970s were conquered with computerized engine management systems, power began to rise rapidly. In the 1980s, a powerful sports car might have produced 200 hp (150 kW)—just 20 years later, average passenger cars have engines that powerful, and some performance models offer three times as much power.

Exemplary modern cars:

- 1974–present VW Golf — The exemplary modern compact car, with a square hatchback body, transverse straight-4 engine, and room for five passengers.
- 1977–present Honda Accord sedan — This Japanese sedan became the most popular car in the United States in the 1990s, pushing the Ford Taurus aside, and setting the stage for today's upscale Asian sedans.

- 1983–present Chrysler minivans — The two-box minivan design nearly pushed the station wagon out of the market and presaged today's crossover SUVs.
- 1986–present Ford Taurus — This large front wheel drive sedan with modern Computer Assisted Design dominated the American market in the late 1980s.
- 1993–present Jeep Grand Cherokee — The archetypal upscale SUV with all-wheel drive, V8 power, and a luxurious interior at a price reachable for the masses.

Antique cars

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An *antique car* is generally defined as a car over 25 years of age, this being the definition used by the Antique Automobile Club of America and many other organisations worldwide. However, the legal definition for the purpose of antique vehicle registration varies widely.

The term classic car is often used synonymously with *antique car*, but the formal definition of that term has it as applying only to certain specific high-quality vehicles from the pre-World War II era.

25 years is about double the design life of modern cars and an even greater increment on those cars now 25 years old; therefore, a car that's reached 25 is a rare survivor, and probably not economic to maintain as regular transportation.

Owning, restoring and collecting antique cars is a popular hobby worldwide.

Considered as investments

Some consider such collecting to be a form of investment. Buying a particular antique car is then done primarily in view of profit in a future sale and not of enjoying a drive or taking pleasure in restoration work. As with art collecting, antique car collecting is another form of gambling. The market for antique cars fluctuates wildly over the years. There have been periods, like the 1980s, which have seen strong and continued increase in price, but other periods (e.g. the early 1990s) which saw precipitous declines.

Experts in antique cars such as Jay Leno give the same advice as serious art dealers and professionals in the antiques trade: Collect what you can enjoy above all because the future monetary value of any craft or art object is completely unpredictable. Still, the other opinion and plan exists: Person's living in naturally dry areas such the South Western Desert region, can approach this as a potential long term investment, due to the lesser chance of destruction of the bodies by rusting. One strategy, requires that you buy a car that is in good condition with original paint and chrome in good order. It should be purchased for less than $500 in good running condition, with no broken glass and low mileage. The car should be at least 20 years old. This seems to be the time when the value of the car "bottoms out". A person needs to have at least 20 of these $500 cars. Parked on blocks, with the glass masked to prevent wind/sand damage. No more than $100 per car per year should go to provide the outdoor storage in the first year. The cars should be started up once every 3 months. 20 cars would cost $2000 the first year in storage. By waiting 20 years, the cars might be worth in adjusted dollars, 20 times or more than when parked. Constant dollar $500 cars might become constant dollar $10,000 cars after 20 years, if long term trends continue... as 99.9% of the same models will be junked, under all normal uses... Rarity is a key basis of value, and the rest is about the inate charm of the car, and its reflection of the era it represents. A 20 fold increase in constant value is much better than most 20 year investments.

Value

As with all collectible antiques, current value is everything to do with current supply vs. demand, and very little else; certainly little to do with the car's price when new or any objective standard. Thus, rare cars that are highly desired are highly expensive, while vehicles that are not fashionable to collect can be very cheap. Condition, of course, influences value. At the present time, the variation in purchase price between a poor condition and good condition vehicle is generally much less than the cost of restoring a poor condition car; thus it is cheaper in the long run to buy the better vehicle.

In some instances, professional restorers can, through economy of scale and performing the work in-house, realise a profit from buying an unrestored car and performing a restoration. This is normally only possible when the car is in high demand and either very rare (e.g. old Ferraris) or quite common (e.g. classic Ford Mustangs). Amateur restorers who are highly skilled may find it cheaper to restore than buy in good condition, but this is through considering their labor enjoyment rather than a cost.

Realising much long-term profit in owning an antique car is mostly about attempting to anticipate future changes in taste, which is highly speculative. Most cars go through a period of being considered merely old and undesirable before becoming valuable, and a car bought then might drastically increase in value. However, a car is a large object that is expensive to store and must be maintained, which cuts into such profits.

Brass Era car

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The automotive *Brass Era* is the first period of automotive manufacturing, named for the prominent brass fittings used during this time for such things as lights and radiators. It extends from the first commercial automobiles marketed in the 1890s down to about World War I. These cars are also often called by the name they were originally known by, "horseless carriages."

In the United Kingdom, this era is split into two periods:

- Pre-1905 vehicles are *veteran cars*
- 1905–1918 vehicles are *Edwardian cars*.

Such very old vehicles present special challenges to today's collectors. Replacement parts must nearly always be handmade and basic documentation such as wiring diagrams and specification sheets are often nonexistent. The huge variety of companies and technologies represented during this formative period is also a complicating factor—it has been estimated that there were well over 1,000 manufacturers in the U.S. alone.

Neverthess, an active collector community exists for these vehicles, which when well restored can be extremely valuable. The very, very rare original-condition survivor can be even more so.

The early Ford Model T is an example of a Brass Era car for the mass market, and the early European Hispano-Suiza models are fairly typical of expensive models of the time.

The gold-tone trim which is occasionally added to modern luxury sedans is a reference back to autodom's great Age of Brass.

Examples

In January, 1904, Frank Leslie's Popular Monthly magazine cataloged the entire range of automobiles available to the mass market in the United States. This list included the following manufacturers:

American Darracq Automobile Company (New York, New York)
Apperson Brothers Automobile Company (Kokomo, Indiana)
Auburn Automobile Company (Auburn, Indiana)
Autocar Company (Ardmore, Pennsylvania)
Automobile Exchange and Storage Company (New York, New York)
Baker Motor Vehicle Company (Cleveland, Ohio)
Berg Automobile Company (New York, New York)
Buffalo Electric Carriage Company (Buffalo, New York)
Cadillac Automobile Company (Detroit, Michigan)
Central Automobile Company (New York, New York)
Clodio and Widmayer (New York, New York)
Columbus Motor Vehicle Company (Columbus, Ohio)
B. V. Covert and Company (Lockport, New York)
Crest Manufacturing Company (Cambridge, Massachusetts)
Daimler Manufacturing Company (Long Island City, New York)
Duryea Power Company (Reading, Pennsylvania)
Eisenhuth Horseless Vehicle Company (Middletown, Connecticut)
Electric Vehicle Company (Hartford, Connecticut)
Elmore Manufacturing Company (Clyde, Ohio)
Ford Motor Company (Detroit, Michigan)
Societe Franco-Americaine d'Automobiles (New York, New York)
H. H. Franklin Manufacturing Company (Syracuse, New York)
Fredonia Manufacturing Company (Youngstown, Ohio)
Grout Brothers (Orange, Massachusetts)
Haynes-Apperson Company (Kokomo, Indiana)
Holley Motor Car Company (Bradford, Pennsylvania)
Thos. B. Jeffery Company (Kenosha, Wisconsin)
Kirk Manufacturing Company (Toledo, Ohio)
Knox Automobile Company (Springfield, Massachusetts)

Locomobile Company of America (Bridgeport, Connecticut)
National Motor Vehicle Company (Indianapolis, Indiana)
National Sewing Machine Company (Belvidere, Illinois)
Northern Manufacturing Company (Detroit, Michigan)
Olds Motor Works (Detroit, Michigan)
Packard Motor Car Company (Detroit, Michigan)
Panhard-Levassor (Paris, France)
Peerless Motor Car Company (Cleveland, Ohio)
Phelps Motor Vehicle Company (Stoneham, Massachusetts)
George N. Pierce Company (Buffalo, New York)
Pope-Robinson Company (Hyde Park, Massachusetts)
Pope-Toledo Company (Toledo, Ohio)
Pope-Waverly Company (Indianapolis, Indiana)
Premier Motor Manufacturing Company (Indianapolis, Indiana)
Renault (New York, New York)
Rochet-Schneider (New York, New York)
Royal Motor Car Company (Cleveland, Ohio)
Sandusky Automobile Company (Sandusky, Ohio)
K. A. Skinner (Boston, Massachusetts)
Smith and Mabley (New York, New York)
St. Louis Motor Carriage Company (St. Louis, Missouri)
Standard Automobile Company of New York (New York, New York)
Stanley Motor Carriage Company (Newton, Massachusetts)
F. B. Stearns Company (Cleveland, Ohio)
J. Stevens Arms and Tool Company (Chicopee Falls, Massachusetts)
Studebaker Brothers Company (South Bend, Indiana)
E. R. Thomas Motor Company (Buffalo, New York)
Waltham Manufacturing Company (Waltham, Massachusetts)
White Sewing Machine Company (Cleveland, Ohio)
Wilson Automobile Manufacturing Company (Wilson, New York)
Winton Motor Carriage Company (Cleveland, Ohio)
Woods Motor Vehicle Company (Chicago, Illinois)

Classic vehicles

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Classic car is a term frequently used to describe an older car, but the exact meaning is subject to serious differences in opinion. One school, the broader "antique car club" faction, are very inclusive. Almost any older car in fine condition becomes a classic. The other extreme are the "Concourse de Elegance" supporters, such as the CCCA, who think that only a few thousand "Classic Era Motor Cars" even exist in good condition. They consider nothing newer than 1948 to qualify...period.

The Classic Car Club of America "claims" to have invented the term *Classic car* and thus they believe that the true definition of the term is "theirs". According to the CCCA:

A CCCA Classic is a "fine" or "distinctive" automobile, either American or foreign built, produced between 1925 and 1948. Generally, a Classic was high-priced when new and was built in limited quantities. Other factors, including engine displacement, custom coachwork and luxury accessories, such as power brakes, power clutch, and "one-shot" or automatic lubrication systems, help determine whether a car is considered to be a Classic.

The Club keeps an exhaustive list of the vehicles they consider Classics, and while any member may petition for a vehicle to join the list, such applications are carefully scrutinised and rarely is a new vehicle type admitted.

This rather exclusive definition of a classic car is by no means universally followed, however, and this is acknowledged by the CCCA: while they still maintain the true definition of 'classic car' is theirs, they generally use terms such as CCCA Classic or the trademarked Full Classic to avoid confusion.

Legally, most states have time-based rules for the definition of "classic" for purposes such as antique vehicle registration; for example, Pennsylvania defines it as "A motor vehicle, but not a reproduction thereof, manufactured at least 15 years prior to the current year which has been maintained in or restored to a condition which is substantially in conformity with manufacturer specifications and appearance."

Alternate usage fundamentally equates Classic car with the definition of antique car as used by the Antique Automobile Club of America, who define an Antique car as "anything" over 25 years old. Thus, in this "broader usage" any car over 25 years old can be called a 'classic car'.

25 years is generally considered a good cut-off age for such terms because it's extremely rare for a vehicle that old to still be owned or used without special consideration for its classic status — by 25 years old, a car will have exceeded its design life by some considerable margin, 10-15 years being the norm barring accidental loss. It will probably need significant maintenance to keep running, and many parts will be hard to obtain through the usual channels. Thus, a non-enthusiast will sensibly conclude that it is not feasible to continue using a car that old for regular driving.

This is not to say that an enthusiast of classic cars might not drive such an old vehicle daily, but that enthusiast will be willing to live with the greater difficulty of so doing or the high cost of restoring the vehicle to reliable condition.

Pre-"Slab-sided" style era, ending in 1948 vrs. all later models

There was a sea-change in styling in the period several years after the end of World War II. The 1949 Ford, for example, utterly changed the traditional discrete "replaceable" fender treatment and the radiator "semi-functional" look. From this point on, automobiles of all kinds became "rounded boxes", in basic plan. The CCCA term, "Classic Cars", over all this time, has been confined to "the functionally traditional designs of the earlier period (mostly pre-war). They tended to have "removable", fenders, trunk, headlights, and a usual vertical grill treatment. In a Large vehicle, a Duesenberg or Pierce Arrow would typify that class, where in a smaller form, the MG TC, traditional lines, might typify the "CCCA" term. Since general antique car owners are "investors" it serves the purposes of those clubs to classify a "new look" car as a classic. Thus, it may be a "classic" example of a later period, but not a car from the "Classic period of Design", in the opinion of the traditionalist CCCA faction. Those of the "Antique Car", school of thought would include a 1980 "Anything", that is "clean".

Latest look acceptable to CCCA definition

The CCCA era runs from 1925 to 1948. There is a certain continuity in the over-all look to the bodies of these "Motor-cars". The French 1948 DelaHaye is a good the example of a final year of "Classic Era Design".

A partial list of the Marques (Brand names) of the cars that can be considered "Classic" by the "traditionalist group".

Auburn - Bentley - BMW - Buick - Cadillac - Cord - Delahaye - Duesenberg - Graham - Hispano-Suiza - Jaguar (car) - LaSalle - Lincoln (automobile) - Mercedes Benz - MG (car) - Morgan - NSU - Packard - Pierce-Arrow - Renault - Rolls Royce - Stutz

7 Automotive industry

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Automobile manufacturers

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Automakers or *automobile manufacturers* are companies that design and manufacture automobiles. Most of them are based in Germany, Japan, South Korea or the United States.

They are often influential political groups, hence they often affect environmental issues.

They also can be thought of as primarily financial services companies, as the majority of their profits come from the loans they give to people to buy their cars. In some cases this is the only source of profit.

While automakers are headquarted in a smaller number of countries, manufacturing facilities exist in a large number of countries. Some countries simply have cheaper labor. Other countries will encourage or mandate a certain amount of local employment and use of locally-produced parts before an automaker is allowed to sell in a country. Others have prohibitive tariffs that lead automakers to produce locally. For instance, the U.S. has a relatively low tariff of 2.5% for imported automobiles. Yet its tariff for imported pickup trucks is 25%, thus hurting the competitiveness of imported pickups. As a result, manufacturers assemble pickups intended for the American market in the U.S., Canada, or Mexico, as these countries are parties to the North American Free Trade Agreement.

Automaker listing

General Motors
Toyota
Honda
Nissan Motors
Fiat
Ford Motor Company
Hyundai Motor Company
DaimlerChrysler
Volkswagen Group

See *List of automobile manufacturers* ***for more.***

See also

- Effects of the automobile on societies

Kit cars

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A *kit-car* is an automobile that is available in kit form, i.e. you buy it in parts that you have to assemble yourself. Usually you take many of the parts from one or more donor vehicles. A common type of kit car is the dune buggy based on VW parts. Many kit cars are made to look like historic or current cars (the AC Cobra is a popular one) while other are completely original designs.

In the UK during the 1950s, 1960s and beyond, "kit cars" were sometimes also production vehicles that were partially assembled in order to circumvent the extraordinarly high "value added" taxes of the era. Often the cars could be taken home and completed in as little as a weekend.

Several of todays sports car producers such as Lotus and TVR started as kit car makers.

According to figures given to the magazine Total Kit Car the most popular kit in the United Kingdom is made by Robin Hood Sportscars who sell 700 kits a year.[1]

See also

Australian Kit Car manufacturers

- Alpha Sports
- PRB

Canadian Kit Car manufacturers

- Lemans Prototypes

Estonian Kit Car manufacturers

- ESTfield

New Zealand Kit Car manufacturers

- Fraser Cars Ltd

Swedish Kit Car manufacturers

- Dala7
- Esther
- Mania Spyder
- Pagano[2]
- Racing Plast Burträsk (RPB)

UK Kit Car manufacturers

- Buckler Cars
- Caterham Cars
- Clan
- Davrian
- Fairthorpe Cars
- Ginetta Cars
- Locost
- Lotus Cars
- Marcos
- Midas Cars
- MK Sportscars
- Robin Hood
- Rochdale
- Tornado (car company)
- Trident (car company)
- TVR
- Unipower
- Westfield Cars

Additionally, there are over 120 kit cars based around the Mini

Automotive chemicals

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Antifreeze

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Antifreeze is a water-based liquid coolant used in gasoline and diesel engines. Compounds are added to the water to reduce the freezing point of the mixture below the lowest temperature that the engine is likely to be exposed to, and to inhibit corrosion in cooling systems which often contain a range of electrochemically incompatible metals (aluminum, cast iron, copper, lead solder, etc.). The term 'colligative agent' is to be preferred as, in warm climates, the benefit of these compounds is to increase the boiling point of the coolant, which should then be more properly referred to as 'anti-boil', and as anti-freeze decreases and increases both properties, respectively, 'colligative agent' more accurately describes the liquid.

Until the late 1930s, methanol was the most widely used antifreeze. While effective in preventing the coolant from freezing, its low boiling point and low specific heat capacity led to considerably less cooling than water alone. Also, the concentration of methanol would tend to be reduced over time due to its greater tendency to evaporate than the water with which it was mixed.

Ethylene glycol solutions became available in 1937 and were marketed as "permanent antifreeze", since their higher boiling points provided advantages for summertime use as well as during cold weather. They are still used today. Ethylene glycol antifreezes are poisonous and should be kept away from any person or animal (children and especially dogs) that might be tempted by its taste. They form calcium oxalate crystals in the kidneys and can cause acute renal failure and death. All spills should be cleaned, or else an area in which it may be present should be kept inaccessible to those who might ingest it. Should ingestion of antifreeze occur, ethanol can be administered until proper treatment can be started in order to slow the conversion of methanol to formaldehyde and formic acid which are the substances responsible for methanol's toxicity.

For this reason bittering agent (denatonium benzoate - trade name Bitrex) is usually added to engine coolant to make it taste unpleasant. In the United States, there is legislation before Congress (H.R.2567/S.1110) that would make the use of a bittering agent mandatory.

Propylene glycol, on the other hand, is considerably less toxic and may be labelled as "non-toxic antifreeze". It is used as antifreeze where ethylene glycol would be inappropriate, such as in food-processing systems or in pipes in homes, as well as numerous other settings. It is also used in food, medicines, and cosmetics, often as a binding agent. Propylene glycol is "generally recognized as safe" by the FDA for use in food. However, it should not be thought that propylene glycol based antifreeze is safe for consumption. In the event of accidental exposure emergency medical services should be contacted.

Most commercial antifreeze formulations include corrosion inhibiting compounds, and a colored dye (commonly a green, red or blue fluorescent) to aid in identification. A 1:1 dilution with water is usually used, resulting in a freezing point of approximately -40°F (-40°C). In warmer areas weaker dilutions are used.

Glycol antifreeze solutions should generally be replaced with fresh mixture every two years. Many modern cars now come filled with organic acid technology (OAT) antifreeze, which has an extended service life of five years. OAT solutions are not compatible with glycol and, if changing from one type to the other, the cooling system must be thoroughly flushed with clean water. Typically OAT antifreeze contains a red or pink dye to differentiate it from glycol (blue or green).

If ingested, the antidote for antifreeze is usually ethanol or fomepizole.

Brake fluid

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Brake fluid is a type of hydraulic fluid used in brake applications in automobiles and light trucks. It is used to transfer force under pressure from where it is created through hydraulic lines to the braking mechanism near the wheels. It works because liquids are not appreciably compressible. Braking applications produce a lot of heat so brake fluid must have a high boiling point to remain effective and must also not freeze under normal temperatures. These requirements eliminate most water-based solutions.

Brake fluid can come in a number of forms, standardized under the DOT (Department of Transportation) standard. DOT 2 is essentially castor oil; DOT 3, DOT 4, and DOT 5.1 are composed of various glycol esters and ethers; and DOT 5 is silicone-based. Most cars produced in the US use DOT 3.

Glycol based fluids are 2 times less compressible than silicone type fluids, even when heated. Less compressibility of brake fluid will increase pedal feel (firmness), but in either case this effect is minimal. The US Army has used silicone brake fluid exclusively since 1982 successfully. Glycols are hygroscopic and will absorb water from the atmosphere, reducing the boiling point of the fluid and degrading hydraulic efficiency. Changing fluid on a regular basis will greatly increase the performance of the brake system, but this is often not a concern in passenger cars. On the other hand, changing fluid at least every several years will preserve the life of brake system components (by removing accumulated water and other contaminants) and increase the overall reliability of the brake system.

Polyethylene glycol and other brake fluid ingredients may be corrosive to paint and finished surfaces such as chrome and thus care should be taken when working with the fluid.

Hotwheelscollectors.com, which cites that hobby modelers use brake fluid as a safe ,if somewhat slow, paint stripper. It is less likey to harm skin and will not harm plastics.

Components of mineral brake fluid

Alkyl ester
Aliphatic amine
Diethylene glycol
Diethylene glycol monobutyl ether
Diethylene glycol monoethyl ether
Diethylene glycol monomethyl ether
Dimethyl dipropylene glycol
Polyethylene glycol monobutyl ether
Polyethylene glycol monoethyl ether
Polyethylene glycol monomethyl ether
Polyethylene oxide
Triethylene glycol monobutyl ether
Triethylene glycol monoethyl ether
Triethylene glycol monomethyl ether

Components of silicone brake fluid

Di-2-ethylhexyl sebacate
Dimethyl polysiloxane
Tributyl phosphate

Automotive design

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Automobile design *or* car design *is the design of automobiles.*

The design of modern cars is typically handled by a large team of designers and engineers from many different disciplines. As part of the product development effort the team of designers will work closely with teams of design engineers responsible for all aspects of the vehicle. These engineering teams include: chassis, body and trim, powertrain, electrical and production. The design team under the leadership of the design director will typically comprise of an exterior designer, an interior designer (usually referred to as stylists) and a color and materials designer. A few other designers will be involved in detail design of both exterior and interior for example a designer might be tasked with designing the rear light clusters or the steering wheel. The color and materials designer will work closely with the exterior and interior designers in developing exterior color paints, interior colors, fabrics, leathers, carpet, wood trim and so on.

In the USA automotive design reached a turning point in 1924, when the American national automobile market began reaching saturation. To maintain unit sales, General Motors head Alfred P. Sloan Jr. devised annual model-year design changes, to convince car owners that they needed to buy a new replacement each year. Critics called his strategy planned obsolescence. Sloan preferred the term "dynamic obsolescence". This strategy had far-reaching effects on the auto business, the field of product design, and eventually the American economy. The smaller players could not maintain the pace and expense of yearly re-styling. Henry Ford did not like the model-year change, and because he clung to an engineer's notions of simplicity, economics of scale, and design integrity, GM surpassed Ford's sales in 1931 and became the dominant player in the industry thereafter. The frequent design changes also made it necessary to use a body-on-frame rather than the lighter, but less flexible monocoque design used by most European car makers.

Another turning point came in 1935, when automotive engineers abruptly dropped aerodynamic research when they discovered that, among other problems, aerodynamics would tend to produce one single optimal exterior shape. This would be bad for unit sales, and for GM it would obviously work against their new strategy of market differentiation. Style and engineering went their separate ways, and all body shapes underwent plastic surgery every year, whether or not the underlying automobile had changed.

Since 1935 automotive form has been driven more by consumer expectations than by engineering improvement. Form still follows function, but the primary function of the car was to get itself sold. The notable exception in the American market was the postwar appearance of the imported Volkswagen Beetle. VW represented a surprising experiment in product-driven design integrity: one body shape that remained constant from year to year, parts interchangeable from year to year, and that stability made it possible to make incremental technical improvements with a cumulative effect.

The most famous auto stylist is probably Harley Earl, who brought the tailfin and other aeronautical design references to auto design in the 1950s.

Aftermarket

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Aftermarket is an umbrella term for the collective network of vendors who design and sell vehicular components that are intended to replace the stock manufacturer's parts. The two main reasons for this are (i) in order to alter the appearance or performance of the vehicle; or (ii) as a straight replacement for a stock item at a lower price, with no intention to cause such a change in appearance or performance.

The criteria used to design a vehicle are based in large part on the features that would sell to the widest audience at a reasonable price for the vehicle's class. Reliability, price, and fuel economy are typically factors in the decision-making process.

The aftermarket has become the means by which one may customize one's vehicle to suit a particular personality, to provide a role not satisfied by the stock vehicle, or to simply stand out. Aggressive styling and/or performance enhancements, which might not be important to the average buyer, usually make up a significant portion of the aftermarket. In fact, some parts come bundled together within a larger kit that one may choose to install in order to alter one's vehicle to a more significant degree.

The aftermarket also caters for the wish of many vehicle owners to have access to replacement parts that are less expensive than the official spare parts produced by vehicle manufacturers.

Industry

In the United States, in 2004, the automotive aftermarket industry accounted for $257B in sales. The industry employs 4.54 million people in the U.S.

References

- Aftermarket Factbook, 2005

Tires

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A *tire* (U.S. spelling) or *tyre* (UK spelling) is a roughly toroidal shaped piece of synthetic rubber which covers the circumference of a wheel. It is an essential part of most ground vehicles and is used to dampen the oscillations caused by irregularities in the road surface, to protect the wheel from wear and tear as well as to provide a high-friction bond between the car and the road to improve acceleration and handling .

History

For most of history wheels had very little in the way of shock absorption and journeys were very bumpy and uncomfortable. The modern tire came about in stages in the 19th century.

In 1844, Charles Goodyear invented vulcanization, the process that would later be used to produce cured rubber tires.

John Boyd Dunlop, a Scottish veterinary surgeon working in Belfast, Ireland, is widely recognized as the father of the modern tire, although he was not the first to come up with the idea. In 1845 the first pneumatic (inflatable) tire was patented by fellow Scotsman, the engineer Robert William Thomson, born in Stonehaven, Scotland, as the Aerial Wheel. This invention consisted of a canvas inner tube surrounded by a leather outer tire. The tire gave a good ride, but there were so many manufacturing and fitting problems that the idea had to be abandoned. John Dunlop re-invented the tire for his ten year old son's tricycle in 1887 and was awarded a patent for his tire in 1888 (rescinded 1890). Dunlop's tire had a modified leather hosepipe as an inner tube and rubber treads. It wasn't long before rubber inner tubes were invented.

Because neither bicycles nor automobiles had been invented when Thomson produced his tire, that tire was only applied to horse drawn carriages. By Dunlop's time, the bicycle had been fully developed (see Rover) and it proved a far more suitable application for pneumatic tires.

Dunlop partnered with William Harvey du Cros to form a company which later became the Dunlop Rubber Company to produce his invention. The invention quickly caught on for bicycles and was later adapted for use on cars. Dunlop is now a subsidiary of the Goodyear Tire and Rubber Company.

The radial tire was invented by Michelin, a French company, in 1946, but did not see wide use in the United States, the largest market at that time, until the 1970s. This type of tire uses parallel carcass plies for the sidewalls and crossed belts for the crown of the tire. All modern car tires are now radial. In 2005, Michelin was reported to be attempting to develop a tire and wheel combination, the Tweel, which does not use air.

Etymology

According to the Oxford English Dictionary, quoted in Fowler's Modern English Usage, the word is a shortening of attire, and the British spelling tyre is a recent divergence from historical tradition. Fowler also notes that the altered spelling tyre originally met with resistance from conservative British institutions such as The Times newspaper.

Nomenclature

The outer perimeter of the tire, often called the crown, has various designs of jagged shaped grooves in it, known as the tread. These grooves are especially useful during weather with rain (or snow). The water from the rain would be compressed into the grooves by the vehicle's weight, providing better traction in the tire to road contact. Without such grooves, a layer or film of water would form between the wet roads and the tire surface, which would cause hydroplaning, substantially reducing traction. Traction is especially important for good braking. The depth of these grooves essentially constitutes the tread depth at any time during the lifetime of the car. When the tread on the outer perimeter of the tire inevitably wears away from use, reducing the tread depth, the tire should be replaced. The sidewalls are the sections of the tire which are between the crown and the inner circular edges of the tire contacting the rim. To avoid tearing at these inner edges, particularly when the tire is being mounted, there are a number of concentric steel wires buried inside the rubber at both inner edges of the tire. This inner rim is called the bead.

Some air-filled tires, especially those used with spoked wheels such as on bicycles, or on vehicles travelling on rough roads, have an inner tube; this was also formerly the case of automobile tires. This is a fully sealed rubber tube with a valve to control flow of air in and out. Others, including modern radial tires, use a seal between the metal wheel and the tire to maintain the internal air pressure (tubeless tire). This method, however, tends to fail desperately if the vehicle is used on rough roads (for example Kenyan roads) as a small bend on the rim (metal wheel) will result in deflation. The inner tubes are usually made of halobutyl rubber, because of its suitable mechanical properties and excellent impermeability for air.

Pneumatic tires generally have reinforcing threads in them; based on the orientation of the threads, they are classified as bias-ply/cross ply or radial. Tires with radial yarns (known as *radial tires*) are standard for almost all modern automobiles.

Tire types

Wagon tires

The earliest tires were hoops of metal placed around wagon wheels. The tire was heated in a forge, placed on the wheel and quenched, causing the metal to shrink, which drew the rim against the spokes and provided stiffness to the wheel. This work was done by a wheelwright, a craftsman who specialized in making wagon wheels.

Pneumatic tires

Air-filled tires are known as pneumatic tires, and these are the type in almost universal use today. Pneumatic tires are made of a flexible elastomer material such as rubber with reinforcing threads/wires inside the elastomer material. The air compresses as the wheel goes over a bump and acts as a shock absorber. Tires are inflated through a Schrader valve. Attempts have been made to make various types of solid tire but none has so far met with much success. The air in conventional pneumatic tires acts as a near constant rate spring because the decrease in the tire's volume as the tire compresses over a bump is minimal. "Airless" tires usually employ a type of foam or sponge like construction which consists of a large number of small air filled cells. As a result compression is localised within the tire and the effective spring rate rises sharply as the tire compresses. The result is a tire which is less forgiving, particularly with regards to sharp transient bumps and provides poor ride and handling characteristics. The "steering feel" of such tires is also different from that of pneumatic tires, as their solidity does not allow the amount of torsion that exists in the carcass of a pneumatic tire under steering forces, and the resultant sensory feedback through the steering apparatus.

The common motor vehicle tire is mounted around a steel rim at service stations or repair shops for vehicles using a special tire mounting apparatus while the wheel is off the vehicle. After mounting, the tire is inflated (pressurized) with air through the valve stem to manufacturer's specified pressure, which is more than atmospheric pressure. The rim with the tire mounted onto it comprises the removable wheel, which is then attached to the vehicle through a number of holes in the rim using lug nuts. Because tires are often not made with perfectly even mass all around the tire, a special tire-balancing apparatus at a repair shop spins the wheel with the tire to determine where small weights should be attached to the outer edge of the rim to balance out the wheel. Such tire balancing with these kind of weights avoids vibration when the vehicle is driven at higher speeds.

With the introduction of radial tires, however, it was found that some vibrations could not be cured by adding balance weights. This was because the structure and manufacture of a radial tire lends itself to the problems of variation in stiffnes around the tire. These variations are measured as Radial Force Variation and Lateral Force Variation, which are measured on a Force Variation Machine at the end of the manufacturing process. Tires outside the specified limits for RFV and LFV are rejected. This is known in general throughout the industry as Tire Uniformity.

Automobile tires

Automobile tires have numerous rating systems.

New automotive tires now also have ratings for traction, treadwear, and temperature resistance (collectively known as UTQG ratings); as well as speed and load ratings.

Some tread designs are unidirectional and the tire has a rotation direction indicated by an arrow showing which way the tire should rotate when the vehicle is moving forwards. It is important not to put a 'clockwise' tire on the left hand side of the car or a 'counter-clockwise' tire on the right side. Tire rotation moves tires between the different wheels of the vehicle as front and back axles carry different loads and thus the tires wear differently.

Tire tread gauges are small rulers designed to be inserted into tire treads to measure the remaining tread depth. Local legislation may specify minimum tread depths, typically between 1/8" (3.2 mm) and 1/32" (0.8 mm). *Wearbars* may be designed into the tire tread to indicate when it is time to replace the tire. Essentially, part of the tire tread is shallower than the rest and will show when the tire is worn down to that level.

There is currently an attempt to reinforce the tire with nanomaterial. This is likely to increase the tire life, but may turn out to be a bad idea if the worn out part of nanocarbon deposited on the roads is washed off and ends up in the food chain.

Types of automobile tires

- Performance tires
  - Performance tires tend to be designed for use at higher speeds. They often have a softer rubber compound for improved traction, especially on high speed cornering. The trade off of this softer rubber is a lower treadwear rating.
  - Performance tires are often called summer tires, because they sacrifice wet weather handling, by having shallower water channels, and tire life from softer rubber compounds, for dry weather performance. The ultimate variant of performance tires has no tread pattern at all and is called slick tire. Slick tires are not legal for use on public roads in most countries due to their extremely poor wet weather characteristics.
- Winter tires
  - Winter tires are designed to provide improved performance under winter conditions compared to tires made for use in summer. The rubber compound used in the tread of the tire is usually softer than that used in tires for summer conditions, so providing better grip on ice and snow. Winter tires often have fine grooves and siping in the tread patterns that are designed to grip any unevenness on ice. Winter tires are usually removed for storage in the spring, because the rubber compound becomes too soft in warm weather resulting in a reduced tire life.
  - Winter tires are marked M+S or MS (Mud & Snow), although there is no valid criterion based on testing for marking a tire M+S.
  - Many winter tires are designed to be studded for additional traction on icy roads. The studs also roughen the ice, so providing better friction between the ice and the soft rubber in winter tires. Use of studs is regulated in most countries, and even prohibited in some countries due to the increased road wear caused by studs.
- All-season tires
  - These are an attempt to make a tire that will be a compromise between a tire developed for use on dry and wet roads during summer, and a tire developed for use under winter conditions, when there is snow and ice on the

road. However, the type of rubber and the tread pattern best suited for use under summer conditions cannot, for technical reasons, give good performance on snow and ice. The all-season tire is therefore a poor compromise, and is neither a good summer tire, nor a good winter tire.

