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# Cargo

**Cargo** consists of bulk goods conveyed by water, air, or land. In economics, **freight** is cargo that is transported at a freight rate for commercial gain. *Cargo* was originally a shipload but now covers all types of freight, including transport by rail, van, truck, or intermodal container.[1] The term cargo is also used in case of goods in the cold-chain, because the perishable inventory is always in transit towards a final end-use, even when it is held in cold storage or other similar climate-controlled facility. The term freight is commonly used to describe the movements of flows of goods being transported by any mode of transportation.[2]

Multi-modal container units, designed as reusable carriers to facilitate unit load handling of the goods contained, are also referred to as cargo, especially by shipping lines and logistics operators. Similarly, aircraft ULD boxes are also documented as cargo, with an associated packing list of the items contained within. When empty containers are shipped each unit is documented as a cargo and when goods are stored within, the contents are termed containerized cargo.

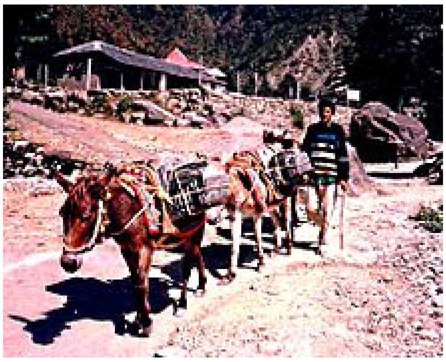
## Contents



## Description

Transportation types: Cargo can travel via many different modes:

Very small freight transporter—a cargo tricycle



Animals used to transport goods—Mules carrying slate roof tiles in India in 1993.

## Marine

Seaport terminals handle a wide range of maritime cargoes.

Container ship at the Port of Helsinki in Finland

Break bulk / general cargo are goods that are handled and stowed piecemeal to some degree, as opposed to cargo in bulk or in modern shipping containers. Typically bundled in batches for hoisting, either with cargo nets, slings, crates, or stacked on trays, pallets or skids; at best (and today mostly) lifted directly into and out of a vessel's holds, but otherwise onto and off its deck, by cranes or derricks present on the dock or on the ship itself. If hoisted on deck instead of straight into the hold, liftable or rolling unit loads, like bags, barrels/vats, boxes, cartons and crates, then have to be man-handled and stowed competently by stevedores. Securing break bulk and general freight inside a vessel, includes the use of dunnage. When no hoisting equipment available, break bulk would previously be man-carried on and off ship, over a plank, or by passing via human chain. Since the 1960s, the volume of break bulk cargo has enormously declined worldwide in favor of mass adoption of containers. Bulk cargo, such as salt, oil, tallow, but also scrap metal, is usually defined as commodities that are neither on pallets nor in containers.

Bulk cargoes are not handled as individual pieces, the way heavy-lift and project cargoes are. Alumina, grain, gypsum, logs, and wood chips, for instance, are bulk cargoes. Bulk cargo is classified as liquid or dry.

## Air


Cargolux Boeing 747-400F with the nose loading door open

Air cargo, commonly known as *air freight*, is collected by firms from shippers and delivered to customers. Aircraft were first used for carrying mail as cargo in 1911. Eventually manufacturers started designing aircraft for other types of freight as well.


Boeing 777 freighter of Emirates arrives at London Heathrow Airport (2015).

There are many commercial aircraft suitable for carrying cargo such as the Boeing 747 and the bigger An-124, which was purposely built for easy conversion into a cargo aircraft. Such large aircraft employ standardized quick-loading containers known as unit load devices (ULDs), comparable to ISO containers on cargo ships. ULDs can be stowed in the lower decks (front and rear) of a number of wide-body aircraft,[3] and on the main deck of some narrow-bodies. Some dedicated cargo planes have a large opening front for loading.

Most nations own and utilize large numbers of military cargo aircraft such as the C-17 Globemaster III for logistical needs.

Popular commercial aircraft transformed to a cargo aircraft such as Saab 340A is designed for high revenue and profitability in short / medium haul operations.

Precious Cargo: Precious Cargo refers to the shipping of valuables like gems and jewellery safely. In today's changing times there are many companies that specialise in dealing with such shipments.

### Air freight

**Air freight shipments** are very similar to LTL shipments in terms of size and packaging requirements. However, air freight or air cargo shipments typically need to move at much faster speeds than 800 km or 497 mi per hour. Air shipments may be booked directly with the carriers, through brokers or with online marketplace services. While shipments move faster than standard LTL, air shipments don't always actually move by air. In the US, there are certain restrictions on shipments moving via air freight on passenger aircraft. Shippers in the US must be approved and be "known" in the Known Shipper Management System before their shipments can be tendered on passenger aircraft.

## Rail

Trains are capable of transporting a large number of containers that come from shipping ports. Trains are also used for the transportation of water, cement, grain, steel, wood and coal. They are used because they can carry a large amount and generally have a direct route to the destination. Under the right circumstances,

An articulated double-stack well car owned by the TTX Company. The 53 ft (16.15 m) capacity car is a Gunderson Maxi-IV.

P&O Nedlloyd intermodal container in a tiphook intermodal freight well wagon at Banbury station. England, (2001)

freight transport by rail is more economic and energy efficient than by road, especially when carried in bulk or over long distances.

The main disadvantage of rail freight is its lack of flexibility. For this reason, rail has lost much of the freight business to road transport. Rail freight is often subject to transshipment costs, since it must be transferred from one mode of transportation to another. Practices such as containerization aim at minimizing these costs. When transporting point-to-point bulk loads such as cement or grain, with specialised bulk handling facilities at the rail sidings, rail mode of transport remains the most convenient and preferred option.

Many governments are currently trying to encourage shippers to use trains more often because of the environmental benefits.

## Road

Many firms, like Parcelforce, FedEx and R+L Carriers transport all types of cargo by road. Delivering everything from letters to houses to cargo containers, these firms offer fast, sometimes same-day, delivery.

A good example of road cargo is food, as supermarkets require deliveries daily to replenish their shelves with goods. Retailers and manufacturers of all kinds rely upon delivery trucks, be they full size semi trucks or smaller delivery vans. These smaller road haulage companies constantly strive for the best routes and prices to ship out their products. Indeed, the level of commercial freight transported by smaller businesses is often a good barometer of healthy economic development as it is these types of vehicles that move and transport literally anything, including couriers transporting parcel and mail.[4] You can see the different types and weights of vehicles that are used to move cargo around .[5]

### Less-than-truckload freight

**Less than truckload (LTL) cargo** is the first category of freight shipment, which represents the majority of freight shipments and the majority of business-to-business (B2B) shipments. LTL shipments are also often referred to as *motor freight* and the carriers involved are referred to as *motor carriers*.

LTL shipments range from 50 to 7,000 kg (110 to 15,430 lb), being less than 2.5 to 8.5 m (8 ft 2.4 in to 27 ft 10.6 in) the majority of times. The average single piece of LTL freight is 600 kg (1,323 lb) and the size of a standard pallet. Long freight and/or large freight are subject to extreme length and cubic capacity surcharges.

Trailers used in LTL can range from 28 to 53 ft (8.53 to 16.15 m). The standard for city deliveries is usually 48 ft (14.63 m). In tight and residential environments the 28 ft (8.53 m) trailer is used the most.

The shipments are usually palletized, stretch [shrink]-wrapped and packaged for a mixed-freight environment. Unlike express or parcel, LTL shippers must provide their own packaging, as carriers do not provide any packaging supplies or assistance. However, circumstances may require crating or other substantial packaging.

## Truckload freight

In the United States, shipments larger than about 7,000 kg (15,432 lb) are typically classified as **truckload (TL) freight**. This is because it is more efficient and economical for a large shipment to have exclusive use of one larger trailer rather than share space on a smaller LTL trailer.

By the Federal Bridge Gross Weight Formula the total weight of a loaded truck (tractor and trailer, 5-axle rig) cannot exceed 80,000 lb (36,287 kg) in the United States. In ordinary circumstances, long-haul equipment will weigh about 15,000 kg (33,069 lb), leaving about 20,000 kg (44,092 lb) of freight capacity. Similarly a load is limited to the space available in the trailer, normally 48 ft (14.63 m) or 53 ft (16.15 m) long, 2.6 m (102$^3⁄_8$ in) wide, 9 ft 0 in (2.74 m) high and 13 ft 6 in or 4.11 m high over all.

While express, parcel and LTL shipments are always intermingled with other shipments on a single piece of equipment and are typically reloaded across multiple pieces of equipment during their transport, TL shipments usually travel as the only shipment on a trailer. In fact, TL shipments usually deliver on exactly the same trailer as they are picked up on.

## Shipment categories

Freight is usually organized into various shipment categories before it is transported. An item's category is determined by:

- the type of item being carried. For example, a kettle could fit into the category 'household goods'.
- how large the shipment is, in terms of both item size and quantity.
- how long the item for delivery will be in transit.

Shipments are typically categorized as household goods, express, parcel, and freight shipments:

- *Household goods (HHG)* include furniture, art and similar items.
- *Express:* Very small business or personal items like envelopes are considered *overnight express* or *express letter shipments*. These shipments are rarely over a few kilograms or pounds and almost always travel in the carrier's own packaging. Express shipments almost always travel some distance by air. An envelope may go coast to coast in the United States overnight or it may take several days, depending on the service options and prices chosen by the shipper.
- *Parcel:* Larger items like small boxes are considered *parcels* or *ground shipments*. These shipments are rarely over 50 kg (110 lb), with no single piece of the shipment weighing more than about 70 kg (154 lb). Parcel shipments are always boxed, sometimes in the shipper's packaging and sometimes in carrier-provided packaging. Service levels are again variable but most ground shipments will move about 800 to 1,100 km (497 to 684 mi) per day. Depending on the origin of the package, it can travel from coast to coast in the United States in about four days. Parcel shipments rarely travel by air and typically move via road and rail. Parcels represent the majority of business-to-consumer (B2C) shipments.

- *Freight:* Beyond HHG, express, and parcel shipments, movements are termed *freight shipments*.

## Shipping costs

Often, an LTL shipper may realize savings by utilizing a freight broker, online marketplace or other intermediary, instead of contracting directly with a trucking company. Brokers can shop the marketplace and obtain lower rates than most smaller shippers can obtain directly. In the LTL marketplace, intermediaries typically receive 50% to 80% discounts from published rates, where a small shipper may only be offered a 5% to 30% discount by the carrier. Intermediaries are licensed by the DOT and have requirements to provide proof of insurance.

Truckload (TL) carriers usually charge a rate per kilometre or mile. The rate varies depending on the distance, geographic location of the delivery, items being shipped, equipment type required, and service times required. TL shipments usually receive a variety of surcharges very similar to those described for LTL shipments above. In the TL market, there are thousands more small carriers than in the LTL market. Therefore, the use of transportation intermediaries or brokers is extremely common.

Another cost-saving method is facilitating pickups or deliveries at the carrier's terminals. By doing this, shippers avoid any accessorial fees that might normally be charged for liftgate, residential pickup/delivery, inside pickup/delivery, or notifications/appointments. Carriers or intermediaries can provide shippers with the address and phone number for the closest shipping terminal to the origin and/or destination.

Shipping experts optimize their service and costs by sampling rates from several carriers, brokers and online marketplaces. When obtaining rates from different providers, shippers may find a wide range in the pricing offered. If a shipper in the United States uses a broker, freight forwarder or other transportation intermediary, it is common for the shipper to receive a copy of the carrier's Federal Operating Authority.[6] Freight brokers and intermediaries are also required by Federal Law to be licensed by the Federal Highway Administration. Experienced shippers avoid unlicensed brokers and forwarders because if brokers are working outside the law by not having a Federal Operating License, the shipper has no protection in the event of a problem. Also, shippers normally ask for a copy of the broker's insurance certificate and any specific insurance that applies to the shipment.

Overall, shipping costs have fallen over the past decades. A further drop in shipping costs in the future might be realized through the application of improved 3D printing technologies.[7]

## Security concerns

Governments are very concerned with the shipment of cargo, as it may bring security risks to a country. Therefore, many governments have enacted rules and regulations, administered by a customs agency, to the handling of cargo to minimize risks of terrorism and other crime. Governments are particularly concerned with cargo entering through a country's borders.

The United States has been one of the leaders in securing cargo. They see cargo as a concern to national security. After the terrorist attacks of September 11th, the security of this magnitude of cargo has become highlighted on the over 6 million cargo containers enter the United States ports each year.[8] The latest US

Government response to this threat is the CSI: Container Security Initiative. CSI is a program intended to help increase security for containerised cargo shipped to the United States from around the world.[9] Europe is also focusing on this issue, with a number of EU-funded projects underway.

# Stabilization

There are many different ways and materials available to stabilize and secure cargo in various modes of transport. Conventional load securing methods and materials such as steel strapping and plastic/wood blocking & bracing have been used for decades and are still widely used. Present load securing methods offer several other options including polyester strapping and lashing, synthetic webbings and dunnage bags, also known as air bags or inflatable bags.

Practical advise on stabilization is given in the International Guidelines on Safe Load Securing for Road Transport.[10]

### Stabilization methods

Application in container

Polyester strapping and dunnage bag

Polyester lashing

Bronze Age amphorae from shipwrecks near Bodrum, Turkey, with rack and roping device illustrating how they might have been kept from shifting

## See also

- Cargo airline
- Cargo cult
- Cargo sampling
- Cargo scanning
- Counter-to-counter package
- DAT Solutions (a.k.a. Dial-a-truck)
- Delivery
- Document automation in management
- Freight company
- Freight Transport Association
- Goods
- Goods train

- List of cargo types
- Products
- Standard Carrier Alpha Codes

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## External links

- The dictionary definition of *cargo* at Wiktionary
- Freight Hashemibar (https://hashemibar.com)
- Media related to Freight at Wikimedia Commons

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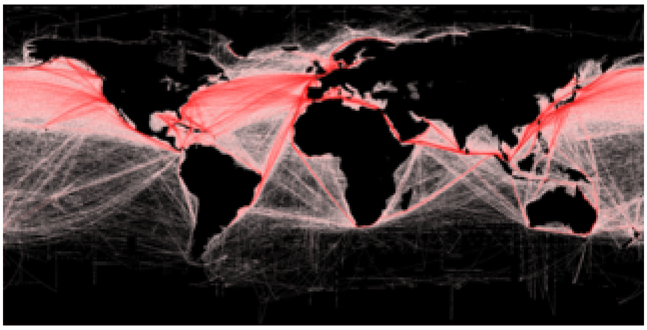
# Freight transport

**Freight transport** is the physical process of transporting commodities and merchandise goods and cargo.[1] The term **shipping** originally referred to transport by sea but in American English, it has been extended to refer to transport by land or air (International English: "carriage") as well. "Logistics", a term borrowed from the military environment, is also used in the same sense.



This map of shipping routes illustrates the relative density of commercial shipping in the world's oceans.

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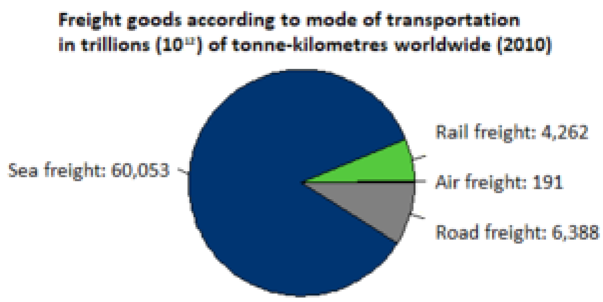
## Modes of shipment

In 2015, 108 trillion tonne-kilometers were transported worldwide (anticipated to grow by 3.4% per year until 2050 (128 Trillion in 2020)): 70% by sea, 18% by road, 9% by rail, 2% by inland waterways and less than 0.25% by air.[2]




Global freight volumes according to mode of transport in trillions of tonne-kilometres in 2010

### Grounds

Land or "ground" shipping can be made by train or by truck (British English: lorry). In air and sea shipments, ground transport is required to take the cargo from its place of origin to the airport or seaport and then to its destination because it is not always possible to establish a production facility near ports due to the limited coastlines of countries. Ground transport is typically more affordable than air, but more expensive than sea, especially in developing countries, where inland infrastructure may not be efficient.

### Ship

Harbour cranes unload cargo from a container ship at the Jawaharlal Nehru Port, Navi Mumbai, India.

Much freight transport is done by cargo ships. An individual nation's fleet and the people that crew it are referred to as its merchant navy or merchant marine. According to a 2018 report from the United Nations Conference on Trade and Development (UNCTAD), merchant shipping (or seaborne trade) carries 80-90% of international trade and 60-70% by value.[3]:4 On rivers and canals, barges are often used to carry bulk cargo.

### Air

Cargo is transported by air in specialized cargo aircraft and in the luggage compartments of passenger aircraft. Air freight is typically the fastest mode for long-distance freight transport but it is also the most expensive.

### Multimodal

Cargo is shipped under a single contract but performed using at least two different modes of transport (e.g. ground and air). Cargo may not be containerized. Cargo is exchanged between different modes of transportation via transport hubs also known as transport interchanges or nodes (e.g. train stations, airports, etc.).

### Intermodal

Multimodal transport featuring containerized cargo (or intermodal container) that is easily transferred between ship, rail, plane and truck.

For example, a shipper works together with both ground and air transportation to ship an item overseas. Intermodal freight transport is used to plan the route and carry out the shipping service from the manufacturer to the door of the recipient.[4][5]

## Terms of shipment

The Incoterms (or International Commercial Terms) published by the International Chamber of Commerce (ICC) are accepted by governments, legal authorities, and practitioners worldwide for the interpretation of the most commonly used terms in international trade. Common terms include:

- Free on Board (FOB)
- Cost and Freight (CFR, C&F, CNF)
- Cost, Insurance & Freight (CIF)

The term "best way" generally implies that the shipper will choose the carrier who offers the lowest rate (to the shipper) for the shipment. In some cases, however, other factors, such as better insurance or faster transit time will cause the shipper to choose an option other than the lowest bidder.

## Door-to-door shipping

**Door-to-door (DTD or D2D) shipping** refers to domestic or international shipment of cargo from the point of origin (POI) to the destination while generally remaining on the same piece of equipment and avoiding multiple transactions, transloading, and cross-docking without interim storage.

International DTD is a service provided by many international shipping companies and may feature intermodal freight transport using containerized cargo. The quoted price of this service includes all shipping, handling, import and customs duties, making it a hassle-free option for customers to import goods from one jurisdiction to another. This is compared to standard shipping, the price of which typically includes only the expenses incurred by the shipping company in transferring the object from one place to another. Customs fees, import taxes and other tariffs may contribute substantially to this base price before the item ever arrives.[6]

## See also

- Affreightment
- Automatic Identification System
- Mid-stream operation
- Outline of transport
- Ship transport
- Rail transport
- Transshipment
- Greek shipping
- Chinese shipping
- Environmental issues with shipping
- List of cargo types
- Right of way (shipping)
- Shipping markets
- Full container load (FCL)
- Less than container load (LCL)

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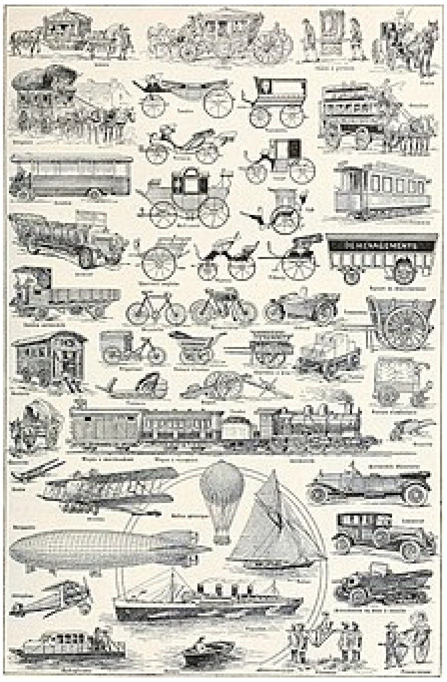
Wikipedia

# History of transport



The **history of transport** is largely one of technological innovation. Advances in technology have allowed people to travel farther, explore more territory, and expand their influence over larger and larger areas. Even in ancient times, new tools such as foot coverings, skis, and snowshoes lengthened the distances that could be traveled. As new inventions and discoveries were applied to transport problems, travel time decreased while the ability to move more and larger loads increased. Innovation continues as transport researchers are working to find new ways to reduce costs and increase transport efficiency.

International trade was the driving motivator behind advancements in global transportation in the Pre Modern world. "...there was a single global world economy with a worldwide division of labor and multilateral trade from 1500 onward."[1] The sale and transportation of textiles, silver and gold, spices, slaves, and luxury goods throughout Afro-Eurasia and later the New World would see an evolution in overland and sea trade routes and travel.

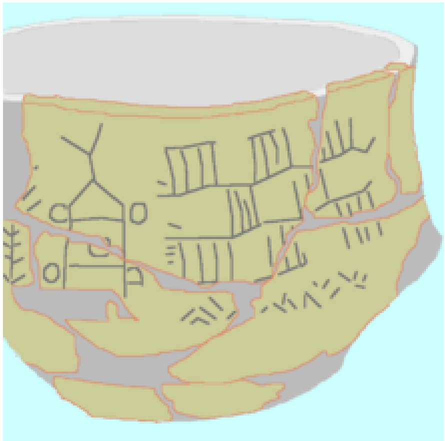
# Contents



# Land

## Road

The first earth tracks were created by humans carrying goods and often followed trails. Tracks would be naturally created at points of high traffic density. As animals were domesticated, horses, oxen and donkeys became an element in track-creation. With the growth of trade, tracks were often flattened or widened to accommodate animal traffic (hollow way or drover's road). Later, the travois, a frame used to drag loads, was developed. Animal-drawn wheeled vehicles were probably developed in the ancient Near East in the 4th or 5th millennium BC and spread to Europe and India in the 4th millennium BC and China in about 1200 BC. The Romans had a significant need for good roads to extend and maintain their empire and developed Roman roads.



Bronocice pot with the earliest known image of a wheeled vehicle in the world.

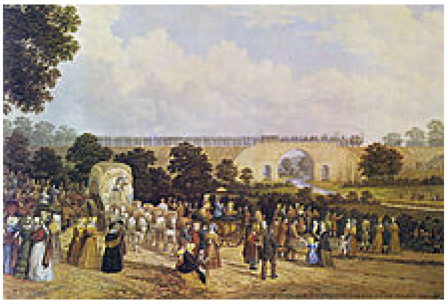
In the Industrial Revolution, John Loudon McAdam (1756–1836) designed the first modern highways, using inexpensive paving material of soil and stone aggregate (macadam), and the embanked roads a few feet higher than the surrounding terrain to cause water to drain away from the surface.

With the development of motor transport, starting in 1886 in Germany and in the U.S. in 1908 with the production of Ford's first Model T,[2] there was an increased need for hard-topped roads to reduce washaways, bogging and dust on both urban and rural roads, originally using cobblestones and wooden paving in major western cities and in the early 20th century tar-bound macadam (tarmac) and concrete paving. In 1902, Nottingham's Radcliffe Road became the first tarmac road in the world.


Modes of road transport in Dublin, 1929

## Rail

The history of rail transportation dates back nearly 500 years and includes systems with man or horsepower and rails of wood (or occasionally stone). This was usually for moving coal from the mine down to a river, from where it could continue by boat, with a flanged wheel running on a rail. The use of cast iron plates as rails began in the 1760s, and was followed by systems (plateways) where the flange was part of the rail. However, with the introduction of rolled wrought iron rails, these became obsolete.


Stockton Darlington steam locomotive Railway construction 1820

The first passenger-carrying public railway was opened by the Swansea and Mumbles Railway at Oyster mouth in 1807, using horse-drawn carriages on existing tramlines. In 1802, Richard Trevithick designed and built the first (unnamed) steam locomotive to run on smooth rails. He was a Cornish engineer and showed off his railway invention in the Welsh mining town of Merthyr Tydfil.[3]


Liverpool and Manchester steam locomotive Railway opening (1830)

Before actual making the breakthrough for the first railway engine, Trevithick had been facing failures and successes along the route. One of his first successful demonstrations was the "Puffing Devil" steam powered locomotive in 1802 whereas a disaster in Greenwich in 1803 almost sealed the fate of locomotive travel, when four men were killed by an explosion of one of Trevithick's engines. This incident was used as a leverage by his rivals to stop the production of the high-pressure steam engines.

However, Trevithick's "Penydarren locomotive", marked its place in history by becoming the first full scale working railway steam locomotive. A bet between Trevithick's benefactor Samuel Homfray and Richard Crawshay prompted the key demonstration of the locomotive. Homfray had placed a wager of 500 guineas that the locomotive will transport ten tonnes of iron from the Pendydarren Ironworks to the village of Abercynon which was nearly ten miles away.

Trevithick's locomotive completed the journey in just over four hours, ultimately proving the locomotives sturdiness and reliability. However, Trevithick never got the credit he deserved and died a destitute in 1833.[4]

### Modern locomotive

Modern rail transport systems first appeared in England in the 1820s.

Matthew Murray proved the viability of the steam engine in 1812. Salamanca was the first locomotive to incorporate two cylinders.

George Stephenson who went on to become known as the father of railways is said to have built 16 experimental locomotives for use from the year 1814–1826, the last train which he introduced known as the Killingworth Billy ran until 1881. The first intercity railway between Liverpool and Manchester was built by Stephenson in 1830.[5] These systems, which made use of the steam locomotive, were the first practical form of mechanized land transport, and they remained the primary form of mechanized land transport for the next 100 years. The first railroad built in Great Britain was the Stockton and Darlington, which opened in 1825. It used a steam locomotive built by George Stephenson and was practical only for hauling minerals. The Liverpool and Manchester Railway, which opened in 1830, was the first modern railroad. It was a public carrier of both passengers and freight. By 1870, Britain had about 13,500 miles (21,700 km) of railroad.

In 1879, electric locomotive development was booming in Germany. In the late 19th century, Werner von Siemens demonstrated the first experimental electric passenger train. The train transported around 90,000 people and worked on the concept of insulated third rail to supply electricity. In 1881, Siemens built the world's first electric tram line in the Berlin suburb of Lichterfelde. Following this trend, many such initiatives were set up in Brighton and Vienna in 1883.

### Diesel locomotives

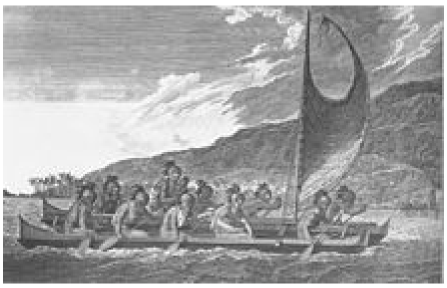
A new type of railway locomotives was developed by Dr. Rudolf Diesel, which involved a new internal combustion method to propel the railway. In 1892, he proposed this method and soon sparked speculation on whether this type of engine would actually work. From the late 19th century to the early 20th century, Rudolf Diesel worked on putting diesel on track and tried to improve the power-to-weight ratio. He worked at a Swiss engineering firm Sulzer. Eventually, by the end of the Second World War, steam engines became obsolete and were rarely used in developed countries.[5]

At the system's greatest extent, in 1914, there were about 20,000 miles (32,000 km) of the track, run by 120 competing companies. The British government combined all these companies into four main groups in 1923 as an economic measure.

British Railways, by name British Rail, the former national railway system of Great Britain, was created by the Transport Act of 1947, which inaugurated public ownership of the railways.

The history of rail transport also includes the history of rapid transit and arguably history of monorail.

# Water



A traditional Polynesian catamaran in 1778 CE

In the Stone Age, primitive boats developed to permit navigation of rivers and for fishing in rivers and off the coast. It has been argued that boats suitable for a significant sea crossing were necessary for people to reach Australia an estimated 40,000-45,000 years ago. With the development of civilization, vessels evolved for expansion and generally grew in size for trade and war. In the Mediterranean, galleys were developed about 3000 BC. Polynesian double-hulled sailing vessels (http://pvs.kcc.hawaii.edu/ike/kalai_waa/kane_search_voyaging_canoe.html)[6] with advanced rigging were used between 1,300 BC and 900 BC by the Polynesian progeny of the Lapita culture to expand 6,000 km across open ocean from the

Bismarck Archipelago east to Micronesia and, eventually Hawaii. Galleys were eventually rendered obsolete by ocean-going sailing ships, such as the Arabic caravel in the 13th century, the Chinese treasure ship in the early 15th century, and the Mediterranean man-of-war in the late 15th century.

In the Industrial Revolution, the first steamboats and later diesel-powered ships were developed. Eventually submarines were developed mainly for military purposes for people's general benefit.

Meanwhile, specialized craft were developed for river and canal transport. Canals were developed in Mesopotamia c. 4000 BC. The Indus Valley civilization in Pakistan and North India (from c. 2600 BC) had the first canal irrigation system in the world.[7] China's canal system, whose greatest accomplishment was the Sui Dynasty's 1,794-kilometer (1,115 mi) 7th-century Grand Canal between Hangzhou and Beijing, was an essential aspect of its civilization, used for irrigation, flood control, taxation, commercial and military transport, and colonization of new lands from the Zhou Dynasty until the end of the imperial era. Canals were developed in the Middle Ages in Europe in Venice and the Netherlands. Ramps for water were made in 1459. Pierre-Paul Riquet began to organise the construction of the 240 km-long Canal du Midi in France in 1665 and it was opened in 1681. In the Industrial Revolution, inland canals were built in England and later the United States before the development of railways. Specialized craft were also developed for fishing and later whaling.

Maritime history also deals with the development of navigation, oceanography, cartography, and hydrography.

## Trade

Often cities as well as their surrounding agricultural areas are typically are not self-sufficient for agriculture. Because of this, people living in these regions had forced to trade with either other cities, nomads, or other pastoralists. People would usually trade one another for things like raw materials, (such as metals like tin, bronze, copper, or iron ore) or animals.[8] An "intercontinental model" of world trade, "between 1500 and 1800 on the basis of interregional competition in production and trade"[9] was proposed by Frederic Mauro, but the early existence of it was already observed by Dudley North in the year 1691. This world market of trade, as well as the flow of finances throughout, spanned out an interconnected throughout the entire globe, permitted the intersectoral and intersectional regional divisions of both generated competition, and labor.[10]

Through the water frontier, many people throughout history have traveled by water as much as they have by land. Along with this, quite a large number of individuals relied on the sea and maritime trade, raiding, piracy, or smuggling for survival.[10] Littoral peoples, reflecting symbiosis of both land and sea, would often have more in common with one another than they would with their neighboring islands. Throughout centuries in the past, water supplied the cheapest, and sometimes the only means of transporting bulk materials on a large scale, and it was also the most secure way to ensure transport over long distances. Because of this, the proximity of the sea drew Southeast Asians to participate in long-distance trade, but it was not only water that linked the shores to one another - seafaring people, along with traders contributed to these trade routes as well.[10]

### Ports and inland

Maritime traders most often congregated in ports, which were considered the point in which land and sea met that linked the hinterland to the wider world.[10] There were some ports that were more favored than others, blessed with a good location, with sufficient warehouse facilities, accessible harbors, and adequate supplies of food and water became "entrepôts," which were essentially the super-centers for trade. It was rare that these ports were ever considered a final destination, though, but rather central meeting points in what was an ever-changing economic and political environment.[10] Whether in Asia, Europe, or Africa, these port centers consisted of ethnically and culturally diverse communities. Many had officials that were of foreign birth or ancestry - they were skilled in being knowledgeable of the various cultures and languages of merchants that would work throughout the ports who were also foreign, this was done in order to be successful in supervising the trade that had occurred. Throughout many of the ports, merchants had become a more powerful group in local politics. Further, these ports promoted cultural exchange, along with economic exchange, due to the fact that it had been open to the world for races, cultures, and ideas to intermix with one another, along with the fact that this blend of both locals and outsiders from diverse backgrounds that were open to accepting cultural differences.[10] Nation-building and modernity reduced the role of trade through the sea and increased the reliance on trade through the land and the air in economic and social exchange. Even though Singapore, Bangkok, and Hong Kong are still vibrant and available to the world, similar to their early modern counterparts serving functions such as tourism which is unrelated to foreign trade, only a few ports are as economically crucial today as they had been in the past.[8]

Inland trade moved both by water, and overland itself. For example, shipping in small boats went along the coasts of India, but inland waterways were readily available to use to transport goods throughout many parts of India, especially in the south. Caravans that contained numbers from ten, all the way to up forty thousand pack or draft animals moved overland at a time. Combinations of these forms of transportation carried throughout the subcontinent and were therefore transshipped to and from long-distance maritime trade.[9] The majority of all of the port cities were in symbiosis with the caravan routes to and from their related hinterland interiors, and sometimes even with distant transcontinental regions. This is especially true in Central Asia - and it is suggested that the continental trade over both the land and the ocean maritime trade should be viewed not as separate or competitive, but rather as mirror images of one another.[9]

# Air

Humanity's desire to fly likely dates to the first time man observed birds, an observation illustrated in the legendary stories of Daedalus and Icarus in Greek mythology, and the Vimanas in Indian mythology. Much of the focus of early research was on imitating birds, but through trial and error, balloons, airships, gliders and eventually powered aircraft and other types of flying machines were invented.

Kites were the first form of man-made flying objects,[11] and early records suggest that kites were around before 200 BC in China.[12] Leonardo da Vinci's dream of flight found expression in several designs, but he did not attempt to demonstrate flight by literally constructing them.

During the 17th and 18th century, when scientists began analysing the Earth's atmosphere, gases such as hydrogen were discovered which in turn led to the invention of hydrogen balloons.[11] Various theories in mechanics by physicists during the same period of time—notably fluid dynamics and Newton's laws of motion—led to the foundation of modern aerodynamics. Tethered balloons filled with hot air were used in the first half of the 19th century and saw considerable action in several mid-century wars, most notably the American Civil War, where balloons provided observation during the Siege of Petersburg.

Apart from some scattered reference in ancient and medieval records, resting on slender evidence and in need of interpretation, the earliest clearly verifiable human flight took place in Paris in 1783, when Jean-François Pilâtre de Rozier and François Laurent d'Arlandes went 5 miles (8.0 km) in a hot air balloon invented by the Montgolfier brothers. The Wright brothers made the first sustained, controlled and powered heavier-than-air flight on 17 December 1903, in their revolutionary aircraft, the Wright Flyer.

World War II saw a drastic increase in the pace of aircraft development and production. All countries involved in the war stepped up development and production of aircraft and flight-based weapon delivery systems, such as the first long-range bomber.

After the war ended, commercial aviation grew rapidly, using mostly ex-military aircraft to transport people and cargo. This growth was accelerated by the glut of heavy and super-heavy bomber airframes like the Lancaster that could be converted into commercial aircraft. The first commercial jet airliner to fly was the British De Havilland Comet. This marked the beginning of the Jet Age, a period of relatively cheap and fast international travel.


Pilots of 611 *West Lancashire* Squadron lend a hand pushing an early Spitfire Mark IXb, Biggin Hill, late 1942.

In the beginning of the 21st century, subsonic military aviation focused on eliminating the pilot in favor of remotely operated or completely autonomous vehicles. Several unmanned aerial vehicles or UAVs have been developed. In April 2001, the unmanned aircraft Global Hawk flew from Edwards AFB in the US to Australia non-stop and unrefueled. This is the longest point-to-point flight ever undertaken by an unmanned aircraft, and took 23 hours and 23 minutes. In October 2003, the first totally autonomous flight across the Atlantic by a computer-controlled model aircraft occurred. Major disruptions to air travel in the 21st century included the closing of U.S. airspace following the September 11 attacks, the closing of northern European airspace after the 2010 eruptions of Eyjafjallajökull, and the COVID-19 pandemic.

# Space

The realistic dream of spaceflight dated back to Konstantin Tsiolkovsky, however Tsiolkovsky wrote in Russian, and this was not widely influential outside Russia. Spaceflight became an engineering possibility with the work of Robert H. Goddard's publication in 1919 of his paper 'Robert H. Goddard#A Method of Reaching Extreme Altitudes ,A Method of Reaching Extreme Altitudes'; where his application of the de Laval nozzle to liquid-propellant rockets gave sufficient power that interplanetary travel became possible. This paper was highly influential on Hermann Oberth and Wernher von Braun, later key players in spaceflight.

The first human spaceflight was achieved with the Soviet space program's Vostok 1 mission in 1961. The lead architects behind the mission were Sergei Korolev and Kerim Kerimov, with Yuri Gagarin being the first astronaut. On May 5, 1961, the US launched its first suborbital Mercury astronaut, Alan Shepard, in the *Freedom 7* capsule. Unlike Gagarin, Shepard manually controlled his spacecraft's attitude and landed inside it hence making his mission the first "completed" human spaceflight according to previous FAI definitions.[13][14] Kerimov later went on to launch the first space docks (Kosmos 186 and Kosmos 188) in 1967 and the first space stations (Salyut and Mir series) from 1971 to 1991.[15][16] The first spaceflight to the Moon was achieved with NASA's Apollo 11 mission in 1969, with Neil Armstrong and Buzz Aldrin being the first astronauts on the Moon.

# Navigational advances

The thirteenth century saw the rise of the magnetic compass for overseas travel. Prior to its creation, seamen would have to rely on landmarks and stars as guides for navigation. The compass allowed sailors to plot a course, and using magnetic north as a reference, could travel through fog and overcast. This also led to shorter voyages, as they could plot more linear approaches to destinations. Portolan charts rose up, plotting this linear excursion routes, making sea navigation more accurate and efficient.[17] In 1761, marine chronometer was invented.

## See also

- History of public transport
- Medieval transport
- Timeline of artificial satellites and space probes
- Timeline of aviation
- Timeline of diving technology
- Timeline of jet power
- Timeline of transportation technology

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# External links

- *The Journal of Transport History* (https://journals.sagepub.com/home/jth)

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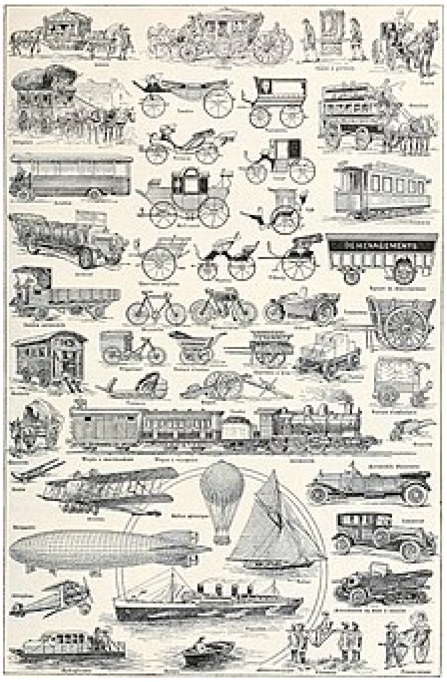
# Land transport



Carriages, carts, bicycles, cars, trains, boats, airships and airplanes

**Land transport** is the transport or movement of people, animals or goods from one location to another location on land. The two main forms of land transport can be considered to be rail transport and road transport.

## Contents



# Systems

Several systems of land transport have been devised, from the most basic system of humans carrying things from place to sophisticated networks of ground-based transportation utilising different types of vehicles and infrastructure. The three types are human-powered, animal powered and machine powered

## Human powered transportation

Human powered transport, a form of sustainable transportation, is the transport of people and/or goods using human muscle-power, in the form of walking, running and swimming. Modern technology has allowed machines to enhance human power. Human-powered transport remains popular for reasons of cost-saving, leisure, physical exercise, and environmentalism; it is sometimes the only type available, especially in underdeveloped or inaccessible regions.


Human-powered transport remains common in developing countries.

Although humans are able to walk without infrastructure, the transport can be enhanced through the use of roads, especially when using the human power with vehicles, such as bicycles and inline skates. Human-powered vehicles have also been developed for difficult environments, such as snow and water, by watercraft rowing and skiing; even the air can be entered with human-powered aircraft.

## Animal-powered transportation

Animal-powered transport is the use of working animals for the movement of people and goods. Humans may ride some of the animals directly, use them as pack animals for carrying goods, or harness them, alone or in teams, to pull sleds or wheeled vehicles.

## Road transportation

A road is an identifiable route, way or path between two or more places.[1] Roads are typically smoothed, paved, or otherwise prepared to allow easy travel;[2] though they need not be, and historically many roads were simply recognizable routes without any formal construction or maintenance.[3] In urban areas, roads may pass through a city or village and be named as streets, serving a dual function as urban space easement and route.[4]


The Harbor Freeway is often heavily congested at rush hour in Downtown Los Angeles.

The most common road vehicle is the automobile; a wheeled passenger vehicle that carries its own motor. Other users of roads include buses, trucks, motorcycles, bicycles and pedestrians. As of 2002, there were 590 million automobiles worldwide. Automobiles have caused air pollution which results to people getting Asthma . Road transport offers a complete freedom to road users to transfer the vehicle from one lane to the other and from one road to another according to the need and convenience. This flexibility of changes in location, direction, speed, and timings of travel is not available to other modes of transport. It is possible to provide door to door service only by road transport.

Automobiles offer high flexibility and with low capacity, but are deemed with high energy and area use, and the main source of noise and air pollution in cities; buses allow for more efficient travel at the cost of reduced flexibility.[5] Road transport by truck is often the initial and final stage of freight transport.

## Rail transportation

InterCityExpress, a German high-speed passenger train

Rail transport is where a train runs along a set of two parallel steel rails, known as a railway or railroad. The rails are anchored perpendicular to ties (or sleepers) of timber, concrete or steel, to maintain a consistent distance apart, or gauge. The rails and perpendicular beams are placed on a foundation made of concrete, or compressed earth and gravel in a bed of ballast. Alternative methods include monorail and maglev.

A train consists of one or more connected vehicles that run on the rails. Propulsion is commonly provided by a locomotive, that hauls a series of unpowered cars, that can carry passengers or freight. The locomotive can be powered by steam, diesel or by electricity supplied by trackside systems. Alternatively, some or all the cars can be powered, known as a multiple unit. Also, a train can be powered by horses, cables, gravity, pneumatics and gas turbines. Railed vehicles move with much less friction than rubber tires on paved roads, making trains more energy efficient, though not as efficient as ships.

Intercity trains are long-haul services connecting cities;[6] modern high-speed rail is capable of speeds up to 350 km/h (220 mph), but this requires specially built track. Regional and commuter trains feed cities from suburbs and surrounding areas, while intra-urban transport is performed by high-capacity tramways and rapid transits, often making up the backbone of a city's public transport. Freight trains traditionally used box cars, requiring manual loading and unloading of the cargo. Since the 1960s, container trains have become the dominant solution for general freight, while large quantities of bulk are transported by dedicated trains.