  - All-Season tires are marked M+S, i.e. the same as winter tires. However, due to the compromise with performance during summer, winter performance is usually not comparable with a winter tire.

- Run flat tires
- All-terrain tires
  - All-terrain tires are typically used on SUVs and light trucks. These tires often have stiffer sidewalls for greater resistance against puncture when traveling off-road, the tread pattern offers wider spacing than all-season tires to evacuate mud from the tread.
  - Within the all-terrain category, many of the tires available are designed primarily for on-road use, particularly all-terrain tires that are originally sold with the vehicle.
- Mud tires
  - Mud terrain tires are characterized by large, chunky tread patterns designed to bite into muddy surfaces and provide grip. The large open design also allows mud to clear more quickly from between the lugs.
  - Mud terrain tires also tend to be wider than other tires, to spread the weight of the vehicle over a greater contact patch to prevent the vehicle from sinking too deep into the mud.
  - Depending on the composition and tread pattern, many mud terrain tires are not well suited to on-road use. They can be noisy at highway speeds, and due to the open tread design, they have less of a contact area with the road, limiting traction. The large lugs on mud tires tend to tear and chip on roads, because they are made from hard rubber compounds that do not bend easily.

Train tires

The steel wheels of trains are fitted with tires which are themselves usually made of steel.

(Some trains, mostly certain types of metros and people movers, have rubber tires, including some lines of the Paris Métro, the Mexico City Metro, the Caracas Metro and the Montreal Metro).

Efficient though the rolling of steel wheel on steel rail is, wear still takes place - on acceleration, on braking, and on cornering. As well as the simple wearing away of the wheel surface, a wheel that wears begins to deviate from the correct profile. The shape of a train wheel is designed and specified precisely for the best possible riding and cornering characteristics, and too much wear can alter that. Wear can also take place unevenly if wheels lock up under heavy braking, causing flat spots.

Another, different form of damage to a train's wheels takes place if violent wheelslip occurs. The friction so caused can heat the wheel (and rail) enough to cause permanent heat damage.

Replacing a whole wheel because of a worn contact surface proves expensive, so the concept of fitting steel tires to train wheels came about. The tire is a hoop of steel that is fitted around the steel or iron wheel. No obvious form of fastening is generally used to attach it. As with wagon wheels, the tire is held by an interference fit - it is made slightly smaller than the wheel on which it is supposed to fit. To fit a tire, it is heated up until it is glowing hot. Railroad workshops generally have special equipment to do so. As the tire heats, it expands, making it big enough to fit around the wheel. After placing it on the wheel, the tire is cooled, and it shrink fits onto the wheel. When cold, friction between the tire and the wheel is such that the tire will not budge even under quite extreme forces.

Removing a tire is done in reverse - the tire is heated while on the wheel until it loosens.

Tires are reasonably thick, up to about an inch thick or more, giving plenty of room to wear. If a tire wears out of shape, or gets flat-spotted, but has a reasonable amount of metal left, it can be turned on a wheel lathe to refinish it, reshaping it to the correct profile.

Tire manufacturing & maintenance

Some tire manufacturing companies

Bridgestone
Firestone
Continental
Cooper
Dunlop
Goodyear
Kelly Springfield Tire and Rubber Company
Kumho
Michelin
B.F. Goodrich
Uniroyal
Pirelli
Nokian Tyres
Toyo
Yokohama

Maintenance of automobile tires

Friction from moving contact with the road causes the tread on the outer perimeter of the tire to eventually wear away. When the tire tread becomes too shallow, the tire is worn out and should be replaced. The same tire rims can usually be used throughout the lifetime of the car. Uneven or accelerated tire wear can be caused by bad wheel alignment. More wear on a tire facing the outside or the inside of a car is often a sign of bad wheel alignment. When the tread is worn away completely and especially when the wear on the outer rubber exposes the reinforcing threads inside them, the tire is said to be bald. A bald tire should be replaced as soon as possible. Sometimes tires with worn tread are recapped, i. e. a new layer of rubber with grooves is bonded onto the outer perimeter of a worn tire. Because this bonding may occasionally come loose on the tire, new tires are superior to recapped tires.

Sometimes a pneumatic tire gets a hole or a leak through which the air inside leaks out resulting in a flat tire, a condition which must be fixed before the car can be driven further safely. A leak may be slow in a few cases, such as is sometimes observed when the seal between the rim and tire edge is not perfect. Many leaks in flat tires, though, are caused by nails, screws, caltrops, broken glass or other sharp objects puncturing the rubber tire wall. If the hole is small and not elongated, the tire can often be repaired by using plugs from a tire repair kit. A leak in a tire can often be found by submerging the tire, pressurized with air, under water to see where air bubbles come out. If submerging a tire underwater is not possible, the leak can be searched for by covering the pressurized tire surface with a soapy solution to see where leaking air forms soap bubbles. A puncturing object, such as a nail or a screw, can be pulled out using pliers. Then a plug coated with a semi-liquid form of rubber can be inserted into the hole with a special tool. The rubber covering the plug solidifies rather quickly, after which the protruding ends of the plug can be cut off, the tire can be refilled with air to the appropriate pressure, and the repaired wheel replaced on the vehicle. Patches covering a hole have been glued or rubber-cemented to the interior surface of a tire also, particularly if a hole is too elongated for a simple plug. Tire repair with such patches requires the tire to be taken off the rim and then remounted after the patch is applied. Sometimes a more serious rupture of the tire material occurs resulting in a blowout. The damaged tire typically must be replaced after that. A leaking valve stem may occasionally be the cause of a leak, necessitating valve stem replacement. This replacement means the tire will have to be taken off the rim and remounted after the valve replacement. Occasionally, other types of damage require replacement of a tire.

Vehicles typically carry a *spare tire*, already mounted on a rim, to be used in case a flat tire or blowout occurs. These days, most spare tires for cars are smaller than normal tires (to save on trunk space, gas mileage, and cost) and should not be driven very far before replacement with a full-size tire. Years ago, full-size or conventional spare tires were used. A few modern vehicle models may use conventional spare tires also. Jacks and tire irons for emergency replacement of a flat tire with a spare tire are included when buying a new car. Not included, but sometimes available separately, are hand or foot pumps for filling a tire with air by the vehicle owner. Cans of pressurized "gas" can sometimes be bought separately for convenient emergency refill of a tire.

Alternatively, many modern cars and trucks are equipped with run flat tires that may be driven with a puncture - or perhaps are even self-repairing for moderate sized holes.

Front tires, especially on front wheel drive vehicles, have a tendency to wear out more quickly than rear tires. Routine maintenance including tire rotation, exchanging the front and rear tires with each other, is often done periodically to even out tire wear. There are simple hand-held tire-pressure gauges which can be temporarily attached to the valve stem to check a tire's interior air pressure. Because of slow leaks or changes in weather or other conditions, tire pressure may occasionally have to be adjusted, usually by refilling through the valve stem with some pressurized air which is often available at service stations.

Other use and recycling

Used tires, with too much wear to be safe on vehicles, or even punctured, are among the most re-used Waste-materials, as rubber is very resilient; it also yields much energy when burned.

While salvaged tires make cheap toys which can be used variously for pets, animals in captivity or human children, they can also be deliberately torn apart to re-use the rubber.

Furthermore tire strips are used as a severe instrument for punitive flagellation, which leaves dark bruises.

8 Traffic

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Traffic refers to the movement of motorized vehicles, unmotorized vehicles and pedestrians on roads. *Traffic laws* are the laws which govern traffic and regulta vehicles, while *rules of the road* are both the laws and the informal rules that may have developed over time to facilitate the orderly and timely flow of traffic.

Organized traffic generally has well-established priorities, lanes, right-of-way, and traffic control at intersections.

Organization

In many parts of the world traffic is generally organized, flowing in lanes of travel for a particular direction, with junctions, intersections, interchanges, traffic signals, or signs. Traffic may be separated into classes: vehicular; non-vehicular (e.g. bicycles); and pedestrian. Different classes may share speed limits and easement, or may be segregated. Some countries may have very detailed and complex traffic laws while others rely on drivers' common sense and willingness to cooperate.

Organization typically reduces travel time. Though vehicles wait at some intersections, wait time at others is much shorter. An unexpected occurrence may cause traffic to degenerate into a disorganized mess: road construction, accidents, or debris may all disrupt the flow. On particularly busy freeways, a minor disruption may persist in a phenomenon known as traffic waves. A complete breakdown of organization may result in traffic jams and gridlock. Simulations of organized traffic frequently involve queuing theory, stochastic processes and equations of mathematical physics applied to traffic flow.

Rules of the road

Rules of the road are the general practices and procedures that road users follow, especially motorists and cyclists. They govern interactions with other vehicles and pedestrians. The basic traffic rules are defined by an international treaty under the authority of the United Nations, the 1968 Vienna Convention on Road Traffic. Not all countries are signatory to the convention and, even among signatories, local variations in practice may be found. Driving safely is usually easier if a driver can adapt to both written and unwritten local rules of the road.

These rules should be distinguished from the mechanical procedures required to operate one's vehicle.

Directionality

Main article: **Driving on the left or right.**

Traffic going in opposite directions should be separated in such a way that they do not block each other's way. The most basic rule regarding this concept is which side of the road should be used for travel. About 34% of the world by country population drives on the left, and 66% keeps right. By roadway miles, about 72% drive on the right.

Highway code

In many countries, the *rules of the road* are codified, setting out the legal requirements and punishments for breaking them.

In the United Kingdom, the rules are set out in the Highway Code, including some obligations, but also a lot of other advice on how to drive sensibly and safely. For this second set of advice, it states: Although failure to comply with the other rules of the Code will not, in itself, cause a person to be prosecuted, The Highway Code may be used in evidence in any court proceedings under Traffic Acts to establish liability. Many of its ex-colonies still retain this notice.

In the United States, traffic laws are regulated by the states and municipalities through their respective traffic code. The federal government's Department of Transportation has some control over road signage and vehicle safety, and limited control over the Interstate highway system (which is actually built and maintained by the states). However, all state vehicle or traffic laws have common elements. These include the mandatory automobile insurance requirement, right-of-way rules, the basic speed rule (go only as fast as is safe under the circumstances up to the maximum posted speed limit), and the requirement to stop after an accident. The most common state-by-state variation is in maximum speed limits; for example, rural states like Montana have speed limits as high as 75 mph (120 km/h), but Oregon has a maximum speed limit of 65 mph (104 km/h) and Hawaii has a maximum of 55 mph. (88 km/h).

Speed limits

Main article: Speed limit

One of the main factors that affect the damage caused by a collision is speed. Therefore, many countries of the world impose speed limits on their roads. Drivers are not supposed to drive at speeds which are higher than the posted limit.

To enforce the speed limit, two approaches are generally employed. In the USA it is common for the police to patrol the streets and use special equipment to measure the speed of vehicles, and "pull over" any vehicle found to be in violation of the speed limit. In Brazil and some European countries, there are computerized speed-measuring devices spread throughout the city, which will automatically detect speeding drivers and take a photograph of the license plate, which is later used for applying and mailing the ticket.

Another interesting mechanism that was developed in Germany is the Grüne Welle, or green wave, which is an indicator that shows the optimal speed to travel for the synchronized green lights along that corridor. This encourages drivers to travel at the posted limit in order to minimize stopping.

Priority

As well as the side of the road, priority rules also differ between countries. In the United Kingdom, priority is always indicated by signs or road markings, in that every junction has a concept of a major road and minor road (except those governed by traffic lights). In most of Continental Europe, the default priority is to give way to the right, but this default may be overridden by signs or road markings. In France, until the 1980s, the "priorité à droite" (give way to the right) rule was employed at most roundabouts, in that traffic already on the roundabout had to give way to traffic entering the roundabout. Most French roundabouts now have give-way signs for traffic entering the roundabout, but there remain some notable exceptions that operate on the old rule, such as the Place de l'Étoile around the Arc de Triomphe. Traffic on this particular roundabout is so chaotic that French insurance companies deem any accident on the roundabout to be equal liability. The default give-way-to-the-right rule used in Continental Europe causes problems for many British and Irish drivers who are accustomed to having right of way by default unless they are specifically told to give way.

4-way stop intersections

In the United States and Canada, there are many 4-way intersections with a stop sign at every entrance. In this case, the default rule is:

1. Whichever vehicle stops first has priority.
2. If two vehicles stop at the same time, priority is given to the vehicle on the right.
3. If three vehicles stop at the same time, priority is given to the two vehicles going in the same direction.
4. If four vehicles stop, drivers usually use gestures and other communication to establish right-of-way. In some areas, the custom is for the north-south or the more-trafficked road to have priority, although this is rare.

Overtaking

Overtaking, or *passing* refers to a maneuver that is in effect passing vehicles traveling in the same direction. On two-lane roads, when there is a split line or a dashed line on the side of the overtaker, drivers may overtake when it is safe. In multi-lane roads in most jurisdictions, overtaking is permitted in the 'slower' lanes. See *lanes* below.

Lanes

When a street is wide enough to accommodate several vehicles traveling side-by-side, it is usual for traffic to organize itself into *lanes*, that is, parallel corridors of traffic. Some roads have one lane for each direction of travel and other have multiple lanes for each direction. Some countries apply pavement markings to clearly indicate the limits of each lane and the direction of travel that it must be used for. In other countries lanes have no markings at all and drivers follow them mostly by instinct rather than visual stimulus.

On roads that have multiple lanes going in the same direction, drivers may usually shift amongst lanes as they please, but they must do so in a way that does not cause inconvenience to other drivers. Driving cultures vary greatly on the issue of "lane ownership": in some countries, drivers traveling in a lane will be very protective of their right to travel in it while on others drivers will routinely expect other drivers to shift back and forth.

Designation and overtaking

The usual designation for lanes on divided highways is the fastest lane is the one closest to the center of the road, and the slowest to the edge of the road.

When driving on the left:

- The lane designated for faster traffic is on the right
- The lane designated for slower traffic is on the left
- Most freeway exits are on the left
- Overtaking is permitted to the right, and sometimes to the left.

When driving on the right:

- The lane designated for faster traffic is on the left
- The lane designated for slower traffic is on the right
- Most freeway exits are on the right
- Overtaking is permitted to the left, and sometimes to the right.

In the United States, the *inside lane* refers to the fastest lane, but in the United Kingdom, it refers to the **slowest** lane.

Usually, drivers are expected to keep in the slowest lane unless overtaking, though with more traffic, all lanes are often used. Many areas in North America do not have any laws about staying to the slowest lanes unless overtaking. In those areas, unlike many parts of Europe, traffic is allowed to overtake on any side, even in a slower lane. This practice is known as passing on the right in the United States, where it is common, overtaking on the inside, and 'undertaking' in the United Kingdom.

U.S. state-specific practices

In some U.S. states such as Massachusetts, although there are laws requiring all traffic on a public way to use the right-most lane unless overtaking, this rule is often ignored and seldom enforced on multi-lane roadways.

In other states like California, cars may use any lane on multi-lane roadways. Slower drivers are strongly encouraged to stay in the right-most lanes to keep the way clear for faster vehicles and thus speed up traffic. However, faster drivers can merely pass in the slower lanes if they wish. But the California Vehicle Code also requires trucks to stay in the right lane, or in the right two lanes if the roadway has four or more lanes going in their direction. The oldest freeways in California that pre-dated this rule often have ramps on the left, making signs like "TRUCKS OK ON LEFT LANE" or "TRUCKS MAY USE ALL LANES" necessary to override the default rule.

Right of way

Vehicles will often come into conflict with other vehicles because their intended courses of travel intersect, and thus interfere with each other's routes. The general principle that establishes who has the right to go first is called "right of way". It establishes who has the right to use the conflicting part of the road and who has to wait until the other driver does so.

Different countries have different rules that establish who has the right of way, but a common pattern is for one of the roads, usually the smaller road, to have a marking indicating that it should "yield" to drivers on the other road. This can be in the form of a stop sign, dotted lines painted on the pavement or other devices. Drivers approaching from the road with the stop sign, or equivalent device are required to stop before the intersection and only proceed when a breach occurs in the other road's traffic. Some countries also include pedestrian crossings near the STOP signs, and in this case the approaching drivers must also allow pedestrians to cross the street before advancing.

Another way to resolve the right-of-way conflict is to establish a general rule such as the French priorité-à-droite, or priority to the right when translated to the English language. This rule establishes that the right of way belongs to the driver who is coming from the right, and the driver coming from the left should yield to him. This rule is unambiguous, but may lead to some counterintuitive situations, such as in T-intersections, where, strangely enough, traffic going straight through the top segment of the T must yield to entering traffic that comes from the vertical leg of the T.

In most modern cities the traffic signal is used to establish the right of way on the busy roads. Its primary idea is to give each road a slice of time in which its traffic may use the intersection in an organized way. The intervals of time assigned for each road may be adjusted to take into account factors such as difference in volume of traffic.

Expressways

In large cities, moving from one part of the city to another by means of ordinary streets and avenues can be time-consuming since traffic usually moves at slow speeds and there are many intersections, stop signs, parked cars, pedestrian crossings, bicycle traffic and other obstacles. Therefore, it has become common practice for larger cities to build expressways, which are large and wide avenues that run for long distances and have no intersections or semaphores. Vehicles wishing to travel over great distances within the city will usually take the expressways in order to save on travel time. When another road must cross an expressway, a bridge will be built if the expressway is a ground-level road, or it will pass under the expressway if it is elevated.

Expressways usually have controlled entry and exit, that is, entering and leaving the expressway may only be done at specific points called entries and exits. Vehicles entering the expressway must yield the right of way to the vehicles already traveling on it.

Turning

Vehicles will often want to cease to travel in a straight line and turn onto another road. The vehicle's directional signals (blinkers) are often used as a way to announce one's the intention to turn, thus alerting other drivers. The actual usage of blinkers vary greatly amongst countries. Turning traffic must usually yield the right of way to oncoming traffic—on right-driving countries, vehicles must yield when performing a left turn; on left-driving countries vehicles must yield when performing a right turn.

This will usually mean that turning traffic will have to stop in order to wait for a breach to turn, and this might cause inconvenience for vehicles that follow them but do not want to turn. This is why dedicated lanes and protected traffic signals for turning are sometimes provided. On busier intersections where a protected lane would be ineffective or cannot be built, turning may be entirely prohibited, and drivers will be required to "drive around the block" in order to accomplish the turn.

On roads with multiple lanes, turning traffic is generally expected to move to the lane closest to the direction they wish to turn. For example, traffic intending to turn right will usually move to the rightmost lane before the intersection. Likewise, left-turning traffic will move to the leftmost lane. Exceptions to this rule may exist where for example the traffic authority decides that the two rightmost lanes will be for turning right, in which case drivers may take whichever of them to turn. On certain parts of the world traffic will adapt to informal patterns that rise naturally rather than by force of authority: for example, in Brazil and elsewhere it is common for drivers to observe (and trust) the turn signals used by other drivers in order to make turns from other lanes. For example if several vehicles on the right lane are all turning right, a vehicle may come from the next-to-right lane and turn right as well, doing so in parallel with the other right-turning vehicles.

One-way streets

In more sophisticated systems such as large cities, this concept is further extended: some streets are marked as being *one-way*, and on those streets all traffic must flow in only one direction. A driver wishing to reach a destination he already passed must use other streets in order to return. Usage of one-way streets, despite the inconveniences it can bring to individual drivers, can greatly improve traffic flow since they usually allow traffic to move faster and tend to simplify intersections.

Pedestrian crossings

Pedestrians must often cross from one side of a road to the other, and in doing so may come into the way of vehicles traveling on the road. In many places pedestrians are entirely left to look after themselves, that is, they must observe the road and cross when they can see that no traffic will threaten them. Busier cities usually paint "pedestrian crossings", which are strips of the road where pedestrians are expected to cross.

The actual appearance of pedestrian crossings varies greatly, but the two most common appearances are: (1) a series of parallel white stripes or (2) two long horizontal white lines. The former is usually preferred, as it stands out more conspicuously against the dark pavement.

Some pedestrian crossings also accompany a traffic signal which will make vehicles stop at regular intervals so the pedestrians can cross. Some countries have "intelligent" pedestrian signals, where the pedestrian must push a button in order to assert his intention to cross. The traffic signal will use that information to schedule itself, that is, when no pedestrians are present the signal will never pointlessly cause vehicle traffic to stop.

Pedestrian crossings without traffic signals are also common. In this case, the traffic law usually states that the pedestrian has the right of way when crossing, and that vehicles must stop when a pedestrian uses the crossing. Countries and driving cultures vary greatly as to the extent to which this is respected.

In most areas, an intersection is considered to have a crosswalk, even if not painted, as long as the roads meet about approximately right angles.

Unorganized traffic

Unorganized traffic occurs in the absence of lanes and signals. Roads do not have lanes, though drivers tend to keep to the appropriate side if the road is wide enough. Drivers frequently overtake other drivers, and obstructions are not uncommon.

Intersections have no signals or signage, and a particular road at a busy intersection may be dominant (that is, its traffic flows) until a break in traffic, at which time the dominance shifts to the other road where vehicles are queued. At the intersection of two perpendicular roads, a traffic jam results if four vehicles face each other side-on.

Traffic pre-emption

In some areas, emergency responders are provided with specialized equipment which allows emergency response vehicles, particularly fire fighting apparatus, to have high-priority travel, by changing the lights in their corridor to green and intersecting streets along the corridor to red. The technology behind these methods have evolved, from panels at the fire department that could trigger and control green lights for certain major corridors, to optical systems, which the individual fire apparatus can be equipped with to communicate directly with receivers on the signal head.

Intelligent Transportation Systems

Intelligent Transportation Systems (ITS) is a system of hardware, software and operators that allow better monitoring and control of traffic in order to optimize traffic flow. As the number of vehicle lane miles traveled per year continues to increase dramatically, and as the number of vehicle lane miles constructed per year has not been keeping pace, this has led to ever-increasing traffic congestion. As a cost-effective solution toward optimizing traffic, ITS presents a number of technologies to reduce congestion by monitoring traffic flows through the use of sensors and live cameras, and in turn rerouting traffic as needed through the use of variable message boards (VMS), highway advisory radio (HAR) and other systems. Additionally, the roadway network has been increasingly fitted with additional communications and control infrastructure to allow traffic operations personnel to monitor weather conditions, for dispatching maintenance crews to perform snow or ice removal, as well as intelligent systems such as automated bridge de-icing systems which help to prevent accidents.

See also

- Road safety

Traffic code

Home | Traffic code | Driving | Driving on the left or right | Speed limit | Traffic lights | Car safety | Traffic signs

Traffic code (also *motor vehicle code*) refers to the collection of local statutes, regulations, ordinances and rules that have been officially adopted to govern the orderly operation and interaction of motor vehicles, bicycles, pedestrians and others upon the public (and sometimes private) ways.

The traffic code generally includes provisions relating to the establishment of authority and enforcement procedures, statement of the rules of the road, and other safety provisions. Administrative regulations for driver licensing, vehicle ownership and registration, insurance, vehicle safety inspections and parking violations may also be included, though not always directly related to driving safety. Violations of traffic code (i.e., a "moving violation") are often dealt with by forfeiting a fine in response to receiving a valid citation ("getting a ticket"). Other violations, such as drunk driving or vehicular homicide are handled through the criminal courts, although there may also be civil and administrative cases that arise from the same violation (including payment of damages and loss of driving privileges). In some jurisdictions there is a separate code-enforcement branch of government that handles illegal parking and other non-moving violations (e.g., noise and other emissions, illegal equipment). Elsewhere, there may be multiple overlapping police agencies patrolling for violations of state or federal driving regulations.

In the United States each state has its own traffic code, although most of the rules of the road are similar for the purpose of uniformity, given that all states grant reciprocal driving privileges (and penalties) to each others' licensed drivers. There is also a "Uniform Vehicle Code" which has been proposed by a private, non-profit group, based upon input by its members. As with many such offerings, some states adopt selected portions as written, or else with modifications, and others create their own versions. Similarly, most states have adopted relevant standards for signs and signals, based upon the Manual on Uniform Traffic Control Devices from the U.S. Department of Transportation. Many of the standard rules of the road involve consistent interpretation of the standard signs and signals, such as what to do when approaching a stop sign, or the driving requirements imposed by a double-yellow line on the street or highway. Many federal departments have also adopted their own traffic code for enforcement on their respective reservations (e.g., national parks, military bases).

List of some standard Rules of the Road:

- Entering and leaving roadways.
- Right of way at marked and unmarked intersections under various conditions.
- Observing and interpreting traffic signs (especially warning, priority or prohibitory traffic signs)
- Keeping to right side (or left side) except to pass others, where passing is allowed.
- Direction of travel and turning (one way, do not enter, no U-turn, etc)
- Speed, height, width and weight limits.
- Bicycle and pedestrian priority.
- Yielding to special vehicles (emergency, funeral, school bus).
- Vehicle lighting and signalling.
- Stopping if there has been a collision.

See also

- Traffic

Driving

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Driving is the controlled operation of a vehicle, which is usually a motor vehicle such as a truck, bus, or car. For bicycles and mounted animals and — at least in the United Kingdom, the United States and Canada — motorcycles, the corresponding activity is called riding, unless a chariot is being used.

Driving includes knowing how to operate the mechanisms which control the speed and direction (which in technical terminology are both components of the velocity), and the braking of the vehicle, and especially includes knowing how to do both safely. An experienced driver usually has an intuitive understanding of the basics of car handling.

Driving as a physical skill

In terms of the basic physical tasks required, driving a motor vehicle generally involves:

- Starting the vehicle's engine with the starting system
- Setting the transmission to the correct gear
- Depressing the pedals with one's feet to accelerate and slow the vehicle (and, if necessary, to change gears)

- Steering the vehicle's direction with the steering wheel
- Operating other important ancillary devices like the headlights and windshield wipers
- Watching the road conditions in all directions around the vehicle (including frequent checks behind the vehicle using mirrors) to monitor the relative location of other vehicles, bicyclists, and pedestrians.

Driving as a survival skill

Of course, driving is far more complicated than simply pressing pedals and turning the steering wheel; it also involves looking out for everyone else (and everything) on the road. The skill of safe driving is necessary to avoid collisions, which kill many thousands of people annually.

And safe driving is much more than following the legally prescribed rules of the road. It goes beyond that into the cultivation of good habits, maintaining attention, and a thoughtful, cooperative attitude that avoids and prevents accidents. This is often described as defensive driving.

Laws covering driving

In most countries, the use of public roads is heavily governed by law. Laws cover the construction and maintenance of roads, the construction and use of vehicles, the rules of the road, the requirements for driver and vehicle licensing (see *Driver's license* and *License plate*), vehicle taxation, safety inspections and compulsory insurance. These laws reflect the high degree of responsibility which is imposed upon both the drivers and manufacturers of vehicles to make them as safe in use as they can possibly be.

Motorists are almost universally required to take lessons with an approved instructor and pass a driving test before being granted a license. The trend has been towards increasingly tougher tests in recent decades. Almost all countries allow all adults with good vision to apply to take a driving test and, if successful, to drive on public roads. Saudi Arabia, however, bans women from driving vehicles (and riding bicycles) on public roads. Saudi women have periodically staged driving protests against these restrictions.

In many countries, even after passing one's driving test, new drivers may be initially subject to special restrictions. For example, in Australia, novice motorists are required to carry "P" ("provisional") plates, and are subject to lower speed limits, alcohol limits, and other restrictions for their first two years of driving. This varies between states.

Minimum driving ages

The minimum age required for driving varies depending on the country. The most common age is 18. Here are the ages required in some countries (in alphabetical order), note that some regions of the countries may start at a different age than other regions, this is just the minimum age requirement to drive:

- Albania: 18

Argentina: 17
Australia

- New South Wales: 17

South Australia: 16
Victoria: 18
Queensland: 17
Northern Territory: 17
Tasmania: 16
Western Australia: 17

- Austria: 17

Belgium: 18
Brazil: 18
Canada: 16
China: 18
Czech Republic: 18
Denmark: 18
Egypt: 18
Ethiopia: 14
Finland: 18
France: 18
Germany: 18
Greece: Varies from 16 to 18 years of age, depending on Vehicle Category. Usually minimum of 17.
Hong Kong: 18
Indonesia:17
Iceland: 17
Iran: 18
Ireland: 17
India: 18
Isle of Man: 16
Israel: 17
Italy: 18
Japan: 18
Luxembourg: 18
Malaysia: 17
Malta: 18
Mauritius: 18
Mexico: 16
Morocco: 18
Netherlands: 18
New Zealand: 15
Norway: 18
Oman: 18

Pakistan: 18
Peru: 18
Philippines: 17
Poland: 18
Portugal: 18
Puerto Rico: 16
Romania: 18
Russia: 18
South Africa: 18
Singapore: 18
Spain: 18
Sweden: 18
Switzerland: 18
Taiwan: 18
Tanzania: 18
United States: Varies from 14 to 18 by state, 16 is most common.
United Kingdom: 17
Uruguay: 18
Venezuela: 18

Enforcement of driving-related laws

Each country has its own unique way of dividing up the responsibility for enforcing all the laws mentioned above. In nearly all countries, though, the laws controlling driving in practice (like speed limits) are enforced by the police, who are in the best position to identify violations as they occur and to issue citations or make arrests.

Some countries, like Australia, prefer to put everything road-related into a single agency at the state level. Thus, in the Australian state of New South Wales, the Roads and Traffic Authority (RTA) is responsible for driver licensing; highway construction, maintenance, and patrol; and many other things. Policing on Australian roads is provided by the relevant state police.

In contrast, in the United States, many U.S. state governments have a Department of Transportation that handles road construction and maintenance (subject to some guidance from the federal Department of Transportation), and a separate Department of Motor Vehicles that handles driver licensing and vehicle registration. There is usually a state police agency (called the Highway Patrol or Department of Public Safety) which enforces driving laws on state highways. On local roads, driving laws are enforced by county sheriff's departments or city police departments.

In many jurisdictions, bicycles are legally considered to be vehicles and cyclists are legally classified as drivers. The riding of bicycles is rarely subject to licensing. However, some municipalities permit for the bicycle.

See also

- Traffic

- Driving under the influence
- Road safety
- Traffic sign

Driving on the left or right

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In organized traffic, vehicles going in opposite directions are separated to a side of the road so they will not block each other's way. By keeping to the left or right, vehicles traveling in opposite directions will not run into each other. This is so fundamental that it is sometimes known simply as the rule of the road. About 34% of the world by country population drives on the left, and 66% keeps right. By roadway miles, about 28% drive on the left, and 72% on the right.

In more sophisticated systems such as large cities, this concept is further extended: some streets are marked as being *one-way*, and on those streets all traffic must flow in only one direction. A driver wishing to reach a destination he already passed must use other streets in order to return.

History

In most early motor vehicles the driving seat was in the middle. Later some carmakers chose to have it nearest the centre of the road to help drivers look out for oncoming traffic, whilst others chose to put the seat on the other side so that the drivers could avoid damaging their vehicles on walls, hedges, roadside gutters and other obstacles. Eventually the former idea prevailed.

The advantages of driving on one side or the other typically concern conformity and uniformity rather than practical or natural benefits. There are historical exceptions such as postilion riders in France, but such historical advantages do not apply to modern road vehicles.

There is some evidence of cart tracks from a quarry in Blunsdon Ridge near Swindon which suggests that Roman traffic was on the left, and until the 18th century, this was probably the most common choice in Europe. However, driving on the right was more common in France; this was imposed by Napoleon Bonaparte (who is said to have been left-handed) on the countries he occupied, and thus it became the practice in their colonies.

Driving on the right

- Oncoming traffic is seen coming from the left;
- The driving seat is mostly on the left side of the vehicle, hence the designation *left hand drive* (LHD);
- Left-turning traffic must cross oncoming traffic.
- Most traffic signs facing motorists are on the right side of the road;

- Roundabouts (traffic circles or rotaries) go anti-clockwise (counter-clockwise);
- Pedestrians crossing a two-way road should watch out for traffic from the left first.

Advantages

- When driving a car, a right-handed driver can operate the gear shift and other dashboard controls requiring fine motor skills with their right hand, while using their left to operate the steering wheel, which requires larger, less fine, movements. Race cars, even in countries that drive on the left, are usually configured with the gear shift on the right.
- Traffic on roundabouts and other gyratory systems flows in a counter-clockwise direction. This is more natural to most people, who draw circles counter-clockwise and navigate buildings counter-clockwise by turning right upon entering. [1]
- For bicycle and motorcycle riders, most arm signals are done with the left arm, allowing the right arm to steer the bike, which is easier and safer for the majority of people who are right-handed. This is especially important since handlebars have a steering ratio of 1°:1°, unlike a car, which is often closer to 10°:1° (10 degrees turning on the steering wheel results in a 1 degree turn of the wheels).
- Approximately two-thirds of the world's population, and more of the driving population, lives in countries that drive on the right. With increased international travel, it is safer and more practical for a country to drive on the same side of the road as its neighbours. This is the most common reason for countries to switch to driving on the right.
- Left-hand drive cars tend to be cheaper, as they are usually produced in higher volumes than right hand drive equivalents, while many cars, usually U.S. models, may not be produced in right hand drive at all. It is rare that models are produced in right hand drive only, except in Japan and Australia. However in Europe, this difference in price only occurs because of artificially inflated prices for the equivalent right hand drive models in the UK. Such price differentials are often outlawed by government regulations, for example by the European Commission.

Driving on the left

- Oncoming traffic when driving on the left is seen on the right side.
- The driving seat is mostly on the right side of the vehicle, hence the designation *right hand drive* (RHD);
- Right-turning traffic must cross oncoming traffic;
- Most traffic signs facing motorists are on the left side of the road;
- Roundabouts (traffic circles or rotaries) go clockwise;

- Pedestrians crossing a two-way road should watch out for traffic from the right first.