## Other modes


Trans-Alaska Pipeline for crude oil

Pipeline transport sends goods through a pipe; most commonly liquid and gases are sent, but pneumatic tubes can also send solid capsules using compressed air. For liquids/gases, any chemically stable liquid or gas can be sent through a pipeline. Short-distance systems exist for sewage, slurry, water and beer, while long-distance networks are used for petroleum and natural gas.

Cable transport is a broad mode where vehicles are pulled by cables instead of an internal power source. It is most commonly used at steep gradient. Typical solutions include aerial tramway, elevators, escalator and ski lifts; some of these are also categorized as conveyor transport.

## Connections with other modes

### Airports

Airports serve as a terminus for air transport activities, but most people and cargo transported by air must use ground transport to reach their final destination.

Airport-based services are sometimes used to shuttle people to nearby hotels or motels when overnight stay is required for connecting flights. Companies provide rental car, private bus and taxi services while mass transportation is usually provided by a municipality or other source of public funding.

Several major airports, including Denver International and JFK International, provide many types of ground transportation, often by working with livery companies and similar businesses. Smaller airports might only have a few private rental companies and a bus service. Larger airports tend to offer several different transportation options. Larger airports also sometimes have light rail and/or roads that loop around an airport to provide access from multiple terminals.

### Seaports

As with air transport, sea transport typically requires use of ground transport at either end of travel for people and goods to reach their final destinations. Significant infrastructure is used at ports to transfer people and goods between sea and land systems.

# Elements

## Infrastructure

Infrastructure is the fixed installations that allow a vehicle to operate. It consists of a way, a terminal and facilities for parking and maintenance. For rail, pipeline, road and cable transport, the entire way the vehicle travels must be built up.

Bridges, such as Golden Gate Bridge, allow roads and railways to cross bodies of water.

Terminals such as stations are locations where passengers and freight can be transferred from one vehicle or mode to another. For passenger transport, terminals are integrating different modes to allow riders to interchange to take advantage of each mode's advantages. For instance, airport rail links connect airports to the city centers and suburbs. The terminals for automobiles are parking lots, while buses and coaches can operate from simple stops.[7] For freight, terminals act as transshipment points, though some cargo is transported directly from the point of production to the point of use.

The financing of infrastructure can either be public or private. Transport is often a natural monopoly and a necessity for the public; roads, and in some countries railways and airports are funded through taxation. New infrastructure projects can have high cost, and are often financed through debt. Many infrastructure owners therefore impose usage fees, such as landing fees at airports, or toll plazas on roads. Independent of this, authorities may impose taxes on the purchase or use of vehicles. Because of poor forecasting and overestimation of passenger numbers by planners, there is frequently a benefits shortfall for transport infrastructure projects.[8]

## Vehicles

A vehicle is any non-living device that is used to move people and goods. Unlike the infrastructure, the vehicle moves along with the cargo and riders. Unless being pulled by a cable or muscle-power, the vehicle must provide its own propulsion; this is most commonly done through a steam engine, combustion engine, or electric motor, though other means of propulsion also exist. Vehicles also need a system of converting the energy into movement; this is most commonly done through wheels, propellers and pressure.


A Fiat Uno in 2018

Vehicles are most commonly staffed by a driver. However, some systems, such as people movers and some rapid transits, are fully automated. For passenger transport, the vehicle must have a compartment for the passengers. Simple vehicles, such as automobiles, bicycles or simple aircraft, may have one of the passengers as a driver.

# Users

## Public

Public land transport refers to carriage of people and goods by government or commercial entities which is made available to the public at large for the purpose of facilitating the economy and society they serve. Most transport infrastructure and large transport vehicles are operated in this manner. Funds to pay for such transport may come from taxes, subscriptions, direct user fees, or some combination. The vast majority of public transport is land-based, with commuting and postal delivery being the primary purposes.

## Commerce

Commercial land transport refers to carriage of people and goods by commercial entities made available at cost to individuals, businesses, and the government for the purpose of profiting the entities providing the travel. Most infrastructure used is publicly owned, and vehicles tend to be large and efficient to maximize capacity and profit margins. Freight shipping and long-distance travel are common uses served by commercial land transport.

## Military

Military land transport refers to carriage of people and goods by the military or other operators for the purpose of supporting military operations, both in peacetime as well as in combat areas. Such activity may use a combination of public infrastructure as well as military-specific infrastructure and in many cases is designed to operate with little or no infrastructure when necessary. Vehicles can range from basic commercial or even private vehicles to those specifically designed for military use.

## Private

Private land transport refers to individuals and organizations transporting themselves and their own people, animals, and goods at their own discretion. Vehicles used are typically smaller, though publicly owned infrastructure is often used for travel.

# Function

Relocation of travelers and cargo are the most common uses of transport. However, other uses exist, such as the strategic and tactical relocation of armed forces during warfare, or the civilian mobility construction or emergency equipment.

## Passenger


A local transit bus operated by Transperth in Perth, Australia


A taxicab operated in New York City, United States

Passenger transport, or travel, is divided into public and private transport. Public transport is scheduled services on fixed routes, while private is vehicles that provide ad hoc services at the riders desire. The latter offers better flexibility, but has lower capacity, and a higher environmental impact. Travel may be as part of daily commuting, for business, leisure or migration.

Short-haul transport is dominated by the automobile and mass transit. The latter consists of buses in rural and small cities, supplemented with commuter rail, trams and rapid transit in larger cities. Long-haul transport involves the use of the automobile, trains, coaches and aircraft, the last of which have become predominantly used for the longest, including intercontinental, travel. Intermodal passenger transport is where a journey is performed through the use of several modes of transport; since all human transport normally starts and ends with walking, all passenger transport can be considered intermodal. Public transport may also involve the intermediate change of vehicle, within or across modes, at a transport hub, such as a bus or railway station.

Taxis and buses can be found on both ends of the public transport spectrum. Buses are the cheaper mode of transport but are not necessarily flexible, and taxis are very flexible but more expensive. In the middle is demand-responsive transport, offering flexibility whilst remaining affordable.

International travel may be restricted for some individuals due to legislation and visa requirements.

## Freight

Freight transport, or shipping, is a key in the value chain in manufacturing.[9] With increased specialization and globalization, production is being located further away from consumption, rapidly increasing the demand for transport.[10] While all modes of transport are used for cargo transport, there is high differentiation between the nature of the cargo transport, in which mode is chosen.[11] Logistics refers to the entire process of transferring products from producer to consumer, including storage, transport, transshipment, warehousing, material-handling and packaging, with associated exchange of information.[12] Incoterm deals with the handling of payment and responsibility of risk during transport.[13]

Containerization, with the standardization of ISO containers on all vehicles and at all ports, has revolutionized international and domestic trade, offering huge reduction in transshipment costs. Traditionally, all cargo had to be manually loaded and unloaded into the haul of any car; containerization allows for automated handling and transfer between modes, and the standardized sizes allow for gains in economy of scale in vehicle operation. This has been one of the key driving factors in international trade and globalization since the 1950s.[14]

Freight train with shipping containers in the United Kingdom

Bulk transport is common with cargo that can be handled roughly without deterioration; typical examples are ore, coal, cereals and petroleum. Because of the uniformity of the product, mechanical handling can allow enormous quantities to be handled quickly and efficiently. The low value of the cargo combined with high volume also means that economies of scale become essential in transport, and whole trains are commonly used to transport bulk. Liquid products with sufficient volume may also be transported by pipeline.

# History

Humans' first means of land transport was walking. The domestication of animals introduces a new way to lay the burden of transport on more powerful creatures, allowing heavier loads to be hauled, or humans to ride the animals for higher speed and duration. Inventions such as the wheel and sled helped make animal transport more efficient through the introduction of vehicles. However, water transport, including rowed and sailed vessels, was the only efficient way to transport large quantities or over large distances prior to the Industrial Revolution.

Bullock team hauling wool in Australia

The first forms of road transport were horses, oxen or even humans carrying goods over dirt tracks that often followed game trails. Paved roads were built by many early civilizations, including Mesopotamia and the Indus Valley civilization. The Persian and Roman empires built stone-paved roads to allow armies to travel quickly. Deep roadbeds of crushed stone underneath ensured that the roads kept dry. The medieval Caliphate later built tar-paved roads. Until the Industrial Revolution, transport remained slow and costly, and production and consumption were located as close to each other as feasible.

The Industrial Revolution in the 19th century saw a number of inventions fundamentally change transport. With telegraphy, communication became instant and independent of transport. The invention of the steam engine, closely followed by its application in rail transport, made land transport independent of human or animal muscles. Both speed and capacity increased rapidly, allowing specialization through manufacturing being located independent of natural resources.

With the development of the combustion engine and the automobile at the turn into the 20th century, road transport became more viable, allowing the introduction of mechanical private transport. The first highways were constructed during the 19th century with macadam. Later, tarmac and concrete became the dominant paving material.

After World War II, the automobile and airlines took higher shares of transport, reducing rail to freight and short-haul passenger.[15] In the 1950s, the introduction of containerization gave massive efficiency gains in freight transport, permitting globalization.[14] International air travel became much more accessible in the

1960s, with the commercialization of the jet engine. Along with the growth in automobiles and motorways, this introduced a decline for rail transport. After the introduction of the Shinkansen in 1964, high-speed rail in Asia and Europe started taking passengers on long-haul routes from airlines.[15]

Modes of road transport in Dublin, 1929

Early in U.S. history, most aqueducts, bridges, canals, railroads, roads, and tunnels were owned by private joint-stock corporations. Most such transportation infrastructure came under government control in the late 19th and early 20th centuries, culminating in the nationalization of inter-city passenger rail service with the creation of Amtrak. Recently, however, a movement to privatize roads and other infrastructure has gained some ground and adherents.[16]

# Impact

## Economic

Transport is a key component of growth and globalization, such as in Seattle, Washington, United States.

Transport is a key necessity for specialization—allowing production and consumption of products to occur at different locations. Transport has throughout history been a spur to expansion; better transport allows more trade and a greater spread of people. Economic growth has always been dependent on increasing the capacity and rationality of transport.[17] But the infrastructure and operation of transport has a great impact on the land and is the largest drainer of energy, making transport sustainability a major issue.

Modern society dictates a physical distinction between home and work, forcing people to transport themselves to places of work or study, as well as to temporarily relocate for other daily activities. Passenger transport is also the essence of tourism, a major part of recreational transport. Commerce requires the transport of people to conduct business, either to allow face-to-face communication for important decisions or to move specialists from their regular place of work to sites where they are needed.

## Planning

Transport planning allows for high utilization and less impact regarding new infrastructure. Using models of transport forecasting, planners are able to predict future transport patterns. On the operative level, logistics allows owners of cargo to plan transport as part of the supply chain. Transport as a field is studied through transport economics, the backbone for the creation of regulation policy by authorities. Transport engineering, a sub-discipline of civil engineering, must take into account trip generation, trip distribution, mode choice and route assignment, while the operative level is handled through traffic engineering.

Because of the negative impacts made, transport often becomes the subject of controversy related to choice of mode, as well as increased capacity. Automotive transport can be seen as a tragedy of the commons, where the flexibility and comfort for the individual deteriorate the natural and urban environment for all. Density of development depends on mode of transport, with public transport allowing for better spatial utilization. Good land use keeps common activities close to people's homes and places higher-density development closer to transport lines and hubs, to minimize the need for transport. There are economies of agglomeration. Beyond transportation some land uses are more efficient when clustered. Transportation facilities consume land, and in cities, pavement (devoted to streets and parking) can easily exceed 20 percent of the total land use. An efficient transport system can reduce land waste.

The engineering of this roundabout in Bristol, United Kingdom, attempts to make traffic flow free-moving.

Too much infrastructure and too much smoothing for maximum vehicle throughput means that in many cities there is too much traffic and many—if not all—of the negative impacts that come with it. It is only in recent years that traditional practices have started to be questioned in many places, and as a result of new types of analysis which bring in a much broader range of skills than those traditionally relied on—spanning such areas as environmental impact analysis, public health, sociologists as well as economists—the viability of the old mobility solutions is increasingly being questioned. European cities are leading this transition.

## Environment

Traffic congestion persists in São Paulo, Brazil despite the no-drive days based on license numbers.

Transport is a major use of energy and burns most of the world's petroleum. This creates air pollution, including nitrous oxides and particulates, and is a significant contributor to global warming through emission of carbon dioxide,[18] for which transport is the fastest-growing emission sector.[19] By subsector, road transport is the largest contributor to global warming.[18] Environmental regulations in developed countries have reduced individual vehicles' emissions; however, this has been offset by increases in the numbers of vehicles and in the use of each vehicle.[18] Some pathways to reduce the carbon emissions of road vehicles considerably have been studied.[20][21] Energy use and emissions vary largely between modes, causing environmentalists to call for a transition from road to rail and human-powered transport, as well as increased transport electrification and energy efficiency.

Other environmental impacts of transport systems include traffic congestion and automobile-oriented urban sprawl, which can consume natural habitat and agricultural lands. By reducing transportation emissions globally, it is predicted that there will be significant positive effects on Earth's air quality, acid rain, smog and climate change.[22]

## See also

- Transport
- Public transport
- Fuel efficiency in transportation
- List of emerging transportation technologies
- Outline of transport
- IEEE Intelligent Transportation Systems Society
- *Journal of Transport and Land Use*

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# External links

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# Logistics

**Logistics** is generally the detailed organization and implementation of a complex operation. In a general business sense, logistics manages the flow of goods between the point of origin and the point of consumption to meet the requirements of customers or corporations. The resources managed in logistics may include tangible goods such as materials, equipment, and supplies, as well as food and other consumable items.

In military science, logistics is concerned with maintaining army supply lines while disrupting those of the enemy, since an armed force without resources and transportation is defenseless. Military logistics was already practiced in the ancient world and as the modern military has a significant need for logistics solutions, advanced implementations have been developed. In military logistics, logistics officers manage how and when to move resources to the places they are needed.

Logistics management is the part of supply chain management and supply chain engineering that plans, implements, and controls the efficient, effective forward, and reverse flow and storage of goods, services, and related information between the point of origin and point of consumption to meet customers' requirements. The complexity of logistics can be modeled, analyzed, visualized, and optimized by dedicated simulation software. The minimization of the use of resources is a common motivation in all logistics fields. A professional working in the field of logistics management is called a logistician.

## Contents



A warehouse implementing a pallet rack storage system

# Nomenclature

Logistics Specialist inventories supplies in a storeroom aboard the aircraft carrier USS *George H.W. Bush*

The term *logistics* is attested in English from 1846, and is from French: *logistique*, where it was either coined or popularized by Swiss military officer and writer Antoine-Henri Jomini, who defined it in his *Summary of the Art of War* (*Précis de l'Art de la Guerre*). The term appears in the 1830 edition, then titled *Analytic Table* (*Tableau Analytique*),[1] and Jomini explains that it is derived from French: *logis*, lit. 'lodgings' (cognate to English *lodge*), in the terms French: *maréchal des logis*, lit. 'marshall of lodgings' and French: *major-général des logis*, lit. 'major-general of lodging':

> Autrefois les officiers de l'état-major se nommaient: maréchal des logis, major-général des logis; de là est venu le terme de logistique, qu'on emploie pour désigner ce qui se rapporte aux marches d'une armée.

> Formerly the officers of the general staff were named: marshall of lodgings, major-general of lodgings; from there came the term of logistics [*logistique*], which we employ to designate those who are in charge of the functioning of an army.

The term is credited to Jomini, and the term and its etymology criticized by Georges de Chambray in 1832, writing:[2]

> *Logistique*: Ce mot me paraît être tout-à-fait nouveau, car je ne l'avais encore vu nulle part dans la littérature militaire. … il paraît le faire dériver du mot *logis*, étymologie singulière …

> *Logistic*: This word appears to me to be completely new, as I have not yet seen it anywhere in military literature. … he appears to derive it from the word *lodgings* [*logis*], a peculiar etymology …

Chambray also notes that the term *logistique* was present in the *Dictionnaire de l'Académie française* as a synonym for algebra.

The French word: *logistique* is a homonym of the existing mathematical term, from Ancient Greek: λογῐστῐκός, romanized: *logistikós*, a traditional division of Greek mathematics; the mathematical term is presumably the origin of the term *logistic* in logistic growth and related terms. Some sources give this instead as the source of *logistics*,[3] either ignorant of Jomini's statement that it was derived from *logis*, or dubious and instead believing it was in fact of Greek origin, or influenced by the existing term of Greek origin.

# Definition

Jomini originally defined logistics as:[1]

> ... l'art de bien ordonner les marches d'une armée, de bien combiner l'ordre des troupes dans les colonnes, les tems [temps] de leur départ, leur itinéraire, les moyens de communications nécessaires pour assurer leur arrivée à point nommé ...
>
> ... the art of well-ordering the functionings of an army, of well combining the order of troops in columns, the times of their departure, their itinerary, the means of communication necessary to assure their arrival at a named point ...

The *Oxford English Dictionary* defines logistics as "the branch of military science relating to procuring, maintaining and transporting material, personnel and facilities". However, the *New Oxford American Dictionary* defines logistics as "the detailed coordination of a complex operation involving many people, facilities, or supplies", and the Oxford Dictionary on-line defines it as "the detailed organization and implementation of a complex operation".[4] As such, logistics is commonly seen as a branch of engineering that creates "people systems" rather than "machine systems".

According to the Council of Supply Chain Management Professionals (previously the Council of Logistics Management),[5] logistics is the process of planning, implementing and controlling procedures for the efficient and effective transportation and storage of goods including services and related information from the point of origin to the point of consumption for the purpose of conforming to customer requirements and includes inbound, outbound, internal and external movements.[6]

Academics and practitioners traditionally refer to the terms operations or production management when referring to physical transformations taking place in a single business location (factory, restaurant or even bank clerking) and reserve the term logistics for activities related to distribution, that is, moving products on the territory. Managing a distribution center is seen, therefore, as pertaining to the realm of logistics since, while in theory, the products made by a factory are ready for consumption they still need to be moved along the distribution network according to some logic, and the distribution center aggregates and processes orders coming from different areas of the territory. That being said, from a modeling perspective, there are similarities between operations management and logistics, and companies sometimes use hybrid professionals, with for example a "Director of Operations" or a "Logistics Officer" working on similar problems. Furthermore, the term "supply chain management" originally referred to, among other issues, having an integrated vision of both production and logistics from point of origin to point of production.[7] All these terms may suffer from semantic change as a side effect of advertising.

# Logistics activities and fields

**Inbound logistics** is one of the primary processes of logistics concentrating on purchasing and arranging the inbound movement of materials, parts, or unfinished inventory from suppliers to manufacturing or assembly plants, warehouses, or retail stores.

**Outbound logistics** is the process related to the storage and movement of the final product and the related information flows from the end of the production line to the end user.

Given the services performed by logisticians, the main fields of logistics can be broken down as follows:

- Procurement logistics
- Distribution logistics
- After-sales logistics
- Disposal logistics
- Reverse logistics
- Green logistics
- Global logistics
- Domestics logistics
- Concierge service
- Reliability, availability, and maintainability
- Asset control logistics
- Point-of-sale material logistics
- Emergency logistics
- Production logistics
- Construction logistics
- Capital project logistics
- Digital logistics
- Humanitarian logistics

**Procurement logistics** consists of activities such as market research, requirements planning, make-or-buy decisions, supplier management, ordering, and order controlling. The targets in procurement logistics might be contradictory: maximizing efficiency by concentrating on core competences, outsourcing while maintaining the autonomy of the company, or minimizing procurement costs while maximizing security within the supply process.

Loading of a thermal oxidizer at the point of origin en route to a manufacturing plant

**Advance Logistics** consists of the activities required to set up or establish a plan for logistics activities to occur.

**Global Logistics** is technically the process of managing the "flow" of goods through what is called a supply chain, from its place of production to other parts of the world. This often requires an intermodal transport system, transport via ocean, air, rail, and truck. The effectiveness of global logistics is measured in the Logistics Performance Index.

**Distribution logistics** has, as main tasks, the delivery of the finished products to the customer. It consists of order processing, warehousing, and transportation. Distribution logistics is necessary because the time, place, and quantity of production differ with the time, place, and quantity of consumption.[8]

**Disposal logistics** has as its main function to reduce logistics cost(s) and enhance service(s) related to the disposal of waste produced during the operation of a business.

**Reverse logistics** denotes all those operations related to the reuse of products and materials. The reverse logistics process includes the management and the sale of surpluses, as well as products being returned to vendors from buyers. Reverse logistics stands for all operations related to the reuse of products and materials. It is "the process of planning, implementing, and controlling the efficient, cost-effective flow of raw materials, in-process inventory, finished goods and related information from the point of consumption to the point of origin for the purpose of recapturing value or proper disposal. More precisely, reverse logistics is the process of moving goods from their typical final destination for the purpose of capturing value, or proper disposal. The opposite of reverse logistics is **forward logistics**."

**Green Logistics** describes all attempts to measure and minimize the ecological impact of logistics activities. This includes all activities of the forward and reverse flows. This can be achieved through intermodal freight transport, path optimization, vehicle saturation and city logistics.

**RAM Logistics** (see also Logistic engineering) combines both **business logistics** and **military logistics** since it is concerned with highly complicated technological systems for which Reliability, Availability and Maintainability are essential, ex: weapon systems and military supercomputers.

**Asset Control Logistics**: companies in the retail channels, both organized retailers and suppliers, often deploy assets required for the display, preservation, promotion of their products. Some examples are refrigerators, stands, display monitors, seasonal equipment, poster stands & frames.

A forklift truck loads a pallet of humanitarian aid to Pakistan on board a C-17 aircraft, following devastating floods in the country in 2010.

The Logistics Centre of the Finnish Red Cross in Tampere, Finland

**Emergency logistics** (or **Humanitarian Logistics**) is a term used by the logistics, supply chain, and manufacturing industries to denote specific time-critical modes of transport used to move goods or rapidly in the event of an emergency.[9] The reason for enlisting emergency logistics services could be a production delay or anticipated production delay, or an urgent need for specialized equipment to prevent events such as aircraft being grounded (also known as "aircraft on ground"—AOG), ships being delayed, or telecommunications failure. Humanitarian logistics involves governments, the military, aid agencies, donors, non-governmental organizations and emergency logistics services are typically sourced from a specialist provider.[9][10]

The term **production logistics** describes logistic processes within a value-adding system (ex: factory or a mine). Production logistics aims to ensure that each machine and workstation receives the right product in the right quantity and quality at the right time. The concern is with production, testing, transportation, storage, and supply. Production logistics can operate in existing as well as new plants: since manufacturing in an existing plant is a constantly changing process, machines are exchanged and new ones added, which gives the opportunity to improve the production logistics system accordingly.[11] Production logistics provides the means to achieve customer response and capital efficiency. Production logistics becomes more important with decreasing batch sizes. In many industries (e.g. mobile phones), the short-term goal is a batch size of one, allowing even a single customer's demand to be fulfilled efficiently. Track and tracing, which is an essential part of production logistics due to product safety and reliability issues, is also gaining importance, especially in the automotive and medical industries.

**Construction Logistics** has been employed by civilizations for thousands of years. As the various human civilizations tried to build the best possible works of construction for living and protection. Now construction logistics has emerged as a vital part of construction. In the past few years, construction logistics has emerged as a different field of knowledge and study within the subject of supply chain management and logistics.

# Concept of Seven R's

..is a popular concept used to enforce best practices in Logistics Management which consists of following: [12]

- Right Product (including the right information about it)
- (At) Right Quantity
- Right Time
- Right Condition
- Right Place
- (to) The Right Customer
- (with the) Right (financial) Resources

# Military logistics

In military science, maintaining one's supply lines while disrupting those of the enemy is a crucial—some would say the most crucial—element of military strategy, since an armed force without resources and transportation is defenseless. The historical leaders Hannibal, Alexander the Great, and the Duke of Wellington are considered to have been logistical geniuses: Alexander's expedition benefited considerably from his meticulous attention to the provisioning of his army,[14] Hannibal is credited to have "taught logistics" to the Romans during the Punic Wars[15] and the success of the Anglo-Portuguese army in the Peninsula War was due to the effectiveness of Wellington's supply system, despite the numerical disadvantage.[16] The defeat of the British in the American War of Independence and the defeat of the Axis in the African theater of World War II are attributed by some scholars to logistical failures.[17]

Punjab Regiment uses mules for carrying cargo in Burma during WWII. Animals have been used for logistic purposes by different people throughout history; the Roman army in particular preferred mules over donkeys for their moving capacity.[13]

Militaries have a significant need for logistics solutions and so have developed advanced implementations. Integrated Logistics Support (ILS) is a discipline used in military industries to ensure an easily supportable system with a robust customer service (logistic) concept at the lowest cost and in line with (often high) reliability, availability, maintainability, and other requirements, as defined for the project.

In military logistics, Logistics Officers manage how and when to move resources to the places they are needed.

Supply chain management in military logistics often deals with a number of variables in predicting cost, deterioration, consumption, and future demand. The United States Armed Forces' categorical supply classification was developed in such a way that categories of supply with similar consumption variables are grouped together for planning purposes. For instance, peacetime consumption of ammunition and fuel will be considerably lower than wartime consumption of these items, whereas other classes of supply such as subsistence and clothing have a relatively consistent consumption rate regardless of war or peace.

Some classes of supply have a linear demand relationship: as more troops are added, more supply items are needed; or as more equipment is used, more fuel and ammunition are consumed. Other classes of supply must consider a third variable besides usage and quantity: time. As equipment ages, more and more repair parts are needed over time, even when usage and quantity stay consistent. By recording and analyzing these trends over time and applying them to future scenarios, the US Armed Forces can accurately supply troops with the items necessary at the precise moment they are needed.[18] History has shown that good logistical planning creates a lean and efficient fighting force. The lack thereof can lead to a clunky, slow, and ill-equipped force with too much or too little supply.

## Business logistics

One definition of business logistics speaks of "having the right item in the right quantity at the right time at the right place for the right price in the right condition to the right customer".[19] Business logistics incorporates all industry sectors and aims to manage the fruition of project life cycles, supply chains, and resultant efficiencies.

A forklift stacking a logistics provider's warehouse of goods on pallets

The term "business logistics" has evolved since the 1960s[20] due to the increasing complexity of supplying businesses with materials and shipping out products in an increasingly globalized supply chain, leading to a call for professionals called "supply chain logisticians".

In business, logistics may have either an internal focus (inbound logistics) or an external focus (outbound logistics), covering the flow and storage of materials from point of origin to point of consumption (see supply-chain management). The main functions of a qualified logistician include inventory management, purchasing, transportation, warehousing, consultation, and the organizing and planning of these activities. Logisticians combine professional knowledge of each of these functions to coordinate resources in an organization.

There are two fundamentally different forms of logistics: One optimizes a steady flow of material through a network of transport links and storage nodes, while the other coordinates a sequence of resources to carry out some project (e.g., restructuring a warehouse).

### Nodes of a distribution network

The nodes of a distribution network include:

- Factories where products are manufactured or assembled

- A depot or deposit, a standard type of warehouse for storing merchandise (high level of inventory)
- Distribution centers for order processing and order fulfillment (lower level of inventory) and also for receiving returning items from clients. Typically, distribution centers are way stations for products to be disbursed further down the supply chain. They usually do not ship inventory directly to customers, whereas fulfillment centers do.
- Transit points for cross docking activities, which consist of reassembling cargo units based on deliveries scheduled (only moving merchandise)
- Traditional "mom-and-pop" retail stores, modern supermarkets, hypermarkets, discount stores or also voluntary chains, consumers' co-operative, groups of consumer with collective buying power. Note that subsidiaries will be mostly owned by another company and franchisers, although using other company brands, actually own the point of sale.

There may be some intermediaries operating for representative matters between nodes such as sales agents or brokers.

## Logistic families and metrics

A logistic family is a set of products that share a common characteristic: weight and volumetric characteristics, physical storing needs (temperature, radiation,...), handling needs, order frequency, package size, etc. The following metrics may be used by the company to organize its products in different families:[21]

- Physical metrics used to evaluate inventory systems include stocking capacity, selectivity, superficial use, volumetric use, transport capacity, transport capacity use.
- Monetary metrics used include space holding costs (building, shelving, and services) and handling costs (people, handling machinery, energy, and maintenance).

Other metrics may present themselves in both physical or monetary form, such as the standard Inventory turnover.

## Handling and order processing

Unit loads for transportation of luggage at the airport. In this case, the unit load has a protective function.

Unit loads are combinations of individual items which are moved by handling systems, usually employing a pallet of normed dimensions.[22]

Handling systems include: trans-pallet handlers, counterweight handler, retractable mast handler, bilateral handlers, trilateral handlers, AGV and other handlers.

Storage systems include: pile stocking, cell racks (either static or movable), cantilever racks and gravity racks.[23]

Order processing is a sequential process involving: processing withdrawal list, picking (selective removal of items from loading units), sorting (assembling items based on the destination), package formation (weighting, labeling, and packing), order consolidation (gathering packages into loading units for transportation, control and bill of lading).[24]

Picking can be both manual or automated. Manual picking can be both man to goods, i.e. operator using a cart or conveyor belt, or goods to man, i.e. the operator benefiting from the presence of a mini-load ASRS, vertical or horizontal carousel or from an Automatic Vertical Storage System (AVSS). Automatic picking is done either with dispensers or depalletizing robots.

Sorting can be done manually through carts or conveyor belts, or automatically through sorters.

## Transportation

Cargo, i.e. merchandise being transported, can be moved through a variety of transportation means and is organized in different shipment categories. Unit loads are usually assembled into higher standardized units such as: ISO containers, swap bodies or semi-trailers. Especially for very long distances, product transportation will likely benefit from using different transportation means: multimodal transport, intermodal transport (no handling) and combined transport (minimal road transport). When moving cargo, typical constraints are maximum weight and volume.

Operators involved in transportation include: all train, road vehicles, boats, airplanes companies, couriers, freight forwarders and multi-modal transport operators.

Merchandise being transported internationally is usually subject to the Incoterms standards issued by the International Chamber of Commerce.

## Configuration and management

Push-back rack for motorcycles, a LIFO rack system for storage

Similarly to production systems, logistic systems need to be properly configured and managed. Actually a number of methodologies have been directly borrowed from operations management such as using Economic Order Quantity models for managing inventory in the nodes of the network.[25] Distribution resource planning (DRP) is similar to MRP, except that it doesn't concern activities inside the nodes of the network but planning distribution when moving goods through the links of the network.

Traditionally in logistics **configuration** may be at the level of the warehouse (node) or at level of the distribution system (network).

Regarding a single warehouse, besides the issue of designing and building the warehouse, configuration means solving a number of interrelated technical-economic problems: dimensioning rack cells, choosing a palletizing method (manual or through robots), rack dimensioning and design, number of racks, number and typology of retrieval systems (e.g. stacker cranes). Some important constraints have to be satisfied: fork and load beams resistance to bending and proper placement of sprinklers. Although picking is more of a tactical planning decision than a configuration problem, it is important to take it into account when deciding the layout of the racks inside the warehouse and buying tools such as handlers and motorized carts since once those decisions are taken they will work as constraints when managing the warehouse, the same reasoning for sorting when designing the conveyor system or installing automatic dispensers.

Configuration at the level of the distribution system concerns primarily the problem of location of the nodes in geographic space and distribution of capacity among the nodes. The first may be referred to as facility location (with the special case of site selection) while the latter to as capacity allocation. The problem of outsourcing typically arises at this level: the nodes of a supply chain are very rarely owned by a single enterprise. Distribution networks can be characterized by numbers of levels, namely the number of intermediary nodes between supplier and consumer:

- Direct store delivery, i.e. zero levels
- One level network: central warehouse
- Two level network: central and peripheral warehouses

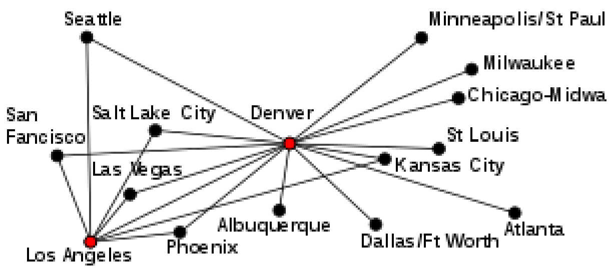
This distinction is more useful for modeling purposes, but it relates also to a tactical decision regarding safety stocks: considering a two-level network, if safety inventory is kept only in peripheral warehouses then it is called a dependent system (from suppliers), if safety inventory is distributed among central and peripheral warehouses it is called an independent system (from suppliers).[21] Transportation from producer to the second level is called primary transportation, from the second level to a consumer is called secondary transportation.

Although configuring a distribution network from zero is possible, logisticians usually have to deal with restructuring existing networks due to presence of an array of factors: changing demand, product or process innovation, opportunities for outsourcing, change of government policy toward trade barriers, innovation in transportation means (both vehicles or thoroughfares), the introduction of regulations (notably those regarding pollution) and availability of ICT supporting systems (e.g. ERP or e-commerce).

Once a logistic system is configured, **management**, meaning tactical decisions, takes place, once again, at the level of the warehouse and of the distribution network. Decisions have to be made under a set of constraints: internal, such as using the available infrastructure, or external, such as complying with the given product shelf lifes and expiration dates.

At the warehouse level, the logistician must decide how to distribute merchandise over the racks. Three basic situations are traditionally considered: shared storage, dedicated storage (rack space reserved for specific merchandise) and class-based storage (class meaning merchandise organized in different areas according to their access index).

Picking efficiency varies greatly depending on the situation.[24] For a man to goods situation, a distinction is carried out between high-level picking (vertical component significant) and low-level picking (vertical component insignificant). A number of tactical decisions regarding picking must be made:



Airline logistic network. Denver works as a hub in the network.

- Routing path: standard alternatives include transversal routing, return routing, midpoint routing, and largest gap return routing
- Replenishment method: standard alternatives include equal space supply for each product class and equal time supply for each product class.
- Picking logic: order picking vs batch picking

At the level of the distribution network, tactical decisions involve mainly inventory control and delivery path optimization. Note that the logistician may be required to manage the reverse flow along with the forward flow.

## Warehouse management system and control

Although there is some overlap in functionality, warehouse management systems (WMS) can differ significantly from warehouse control systems (WCS). Simply put, a WMS plans a weekly activity forecast based on such factors as statistics and trends, whereas a WCS acts like a floor supervisor, working in real-time to get the job done by the most effective means. For instance, a WMS can tell the system that it is going to need five of stock-keeping unit (SKU) A and five of SKU B hours in advance, but by the time it acts, other considerations may have come into play or there could be a logjam on a conveyor. A WCS can prevent that problem by working in real-time and adapting to the situation by making a last-minute decision based on current activity and operational status. Working synergistically, WMS and WCS can resolve these issues and maximize efficiency for companies that rely on the effective operation of their warehouse or distribution center.[26]

## Logistics outsourcing

Logistics outsourcing involves a relationship between a company and an LSP (logistic service provider), which, compared with basic logistics services, has more customized offerings, encompasses a broad number of service activities, is characterized by a long-term orientation, and thus has a strategic nature.[27]

Outsourcing does not have to be complete externalization to an LSP, but can also be partial:

- A single contract for supplying a specific service on occasion
- Creation of a spin-off
- Creation of a joint venture

**Third-party logistics** (3PL) involves using external organizations to execute logistics activities that have traditionally been performed within an organization itself.[28] According to this definition, third-party logistics includes any form of outsourcing of logistics activities previously performed in house. For example, if a company with its own warehousing facilities decides to employ external transportation, this would be an example of third-party logistics. Logistics is an emerging business area in many countries. External 3PL providers have evolved from merely providing logistics capabilities to becoming real orchestrators of supply chains that create and sustain a competitive advantage, thus bringing about new levels of logistics outsourcing.[29]

The concept of a **fourth-party logistics** (4PL) provider was first defined by Andersen Consulting (now Accenture) as an integrator that assembles the resources, planning capabilities, and technology of its own organization and other organizations to design, build, and run comprehensive supply chain solutions. Whereas a third-party logistics (3PL) service provider targets a single function, a 4PL targets management of the entire process. Some have described a 4PL as a general contractor that manages other 3PLs, truckers, forwarders, custom house agents, and others, essentially taking responsibility of a complete process for the customer.

## Horizontal alliances between logistics service providers

Horizontal business alliances often occur between logistics service providers, i.e., the cooperation between two or more logistics companies that are potentially competing.[30] In a horizontal alliance, these partners can benefit twofold. On one hand, they can "access tangible resources which are directly exploitable". In this example extending common transportation networks, their warehouse infrastructure and the ability to provide more complex service packages can be achieved by combining resources. On the other hand, partners can "access intangible resources, which are not directly exploitable". This typically includes know-how and information and, in turn, innovation.[30]

## Logistics automation

Logistics automation is the application of computer software or automated machinery to improve the efficiency of logistics operations. Typically, this refers to operations within a warehouse or distribution center with broader tasks undertaken by supply chain engineering systems and enterprise resource planning systems.

Industrial machinery can typically identify products through either barcode or RFID technologies. Information in traditional bar codes is stored as a sequence of black and white bars varying in width, which when read by laser is translated into a digital sequence, which according to fixed rules can be converted into a decimal number or other data. Sometimes information in a bar code can be transmitted through radio frequency, more typically radio transmission is used in RFID tags. An RFID tag is a card containing a memory chip and an antenna that transmits signals to a reader. RFID may be found on merchandise, animals, vehicles, and people as well.

Automated storage and retrieval system used by the U.S. military, also used by business in conjunction with manual picking.

## Logistics: profession and organizations

A **logistician** is a professional logistics practitioner. Professional logisticians are often certified by professional associations. One can either work in a pure logistics company, such as a shipping line, airport, or freight forwarder, or within the logistics department of a company. However, as mentioned above, logistics is a broad field, encompassing procurement, production, distribution, and disposal activities. Hence, career perspectives are broad as well. A new trend in the industry is the 4PL, or fourth-party logistics, firms, consulting companies offering logistics services.

Some universities and academic institutions train students as logisticians, offering undergraduate and postgraduate programs. A university with a primary focus on logistics is Kühne Logistics University in Hamburg, Germany. It is non-profit and supported by Kühne-Foundation of the logistics entrepreneur Klaus Michael Kühne.

The Chartered Institute of Logistics and Transport (CILT), established in the United Kingdom in 1919, received a Royal Charter in 1926. The Chartered Institute is one of the professional bodies or institutions for the logistics and transport sectors that offer professional qualifications or degrees in logistics management. CILT programs can be studied at centers around the UK, some of which also offer distance learning options.[31] The institute also have overseas branches namely The Chartered Institute of Logistics & Transport Australia (CILTA)[32] in Australia and Chartered Institute of Logistics and Transport in Hong Kong (CILTHK)[33] in Hong Kong. In the UK, Logistics Management programs are conducted by many universities and professional bodies such as CILT. These programs are generally offered at the postgraduate level.

The Global Institute of Logistics[34] established in New York in 2003 is a Think tank for the profession and is primarily concerned with intercontinental maritime logistics. It is particularly concerned with container logistics and the role of the seaport authority in the maritime logistics chain.

The International Association of Public Health Logisticians (IAPHL)[35] is a professional network that promotes the professional development of supply chain managers and others working in the field of public health logistics and commodity security, with particular focus on developing countries. The association supports logisticians worldwide by providing a community of practice, where members can network, exchange ideas, and improve their professional skills.

### Logistics museums

There are many museums in the world which cover various aspects of practical logistics. These include museums of transportation, customs, packing, and industry-based logistics. However, only the following museums are fully dedicated to logistics:

*General logistics*

- Logistics Museum (Saint Petersburg, Russia)[36]
- Museum of Logistics (Tokyo, Japan)[37]
- Beijing Wuzi University Logistics Museum (Beijing, China)

*Military logistics*

- Royal Logistic Corps Museum (Surrey, England, United Kingdom)
- The Canadian Forces Logistics Museum (Montreal, Quebec, Canada)[38]
- Logistics Museum (Hanoi, Vietnam)

## See also

- Automated identification and data capture
- Document automation in supply chain management and logistics
- Field inventory management
- Freight claim
- Freight forwarder
- Incoterms
- Containerization
- Integrated Service Provider
- Inventory management software
- Performance-based logistics
- Physical inventory
- Sales territory
- Storage management system
- Blockchain
- Dutch flower bucket
- Self-driving truck
- Automated storage and retrieval system

- Automated guided vehicle

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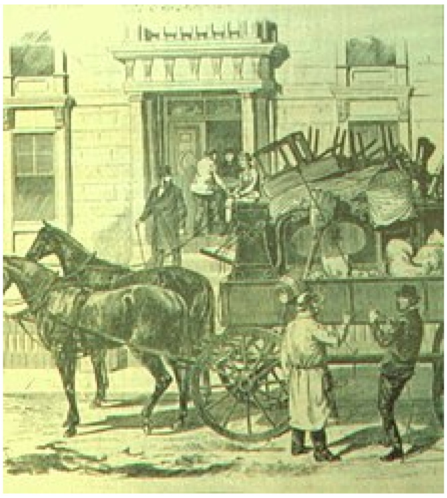
# Moving company

A **moving company**, **removalist** or **van line** is a company that helps people and businesses move their goods from one place to another. It offers all-inclusive services for relocations, like packing, loading, moving, unloading, unpacking, and arranging of items to be shifted. Additional services may include cleaning services for houses, offices or warehousing facilities.


Early movers from 1885, Montréal, Québec

## Contents



## Overview

Movers in Salt Lake City, 1911

According to the U.S. Census Bureau, 40 million United States citizens have moved annually over the last decade.[1] Of those people who have moved in the United States, 84.5% of them have moved within their own state, 12.5% have moved to another state, and 2.3% have moved to another country.[2]

The U.S. Department of Defense is the largest household goods shipper in the world with the Personal Property Program accounting for 20% of all moves.[3]


Moving van and lift, Germany, 2007

In the U.S. and Canada, the cost for long-distance moves is typically determined by the weight of the items to be moved, the distance, how quickly the items are to be moved, and the time of the year or month when the move takes place. Some movers also offer consolidated shipping, which reduces costs by transporting several clients' items in the same shipment. In the United Kingdom and Australia, the price is based on the volume of the items rather than their weight. Some movers may offer flat rate pricing.