Advantages

- With a right-hand-drive car, given that most people are right-handed, the less coordinated hand is used for changing gear and operating dashboard controls, leaving the more coordinated right hand free to steer. Driving on the left avoids the difficult combination of steering with the left hand and changing gear with the right hand and at the same time viewing the oncoming traffic with the left eye. The 10:1 car steering ratio also makes it important to keep the right hand on the steering wheel.
- It is more common to be right-eye dominant. Traffic flows in a clockwise direction when driving on the left which enables right eyed people to use the right eye to see oncoming traffic. When overtaking on a right-hand-driving road the right-eyed driver looks in the outside mirror with the left eye and also views the oncoming traffic with the left eye which is not suited to the majority right-eyed people.
- When reversing and looking over one's shoulder, the driver is able to keep the more coordinated right hand on the steering wheel in a right hand drive car. This also enables easier viewing through the rear window.
- When driving on the left, right-handed people mount bicycles from the kerb, who find it easier to put their right leg over the bicycle. This keeps a right-handed bicycle rider out of the stream of traffic.
- Research in 1969 by J J Leeming showed that countries that drove on the left had a lower accident rate than countries that drove on the right. Some countries that have switched to driving on the right (for example Sweden) saw their long term accident rates increase by more than any increase in traffic volumes. It has been suggested, but not proven, that this is partly because most people are right-eyed, and are therefore better able to judge the position of oncoming traffic when they see it on their right.

Myths

Approximately one quarter to one third of the world's traffic goes on the left-hand side of the road. Some claim that this practice arose from the prevalence of right-handedness, although such prevalence occurs in virtually all populations, regardless of which side of the road is used. In any case, the need to be ready for self-defence on rural roads inclined most horse-riders to keep to their left when encountering oncoming wayfarers, so as to be able to deploy a sword or other hand-weapon more swiftly and effectively should the need arise. Also, those on foot and in charge of horse-drawn vehicles would more usually hold the animals' heads with their right hand, and thus walk along the left hand side of the road.

The first legal reference in Britain to an order for traffic to remain on the left occurred in 1756 with regard to London Bridge. The General Highways Act of 1773, contained a recommendation that horse traffic should remain on the left and this was enshrined in the Highways Bill in 1835. At one point the rule was enshrined in a piece of doggerel:

The rule of the road is a paradox quite,
For if you keep to the left, you're sure to be right.

The British author C. Northcote Parkinson has presented what he calls "proof" that the British way of driving (on the left side of the road) is the natural one. However, this is only an opinion, since there is no "right" or "wrong" way to drive.

Some ex-colonies of the British Empire continue to drive on the left, but others, such as Canada, Gambia, Ghana, Nigeria, Sierra Leone, and the United States switched to the other side.

Apart from former British colonies, most countries' traffic moves on the right side, but Japan, Indonesia, Macau, Mozambique, Thailand and the U.S. Virgin Islands are exceptions to this rule.

Changing sides

There are still many instances of traffic having to change sides at border crossings, such as at those between Afghanistan and Pakistan, Laos and Thailand, Sudan and Uganda. Thailand is particularly notable in the context of border crossings, as it is the only sizeable country that has nearly all of its borders with countries that drive on the opposite side. It drives on the left, but 90% (4357km or 2707 miles) of its borders are with countries that drive on the right, with only Malaysia driving on the left.

Some countries have changed the side of the road on which their motorists drive in order to increase the safety of cross-border traffic. For example, former British colonies in Africa, such as Gambia, Sierra Leone, Nigeria and Ghana, have all changed from left- to right-hand traffic, as they all share borders with former French colonies, which drive on the right. The former Portuguese colony of Mozambique has always driven on the left, as all its neighbours are former British colonies.

In the former British Crown colony of Hong Kong and the former Portuguese enclave of Macau, traffic continues to drive on the left, unlike in mainland China, despite the fact that they are now its Special Administrative Regions. However, Taiwan, formerly under Japanese rule, changed to driving on the right in 1946 after the government of the Republic of China assumed administration; the same happened in Korea (both North and South), a former Japanese colony under US and Soviet occupation.

Foreign occupation

However, many countries changed this rule of the road as a result of foreign occupation, notably during the Napoleonic Wars. More recently there are examples such as Austria, Czechoslovakia (details) and Hungary under German rule in the 1930s and '40s. The Channel Islands also changed to driving on the right under German occupation, but changed back after liberation in 1945. The Falkland Islands did the same under Argentine control during the 1982 Falklands War, (although the Argentine government officially ordered the islanders to drive on the right, they often drove on the left to assert their defiance to occupation). East

Timor changed to driving on the left under Indonesian rule in 1976, and continues the practice as an independent state. The Japanese region of Okinawa changed from left to right under US occupation; after the occupation ended, it changed back to driving on the left to match the rest of Japan.

Vehicles

For safety reasons (and in some cases political or economic reasons), some countries have banned the sale or import of vehicles with the steering wheel on the "wrong" side.

In Australia this is the case with non-vintage LHD vehicles, with the result that Australians who do import such vehicles must pay thousands of dollars to convert them to RHD.

In New Zealand, LHD vehicles may have been privately imported, and driven locally under a LHD permit. Since 1999, only LHD vehicles older than 20 years or cars owned and operated for at least 90 days may be privately imported.

In the Philippines, RHD cars are banned. Public buses and vans imported from Japan are converted to LHD, and passenger doors are created on the right side. However, some vans keep their doors on the left side, leading to the odd (and dangerous) situation in which passengers have to exit toward oncoming traffic.

Cambodia banned the use of RHD cars, most of which were smuggled from Thailand, from 2001, even though these accounted for 80 per cent of vehicles in the country. The government threatened to confiscate all such vehicles unless they were converted to LHD, in spite of the considerable expense involved. According to a BBC report, changing the steering column from right to left would cost between US$600 and US$2000, in a country where average annual income was less than US$1000.

North Korea, although it drives on the right, imported various used RHD vehicles from Japan, from tourist buses to Toyota Land Cruisers for its army and secret police, and cars for high rank party members.

However, many used vehicles exported from Japan to countries like Russia, Peru are already converted to LHD. But even if the driver's position is left unchanged some jurisdictions require at least headlights readjustment.

Singapore bans LHD vehicles from being imported for personal local registration, but temporary usage by tourists of LHD vehicles is allowed. It is also notable that embassy vehicles in Singapore are exempt from the RHD-only ruling, and that there are few hydrogen powered LHD vehicles currently undergoing trials in Singapore.

In West Africa, Ghana and Gambia have also banned RHD vehicles.

Most of the above bans on RHD and LHD vehicles apply only to locally-registered vehicles. Countries that have signed the 1968 Vienna Convention on Road Traffic are not allowed to make such restrictions on foreign-registered vehicles. Paragraph 1 of Annex 5 states "All vehicles in international traffic must meet the technical requirements in force in their country of registration when they first entered into service". Therefore all signatory countries and most non-signatory countries allow the temporary import (e.g. by tourists) of foreign-registered vehicles, no matter which side the steering wheel is on. Oman, which has not signed the convention. bans all foreign-registered RHD vehicles. [1]

Both RHD and LHD vehicles may generally be registered in any European Union member state, but there are some restrictions and regulations. Slovakia, despite being a member of the European Union, does not allow the local registration of RHD vehicles [2], even if the vehicle is imported from one of the four EU countries that drive on the left. If a LHD vehicle is registered in the United Kingdom, then its headlights must be permanently adjusted to dip to the left, which often involves the lenses being replaced.

Most headlights are manufactured so that when dipped, they are aimed slightly towards the kerb side. In this way, RHD vehicles' headlights dip to the left and LHD vehicles' headlights dip to the right. Within Europe, when driving a RHD vehicle in a country that drives on the right or a LHD vehicle in a country that drives on the left, it is a legal requirement to adjust headlights so that they do not shine towards oncoming vehicles when dipped. This may be achieved by fixing adhesive blackout strips to the part of the lens that deflects light to one side, but an increasing number of vehicles, particularly those with Xenon headlights, can be more simply adjusted by a lever or switch on the back of the headlights, whenever switching sides of the road. However, the requirement to adjust headlights is respected by a decreasing number of drivers, and is now rarely enforced by European police forces. In France, this is probably because, since amber-tinted headlights were abolished in 1993, foreign-registered vehicles have been much less conspicuous at night.

Priority

Main article: Priority in Traffic

As well as the side of the road, priority rules also differ between countries. In the United Kingdom, priority is always indicated by signs or road markings, in that every junction has a concept of a major road and minor road (except those governed by traffic lights). In most of Continental Europe, the default priority is to give way to the right, but this default may be overridden by signs or road markings. In France, until the 1980s, the "priorité à droite" (give way to the right) rule was employed at most roundabouts, in that traffic already on the roundabout had to give way to traffic entering the roundabout. Most French roundabouts now have give-way signs for traffic entering the roundabout, but there remain some notable exceptions that operate on the old rule, such as the Place de l'Étoile around the Arc de Triomphe. Traffic on this particular roundabout is so chaotic that French insurance companies deem any accident on the roundabout to be equal liability. The default give-way-to-the-right rule used in Continental Europe causes problems for many British and Irish drivers who are accustomed to having right of way by default unless they are specifically told to give way.

Lanes

Main article: Lanes in Traffic

When driving on the left:

- The lane designated for faster traffic is on the right
- The lane designated for slower traffic is on the left
- Most freeway exits are on the left

- Overtaking is permitted to the right, and sometimes to the left.

When driving on the right:

- The lane designated for faster traffic is on the left
- The lane designated for slower traffic is on the right
- Most freeway exits are on the right
- Overtaking is permitted to the left, and sometimes to the right.

Places of interest

Canada

Until the 1920s, the rule of the road in Canada varied from province to province, with British Columbia, New Brunswick, Nova Scotia, and Prince Edward Island having cars driving on the left, and the other provinces and territories having motorists driving on the right. Starting with the interior of British Columbia on 15 July 1920 and ending with Prince Edward Island on 1 May 1924, these provinces changed to driving on the right. Newfoundland was not part of Canada until 1949, and its motorists drove on the left until 2 January 1947.

Caribbean

In many Caribbean islands where traffic drives on the left, such as the British Virgin Islands, US Virgin Islands, the Cayman Islands, the Bahamas and Turks and Caicos Islands, most passenger cars are LHD, being imported from the United States. Only government cars and those imported from Asia are RHD. The US Virgin Islands are particularly known for having a high accident rate caused by American tourists from the mainland who are unfamiliar with driving on the left in their rental cars - the confusion from which is obviously compounded by using a LHD vehicle.

China (mainland)

Until 1946, driving in mainland China was mixed, with cars in the northern provinces driving on the right (probably to concur with Russian practice, which was "keep right" from 1920), and cars in the southern provinces such as Guangdong driving on the left, probably a result of their proximity to the British crown colony of Hong Kong and the Portuguese enclave of Macau.

After 1946, China followed the United States, by changing to driving on the right, due to political reasons that the United States helped China to fight against Japanese occupation during World War II and American cars (mostly LHD) were already popular in China.

Gibraltar

Although the British overseas territory of Gibraltar changed to driving on the right on 16 June 1929, in order to avoid accidents involving vehicles from Spain, some public buses until recently were RHD, with a special door allowing passengers to enter on the right hand side. However, most passenger cars are LHD, as in Spain, with the exception of second-hand cars brought in from the UK and Japan and some vehicles used by the British forces.

Guyana and Suriname

Guyana and Suriname are the only two remaining countries in the mainland Americas that still drive on the left. As a result of the construction of the Pan-American Highway, four mainland American countries switched to driving on the right between 1943 and 1961, the last of which was Belize. Both Guyana and Suriname are separated from their neighbours by large rivers, over which no road bridges have yet been built. The inland south of both countries is sparsely populated with very few roads and hence no border crossings. However, in the south west of Guyana near Lethem, work is underway to build the Takutu Bridge across the Takutu river into neighbouring Brazil, which drives on the right. Unlike road bridges between other countries that drive on opposite sides of the road, the changeover system will unusually be in the country that drives on the left, i.e. Guyana, where one lane will pass under the other on the bridge's access road. Despite stalling construction in recent years, Brazil is keen to open the bridge, as it will give Brazil access to Caribbean sea ports on the north coast of South America. Brazil intends to limit Guyana registered (RHD) vehicles to no further than the Brazilian border town of Bonfim, but it is expected that Brazilian (LHD) vehicles will be able to drive all the way through Guyana to the coast. Once opened, the Takutu Bridge will be the Americas' only border crossing where traffic changes sides of the road.

Hong Kong and Macau

Being a former British colony, Hong Kong follows the United Kingdom in driving on the left. Macau, a former Portuguese exclave, follows Hong Kong in driving on the left because most of the RHD cars in Macau are imported through Hong Kong. It is such a separate entity that Macau did not follow either Mainland China in 1946 or Portugal in 1928 in switching to driving on the right.

Under the auspices of the one country, two systems arrangement, traffic continues to move on the left in Hong Kong and Macau, now Special Administrative Regions of the People's Republic of China, unlike in the mainland. Most vehicles are RHD and even suppliers for the People's Liberation Army have specially made RHD version vehicles for the garrison to drive in Hong Kong and Macau. LHD exceptions include some buses providing services to and from the mainland. Vehicles registered in Hong Kong and Macau are required to have a special number plate issued by the authorities in Guangdong province to drive legally on the mainland.

There are three road border crossing points between mainland China and Hong Kong. The largest and busiest is Lok Ma Chau, which features two separate changeover systems on the mainland side. The next largest is Man Kam To, where there is no changeover system and the border roads on the mainland side simply intersect as one-way streets with a main road. There are two border crossing points between mainland China and Macau. The newer crossing point is the Lotus Bridge, which crosses a narrow channel of sea between the mainland and Macau, and was opened at the end of 1999. The Lotus Bridge was designed to cater for high traffic volumes and features three lanes in each direction as well as a full changeover system on the mainland side, comprising bridges that loop around each other by 360° to swap the direction of the traffic. At the older Macau crossing point, there is no changeover system and the border roads continue with traffic on the left on the mainland side, and simply intersect on to a roundabout. All of these Chinese changeover systems can be viewed in high resolution using Google Earth.

Iceland

Sweden's fellow Nordic country Iceland followed in switching traffic from left to right at 6am on Sunday, May 26, 1968. The only casualty from the changeover was a boy on a bicycle who broke his leg (New York Times, May 28, 1968, p. 94). Numerous buses were also stuck in traffic jams.

India

India adopted the practice of driving on the left hand side of the road, more as a continuation of the colonial past rather than any specfic reason. Drivers in Indian roads tend to disregard road safety in general and you could find the overtaking being done from any side which is relatively free of traffic. This is further exaggerated by the fact that most of the dirvers tend to stay to the middle of the road (most of the roads are single carriageways).

Italy

In Italy the practice of traffic driving on the right first began in the late 1890s, but it was not until the mid 1920s that it became standard throughout the country. There was a long period when traffic in the countryside drove on the right while major cities continued to drive on the left. Rome, for example, did not change from left to right until 20 October 1924. Cars had remained right-hand drive (RHD) until this time. Lancia did not produce LHD cars until as late as the early 1960s, and stopped making RHD cars altogether in 1994. Lancia is expected to start manufacturing RHD cars again in 2008.

Japan

In Japan, foreign brands of car sold locally have traditionally been LHD, which is regarded as exotic or a status symbol. This even applies to British brands (although cars for the British market have the steering wheel on the right), in part because many have been imported via the US. However, some US manufacturers have made RHD models for the Japanese market, though with limited success; and as continental European brands become more popular, the preference is increasingly for RHD models. Many tollbooths in Japan have a special lane for LHD vehicles.

Okinawa

After the defeat of Japan during World War II, Okinawa was occupied by the United States and made to drive on the right side. Okinawa changed back to driving on the left when it was returned to Japan. The change took place at 06:00 on 30 July 1978. It is one of very few places to have changed from right to left side driving in the late twentieth century.

Myanmar (Burma)

As a former British colony, cars in Myanmar (formerly Burma) drove on the left side until 1970, when the military administration of Ne Win decreed that traffic would drive on the right side of the road. It is alleged that this was because Ne Win had been advised by his soothsayer, who had said "move to the right", although this was in fact a reference to economic policy. In spite of the change, most passenger cars in the country today are RHD, being second-hand vehicles imported from Japan, Thailand, and Singapore. However, government limousines, imported from China, are LHD. Virtually all vehicles are driven with a passenger in place to watch the oncoming traffic and inform the driver as to whether it is safe to overtake or not, as the driver cannot see this from his RHD position.

New Zealand

Even though New Zealand drives on the left, drivers must give way to traffic coming from their right at intersections. Thus, the give way rules have more in common with those of countries that drive on the right than of other countries that drive on the left.

Russian Federation

Although Russia drives on the right, cheaper grey import cars from Japan are more popular than LHD cars of the same class. Russia is estimated to have more than 1.5 million RHD vehicles on its roads. In the far eastern regions, such as Vladivostok or Khabarovsk, RHD vehicles make up to 90% of the total. This includes not only private cars, but also police cars, ambulances, and many other municipal and governmental vehicles as well.

Considering that RHD vehicles by far outnumber the LHD ones (better suited to the rules) on the Pacific side of Russia, drivers in those regions have made multiple proposals about switching the sides of the road. However, they were denied by Russian government. During spring 2005, the rumour that RHD vehicles would be completely banned from the roads drove thousands of protestors to the streets everywhere in the country. On 4 July 2005 Russian minister of industry and energy Viktor Khristenko announced that RHD vehicles would be allowed on the roads but would have to conform to all Russian traffic safety requirements.

Sweden

Sweden had left-hand traffic (Vänstertrafik in Swedish) from approximately 1734, when it changed back from a short period of right-hand traffic starting in 1718. Finland, under Swedish rule until 1809, also drove on the left, and continued to do so as a Russian Grand Duchy until 1858.

This continued well into the 20th century, despite the fact that virtually all the cars on the road in Sweden were actually LHD. (One argument for this was that it was necessary to keep an eye on the edge of the road, something that was important on the narrow roads in use at the time.) Also, Sweden's neighbours, Norway and Finland already drove on the right, leading to confusion at border crossings.

In 1955 a referendum was held on the issue, resulting in an 82.9%-to-15.5% vote against a change to driving on the right. Nevertheless, in 1963 the Swedish parliament passed legislation ordering the switch to right-hand traffic. The changeover took place at 5am on Sunday, September 3, 1967, which was known in Swedish as Dagen H (H-Day), the 'H' being for Högertrafik or right-hand traffic.

Since Swedish cars were LHD, experts had suggested that changing to driving on the right would be safer, because drivers would have a better view of the road ahead. Indeed, fatal car-to-car and car-to-pedestrian accidents dropped sharply as a result. However, the accident rate rose back to its original position within two years.

United Kingdom

- Vehicles within United States visiting forces bases in the UK drive on the left, even though the US does not provide specific right-hand drive vehicles for their green fleet. But their white fleet does have right-hand drive vehicles. This is unlike British practice in Germany where even UK green fleet vehicles for British Forces Germany have been left-hand drive.
- On some British Army training locations, where the army once trained for conflict in Eastern Europe during the Cold War, traffic is meant to travel on the right. Most military bases in the UK though have the normal rule of driving on the left.
- There are several locations in the UK where traffic passes other traffic coming in the opposite direction on the left hand side, but most locations are separated by a barrier (such as on the south side of Portman Square in London). In Savoy Court outside the Savoy Hotel, among other places, however, there is no barrier.
- Although the United Kingdom is separated from Continental Europe by the English Channel, the level of cross-Channel traffic is higher than any other place in the world where road traffic changes sides of the road; the Channel Tunnel alone carries 3.5 million vehicles per year between the UK and France. Most vehicles crossing the English Channel, whether via the Channel Tunnel or on ferries, are UK-registered RHD vehicles. Relatively few drivers from Continental Europe take their LHD cars to the UK, but large numbers of British

drivers take their RHD cars to Continental Europe for holidays and even for one-day shopping trips. It was reported in 2000 that Eurotunnel wished to build a second Channel Tunnel because the existing rail services are expected to outgrow their capacity by 2025. Unlike the existing rail tunnels, a drive-through road tunnel is planned, comprising a single bore tunnel containing one carriageway on top of the other. Each carriageway would have at least two lanes in each direction and it is likely that the rule of the road would change upon passing through immigration entry controls. When using the existing Channel Tunnel, one passes through immigration entry controls of the destination country before entering the tunnel. This principle would no doubt also be used for a road tunnel, particularly to prevent any queuing of vehicles back into the tunnel. This being the case, vehicles travelling to France would keep to the right and vehicles travelling to the UK would keep to the left. Therefore when exiting the tunnel, drivers would continue directly on to the road network in the destination country without stopping. The current status of this project is unclear.

- As a result of European Union legislation ensuring the free movement of goods, many British consumers exercise their right to buy RHD cars from car dealers in any other EU country, where they are often cheaper, despite originating from the same factories as UK-sourced cars.
- During the Lockerbie bomb trial of 2000-02, Camp Zeist in the Netherlands was decreed to be British territory subject to Scottish law. However, Dumfries and Galloway Police, who were responsible for policing traffic movements within the compound, effected a clause which subjected drivers to the Continental European practice of driving on the right.

United States

Since colonial times, traffic in the United States has always been on the right-hand side, which was greatly influenced by France, a "founder" of drive-on-the-right rule, which indirectly supported American Independence from British colonial rule. There is a common story that this may be due to the construction of Conestoga wagons, which had a high driver's seat on the left side. However, the Conestoga wagon does not date all the way back to the colonial period so this story is likely apocryphal. Many imported RHD cars are also found on the road in the U.S., especially classic cars or other collectors' items.

Today, U.S. motor vehicles are always LHD (except some postal service vehicles, garbage trucks and uncommon specialty vehicles), and motorists always drive on the right and overtake on the left, except in the US Virgin Islands.

American rules of the road sometimes permit overtaking on the right side (multi-lane highways, one-way streets, or when overtaking other vehicles preparing to turn left). The laws vary from state to state.

Places with right-hand traffic

Places with left-hand traffic

Notes and references

- Rule of the Road by Peter Kincaid, 239 pages, published by Greenwood Press in 1986 - ISBN 0-313-25249-1

1. ^ Theodore H. Blau, The torque test: A measurement of cerebral dominance. 1974, American Psychological Association.

See also

- Traffic

Speed limit

Home | Up

A *speed limit* is the maximum speed allowed by law for vehicles on a road.

Signage

The start of a speed limit is usually marked with a speed limit traffic sign. Speed limit signs can appear near political borders and road intersections, and in some cases speed limit reminder signs appear at regular intervals. Political borders can range from country borders to city limits.

Occasionally different units of speed measurement are used on each side of a border. For example, Northern Ireland (part of the UK) still uses miles-per-hour (MPH) for speed limits and miles for distance, while the Republic of Ireland uses the standard international system (SI) of kilometres per hour (km/h) for speed limits and kilometres for distance. The Republic of Ireland completed the changeover from imperial units to SI units in early 2005. The UK and the US are the only major nations still using the imperial units system. The US has no intentions to convert to SI units in the foreseeable future, and in fact, reverted to its current imperial units in states that had both imperial and SI systems such as California and Arizona. However, Ohio still has some signs listed with SI distances and speeds on its exit distance and speed limit signs (such as 70 mph / 110 km/h, or 3 miles / 5 km to next exit).

Factors in Setting Speed Limits

Speed limits are set based on many factors, such as road features, crash records, legal statutues, administrative judgement and engineering judgement. Two common measures for setting speed limits are the design speed of the road, and the eighty-fifth percentile of travel speeds.

See: The United States' Transportation Research Board (TRB) National Cooperative Highway Research Program (NCHRP)

Note that highway design practices in other countries (Australia, Canada, France, Germany, Great Britain, and Switzerland) were surveyed. At one time, most of the countries' policies on design speed were identical to current U.S. policy and are still similar to U.S. practice.

Design speed

In the United States, the design speed is officially defined as "a selected speed used to determine the various geometric design features of the roadway" according to the 2001 AASHTO highway design manual, commonly referred to as the "Green Book". Previous versions of the Green Book referred to design speed as the "maximum safe speed that can be maintained over a specific section of highway when conditions are so favorable that the design features of the highway govern"; however the 2001 edition removed the term “safe” in order to avoid the misperception that speeds greater than the design speed were “unsafe.”

Safe observed operating speeds can exceed the nominal design speed because (a) design speed specifies roadway's most restrictive feature (e.g., a curve, bottleneck, hill, etc.) rather than representative features along a roadway section and (b) actual roadway design may exceed the minimum design specifications. On busy roads, capacity and congestion are primary limiting factors on speeds.

Design speed is therefore considered only a "first guess" at an appropriate speed limit.

85th percentile rule

In the United States, traffic engineers rely on the 85th percentile speed to establish speed limits. They note that traffic laws that reflect the behavior of the majority of motorists are found to be successful, while laws that arbitrarily restrict the majority of motorists encourage violations, lack public support and usually fail to bring about desirable changes in driving behavior.

The idea is that the speed limit should be set to the speed that separates the bottom 85% of vehicle speeds from the top 15%. The 85th percentile closely corresponds to one standard deviation above the mean of a normal distribution.

Traffic engineers observe that the majority of drivers drive in a safe and reasonable manner as demonstrated by consistently favorable driving records. The 85th percentile speed is how drivers "vote with their feet." Studies have shown crash rates are lowest at around the 85th percentile. Vehicles traveling over the 85th percentile speed (or faster than the flow of traffic) have a higher crash risk than vehicles traveling around or modestly below the 85th percentile speed.

Most U.S. jurisdictions report using the 85th percentile speed as the basis for their speed limits, so the 85th percentile speed and speed limits should be closely matched. However, a review of available speed studies demonstrates that the posted speed limit is almost always set below the 85th percentile speed by as much as 8 to 12 mph.

Speed limits in specific countries

Australia

Speed limits in Australia range from 10 km/h (5 mph) Shared Zones to 110 km/h (70 mph). Speed limit signage is always displayed in km/h, and speeds increase or decrease by a minimum interval of 10 km/h. That is, the last digit in all speed signs will be a zero, excepting advisory speed signs for curves or other road obstacles, which end in the digit five.

The default speed limits (one that applies automatically at law to a length of road in the absence of a 'posted' speed limit sign.') are:

- within built-up areas, 50km/h (30 mph).
- outside built-up areas, 100km/h (65 mph). Two exceptions are Western Australia at 110 km/h (70 mph), and the Northern Territory which does not have a rural default speed limit.

Common speed zones are:

- Shared zones (signposted areas where pedestrians and motorised traffic share the same space) are 10 km/h (5 mph)
- School zones are 40 km/h (25 mph) when children are present, except in South Australia, where they are 25 km/h (15 mph).
- Major connector roads and smaller highways are zoned 80 km/h (50 mph) or 90km/h (55 mph).
- Highways and freeways are 100 or 110 km/h (65 or 70 mph) unless otherwise signposted.

The Northern Territory signals the end of its built-up area default, OR END of a posted speed restriction sign on a length of road leading to a rural environment - by use of the speed-derestriction' sign (//). This is an international road traffic sign held in all "United Nations Conventions on Road Traffic, Road Signs and Signals", where it is catalogued as a C,17a - meaning "End of all local prohibitions imposed on moving vehicles". That said, certain license holders, such as learner drivers are restricted in speed by 'license conditions'. Heavy vehicles are also speed restricted by way of separate vehicle construction and other legal regulations. It should be said NT police do NOT tolerate dangerous speeds or behaviour.

Also used to signal the end of a posted speed limit - leading to a rural area default speed limit - is the END speed-limit sign. This is a unique Australian-designed sign which contains the word "END" and a number in a circle beneath this which represents the ceasing speed limit. It is typically used where the road beyond has certain hazards such as hidden driveways, poor camber, soft edges and other hazards where the road authority feels a posted speed limit sign might be too dangerous or otherwise unwarranted. It is intended to invoke particular caution. Again, the rural default applies as a maximum.

Speed traps are used in almost all areas of the country including NT above. Tolerance is from 8% to 10% in most states but only 3 km/h in Victoria, an issue which has caused a lot of controversy in that state. Measures used are police radar, fixed speed cameras, unmarked stationary cameras, fixed 'point to point' cameras and laser.

Canada

Typical speed limits are:

- 30–50 km/h (20–30 mph) within school and playground zones
- 40–50 km/h (25–30 mph) on residential streets within cities and towns
- 60–70 km/h (35–45 mph) on major arterial roads in urban and suburban areas
- 80–90 km/h (50–55 mph) on highways outside of cities and towns and urban expressways
- 90–110 km/h (55–70 mph) on freeways and rural expressways

Note that where more than one limit is given per road, it usually indicates a difference between provinces; however, within provinces, different roads of the same classification have different speed limits. For example, in Alberta and Nova Scotia some freeways have a limit of 100 km/h, while others have a speed limit of 110 km/h (70 mph). In Ontario, all freeways have a maximum speed limit of 100 km/h unless there is a lower posted limit. Speed limits are generally lower in Ontario and Quebec on comparable roads than in other Canadian provinces, except perhaps British Columbia. Examples of this disparity include rural two-lane highways in Ontario which have a standard speed limit of 80 km/h, while comparable roads in other provinces have standard speed limits of 90–100 km/h.

In British Columbia, a review of speed limits conducted in 2002 and 2003 for the Ministry of Transportation found that posted limits on investigated roads were unrealistically low for 1309 km and unrealisticly high for 208 km. The reports recommended to increase speed limits for multilane limited access highways constructed to high design standards from 110 km/h to 120 km/h. As described in that report, the Ministry is currently using "...Technical Circular T-10/00 [...] to assess speed limits. The practice considers the 85th percentile speed (the speed at or below which 85% of the motorists are traveling), road geometry, roadside development, and crash history."

In Canada, as in most other locales, speed violation fines are double (or more) in construction zones.

China

Previously, all expressways in the People's Republic of China were limited to a maximum speed limit of 110 km/h . With the passage of the PRC's first road-related law, the Road Traffic Safety Law of the People's Republic of China, speed limits were raised nationwide to 120 km/h as of May 1, 2004; however, the updating of signs will still take some time.

Semi-expressways and city express routes (called kuaisu gonglu ëlï in Chinese, meaning "high speed public road") generally have lower speed limits topping out at around 100 km/h , and in some cases, the speed limit may be lower.

On China National Highways (which are not expressways), a common speed limit is 80 km/h . In localities, speed limits may drop to 40 km/h .

In reality, few people drive according to the speed limits, and on most roads, enforcement cameras are non-existent.

On some designated "fast through routes" in cities, speed limits can go all the way up to 80 km/h . Otherwise, speed limits remain 70 km/h on roads with two uninterrupted yellow lines and 60 km/h or even 50 km/h otherwise. Signage in towns and on expressways is often present.

Minimum speed limits on expressways vary. A general minimum speed limit of 60 km/h is in force at all times (although traffic jams more than thwart it). The maximum speed limit, as posted on Chinese motorways is 120 km/h. This is a recent change. China is teaching EU/HK/GB like 'lane discipline' to its driver candidates.

Europe

In most European states there is a general speed limit of 50 km/h (30 mph) inside towns.

Comments

The first British motorways did not have imposed speed limits. However, after a series of severe crashes a temporary speed limit of 70 miles per hour (110 km/h) was enforced in 1965, which was made permanent in 1967. It was reduced to 50 mph (80 km/h) in response to the 1973 oil crisis and restored to 70 mph (110 km/h) in 1974. The Association of British Drivers have called for the limit to be increased. The opposition Conservative Party are now proposing to raise the limit to 80 miles per hour (130 km/h) where appropriate.

On French autoroutes, there is a de facto variable speed limit. In dry weather an autoroute has a speed limit of 130 km/h (80 mph), when raining the speed limit is reduced to 110 km/h (70 mph). In 2005, a governmental report advised lowering this speed to 115 km/h in order to save fuel and reduce accident risks, but this proposal was badly received. Since 2002, the French government has installed a number of automatic radar guns on autoroutes, routes nationales and other major thoroughfare, in addition to radar manned by the Police or Gendarmerie. The French authorities have credited this increase in traffic enforcement for a 21% drop in road fatalities from 2002 to 2003.

The German Autobahnen are famous for having no speed limits for cars over much of their length. Blanket speed limits do apply for trucks, buses and cars pulling trailers. Speeds over 200 km/h (125 mph) are not uncommon, but there is a recommended speed (Richtgeschwindigkeit) of 130 km/h (80 mph). In case of a crash, insurance payments can be dropped where the recommended speed is exceeded. Some areas have compulsory speed limits to reduce the noise or for safety reasons. Many car manufacturers (including Mercedes, BMW and Audi) limit the speed of their cars electronically to 250 km/h (155 mph) although this is not a legal requirement.

The Italian Autostradas have a 130 km/h (80 mph) speed limit, with 110 km/h (70 mph) limits on curvy roads and in rainy conditions and 150 km/h (95 mph) limits on newer and straighter roads.

Swiss Autobahnen are limited to 120 km/h (75 mph) as a maximum speed limit. Semi-motorways, known as "motor roads" or Autostrassen, have a generally lower speed limit of 100 km/h (65 mph).

For a period about 1990 to 1995, Sweden banned the highest limit 110 km/h (70 mph) in the large-city provinces, citing environmental reasons. 90 km/h (55 mph) limits were introduced on most motorways, the lowest in Europe. The term "large-city province" was defined as any province having one of the three large cities with suburbs. That meant that the west coast motorway E6 had 90 km/h all along its (then) about 250 km of motorway, but some ordinary roads in less densely populated provinces had 110 km/h. This ban was later removed because the limit was neither popular nor much obeyed.

India

India has a speed limit in towns and this is usually signed. It is a contracting party to the "United Nations Conventions on Road Traffic, Road Signs and Signals". Road condition is historically poor, discouraging high speeds, but in Andhra Pradesh and Tamil Nadu in particular, the roads have been substantially improved in recent years due a buoyant economy.