The use of truck rental services, or simply borrowing similar hardware, is referred to as DIY moving. Typically, the parties who are moving borrow or rent a truck or trailer large enough to carry their household goods and, if necessary, obtain moving equipment such as dollies, furniture pads, and cargo belts to protect the furniture or to facilitate the moving process itself.

The moving process also involves finding or buying materials such as boxes, paper, tape, and bubble wrap with which to pack boxable and/or protect fragile household goods and to consolidate the carrying and stacking on moving day. Self-service moving companies offer another viable option: the person moving buys space on one or more trailers or shipping containers. These containers are then driven by professionals to the new location.

## See also

- Moving scam
- Relocation service
- Structure relocation
- Relocation (personal)

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## External links

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# Moving scam

A **moving scam** is a scam by a moving company in which the company provides an estimate, loads the goods, then states a much higher price to deliver the goods, effectively holding the goods as lien.

## Contents



## History

The moving business in the United States was deregulated with the Household Goods Transportation Act of 1980.[1] This act allowed interstate movers to issue binding or fixed estimates for the first time. Doing so allowed hundreds of new moving companies to begin operations. This led to an increase in competition and soon movers were no longer competing on services but on price. As competition drove prices lower and decreased what were already slim profit margins, "rogue" movers began hijacking personal property as part of a new scam. The Federal Motor Carrier Safety Administration (FMCSA) enforces Federal customer protection regulations related to the interstate shipment of household goods (i.e., household moves that cross State lines). FMCSA has held this responsibility since 1999, and the Department of Transportation has held this responsibility since 1995 (the Interstate Commerce Commission held this authority prior to its termination in 1995).[2]

## Scam

There are many versions to the moving scam, but the basic scam begins with a prospective client contacting a purported licensed moving company and requesting a cost estimate. In today's market this often happens online via moving company marketing websites. These moving companies can be prone to quoting sometimes too low, but usually reasonable prices with no room for the movers to provide a gratuity incentive to provide quality service without upselling packing services.

Once the moving company has secured a move by providing a non-binding or binding estimate, they arrive to pack and deliver the goods and the foreman, a trained loading professional performs a visual estimate. Often the scam movers use deceptive pricing or weight (which is not based on actual weight, figure of cubic footage) measurements including prices based on the gross weight of the moving vehicle. After packing and loading, the client is informed that their goods went over the expected weight estimate and the additional weight will be charged at a substantially higher rate (often double the original price per pound). Rogue movers will not inform a client of these discrepancies until the client's goods have been weighed at a certifiable scale, far from the client's original pickup location. The new price may be four or five times higher than the original estimate. The scam movers know that most people will be forced to pay these exorbitant rates based on their need for the personal effects.

## Regulation

The interstate moving business in America is regulated by the Federal Motor Carrier Safety Administration (FMCSA), part of the United States Department of Transportation.[3] Only a small staff (fewer than 20 people) is available to patrol hundreds of moving companies, making enforcement difficult. Furthermore, in the United States, there are in most cases no regulations that clearly qualify moving companies as "reliable", and thus such scams are relatively common.[4] Moving companies can provide and often display a Department of Transportation (DOT) license.

Moving companies that operate within the borders of a particular state are usually regulated by the state department of transportation or the public utilities commission or another in that state. This applies to some of the US states like in California (California Public Utilities Commission)[5] and Texas (Texas Department of Motor Vehicles).[6]

There are some US federal laws which govern moving cost estimates. For instance, in the case of out-of-state moves, movers must perform an in-person survey of a client's goods before giving an estimate unless a physical survey waiver agreement is signed; furthermore, this estimate must be in writing.[7] In addition, estimates can be either binding (a set fee, regardless of weight),[8] binding not-to-exceed (based on weight but with a maximum fee), or non-binding (based on weight).[9]

## See also

- American Moving & Storage Association
- List of national and international moving associations

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9. Stamm, Brent (27 October 2016). "How to Avoid Long Distance Moving Scams" (http://greatguysmoving.com/how-to-avoid-long-distance-moving-scams/). *Great Guys Moving Companies*. Retrieved 15 December 2016.

# External links

- Protect Your Move (http://www.protectyourmove.gov) - a US government Web site on interstate moving regulations

Wikipedia

# Portal:Transport

## The Transport Portal

Different modes of road transport, on a road in India

**Transport** (in British English), or **transportation** (in American English), is the intentional movement of humans, animals, and goods from one location to another. Modes of transport include air, land (rail and road), water, cable, pipeline, and space. The field can be divided into infrastructure, vehicles, and operations. Transport enables human trade, which is essential for the development of civilizations.

Transport infrastructure consists of both fixed installations, including roads, railways, airways, waterways, canals, and pipelines, and terminals such as airports, railway stations, bus stations, warehouses, trucking terminals, refueling depots (including fueling docks and fuel stations), and seaports. Terminals may be used both for interchange of passengers and cargo and for maintenance.

Means of transport are any of the different kinds of transport facilities used to carry people or cargo. They may include vehicles, riding animals, and pack animals. Vehicles may include wagons, automobiles, bicycles, buses, trains, trucks, helicopters, watercraft, spacecraft, and aircraft. (**Full article...**)

## Selected article -

**Kochi** ([koˈtːʃi ] ( listen)), also known as **Cochin** (/ˈkoʊtʃɪn/ *KOH-chin*) (the official name until 1996) is a major port city on the Malabar Coast of India bordering the Laccadive Sea, which is a part of the Arabian Sea. It is part of the district of Ernakulam in the state of Kerala and is commonly referred to as Ernakulam. Kochi is the most densely populated city in Kerala. As of 2011, it has a corporation limit population of 677,381


Clockwise from top: Marine Drive Skyline, Chinese Fishing Nets at Fort Kochi, Cochin Shipyard, Queen's Way, Hill Palace, InfoPark

within an area of 94.88 km$^2$ and a total urban population of more than of 2.1 million within an area of 440 km$^2$, making it the largest and the most populous metropolitan area in Kerala. Kochi city is also part of the Greater Cochin region and is classified as a Tier-II city by the Government of India. The civic body that governs the city is the Kochi Municipal Corporation, which was constituted in the year 1967, and the statutory bodies that oversee its development are the Greater Cochin Development Authority (GCDA) and the Goshree Islands Development Authority (GIDA). The current metropolitan limits of Kochi include the mainland Ernakulam, Fort Kochi, the suburbs of Edapally, Kalamassery, Aluva and Kakkanad to the northeast; Tripunithura to the southeast; and a group of islands closely scattered in the Vembanad Lake.

Called the "Queen of the Arabian Sea", Kochi was an important spice trading centre on the west coast of India from the 14th century onward, and maintained a trade network with Arab merchants from the pre-Islamic era. In 1505, the Portuguese established trading ports in Cochin. There are still buildings like the Old Harbour House from this period, some of which have been renovated in more recent times. The Kingdom of Cochin allied with the Ming Dynasty, Portuguese, and Dutch and became a princely state of the British. Kochi ranks first in the total number of international and domestic tourist arrivals in Kerala. The city was ranked the sixth best tourist destination in India according to a survey conducted by the Nielsen Company on behalf of the Outlook Traveller magazine. In October 2019, Kochi was ranked seventh in Lonely Planet's list of top 10 cities in the world to visit in 2020. Kochi was one of the 28 Indian cities among the emerging 440 global cities that will contribute 50% of the world GDP by 2025, in a 2011 study done by the McKinsey Global Institute. In July 2018, Kochi was ranked the topmost emerging future megacity in India by global professional services firm JLL. (**Full article...**)

**List of selected articles**

Mass Rapid Transit (Singapore) · London congestion charge · MTR · London Underground · Horses in the Middle Ages · SS Christopher Columbus · AirTrain JFK · Irish Mercantile Marine during World War II · Oil tanker · Flag of convenience · Congestion pricing · Bayview Park ferry wharf · Ambulance · Port of Split · Calais · Port of Ploče · Road transport · Semi-trailer truck · Intermodal container · General aviation in the United Kingdom · Timeline of the London Underground · Rail transport · Steam locomotive · Innherredsferja · Transport in the Soviet Union · High-speed rail · Bulk carrier · Electric vehicle warning sounds · Electric vehicle · Port of Skagen · Port of Rijeka · Ice trade · Skateboarding · Cycling · Car · Canadian Pacific Railway · Winter service vehicle · Indian Railways · Hybrid vehicle · Boeing 747 · Tunnel Railway · Manila Light Rail Transit System · Hellingly Hospital Railway · Isambard Kingdom Brunel · SkyTrain (Vancouver) · Pioneer Zephyr · Talyllyn Railway · Hours of service · Kansas Turnpike · Rail transport in India · Pulaski Skyway · O-Bahn Busway · Pan American World Airways · List of locks on the Kennet and Avon Canal · List of longest suspension bridge spans · San Francisco tech bus protests · Bristol Harbour · Ice block expedition of 1959 · Joseph Hazelwood · Port of Constanța · Pony Express · Royal Road · Finnieston Crane · Trade route · Ben Carlin · Sinking of the Titanic · Octopus card · Monorail · Northwest Seaport Alliance · 2008 Bathurst Boys in Red accident · San Francisco tech bus protests · Tenerife airport disaster · Controlled-access highway · Autobahn · Intermodal freight transport · Washington State Ferries · Gondola · Gondola lift · People mover · Funicular · Glasgow Subway · Rapid transit · High-speed rail in Europe · Shinkansen · Elevator · Escalator · Cable ferry · Port · Pipeline transport · Filling station · Transport in Slovenia · Transport in India · Transport in London · Transport in Edinburgh · Transport in Australia · Transport in Pakistan · Transport in Ireland · Transport in Berlin · Transport in Argentina · Transport in Italy

## General images

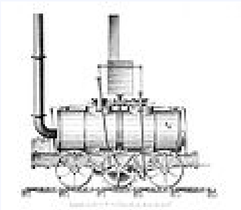
**The following are images from various transport-related articles on Wikipedia.**

Japanese E5 Series Shinkansen (from **Rail transport**)

0-Series Shinkansen, introduced in 1964, triggered the intercity train travel boom. (from **Rail transport**)

Incheon International Airport, South Korea

Swiss & German co-production: world's first functional diesel–electric railcar 1914 (from **Rail transport**)



The *Salamanca* locomotive (from **Rail transport**)

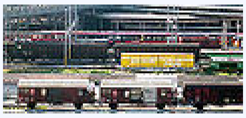


Map of world railway network as of 2022 (from **Rail transport**)

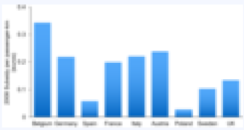
A replica of Trevithick's engine at the National Waterfront Museum, Swansea (from **Rail transport**)

NASA's Helios researches solar powered flight. (from **Aviation**)

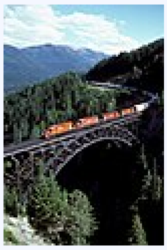
Passengers waiting to board a tube train on the London Underground in the early 1900s (sketch by unknown artist)



Goods station in Lucerne, Switzerland (from **Rail transport**)



European rail subsidies in euros per passenger-km for 2008 (from **Rail transport**)



Long freight train crossing the Stoney Creek viaduct on the Canadian Pacific Railway in southern British Columbia (from **Rail transport**)

Bulk cargo of minerals (from **Rail transport**)

A Hot bearing detector with dragging equipment unit (from **Rail transport**)

The engineering of this roundabout in Bristol, United Kingdom, attempts to make traffic flow free-moving.

KTT set operating the Guangdong Through Train service on the Guangshen railway, used by the MTR Corporation, an example of modern rail transport (from **Rail transport**)

The Boeing 747 (from **Aviation**)

Highway D1 in Slovakia. (from **Road transport**)

The SL Hitoyoshi steam-hauled excursion train operating between Kumamoto and Hitoyoshi in Kyushu, Japan (from **Rail transport**)

A Fiat Uno in 2018 (from **Transport**)

Thomas Telford, the "Colossus of the Roads" in early 19th century Britain. (from **Road transport**)

A DR2800 series passing Sijiaoting railway station in Ruifang District, New Taipei, Taiwan (from **Rail transport**)

San Diego Trolley over Interstate 8 (from **Road transport**)

Transport is a key component of growth and globalization, such as in Seattle, Washington, United States.

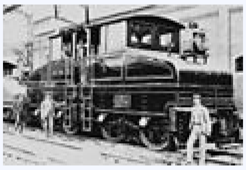
16th-century minecart, an early example of unpowered rail transport (from **Rail transport**)

German Intercity Express (ICE)

Bridges, such as Golden Gate Bridge, allow roads and railways to cross bodies of water. (from **Transport**)

Maschinenfabrik Oerlikon's first commercially AC-driven locomotive, the tramway in Lugano, Switzerland, 1896 (from **Rail transport**)

In the United States, railroads such as the Union Pacific traditionally own and operate both their rolling stock and infrastructure, with the company itself typically being privately owned. (from **Rail transport**)



Baltimore & Ohio electric engine (from **Rail transport**)

Various modes of transport (from **Transport**)

The Lockheed SR-71 remains unsurpassed in many areas of performance. (from **Aviation**)

The VR Class Sm3 *Pendolino* high-speed train at the Central Railway Station of Tampere, Finland (from **Rail transport**)

Air traffic control towers at Amsterdam Airport (from **Aviation**)

German soldiers in a railway car on the way to the front in August 1914. The message on the car reads **Von München über Metz nach Paris**. ("From Munich via Metz to Paris"). (from **Rail transport**)

The Beijing Subway is one of the world's largest and busiest rapid transit networks. (from **Transport**)

Long, double-stack container train in Arizona, USA (from **Rail transport**)

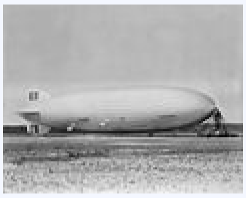
Northwest Airlines Airbus A330-323 (from **Aviation**)

The Great North Road near High gate on the approach to London before turnpiking. The highway was deeply rutted and spread onto adjoining land. (from **Road transport**)

Road transport (from **Transport**)

First powered and controlled flight by the Wright brothers, December 17, 1903 (from **Aviation**)

Traffic congestion persists in São Paulo, Brazil, despite the no-drive days based on license numbers.



LZ 129 Hindenburg at Lakehurst Naval Air Station, 1936 (from **Aviation**)

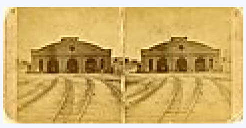
A local transit bus operated by ACTION in Canberra, Australia

The Wright brothers' first flight in 1903 (from **Transport**)

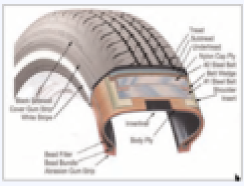
SEPTA regional passenger train (from **Rail transport**)

Railway in the 1890s in Helsinki, Finland (from **Rail transport**)

Human-powered transport remains common in developing countries. (from **Transport**)



Railroad in Macon, Georgia, c. 1876 (from **Rail transport**)



Tire components -- NHTSA The Pneumatic Tire (from **Road transport**)

Lichterfelde tram, 1882 (from **Rail transport**)

Freight train with shipping containers in the United Kingdom (from **Transport**)

BNSF Railway freight service in the United States

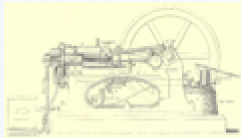
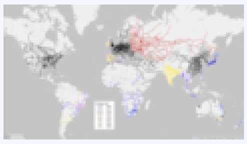


Diagram of Priestman Oil Engine from *The Steam engine and gas and oil engines* (1900) by John Perry (from **Rail transport**)

A prototype of a Ganz AC electric locomotive in Valtellina, Italy, 1901 (from **Rail transport**)

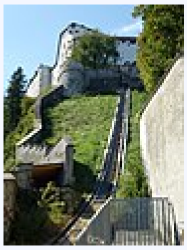
The Cessna 172 is the most produced aircraft in history (from **Aviation**)



Map of the world's railways showing the different gauges in use. Breaks of gauge generally occur where lines of different track gauge meet. (from **Rail transport**)

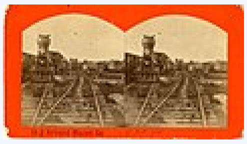
Automobile ferry in [Croatia](#) (from **Transport**)


According to Eurostat and the European Railway Agency, the fatality risk for passengers and occupants on European railways is 28 times lower when compared with car usage (based on data by EU-27 member nations, 2008–2010). (from **Rail transport**)



Reisszug in 2011 (from **Rail transport**)

A replica of a "Little Eaton Tramway" wagon; the tracks are plateways. (from **Rail transport**)

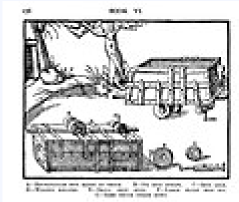


Railroad at Central of Georgia roundhouse, c. 1875 (from **Rail transport**)

1940 Piper Cub (from **Aviation**)

Interior view of a high-speed bullet train, manufactured in China (from **Rail transport**)

A USAF Thunderbird pilot ejecting from his F-16 aircraft at an air show in 2003 (from **Aviation**)

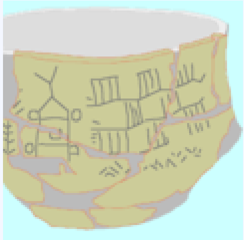


Minecart shown in *De Re Metallica* (1556). The guide pin fits in a groove between two wooden planks. (from **Rail transport**)

Russian 2TE10U Diesel-electric locomotive (from **Rail transport**)

Tunnels, such as the Tampere Tunnel, allow traffic to pass underground or through rock formations. (from **Transport**)

Intercity Express, a German high-speed passenger train



Bronocice pot with the earliest known image of a wheeled vehicle in the world, found in Poland (from **Transport**)

A bulk carrier, *BW Fjord* (from **Transport**)

An Air France Airbus A318 lands at London Heathrow Airport.

## Selected picture -

A **grand union** cross junction in the northwest corner of the Loop in Chicago, at control tower 18

**More selected pictures**

## Did you know (auto-generated) -

- ... that **only about a quarter of New York City's 472 subway stations had elevators** in 2018, among the lowest accessibility rates of the world's major transit systems?
- ... that United States Secretary of Transportation **Pete Buttigieg** wrote an essay in 2000 on Bernie Sanders, his future competitor in the 2020 Democratic Party presidential primaries?
- ... that a guerrilla garden established atop **an abandoned railroad** in Long Island City became legally recognized by the MTA?

- ... that when **Charles P. Gross** became the chairman of the New York City Board of Transportation, the mayor told him that "if you think war is Hell, then you have something waiting for you on this job"?
- ... that the Houston Chamber of Commerce and the Southern Pacific Railroad invited Japanese farmers to advise them about **rice production in Texas**?
- ... that the National Transportation Safety Board concluded that the probable cause of the **2014 Bedford Gulfstream IV crash** was the flight crew's failure to perform the flight-control check before takeoff?
- ... that lifelong Democrat **Stephanie Pollack** was appointed by lifelong Republican Charlie Baker to lead the Massachusetts Department of Transportation?
- ... that the route of the former **Waycross Air Line Railroad** is now an important CSX Transportation line?

Highway by Outram at and Museum

## Media galleries

The following portal pages provide extensive galleries of pictures, maps and other media.

- **Portal aviation media**
- **Portal bus media**
- **Portal highway media**
- **Portal nautical media**
- **Portal tram media**
- **Portal trucking media**

Aerial tramway across the Yangtze river in the Chongqing CBD, China

## Transport topics

**By country** • **History** • **Topics**

**Animal**: Camel • Cart • Chariot • Carriage • Dog • Donkey • Elephant • Pigeon • Horse • Horse-drawn boat • Mule • Llama • Ox • Pack animal • Reindeer • Sled • Stagecoach • Yak

**Aviation**: Aircraft (list) • Airline (lists) • Airport (list) • Airship • Air traffic control • Helicopter • Heliport • History • Military • Safety • Supersonic

**Human**: Aircraft • Bicycle • Ice skate • Pedestrian • Pulled rickshaw • Cycle rickshaw • Watercraft rowing • Roller skates • Skateboard • Skis • Walking • Wheelbarrow • Wheelchair

**Public**: Aerial tramway • Class • Elevator • Escalator • Fare • Intermodal • Moving walkway • Passenger • Private • Share taxi

**Rail**: By country • Cable car • Car • Freight train • Funicular • High-speed • History • Locomotive (list • diesel • electric • steam) • Light rail (list) • Maglev • Monorail • Multiple unit • Passenger train • People mover • Personal rapid transit • Track • Rapid transit (lists) • Station • Terminology • Train (list) • Tram

**Road**: All-terrain vehicle • Automobile (lists) • Bus • Continuous track • Engineering • Freeway • Highway • History • Junction • Moped • Motorcycle • Off-road • Parking • Auto rickshaw • Road (list) • Road pricing • Safety • Sidewalk • Snowmobile • Tractor • Trolleybus • Truck • Van

**Shipping**: Bulk • Cargo • Containerization • Conveyor belt • Intermodal • Mail • Logistics • Transshipment

**Space**: Interplanetary • Rocket • Spaceport • Spacecraft

**Technology**: Bridge • Cable • Conveyor • Engine • Engineering • Pipeline transport • Vehicle propulsion • Tunnel • Wheel

**Theory**: Behavior • Congestion • Economics • Finance • Forecasting • Law • Navigation • Planning • Psychology • Queueing • Spoke–hub • Traffic engineering

**Water**: Amphibious • Barge • Boat (types) • Bulk carrier • Canal • Coastal trading vessel • Container ship • Cruise ship • Ferry (list) • Harbor • Hovercraft • Hydrofoil • Lighthouse • Naval ship • Port (list) • Reefer ship • Roll-on/roll-off • River • Sailing ship • Sea mark • Ship (lists) • Submarine • Tanker • Tugboat • Vessel

**Timelines**: 2020s in transportation technology • 2022 in aviation • 2022 in rail transport • 2022 in spaceflight

## Featured content

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**London transport** **Roads** **Spaceflight** **Trains**
**U.S. Roads**

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**Lists**: Numbered highways in Maryland · Highways in Warren County, New York · Interstate Highways in Texas · Locks on the Kennet and Avon Canal · Longest suspension bridge spans · London Underground stations · Railway stations in the West Midlands · Timeline of the London Underground

**Topics**: New York State Route 20N

**Portals**: Aviation Portal · Trains Portal

## Subcategories

Select [►] to view subcategories

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- Transport by continent
- Transport by country
- Transport by mode
- Transport by mountain range
- Transport by time
- Transport by sea or ocean
- Transport in culture
- People in transport
- Accessible transportation
- Ambulance services
- Transport companies
- Transport controversies
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- Transport economics
- Economics of transport and utility industries
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## In the news

**Wikinews Transport category**

- June 21: Police reports indicate theft of automotive catalytic converters up across parts of US
- June 16: Wikinews interviews candidate for New York City mayor Vitaly Filipchenko
- May 29: Austrian Airlines cancels Moscow-bound flight after Russia refuses a reroute outside Belarusian airspace
- May 20: Wikinews interviews Jonathan Stanley, Scottish Unionist candidate for 2021 Airdrie and Shotts by-election in Scotland
- May 10: Wikinews interviews Neil Manson, SDP candidate for 2021 Airdrie and Shotts by-election in Scotland

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### WikiProject Transport

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**Bridges and Tunnels**

**Highways** (Australian Roads • Automobiles • Buses • Canada Roads • Cycling • Hong Kong Roads • Indian roads • Motorcycling • Trucks • UK Roads • U.S. Roads)

**Ships** (Australian Maritime History • Irish Maritime • Lighthouses • Maritime Trades • Piracy • Ports • Shipwrecks)

**Spaceflight** (Human spaceflight • Rocketry • Unmanned spaceflight)

**Trains** (Stations • Streetcars • Rapid Transit • NZ Railways • Pakistan Railways • UK Railways • UK Trams • London Transport • New York City Public Transportation • Washington Metro)

## Things you can do

- Write **requested articles**
- **Expand stubs:** transport stubs, aviation stubs, rail transport stubs, road stubs, transport company stubs, vehicle stubs, water transport stubs
- Add {{Portal|Transport}} to the see also section of Transport-related articles.
- Join **WikiProject Transport**.
- Tag the talk pages of Transport-related articles with the {{WikiProject Transport}} banner.
- **Rate** the unassessed transport articles in the WikiProject Transport.

## Associated Wikimedia

The following Wikimedia Foundation sister projects provide more on this subject:

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**Wikidata**
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Collection of quotations

**Wikisource**
Free-content library

**Wikiversity**
Free learning tools

**Wikivoyage**
Free travel guide

**Wiktionary**
Dictionary and thesaurus

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WIKIPEDIA

# Road transport

**Road transport** or **road transportation** is a type of transport using roads. Transport on roads can be roughly grouped into the transportation of goods and transportation of people. In many countries licensing requirements and safety regulations ensure a separation of the two industries. Movement along roads may be by bike, automobile, bus, truck, or by animal such as horse or oxen. Standard networks of roads were adopted by Romans, Persians, Aztec, and other early empires, and may be regarded as a feature of empires. Cargo may be transported by trucking companies, while passengers may be transported via mass transit. Commonly defined features of modern roads include defined lanes and signage. Various classes of road exist, from two-lane local roads with at-grade intersections to controlled-access highways with all cross traffic grade-separated.

The nature of road transportation of goods depends on, apart from the degree of development of the local infrastructure, the distance the goods are transported by road, the weight and volume of an individual shipment, and the type of goods transported. For short distances and light small shipments, a van or pickup truck may be used. For large shipments even if less than a full truckload a truck is more appropriate. (Also see Trucking and Hauling below). In some countries cargo is transported by road in horse-drawn carriages, donkey carts or other non-motorized mode. Delivery services are sometimes considered a separate category from cargo transport. In many places, fast food is transported on roads by various types of vehicles. For inner city delivery of small packages and documents bike couriers are quite common.

People are transported on roads. Special modes of individual transport by road such as cycle rickshaws may also be locally available. There are also specialist modes of road transport for particular situations, such as ambulances.

## Contents

# History

## Early roads

Road construction, depicted on Trajan's Column.

The first methods of road transport were horses, oxen or even humans carrying goods over dirt tracks that often followed game trail. The Persians later built a network of Royal Roads across their empire.

With the advent of the Roman Empire, there was a need for armies to be able to travel quickly from one region to another, and the roads that existed were often muddy, which greatly delayed the movement of large masses of troops. To resolve this issue, the Romans built solid and lasting roads. The Roman roads used deep roadbeds of crushed stone as an underlying layer to ensure that they kept dry, as the water would flow out from the crushed stone, instead of becoming mud in clay soils. The Islamic Caliphate later built tar-paved roads in Baghdad.[1]

## New road networks

From the 17th century, road transport throughout the Ashanti Empire was maintained via a network of well-kept roads that connected the Ashanti mainland with the Niger river and other trade cities.[2][3] After significant road construction undertaken by the kingdom of Dahomey, toll roads were established with the function of collecting yearly taxes based on the goods carried by the people of Dahomey and their occupation.[4] As states developed and became richer, especially with the Renaissance, new roads and bridges began to be built, often based on Roman designs. Although there were attempts to rediscover Roman methods, there was little useful innovation in road building before the 18th century.

The Great North Road near High gate on the approach to London before turnpiking. The highway was deeply rutted and spread onto adjoining land.

Starting in the early 18th century, the British Parliament began to pass a series of acts that gave the local justices powers to erect toll-gates on the roads, in exchange for professional upkeep.[5][6] The toll-gate erected at Wade's Mill became the first effective toll-gate in England. The first scheme that had trustees who were not justices was established through a Turnpike Act in 1707, for a section of the London-Chester road between Foothill and Stony Stafford. The basic principle was that the trustees would manage resources from the several parishes through which the highway passed, augment this with tolls from users from outside the parishes and apply the whole to the maintenance of the main highway. This became the pattern for the turnpiking of a growing number of highways, sought by those who wished to improve flow of commerce through their part of a county.[5]

The quality of early turnpike roads was varied.[7] Although turnpiking did result in some improvement to each highway, the technologies used to deal with geological features, drainage, and the effects of weather were all in their infancy. Road construction improved slowly, initially through the efforts of individual surveyors such as John Metcalf in Yorkshire in the 1760s.[8] British turnpike builders began to realize the importance of selecting clean stones for surfacing while excluding vegetable material and clay, resulting in more durable roads.[9][10]

## Industrial civil engineering


Thomas Telford, the "Colossus of the Roads" in early 19th century Britain.

By the late 18th and early 19th centuries, new methods of highway construction had been pioneered by the work of three British engineers, John Metcalf, Thomas Telford and John Loudon McAdam, and by the French road engineer Pierre-Marie-Jérôme Trésaguet.

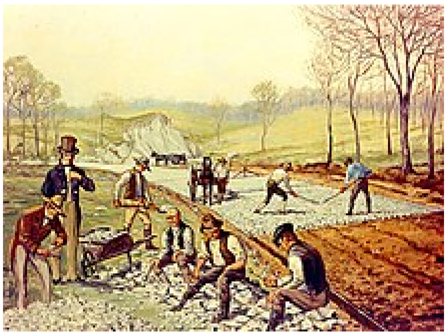
The first professional road builder to emerge during the Industrial Revolution was John Metcalf, who constructed about 180 miles (290 km) of turnpike road, mainly in the north of England, from 1765. He believed a good road should have good foundations, be well drained and have a smooth convex surface to allow rainwater to drain quickly into ditches at the side. He understood the importance of good drainage, knowing it was rain that caused most problems on the roads.

Pierre-Marie-Jérôme Trésaguet established the first scientific approach to road building in France at the same time. He wrote a memorandum on his method in 1775, which became general practice in France. It involved a layer of large rocks, covered by a layer of smaller gravel. The lower layer improved on Roman practice in that it was based on the understanding that the purpose of this layer (the sub-base or base course) is to transfer the weight of the road and its traffic to the ground, while protecting the ground from deformation by spreading the weight evenly. Therefore, the sub-base did not have to be a self-supporting structure. The upper running surface provided a smooth surface for vehicles while protecting the large stones of the sub-base.

The surveyor and engineer Thomas Telford also made substantial advances in the engineering of new roads and the construction of bridges. His method of road building involved the digging of a large trench in which a foundation of heavy rock was set. He also designed his roads so that they sloped downwards from the centre, allowing drainage to take place, a major improvement on the work of Trésaguet. The surface of his roads consisted of broken stone. He also improved on methods for the building of roads by improving the selection of stone based on thickness, taking into account traffic, alignment and slopes. During his later years, Telford was responsible for rebuilding sections of the London to Holyhead road, a task completed by his assistant of ten years, John MacNeill.[11]

It was another Scottish engineer, John Loudon McAdam, who designed the first modern roads. He developed an inexpensive paving material of soil and stone aggregate (known as macadam). His road building method was simpler than Telford's, yet more effective at protecting roadways: he discovered that massive foundations of rock upon rock were unnecessary, and asserted that native soil alone would support the road and traffic upon it, as long as it was covered by a road crust that would protect the soil underneath from water and wear.[13]

Also unlike Telford and other road builders, McAdam laid his roads as level as possible. His 30-foot-wide (9 m) road required only a rise of three inches from the edges to the center. Cambering and elevation of the road above the water table enabled rainwater to run off into ditches on either side.[14] Size of stones was central to the McAdam's road building theory. The lower 200-millimetre (8 in) road thickness was restricted to stones no larger than 75 millimetres (3.0 in). The upper 50-millimetre (2 in) layer of stones was limited to 20 millimetres (1 in) size and stones were checked by supervisors who carried scales. A workman could check the stone size himself by seeing if the stone would fit into his mouth. The importance of the 20 mm stone size was that the stones needed to be much smaller than the 100 mm width of the iron carriage tyres that traveled on the road. Macadam roads were being built widely in the United States and Australia in the 1820s and in Europe in the 1830s and 1840s.[15]



Construction of the first macadamized road in the United States (1823). In the foreground, workers are breaking stones "so as not to exceed 6 ounces in weight or to pass a two-inch ring".[12]

### 20th century

Macadam roads were adequate for use by horses and carriages or coaches, but they were very dusty and subject to erosion with heavy rain. The Good Roads Movement occurred in the United States between the late 1870s and the 1920s. Advocates for improved roads led by bicyclists turned local agitation into a national political movement.

Outside cities, roads were dirt or gravel; mud in the winter and dust in the summer. Early organizers cited Europe where road construction and maintenance was supported by national and local governments. In its early years, the main goal of the movement was education for road building in rural areas between cities and to help rural populations gain the social and economic benefits enjoyed by cities where citizens benefited from railroads, trolleys and paved streets. Even more than traditional vehicles, the newly invented bicycles could benefit from good country roads. Later on, they did not hold up to higher-speed motor vehicle use. Methods to stabilise macadam roads with tar date back to at least 1834 when John Henry Cassell, operating from *Cassell's Patent Lava Stone Works* in Millwall, patented "Pitch Macadam".[16] This method involved spreading tar on the subgrade, placing a typical macadam layer, and finally sealing the macadam with a mixture of tar and sand. Tar-grouted macadam was in use well before 1900 and involved scarifying the surface of an existing macadam pavement, spreading tar, and re-compacting. Although the use of tar in road construction was known in the 19th century, it was little used and was not introduced on a large scale until the motorcar arrived on the scene in the early 20th century.

Modern tarmac was patented by British civil engineer Edgar Purnell Hooley, who noticed that spilled tar on the roadway kept the dust down and created a smooth surface.[17] He took out a patent in 1901 for tarmac.[18]

## Trucking and haulage

Trucking companies (in American English terminology) or haulage companies / hauliers (in British English) accept cargo for road transport. Truck drivers operate either independently – working directly for the client – or through freight carriers or shipping agents. Some big companies (e.g. grocery store chains) operate their own internal trucking operations. The market size for general freight trucking was nearly $125 billion in 2010.

A truck transporting a container on Interstate 95 in South Florida.

In the U.S. many truckers own their truck (rig), and are known as owner-operators. Some road transportation is done on regular routes or for only one consignee per run, while others transport goods from many different loading stations/shippers to various consignees. On some long runs only cargo for one leg of the route (to) is known when the cargo is loaded. Truckers may have to wait at the destination for a backhaul.[19]

B double parked near the Hume Highway


and safety sign on rear

A bill of lading issued by the shipper provides the basic document for road freight. On cross-border transportation the trucker will present the cargo and documentation provided by the shipper to customs for inspection (for EC see also Schengen Agreement). This also applies to shipments that are transported out of a free port.[20]

## Hours of service

To avoid accidents caused by fatigue, truckers have to adhere to strict rules for drive time and required rest periods. In the United States and Canada, these regulations are known as hours of service, and in the European Union as drivers working hours. One such regulation is the Hours of Work and Rest Periods (Road Transport) Convention, 1979.[21] Tachographs or Electronic on-board recorders record the times the vehicle is in motion and stopped. Some companies use two drivers per truck to ensure uninterrupted transportation; with one driver resting or sleeping in a bunk in the back of the cab while the other is driving.

## Licenses

Truck drivers often need special licenses to drive, known in the U.S. as a commercial driver's license. In the U.K. a large goods vehicle licence is required. For transport of hazardous materials (see dangerous goods) truckers need a licence, which usually requires them to pass an exam (e.g. in the EU). They have to make sure they affix proper labels for the respective hazard(s) to their vehicle. Liquid goods are transported by road in tank trucks (in American English) or tanker lorries (in British English) (also road-tankers) or special tank containers for intermodal transport. For transportation of live animals special requirements have to be met in many countries to prevent cruelty to animals (see animal rights). For fresh and frozen goods refrigerator trucks or reefers are used.

## Weights

Some loads are weighed at the point of origin and the driver is responsible for ensuring weights conform to maximum allowed standards. This may involve using on-board weight gauges (load pressure gauges), knowing the empty weight of the transport vehicle and the weight of the load, or using a commercial weight scale.[22] In route weigh stations check that gross vehicle weights do not exceed the maximum weight for that particular jurisdiction and will include individual axle weights. This varies by country, states within a country, and may include federal standards. The United States uses FMCSA federal standards that include bridge law formulas. Many states, not on the national road system, use their own road and bridge standards.[23] Enforcement scales may include portable scales, scale houses with low speed scales or weigh-in-motion (WIM) scales.

The European Union uses the *International Recommendation*, OIML R 134-2 (2009). The process may involve a scale house and low-speed scales or higher-speed WIM road or bridge scales with the goal of public safety, as well as road and bridge safety, according to the Bridges Act.[24]

# Modern roads

Highway D1 in Slovakia.

Today, roadways are primarily asphalt or concrete. Both are based on McAdam's concept of stone aggregate in a binder, asphalt cement or Portland cement respectively. Asphalt is known as a flexible pavement, one which slowly will "flow" under the pounding of traffic. Concrete is a rigid pavement, which can take heavier loads but is more expensive and requires more carefully prepared subbase. So, generally, major roads are concrete and local roads are asphalt. Concrete roads are often covered with a thin layer of asphalt to create a wearing surface.

Modern pavements are designed for heavier vehicle loads and faster speeds, requiring thicker slabs and deeper subbase. Subbase is the layer or successive layers of stone, gravel and sand supporting the pavement. It is needed to spread out the slab load bearing on the underlying soil and to conduct away any water getting under the slabs. Water will undermine a pavement over time, so much of pavement and pavement joint design are meant to minimize the amount of water getting and staying under the slabs.

Shoulders are also an integral part of highway design. They are multipurpose; they can provide a margin of side clearance, a refuge for incapacitated vehicles, an emergency lane, and parking space. They also serve a design purpose, and that is to prevent water from percolating into the soil near the main pavement's edge. Shoulder pavement is designed to a lower standard than the pavement in the traveled way and won't hold up as well to traffic, so driving on the shoulder is generally prohibited.

Pavement technology is still evolving, albeit in not easily noticed increments. For instance, chemical additives in the pavement mix make the pavement more weather resistant, grooving and other surface treatments improve resistance to skidding and hydroplaning, and joint seals which were once tar are now made of low maintenance neoprene.

## Traffic control

Disruptions in organized traffic flow can create delays lasting hours.

Nearly all roadways are built with devices meant to control traffic. Most notable to the motorist are those meant to communicate directly with the driver. Broadly, these fall into three categories: signs, signals or pavement markings. They help the driver navigate; they assign the right-of-way at intersections; they indicate laws such as speed limits and parking regulations; they advise of potential hazards; they indicate passing and no passing zones; and otherwise deliver information and to assure traffic is orderly and safe.

Two hundred years ago these devices were signs, nearly all informal. In the late 19th century signals began to appear in the biggest cities at a few highly congested intersections. They were manually operated, and consisted of semaphores, flags or paddles, or in some cases colored electric lights, all modeled on railroad signals. In the 20th century signals were automated, at first with electromechanical devices and later with computers. Signals can be quite sophisticated: with vehicle sensors embedded in the pavement, the signal can control and choreograph the turning movements of heavy traffic in the most complex of intersections. In the 1920s traffic engineers learned how to coordinate signals along a thoroughfare to increase its speeds and volumes. In the 1980s, with computers, similar coordination of whole networks became possible.

In the 1920s pavement markings were introduced. Initially they were used to indicate the road's centerline. Soon after they were coded with information to aid motorists in passing safely. Later, with multi-lane roads they were used to define lanes. Other uses, such as indicating permitted turning movements and pedestrian crossings soon followed.

In the 20th century traffic control devices were standardized. Before then every locality decided on what its devices would look like and where they would be applied. This could be confusing, especially to traffic from outside the locality. In the United States standardization was first taken at the state level, and late in the century at the federal level. Each country has a Manual of Uniform Traffic Control Devices (MUTCD) and there are efforts to blend them into a worldwide standard.

Besides signals, signs, and markings, other forms of traffic control are designed and built into the roadway. For instance, curbs and rumble strips can be used to keep traffic in a given lane and median barriers can prevent left turns and even U-turns.

## Toll roads


Eastlink - Wellington Rd Nortbound Toll Gantry

Early toll roads were usually built by private companies under a government franchise. They typically paralleled or replaced routes already with some volume of commerce, hoping the improved road would divert enough traffic to make the enterprise profitable. Plank roads were particularly attractive as they greatly reduced rolling resistance and mitigated the problem of getting mired in mud. Another improvement, better grading to lessen the steepness of the worst stretches, allowed draft animals to haul heavier loads.

A *toll road* in the United States is often called a *turnpike*. The term *turnpike* probably originated from the gate, often a simple pike, which blocked passage until the fare was paid at a *toll house* (or *toll booth* in current terminology). When the toll was paid the pike, which was mounted on a swivel, was turned to allow the vehicle to pass. Tolls were usually based on the type of cargo being transported, not the type of vehicle. The practice of selecting routes so as to avoid tolls is called shunpiking. This may be simply to avoid the expense, as a form of economic protest (or boycott), or simply to seek a road less traveled as a bucolic interlude.

Companies were formed to build, improve, and maintain a particular section of roadway, and tolls were collected from users to finance the enterprise. The enterprise was usually named to indicate the locale of its roadway, often including the name of one of both of the termini. The word *turnpike* came into common use in the names of these roadways and companies, and is essentially used interchangeably with *toll road* in current terminology.

In the United States, toll roads began with the Lancaster Turnpike in the 1790s, within Pennsylvania, connecting Philadelphia and Lancaster. In the state of New York, the Great Western Turnpike was started in Albany in 1799 and eventually extended, by several alternate routes, to near what is now Syracuse, New York.

Toll roads peaked in the mid 19th century, and by the turn of the twentieth century most toll roads were taken over by state highway departments. The demise of this early toll road era was due to the rise of canals and railroads, which were more efficient (and thus cheaper) in moving freight over long distances. Roads wouldn't again be competitive with rails and barges until the first half of the 20th century when the internal combustion engine replaces draft animals as the source of motive power.

With the development, mass production, and popular embrace of the automobile, faster and higher capacity roads were needed. In the 1920s limited access highways appeared. Their main characteristics were dual roadways with access points limited to (but not always) grade-separated interchanges. Their dual roadways allowed high volumes of traffic, the need for no or few traffic lights along with relatively gentle grades and curves allowed higher speeds.

The first limited access highways were *Parkways*, so called because of their often park-like landscaping and, in the metropolitan New York City area, they connected the region's system of parks. When the German autobahns built in the 1930s introduced higher design standards and speeds, road planners and road-builders in the United States started developing and building toll roads to similar high standards. The Pennsylvania Turnpike, which largely followed the path of a partially built railroad, was the first, opening in 1940.