India for the past few years has embarked on a large road building effort with some 47,000 kilometres of world class motorway reportedly under construction, and finalised. (National Highways Agency India). On highways where speed restrictions end, it so signaled by use of the 'speed derestriction' sign, known by catalogue number in the UN Convention as a C,17a 'End of all local prohibitions imposed on moving vehicles'.

Japan

The general limit is 60km/h except for divided national highways where the limit is 100km/h. Urban areas are usually zoned at 40km/h. Limits in Japan are different from most countries by:

- having no separate urban limit, with urban limits being set by zoning rather than statute.
- emergency vehicles are not exempt but have a higher speed limit
- there are many lower limits set for vehicle classes other than ordinary cars and motorcycles.

New Zealand

Speed limits in New Zealand range from 20 km/h to 100 km/h. Specifically:

- 20 km/h (10 mph) past school buses and accident sites
- 30 km/h (20 mph) past roadworks
- 50 km/h (30 mph) in most urban areas
- 60 km/h (40 mph) for many city arterial routes
- 70 km/h or 80 km/h (45–50 mph) on highways through built-up areas, or on dangerous or older roads.
- 100 km/h (65 mph) on expressways and highways

(It must be noted that New Zealand misuse, like GB:- the international speed de-restriction sign (//) to signal a maximum speed limit of 100km/h. Tourists to New Zealand should remember this when visiting. "End of all local prohibitions on moving vehicles" as held in international law in the governing Convention is hardly 100km/h, so be warned).

Some vehicles are restricted to lower speeds:

- 90 km/h (55 mph) for trucks and vehicles with trailers
- 80 km/h (50 mph) for school buses
- 70 km/h (45 mph) for motorcyclists with learner licences

South Africa

The general speed limits in terms of the South African National Road Traffic Act, 1989 and its Regulations are:

- 60 km/h on a public road within an urban area
- 100 km/h on public road outside an urban area which is not a freeway; and
- 120 km/h on every freeway.

United States

Speed limits on United States roads are usually as follows:

- 25–30 mph (40–50 km/h) on residential streets in cities and towns
- 35–45 mph (60–70 km/h) on major arterial roads in urban and suburban areas
- 50–65 mph (80–100 km/h) on major divided highways inside cities
- 45–65 mph (70–100 km/h) on rural two-lane roads*55–70 mph (90–110 km/h) on non-Interstate highways and rural expressways.
- 65–75 mph (100–120 km/h) on rural Interstate highways

In general, speed limits are reactionary figures to an observed average volume and its potential for flucuation. In other words, an urban interstate with many interchanges/junctions near each other will have a significantly lower speed limit then a rural highway that sees relatively little traffic and have several miles between two interchanges. Due to this, the more urbanized east has lower speed limits on average then the more spread out west.

Speeding

Speeding is defined by the U.S. Federal Government as either exceeding posted limits or driving too fast for conditions [1]. Speeds in excess of posted maximum speed limits account for most speed-related traffic citations. Most speed-related crashes involve speed too fast for conditions [2] such as limited visibility or reduced road traction. Variable speed limits offer some potential to reduce speed-related crashes, but due to the high cost of implementation exist primarily on motorways, while most speed-related crashes occur on local and collector roads [3] Speed-related crashes can also occur at speeds below 30 miles per hour; for example, truck rollovers on exit ramps.

Enforcement

Prior to the invention of radar, speed limits were normally enforced by clocking vehicles travelling through speed traps. Clocking a vehicle simply means timing how long it takes for the automobile to pass between two fixed landmarks along a roadway, from which the vehicle's average speed could easily be determined. Setting up a speed trap that could provide legally satisfactory evidence was usually time consuming, however, and early speed traps were often difficult to hide. As a result, organizations such as the Automobile Association could often keep fairly accurate records of speed trap locations.

In the early 21st century, police used radar, LIDAR, planes, and automated devices. Officers may also use a method called pacing: following a car for a certain time to establish speed using the calibrated speedometer of the patrol car. Recently, Automatic Number Plate Recognition (ANPR) camera systems have been used which time a vehicle between long sections of road (approximately one mile), calculating the average speed between two points. This method eliminates the risk of heavy braking at the locations of conventional speed cameras, but may raise privacy issues.

In several countries, notably the Netherlands and the United Kingdom, an increase in automated speed enforcement has resulted in a significant increase in the number of fake number plates. In France, the use of automated enforcement has been credited with contributing to a substantial reduction in fatalities. Most Western European countries now use automated enforcement on at least some roads.

Speed limit policy can affect enforcement. According to the AASHTO, "experience has ... shown that speed limits set arbitrarily below the reasonable and prudent speed perceived by the public are difficult to enforce, produce noncompliance, encourage disrespect for the law, create unnecessary antagonism toward law enforcement officers, and divert traffic to lesser routes[.]" Arbitrarily low limits can turn otherwise reasonable drivers into habitual speed limit violators.

Safety and efficacy

Essential physics

Forces in a motor vehicle collision are proportional to the square of the speed change (sometimes referred to as "delta-V", symbolized as ´v) at impact. This means that crash forces rise much faster than speed. The probability of a fatality is proportional to the fourth power of the speed change at impact, rising much faster than crash forces.

To illustrate these statistics, suppose two vehicles crash into a massive, fixed object, and one vehicle’s speed is 10% greater than the other vehicle. The faster vehicle will experience 21% higher crash forces, and its occupants will experience a 46% higher probability of a fatality.

When interpreting this, it should be noted that crashes with dramatic, sudden speed changes that terminate almost all velocity are atypical. These kinds of atypical crashes can include head on collisions or collisions with massive, fixed objects like trees or concrete bridge piers.

Although the basic relationship between vehicle speed and crash severity is unequivocal and based on the laws of physics, the probability of a crash as well as crash severity can be mitigated. Safety devices like crash attenuators, barriers, or wide medians are examples. The highest degree of mitigation is found on motorways (which may be called freeways, limited access highways, also Autobahns, Interstates or other national names), which are internationally documented as being the safest roads per-mile-travelled despite their higher speeds, due to designing out of most conflict opportunities as well as restricted access.

Speed limits, actual speeds, and aggregate safety

The 1998 Synthesis of Safety Research Related to Speed and Speed Management sponsored by the US Federal Highway administration found, "on freeways and other high-speed roads, speed limit increases generally lead to higher speeds and crashes." Increasing a speed limit by 4 mi/h would increase the average speed by 1 mi/h and increase injury accidents by 5%. The report cautions that "changing speed limits on low and moderate speed roads appears to have little or no effect on speed and thus little or no effect on crashes". The report noted that traffic calming significantly reduced speeds and injuries in treated areas but that the decrease may be due to reduced traffic volumes. The report also suggests that "variable speed limits that adjust with traffic and environmental conditions could provide potential benefits" as most of the speed related crashes involve speed too fast for conditions.

The report noted the landmark study (D. Solomon, "Accidents on Main Rural Highways Related to Speed, Driver, and Vehicle", Federal Highway Administration, Washington, DC, July 1964) that observed a "U-shaped curve" of crash probability versus speed, where crash rates were lowest for travel speeds near the mean speed of traffic, and increased with greater deviations above and below the mean. Subsequent research has found that "The occurrence of a large number of crashes involving turning maneuver partly explains the increased risk for motorists traveling slower than average and confirms the importance of safety programs involving turn lanes, access control, grade separation, and other measures to reduce conflicts resulting from large differences in travel speeds."

Speed and crash factors

Some safety factors are not always under the full control of the driver, such as driver alertness and distractions, road conditions, weather, daylight availability, actions and alertness of other drivers, and wildlife. While these factors are not directly related to vehicle speed, the effects of these factors can be more severe with more speed. For example, a deer running across the road has no consequences to a vehicle parked at 0 mph but could have disastrous consequences for a vehicle traveling at 100 mph. This suggests that lower speeds can reduce the frequency and severity of crashes; lower speeds can give the driver more time to respond appropriately in the face of unexpected dangers, and it can reduce the severity of a crash should one happen. However, since the efficacy of speed limits in restraining driver speed is subject to debate, it is not clear how well speed limits can ameliorate these other factors.

Another view is that, while speed can play a part of the causal chain which leads to crashes, speed's role is mostly to magnify the consequences of other unsafe acts. This viewpoint is reinforced by the fact that speed is rarely the sole crash factor. In many cases, removing the other crash factors, such as a right of way violation, would have absolutely prevented the collision. However, while reducing the speed could have a beneficial effect on the severity and probability of the crash, it usually cannot guarantee crash prevention.

Variable speed limits

Recently some jurisdictions have begun experimenting with variable speed limits which change with road congestion and other factors (this is distinct from France's reduction of limits during adverse weather). One example is on Britain's M25 motorway, which circumnavigates London. On the most heavily-traveled 22 kilometre section of the M25 variable speed limits combined with automated enforcement have been in force since 1995. Initial results of the 1995 trial indicated savings in journey times, smoother flowing traffic and a fall in the number of accidents, so the trial implementation was made permanent in 1997. Further trials on M25 have been thus far inconclusive.

Opposition

Speed limits and their enforcement have been opposed by some motorists since their inception. Britain's first motoring organization, the AA, was formed to warn members about speed traps.

Other organizations, such as the Association of British Drivers and Safe Speed, have sought to discredit certain speed limits as well as other measures, such as automated camera enforcement. At the same time, organizations such as the Safer Streets Coalition and RoadPeace have proposed reducing speed limits, especially in residential areas and around schools.

The debate over speed limit enforcement has become a large part of the road safety policy debate in some countries.

Skepticism about speed limits and strict enforcement outside built-up areas is attributable to:

- Inconclusive results from most speed limit studies. For example, a 1972 OECD Road Research Group report entitled 'Speed Limits Outside Built-Up Areas' reviewed most international studies to that date. They concluded that "because of the weaknesses in the research designs of many investigations, scientifically well-established conclusions cannot be drawn." "Indeed, some of the speed limit changes were more in the nature of administrative exercises than scientifically designed experiments and the methods of analysis in these cases were deficient from the statistical point of view." The Group stated that "speed limit policies should be based on reliable research work and generally accepted scientific evidence". They proposed an international co-operative experiment to overcome weaknesses in prior studies. However, the 1973-1974 oil price crisis intervened, and wide-spread blanket speed limits became more common without exacting study.
- Definition of 'speeding' or 'speed-related' to encompass two distantly-related concepts belies the presumed, strict relationship between speed and safety.

The 1998 U.S. Federal Synthesis found "limited evidence that suggests the net effect of {higher motorway} speed limits may be positive on a system wide basis {by shifting more traffic to these safer roads}. More research is needed to evaluate the net safety effect of speed limit changes".

- Motorists generally pick reasonable speeds for conditions, even on motorways. For example, the 75-mph speed limit in the U.S. State of South Dakota has good compliance: the average speed is less than or equal to the posted limit almost a decade after it was increased.

Prior to the (now defunct) 1974 national 55-mph speed limit in the U.S., German Autobahns had a higher fatality rate than U.S. Interstates; however, a few years later, the Autobahn rate fell below that of (then) 55-mph limited U.S. Interstates. IRTAD records show the U.S. rate remains higher than that on the largely unrestricted German Autobahn network. While the fatality rate on the UK's 70-mph speed-limited motorways is about half of Germany's, the 60-mph limit in rule-conscious Japan corresponds to a motorway fatality rate greater than Germany's. However, simple comparisons of fatality rates between countries neglect to account for differences in traffic density, quality of medical care, and Smeed's law.

Roads without speed limits

A few public roads still have no speed limit.

The most famous are the German intercity Autobahn, much of which has no speed limit or only advisory limits.

Australia's Northern Territory has no blanket speed limits outside major towns.

The Isle of Man has no speed limit on most rural roads. A 2004 proposal for 70 and 60 mph (110 and 95 km/h) speed limits was very unpopular.

Montana has had a numeric speed limit since June 1999. Please see the Montana section of the Speed limits in United States page for more information.

Footnotes

1. ʻ The usage of arbitrary here is not meant to convey a point of view. Rather, it is meant to convey that the selection of speed limits in the United States is often constricted or absolutely specified by broadly applicable legislative fiat. For example, it is no coincidence that virtually all rural speed limits match a speed that is prescribed in statutes. Commonly accepted speed zoning procedures would usually result in higher limits.

Traffic lights

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A *traffic light* or *traffic signal* is a signalling device positioned at a road intersection or pedestrian crossing to indicate when it is safe to drive, ride or walk, using a universal color code.

Introduction

Traffic lights for normal vehicles or pedestrians always have two main lights, a red light that means stop and a green (or sometimes white for pedestrians) light that means go. Usually, the red light contains some orange in its hue, and the green light contains some blue, to provide some support for people with red-green color blindness. In most countries there is also a yellow (or amber) light, which when on and not flashing means stop if able to do so safely. In some systems, a flashing amber means that a motorist may go ahead with care if the road is clear, giving way to pedestrians and to other road vehicles that may have priority. A flashing red essentially means the same as a regular stop sign. There may be additional lights (usually a green arrow or "filter") to authorize turns. A turn light preceding the opposing through movement is called a leading left turn in the U.S., because it leads the opposing through green light (likewise, in the U.S., a left turn arrow that follows the opposing through movement is known as a "lagging left turn").

Traffic lights for special vehicles (such as buses or trams) may use other systems, such as vertical vs. horizontal bars of white light.

In most countries, the sequence is red (stop), green (go), amber (prepare to stop). In the UK, amber officially means 'stop' (unless it would cause an accident to do so) but in practice, is treated as 'prepare to stop'. In the UK, Hong Kong (but not mainland China), Germany, Poland, and Iceland, among others, the sequence includes red + amber together before green, which helps draw attention to the impending change to green, to allow drivers to prepare to move off. (In many of these jurisdictions, such as the UK, it is customary for drivers to shift into neutral and/or set the parking brake at red lights; the additional phase gives the driver time to shift into gear/release the brake before the light turns green). The single flashing amber signal is used in the UK and Australia at Pelican crossings. Some older signals in New England, mainly near Boston, use the red + amber phase to signify an all-pedestrian phase ("Barnes dance"), as they were installed before pedestrian signals came to the area, and before the national standard prohibited them. See "Pedestrian scrambles" below, or the main article.

Depending on the jurisdiction, traffic may turn after stopping on a red (right in right-driving countries; left in left-driving countries), provided they yield to pedestrians and other vehicles. In some jurisdictions which generally forbid this, a green arrow sign next to the traffic light indicates that it is allowed at a particular intersection. Conversely, jurisdictions which generally allow this might forbid it at a particular intersection with a "no turn on red" sign, or might put a green arrow to indicate specifically when a right turn is allowed without having to yield to pedestrians (this is usually when traffic from the perpendicular street is making a left turn onto one's street and thus no pedestrians are allowed in the intersection anyway). Some jurisdictions allow turning on red in the opposite direction (left in right-driving countries; right in left-driving countries) from a one-way road onto another one-way road; some of these even allow these turns from a two-way road onto a one-way road. Also differing is whether a red arrow prohibits turns; some jurisdictions require a "no turn on red" sign in these cases. A study in the State of Illinois concluded that allowing drivers to proceed straight on red after stopping, at specially posted T-intersections where the intersecting road went only left, was dangerous. Proceeding straight on red at T-intersections where the intersecting road went only left was once legal in Mainland China with right-hand traffic provided that such movement would not interfere with other traffic, but when the Road Traffic Safety Law of the People's Republic of China took effect on 1 May 2004, such movement was outlawed.

In France and Spain permission to turn right (or more rarely to turn left or to go straight on) on a red light is indicated by a flashing amber arrow (cars do not have to stop but must yield way to other cars and pedestrians).

Another distinction is between intersections that have dedicated signals for turning across the flow of opposing traffic and those that do not. Such signals are called dedicated left-turn lights in the United States (since opposing traffic is on the left); it is a "protected" signal if a red arrow appears after the phase; a "permissive" signal, in a configuration known as a "doghouse", has no red left arrow, and the red ball is in the middle, above the left and straight columns. If there is such a signal, it turns green when traffic may turn left without conflict, and turns red or disappears otherwise. If there is no such signal, one must yield to opposing traffic and turn when it is safe to do so. In the U.S., many inner-city and rural areas do not have such dedicated lights, while most suburban areas have them. Such lights tend to make intersections safer by reducing the risk of head-on collisions and may speed up through traffic, but may decrease the overall efficiency of the intersection as it becomes congested, depending on what proportion of traffic is turning.

Intersections without dedicated protected signals occasionally have what is known as a "left turn trap" (in right-driving countries). This happens when traffic proceeding the other way gets a green light for a longer period of time than the direction of a turning vehicle, to allow opposing left turns to proceed (and the other direction may have a "delayed green", allowing left turns in this direction). A driver that has entered the intersection on green to turn left is trapped when the light turns red, as the other direction still has a green light, and the driver has no way of knowing when that direction will change, despite the right to proceed.

In the UK, traffic lights only applicable to traffic going a certain direction are called "filter lights" and are indicated as a green arrow pointing in the direction traffic is allowed to proceed. Thus, traffic lights displaying a red light and a green arrow to the left allow traffic turning left to proceed, but all other traffic must remain stopped. This is commonly used at junctions where traffic needs to turn across oncoming traffic. Traffic turning right can proceed on a full green if safe to do so, but if a filter right light is display this indicates that oncoming traffic has been stopped.

Traffic light failure in most jurisdictions must be handled by drivers as a four-way stop (or, in Europe, a priority-to-the-right intersection), pending the arrival of a police officer to direct traffic. Some jurisdictions (e.g. Switzerland, France, Austria or Australia), however, have additional right-of-way signs mounted above the traffic lights (below in Australia); these take effect when the lights are no longer active. In preparation for Y2K, some jurisdictions installed emergency unfoldable stop signs at intersections.

In some countries, pedestrian traffic lights include a siren or warbler, which sounds during the red phase, in order to alert visually impaired pedestrians that it is safe to cross.

These are generally set to a timer and only sound at day time, to avoid annoying residents. Some also include tactile warnings, generally in the form of a cone, attached to the base of the 'wait' button panel, which rotates during the red phase, to help deafblind people cross the road.

Mounting

There are significant differences from place to place in how traffic lights are mounted or positioned so that they are visible to drivers. Depending upon the location, traffic lights may be mounted on poles situated on street corners, hung from wires strung over the roadway, or even hung from horizontal poles or installed within large horizontal gantries that extend out from the corner and over the right-of-way. In the last case, such poles or gantries often have a lit sign with the name of the cross-street.

Some places mount lights with their multiple faces arranged horizontally and others vertically.

California is particularly fastidious in ensuring that drivers can see the current state of a traffic light. One entrance to a typical large intersection, with three through lanes, two dedicated left-turn lanes, and a crosswalk, may have as many as three traffic lights for the left-turn lanes, three for the through lanes, and a pedestrian signal for the crosswalk. And those numbers must be multiplied by four to cover all four ways to enter a typical intersection.

In addition to being positioned and mounted for desired visibility for their respective traffic, some traffic lights are also aimed, louvered, or shaded to minimize mis-interpretation from other lanes. For example, a Fresnel lens on an adjacent through-lane signal may be aimed to prevent left-turning traffic from anticipating its own green arrow.

Shades and backpanels are also useful in areas where sunlight would diminish the contrast and visibility of a signal face.

Traffic signals in most areas of Europe are located at the stop line on same side of the intersection as the approaching traffic and are often mounted overhead as well as on the right and left sides of the road. The stop line alignment is done to prevent crosswalk blocking and allow for better pedestrian traffic flow.

History

On 10 December 1868, the first traffic lights were installed outside the British Houses of Parliament in London. They resembled railway signals of the time, with semaphore arms and red and green gas lamps for night use.

The modern electric traffic light is an American invention. As early as 1912, Salt Lake City policeman Lester Wire set up the first red-green electric traffic lights. On 5 August 1914, the American Traffic Signal Company installed a traffic signal system on the corner of 105th Street and Euclid Avenue in Cleveland, Ohio. Based on the design of James Hoge, it had two colors, red and green, and a buzzer to provide a warning for color changes. The first three-color traffic lights were introduced in New York and Detroit in 1920.

The first interconnected traffic signal system could be seen in Salt Lake City, Utah in 1917, with six connected intersections controlled simultaneously from a manual switch. Automatic control of interconnected traffic lights was introduced March 1922 in Houston, Texas.

The first automatic experimental traffic lights in England were deployed in Wolverhampton in 1927.

Garrett Morgan is sometimes mistakenly credited as the inventor of the traffic light.

Ampelmännchen traffic lights have come to be seen as a nostalgic sign for the former German Democratic Republic.

London, Salt Lake City, and Saint Paul all maintain that they were the city to first install traffic lights.

Technology

In the mid 1990s, cost-effective traffic light lamps using light emitting diodes (LEDs) were developed; prior to this date traffic lights were designed using incandescent or halogen light bulbs. Unlike the incandescent-based lamps, which use a single large bulb, the LED-based lamps consist of an array of LED elements, arranged in various patterns. When viewed from a distance, the array appears as a continuous light source (unless closely examined).

LED-based lamps have numerous advantages over incandescent lamps; among them are:

- Much greater energy efficiency
- Much longer lifetime between replacement, measured in years rather than months. Some of the longer lifetime is due to the fact that the light is an array which allows the light to be used even if some of the LEDs in the array are dead.
- Brighter illumination.
- The ability to display multiple colors and patterns from the same lamp. Individual LED elements can be enabled or disabled, and different color LEDs can be mixed in the same lamp.
- Much faster switching.

The operational expenses of LED-based signals are far lower than equivalent incandescent-based lights. As a result, most new traffic light deployments in the United States, Canada and elsewhere have been implemented using LED-based lamps; in addition many existing deployments of incandescent traffic lights are being replaced. (LEDs are also replacing incandescent lamps in many other applications, such as vehicle taillights). Many of the more exotic traffic signals discussed on this page would not be possible to construct without using LED technology.

In some areas, LED-based signals have been fitted (or retrofitted) with special Fresnel lenses and/or diffusers to limit the line of sight to a single lane. These signals typically have a "projector"-like visibility; and maintain an intentionally limited range of view.

Pedestrian scrambles

A pedestrian scramble, or Barnes Dance (named for Henry Barnes), is a special traffic light that stops all vehicular traffic. Pedestrians then have exclusive access to the intersection and can diagonally cross the intersection. Pedestrian scrambles are useful when there is heavy diagonal pedestrian traffic, or heavy pedestrian traffic in general. In intersections with heavy pedestrian traffic, pedestrians have the right-of-way, blocking drivers from turning. A pedestrian scramble gives vehicles exclusive access to the intersection for a period of time as well. In many cities in the Netherlands a similar system is used to allow cyclists to cross busy intersections.

Usually these are displayed as simply a red signal in all directions with walk signals; some older intersections, at least in the Boston area, show both red and amber signals in all directions for this.

Hachiko Square, in Shibuya, Tokyo, has a famous pedestrian scramble at an intersection of seven streets (some pedestrian-only) in front of Shibuya Station.

In the United States, the city of Beverly Hills is famous for being the first California city to implement diagonal crossing (at some intersections on Rodeo Drive). Pasadena also has pedestrian scrambles in its Old Pasadena shopping and nightlife district, as do certain intersections in San Diego's Gaslamp Quarter.

In Pittsburgh, there are intersections near a school for the blind which has a pedestrian scramble that also includes audio signals.

In Trondheim, Norway, nearly all the traffic lights in the centre of the city are pedestrian scrambles.

The main intersection in downtown Jerusalem, Israel was re-instated as a pedestrian scramble after public protest.

Control and coordination

Traffic signals must be instructed when to change phase. They can also be coordinated so that the phase changes called for occur in some relationship with nearby signals.

Traffic signal phase changes are based on one of three systems: pre-timed, semi-actuated, and fully-actuated. The simplest control system uses a timer; each phase of the signal lasts for a specific duration before the next phase occurs; this pattern repeats itself regardless of traffic. Many older traffic light installations still use timers; timer-based signals are effective in one way grids where it is often possible to coordinate the traffic lights to the posted speed limit.

More sophisticated control systems use electronic sensor loops buried in the pavement to detect the presence of traffic waiting at the light, and thus can avoid giving the green light to an empty road while motorists on a different route are stopped. A timer is frequently used as a backup in case the sensors fail; an additional problem with sensor-based systems is that they may fail to detect vehicles such as motorcycles or bicycles and cause them to wait forever (or at least until a detectable vehicle also comes to wait for the light). The sensor loops typically work in the same fashion as metal detectors; small vehicles or those with low metal content may fail to be detected. This system is popular on most traffic lights in the province of British Columbia in Canada.

It is also commonplace to alter the control strategy of a traffic light based on the time of day and day of the week, or for other special circumstances (such as a major event causing unusual demand at an intersection). Attempts are often made to place traffic signals on a coordinated system so that drivers encounter long strings of green lights. The distinction between coordinated signals and synchronized signals is very important. Synchronized signals all change at the same time and are only used in special instances or in older systems. Coordinated systems are controlled from a master controller and are set up so lights "cascade" in sequence so platoons of vehicles can proceed through a continuous series of green lights. A graphical representation of phase state on a two-axis plane of distance versus time clearly shows a "green band" that has been established based on signalized intersection spacing and expected vehicle speeds. In some countries (e.g. Germany and The Netherlands), this "green band" system is used to limit speeds in certain areas. Lights are timed in such a way that motorists can drive through without stopping if their speed is lower than a given limit, mostly 50 km/h in urban areas. This system is known as "grüne Welle" in German, or "groene golf" in Dutch (English: "green wave").

In modern coordinated signal systems (such as US 24, Telegraph Rd, in suburban Detroit, Michigan, USA), it is possible for drivers to go many miles without encountering a red light. This coordination is done easily only on one-way streets with fairly constant levels of traffic. Two-way streets are often arranged to correspond with rush hours to speed the heavier volume direction. Congestion can often throw off any coordination, however. On the other hand, some traffic signals are coordinated to prevent drivers from encountering a long string of green lights. This practice discourages high volumes of traffic by inducing delay yet preventing congestion. Speed is self-regulated in coordinated signal systems; drivers travelling too fast will arrive on a red indication and end up stopping, drivers travelling too slowly will not arrive at the next signal in time to utilize the green indication. In synchronized systems, however, drivers will often use excessive speed in order to "make" as many lights as possible.

More recently even more sophisticated methods have been employed. Traffic lights are sometimes centrally controlled by monitors or by computers to allow them to be coordinated in real time to deal with changing traffic patterns. Video cameras, or sensors buried in the pavement can be used to monitor traffic patterns across a city. Non-actuated sensors occasionally impede traffic by detecting a lull and turning red just as cars arrive from the previous light. To prevent this, the most high-end systems use dozens of sensors and cost hundreds of thousands of dollars per intersection, but can very finely control traffic levels. This relieves the need for other measures (like new roads) which are even more expensive.

In some areas traffic lights may also be turned off late at night when traffic is very light. Under these circumstances, traffic in the main street may get a flashing amber to warn of an intersection. Traffic in the secondary street gets a flashing red (see above), or sometimes the lights are marked as operating at set times only. In many parts of Europe, traffic light-controlled intersections also have yield and right-of way signs in case the signals fail or are turned off. Some lights outside of fire stations have no green, as they may only turn amber and then red while fire trucks are exiting the station en route to an emergency. See also the "Unusual traffic-light usages" described below.

Some traffic lights at pedestrian crossings, especially those away from junctions, include a button which must be pressed in order to activate the timing system. This is generally accompanied by a large display reading "wait", which lights up when the button is pressed, and off when the lights enter the red phase. Often, other displays, such as countdowns or the green & red pedestrian lights are included in this panel.

Preemption

Some regions have signals that are interruptible, giving priority to special traffic. This is usually reserved for emergency vehicles such as ambulances and police squad cars, though sometimes mass transit vehicles including buses and light rail trains can interrupt lights. Most of the systems operate with small transmitters that send radio waves or infrared signals that are received by other devices on or near the traffic lights. Sometimes, an additional signal light is placed nearby to warn motorists that an oncoming vehicle is preempting the signals. In one recent Oregon incident (2005) a fire engine pre-empted a signal at a light rail crossing, and proceeded to collide with a light-rail train. A subsequent inquiry determined that the light-rail driver was at fault; falsely believing that once the LRT had obtained the right-of-way across an intersection, it could not be lost until the train had cleared the intersection. Normally, this was the case, but pre-emption by an emergency vehicle was an exception to the rule.

There have been some concerns that unauthorized people may have obtained devices that can trigger light preemption. The original 3M Opticom pre-emption system was activated by a 14 Hz strobe light added to the light bar of fire trucks, ambulances, and squad cars. When the sensor senses the 14 Hz strobe signal, the pre-emption is activated. Unfortunately, the 14 Hz "secret" was discovered and MIRTs (Mobile InfraRed Transmitters) hit the market — basically a 14 Hz strobe with an infrared filter installed on it, making the light invisible to the naked eye and police officers. Legal opinions on this vary. 3M has developed an encrypted Opticom system, however, the original traffic signal sensors (as well as the vehicle mounted emitters) must be replaced. Cities that already spent quite a bit of money purchasing the original Opticom system are now weighing the cost vs. benefits of upgrading to the encrypted system.

Another type of preemption is railroad preemption. Traffic-signal-controlled intersections next to railroad crossings on one of the roads usually have this feature. Approaching trains activate a routine where, before the train signals and gates are activated, all traffic signal phases go to red, except for the signal immediately after the train crossing, which turns green (or flashing yellow) to allow traffic on the tracks to clear (in some cases, there are auxiliary traffic signals prior to the railroad crossing which will turn red, keeping new traffic from crossing the tracks. This is in addition to the flashing lights on the crossing gates themselves). After enough time to clear the crossing, the signal will turn. The crossing lights may begin flashing and the gates lower immediately, or this might be delayed until after the traffic light turns red. The operation of a traffic signal while a train is present may differ from municipality to municipality. In some areas, all directions will flash red, turning the intersection into an all-way stop. In other areas, the traffic parallel to the railroad track will have a green light for the duration of the train while the other directions face a red light for the duration of the train. The Chicago Drive/Ivanrest Avenue intersection in Grandville, Michigan, gives Chicago Drive traffic (parallel to the tracks) a flashing yellow with fiber-optic lit signs indicating "no right turn" or "no left turn" over the tracks, and Ivanrest traffic faces a solid red light. In Goshen, Indiana, the signals at the intersections on Lincolnway will run normally, with the exception that oncoming traffic (across from the railroad crossing) will face "doghouse" signals with left and right arrows lit: all traffic is required to turn left or right if a train is present, to keep traffic moving.

There have been recent concerns about the security of traffic light preemptive systems and the actual underlying network controlling them and traffic lights in general. In the hacker E-zine Phrack has outlined flaws in the traffic controlling system that could allow an unauthorized malicious person to abuse it as he sees fit. By issuing valid signal controlling messages from the area traffic control center if access is gained to it, an attacker could essentially control any phase, test phase, preemptive signals, or any function of the traffic system that is controllable remotely. The article also sparked a response by Transport for London where it is reported that a skilled attacker armed with this “step-by-step” guide could in fact cause malicious damage, as reported by a Transport for London spokesman.

Other attempts to violate preemptive traffic light systems are being created. "Foxmanifestj" and others from Jinx Hacking Forums believe it is possible to create a .wav file that, with the aid of an Audio-to-Infrared converter, will easily change traffic lights from any vehicle using an MP3 player.

In lieu of preemptive mechanisms, in most jurisdictions, emergency vehicles are not required to respect traffic lights, but must activate their own emergency lights when crossing an intersection against the light, in order to alert oncoming drivers to the preemption.

Unusual traffic-light usages

In parts of Canada (the Maritime Provinces, Quebec, Ontario and Alberta), a flashing green light has a special meaning. It is identical in meaning to signals where one side has both green and a green left-turn arrow, and the opposite side has red (cross-traffic has red as well). The light phase is known as "advanced green", and a sign saying "Advanced green when flashing" is usually attached to the light in question. The opposite side often has a sign attached to their lights saying "Delayed Green Wait for signal." Advanced green indicates that the opposing traffic is facing a red light, and it is safe for the driver to turn left. In Ontario, older lights with this system are slowly being phased out in favour of more universally-understood left-turn arrow signals.

In Winnipeg, Manitoba, Canada, some of the older signals have a phase where there is a red light illuminated simultaneously with a green straight arrow. The meaning of this odd configuration is that a motorist may proceed straight, but is restricted from turning both left and right. An example of this is at Nairn Avenue and Archibald Street. Also, there is a traffic light on McPhillips Street and Kingsbury Avenue that has a U-turn signal on it.

In British Columbia and Massachusetts and a few other states, a flashing green signal is used to warn of a crosswalk at which pedestrians have the ability to stop traffic to allow a safe crossing. They may also be used at a drawbridge. The flashing green indicates that the signal is not currently in use. It changes to solid green for a short time before entering the normal yellow/red/green sequence, then returns to flashing green until another crossing is requested; however, in some places such as Vancouver, it goes directly from flashing green to yellow, leaving out the solid green sequence.

In Massachusetts only, a red and yellow light on at the same time, indicates that persons may be crossing in the crosswalk. This replaces the extra walk/don't walk, signal.

In Oregon (and elsewhere in the United States) signals with a flashing yellow arrow are being phased in to replace the 5-lamp protected/permitted signals in widespread use. Two models of this signal have been seen in Oregon; one with 4 lamps — a (solid) red arrow, a (solid) yellow arrow, a (flashing) yellow arrow, and a (solid) green arrow; and another with 3 lamps — a solid red arrow, a solid yellow arrow, and a third lamp which can either be a solid green or a flashing yellow arrow. The solid arrows all have their usual meanings; a flashing yellow arrow indicates a "permitted" left-hand turn (drivers may turn left without stopping, but opposing traffic has the right-of-way). Unlike the five-lamp protected/permitted signals, the 3/4 lamp signal with flashing yellow arrow has one unusual configuration; if traffic in one direction has a protected left turn (green arrow) along with a green light for traffic heading straight — the signals in the opposite direction can (and do) show a red light for traffic going straight, but a flashing yellow for traffic turning left. Thus the traffic facing a green light has fully protected left turns (oncoming traffic is stopped) but straight-through traffic is not fully protected — left turns across its path from the opposite direction may be legal. However, the straight-through traffic does have the right-of-way.