After 1940 with the Pennsylvania Turnpike, toll roads saw a resurgence, this time to fund limited access highways. In the late 1940s and early 1950s, after World War II interrupted the evolution of the highway, the US resumed building toll roads. They were to still higher standards and one road, the New York State Thruway, had standards that became the prototype for the U.S. Interstate Highway System. Several other major toll-roads which connected with the Pennsylvania Turnpike were established before the creation of the Interstate Highway System. These were the Indiana Toll Road, Ohio Turnpike, and New Jersey Turnpike.

### Interstate Highway System

In the United States, beginning in 1956, Dwight D. Eisenhower National System of Interstate and Defense Highways, commonly called the Interstate Highway System was built. It uses 12 foot (3.65m) lanes, wide medians, a maximum of 4% grade, and full access control, though many sections don't meet these standards due to older construction or constraints. This system created a continental-sized network meant to connect every population center of 50,000 people or more.

Arizona - North America - Southwest - Interstate Highway System (4893585908)

By 1956, most limited access highways in the eastern United States were toll roads. In that year, the Federal Aid Highway Act of 1956 was passed, funding non-toll roads with 90% federal dollars and 10% state match, giving little incentive for states to expand their turnpike system. Funding rules initially restricted collections of tolls on newly funded roadways, bridges, and tunnels. In some situations, expansion or rebuilding of a toll facility using Interstate Highway Program funding resulted in the removal of existing tolls. This occurred in Virginia on Interstate 64 at the Hampton Roads Bridge-Tunnel when a second parallel roadway to the regional 1958 bridge-tunnel was completed in 1976.

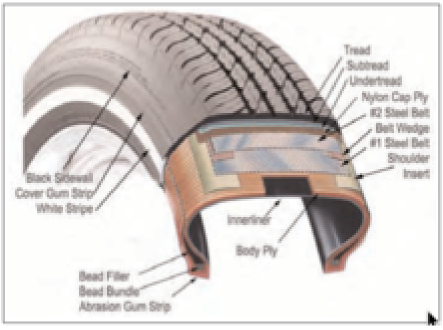
San Diego Trolley over Interstate 8

Since the completion of the initial portion of the Interstate Highway System, regulations were changed, and portions of toll facilities have been added to the system. Some states are again looking at toll financing for new roads and maintenance, to supplement limited federal funding. In some areas, new road projects have been completed with public-private partnerships funded by tolls, such as the Pocahontas Parkway (I-895) near Richmond, Virginia.

The newest policy passed by Congress and the Obama Administration regarding highways is the Surface and Air Transportation Programs Extension Act of 2011.

### Pneumatic tyres

As the horse-drawn carriage was replaced by the car, bus and lorry or truck, and speeds increased, the need for smoother roads and less vertical displacement became more apparent, and pneumatic tyres were developed to decrease the apparent roughness. Wagon and carriage wheels, made of wood, had a tyre in the form of an iron strip that kept the wheel from wearing out quickly. Pneumatic tyres, which had a larger footprint than iron tyres, also were less likely to get bogged down in the mud on unpaved roads.



Tire components -- NHTSA The Pneumatic Tire

## See also

- National Highway System (USA)
- Passenger vehicles in the USA
- Transportation in the United States
- National Transportation Safety Board
- German autobahns
- Glossary of road transport terms
- Neo-bulk cargo
- Public transport
- Traffic congestion
- Transportation forecasting
- Transport engineering
- List of roads and highways

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# Transport

**Transport** (in British English), or **transportation** (in American English), is the intentional movement of humans, animals, and goods from one location to another. Modes of transport include air, land (rail and road), water, cable, pipeline, and space. The field can be divided into infrastructure, vehicles, and operations. Transport enables human trade, which is essential for the development of civilizations.

Transport infrastructure consists of both fixed installations, including roads, railways, airways, waterways, canals, and pipelines, and terminals such as airports, railway stations, bus stations, warehouses, trucking terminals, refueling depots (including fueling docks and fuel stations), and seaports. Terminals may be used both for interchange of passengers and cargo and for maintenance.

Means of transport are any of the different kinds of transport facilities used to carry people or cargo. They may include vehicles, riding animals, and pack animals. Vehicles may include wagons, automobiles, bicycles, buses, trains, trucks, helicopters, watercraft, spacecraft, and aircraft.

## Contents



## Modes

A mode of transport is a solution that makes use of a certain type of vehicle, infrastructure, and operation. The transport of a person or of cargo may involve one mode or several of the modes, with the latter case being called inter-modal or multi-modal transport. Each mode has its own advantages and disadvantages, and will be chosen on the basis of cost, capability, and route.

Governments deal with the way the vehicles are operated, and the procedures set for this purpose, including financing, legalities, and policies. In the transport industry, operations and ownership of infrastructure can be either public or private, depending on the country and mode.

Passenger transport may be public, where operators provide scheduled services, or private. Freight transport has become focused on containerization, although bulk transport is used for large volumes of durable items. Transport plays an important part in economic growth and globalization, but most types cause air pollution and use large amounts of land. While it is heavily subsidized by governments, good planning of transport is essential to make traffic flow and restrain urban sprawl.

Various modes of transport

## Human-powered

Human-powered transport, a form of sustainable transport, is the transport of people and/or goods using human muscle-power, in the form of walking, running, and swimming. Modern technology has allowed machines to enhance human power. Human-powered transport remains popular for reasons of cost-saving, leisure, physical exercise, and environmentalism; it is sometimes the only type available, especially in underdeveloped or inaccessible regions.

Although humans are able to walk without infrastructure, the transport can be enhanced through the use of roads, especially when using the human power with vehicles, such as bicycles and inline skates. Human-powered vehicles have also been developed for difficult environments, such as snow and water, by watercraft rowing and skiing; even the air can be entered with human-powered aircraft.

## Animal-powered

Human-powered transport remains common in developing countries.

Animal-powered transport is the use of working animals for the movement of people and commodities. Humans may ride some of the animals directly, use them as pack animals for carrying goods, or harness them, alone or in teams, to pull sleds or wheeled vehicles.

## Air

A fixed-wing aircraft, commonly called an airplane, is a heavier-than-air craft where movement of the air in relation to the wings is used to generate lift. The term is used to distinguish this from rotary-wing aircraft, where the movement of the lift surfaces relative to the air generates lift. A gyroplane is both fixed-wing and rotary wing. Fixed-wing aircraft range from small trainers and recreational aircraft to large airliners and military cargo aircraft.

Two things necessary for aircraft are air flow over the wings for lift and an area for landing. The majority of aircraft also need an airport with the infrastructure for maintenance, restocking, and refueling and for the loading and unloading of crew, cargo, and passengers.[1] While the vast majority of aircraft land and take off on land, some are capable of take-off and landing on ice, snow, and calm water.

An Air France Airbus A318 lands at London Heathrow Airport.

The aircraft is the second fastest method of transport, after the rocket. Commercial jets can reach up to 955 kilometres per hour (593 mph), single-engine aircraft 555 kilometres per hour (345 mph). Aviation is able to quickly transport people and limited amounts of cargo over longer distances, but incurs high costs and energy use; for short distances or in inaccessible places, helicopters can be used.[2] As of April 28, 2009, *The Guardian* article notes that "the WHO estimates that up to 500,000 people are on planes at any time."[3]

## Land

Land transport covers all land-based transport systems that provide for the movement of people, goods, and services. Land transport plays a vital role in linking communities to each other. Land transport is a key factor in urban planning. It consists of two kinds, rail and road.

### Rail

Intercity Express, a German high-speed passenger train

Rail transport is where a train runs along a set of two parallel steel rails, known as a railway or railroad. The rails are anchored perpendicular to ties (or sleepers) of timber, concrete, or steel, to maintain a consistent distance apart, or gauge. The rails and perpendicular beams are placed on a foundation made of concrete or compressed earth and gravel in a bed of ballast. Alternative methods include monorail and maglev.

A train consists of one or more connected vehicles that operate on the rails. Propulsion is commonly provided by a locomotive, that hauls a series of unpowered cars, that can carry passengers or freight. The locomotive can be powered by steam, by diesel, or by electricity supplied by trackside systems. Alternatively, some or all the cars can be powered, known as a multiple unit. Also, a train can be powered by horses, cables, gravity, pneumatics, and gas turbines. Railed vehicles move with much less friction than rubber tires on paved roads, making trains more energy efficient, though not as efficient as ships.

The Beijing Subway is one of the world's largest and busiest rapid transit networks.

Intercity trains are long-haul services connecting cities;[4] modern high-speed rail is capable of speeds up to 350 km/h (220 mph), but this requires specially built track. Regional and commuter trains feed cities from suburbs and surrounding areas, while intra-urban transport is performed by high-capacity tramways and rapid transits, often making up the backbone of a city's public transport. Freight trains traditionally used box cars, requiring manual loading and unloading of the cargo. Since the 1960s, container trains have become the dominant solution for general freight, while large quantities of bulk are transported by dedicated trains.

### Road

A road is an identifiable route, way, or path between two or more places.[5] Roads are typically smoothed, paved, or otherwise prepared to allow easy travel;[6] though they need not be, and historically many roads were simply recognizable routes without any formal construction or maintenance.[7] In urban areas, roads may pass through a city or village and be named as streets, serving a dual function as urban space easement and route.[8]


Road transport

The most common road vehicle is the automobile; a wheeled passenger vehicle that carries its own motor. Other users of roads include buses, trucks, motorcycles, bicycles, and pedestrians. As of 2010, there were 1.015 billion automobiles worldwide. Road transport offers complete freedom to road users to transfer the vehicle from one lane to the other and from one road to another according to the need and convenience. This flexibility of changes in location, direction, speed, and timings of travel is not available to other modes of transport. It is possible to provide door-to-door service only by road transport.

Automobiles provide high flexibility with low capacity, but require high energy and area use, and are the main source of harmful noise and air pollution in cities;[9] buses allow for more efficient travel at the cost of reduced flexibility.[10] Road transport by truck is often the initial and final stage of freight transport.

### Water

Water transport is movement by means of a watercraft—such as a barge, boat, ship, or sailboat—over a body of water, such as a sea, ocean, lake, canal, or river. The need for buoyancy is common to watercraft, making the hull a dominant aspect of its construction, maintenance, and appearance.


Automobile ferry in Croatia

In the 19th century, the first steam ships were developed, using a steam engine to drive a paddle wheel or propeller to move the ship. The steam was produced in a boiler using wood or coal and fed through a steam external combustion engine. Now most ships have an internal combustion engine using a slightly refined type of petroleum called bunker fuel. Some ships, such as submarines, use nuclear power to produce the steam. Recreational or educational craft still use wind power, while some smaller craft use internal combustion engines to drive one or more propellers or, in the case of jet boats, an inboard water jet. In shallow draft areas, hovercraft are propelled by large pusher-prop fans. (See Marine propulsion.)

Although it is slow compared to other transport, modern sea transport is a highly efficient method of transporting large quantities of goods. Commercial vessels, nearly 35,000 in number, carried 7.4 billion tons of cargo in 2007.[11] Transport by water is significantly less costly than air transport for transcontinental shipping;[12] short sea shipping and ferries remain viable in coastal areas.[13][14]

### Other modes

Trans-Alaska Pipeline for crude oil

Pipeline transport sends goods through a pipe; most commonly liquid and gases are sent, but pneumatic tubes can also send solid capsules using compressed air. For liquids/gases, any chemically stable liquid or gas can be sent through a pipeline. Short-distance systems exist for sewage, slurry, water, and beer, while long-distance networks are used for petroleum and natural gas.

Cable transport is a broad mode where vehicles are pulled by cables instead of an internal power source. It is most commonly used at steep gradient. Typical solutions include aerial tramways, elevators, and ski lifts; some of these are also categorized as conveyor transport.

Spaceflight is transport out of Earth's atmosphere into outer space by means of a spacecraft. While large amounts of research have gone into technology, it is rarely used except to put satellites into orbit and conduct scientific experiments. However, man has landed on the moon, and probes have been sent to all the planets of the Solar System.

Suborbital spaceflight is the fastest of the existing and planned transport systems from a place on Earth to a distant "other place" on Earth. Faster transport could be achieved through part of a low Earth orbit or by following that trajectory even faster, using the propulsion of the rocket to steer it.

## Elements

### Infrastructure

Infrastructure is the fixed installations that allow a vehicle to operate. It consists of a roadway, a terminal, and facilities for parking and maintenance. For rail, pipeline, road, and cable transport, the entire way the vehicle travels must be constructed. Air and watercraft are able to avoid this, since the airway and seaway do not need to be constructed. However, they require fixed infrastructure at terminals.


Bridges, such as Golden Gate Bridge, allow roads and railways to cross bodies of water.

Terminals such as airports, ports, and stations, are locations where passengers and freight can be transferred from one vehicle or mode to another. For passenger transport, terminals are integrating different modes to allow riders, who are interchanging between modes, to take advantage of each mode's benefits. For instance, airport rail links connect airports to the city centres and suburbs. The terminals for automobiles are parking lots, while buses and coaches can operate from simple stops.[15] For freight, terminals act as transshipment points, though some cargo is transported directly from the point of production to the point of use.

The financing of infrastructure can either be public or private. Transport is often a natural monopoly and a necessity for the public; roads, and in some countries railways and airports, are funded through taxation. New infrastructure projects can have high costs and are often financed through debt. Many infrastructure owners, therefore, impose usage fees, such as


Tunnels, such as the Tampere Tunnel, allow traffic to pass underground or through rock formations.

landing fees at airports or toll plazas on roads. Independent of this, authorities may impose taxes on the purchase or use of vehicles. Because of poor forecasting and overestimation of passenger numbers by planners, there is frequently a benefits shortfall for transport infrastructure projects.[16]

## Means of transport

### Animals

Animals used in transportation include pack animals and riding animals.

### Vehicles

A Fiat Uno in 2018

A vehicle is a non-living device that is used to move people and goods. Unlike the infrastructure, the vehicle moves along with the cargo and riders. Unless being pulled/pushed by a cable or muscle-power, the vehicle must provide its own propulsion; this is most commonly done through a steam engine, combustion engine, electric motor, jet engine, or rocket, though other means of propulsion also exist. Vehicles also need a system of converting the energy into movement; this is most commonly done through wheels, propellers, and pressure.

Vehicles are most commonly staffed by a driver. However, some systems, such as people movers and some rapid transits, are fully automated. For passenger transport, the vehicle must have a compartment, seat, or platform for the passengers. Simple vehicles, such as automobiles, bicycles, or simple aircraft, may have one of the passengers as a driver. Recently, the progress related to the Fourth Industrial Revolution has brought a lot of new emerging technologies for transportation and automotive fields such as Connected Vehicles and Autonomous Driving. These innovations are said to form future mobility, but concerns remain on safety and cybersecurity, particularly concerning connected and autonomous mobility. [17]

## Operation

Incheon International Airport, South Korea

Private transport is only subject to the owner of the vehicle, who operates the vehicle themselves. For public transport and freight transport, operations are done through private enterprise or by governments. The infrastructure and vehicles may be owned and operated by the same company, or they may be operated by different entities. Traditionally, many countries have had a national airline and national railway. Since the 1980s, many of these have been privatized. International shipping remains a highly competitive industry with little regulation,[18] but ports can be public-owned.[19]

## Policy

As the population of the world increases, cities grow in size and population—according to the United Nations, 55% of the world's population live in cities, and by 2050 this number is expected to rise to 68%.[20] Public transport policy must evolve to meet the changing priorities of the urban world.[21] The institution of policy enforces order in transport, which is by nature chaotic as people attempt to travel from one place to another as fast as possible. This policy helps to reduce accidents and save lives.

# Functions

Relocation of travelers and cargo are the most common uses of transport. However, other uses exist, such as the strategic and tactical relocation of armed forces during warfare, or the civilian mobility construction or emergency equipment.

## Passenger

A local transit bus operated by ACTION in Canberra, Australia

Passenger transport, or travel, is divided into public and private transport. Public transport is scheduled services on fixed routes, while private is vehicles that provide ad hoc services at the riders desire. The latter offers better flexibility, but has lower capacity and a higher environmental impact. Travel may be as part of daily commuting or for business, leisure, or migration.

Short-haul transport is dominated by the automobile and mass transit. The latter consists of buses in rural and small cities, supplemented with commuter rail, trams, and rapid transit in larger cities. Long-haul transport involves the use of the automobile, trains, coaches, and aircraft, the last of which have become predominantly used for the longest, including intercontinental, travel. Intermodal passenger transport is where a journey is performed through the use of several modes of transport; since all human transport normally starts and ends with walking, all passenger transport can be considered intermodal. Public transport may also involve the intermediate change of vehicle, within or across modes, at a transport hub, such as a bus or railway station.

Taxis and buses can be found on both ends of the public transport spectrum. Buses are the cheapest mode of transport but are not necessarily flexible, and taxis are very flexible but more expensive. In the middle is demand-responsive transport, offering flexibility whilst remaining affordable.

International travel may be restricted for some individuals due to legislation and visa requirements.

## Medical

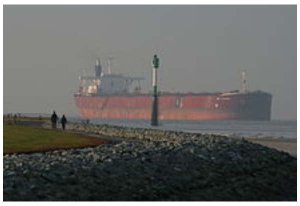
An ambulance is a vehicle used to transport people from or between places of treatment,[22] and in some instances will also provide out-of-hospital medical care to the patient. The word is often associated with road-going "emergency ambulances", which form part of emergency medical services, administering emergency care to those with acute medical problems.

*Air medical services* is a comprehensive term covering the use of air transport to move patients to and from healthcare facilities and accident scenes. Personnel provide comprehensive prehospital and emergency and critical care to all types of patients during aeromedical evacuation or rescue operations, aboard helicopters, propeller aircraft, or jet aircraft.[23][24]


An ambulance from World War I

### Freight

Freight transport, or shipping, is a key in the value chain in manufacturing.[25] With increased specialization and globalization, production is being located further away from consumption, rapidly increasing the demand for transport.[26] Transport creates place utility by moving the goods from the place of production to the place of consumption.[27] While all modes of transport are used for cargo transport, there is high differentiation between the nature of the cargo transport, in which mode is chosen.[28] Logistics refers to the entire process of transferring products from producer to consumer, including storage, transport, transshipment, warehousing, material-handling, and packaging, with associated exchange of information.[29] Incoterm deals with the handling of payment and responsibility of risk during transport.[30]


A bulk carrier, *BW Fjord*

Containerization, with the standardization of ISO containers on all vehicles and at all ports, has revolutionized international and domestic trade, offering a huge reduction in transshipment costs. Traditionally, all cargo had to be manually loaded and unloaded into the haul of any ship or car; containerization allows for automated handling and transfer between modes, and the standardized sizes allow for gains in economy of scale in vehicle operation. This has been one of the key driving factors in international trade and globalization since the 1950s.[31]

Bulk transport is common with cargo that can be handled roughly without deterioration; typical examples are ore, coal, cereals, and petroleum. Because of the uniformity of the product, mechanical handling can allow enormous quantities to be handled quickly and efficiently. The low value of the cargo combined with high volume also means that economies of scale become essential in transport, and gigantic ships and whole trains are commonly used to transport bulk. Liquid products with sufficient volume may also be transported by pipeline.


Freight train with shipping containers in the United Kingdom

Air freight has become more common for products of high value; while less than one percent of world transport by volume is by airline, it amounts to forty percent of the value. Time has become especially important in regards to principles such as postponement and just-in-time within the value chain, resulting in a high willingness to pay for quick delivery of key components or items of high value-to-weight ratio.[32] In addition to mail, common items sent by air include electronics and fashion clothing.

## Industry

## Impact

### Economic

Transport is a key necessity for specialization—allowing production and consumption of products to occur at different locations. Throughout history, transport has been a spur to expansion; better transport allows more trade and a greater spread of people. Economic growth has always been dependent on increasing the capacity and rationality of transport.[33] But the infrastructure and operation of transport have a great impact on the land, and transport is the largest drainer of energy, making transport sustainability a major issue.


Transport is a key component of growth and globalization, such as in Seattle, Washington, United States.

Due to the way modern cities and communities are planned and operated, a physical distinction between home and work is usually created, forcing people to transport themselves to places of work, study, or leisure, as well as to temporarily relocate for other daily activities. Passenger transport is also the essence of tourism, a major part of recreational transport. Commerce requires the transport of people to conduct business, either to allow face-to-face communication for important decisions or to move specialists from their regular place of work to sites where they are needed.

### Planning

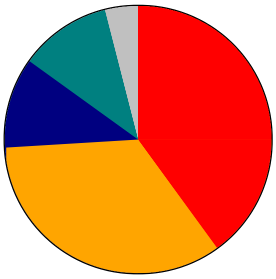
Transport planning allows for high utilization and less impact regarding new infrastructure. Using models of transport forecasting, planners are able to predict future transport patterns. On the operative level, logistics allows owners of cargo to plan transport as part of the supply chain. Transport as a field is also studied through transport economics, a component for the creation of regulation policy by authorities. Transport engineering, a sub-discipline of civil engineering, must take into account trip generation, trip distribution, mode choice, and route assignment, while the operative level is handled through traffic engineering.