In Austria, Estonia, Latvia, most of Israel, parts of Mexico, Turkey, Russia, and in certain other parts of Europe, the green lights will start flashing at the end of the Go or Turn phase to indicate that the amber (Caution phase) lights are about to be engaged. This is useful in fast paced roads to allow for longer slowing down time, and for pedestrians crossing broad streets.

In Michigan, a flashing red ball signal on a "protected" left turn traffic signal indicates that left turning traffic may, after a full stop, complete their turn if and only if there is a long enough break in oncoming traffic. The flashing red usually occurs when the oncoming traffic has a green signal. This function is not enabled at intersections where it may not be safe to do so (restricted view of oncoming traffic, heavy pedestrian crossings, or double-lane left turns are good examples). Also note that Michigan usually indicates signals that are dedicated to turning traffic with a sign displaying "LEFT" or "RIGHT". This sign is normally illuminated at night.

In some cities (such as Kiev, Ukraine or Kraków, Poland) there are signs displaying how fast one has to drive in order to reach the next intersection at the exact time when the light turns green, thus allowing the driver to ease into a green wave.

In some parts of the United States, traffic lights have been fitted to slowly strobe white lights superimposed on the center of the red light when the red light itself has been illuminated. These seem to be located in situations where the driver may have been travelling for a lengthy time without seeing any traffic lights (such as a controlled-access highway), in a place where a regular traveler wouldn't expect a signal (such as a newly erected signal or one put up for construction) or in other situations where extra work may be needed to draw attention to the status of the light (such as in an area where many other red lights approximate the brightness, placement and color of a red traffic signal). These are also used in areas prone to fog, as the strobing white light may be visible from a distance while the standard red light is not.

Tianjin in the People's Republic of China has two very special systems of traffic lights, in use since c. 1999/2000:

- One system is where there is a horizontal bar in a specific colour, with the colour changing and the bar shrinking. The shrinking bar indicates the time remaining in that colour. The colour itself is either red (stop), yellow or green (go). A blinking green one-third-full bar means "reduce speed now", and a blinking yellow full-bar indicates "proceed with caution".

When lights of this system turn from green to red, the diminishing green bar will flash once two-thirds (note: not the *full* bar) of the green bar is "eaten up", with the remaining third intact. A full, uninterrupted yellow bar will appear for a few seconds before, after a short blink, lights turn red. Immediately after the full red bar appears, a tiny (almost unnoticeable) split/division appears to signify the bit that will not be "eaten up". This corresponds to the usual position of a red light (leftmost, or rightmost if at the other end of the road and at the other side of the pavement; or the upper third). When two-thirds of the red bit is "eaten up", the red light extinguishes, only to be replaced nearly immediately with a full chunk of green (again with the minute division). The process then repeats itself.

- Another system is where there is a set of three lights as traffic lights, but every light is an arrow pointing in different directions and every arrow has a colour of its own, to show whether traffic flow is permitted or prohibited in that direction.

The major disadvantage of this system of traffic light is that it is unfamiliar to those who are used to seeing specific colours of the traffic lights at the various ends of a normal traffic light itself (e.g. green rightmost, red leftmost, etc) as well is being problematic for the color blind. It does, however, conserve space.

Elsewhere in China, a blinking green light means "reduce speed now", attempting to stop cars from passing (if that car can still safely stop in time) and is nearly universal in appearance. Some cities or parts of cities show the number of seconds remaining in a specific traffic light colour (a so-called "countdown meter").

The City of Diadema (Metropolitan Area of São Paulo, Brazil) has special traffic lights that show time remaining (in seconds) for both drivers and pedestrians. At every moment, one can tell how much time one has to pass the crossroads. This system is also becoming common in high pedestrian traffic areas in Ontario, Canada.

Other places where there may be traffic lights (normal or special ones):

at the landing-stage of a ferry and aboard the ferry
at the entrance and exit of a parking place or garage
at the entrance and exit of some car washes
at a ramp meter to a freeway or interstate
before a drawbridge
before a narrowing of the road
at a fire station
at a tunnel entrance
HOV Lanes
to allow cattle to cross — as on the A470 in Wales.

Traffic lights for pedestrians are usually different, see pedestrian crossing. Traffic lights at level railroad crossings are again different. Both of these are to avoid confusion as to whom the signal applies.

On some large toll bridges, such as the San Francisco-Oakland Bay Bridge, red/green traffic lights are used to stagger traffic leading into the bridge. In the Bay Bridge's case, approximately 25 lanes of toll booth traffic are reduced to five lanes of bridge traffic in about 1/2 mile. To accomplish this, an overhead red/green traffic light is visible above each lane, several hundred feet beyond the toll plaza. Green is illuminated for 2 seconds, signalling the first driver in that lane to begin acceleration. Then the signal jumps to red for eight seconds. Using this method, there are always five lanes with a "green" signal, staggered throughout the 25 lanes of traffic.

In some areas, a "prepare to stop" sign with two alternately-flashing amber lights is installed in locations where a high-speed road (design speed usually at least 55 mph/90 km/h) leads up to a traffic light, where the traffic light is obscured from a distance (or both conditions), or before the first traffic signal after a long stretch of road with no signals. This is installed so that drivers can view it from a distance. This light begins blinking with enough time for the driver to see it and slow down before the intersection light turns yellow, then red. The flashing amber light can go out immediately when the light turns green, or it may continue for several seconds after the intersection light has turned green, as it usually takes a line of cars some time to accelerate to cruising speed from a red light.

In West Germany, there were or are changing white lights, before the colored traffic lights on surface highways, displaying the speed that one must drive from that place and time to catch a green light and avoid stopping.

Quebec generally uses horizontal traffic lights with red to the left and green to the right. These signals also use specific shapes for each color, which aids color-blind people in distinguishing signal aspects:

- green — an ordinary "ball" shape,
- yellow — a diamond shape, and
- red — a square (somewhat larger than the ball shape).

Lane control

On some high-traffic roads which do not have an even number of total lanes, or on bridges or in tunnels, one or more lanes are designated as counterflow lanes, meaning that the direction of traffic in those lanes can be reversed at any time. Sometimes this is done as a way of managing rush hour traffic (one or more central lanes may flow inbound in the morning and outbound in the evening), in other cases the lanes are only reversed in unusual circumstances (such as a traffic accident or road construction closing one or more of the lanes). Special "lane control signals," placed above the roadway at regular distances, are used for this purpose, with one signal for each lane.

Like regular traffic lights, lane control signals around the world follow their own universal pattern, as specified in the Vienna Convention on Road Signs and Signals. Typical signals include a green downward arrow, used to indicate a lane which is open to traffic facing the signal, a red cross, which indicates a lane is either reserved for opposing traffic or closed to traffic in both directions, and a flashing amber circle, arrow or cross, indicating to traffic facing the signal to immediately clear the lane. (In the Australian state of Victoria, green and yellow are replaced by white, and there may be additional modes such as 'Centre lane turns only' at particular times of the day.) On Jarvis Street in Toronto, Canada the lane control signals are employed without the use of an amber warning signal. Instead, the lane that is to undergo the direction reversal (the middle lane of a 5 lane downtown street) is marked with a red cross in both directions for a short period of time. This allows time for the lane to clear of traffic before a green arrow permits traffic in the reversed direction.

Unlike regular traffic lights, lane control signals either have one face each to indicate all lane conditions (the so-called "searchlight" configuration), or separate faces for each condition (as illustrated). Lane control signals of the latter type are always placed horizontally. Signals that may indicate other conditions for roads without counterflow lanes also exist, such as those that indicate different speed limits for different lanes.

Traffic lights and the law

In virtually all jurisdictions in which they are used, it is a legal offense for motorists to disregard the instructions of traffic lights (or other traffic control devices). The most common infraction associated with traffic lights is failing to stop for a red light (in some jurisdictions, running a yellow light can also incur a penalty). Enforcement of traffic lights varies from jurisdiction to jurisdiction; some places are extremely strict. Other locales are infamous for traffic lights being routinely ignored by motorists, with no serious attempts by law enforcement to alter the situation.

Jurisdictions differ somewhat on how to deal with "red light running" — attempts by motorists to race to an intersection while facing a yellow light, in an attempt to beat the red. In some locales, as long as the light is yellow when the motorist enters the intersection, no offense has been committed; in others, if the light turns red at any time before the motorist clears the intersection, then an offense occurs. In Oregon and other places, a stricter standard applies — running a yellow light is an offense, unless the motorist is unable to stop safely. This standard has been criticized as ambiguous and difficult to enforce (red light cameras in Oregon are only activated if a motorist enters the intersection on a red).

In some jurisdictions (such as San Francisco), there are ordinances against "gridlocking" — any motorist who enters an intersection (even if on a green light) but does not ensure that he/she can proceed through the intersection, and gets stuck in the middle of the intersection (when traffic ahead fails to proceed), and remains there after the light turns red (thus blocking traffic coming from other directions) may receive a citation.

Enforcement of traffic lights is done in one of several ways:

- By police officers observing traffic through the light, and pulling over and issuing citations to motorists who violate the signal.
- As a result of an accident investigation, if it is determined that one or more motorists ran the red light — even if the incident was not observed by a police officer.
- With red light cameras.

Red light cameras

In some areas, a device usually called a red light camera has come into recent use. A camera is connected to the triggering mechanism for the corresponding traffic light, which is targeted to photograph any vehicle which crosses against the light. The driver or owner (depending on local laws) of a vehicle so photographed can then be fined for violating traffic laws. Such cameras have evoked controversy on a number of fronts: in some jurisdictions, the fine cannot be contested, and is therefore seen by some as a violation of due process. Opposition has also stemmed from the practice of paying commissions to the companies which process the photographs from these cameras, as this is seen as an incentive to falsify images. Some have accused municipalities of purposely shortening the yellow-light intervals on intersections equipped with cameras in order to generate more fines. The presence of a red light camera is sometimes, but not always, indicated by a sign some distance before the intersection. Many red light cameras also face the front of vehicles they are used to catch running red lights; therefore, it is possible for vehicles either registered in states that do not use or require front license plates (or vehicles illegally without front plates from states that do require them) to escape being caught.

Traffic lights in other contexts

The symbolism of a traffic light (and the meanings of the three primary colors used in traffic lights) are frequently found in many other contexts.

Use as a rating mechanism or an indication of status

In the UK's British Civil Service and other government offices, traffic lights are used as a coding system for good or bad. For example, for the number of staff one has in relation to the workload, red would mean inadequate, amber would mean reasonable, and green would mean ideal.

In many factories, different stations on the production line(s) are equipped with factory monitoring and control systems; attached to such systems is a "traffic light" status indicator which is generally visible from many places within the factory. Green typically indicates normal levels of production; amber indicates that production has slowed (or attention is otherwise unwarranted); red indicates that production has stopped or the line is down.

Discos

During the mid-to-late 1970s disco craze, discos (especially roller discos), favored a plethora of flashing colored lights. Actual traffic control lights were highly prized, whether stolen or legally purchased retired units. These were generally not controlled in the standard sequence, but driven indirectly from the audio — flashing with the beat.

Humour

A member of the humorous British website B3ta, known as "Koit", created a series of GIF animations exploring the (often explosive) relationship between the red and green men featured on a UK pedestrian crossing sign. These animations are now featured on their own website, Traffic Light Wars.

Car safety

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Car safety is the avoidance of car accidents or the minimization of harmful effects of accidents, in particular as pertaining to human life and health. Special safety features have been built into cars for years, some for the safety of car's occupants only, some for the safety of others.

Road traffic injuries represent about 25% of worldwide injury-related deaths (the leading cause) with an estimated 1.26 million deaths in 2000 (Peden 2002).

Major factors in accidents include driving under the influence of alcohol or other drugs; inattentive driving; driving while fatigued or unconscious; encounters with road hazards such as snow, potholes, and crossing animals; or reckless driving.

History

Car safety became an issue almost immediately after the invention of the automobile, when Nicolas-Joseph Cugnot crashed his steam-powered "Fardier" against a wall in 1771. The first recorded automobile fatality was Bridget Driscoll on August 17, 1896 in London.

In 1958, the United Nations established the World Forum for Harmonization of Vehicle Regulations, an international standards body advancing auto safety. Many of the most life saving safety innovations, like seat belts and roll cage construction were brought to market under its auspices.

In 1966, the US established the United States Department of Transportation (DOT) with automobile safety one of its purposes. The National Transportation Safety Board (NTSB) was created as an independent organization on April 1, 1967, but was reliant on the DOT for administration and funding. However, in 1975 the organization was made completely independent by the Independent Safety Board Act.

The NTSB and its European equivalent, EuroNCAP have each issued independent safety tests for all new automobiles, without reciprocity.

In June, 2004 the NTSB released new tests designed to test the rollover risk of new cars and SUVs. Only the Mazda RX-8 got a 5-star rating. However, the correlation between official crash test results and road deaths in vehicles is not exact. An alternative method of assessing vehicle safety is to study the road accident statistics on a model-by-model basis.

Despite technological advances, the death toll of car accidents remains high: about 40,000 people die every year in the US. While this number increases annually in line with rising population and increased travel, the rate per capita and per vehicle miles travelled decreases. In 1996 the US has about 2 deaths per 10,000 motor vehicles, comparable to 1.9 in Germany, 2.6 in France, and 1.5 in the UK. In 1998 there were 3,421 fatal accidents in the UK, the fewest since 1926.

A much higher number of accidents result in permanent disability.

Color

A Swedish study found pink cars safest, with black cars most likely to be involved in crashes, and also showed Saab to be the "safest car in Sweden [In terms of passive safety]" (Land transport NZ 2005).

An Auckland, New Zealand study found a significantly lower risk of serious injury in silver cars; with high risks for brown, black, and green cars. (Furness et al, 2003).

Pregnant women

When pregnant, women should continue to use seatbelts and airbags properly. A University of Michigan study found that "unrestrained or improperly restrained pregnant women are 5.7 times more likely to have an adverse fetal outcome than properly restrained pregnant women". If seatbelts are not long enough, extensions are available from the car manufacturer or an aftermarket supplier.

Children

Car safety is especially critical for young children, as car safety is generally designed for normal sized adults. Safety features that could save an adult can actually cause more damage to a child than if the feature was not there. It is important to review with others, who may be supervising the child, the rules for car safety. All children age 12 and under should ride in the back seat. This is especially the case if there are airbags in the front seat, as airbags are only designed to protect adults and may injure children.

Child safety locks prevent children from accidentally opening doors from inside the vehicle, even if the door is unlocked. The door, once unlocked, can then be opened only from the outside.

Infants

Newborn babies should be put in a car seat until they weigh at least 20 or 22 pounds (10 or 11 kg). These carriers are designed to be placed in the rear seat and face towards the rear with the baby looking towards the back window. Some of these carriers are "Convertibles" which can also be used forward facing for older children. With infants, these should *only* be used *facing the rear*. Harness straps should be at or below shoulder level.

A rear-facing infant restraint must never be put in the front seat of a vehicle with a front passenger air bag. A rear-facing infant restraint places an infant's head close to the air bag module, which can cause severe head injuries or death if the air bag deploys. Modern cars include a switch to turn off the airbag system of the passenger seat, in which case a child-supporting seat must be installed.

Toddlers

Toddlers over 1 year old and between 20 and 40 pounds (10 and 20 kg) should be placed in forward facing child seats or convertibles placed in the rear seat. Harness straps should be at or above the child's shoulders.

Young children

Children who weigh less than 80 pounds (40 kg), are younger than 8, or are shorter than 4 ft 9 in (1.4 m) are advised to use belt positioning booster seats which raise them to a level that allows seat belts to work effectively. These seats are forward facing and must be used with both lap and shoulder belts.

Make sure the lap belt fits low and tight across the lap/upper thigh area and the shoulder belt fits snug crossing the chest and shoulder to avoid abdominal injuries.

There are two main types of booster seats. If the car's back seat is lower than the child's ears, a *high back booster seat* should be used to help protect the child's head and neck. If the car's seat back is higher than the child's ears, a *backless booster seat* can be used.

Teenage Drivers

Most areas in the United States allow teens the privilege to drive at the age of 16. This age ranges in other countries but all teen drivers are relatively inexperienced compared to other drivers. This lack of experience leads to an increased risk of accidents among this demographic. Several resources are available to help teen drivers including TeenDriving.comand AutoExtra.com's kids first car tips and recommendations.

Safety features

Avoidance

To make driving safer and prevent accidents from occurring, cars may have the following active safety features:

Turn signals and brake lights, including Center High Mounted Stop Lamps (CHMSL)

Anti-lock braking system (ABS) (also Emergency Braking Assistance (EBA), often coupled with Electronic brakeforce distribution (EBD), which prevents the brakes from locking and losing traction while braking. This shortens stopping distances in almost all cases.

Inboard brakes allow large fade resistant discs or drums, without contributing to unsprung weight and wheel bounce, which degrade braking, handling and ride, and increase mechanical loads.

Traction control (TCS) actuates brakes or reduces throttle to restore traction if driven wheels begin to spin.

Four wheel drive (AWD) with a center differential. Distributing power to all four wheels lessens the chances of wheel spin. It also suffers less from oversteer and understeer.

Electronic Stability Control (ESC)(also known for Mercedes-Benz proprietary Electronic Stability Program (ESP), Acceleration Slip Regulation (ASR) and Electronic differential lock (EDL)). Uses various sensors to intervene when the car senses a possible loss of control.

The car's control unit can reduce power from the engine and even apply the brakes to prevent the car from understeering or oversteering.
Dynamic steering response (DSR) corrects the rate of power steering system to adapt it to vehicle's speed and road conditions.
Lane Departure Warning System (LDWS).
Directional headlights.
Low center of gravity and other conventional features promoting good car handling and braking, and helping to avoid rollover.
Large (relative to weight) high performance tires, suited to the weather and road conditions, contribute to braking and handling. Soft high histeresis rubber, tread and cord design are important.
Visibility for the driver, mirrors, elimination of blind spots and possibly other awareness aids such as radar, wireless vehicle safety communications and night vision.
Death Brake; there is a move to introduce deadman's braking into automotive application, primarily heavy vehicles, there may also be a need to add penalty switches to cruise controls.
Four wheel steering gives, at the cost of mechanical complexity, quicker, more accurate manoeuvres at high speed and/or decreased turning circle at low speed. It may also help stability.

Damage control

When an accident is imminent, various passive safety systems work together to minimize damage to those involved. Much research has been done using crash test dummies to make modern cars safer than ever. Recently, attention has also been given to cars' design regarding the safety of pedestrians in car-pedestrian collisions. Controversial proposals in Europe would require cars sold there to have a minimum/maximum hood height. This has caused automakers to complain that the requirements will restrict their design choices, resulting in ugly cars. Others have pointed out that a notable percentage of pedestrians in these accidents are drunk. From 2006 the use of "bull bars" (known as "roo bars" in Australia), in fashion on 4x4s and SUVs, will be illegal.

- Seatbelts (or safety belts) keep a person from being thrown forward or ejected from the vehicle.
- Airbags
  - Front airbags inflate in a medium speed head on collisions to cushion the blow of a head on the dashboard or steering wheel.
  - Side airbags inflate in a side (T-bone) collision to cushion the torso
  - Curtain airbags protect the heads of passengers in a side collision
- Bumpers to withstand low-speed collisions without damaging bodywork.
- Crumple zones absorb the energy of an impact when the car hits something
  - Crash box to dissipate impact forces

- Collapsible steering column, sometimes provided with steel sheet bellows.
- Crash compatibility can be improved by matching vehicles by weight and by matching crumple zones with points of structural rigidity, particularly for side-on collisions. Some pairs of vehicle front end structures interact better than others in crashes. Widely different height and body on rail frame design are particularly bad.
- Cage construction is designed to protect vehicle occupants. Some racing vehicles have a tubular roll cage
- Reinforced side door structural members
- Fuel pump shutoff devices turn off gas flow in the event of a collision for the purpose of preventing gasoline fires.
- Light weight: the possible damage a vehicle can do to outside people and things is roughly proportional to its kinetic energy, which is its weight times the square of its speed.
- Active pedestrian protection systems.

See also

- Road safety
- Safety car

Driving under the influence

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Driving under the influence, *drunk driving*, or *drink-driving*, is the act of operating a motor vehicle (and sometimes a bicycle or similar human-powered vehicle) after having consumed alcohol (ethanol) or other drugs, to the degree that mental and motor skills are impaired. In addition to driving under the influence of alcohol and driving under the influence of other drugs, a third "DUI" offense consists of driving under the combined influence of alcohol and other drugs. The drugs causing or contributing to the impairment need not be illegal, but can consist of lawfully prescribed or over-the-counter medication. Anti-drunk-driving advertising campaigns have aimed to raise awareness of the legal situation and the dangers of driving while intoxicated. Drunk-driving is responsible for a very large number of deaths, injuries, damage and accidents every year.

The specific criminal offence may be called, depending on the jurisdiction, **driving while intoxicated *(*DWI*)*, operating while intoxicated *(*OWI*)*, operating a motor vehicle while intoxicated *(*OMVI*)*, driving under the influence *[of alcohol or other drugs] (*DUI*)*, driving under the combined influence of alcohol and/or other drugs *or* drunk in charge *[of a vehicle]. Such laws may also apply to boating, or piloting aircraft.***

Presumptive guilt may be established by subjective tests of the driver's impairment, or measurement of his blood alcohol content (BAC). This is expressed in terms of milligrams of alcohol per millilitres of blood, or as a percentage. (10 mg/100 ml = 0.01 g/100 g = 0.01 %).

Drinking and driving is the act of driving a vehicle after consuming an alcoholic beverage or while consuming one. It is often confused with drunk driving and the other terms identified above. Driving after consuming alcohol is generally not illegal unless the driver's ability to drive safely is impaired as defined by law.

Driving while consuming alcohol is often defined as illegal, irrespective of whether or not the driver is impaired. In some jurisdictions it is also illegal for an open container of an alcoholic beverage to be in the passenger compartment of a motor vehicle or in some specific area of that compartment.

United States

All states have an illegal per se limit of 0.08%. Some states also include a lesser charge — often known as *driving while impaired* — at a BAC of around 0.05%. Also, in all states, drivers under the drinking age of 21 have committed a drunk driving offence if they have any alcohol in their blood (set at .00%, .01% or .02% to be meaningful). DUID is driving under the influence of drugs. A third possible charge is driving under the combined influence of alcohol and drugs; this requires no particular blood-alcohol level, but only impairment as the result of the combined effects of alcohol and drugs (which may be legal or illegal).

The limit for aircraft pilots is 0.04%, and for commercial drivers 0.04% or 0.05% depending upon the jurisdiction.

VC 23577: Penalty enhancement for refusal to submit to, or willful failure to complete, a chemical test. *Penalty:* 1st Offense (23152 or 23153) - same as penalties for 23152 or 23153; 2nd Offense (23152 or 23153) - additional 96 hours county jail; 3rd Offense (23152) - additional 10 days county jail; 4th Offense (23152) - additional 18 days county jail.

A current defense against drunk driving is already under way in the state of Ohio, and is being looked at in California for DUI offenders to purchase a "scarlet letter" that is placed over the offender's license plates. This identifies them as a DUI offender, and must be purchased for all their household car's plates, along with the regular DUI and court charges.

Canada

Driving under the influence is a generic term for a series of offences under the Canadian Criminal Code. The main offences are operating a motor vehicle while the ability to do so is impaired by alcohol or a drug, contrary to section 253(a) of the Criminal Code, and operating a motor vehicle while having a blood-alcohol concentration of greater than 80 milligrams of alcohol in 100 millilitres of blood, contrary to section 253(b) of the Criminal Code.

The offences are usually investigated by the police coming across a driver with either an erratic driving pattern or who has been pulled over. The police make a demand that the driver give a sample of his breath into an approved screening device, which will determine the driver's blood-alcohol concentration on a preliminary, non-evidentiary basis. If the police believe on reasonable and probable grounds that the driver is commiting an offence under section 253 of the Criminal Code, the police can demand that the driver go to the police station to give samples of his breath for an approved instrument test, which would be used to prosecute the driver.

The punishments for impaired driving or driving over 80 are:

- For the first offence: $600 fine, 1-year driving prohibition;
- For the second offence: 14 days jail, 2-year driving prohibition;
- For the third or subsequent offence: 90 days jail, 3-year driving prohibition.

On Dec 15, 2005, Charly Hart of Watford, Ontario, a man with a 35-year history of impaired driving which included thirty-nine convictions, was on the occasion of his latest such conviction sentenced to six years in prison, the most severe penalty ever handed down in Canada when the offence did not involve a fatality, and the maximum sentence permitted under the law.

Australia

Road laws are state based

- Australian Capital Territory
  - 0.02% for "professional" drivers (taxi, bus, dangerous goods vehicles, heavy vehicles over 4.5 tonnes, Commonwealth vehicles) and learner and P plate drivers
  - 0.05% for experience drivers (that is drivers over 18 years of age who have been driving for more than 3 years and are not classed as "professional" drivers)
- New South Wales:
  - Zero for Learner and Provisional licences and 0.02 % for Drivers of vehicles of "gross vehicle mass" greater than 13.9 tonnes, vehicles carrying dangerous goods or public vehicles such as a taxi or bus.
  - 0.05% for all other drivers
- Queensland
  - A Zero limit applies to the drivers of trucks, buses, articulated vehicles, vehicles carrying dangerous goods, pilot vehicles, and taxis. It also applies to all learner drivers and provisional drivers under 25 years of age.
  - 0.05% for other drivers.
- South Australia
  - Zero limit for learner, provisional, probationary, heavy (greater than 15 tonne) vehicle, taxis, licensed chauffeured vehicles, dangerous goods, and bus licences.
  - 0.05% for all other drivers.
- Tasmania
  - Zero limit for learner, provisional, truck, bus, and taxi licences.
  - 0.05% for all other drivers.
- Victoria

  - Zero limit applies for unlicensed drivers and holders of Learner permits and Probationary licences, as well as any 'professional' drivers - including tram drivers. Also for certain relicensed drink-drivers.
  - 0.05% for most other drivers.
  - Licences cancelled for certain serious drink-driving offences may only be reissued after obtaining a court order. In such cases, the relicensed driver is subject to a zero limit for 3 years following relicensing or for as long as the person is required to use an alcohol interlock.
  - Alcohol interlocks are required whenever a repeat drink-driver is relicensed. In addition, a court may impose an alcohol interlock when relicensing a first offender in certain serious cases (generally when the offence involved a BAC of 0.15% or higher).
  - Zero limit for "prescribed illicit drugs", namely methylamphetamine and THC (Cannabis).
  - Random testing of drivers is in force for alcohol and (on a trial basis) for prescribed illicit drugs.
- Western Australia
  - 0.02% for provisional (probationary) licence holders.
  - 0.05% for all other drivers.

In Australia, there are laws that allow for a police officer to stop any driver and perform a random breath test, without needing any reason. In addition, in Victoria, any driver can be required to perform a random saliva test for a prescribed illicit drug (i.e. methylampetamine and cannabis). Also, in Victoria, if a doctor sees any patient who is 15 years old or older as a result of a vehicle accident, the patient must allow the doctor to take a blood sample for testing for alcohol and drug content in a way that preserves the chain of evidence, regardless of whether the patient claims to be the driver, a passenger or any other circumstances. The results can be used as evidence in subsequent court proceedings.

Europe

Austria: 0.05 % and 0.01 % for drivers who have held a licence for less than 2 years and drivers of vehicles over 7.5 tonnes
Belarus: 0.05 %
Bosnia-Herzegovina: 0.05 %
Bulgaria: 0.05 %
Croatia: Zero
Czech Republic: Zero
Denmark: 0.05 %
Estonia: 0.02 %
France: 0.05 %
Finland: 0.05 %
Germany: 0.05 % and zero for drivers conducting commercial transportation of passengers
Gibraltar: Zero
Greece: 0.05 % and 0.02 % for drivers who have held a license for less than 2 years and

bus drivers
Hungary: Zero
Iceland: 0.05 %
Ireland: 0.08 %
Italy: 0.05 %
Latvia: 0.02 % for drivers with less than 2 years' experience and 0.05 % for those with more than 2 years' experience
Liechtenstein: 0.08 %
Lithuania: 0.04 %
Luxembourg: 0.08 %
Malta: 0.08 %
Netherlands: 0.02 % for drivers with less than 5 years' experience and 0.05 % for those with more than 5 years' experience
Norway: 0.02 %
Poland: 0.02 %
Portugal: 0.05 %
Republic of Moldova: 0.03 %
Romania: Zero
Slovakia: Zero
Slovenia: 0.05 %
Spain: 0.05 % [2] and 0.03 % for drivers with less than 2 years experience and drivers of freight vehicles over 3.5 tonnes, and of passenger vehicles with more than 9 seats.
Sweden: 0.02 % (up to 6 months imprisonment), 0.10% (up to 2 years imprisonment)
Switzerland: 0.05 %
Turkey: 0.05 %
Ukraine: Zero
United Kingdom: 0.08 %.

Note: "Zero" usually means "below detection limit".

Americas

Argentina: 0.05 %
Belize: 0.08 %
Bolivia: 0.07 %
Brazil: 0.06 %
Canada: 0.08 %
Chile: 0.049 %
Colombia: 0.04%
Costa Rica: 0.049 %
Cuba: Zero
Dominican Republic: No Limit and 0.05 % for professional drivers
Ecuador: 0.07 %
El Salvador: 0.05 %
Guatemala: 0.08 %
Guyana: 0.01 %

Honduras: 0.07 %
Jamaica: 0.035 %
Mexico: 0.08 %
Nicaragua: 0.08 %
Panama: Zero
Paraguay: 0.08 %
Peru: 0.045 %
Suriname: 0.08 %
Uruguay: 0.08 %
Venezuela: 0.05 %

Africa

Algeria: 0.01 %
Benin: 0.05 %
Cape Verde: 0.08 %
Central African Republic: 0.08 %
Comoros: No Limit
Congo: No Limit
Equatorial Guinea: Zero
Eritrea: Zero
Ethiopia: No Limit
Gambia: Zero
Ghana: 0.08 %
Guinea: Zero
Guinea-Bissau: 0.05 %
Kenya: 0.08 %
Malawi: Zero
Mauritius: 0.05 %
Namibia: 0.05 %
Niger: 0.08 %
Nigeria: Zero
Seychelles: 0.08 %
South Africa: 0.05 % and 0.02 % for professional drivers (trucks over 3.5 tonnes, and vehicles carrying passengers for reward) South African MoT
Togo: No Limit
Uganda: 0.08 %
Tanzania: 0.05 %
Zambia: 0.08 %

Caucasus

Armenia: Zero
Azerbaijan: Zero
Georgia: 0.03 %

Middle East

Iran: Zero. Drinking alcohol is illegal in Iran.
Israel: 0.05 %
Jordan: Zero
Kuwait: Zero. Drinking alcohol is illegal in Kuwait.

East Asia

China: Varies. "Drinking and driving" and "driving while intoxicated" carry different penalties.
Japan: 0.03 %
Republic of Korea: 0.052 %

Western Pacific

French Polynesia: 0.05 %
Micronesia: 0.05 %
New Zealand has a limit of 0.08% for drivers over 20 years, 0.03% for those under. LTSA website
Palau: 0.01 %

Central Asia

Kyrgyzstan: 0.05 %
Mongolia: 0.02 %
Turkmenistan: 0.033 %

South Asia

India: 0.03 %
Nepal: Zero
Sri Lanka: 0.06 %

South-East Asia

Cambodia: 0.05 %
Laos: No Limit
Malaysia: 0.08 %
Philippines: 0.05 %
Singapore: 0.08 %
Thailand: 0.05 %

Philosophical perspectives

An overview of the philosophical approach to DUI, especially with respect to ethical and pedagogical concerns, is James B. Gould's "A Sobering Topic: Discussing Drunk Driving in Introductory Ethics" in 'Teaching Philosophy' 21:4 (December 1998), 339-360.

Gould's central point is that drink-driving offers an ethical case that, for most people, is clear-cut in the fundamentals, familiar from everyday life, and extraordinarily complicated in the details. In other words, it's ideal for philosophical analysis at the introductory level.

He cites the few articles by academic philosophers that he could find:

- Douglas N. Husak, "Is Drunk Driving a Serious Offense?" 'Philosophy and Public Affairs' 23 (1994).
- Bonnie Steinbock, "Drunk Driving." 'Philosophy and Public Affairs' 14 (1985).
- James D. Stuart, "Deterrence, Desert and Drunk Driving," 'Public Affairs Quarterly' 3 (1989).

Driver's license

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A *driver's license* (UK, Hong Kong, Singapore: *driving licence*; U.S.: *driver's license* or *driver license*; Canada, Australia, New Zealand: *driver's licence*) is an official document which states that a person has the necessary qualifications to operate a motorized vehicle, such as a motorcycle, car, truck, or a bus. Driver's licenses are generally issued after the recipient has passed a successful driving test and proven that they meet the age requirement. Different categories of licenses may exist for different types of motor vehicles. The difficulty of the driving test may vary considerably between jurisdictions.

Country specifics

European Union after standardisation in 1998

In most European countries a person must be at least 17 or 18 years old to drive a car**[1]**.

Some categories like C and D will be issued for 5 years only. After expiration there is medical checkup necessary in order to renew the licence for another 5 years.

Notably, the Republic of Ireland has not moved to the post-1998 EU system and still issues licences of the old type. It has no intention to move to a newer system in the foreseeable future.

In March 2006, the Council of Ministers approved plans to create a single European driving license to replace the 110 different models currently in existence throughout the EU. The plans are supported by the European Commission and the European Parliament meaning a law should be in place by the end of 2006. National licenses will then be phased out between 2012 and 2032.**[2]**.

Categories valid in all EU countries

- Category *A*: Motorcycles.
    - Category *A limited*: Motorcycles up to a maximum power of 25 kW.
    - Category *A1*: Light Motorcycles with a maximum displacement of 125 cm^3 and a maximum power of 11 kW (minimum age: 16 years; speed limit of 80 km/h in some countries).
- Category *B*: Passenger vehicle with a maximum mass of 3.5 t and not more than 8 seats (excluding the driver); with a trailer with a maximum mass of 750 kg, or the mass of an empty car if the total mass of both is less than 3.5 t.
- Category *C*: Vehicles of more than 3.5 t mass and not more than 8 + 1 seats (lorry); with a trailer with a maximum mass of 750 kg.
    - Category *C1*: light lorry with a mass not more than 7.5 t; with a trailer with a maximum mass of 750 kg.
- Category *D*: Vehicles with more than 8 + 1 seats (buses).
    - Category *D1*: light buses with a maximum of 16 + 1 seats.
- Category *E* (combined only with B, C, C1, D or D1): other trailers which are heavier than 750 kg. In combination with C1E and D1E, the maximum total mass of vehicle and trailer is 12 t and the mass of the empty vehicle must be higher than the mass of the trailer. Carrying passengers in a trailer of category D1E is prohibited.

Furthermore there are more national categories for tractors, very light motorcycles, motorised wheel chairs, motor tricycles (modern voiturettes, Category *B1* or *S*) and military categories such as for driving tanks.

Note for sample licence right: German driving licences do not have a licence expiry date (number 4b on the licence) since they are issued for lifetime (exept categories C and D, for which a mandatory medical check is required at age 50, and every 5 years after then).

United Kingdom

The driving age for a car or van is 17 (unless in receipt of a full disability allowance, when you can obtain a provisional licence at the age of 16 years), while a moped or restricted-power motorcycle can be ridden at 16**[3]**. Until a driving test has been passed (which consists of three sections: a theory test, a hazard perception test, and a supervised driving examination) a driver will hold a Provisional Licence and must display learner plates (a large red L on a white background, or optionally a large red D on a white background if the learner does not leave Wales) on the front and back of the vehicle. They must also be accompanied by an adult who is at least 21 years of age and has held a full driving licence for at least three years. [1] If a person holding a provisional licence receives points on his/her licence, they will be unable to drive for six months, no matter how many points they may receive.

Registration was introduced in 1903 with the Motor Car Act. Competency tests were introduced in 1934 by the Motor Vehicles Regulations 1935; they were suspended in 1939 for seven years due to the Second World War and in 1956 for one year due to the Suez Crisis. The only person in the United Kingdom who is not required to have a driving licence in order to drive is the Queen. She also does not require number plates on any of her cars. **[4]**

Until July 1998 [5], mainland Great Britain driving licences did not have photographs. Anyone who holds a licence issued before this date may retain their photo-less licence until expiry (normally one's seventieth birthday) or until they change address, whichever comes sooner. The new "photocard" driving licences are a two-part document, a plastic photocard which has to be renewed every ten years, and a paper sheet (the "Counterpart Driving Licence") which is valid until the holder's seventieth birthday.

Points are given for traffic offences, e.g. typically three or four points for a speeding offence. Points remain on the licence for three years from conviction - twelve points on the licence (6 points or more for those within 2 years of passing their test) leads to automatic suspension. In the case of particularly egregious offences, the court may order the driver to pass the driving test again before the licence is returned.

United States and Canada

In the U.S. and Canada, the driving age is determined by the state or province, with the most common age being sixteen[6]. Most states and provinces also have restricted driver's licenses (also called learner's permits), which allow a person to drive provided they are accompanied by a licensed driver. There has also been a trend toward "graduated driver's licenses," in which new (especially young) drivers are gradually allowed more driving privileges instead of being given complete driving privilege all at once. Learner's permits are granted by some states to drivers as young as fourteen. Some states also issue farm permits or school permits to certain 14 or 15 year old drivers.

All U.S. states have a minimum driving age of exactly sixteen, except for these states:

Alaska: Small Motorcycle: 14 years; Automobile: 14 years (Learner's Permit) / 16 years (License)
Connecticut: 16 years, 6 months
Hawaii: 18 years
Idaho : 15 years (in daylight)
Indiana: 16 years, 1 month
Kansas: 14 years, with parent
Maryland: 16 years, 3 months
Massachusetts: 16 years, 6 months
Michigan: 14 years, 9 months (with parent)
Mississippi: 15 years
Montana: 15 years
New Jersey: 17 years (with some restrictions)
New York: 17 years (with drivers ed)
South Carolina: 15 years
South Dakota: 14 years, 6 or 9 months (6am-10pm)
Virginia: 16 years, 3 months

In Canada:

- Quebec: 16 years[7]
  - Learners permit: Available at age 16 (with adult consent), with the passing of a multiple choice road theory test, a driving permit is issued which

allows the learning driver to drive on roads accompanied by someone with full valid driver's license.

  - Probationary licence: Available after having held a learners permit for 12 months or 8 months if the driver has completed a certain number of driving lessons with recognized driving school. Probationary licence is aquired after successfully completing a road test.
  - Driver's licence: Finished a two year probationary period, if aged 16-24; or if the driver has passed the probationary licence driving test, if age 25 or older.

- Ontario: 16 years
  - Learners permit (G1): Available at age 16, with the passing of a multiple choice road theory test, a driving permit is issued which allows the learning driver to drive on roads accompanied by someone with full valid driver's license who's BAC is less then .05 and has been fully licenced for four years. The driver also cannot drive on large devided highways or between 12:00 AM - 5:00 AM and must maintain their own BAC at zero.
  - Probationary licence (G2): Available after having held a learners permit for 12 months or 8 months if the driver has completed a certain number of driving lessons with recognized driving school. Probationary licence is aquired after successfully completing a road test. At this point the driver must still maintain a BAC of zero. As of 2005 drivers with a G2 licences can carry only one passenger under 19 for the first six months and only 3 passengers under 19 there after.
  - Full licence (G): After 1 year of possessing the G2 licence a driver can take an additional road test that often includes driving on a four lane devided highway. With successful completion they will obtain a full licence which carries no restrictions and are not required to take any further tests until 80 providing they renew their licence regularly. Drivers 80 years of age and over must complete a vision and knowledge test and participate in a 90-minute group education session to renew their licence.

In Ontario, there was a recently proposed legislation to deny driver's licenses to high school dropouts until they turned 18. It was meant as an incentive for students to graduate.[8]

Decline in licensing among young people in the U.S.

In the past decade, fewer and fewer teenagers are getting driver's licenses. According to a December 2004 Los Angeles Times article, only 43% of American 16- and 17-year olds had licenses in 2002. By comparison, the percentage in 1982 was 52%. The rate is even lower in some states (e.g., 9% in Missouri).

Other Information/Use as Identification

Most states require new drivers to complete both driver's education classes (which include both classroom lectures and textbook lessons) and driver training (behind the wheel lessons with a state-licensed driving instructor) in order to earn a driver's license.

In the United States and most of Canada, a driver's license has a unique number or alphanumeric code issued by the Department of Motor Vehicles (or equivalent), a photograph of the bearer, a copy of his or her signature, the address of his or her primary residence, the type or class of license, restrictions and/or endorsements (if any), the physical characteristics of the bearer (like height, weight, hair color, and sometimes even skin color), and birthdate. In the U.S., Social Security numbers are becoming less common on driver's licenses, due to identity theft concerns. Most states require that when a driver establishes residence in a state, he or she must obtain a license issued by that state within a certain timeframe.

The classes of licenses are usually organized so that Class A is usually the license that indicates a person can drive the heaviest and largest vehicles. The license held by the vast majority of ordinary drivers is Class C, D, or E depending upon how the government sets the weight limits for each class. Motorcycles are usually Class M, although some jurisdictions simply add an endorsement permitting the holder to operate motorcycles as well as the class of vehicle for which he or she is licensed.

Because there is no national identity card in the United States, the driver's license is often used as the de facto equivalent for completion of many common business (and governmental) transactions. As a result, driver's licenses are the focus of many kinds of identity theft. Driver's licenses were not always identification cards. Indeed, in many states, drivers licenses did not even have a photograph well into the 1980s. Thanks to pressure from Mothers Against Drunk Driving, who demanded the use of photo ID age verification in conjunction with increasing the drinking age to 21 in order to protect the public from drunk drivers, photographs were added to all state licenses. New York and Tennessee were the last states to add photos in 1986. Later additions, varying from state to state, have included fingerprints, bar codes, magnetic strips, social security numbers, and allegedly tamper-proof features, each new addition needed to protect against identity theft, and to protect underage people using fake ID to purchase alcohol, and more recently, in the war on terror.

Australia

Licensing laws in Australia differ between different states and territories; however, most involve a similar procedure and a graduated licensing scheme.

In New South Wales, the minimum age for a Learner's Permit is 16 for cars and 16 and 9 months for motorcycles. Since the introduction of an enhanced graduated licensing scheme in 2000, new drivers must proceed through 3 different stages before gaining a full, unrestricted licence. Allowing for the mandatory periods of time between each licence, the effective minimum age of full licensing is 20.

The minimum age for a P1 licence is 17 and the mandatory periods of time between each licence makes the effective minimum age of full licensing 20.

- A *Learner's Permit*, gained after passing a computerised knowledge test. Learner drivers are permitted to drive accompanied by a full, unrestricted licence holder (usually a parent or professional driving instructor). Learner drivers are subjected to numerous restrictions: a maximum speed of 80 km/h, a zero alcohol limit, cannot tow a trailer, and must conspicuously display black-on-yellow 'L-plates' while driving. Learner drivers must complete at least 50 hours (verified by a log book completed by the supervising driver) of on-road driving experience, and must hold the permit for at least six months, before they may apply for a Provisional (P1) Picence. In an intentional quirk of the system, drivers may apply for a Learner's permit at the age of 16, but the minimum age for a P1 licence is 17; drivers who apply for a Learner's permit on their sixteenth birthday must therefore hold the licence for a year before progressing to the next stage. This is thought to encourage extra driving experience for younger applicants.
- A *Provisional (P1) Licence* is gained after six months and successful completion of a practical driving test. The licence holder can drive unaccompanied, but is limited to a maximum speed of 90 km/h, towing trailers of up to 250kg, and a zero alcohol limit. They must display red-on-white 'P-plates' while driving. P1 drivers are limited to a total of three demerit points during the term of the licence, as compared to the 12-point limit on unrestricted licences. P1 drivers must hold the licence for one year before progressing to the next stage.
- A *Provisional (P2) Licence* is gained after one year and successful completion of a computerised hazard perception test. The driver is restricted to a speed limit of 100km/h, a zero alcohol limit, and a maximum of six demerit points; however, they are eligible to upgrade the class of their licence, such as those for heavier vehicles. P2 drivers must display a green-on-white 'P-plate' at all times. P2 drivers must hold the licence for two years before progressing to the next stage.
- A *full, unrestricted licence* is gained after two years and successful completion of another computerised test. Unrestricted drivers progress through different "colour" licences: black, silver and gold.

There are several common complaints about the NSW licensing scheme. The relatively high number of road accidents and traffic offences involving P-plate drivers (such as speeding and drink-driving) has prompted calls for further driving restrictions, such as curfews and passenger restrictions, as implemented in other countries. Some consider 50 hours to be insufficient experience for learner drivers. Also, the blanket speed restrictions on Learner and Provisional drivers can pose problems on country roads and freeways, where learner drivers are restricted to 80km/h while other drivers may travel up to 110km/h. In Victoria, this problem is avoided by allowing learners to travel at higher speeds on freeways.

In Western Australia, drivers who have had their licence revoked can obtain an Extraordinary Licence if they can demonstrate that the loss of their licence inflicts hardship and pay a AUD$500 fine. The Extraordinary Licence permits them only to drive to avoid the hardship, for example to and from work.

Tourists and visitors staying less than three months are permitted to drive on the licence of their home country. If the licence is not written in English, then an acceptable translation of the licence must be carried at all times. Visitors staying more than three months must apply for a licence in the state in which they reside.

In Australia, where there is no form of national identity card, driver's licences serve as the primary means of photo identification; 'proof of age' cards were available for non-drivers these have been replaced by Photo cards from Dec 2005. Licences and Photo Cards are hologrammed, and contain a photograph, signature, the driver's address and organ donor status.

As of 2005, Queensland licences are now called a "Driver Licence" (as opposed to the traditional "Driver's Licence", or the more grammatically correct "Driving Licence"), and no longer carry information about the holder's organ donor status. The Australian Organ Donor Register[9] is now used for national registration of tissue donation status, due to criticism of the previous schemes.

New Zealand

New Zealand has had a graduated driver licence system since 1987. It consists of three phases for a car licence:

- Learner Licence, which is gained after scoring 32 out of 35 (or better) on a multiple-choice test relating to road rules. Once gained, it allows a driver to drive during daylight hours, provided they display black-on-yellow learner plates and are accompanied by a "supervisor" (being any person who is over 20 years of age and who has held a Full Licence for at least two years). The learner license is a blue plastic card.
- Restricted Licence, which requires one having held a Learner Licence for six months (three months if aged over 25) and passing a twenty-minute practical driving test. This allows a driver to drive without L-plates, and without a supervisor between 5am and 10pm if not carrying passengers. It is a yellow plastic card.
- Full Licence, which requires having held a Restricted Licence for eighteen months, or twelve months for someone who has taken a defensive driving course (six and three months respectively for people aged over 25), and passing a more thorough, hour-long driving test. It allows a driver to drive at any

time with passengers, and after two years to supervise Learner and Restricted drivers. It is green plastic card.

Alternatively, people who gained a licence before 1987 (or holders of overseas licences) can usually obtain a Full Licence without needing to take a driving test.

A Learner licence can be applied for at age fifteen. This means the minimum possible age to gain a Full Licence is sixteen and a half. In recent years, there have been proposals to raise the minimum driving age to 16 or 17, but so far they have never come to pass, due to objections from farmers who say that their children need to learn to drive early in life because of limited public transport.

The car licence allows the holder to drive a moped, tractor, or all-terrain vehicle as well as a car, however, motorbikes and heavy vehicles require separate licences.

Driver licences carry a unique identifying number, date of birth and photograph of the holder, and apart from passports and a special-purpose 18+ card are the only legal form of ID for buying alcohol or tobacco. They also carry a legend declaring whether or not the holder wishes to donate his or her organs if he or she dies on the road, however, the next-of-kin are consulted first and decide whether or not organs will be donated regardless of the wishes of the licence-holder.

Drivers must carry their license at all times while driving. If they fail to do so they may face a fine of NZD55.

Switzerland

The minimum age limit is 18 for cars (14 for mopeds). In fact, the Learner's Licence for cars is not given until at least the date of the applicant's 18th birthday and is withheld until the theoretical exam is passed. Learner plates (a magnetic or non-magnetic blue square with a white "L" on it) are to be used when the driver is one whom holds a Learner's Licence. Trips driven by the Learner Driver must be accompanied by an individual of at least 23 years of age who has possessed a valid licence for at least three years. Motorways may be accessed only by those who have "experience skills" and are "ready for the exam". Test drives must not interfere with traffic as usual. The official licence is given after an on-the-road exam, based on a successful theoretical examination. Public roads require a driver's licence, while private roads can be driven without one, subject to the land proprietor's consent.

Mainland of the People's Republic of China

Minimum age varies from 18 (for cars) all the way up to 26 (for large buses). Learner's licences, although granted, have little effect, as most training takes place within the confines of specially-designed training areas inaccessible, on paper, to the general motoring public. Previously, expressways were inaccessible even for holders of a normal driver's licence if they did not possess the licence for a full year; however, such a regulation has now been invalidated. Drivers with licences less than a year old, however, are still considered "intern drivers" or "new drivers" (in Chinese, ž`ø:, shíxí siji), and certain limitations apply to them (for example, they must display a uniform label on the car when they are driving). The PRC considers the driving licence, under a new law, an administrative licence (in Chinese, L?¸ï, xíngzhèng xuke).

Norway

Minimum age for cars is 18 years. Mopeds (50 cc) and smaller motorcycles (engine capacity equal to, or less than 125 cubic centimetres) is 16 years. Most larger truck licenses require holder to be 21 years old. Although Norway is not part of the EU, the license is in the form of an EU license.

India

Each state has a "Regional Transport Authority" or RTO which issues licenses. Minimum age is 16 years for small motorcycles (50cc or less) and 18 for all other vehicles. Drivers have to appear for an oral test to get a learners license which is valid for 12 months. Drivers can then pass a driving test to get the drivers license.

Special licenses

In the United States and Canada, persons who drive commercially (especially truckers and taxi drivers) are required to have special licenses. For taxicab drivers, these licenses are usually called Chauffeur Permits. In most cases, commercial truckers must hold a commercial driver's license or CDL. In the United Kingdom, one must hold a Passenger Service Vehicle (PSV) license to drive a bus carrying more than eight passengers, or a Large Goods Vehicle (LGV) license to drive a truck (lorry) licensed to carry a weight greater than 3500 kg. Special licenses can also be required in order to transport hazardous materials. The cost of taking the series of tests and examinations to obtain these licenses usually means that an employer would subsidize their drivers.

International considerations

The holder of a license from any EU member country can drive in any other EU country. Most countries worldwide will also recognize the licenses of citizens of foreign states wishing to drive as visitors. All EU member countries now issue licenses in a standard format, regardless of the language of the license.

The International Driving Permit (IDP) (sometimes erroneously called the International Drivers' Licence) is a booklet which is an authorized translation of a driver's home license into many languages (especially languages with different scripts such as Cyrillic, Arabic, Chinese, Japanese, etc.). In some cases, it is obtained from the Automobile Association or equivalent organization in the driver's home country; in other cases, it is delivered by the same government services that deliver ordinary licenses. The IDP has no validity except when used in conjunction with the driver's own license. The existence of the IDP is motivated by many countries not recognizing driver's licenses written in foreign languages and not coming with an authorized translation.

The People's Republic of China at present does not recognize IDPs (although Hong Kong and Macao do) and requires drivers to get an additional PRC license before being officially allowed on all roads.

Most licence issuing authorities require people who hold "foreign" driving licences who move their residence to their area to obtain a local driving licence within a limited time (typically 1 year), although European Union drivers who move from one EU state to another can continue driving on their original licences until age 70. In most cases, the driver will have to follow the full local procedure for obtaining a licence, but some countries have mutual recognition agreements and will exchange the foreign licence for a local one without the need to take an additional driving test, e.g. U.S. states; Great Britain will (as of 2006) exchange full licences issued by Australia, Barbados, British Virgin Islands, Canada, Falkland Islands, Hong Kong, Japan, Monaco, New Zealand, Singapore, South Africa, South Korea, Switzerland and Zimbabwe.

Use as identification

Because the United States and Canada have no national identification cards and because of the widespread use of cars, drivers' licenses are typically used in both countries as a form of identification. Most state and provincial driver's license bureaus also issue identification cards for nondrivers. It should be noted, however, that as of 2006 Americans are required to present a passport for entry into Canada.

Many European countries require adults to carry an ID card at all times. Citizens of the UK and Ireland and other EU countries which have no national ID cards, have to carry their passports instead when travelling in these countries. In the PRC, the driver's license number is synonymous with the ID number of a Chinese citizen (up to 18 digits long).

Similarly, Saudi Arabia requires all drivers to carry an ID card in addition to a license, and present them whenever requested. Using a driver's license instead is only permitted if the request is made for on-site inspection/identification purposes, especially at check points. Expats may be requested to present their visas too.

Miscellaneous

Under the U.S. Uniform Anatomical Gift Act, the various states are encouraged to set up programs through which licensed drivers can make organ donations for the purpose of transplant by a notation on their licenses.

Likewise, in the UK many choose to have an organ donation listed on their license however it is by no means compulsory.

History

France and Germany were among the earliest countries to require mandatory driver licensing, right at the start of the 20th century. As automobile-related fatalities soared in North America, public outcry provoked legislators to begin studying the French and German statutes as models**[10]**.

On August 1, 1910, North America's first driver licensing law went into effect in the U.S. state of New York, though it initially applied only to professional chauffeurs **[11]**. In July of 1913, the state of New Jersey became the first to require all drivers to pass a mandatory examination before receiving a license **[12]**.

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Radar detector

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A *radar detector* is an electronic device used by motorists to determine if their speed is being monitored. The term originates from early speed-detection technologies, in which police bounced a radio wave off a moving vehicle with a device called a radar gun that determined the vehicle's speed by the Doppler-effect-moderated change in the wave's frequency. Most of today's radar detectors detect signals across a variety of wavelength bands - usually X, K, and Ka bands (and Ku, in Europe, also recently approved for use in the U.S).

Newer speed-detection technology uses pulsed laser light (LIDAR, commonly referred to as laser detection) rather than radio waves. Modern "radar detectors" have been adapted to suit that technology, by detecting the infrared light emitted by these new detection methods. LIDAR detection is not nearly as reliable as the detection of radar, since the light is much more focused and often aimed below the windscreen level, where the detector is usually mounted. (The reflective coating of the vehicle licence plate is an excellent laser beam reflector.)

There are many products that are advertised to claim to "scramble" or "absorb" radar; many of these scrambler devices do not work at all, and if they do work, it is by emitting an active radar scrambling pulse, which makes the device illegal to operate under in many jurisdictions.

Despite the advent of LIDAR speed detection, radar remains more prevalent for several reasons, not the least of which are the lower costs of radar (although some insurance companies supply laser guns to police departments for free). Popular radar detector brands include Escort, Valentine One, Beltronics, Whistler, Cobra and K40.

In some countries, using a radar detector is declared illegal and may be subject of fines or seizure of the device. Because the detectors are built around a superheterodyne receiver, and its local oscillator radiates a little, it is possible to build a radar detector-detector which detects such emissions (usually the frequency of the radar they are detecting, plus about 10 MHz) - some police radar guns are equipped with it. But electronic warfare cuts both ways, and the detector detectors use a superhet receiver too, so some radar detectors are equipped with a radar detector detector detector circuit, which shuts down the main radar receiver when the detector detector's signal is sensed, thus preventing being sensed by the police equipment. This problematics is related to technical surveillance countermeasures and ELINT.

See also

- Road safety

Road safety

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The field of *road safety* is concerned with reducing the numbers or the consequences of vehicle crashes, by developing and implementing management systems ideally based in a multidisciplinary and holistic approach, with interrelated activities in a number of fields. This has not always been the case, some historical road safety initiatives were based on overly simplistic models of driver behaviour.

History

Crashes seem as old as automobile vehicles themselves. Nicolas-Joseph Cugnot crashed his steam-powered "Fardier" against a wall in 1770. The first recorded automobile fatality was Bridget Driscoll in August 17, 1896 in London.

Many of the earliest innovations in road safety are credited to William Phelps Eno, sometimes known as the "father of traffic safety". He is credited with conceiving the stop sign, the traffic circle (roundabout), the one way street, and many other features of traffic control that are taken for granted today.

The earliest methods for improving road safety included traffic signs and signals, and road markings such as center lines, as well as compulsory driver testing and licensing.

The foregoing list of early interventions are some examples of the "three E's": Engineering, Education, and Enforcement efforts to overcome human error and imperfect human reliability. Road user error has been recognised as a principal causative factor of collisions from the beginning, since the percentage of crashes directly attributable to animals or mechanical failure is very small. The term "crash" is preferred by authorities rather than the popular term "accidents" so as to also encompass rare but deliberate acts, such as road rage. Generally, crashes appear to be results of the "three I's", that is, inattention, illness, or impairment, rather than malice or terror. Vulnerable road users bear the consequences of the 3 I's, even in the cases when they themselves are inattentive, ill, or impaired rather than a motorized user being, perhaps, impaired.

Defining the problem

The standard measures used in assessing road safety interventions are fatalities and Killed or Seriously Injured (KSI) rates, usually per billion (10_9) passenger kilometres.

Speed is a key goal of modern road design, but impact speed determines the severity of injury to both occupants and pedestrians. For occupants, Joksch (1993) found the probability of death for drivers in multi-vehicle accidents increased as the fourth power of impact speed (often referred to by the mathematical term ´v ("delta V"), meaning change in velocity).

Pedestrians travel slowly, so ´v is dominated in pedestrian collisions by vehicle speed. Best estimates suggest that 5% of pedestrians who are struck at 20 mph (30 km/h) are killed, 45% at 30 mph (50 km/h) and 85% at 40 mph (65 km/h) (Ashton and Mackay, 1979). On highways there are few pedestrians: same-direction crashes may have a low ´v (although this may end up in a high ´v if one or both vehicles then hits a stationary object) while opposing-direction crashes will have ´v of roughly double mean free travelling speed, so most highways separate opposing traffic flows.

In the United Kingdom, pedestrians and pedal cyclists accounted for about 45% of KSI in built-up (urban) areas -- compared to 5% of KSI on roads intended solely for motorized traffic. Ongoing safety issues in built-up areas has led in some cases to a surprising reversal of a long-standing strategy: the strategy of segregating motorists from other, more vulnerable road users by the use of footpaths, underpasses, guard rails, etc.

The scale of the problem

Increasing motorisation has resulted in a corresponding growth in crashes and it is currently accepted that in most OECD countries the cost of road traffic collisions amounts to about two per cent of their Gross domestic product (GDP). In developing countries, these losses can be greater than the amount received in international aid and loans, a fact that has prompted the World Bank and the Asian Development Bank to include activities in this field as one of its priorities. In terms of fatalities, the worldwide estimation was 800,000 per year in 1999, forecast to grow to between 1.1 and 1.2 million by 2010 and to between 1.3 and 1.4 million by the year 2020. (Silcock, 2003). It has been estimated that cars have killed more people since their invention than all wars in the same period (including both World Wars).

Casualty rates vary widely from country to country, for reasons which are only imperfectly understood, although Smeed's law has been advanced as a partial explanation.

KILLED per 1 BILLION (10^9) Veh·Km year 2003		**KILLED per 1 BILLION Veh·Km** year 2003	
Country (alphabetically)	**Rate**	**Country** (re-ordered by rate)	**Rate**
Australia	8.0	Finland	7.6
Austria	11.7	United Kingdom	7.6
Belgium	16.3	The Netherlands	7.7
Canada	8.9	Australia	8.0
Czech Republic	31.7	Norway	8.3
Denmark	9.7	Sweden	8.3
Finland	7.6	Switzerland	8.8
France	10.9	Canada	8.9
Germany	9.7	The United States	9.4
Greece	26.7	Denmark	9.7
Iceland	16.0	Germany	9.7
Ireland	10.9	France	10.9
Italy	10.9	Ireland	10.9
Japan	11.2	Italy	10.9
Korea	26.0	Japan	11.2
The Netherlands	7.7	Austria	11.7
New Zealand	12.4	New Zealand	12.4
Norway	8.3	Iceland	16.0
Slovak Republic	46.9	Belgium	16.3
Slovenia	16.7	Slovenia	16.7
Sweden	8.3	Korea	26.0
Switzerland	8.8	Greece	26.7
United Kingdom	7.6	Czech Republic	31.7
The United States	9.4	Slovak Republic	46.9

source: International Road Traffic and Accident Database (IRTAD); all countries listed with overall fatality rates.

Top 10 Leading Contributors to the Global Burden of Disease or Injury

1990		2020	
Disease or Injury		Disease or Injury	
1	Lower respiratory infections	1	Ischaemic heart disease
2	Diarrhoeal diseases	2	Unipolar major depression
3	Perinatal conditions	3	Road traffic injuries
4	Unipolar major depression	4	Cerebrovascular disease
5	Ischaemic heart disease	5	Chronic obstructive pulmonary disease
6	Cerebrovascular disease	6	Lower respiratory infections
7	Tuberculosis	7	Tuberculosis
8	Measles	8	War
9	Road traffic injuries	9	Diarrhoeal diseases
10	Congenital Abnormalities	10	HIV

Source: Murray CJL, Lopez AD, eds.

In order to build a ranking, epidemiologist use estimated DALYs (disability-adjusted life years) lost as the measure of the burden of disease.

As can be seen, road traffic injuries are a growing health problem, and for year 2020 it is expected that will come to the third position. This is partly due to improvements in medicine reducing deaths from other causes but largely due to the steady increase in motorisation around the world, reflecting the greater severity of motor traffic versus other causes of injury. In the UK, for example, motor traffic injuries are responsible for one in ten child hospital admissions but over half of all injury fatalities (2002 figures).

The scale of road casualties is also a concern for public health because it deters active travel (walking, cycling, etc.), and journeys deterred from these modes themselves become part of the problem.

Interventions

Interventions take many forms.

Road design

On neighborhood roads where many vulnerable road users, such as pedestrians and bicyclists (both young and old) can be found, traffic calming can be a tool for road safety. Shared space schemes, which rely on human instincts and interactions, such as eye contact, for their effectiveness, and are characterised by the removal of traditional traffic signals and signs, and even by the removal of the distinction between carriageway (roadway) and footway (sidewalk), are also becoming increasingly popular. Both approaches can be shown to be effective.

Outside neighborhood roads, design features are added to increase motorized safety and mobility. These features come at increasing costs; costs which include monetary amounts, decreased or discouraged usage by non-motorized travelers, as well as aesthetics. Benefits include a broader spectrum of occupational, cultural and entertainment options than enjoyed by more travel-limited generations.

At the other end of the spectrum from neigborhood roads are motorways, which may be called freeways, limited access highways, Autobahnen, Interstates or other national names. Motorways have the best engineered road features, limited access and minimise opportunities for conflict so are typically the safest roads per mile travelled and offer better fuel economy despite higher average speeds.

Road Design Features

Better highways are banked on curves in order to reduce the need for tire-traction and increase stability for vehicles with high centers of gravity. Most roads are cambered (crowned), that is, made so that they have rounded surfaces, to reduce standing water and ice, primarily to prevent frost damage but also increasing traction in poor weather. Some sections of road are now surfaced with porous bitumen to enhance drainage; this is particularly done on bends.

Most street furniture is now designed to absorb impact energy and minimize the risk to the occupants of cars, and bystanders. For example, most side rails are now anchored to the ground, so that they cannot skewer a passenger compartment, and most light poles are designed to break at the base rather than violently stop a car that hits them. Some street furniture is designed to collapse on impact. Highways authorities have also removed trees in the vicinity of roads; while the idea of "dangerous trees" has attracted a certain amount of skepticism, unforgiving objects such as trees can cause severe damage and injury to any errant road users.

Road hazards and intersections are now usually marked several times, roughly five, twenty and sixty seconds in advance so that drivers are less likely to attempt violent maneuvers.

Most signs and road line paint are retro-reflective, incorporating small glass spheres to reflect headlights more efficiently.

Lane markers in some countries and states are marked with Cat's eyes or Botts dots, bright reflectors that do not fade like paint. Botts dots are not used where it is icy in the winter, because frost and snowplows can break the glue that holds them to the road, although they can be embedded in short, shallow trenches carved in the roadway, as is done in the mountainous regions of California.

In some countries major roads have "tone bands" impressed or cut into the edges of the legal roadway, so that drowsing drivers are awakened by a loud hum as they release the steering and drift off the edge of the road. Tone bands are also referred to as "rumble strips," owing to the sound they create.

The U.S. has developed a prototype automated roadway, to reduce driver fatigue and increase the carrying capacity of the roadway. Roadside units participating in future Wireless vehicle safety communications networks have been studied.

There is some controversy over the way that the motor lobby has been seen to dominate the road safety agenda. Some road safety activists use the term "road safety" (in quotes) to describe measures such as removal of "dangerous" trees and forced segregation of the vulnerable to the advantage of motorized traffic. Orthodox "road safety" opinion fails to address what Adams describes as the top half of the risk thermostat, the perceptions and attitudes of the road user community.

Motorway

Motorways have the highest design standards for speed, safety and fuel efficiency. Motorways improve safety by:

- prohibiting vulnerable road users
- prohibiting slow-moving vehicles, thus reducing speed variation and potential ´v for same-direction travel
- segregating opposing traffic flows with median dividers or crash barriers, thus reducing potential ´v for opposite-direction collisions
- separating crossing traffic by replacing intersections with interchanges, thus reducing potential ´v into the side, most vulnerable vehicle section (side impacts are also responsible for some of the most serious traumatic brain injuries)
- removing roadside obstacles.

Although these roads may experience greater severity than most roads to due higher speeds in the event of a crash, the probably of a crash is reduced by removing interactions (crossing, passing, slower and opposing traffic), and crash severity is reduced by removing massive, fixed objects or surrounding them with energy attenuation devices (e.g. guardrails, wide grassy areas, sand barrels). These mechanisms deliver lower fatalities per vehicle-kilometer of travel than other roadways, as documented in the following table.

In general, fatality rates are inversely correlated with AADT (average annual daily traffic), and this is remains true for motorways. It is unclear if higher AADT are generally correlated with lower fatality due to better access to medical care, lower speed variances, lower speeds, or other mechanisms such as Smeed's law.

KILLED per 1 BILLION Veh-Km

year 2003

Country	Motorways	Non-Motorways	Motorway AADT	Motorway Usage (% of Road Travel)	Maximum Motorway Speed Limit in 2003 in km/h (mph)
Austria	5.9	13.4	30,077	23%	130 (80)
Czech Republic	9.9	34.3	25,714	11%	130 (80)
Denmark	3.0	11.9	29,454	25%	130 (80)
Finland	1.4	8.3	22,780	10%	120 (75)
France	4.0	12.8	31,979	21%	130 (80)
Germany	3.8	12.4	48,710	31%	130 (80) (advisory)
Ireland	7.4	11.0	26,730	4%	120 (75)
Japan	4.0	11.9	26,152	9%	100 (60)
The Netherlands	2.1	11.7	66,734	41%	120 (75)
Slovenia	8.1	18.7	15,643	19%	130 (80)
Sweden	2.5	9.9	24,183	21%	110 (70)
Switzerland	2.8	11.8	43,641	33%	120 (75)
United Kingdom	2.0	9.3	85,536	23%	110 (70)
United States	5.2	10.7	39,634	24%	120 (75)

definition: AADT - average annual daily traffic. The bi-direction traffic count representing an average 24-hour day in a year. Sometimes called "traffic density" although it ignores or assumes a constant number of travel lanes.

source: International Road Traffic and Accident Database (IRTAD), Risk Values in 2003 and Selected References Values for 2003 -- courtesy of the Bundesanstalt für Straßenwesen, that is, the (German) Federal Highway Research Institute. Travel was computed by dividing the fatality rate by the number of fatalities; AADT by dividing travel by the length of the motorway network. 2003 speed limits were obtained from the Wiki page and verified with other sources.

Motorways are far more expensive and space-consumptive to build than ordinary roads, so are only used as principal arterial routes. In developed nations, motorways bear a significant portion of motorized travel; for example, the United Kingdom's 3533 km of motorways represented less than 1.5% of the United Kingdom's roadways in 2003, but carry 23% of road traffic.

The proportion of traffic borne by motorways is a significant safety factor. For example, even though the United Kingdom had a higher fatality rates on both motorways and non-motorways than Finland, both nations shared the same overall fatality rate in 2003. This result was due to the United Kingdom's higher proportion of motorway travel.

Similarly, the reduction of conflicts with other vehicles on motorways results in smoother traffic flow, reduced collision rates, and reduced fuel consumption compared with stop-and-go traffic on other roadways.

The improved safety and fuel economy of motorways are common justifications for building more motorways. However, the planned capacity of motorways is often exceeded in a shorter timeframe than initially planned, due to the under estimation of the extent of the suppressed demand for road travel. In developing nations, there is significant public debate on the desirability of continued investment in motorways.

Motorways around the world are subject to a broad range of speed limits. Recent experiments with variable speed limits based on automatic measurements of traffic density have delivered both improvements in traffic flow and reduced collision rates, based on principles of turbulent flow analysis.

Drivers and vehicles

Safety interventions focusing on the driver and vehicle include:

- Seat belts, including seat belt legislation. Seat belts are now fitted by law in both front and rear of most passenger cars and an increasing number of public transit vehicles.
- Safety cages, which protect the driver from intrusion by impacting objects, and crumple zones, which absorb collision energy.
- Compulsory training and licensing (although this is often a once-off thing some countries require periodic retests and others will require drivers convicted of offences to undergo certain training and retests before being allowed back on the roads).
- Restrictions on driving while drunk or impaired by drugs.
- Restrictions on mobile phone use while on the move.
- Compulsory safety testing of vehicles over a certain age.
- Compulsory insurance to compensate victims.
- Restrictions on commercial vehicle driver hours, and fitting of tachographs.

Some of these interventions have been opposed by car manufacturers (see Unsafe at Any Speed) or by drivers, or by academics who believe that because of the risk compensation effect some of these measures may actually reduce road safety overall.

Employers currently escape, for the most part, the chain of responsibility for their employees' driving on company business. Truck drivers, especially self-employed ones, can be given unrealistic deadlines to meet. There are moves to bring driving for work (both commercial vehicles and, more controversially, private cars driven on company business) under the umbrella of workplace safety legislation. These are strongly resisted as they would place a far greater burden on employers and employees alike: penalties for industrial safety infractions are typically much greater than for negligent motor vehicle use.

Other road users

Interventions aimed at improving safety of non-motorised users:

- segregated facilities such as cycle lanes, underpasses and overbridges
- pedestrian barriers to prevent pedestrians crossing at junctions
- limiting pedestrian access to highways
- bicycle helmet promotion and compulsion

- traffic awareness campaigns such as the "one false move" campaign documented by Hillman et. al.
- pedestrian crossings, which are seen as restricting the number of points at which a road may be crossed and often requiring detours.
- traffic calming and speed humps
- shared space schemes giving ownership of the road space and equal priority to all road users, regardless of mode of use
- reduced urban speed limits
- rigorous speed limit enforcement by automated means such as speed cameras

Criticisms

Non-motorised lobby

Pedestrians' advocates, environmental groups and related organisations such as RoadPeace have been strongly critical of what they see as moves to solve the problem of danger posed to vulnerable road users by motor traffic through increasing restrictions on vulnerable road users, an approach which they believe both blames the victim and fails to address the problem at source. This is discussed in detail by Dr Robert Davis in the book Death on the Streets: Cars and the mythology of road safety, and the core problem is also addressed in books by Professor John Adams, Mayer Hillman and others.

It is argued by some that the problem of road safety is largely being stated in the wrong terms because most road safety measures are designed to increase the safety of drivers, but many road traffic casualties are not drivers (in the UK only 40% of causalties are drivers), and those measures which increase driver safety may, perversely, increase the risk to these others, through risk compensation.

The core elements of the thesis are:

- that vulnerable road users are marginalised by the "road safety" establishment
- that "road safety" interventions are often centred around reducing the severity of results from dangerous behaviours, rather than reducing the dangerous behaviours themselves
- that improved "road safety" has often been achieved by making the roads so hostile that those most likely to be injured cannot use them at all
- that the increasing "safety" of cars and roads is often counteracted wholly or in part by driver responses (risk compensation).

Pedestrians in particular are often reluctant to use segregated facilities which involve them in extra distance, extra effort (e.g. overbridges) or perceived extra risk (underpasses, often a haunt of muggers). Pedestrians' advocates question the equitability of reducing the danger posed to pedestrians by car drivers, through mechanisms which place the primary burden on the victims.

Case study: UK pedestrian safety

The "road safety" establishment is proud of the fact that the UK has among the best pedestrian safety records in Europe, as measured in pedestrian KSI per head of population. But it has been noted that this value would also be low if the roads were sufficiently dangerous as to deter pedestrians from using them at all. One way of testing this hypothesis would be to compare rates for those whose transport options are most limited, the elderly and children. Hillman and others have done this and found that:

- Britain's child pedestrian safety record is worse than the average for Europe, in contrast to the better than average all-ages figure (Department for Transport)
- Children's independent mobility is increasingly curtailed, with fear of traffic being cited as a dominant cause (Hillman, Adams, Whitelegg)
- Distances walked have declined more than in other European countries
- Similar (though less well-defined) observations can be made regarding the elderly

So there is some evidence at least to support the contention that Britain's roads are not in fact particularly safe at all, it is just that the vulnerable are too intimidated to use them.

Motorised lobby

Driver's organisations and road safety campaigning organisations such as the Association of British Drivers and Safe Speed in the UK argue that the strict enforcement of speed limits does not necessarily result in safer driving, and may even have a negative effect on road safety in general. These claims are not supported by peer-reviewed evidence.

Many groups argue that speed humps result in increased air pollution, increased noise pollution, and even unnecessary vehicle damage.

See also

- Car safety
- Stop sign

Further reading

- Death on the Streets: Cars and the mythology of road safety, Robert Davis, Leading Edge 1993, ISBN 0948135468
- One False Move: a study of children's independent mobility, Mayer Hillman, John Adams, John Whitelegg, Policy Studies Institute 1991, ISBN 0853744947
- Risk, John Adams, UCL Press 1995, ISBN 1857280687

Traffic signs

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Most countries erect signage, known as *traffic signs* or *road signs*, at the side of roads to impart information to road users. Since language differences can create barriers to understanding, international signs using symbols in place of words have been developed in Europe and adopted in most countries and areas of the world. Annexe 1 of the Vienna Convention on Road Signs and Signals of November 8, 1968 defines eight categories of signs:

- **A. Danger** warning signs
  - B. Priority signs
  - C. Prohibitory or restrictive signs
  - D. Mandatory signs
  - E. Special regulation signs
  - F. Information, facilities, or service signs
  - G. Direction, position, or indication signs
  - H. Additional panels

However, countries and areas categorise road signs in different ways. In the U.S., the type, placement, and graphic standards of traffic signs and pavement markings are legally regulated — the Federal Highway Administration's Manual on Uniform Traffic Control Devices is the standard.

History

The earliest road signs gave directions; for example, the Romans erected stone columns throughout their empire giving the distance to Rome. In the Middle Ages multidirectional signs at intersections became common, giving directions to cities and towns.

Traffic signs became more important with the development of automobiles. The basic patterns of most traffic signs were set at the 1908 International Road Congress in Rome. Since then there have been considerable change. Today they are almost all metal rather than wood and are coated with retroreflective sheetings of various types for nighttime and low-light visibility.

New generations of traffic signs based on big electronic displays can also change its symbols and also provide intelligent behavior by means of sensors or by remote control. In this sense, "road beacons" or RBS based in the use of RFID special transponders buried in the asphalt arise as an innovative evolution for on-board signalling.

Yet another "medium" for transferring information ordinarily associated with visible signs is RIAS (Remote Infrared Audible Signage), for print-handicapped (including blind/low-vision/illiterate) people. These are infra-red transmitters serving the same purpose as the usual graphic signs when received by an appropriate device such as a hand-held receiver or one built into a cell phone.

North America and Australia

Categorization

Regulatory signs
Warning signs
Guide signs
Route marker signs
Expressway signs
Freeway signs
Informational signs
Recreational and cultural interest signs
Emergency management (civil defense) signs
Temporary traffic control (construction or work zone) signs
School signs
Railroad and light rail signs
Bicycle signs

Colour schemes

The North American colors and the Australian colours are normally significant as followed:

green with white letters for informational signs, such as directions, distances, and places
brown with white for signs to parks, historic sites, ski areas, forests, and campgrounds
blue with white for rest areas, food, gasoline or petrol, and lodging
white with red or black letters for regulatory signs, such as speed limits or parking
yellow with black letters and symbols for warning signs, such as curves and school zones
orange with black letters for temporary traffic control zones and detours

Regulatory signs are also sometimes seen with white letters on red or black signs. In Quebec, the usage of blue and brown is reversed, and many black-on-yellow signs are red-on-white instead. Many U.S. states now use fluorescent orange for construction signs, and fluorescent yellow-green (FYG) for school zone, crosswalk, pedestrian, and bicycle warning signs. Fluorescent pink signs are sometimes used for incident management warning.

Highway symbols and markers

Every state and province has different markers for its own highways, but use standard ones for all federal highways. Many special highways, such as the Queen Elizabeth Way or Trans-Canada Highway, or originally on U.S. highways like the Dixie Highway, have used unique signs. Counties in the U.S. sometimes use a pentagon-shaped blue sign with yellow letters for numbered county roads, though the use is inconsistent even within states.

Units

Most American road signs measure distances in miles rather than kilometres although the US Department of Transportation has developed metric standards for all signs. Traffic signs in the United States have been standardised through the Manual on Uniform Traffic Control Devices (MUTCD), though they sometimes still vary from state to state, particularly on older signs.

Languages

Signs in most of Canada, the U.S. and Australia are written in English. Quebec uses French, while New Brunswick uses both English and French and a number of other provinces such as Ontario and Manitoba use bilingual French-English signs in certain localities. Mexico uses Spanish. Within a few miles of the U.S.-Mexico border, road signs are often in English and Spanish.

Typefaces

The typefaces predominantly used on signs in the U.S. and Canada are the FHWA alphabet series (Series B through Series F and Series E Modified). Details of letter shape and spacing for these alphabet series are given in "Standard Alphabets for Traffic Control Devices," first published by the Bureau of Public Roads (BPR) in 1945 and subsequently updated by the Federal Highway Administration (FHWA). It is now part of Standard Highway Signs (SHS), the companion volume to the MUTCD which gives full design details for signfaces.

Initially, all of the alphabet series consisted of uppercase letters and digits only, although lowercase extensions were provided for each alphabet series in a 2002 revision of SHS. Current Series B through Series F evolved from identically named alphabet series which were introduced in 1927.

Straight-stroke letters in the 1927 series were substantially similar to their modern equivalents, but unrounded glyphs were used for letters such as B, C, D, etc., to permit more uniform fabrication of signs by illiterate painters. Various state highway departments and the federal BPR experimented with rounded versions of these letters in the following two decades.

The modern, rounded alphabet series were finally standardised in 1945 after rounded versions of some letters (with widths loosely appropriate for Series C or D) were specified as an option in the 1935 MUTCD and draft versions of the new typefaces had been used in 1942 for guide signs on the newly constructed Pentagon road network.

The mixed-case alphabet now called Series E Modified, which is the standard for destination legend on freeway guide signs, originally existed in two parts: an all-uppercase Series E Modified, which was essentially similar to Series E except for a larger stroke width, and a lowercase-only alphabet. Both parts were developed by the California Division of Highways (now Caltrans) for use on freeways in 1948-50.

Initially the Division used all-uppercase Series E Modified for button-reflectorized letters on ground-mounted signs and mixed-case legend (lowercase letters with Series D capitals) for externally illuminated overhead guide signs. Several Eastern turnpike authorities blended all-uppercase Series E Modified with the lowercase alphabet for destination legends on their guide signs.

Eventually this combination was accepted for destination legend in the first manual for signing Interstate highways, which was published in 1958 by the American Association of State Highway Officials (AASHO) and adopted as the national standard by the BPR.

Uses of Non-FHWA Typefaces

The National Park Service uses Clarendon, a serif typeface, for guide signage (typically, but not always, on a brown background); some states also use Clarendon for recreational signage.

Georgia, in the past, used uppercase Series D with a custom lowercase alphabet on its freeway guide signs; the most distinctive feature of this typeface is the lack of a dot on lowercase 'i' and 'j'. More recent installations appear to include the dots.

A new typeface family titled "Clearview" has been developed by U.S. researchers in recent years to provide improved legibility, and is currently permitted for light legend on dark backgrounds under FHWA interim approval. Thus far, Clearview has only seen widespread use by state departments of transportation in Michigan, Pennsylvania, and Texas.

It is common for local governments, airport authorities, and contractors to fabricate traffic signs using typefaces other than the FHWA series; Arial and Helvetica are common choices.

Europe

In 1968, the European countries signed the Vienna Convention on Road Traffic treaty, the aim of which was to standardize traffic regulations in participating countries in order to facilitate international road traffic and to increase road safety. Part of the treaty was the Vienna Convention on Road Signs and Signals, which defined the traffic signs and signals. As a result, in Western Europe the traffic signs are well standardised nowadays, although there are still some country-specific exceptions in many countries, mostly dating from the pre-1968 era. The convention has been adapted to allow variations when countries weren't expected to follow the main standard.

The basic principle of the European traffic sign standard is that usage of certain shapes and colours are to be used systematically for indicating same purposes. Triangular shapes (white or yellow background) are used in warning signs. Additionally, the Vienna convention allows an alternative shape for warning signs, a diamond shape, which is rarely used in Europe. The prohibition signs in Europe are round with a red border. Informative and various other secondary signs are of rectangular shape. With the animal warning signs, one can notice national flavour quite often, (moose, frog, deer, cow etc.), and the convention allows any animal to be used.

Directional signs have not been harmonised under the Convention, at least not on ordinary roads. As a result, there are substantial differences in directional signage throughout Europe. Differences apply in typeface, type of arrows and, most notably, colour scheme. The convention however specifies a difference between motorways and ordinary roads, and that the motorways to have white-on-green (e.g. Italy, Switzerland, Sweden) or white-on-blue (e.g. Germany, France, UK).

Differences are larger for non-motorways: red-on-white in Denmark, white-on-blue in Italy, Sweden and Switzerland and black-on-yellow in Germany, Luxembourg and Norway. Other nations split among the non-motorways. In France and the UK, primary roads are signposted in white-on-green and other roads go in black-on-white.

Signposting road numbers differs greatly as well. Only European route number, if signposted, will always be placed in white letters on a green rectangle.

European countries use the metric system on road signs (distances in kilometres or metres, heights/widths in metres) with the notable exception of the UK, where distances are still indicated in miles. For countries driving on the left, the convention stipulates that the traffic signs should be mirror images of those used in countries driving on the right. This practice, however, is not systematically followed in the two European countries driving on the left, Ireland and the United Kingdom. The convention permits the usage of two background colours for commonly used signs with a light background, white or yellow. Most countries use white with a few exceptions like Sweden and Finland, for instance, where the yellow colour was chosen.

United Kingdom

Traffic signing in the UK conforms broadly to European norms, though a number of signs are unique to Britain and direction signs omit European route numbers. The standards governing the system remained of an advisory nature until 1933 when regulations for traffic signs were published under powers created by the Road Traffic Act 1930. In the late 1950s and early 1960s, the system currently in use was developed by the Anderson Committee, which established the motorway signing system, and by the Worboys Committee, which reformed signing for existing all-purpose roads.

The document governing traffic signing in Britain is the [Traffic Signs Regulations and General Directions (TSRGD)]. The current signing system was introduced on 1 January 1965. Britain remains the only European Union member nation to use Imperial measurements for distance and speed, although metric authorised-mass signs were prescribed in 1981 and there is now a dual-unit (imperial first) option for clearance signing.

Three separate colour schemes exist for direction signs. A road may be a motorway (white on blue), a primary route (white on dark green with yellow route numbers), or a non-primary route (black on white). Most trunk roads, which carry most of the automobile traffic and are owned by central government, and some local authority principal routes are signed as primary routes.

Guildford Rules

A system called the *Guildford Rules* is used to put directional information pertaining to routes of different class on patches coloured appropriately for those classes on direction signs. This patching system was developed in the mid-1980s as part of an effort to eliminate sign clutter and receives its name from the town of Guildford, Surrey, where the experimental signs were placed.

Example directional sign

The direction sign is patched according to the Guildford Rules. It gives directions to (Bristol) Parkway railway station (red British Rail symbol), motorways (blue-background patches), and towns reached via non-primary A-roads. Red-edged patches and red-bordered signs are used for military establishments (the Ministry of Defence at Abbey Wood in this example). Destinations which are reached indirectly have the corresponding road number in brackets; for instance, this sign says that Filton is reached by following the A4174 ring road to the A38, and then turning onto the A38 for Filton.

Typefaces

Multiple typefaces are specified for current British road signs. The Transport fonts are used for all legend on fixed permanent signs except route numbers on motorway signs. Two other typefaces called Motorway, are used for route numbers on motorway signs; these have elongated letters and are designed to add emphasis to route numbers on motorways.

Language

Bilingual signs are used in Wales. Welsh highway authorities choose whether they are "English-priority" or "Welsh-priority" and the language having priority in the highway authority's area appears first on signs. Most of south Wales is English-priority while north Wales is Welsh-priority. Bilingual signing in Wales and elsewhere has caused traffic engineers to inquire into the safety ramifications of providing sign legend in multiple languages. As a result some countries, like New Zealand, have opted to limit the use of bilingual signing.

In the Scottish Highlands, road signs often are found with the Scottish Gaelic given (in green) as well as the English (in black).

The Netherlands

Road signs in The Netherlands follow the Vienna Convention. Directional signs (which have not been harmonised under the Convention) always use blue as the background colour. The destinations on the sign are typically printed in white. If the destination is not a town (but an area within town or some other kind of attraction), that destination will be printed in black on a separate white background within the otherwise blue sign.

The Netherlands always signpost European road numbers where applicable (i.e. on the advance directional signs, the ID signs and on the reassurance signs). Dutch national road numbers are placed on a rectangle, with motorways being signposted in white on a red rectangle (as a A xx) and primary roads in black on a yellow rectangle (as N xx).

Signage intended for bike-riders always goes on white signs with red or blue letters.

The Dutch typeface, known as ANWB-Ee, is based on the US typeface. A new font, named ANWB-Uu (also known as Redesign), has been developed in 1997 and appears on many recent Dutch signs. The language of the signs is typically Dutch, even though bilingual signage may be used, when the information is relevant for tourists.

Finland and Sweden

The road signs in Finland and Sweden are similar and mostly follow the Vienna Convention with a few adaptations, however allowed within the convention:

- the background of warning and prohibitory signs is yellow
- the warning signs of moose and reindeer
- the background of direction signs is blue with white text
- the background of motorway direction signs is green with white text
- when applicable, the language of text is Swedish in Sweden, and either Finnish, Swedish or both in Finland.

Ireland

Until the partition of Ireland in 1922 and the independence of Southern Ireland (now the Republic of Ireland) British standards applied across the island. In 1926 road sign standards similar to those used in the UK at the time were adopted, albeit with Irish (Gaelic) type in addition to English. In 1956, road signs in the south were changed to markedly differ from the UK standard with the adoption of US-style "diamond" signs for many road hazard warnings (junctions, bends, railway crossings, traffic lights). Some domestic signs were also invented, such as the stay-left sign (a black curved arrow pointing to the upper-left, although these have mostly been replaced by the UK/European 'white arrow on blue disk' signs), while some other signs are not widely adopted outside Ireland, such as the no-entry sign (a black arrow pointing ahead in a white circle with a red slashed circumference).

In January 2005 Ireland adopted metric speed limits. Around 35,000 existing signs were replaced and a further 23,000 new signs erected bearing the speed limit in kilometres per hour. To avoid confusion with the old signs, each speed limit sign now has ‘km/h’ beneath the numerals.

Central and South America

Road signs in Central and South America vary from country to country. For the most part, conventions in signage tend to resemble North American signage conventions more so than European and Asian conventions. For example, warning signs are typically diamond shaped and yellow rather than triangular and white. Some variations include the "No Parking" sign, which uses a letter 'E' instead of 'P' (the Spanish and Portuguese word for 'Parking' is 'Estacionar'). Notable exceptions include speed limit signs, which follow the European conventions.

Asia

Singapore

Road signs in Singapore are all in English, one of the country's four official languages and the lingua franca of most of the population.

Expressway names are usually in 3 letter contractions such as PIE, for Pan Island Expressway. Singapore's road signs tend to be similar to those of the United Kingdom, with triangular warning signs and circular signs as restrictive signs. The signs usually use the Bureau Grotesque One Seven typeface, with the exception of street name signs, which have been produced using the Rotis Serif typeface since August 2001.

Malaysia

Traffic signs in Malaysia used blue signs for federal, state and municipal roads. Green signs used for toll expressway or highways only. State Road use letter. ExampleNegeri Sembilan <N125>, Melaka <M70>

People's Republic of China

Mainland China uses simplified Chinese characters for its traffic signs. It is gradually moving toward internationally-accepted signs; it abandoned, for example, a localised version of the "no parking sign" (with a Hanzi character) and used the blue-red cross sign as of the late 1990s.

In larger cities and on expressways of China, both English and Chinese are used.

Hong Kong Special Administrative Region

Although the mainland uses simplified Chinese characters, traditional Chinese characters are still used in Hong Kong (as the policy of "one country, two systems" allows Hong Kong to maintain most affairs, including road traffic regulations, the way they were prior to the handover).

Most, if not all, of Hong Kong's signs are bilingual, as English and Chinese are considered official languages. English often appears on top of text in traditional Chinese.

India

Africa

South Africa

South Africa has well developed standards for road signs. Triangular signs are used for warnings and circular signs are used for prohibitions. In the 1990s the colours of these signs were changed from white-on-blue with a red border to black-on-white with a red border. Some regulatory signs that enforce the direction of traffic flow, or minimum speed limits are white on blue.

Informational signs are rectangular and white on green on normal roads and white on blue on freeways. The information on these signs is usually in English, and sometimes in Afrikaans. Other informational signs, such as those that name rivers and towns are white, while tourist information signs are white on brown.

See also

- Traffic light

Circular highway shield

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A *circular highway shield* is a route marker consisting of a number superimposed on a circle. It is officially used for state highways in Delaware, Iowa, Kentucky, Mississippi, New Jersey, and Oklahoma, though Oklahoma will soon be changing to a state-outline design [1]. It is also officially used in Virginia for state secondary and frontage routes. Many road maps of areas in the United States use a circular highway shield as a generic marker for all state highways, because other designs are difficult to print and read.

Since three-digit route numbers are often too wide to fit in a circle of the same size and shape as a regular shield, some states horizontally elongate the circle. Other states will condense the typeface used, giving the numbers a tall, slender appearance.

Gantry

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A *gantry* is a traffic sign assembly in which signs are mounted on an overhead support. Gantries are usually built on high-traffic roads or routes with several lanes, where signs posted on the side of the highway would be hard to see for drivers.

Prohibitory traffic sign

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Prohibitory traffic signs are used to prohibit certain types of manoeuvres or some types of traffic.

Prohibitory traffic signs

No entry

This sign is used to indicate that no vehicles may enter; however, it often will not apply to pedestrians as well as pushed bicycles unless signalled otherwise.

Speed limits

See: Speed limit

Used to indicate either a minimum or maximum speed limit, or, in Germany, a recommended speed limit.

No parking

Amongst one of the most familiar signs, this sign is used where parking or stopping should be prohibited.

No overtaking

Either overtaking is prohibited for *all* vehicles or certain kinds of vehicles only (e.g. lorries, motorcycles, etc...)

Reassurance marker

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A *reassurance marker* is a form of guide sign that indicates the current route, typically posted at the side of a numbered highway. They are intended to reassure drivers that they are traveling on the correct road, hence the name. Such markers are most commonly found in the United States and Canada, where they usually take the form of a shield with the road number posted on it, with a plate above or below it indicating compass direction. Roads in many other countries, such as Australia and New Zealand, have similar marker setups, but usually without the direction sign. On larger roads, reassurance markers are sometimes posted on a sign that is elevated on a gantry.

Certain nations forgo reassurance markers for other forms of identification. In the United Kingdom and Ireland, for example, the current route is indicated on every sign at motorway junctions, underneath or beside which are forward destinations and an arrow pointing ahead.

Stop sign

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A *stop sign* is a traffic sign, usually erected at road junctions, that instructs drivers to make a brief and temporary, but complete, stop upon reaching it, and then to proceed only if the way ahead is clear.

Stop signs are not generally required at every intersection, but they are often used to control conflicting traffic movements at dangerous intersections which are not busy enough to justify the installation of either traffic lights or, especially in Europe, a roundabout. In the United States and Canada they are commonly used in residential areas, and near places where children play, as a general traffic calming measure. In these countries it is not uncommon for stop signs to be erected on all three or four intersecting roads.

The intentional removal of stop signs from their posted locations is a crime in most U.S. states. Fatal accidents caused by someone removing a stop sign on purpose could also result in manslaughter charges against the offender. The purposeful removal of stop signs began in the 1980s as a college prank and, today, one may find illegally obtained stop signs hanging in the occasional college dorm rooms. Anyone who wishes to legitimately obtain a stop sign for home display can purchase one new from a traffic supply house for about US$75.

The following remarks concerning the right-of-way rules at intersections with multiple stop signs apply to the United States and Canada:

- Generally, the driver who stops first continues first.
- If two drivers stop simultaneously at stop signs at a single intersection, the rule is that the car that comes to a complete stop first has the right of way. Common sense applies.
- Stop signs may be augmented with additional information such as a plate bearing the legend "4-way stop". This is important, because a driver accustomed to negotiating four-way stops may falsely believe when encountering a two-way stop that cross traffic is required to stop. Since the first car to stop has the right of way at a four-way stop, this driver may believe that it is safe to turn in front of the oncoming traffic. Therefore, if there is only a plain stop sign, the assumption has to be that cross traffic will not stop. "4-way stop" plates are provided on the fail-safe principle that if they are missing (through disrepair, vandalism, etc.) the "more dangerous" message is given.

Stop signs, usually based on the American design, are found all over the world, although in Europe they tend to be used far more sparingly than in North America (with most intersections lacking traffic lights being controlled by give way signs or equivalent road markings), stop signs generally being restricted (on the principle that "familiarity breeds contempt") to situations where coming to a dead stop is absolutely essential because of poor visibility at the intersection concerned. In all countries, the driver must actually stop at stop signs even if no vehicles or pedestrians are visible. However, some drivers practice the illegal manoeuvre known as a rolling or "California" stop: slowing down significantly but not stopping completely at the sign.

Yield signs ("Give way" signs in the UK, Australia, and New Zealand), on the other hand, require the driver only to slow and prepare to stop, but do not require an actual stop if the way ahead is clear.

History

Stop signs originated in Detroit, Michigan in 1915. The first had black letters on a white background and were somewhat smaller than the modern one. As they became more widespread, a committee supported by the American Association of State Highway and Transportation Officials (AASHO) met in 1922 to standardize them, and it selected the octagonal shape that has been used in the U.S. ever since. The unique eight-sided shape of the sign allows drivers facing the back of the sign to identify that oncoming drivers have a stop sign and prevent confusion with other traffic signs.

In 1924, the sign changed to black on yellow, the predominant color until 1954. Another competing group, the NCSHS, simultaneously advocated an even smaller, red-on-yellow stop sign. All of these signs were typically mounted only two or three feet above the ground.

These two organizations conflicted but eventually combined into the Joint Committee on Uniform Traffic Control Devices, which in 1935 published the famous Manual on Uniform Traffic Control Devices for Streets and Highways (MUTCD) detailing the stop sign's appearance. The MUTCD stop sign was altered eight times between 1935 and 1971, mostly dealing with its reflectorization and its mounting height; the most drastic change came in 1954, when the sign gained its white-on-red color. Red is also the color for stop on traffic signals, unifying red as stop signal for drivers worldwide.

The mounting height reached its current level of 2.1 m (7 ft) in 1971. Although already widespread, use of the MUTCD stop sign passed into law in the United States in 1966. They were later adopted by the European Union as part of their effort to standardize road travel across member countries.

Sign variants

Although English-speaking and European Union countries use the original word "STOP" on stop signs, most countries, and sometimes even smaller political districts, prefer to use a roughly equivalent word in their primary language instead; its appearance is otherwise the same of white text on a red octagon. The few known exceptions include Israel (which uses a solid white hand on a red octagon) and Japan (which uses the local word for Stop in white type on an inverted solid red triangle). Although the word used isn't universally standardized, some commonly seen examples are:

Language

Word

Countries or regions where used

Example

Arabic

BA

Arab countries including Saudi Arabia

Bulgarian

CTO

Bulgaria

Chinese

\ (tíng)

China, Hong Kong, Taiwan

In Mainland China, a stop sign is officially defined to "stop the vehicle to yield the passage" (Simplified Chinese: \f©L; Hanyu Pinyin: tíng ch ràng xíng). Older stop sign pursuant to GB 5768-86 resembled a triangular Yield sign [1], with more red color, so that it was more emphatic. GB 5768-1999 replacing GB 5768-86 (link in Chinese) has adopted the red octogon that would be almost the same as, though a little different from, the Taiwanese stop sign. However, the red triangular stop sign is still used in Japan (see below).

In Hong Kong both English and Chinese Language appears on the same stop sign, with English on top of Chinese.

In Taiwan, a standard stop sign is in Chinese only. English supplemental plates may be used, but they are rare on the road.

English

STOP

Australia, Canada outside of French-speaking Quebec and bilingual New Brunswick, European Union countries, Hong Kong, Russia, Singapore, United States.

French

ARRÊT

Parts of Canada such as Quebec, New Brunswick and Canadian airports. In Quebec, New Brunswick, and in the National Capital Region of Ontario and Quebec (Ottawa, Ontario and the surrounding suburbs in both Ontario and Quebec) it is common to find signs that are both unilingual French ("ARRÊT") or signs that are bilingual French and English ("STOP ARRÊT", or, more rarely, "ARRÊT STOP"). It is interesting to note that in Québécois French stop signs, the word "ARRÊT" is the noun form of the word "Stop", as in "a stop". In France, the English word "STOP" is used on all stop signs, due to European Union standarization.

Huron

SETEN

In parts of Canada with Wyandot people. Often seen as bilingual "ARRÊT SETEN" signs.

Inuktitut

Ä...rFf

Nunavut, Canada
Japanese

The Japanese Stop Sign resembles a triangular Yield sign, with more red color, so that it is more emphatic.
Portuguese

PARE

Brazil

Serbian

CTO

Serbia (This is not a Slavic word but merely the transliteration of the word "STOP" into Cyrillic characters)

Spanish

ALTO

Mexico and elsewhere

Spanish

PARE

Colombia, Ecuador, Peru, Dominican Republic, Puerto Rico, Argentina. (Stop signs are almost universally ignored in Argentina; at best, drivers slow down a bit.)

Turkish

DUR

Turkey

English / Spanish

STOP/ALTO

Along U.S.-Mexico border

See also

- Traffic sign
- Road safety

Street sign theft

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Street sign theft is when street signs are stolen, often to be used as decorations. Although the theft often seems arbitrary, unusual or amusing signs tend to be stolen more frequently. Sometimes considered to be a prank by the perpetrators, the theft is often expensive and inconvenient, and sometimes dangerous.

Popular culture can act as a catalyst to street sign theft. Popular bands The Beatles and Lynyrd Skynyrd have inadvertently perpetuated street sign theft as their songs and albums include real place names including Penny Lane, Abbey Road, and Brickyard Road. Television or radio productions named after addresses or streets will usually increase the theft of those signs. Jeff Foxworthy has alluded to street sign theft being a family hobby as a "sign one might be a redneck".

In law

In one notable United States case, the thieves were found guilty of manslaughter for stealing a stop sign, and thereby causing a deadly collision. This was popularized in the novel Driver's Ed by Caroline B. Cooney.

Specific and/or common examples

Popular culture examples

- Penny Lane and Abbey Road, caused by the Beatles (See above). In addition, Penny Lane in Liverpool is directly opposite halls of residence used by first years at the University of Liverpool; presumably due to constant theft, the road sign at one end is painted on, while at the other end it is positioned high up on the side of a house.
- Brickyard Road, Clay County, Florida (See above). Fans repeatedly stole the road sign because lead singer Ronnie Van Zant was living there before his

death in 1977 and his brother, Johnny Van Zant, released an album and single called Brickyard Road in 1990.

  - The county eventually erected a concrete pillar with the street name painted on it, as opposed to a traditional road sign.

- Nirvana Avenue, Melbourne, Australia generally suffers the same fate because of the association with the band called Nirvana.
- Beer Road, on the outskirts of Orange, Australia. Due to the street sign being constantly stolen, the local council has resorted to attaching name stickers to armco guard railings at the start of the road.

TV shows

Coronation Street
Jump Street
Wisteria Lane
Shortland Street

Other culture and language

- Any highway or road numbered 420 is a prime target for theft because of its cannabis connotations.
- The same holds true for 666. U.S. Highway 666 was renamed to 491 in 2003 due to pressure by New Mexico governor Bill Richardson over "infamy brought by the inopportune naming of the road [as the 6th branch of Highway 66." An enthusiast cites Department of Transportation officials which pointed to sign theft. Skeptics, including National Geographic, believe that the religious right were the driving force behind the change.
- New Jersey suffered a similar problem: the state changed its Route 69 to Route 31 in 1967 because of theft, due to the sexual meaning of the number 69.
- Shades Of Death Road in Liberty Township, New Jersey, is desirable for a number of tales about the road and the name itself. Local vigilantes took matters into their own hands and put various lubricants on the pole holding the sign to make it impossible to climb. The other street signs along the road, in two other townships, are metal poles with the names of both intersecting streets in vertical type, harder to read but less attractive to thieves.
- Fucking, Austria is also a popular target for street sign thieves, and its border sign is the most stolen street sign in Austria.
- Because of the sexual connotation of its name, the town of Intercourse, Pennsylvania is a frequent victim of sign theft.
- Swedish Moose warning signs are often stolen by German tourists fascinated by the animal.

Variable message signs

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A *variable* (also *changeable*, *electronic*, or *dynamic*) *message sign*, often abbreviated *VMS* or *CMS*, is an electronic traffic sign often used on roadways to give travelers information about special events. Such signs warn of traffic congestion, accidents, incidents, roadwork zones, or speed limits on a specific highway segment. They may also ask vehicles to take alternative routes, limit travel speed, warn of duration and location of the incidents or just inform of the traffic conditions.

A complete message on a panel generally includes a problem statement indicating incident, roadwork, stalled vehicle etc; a location statement indicating where the incident is located; an effect statement indicating lane closure, delay, etc and an action statement giving suggestion what to do traffic conditions ahead. These signs are also used for AMBER Alert messages.

In some places, VMSes are set up with permanent, semi-static displays indicating predicted travel times to important traffic destinations such as major cities or interchanges along the route of a highway.

VMSes were deployed at least as early as the 1960s. The current VMS systems are largely deployed on freeways or trunk highways.

Typical messages (such as those stipulated by the Minnesota Department of Transportation) provide the following information:

- Crashes, including vehicle spin-out or rollover
- Stalls affecting normal flow in a lane or on shoulders
- Non-recurring congestion, often a residual effect of cleared crash
- Closures of an entire road
- Downstream exit ramp closures
- Debris on roadway
- Vehicle fires
- Short-term maintenance or construction lasting less than three days
- Pavement failure alerts

The information comes from a variety of traffic monitoring and surveillance systems. It is expected that by providing real-time information on special events on the oncoming road, VMS can improve vehicles' route selection, reduce travel time, mitigate the severity and duration of incidents and improve the performance of the transportation network.

Warning signs

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A traffic *warning sign* is a type of traffic sign that indicates a hazard ahead on the road.

In most countries outside of North America, they often take the shape of an equilateral triangle with a thick red border and a white or yellow background.

In the People's Republic of China, however, they appear with a black border and a yellow background. In Sweden, Serbia and Montenegro, Bosnia and Herzegovina, Croatia, Finland, the (Former Yugoslav) Republic of Macedonia and Poland they have a red border with a yellow background. This is due to the weather, as it is easier to see a red/yellow sign in the snowy weather then a red/white sign. The polar bear warning sign on Svalbard recently changed from displaying a black bear on white background to a white bear on black background (both sign are/were triangular with a red border).

In the United States,Canada, Mexico, Australia, Japan, Philippines, and Malaysia warning signs are black on yellow and usually diamond-shaped, and construction signs are black on orange. Ireland also adopted these standards, diverging from UK standards. Some other countries also use these standards for some signage.

Warning signs

Warning signs can indicate any potential hazard, such as:

General Caution

Obstacles

Diamond-shaped with reflectors are placed at point of curbs, dividers, or other lane obstacles. Rectangular signs with diagonal stripes indicate solid objects such as barricades, bridge abutments, utility poles or natural obstacles near the roadway. Left side obstacles are marked with stripes running high to low, left to right; right side obstacle signs use stripes running high to low, right to left; in a sense akin to International symbol of arrow pointing down toward side toward roadway.

Things Near or Crossing the Roadway

Warns of wild animals (moose, bear, elk, deer, wallabies, kangaroos, aligators, etc) or farm animals (cows, horses, ducks, sheep) that may stray onto the road. Also equipment (tractors, forklifts, snowmobiles, golf carts, bicycles) crossing or traveling along the road. In the United States, a SHARE THE ROAD plaque is sometimes placed below these warning signs when used in this manner.

Road works or construction

Indicates road works (construction), poor roads, or temporary conditions ahead on the road including: flagmen, survey crew, single-lane, detour, bridge out, utility crew ahead, blasting area, bump, dip, frost heaves, flooding (or "High water"), soft shoulder, uneven pavement, freshly oiled road, loose gravel, smoke on road, trucks entering, etc.

Chevron Arrows

Used to indicate unexpected bends in the road, some being continuous, others being sharp-ended (right-angle turns). Left curve, right curve, series of curves. May also indicate direction of intersections along the upcoming curve. Also used to indicate "merge" with other traffic, as for an on-ramp of a limited-access highway.

Tunnels

Used to indicate tunnels, where lights are usually required, and a general change in the light level. May also indicate low ceiling clearance. Truck drivers should also watch for prohibited cargo signs (e.g., Hazmat, propane, explosives) upon approach to tunnels.

Bridges

Used where traffic may be constricted to a narrow bridge, or where the bridge may have a movable span closed to vehicles while boats pass (e.g., drawbridge or floating bridge). Also used for underpass to indicate low overhead clearance.

Traffic Lights

Used to indicate traffic lights, present when it is difficult to see that a traffic light may already be showing red, to warn a driver to prepare to slow down. May be supplemented with flashing light or lighted sign when light is red or turning red.

Warning Signs for Regulatory Signs

As for traffic signals, above, some "stop" or "yield" signs may require additional warning or reminder, especially in dense areas or where the sign has been added recently.

Level Crossings and Intersections

Warns drivers of road crossings at even level (crossroads, T-intersection, forks (Y-intersection), rotary/roundabout). May also indicate "hidden driveway" intersecting the road ahead. (Compare with bridges/overpasses/viaducts).

Lane Starts/ends

Indicates when a multilane highway is being narrowed, a passing lane is ending, or where the road is widening or a passing lane starting. Another type is used to indicate central "two-way" left turning lane in center of roadway. Warning signs may also warn of "Highway ends", where the road changes class or type. Also used for "dead end", "not a through street" or "no outlet" roadways.

No Passing Zone

Vertical yellow sign in triangular shape (in U.S.) to supplement solid yellow lane stripe where it is dangerous to overtake another vehicle, especially where roadway may be obscured by snow or other precipitation.

Pedestrians

Used to warn drivers of people walking in the street. Also used to warn of children playing, playgrounds, bicycle area, deaf child, blind pedestrians, and thickly settled zones where pedestrians may enter the road.

In parts of the United States near the southern border with Mexico, there are warning signs (dubbed "W54") showing a running family. This is to warn motorists to look out for illegal immigrants who try to escape authorities by running through freeway traffic.

Schools

For school zones (slow down), student crossings (pointed at top), crossing guards or signals ahead.

Fire stations

Warning upon approach to where firefighters may be entering the road with fire engines or other emergency apparatus, where other drivers will have to stop and wait until they pass.

Oncoming Traffic

Used to warn people of oncoming traffic; shown when a motorway becomes a dual carriageway or a normal road without a central reservation or median.

Level crossing/Railway crossing

Used to warn people of level crossings ahead. In most countries a red triangle warning sign is used, with various pictograms for unguarded crossings, crossings with manual gates, and automatic level crossings. These pictograms are also used in Ireland albeit on an amber diamond sign. In the United States the actual crossing is marked with crossed "Railroad Crossing" sawbuck signs (Stop, look, listen) and possibly lights, bells, and barriers.

Falling Rocks

Used to indicate the hazards of fallen or falling rocks on the road ahead. May be words or pictographs. May be "Fallen rock", "falling rock", or "rock slide" areas posted as such. In Italy the words may be "caduta sassi" or "caduta massi". In France "chûte des pierres".

The Unexpected

For example, a warning sign with the image of an aircraft in the middle of it indicates an airport or airfield, where drivers should be prepared for low-flying aircraft.

General dangers are signalled by placing a black exclamation mark in the middle of the red triangle.

Road conditions

"Slippery when wet", warnings for motorcyclists of "grooved pavement", "Open joints on bridge", "Icy Road", "Bridge freezes before roadway," also "bump" or "dip" ahead (not related to construction). Truck drivers will need to pay attention to "Steep grade" warnings (or "Down grade, use lower gear"), sometimes posted with the percent grade (e.g., 5 percent), but they may be relieved to see "Runaway truck escape" near the bottom of the hill! The UK has a sign warning of "Adverse camber" on a curve. Also "Loose gravel", "Soft shoulder", "Speed hump", and "Watch for Ice."

Side Wind

Flying socks, as indicated by a windsock on red triangle or yellow diamond signs, indicate locations where a strong side wind may cause the trajectory of the moving vehicle to change drastically, perhaps even "flying" across lanes, causing an accident.

Slow Down

Used at least in U.S. and China, this sign advises drivers to slow

Merge To Stay With Through Traffic

In the United States, there is special signage for lanes that are about to exit, so that drivers who wish to remain on the main road have adequate time to merge. All such lanes are sometimes indicated by special striping ("alligator stripes") and the sign, "Thru Traffic Merge Left" (or right). On freeways, the green directions sign for the exit ramp may have the additional notation, "Exit Only," and should have black letters on a yellow background for emphasis.

Warning Signs with lights

Some warning signs have flashing lights to alert drivers of conditions ahead or remind drivers to slow down. In Britain, they are called warning light.

Evacuation Routes

Some areas have special evacuation route signs that are to be followed in case of certain disasters. The signs point to routes either to safety or to less danger.

Evacuation signs are common in areas where there is a high risk of dangers such as flash flooding, volcanic activity and lahar, tsunami, hurricane and storm surge.

Yield sign

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In road transport, a *yield* (American English and Republic of Ireland) or *give way* (Commonwealth English) traffic sign indicates that a driver of a vehicle must slow down and prepare to stop if necessary (usually while merging into traffic on another road) but does not need to stop if there is no reason to. A driver who has actually stopped in this situation is said to have yielded the right-of-way to through traffic on the main road. In contrast, a stop sign always requires a full stop. The first *yield* sign was installed in Tulsa, Oklahoma and was invented by Tulsan Clinton Riggs

According to one rulebook, a yield sign may be warranted:

1. on a minor road at the entrance to an intersection where it is necessary to assign right-of-way to the major road, but where a stop is not necessary at all times, and where the safe approach speed on the minor road exceeds 10 miles per hour;
2. on the entrance ramp to an expressway where an acceleration lane is not provided;
3. within an intersection with a divided highway, where a STOP sign is present at the entrance to the first roadway and further control is necessary to the entrance to the second roadway, and where the median width between the two roadways exceeds 30 feet;
4. where there is a separate or channelized right-turn lane, without an adequate acceleration lane;
5. at any intersection where a special problem exists and where an engineering study indicates the problem to be susceptible to correction by use of the yield sign.

The same rulebook states that yield signs should not ordinarily be placed to control the major flow of traffic at an intersection.

Give way signs (or just the equivalent road markings) are often used at UK road junctions at which stop signs would have been used in the USA.

9 Art cars

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An *art car* is a vehicle that has its appearance modified as an act of personal artistic expression. Art car owners often dress in a matching motif (much like their previous generation hippie counterparts) when displaying their cars.

Overview

Art cars are public and mobile expressions of the artistic need to create. In creating an art car, the

"exteriors and interiors of factory-made automobiles are transformed into expressions of individual ideas, values, beliefs and dreams. The cars range from imaginatively painted vehicles to extravagant fantasies whose original bodies are concealed beneath newly sculptured shells"

(from Petersen Automotive Museum's Spring 2003 Los Angeles, California exhibit Wild Wheels: Art for the Road Gallery Guide)

The origins of the art car have been debated. Some would consider the lowriders as the first art cars since airbrushed graphics are commonly painted on the trunk lid and hood panels. During the late 1960s, singer Janis Joplin had a psychedelic-painted Porsche 356 and John Lennon, a paisley Rolls Royce. Partly in imitation, the late 1960s/early 1970s counterculture featured many Day-Glo painted VW Buses and customized vehicles (e.g. a customized 1977 Cadillac Fleetwood seen in the film Escape From New York). But cartistry truly attained unstoppable momentum as a social and artistic movement in the 1990s, on the spur of movies and books with a wide underground following, and the development of innovative art display venues such as Burning Man.

At this writing, Art Cars are a nationwide (and Canada-wide) phenomenon. In the U.S. Art Cars are strongest throughout Texas and the Southeast, in the Minnesota/Wisconsin area, and on the west coast. They are least evident in the Northeast, although there is a large Baltimore show. In Canada, Art Cars are very big in British Columbia and also in the western Canadian plains (see Artcar Society of Canada) with shows in Nanaimo, B.C. and Regina, SK.

Some art cars

The Worthington Bottle Car

One of the earliest examples are the Bottle Cars built in the 1920s to advertise Worthington Beer in England. The five cars were fitted out with boiler plate bodies to resemble the shape of a bottle laid on its side - each one weighed about 2.3 tons.

The Nevada Car

Built on an International Harvester pickup truck as a *community project* during Reno, Nevada's *Reno Days* event. Features a "supercharger" on the hood which is actually the motor head unit from a Kirby Sani-Tronic vacuum cleaner. Owned and (formerly) driven by *Patrick Dailey* of Novato, California, who states: " Wherever we go people are always trying to give us more junk to put on it." and "...we hardly ever have to buy our own gas." As of summer 2005 the Nevada Car is stored in Boulder City, Nevada, in need of engine repairs.

Buddha Buggy

A 1987 Honda CRX, the *Buddha Buggy* features a 1.6 m high detachable *Nepalese Buddhist stupa* on the roof, with strings of prayer flags running up to the golden pinnacle of the stupa. In back, a 300 mm golden Buddha, holding a miniature pagoda, is flanked by intent Laptop Buddhas. These are but a few of the 50 golden statuettes, mostly on Buddhist or Asian spiritual themes, that adorn the car and stupa. Adding to the effect are twirling yin-yang hubcaps, psychedelic-era stickers, and the vanity license plates, TOOCOOL. Not visible are the image is a 330 mm high *porcelain Amitabha Buddha* in its niche in the stupa, and paintings of the Buddha], comic dragons, a cartoon portrait of the owner, comets, a flying saucer with 2 green aliens, and toothy, two-legged fishes. The car's interior includes a velvet altarcloth-draped dashboard with brass Tibetan incense burners, statues, and gold tassels; a painted explosion of cosmic love inside the doors; and a temporary installation of spiritual beings meditating in a circle in the back cargo area. The Buddha Buggy is the work of its Seattle, Washington owner, Larry Neilson, and his many collaborators. It has appeared at Art Car events all over the western U.S. and Canada, including the *Tacoma_Art_Museum* and *San Jose (CA) Museum of Art*.

Camera Van

A van entirely covered with photographic and videocameras and featuring a video display, built by filmmaker and art car guru Harrod Blank. This vehicle has the distinction of being one of the few works of art that actually *looks back at the viewer*, as it photographs and videotapes them using some of the cameras mounted upon it, and has the ability to play the video back on the external screen, allowing you to *watch it - watching* **you** *as you are watching* **it** *watch you.* (Seen in Oakland, California.)

Flying Saucer

This is an otherwise conventional VW Beetle but with aluminum arching skirts all around that make the platform completely circular. In place of the sun roof is somewhat hemispherical transparent plastic dome. (Seen in a Berkeley, California parade.)

Oh my God!

A 1965 Volkswagen Beetle with the California license plate *OMYGAWD*, which features exotic plastic fruits and vegetables, a world globe and the phrase "Oh my God" painted in dozens of languages. A creation of Harrod Blank, this Beetle was featured in the 1992 documentary Wild Wheels (the documentary featured a scene in a courtroom where Blank was seen contesting a parking citation to the point that art cars and their respective artists were usually subjected to police harassment).

Phone Car

Created by business owner, Howard Davis (seen here as his alter-ego, Teleman), as a way to promote his business telephone company. It was featured in various magazines including Motor Trend and Weekly World News, and was also in the Petersen Automotive Museum in Los Angeles for its exhibit on art cars.

The Phone Car is built on a 1975 Volkswagen Beetle frame and has a tinted glass windshield which allows the driver to see clearly out of it. It also has a telephone ringer as its horn, so instead of a honk, it rings!

Rocket Car

A car that looks like a Buck Rogers style art deco rocket ship, *complete with a gauge-filled cockpit* interior which appears to be suitable for a jet aircraft.

Furthur and Further

The day-glo painted schoolbus Further is a 'remake' of the original bus known as "Furthur" (the original) which is the actual real-life Merry Pranksters' *hippie bus* whose destination sign read simply "Furthur" and which "tootled the multitudes" in 1964 in 'real life' and in Tom Wolfe's book The Electric Kool Aid Acid Test The bus is also prominently mentioned in the Grateful Dead's song "(That's it for) The Other One", as "*the bus to never-ever land*" with "...Cowboy Neal (Neal Cassady) at the wheel...".

H-Wing Carfighter

A "next generation" art car is the H-Wing Carfighter, a science fiction-themed 1995 Honda Civic del Sol SI two-seater. Designed after a Rebel Alliance A-Wing fighter from Star Wars, it features external laser cannons, lighting effects and an automated R2-D2 "Astromech droid". The interior features computers and other gadgetry. Many modifications are made from "found" parts including sports equipment, plumbing fixtures, and toys. The overall design blends elements of real war machines through the ages, such as World War Two fighter planes, with the fictional. H-Wing is a member of Road Squadron, a collection of science fiction-related art cars, and generated a great deal of web traffic when featured on Fark.com and Slashdot.

History

Mankind's fascination with decorating vehicles probably predates the custom of Roman charioteers adorning their chariots with objects of a personal nature. More recently, in the Roaring Twenties people who wished to express their free spirit often decorated old cars ("flivvers") with sexy or bizarre cartoon characters, such as Betty Boop. One can imagine rows of these raffish vehicles pulled up at a roadhouse where gargantuan drinking bouts would be accompanied by uninhibited jazz, lewd dancing, and eventual trips to the 'back seat.'

There is some dispute as to what precisely started the Art Car Movement. It can be seen as a twining together of several influences - the hippie-themed VWs of the late 1960s, the low rider kustom kars, the Merry Pranksters' Further, and artist *David Best*, could all be deemed as contributors. More of a latecomer, but an ever-present influence, has been filmmaker Harrod Blank, who has not only made 3 full-length documentary films on Art Cars, but has made three outstanding arted vehicles himself, and who founded the U.S.'s second largest Art Car festival in the San Francisco Bay Area (q.v.)

A well known early art car used for commercial advertisement was the *Oscar Meyer Wienie Wagon* - Later versions were known as the *Oscar Meyer Wienermobile*. These are bus-sized vehicles styled to appear as a hot dog on a bun. Later themes have become more widely focused and more satirical or dark in theme: the Latte Mobile, the Copper Car. The Grape (Revenge of the Road Kill), Rocket Van, Titanic Limo. One of the funniest and most inventive entries in recent memory was titled "Student Driver:" it featured a telephone pole laminated through one corner of the cabin; a leg with roller skate still attached projecting from one wheel well; and sundry jokey dents and marks of mayhem all over the vehicle. Science fiction themes (monsters, giant insects from **THEM**, flying saucers) are common crowd pleasers. Expressions of the Gothic and the sublime are not unknown. Surrealism is commonplace. In parades and shows, shtick often includes arted bicycles or motor-scooters or costumed roller-skaters weaving among the art cars. Many Art Car owners are natural-born hams, and incorporate elements of music or street theater in their presentation.

Art cars have been surfaced with stone, with brick, with computer boards, with pennies, with tree bark. There is an ever-expanding search for new frontiers and new effects: spinning windmills, orifices spewing flames, steam, or smoke, things that light up after dark, random noise generators, mini performance stages on roofs, truck beds, skirts. An art cartist is limited only by his/her imagination. Sympathetic souls often turn up to compensate for gaps in technical expertise, enabling the artist to reach beyond perceived physical limitations and achieve an artistic triumph. Providing an example of the unexpected and wondrous, Art Cars bring surprise and laughter wherever they roam, helping to defuse road rage on the congested highways of the U.S.A. As one Cartist said, "It gets 500 smiles to the gallon."

Art car events

- Burning Man
- Houston Art Car Parade

10 Effects of the automobile on societies

Home

Over the course of the 20th century, the automobile rapidly developed from an expensive technological wonder into the de facto standard for passenger transport. The development of the automobile built upon the transport revolution started by railways, and like the railways, introduced sweeping changes in infrastructure, manufacturing and legislation. The wide reaching effects of automobiles on everyday life have been a subject of much controversy. Proponents on one end of the spectrum claim the car is a marvel of technology that has brought about unprecedented prosperity, while opponents on the other end claim it is a cancer on cities that has caused more harm than good.

Economic changes

The development of the automobile has caused changes in city planning, as well as changing the roles of horses and railroads.

Industry restructuring

Huge industries devoted only to the automobile were created. Others were expanded from once trivial insignificance to imminent importance. Before the internal-combustion engine was developed, gasoline was a waste product, often discarded. Once the automobile became commonplace, the production of gasoline blossomed into a matter of such importance that the governments took action to secure a steady flow of oil. The steel industry was already established, but the coming of the automobile created huge amounts of business for it. The chemical, rubber, and petroleum industries were remade to suit the needs of the automobile and industries sprang up, such as service stations, motels, and automobile insurance, that were completely reliant upon the automobile for their livelihood.

As automobiles began to travel at higher and higher speeds, the sign industry began building larger and larger signs and billboards to draw the attention of drivers. Larger signs mean more people.

Infrastructure

Aside from industries, one of the most visible effects the automobile has had on the world is the huge increase in the amount of surfaced roads. For example, between 1921 and 1941, the United States spent US$40 billion on roads, increasing the amount of surfaced road from 387,000 miles (619,000 kilometres) to over 1,000,000 miles (1.6 million kilometres) which doesn't even take into account road widening.

With increased road-building came loss of habitat for wildlife on a massive scale. Loss of rural areas and agricultural land to pavement has also been extensive.

The quality of roads was also improved. Roads were paved with asphalt, and roads with more than one lane on each side became commonplace.

Technological changes

Production

The assembly line and other methods of mass production were developed when American businessmen began seeking ways to build more automobiles at a lower price. The idea of using many small identical parts that could be exchanged for each other was engendered by the president of the Cadillac Automobile Company, Henry M. Leland. Once other automobile makers realized the value of small identical parts that were interchangeable, they hired many small machine shops to make identical parts that were then put together at assembly plants. Because of this, broken parts could easily be sent to car owners. This greatly prolonged the life of the automobile, making it even more attractive to consumers.

Ransom E. Olds took the first step towards assembly line production when he had the framework of each automobile pushed on a wooden platform supported by rolling casters. Henry Ford built on this when he used conveyor belts to pull along the bare frame of an automobile while workmen added parts to it that were brought to them by other conveyor belts. Ford's utilization of the conveyor belt in the factory was inspired by the Chicago Packing Association's disassembly line, where workers dressed beef pulled along by an overhead trolley.

Cultural changes

Prior to the appearance of the automobile, horses, streetcars and bicycles were the major modes of transportation within cities. Horses require a large amount of care, and were therefore kept in public facilities that were usually far from residences. The manure they left on the streets also created a sanitation problem. The automobile had neither of those disadvantages.

The automobile made regular medium-distance travel more convenient and affordable, also in areas without railways. Because automobiles did not require rest, and were faster than horse-drawn conveyances, people were routinely able to travel farther than in earlier times. Historically, most people never travelled more than a few tens of kilometres of their birthplace in their entire lives; the advent of the automobile began the transformation of society in such a way that those who had never travelled that distance were only a tiny minority.

Changes to urban society

Beginning in the 1940s, most urban environments in United States lost their streetcars, Cable cars, and other forms of light rail, to be replaced by diesel-burning motor coaches or buses. Many of these have never returned, though some urban communities eventually installed subways.

Another change brought about by the automobile is that modern urban pedestrians must be more alert than their ancestors. In the past one had to worry about being run over by streetcars, kicked in the face by horses, or stepping in horse dung. Now, one must worry about being hit by automobiles at much higher speeds, and breathing noxious exhaust fumes. The Futurama exhibit at the 1939 New York World's Fair showed a City of the Future in which pedestrian and automobile traffic was fully grade-separated. However, for cost reasons, this vision has never come to pass outside of small experiments in a handful of downtowns.

The loss of pedestrian-scale villages caused a loss of community connection. People no longer know their neighbors and rarely walk unless they place a high value on exercise. Unfortunately, many people find themselves spending so much time stuck in traffic jams that they do not get as much exercise as they should. For example, since the 1980s, obesity has reached epidemic proportions in the United States.

Also, in countries with high levels of violent crime, most people who exercise prefer to do so in the safety of their home or in subscriber-only fitness clubs (which they drive to and from).

Advent of suburban society

Because of the automobile, the outward growth of cities accelerated, and suburbs began developing rapidly for the first time. Until the advent of the automobile, factory workers lived close to the factory or a railroad line that led to the factory. The automobile allowed them to live miles away from the factories or other workplace in the city centre, without losing their job. The developing suburbs created few local jobs, and most residents commute elsewhere to their jobs.

Shopping centers were then built in or near suburbs to save residents trips to the city. The shopping centers provided enough goods and services to reduce the need of suburban residents to visit the city.

Finally, as the service economy gained importance, business parks appeared, allowing suburb dwellers to even work in the suburbs, often at the cost of increasing commute distances, however.

Car culture

The car had a significant effect on the culture of the middle class. Automobiles were incorporated into all parts of life from music to books to movies. Between 1905 and 1908, more than 120 songs were written in which the automobile was the subject. The automotive themes of these songs reflected the general culture of the automotive industry: sexual adventure, liberation from social control, and masculine power. Books centered on motor boys who liberated themselves from the average, normal, middle class life, to travel and seek adventure in the exotic. Car ownership came to be associated with independence, freedom, and increased status.

Changes to individual lifestyle in America

At the end of the 19th century, Americans put a great deal of emphasis on personal freedom and individual mobility. The automobile encompassed both of these ideals. Individuality was increased for the automobile owner. This individual zeal didn’t apply to everyone.

Critics felt that the automobile decreased church attendance, increased sexual activity, and weakened family unity. A popular religious magazine of the day, the Independent, argued that it took away from even more important things. It argued, for example, that middle class men were prone to delay marriage in order to buy an automobile. It then argued that the automobile led to an augmented divorce rate, due to an increased stress rate over car payments. Others felt that couples delayed having children or even had fewer children, owing to the expense. Despite these negative impacts on American culture, the automobile had numerous benefits.

Social status

The automobile signifies much more to many than simply a mode of transportation. Henri Lefebvre called the automobile "the epitome of possessions". In the early years, when the first automobiles were imported to America from France for the bourgeois and elite, the car served as a mark of distinction above all others. The automobile rapidly became a symbol of social status, and in some cases, a fashion item. The automobile, more than almost any other possession, allowed people to flaunt wealth. Not only was the ownership of an automobile demonstrative of a certain level of income and prestige (and still is, especially in poorer nations where the automobile isn't ubiquitous), it is also highly visible.

Recreation

The creation of good roads and dependable automobiles changed recreation and vacations. Before the automobile, resorts were predominantly found near the coast or a railroad. If people did not live near either one, then they were unlikely to be able to visit one. Once the automobile became abundant, resorts sprang up that were off the beaten path. Resorts appeared in scenic places, far away from the hectic life of the cities. In the United States, national parks became popular tourist attractions and developed designs with automobile travelers in mind.

Safety

Automobile accidents caused many deaths before automobile safety laws were implemented. To this date, automobiles remain a major cause of accidental death and injury, not to mention emotional stress.

Drivers of automobiles are able to move relatively quickly in and out of inner-city urban cores. In comparison to pedestrians or users of mass transit, they are slightly less vulnerable to mugging, but are naturally vulnerable to crimes like carjacking, to torts like injuries sustained in car accidents, and to the inconvenience of vehicle breakdowns.

The automobile expanded the role, abilities and efficiency of the emergency services such as the response to emergency calls for firefighters or paramedics.

Car-oriented convenience

Many aspects of daily life in the First World industrialized countries reflect an impulse to make life convenient for car users.

Without having to exit one's car, a resident of a typical large North American city may accomplish the following:

- Buy gasoline at a gas station (in areas where full service is still available)
- Have the car washed
- Obtain cash from an ATM
- Buy many different kinds of fast food, and eat it
- Buy freshly prepared coffee or other similar beverages
- Deposit mail for delivery by the postal service
- Drop off apparel for dry cleaning
- Pick up and pay for prescription drugs at a pharmacy
- Return library books, videotapes, or almost any other small object that is regularly lent to the public

Environmental changes

The automobile is one of the most noticeable modern influences on the environment. For a large part of its development, no consideration was given to concerns such as air pollution, destruction caused by road-building, and the massively increased consumption of limited natural resources, most notably petroleum and land. Some of these concerns are now starting to be addressed in some parts of the world. European Union is the leader in that, and it has many possibilities to do so, for example because the cities in Europe are planned to pedestrians and mass transit, before the automobile became common.

11 Future of the car

Home

The *future of the car* is a controversial topic, with some advocates arguing that the car has no future, and others that the car will in the future supplant most other forms of transport.

The main trend at the beginning of the 21st century is an increase in the number of cars in Asia.

There are significant challenges in the near future to continued use of the car:

- Petroleum refining and car use are major factors in pollution and greenhouse gas emissions.
- 50-70% of US oil production is consumed by cars and trucks. This is more due to the size, weight, shape and power of conventional cars than to necessity.
- Cars are one of the most dangerous form of transport. 1 million people die each year in car accidents worldwide.
- Increasing population and prosperity tends to increase traffic congestion.

Technological advances

There are many possible advances in technology that could influence the future of the car (NB: This section is most controversial. Please see the discussion.):

- Duraluminum, fiberglass and carbon fiber will continue to replace heavier steel.
- Hybrid cars and more advanced combustion engines (eg. gas turbines) will improve fuel efficiency. Toyota intends to have hybrid versions for all its models by 2012, including the hybrid Toyota Prius which is already available. Ford intends to make five hybrids available by 2008. Both Ford and GM have also begun to develop hybrid SUV's.
- Utilisation of waste heat from the engine as useful mechanical energy through exhaust powered steam, stirling engines, thermal diodes or etc.. [1]
- E911 compliant mobile phones required in the US by 2006 can be used to coordinate ridesharing.
- Improvements to hands-free technology will increase driver safety.
- Radio technology (DSRC or wireless vehicle safety communications) will permit on-board collision warnings.
- Traffic lights will continue to become smarter. This could include short range milimeter band radar, neural network processors and sharing wireless networks with the cars.
- The smart car and driverless car making driving easier and safer.
- Cars linking up to form platoons and car-trains.

- Dualmode cars platooning on a guideways or a Personal Rapid Transit system, such as ULTra, for increased speed, safety and economy.
- Dualmode or cars able to platoon that use relatively small electric motors and fuel supplies or battery reserves for door-to-door service off electrically powered arteries.
- Battery electric vehicles have the potential of using locally available sustainable energy resources while at the same time reducing vehicle energy requirements by 1/2 to 1/4 when using batteries to store electricity.
- Hydrogen cars could also use sustainable energy resources and water. The resulting hydrogen could be burnt in an engine or converted back into electricity by a fuel cell and its support systems instead of a battery to be powered as an electric vehicle. Due to the additional conversion losses and added distribution and support logistics overall efficiency may remain no better than current ICE ("internal combustion engine") vehicles. Rather it is far simpler to transmit locally available sustainable electricity directly into the batteries of an otherwise hydrogen car.
- Alternative fuels are being proposed : alcohol fuel, water (see hydrogen fuel), air (see air car), garbage, hemp oil, magnetism, solar power, Tesla electric cars (with no car batteries), and high speed electric cars (freeway-capable).
- Nanotechnology-enhanced cars will be stronger than steel which can help to reduce weight and better protect passengers.
- The potential application of magnetic levitation to transportation has been known since the 19th century and been implemented in numerous Magnetic levitation trains. Although trains with fixed guideways are not cars, since cars are somewhat smaller they could be loaded onto trains to move them rapidly across country for long distances. This would obviously require a committed national infrastructure construction effort. Due to their lack of rolling friction and smooth ride they can travel much faster than conventional trains. While high speeds dramatically increase aerodynamic drag, its small frontal with only one lead car area makes it less of a factor than with cars. Laminar flow losses are insubstantial, and evacuating the atmosphere in a tunnel would nearly eliminate both of these losses and allow for supersonic speeds.
- Although flying cars have been proposed for decades, cost and air traffic control issues have so far prevented mass use of private aircraft. Energy consumption is also considerably greater for current aircraft than typical cars. Though NASA is said to be currently working on a system whereby everyone who intends to fly would have his own personal air space.

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