Because of the negative impacts incurred, transport often becomes the subject of controversy related to choice of mode, as well as increased capacity. Automotive transport can be seen as a tragedy of the commons, where the flexibility and comfort for the individual deteriorate the natural and urban environment for all. Density of development depends on mode of transport, with public transport allowing for better spatial utilization. Good land use keeps common activities close to people's homes and places higher-density development closer to transport lines and hubs, to minimize the need for transport. There are economies of agglomeration. Beyond transport, some land uses are more efficient when clustered. Transport facilities consume land, and in cities pavement (devoted to streets and parking) can easily exceed 20 percent of the total land use. An efficient transport system can reduce land waste.


The engineering of this roundabout in Bristol, United Kingdom, attempts to make traffic flow free-moving.

Too much infrastructure and too much smoothing for maximum vehicle throughput mean that in many cities there is too much traffic and many—if not all—of the negative impacts that come with it. It is only in recent years that traditional practices have started to be questioned in many places; as a result of new types of analysis which bring in a much broader range of skills than those traditionally relied on—spanning such areas as environmental impact analysis, public health, sociology, and economics—the viability of the old mobility solutions is increasingly being questioned.

## Environment



Global greenhouse gas emissions from transportation:[34]

- Cars (40%)
- Trucks (34%)
- Planes (11%)
- Boats (11%)
- Trains (4%)

Transport is a major use of energy and burns most of the world's petroleum. This creates air pollution, including nitrous oxides and particulates, and is a significant contributor to global warming through emission of carbon dioxide,[35] for which transport is the fastest-growing emission sector.[36] By sub-sector, road transport is the largest contributor to global warming.[37] Environmental regulations in developed countries have reduced individual vehicles' emissions; however, this has been offset by increases in the numbers of vehicles and in the use of each vehicle.[35] Some pathways to reduce the carbon emissions of road vehicles considerably have been studied.[38][39] Energy use and emissions vary largely between modes, causing environmentalists to call for a transition from air and road to rail and human-powered transport, as well as increased transport electrification and energy efficiency.

Other environmental impacts of transport systems include traffic congestion and automobile-oriented urban sprawl, which can consume natural habitat and agricultural lands. By reducing transport emissions globally, it is predicted that there will be significant positive effects on Earth's air quality, acid rain, smog, and climate change.[40]

While electric cars are being built to cut down CO2 emission at the point of use, an approach that is becoming popular among cities worldwide is to prioritize public transport, bicycles, and pedestrian movement. Redirecting vehicle movement to create 20-minute neighbourhoods[41] that promotes exercise while greatly reducing vehicle dependency and pollution. Some policies are levying a congestion charge[42] to cars for travelling within congested areas during peak time.

## Sustainable development

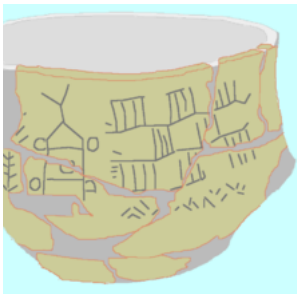
Traffic congestion persists in São Paulo, Brazil, despite the no-drive days based on license numbers.

The United Nations first formally recognized the role of transport in sustainable development in the 1992 United Nations Earth summit. In the 2012 United Nations World Conference, global leaders unanimously recognized that transport and mobility are central to achieving the sustainability targets. In recent years, data has been collected to show that the transport sector contributes to a quarter of the global greenhouse gas emissions, and therefore sustainable transport has been mainstreamed across several of the 2030 Sustainable Development Goals, especially those related to food, security, health, energy, economic growth, infrastructure, and cities and human settlements. Meeting sustainable transport targets is said to be particularly important to achieving the Paris Agreement.[43]

There are various Sustainable Development Goals (SDGs) that are promoting sustainable transport in order to meet the defined goals. These include SDG 3 on health (increased road safety), SDG 7 on energy, SDG 8 on decent work and economic growth, SDG 9 on resilient infrastructure, SDG 11 on sustainable cities (access to transport and expanded public transport), SDG 12 on sustainable consumption and production (ending fossil fuel subsidies), and SDG 14 on oceans, seas, and marine resources.[44]

# History

## Natural



Bronocice pot with the earliest known image of a wheeled vehicle in the world, found in Poland

Humans' first ways to move included walking, running, and swimming. The domestication of animals introduced a new way to lay the burden of transport on more powerful creatures, allowing the hauling of heavier loads, or humans riding animals for greater speed and duration. Inventions such as the wheel and the sled (U.K. sledge) helped make animal transport more efficient through the introduction of vehicles.

The first forms of road transport involved animals, such as horses (domesticated in the 4th or the 3rd millennium BCE), oxen (from about 8000 BCE),[45] or humans carrying goods over dirt tracks that often followed game trails.

## Infrastructure

Many early civilizations, including those in Mesopotamia and the Indus Valley, constructed paved roads. In classical antiquity, the Persian and Roman empires built stone-paved roads to allow armies to travel quickly. Deep roadbeds of crushed stone underneath kept such roads dry. The medieval Caliphate later built tar-paved roads.

## Water transport

A bullock team hauling wool in Australia

Water transport, including rowed and sailed vessels, dates back to time immemorial and was the only efficient way to transport large quantities or over large distances prior to the Industrial Revolution. The first watercraft were canoes cut out from tree trunks. Early water transport was accomplished with ships that were either rowed or used the wind for propulsion, or a combination of the two. The importance of water has led to most cities that grew up as sites for trading being located on rivers or on the sea-shore, often at the intersection of two bodies of water.

## Mechanical

Until the Industrial Revolution, transport remained slow and costly, and production and consumption gravitated as close to each other as feasible. The Industrial Revolution in the 19th century saw several inventions fundamentally change transport. With telegraphy, communication became instant and independent of the transport of physical objects. The invention of the steam engine, closely followed by its application in rail transport, made land transport independent of human or animal muscles. Both speed and capacity increased, allowing specialization through manufacturing being located independently of natural resources. The 19th century also saw the development of the steam ship, which sped up global transport.

With the development of the combustion engine and the automobile around 1900, road transport became more competitive again, and mechanical private transport originated. The first "modern" highways were constructed during the 19th century with macadam. Later, tarmac and concrete became the dominant paving materials.

In 1903 the Wright brothers demonstrated the first successful controllable airplane, and after World War I (1914–1918) aircraft became a fast way to transport people and express goods over long distances.[46]

The Wright brothers' first flight in 1903

After World War II (1939–1945) the automobile and airlines took higher shares of transport, reducing rail and water to freight and short-haul passenger services.[47] Scientific spaceflight began in the 1950s, with rapid growth until the 1970s, when interest dwindled. In the 1950s the introduction of containerization gave massive efficiency gains in freight transport, fostering globalization.[31] International air travel became much more accessible in the 1960s with the commercialization of the jet engine. Along with the growth in automobiles and motorways, rail and water transport declined in relative importance. After the introduction of the Shinkansen in Japan in 1964, high-speed rail in Asia and Europe started attracting passengers on long-haul routes away from the airlines.[47]

Early in U.S. history, private joint-stock corporations owned most aqueducts, bridges, canals, railroads, roads, and tunnels. Most such transport infrastructure came under government control in the late 19th and early 20th centuries, culminating in the nationalization of inter-city passenger rail-service with the establishment of Amtrak. Recently, however, a movement to privatize roads and other infrastructure has gained some ground and adherents.[48]

## See also

- Environmental impact of aviation
- Energy efficiency in transport
- Green transport hierarchy
- IEEE Intelligent Transportation Systems Society
- List of emerging transportation technologies
- *Journal of Transport and Land Use*
- Outline of transport
- Public transport
- Rail transport by country
- Speed record
- Taxicabs by country
- Transportation engineering

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## External links

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- Transportation (https://curlie.org/Science/Technology/Transportation) at Curlie
- America On the Move (http://americanhistory.si.edu/onthemove/) An online transportation exhibition from the National Museum of American History, Smithsonian Institution

- World Transportation Organization (https://web.archive.org/web/20130604022027/http://www.transport.org/) The world transportation organization (The Non-Profit Advisory Organization)

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# Transport law

**Transport law** (or **transportation law**) is the area of law dealing with transport. The laws can apply very broadly at a transport system level or more narrowly to transport things or activities within that system such as vehicles, things and behaviours. Transport law is generally found in two main areas:

- legislation or statutory law passed or made by elected officials like Parliaments or made by other officials under delegation
- case law decided by courts.

Legislation typically consists of statutes known as Acts and delegated legislation like regulations, orders or notices. Case law consists of judgments, findings and rulings handed down by courts.

## Contents



## Transport system things and activities

Transport laws can apply at a global transport system-wide level. A transport system can encompass a wide range of matters which make up the system. These include -

- heavy and light rail systems including associated land, infrastructure and rolling stock which comprise trains, trams and light rail vehicles
- roads including freeways, arterial roads and paths
- vehicles including cars, trucks, buses and bicycles
- ports and waterways
- commercial ships and recreational vessels
- air transport systems and aircraft.

A transport system includes not only system infrastructure and conveyances, but also things like -

- communication systems and other technologies
- strategic, business and operational plans
- schedules, timetables and ticketing systems
- safety systems
- labour components

- service components
- government decision makers like Ministers, departments, authorities, corporations, agencies and other legal persons.

The Transport Integration Act of Victoria, Australia provides an example of the use of a broad statutory formulation to circumscribe the operation of a transport law in legislative form.[1]

Individual components can be identified from this broad transport system formulation and then regulated discreetly. For example, a bus or a car forms part of a broad transport system but are commonly regulated on an individual basis in terms of identification (registration), control of the vehicle (driver licensing and drug and blood alcohol controls), vehicle forms and fittings (vehicle standards) and other safety requirements.

# Examples of transport legislation

Victoria again provides an example of a jurisdiction with a suite of transport legislation which operates both at transport system and modal or activity levels.

## System level

The Transport Integration Act sets out the overall policy framework for transport in Victoria. It also establishes and sets the charters of the key government agencies which make decisions affecting the planning and operation of the State's transport system and each agency is required by the statute to have regard to the policy framework.

As a general rule, transport agencies and officials do not exist in their own right and have no existence or power without conferral from a transport law. Legislation is commonly required for this purpose. Transport decision makers and agencies established and/or empowered by the Transport Integration Act[2] include -

- key government figures such as Ministers (currently the Minister for Public Transport, the Minister for Roads and the Minister for Ports)
- a central government Department - the Department of Transport (Victoria, 2019–) - responsible for system-wide planning, integration and coordination
- a public transport agency responsible for providing or regulating train, tram, light rail, bus and taxi services - the Public Transport Development Authority
- a road agency responsible for road construction and maintenance and vehicles and towing services regulation - the Roads Corporation (VicRoads)
- agencies responsible for discrete parts of the rail system such as land, infrastructure and other assets (Victorian Rail Track (VicTrack)) and regional services (V/Line Corporation)
- agencies responsible for ports and other waters - the Port of Melbourne Corporation, the Port of Hastings Development Authority, the Victorian Regional Channels Authority and local and other authorities
- an independent transport safety regulator (Director, Transport Safety) and independent safety investigator (the Chief Investigator, Transport Safety)

The Transport Integration Act establishes these agencies and sets their statutory charters. The charters circumscribe the agencies' jurisdiction or power to operate in and to regulate their respective components of the transport system.

### Mode or activity-based legislation

Victoria has a range of statutes which regulate transport modes and transport-related activities throughout the State. These include—

- the Road Management Act 2004
- the Road Safety Act 1986
- the Rail Management Act 1996
- the Rail Safety Act 2006
- the Bus Safety Act 2009
- the Bus Services Act 1995
- the Accident Towing Services Act 2007
- the Major Transport Projects Facilitation Act 2009
- the Port Management Act 1995
- the Marine Act 1988
- the Tourist and Heritage Railways Act 2010.

## Case law and law from other sources

Areas of transport law governed by court decisions and other non transport statutes or laws include property law, contract law, torts law and specialist regulation governing the contract of carriage, and the relationship between carriers and passengers in public transport and shippers and cargo owners in shipping.

## References


1. Transport Integration Act 2010 - see www.legislation.vic.gov.au (http://www.legislation.vic.gov.au). See the definition of "transport system" in section 3 of the Act.
2. Transport Integration Act 2010 - see Parts 3, 5, 5A, 6, and 6A.


## External links

- Media related to Transport law at Wikimedia Commons

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# Bulk cargo

**Bulk cargo** is commodity cargo that is transported unpackaged in large quantities.[1]

A mini-bulker taking on scrap iron cargo in Brest, France.

## Contents



## Description


Modern tank cars carry all types of liquid and gaseous commodities.

Bulk cargo refers to material in either liquid or granular, particulate form, as a mass of relatively small solids, such as petroleum/crude oil, grain, coal, or gravel. This cargo is usually dropped or poured, with a spout or shovel bucket, into a bulk carrier ship's hold, railroad car/railway wagon, or tanker truck/trailer/semi-trailer body. Smaller quantities can be boxed (or drummed) and palletised; cargo packaged in this manner is referred to as breakbulk cargo.[2] Bulk cargo is classified as liquid or dry.[2]

The Baltic Exchange is based in London and provides a range of indices benchmarking the cost of moving bulk commodities, dry and wet, along popular routes around the seas. Some of these indices are also used to settle Freight Futures, known as FFA's. The most famous of the Baltic indices is the Baltic Dry Indices, commonly called the BDI. This is a derived function of the Baltic Capesize index (BCI), Baltic Panamax index (BPI), Baltic Supramax index (BSI) and the Baltic Handysize index (BHSI). The BDI has been used as a bellwether for the global economy as it can be interpreted as an indicator of an increase or decrease in the amount of raw commodities countries are importing/exporting.

## Dry bulk

Dry bulk refers to any cargo which is carried in bulk in solid form. Such carriage is often referred to as the "dry" trades.[3] They would include:

- Bauxite
- Bulk minerals (sand & gravel, copper, limestone, salt, etc.)
- Cements
- Chemicals (fertilizer, plastic granules & pellets, resin powder, synthetic fiber, etc.)
- Coals and cokes
- Agricultural products such as dry edibles (for animals or humans: alfalfa pellets, citrus pellets, livestock feed, flour, peanuts, raw or refined sugar, seeds, starches, etc.)
- Grains (wheat, maize, rice, barley, oats, rye, sorghum, soybeans, etc.)
- Iron (ferrous & non-ferrous ores, ferroalloys, pig iron, scrap metal, pelletized taconite), etc.
- Wood chips


This heap of iron ore pellets will be used in steel production.

# Liquid bulk cargo

Liquid bulk cargo includes any cargo carried in closed tanks and poured or pumped into the carrying vessel. This would include:

- Hazardous chemicals in liquid form
- Petroleum
- Gasoline
- Liquefied natural gas (LNG)
- Liquid nitrogen
- Cooking oil
- Fruit juices
- Rubber
- Vegetable oil

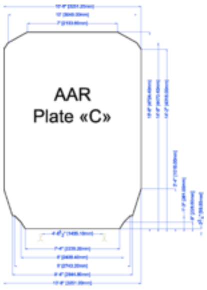
# Gallery


A milk tank car for bulk loading.


DME 49328, a covered hopper owned and operated by the Dakota, Minnesota and Eastern Railroad

A rotary car dumper

Bulk loading of a feeder ship with rapeseed meal




# Large ports specializing in bulk cargo

- Port of Port Hedland, Australia
- Port of Rotterdam
- Port of Vancouver
- Port of Liverpool
- Port of Tyne
- Port of Amsterdam

- Port of Hamilton (Canada)

## See also

- Bulk material handling
- Covered hopper
- Flexible intermediate bulk container (bigbag)
- Harmonized System
- Hopper car
- Lake freighter
- Loading gauge
- Maritime transport
- Milk tank car
- Neo-bulk cargo
- Rotary car dumper
- Selfdischarger
- Tank car
- Tank truck
- World's busiest port

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Wikipedia

# Car classification

Governments and private organizations have developed **car classification** schemes that are used for various purposes including regulation, description, and categorization of cars.

The International Standard ISO 3833-1977 *Road vehicles – Types – Terms and definitions* also defines terms for classifying cars.[1]

## Contents

## Summary of classifications

The following table summarises the commonly used terms of market segments and legal classifications.

## Car market segments and legal classifications

| Euro Car Segment[2] | Euro NCAP Class | US EPA Size Class[3] | Other common segment terms | Examples |
|---|---|---|---|---|
| Quadricycle | — | — | Microcar<br>Bubble car | Bond Bug, Smart ForTwo, Isetta, Mega City, Renault Twizy |
| A-segment mini cars | Supermini (http://www.euroncap.com/supermini.aspx) | Minicompact | City car<br>Kei car (JP) | Chevrolet Spark, Fiat 500, Kia Picanto, Suzuki Alto, Renault Twingo |
| B-segment small cars | | Subcompact | — | Ford Fiesta, Kia Rio, Opel Corsa, Peugeot 208, Volkswagen Polo |
| C-segment medium cars | Small family car (http://www.euroncap.com/small_family_car.aspx) | Compact | — | Honda Civic, Hyundai Elantra, Ford Focus, Toyota Corolla, Volkswagen Golf |
| | | | Subcompact executive | Acura ILX, Audi A3, BMW 1 Series, Lexus CT, Mercedes-Benz A-Class |
| D-segment large cars | Large family car (http://www.euroncap.com/large_family_car.aspx) | Mid-size | — | Ford Mondeo, Toyota Camry, Peugeot 508, Mazda6, Volkswagen Passat |
| | | | Compact executive (U.K.)<br>Entry-level luxury (U.S.) | Alfa Romeo Giulia, Audi A4, BMW 3 Series, Lexus IS, Mercedes-Benz C-Class |
| E-segment executive cars | Executive (http://www.euroncap.com/executive.aspx) | Large | Full-size car (U.S.) | Chevrolet Impala, Chrysler 300, Ford Taurus, Holden Caprice, Toyota Avalon |
| | | | Mid-size luxury (U.S.) | Audi A6, BMW 5 Series, Cadillac CT5, Mercedes-Benz E-Class, Tesla Model S |
| F-segment luxury cars | — | | Full-size luxury (U.S.)<br>Luxury saloon (U.K.) | Audi A8, BMW 7 Series, Jaguar XJ, Mercedes-Benz S-Class, Porsche Panamera |

| | | | | |
|---|---|---|---|---|
| S-segment sports coupés | — | — | Supercar | Bugatti Chiron, LaFerrari, Lamborghini Aventador, Pagani Huayra, Porsche 918 Spyder |
| | — | — | Convertible | Chevrolet Camaro, Mercedes-Benz CLK, Volvo C70, Volkswagen Eos, Opel Cascada |
| | Roadster sports (http://www.euroncap.com/roadster_sports.aspx) | Two-seater | Roadster Sports car | BMW Z4, Lotus Elise, Mazda MX-5, Porsche Boxster, Mercedes-Benz SLK |
| M-segment multi purpose cars | Small MPV (http://www.euroncap.com/small_mpv.aspx) | Minivan | Mini MPV | Citroën C3 Picasso, Kia Venga, Ford B-Max, Opel Meriva, Fiat 500L |
| | | | Compact MPV | Chevrolet Orlando, Ford C-Max, Suzuki Ertiga, Renault Scénic, Volkswagen Touran |
| | Large MPV (http://www.euroncap.com/large_mpv.aspx) | | People mover (AU) | Chrysler Pacifica (RU), Kia Carnival, Renault Espace, Toyota Sienna, Citroën C4 Grand Picasso |
| J-segment sport utility cars | Small off-road 4x4 (http://www.euroncap.com/small_off_road_4_4.aspx) | Small SUV | Mini 4x4 (U.K.)<br>Mini SUV (U.S.) | Daihatsu Terios, Ford EcoSport, Jeep Renegade, Peugeot 2008, Suzuki Jimny |
| | | | Compact 4x4 (U.K.)<br>Compact SUV | Toyota RAV4, Ford Escape, Honda CR-V, Peugeot 3008, Kia Sportage |
| | Large off-road 4x4 (http://www.euroncap.com/large_off_road_4_4.aspx) | Standard SUV | Large 4x4 (U.K., AU)<br>Mid-size SUV (U.S.) | Ford Edge, Hyundai Santa Fe, Jeep Grand Cherokee, Volkswagen Touareg, Volvo XC90 |
| | | | Full-size SUV (U.S.)<br>Large 4x4 (U.K.)<br>Upper Large SUV (AU) | Lincoln Navigator, Range Rover, Chevrolet Suburban, Toyota Land Cruiser, Mercedes-Benz GLS |

# Market segments

## Microcar / kei car

2018 Aixam Crossline

Microcars and their Japanese equivalent— kei cars— are the smallest category of automobile.[4]

Microcars straddle the boundary between car and motorbike, and are often covered by separate regulations to normal cars, resulting in relaxed requirements for registration and licensing. Engine size is often 700 cc (43 cu in) or less, and microcars have three or four wheels.

Microcars are most popular in Europe, where they originated following World War II. The predecessors to micro cars are voiturettes and cycle cars. Kei cars have been used in Japan since 1949.

Examples of microcars and kei cars:

- Honda Life
- Smart ForTwo
- Tata Nano

## A-segment / City car / Minicompact

2014–present Citroën C1

The smallest category of vehicles that are registered as normal cars is called A-segment in Europe, or "city car" in Europe and the United States. The United States Environmental Protection Agency defines this category as "minicompact." However, this term is not widely used.

The equivalents of A-segment cars have been produced since the early 1920s. However, the category increased in popularity in the late 1950s when the original Fiat 500 and BMC Mini were released.

Examples of A-segment / city cars / minicompact cars:

- Fiat 500
- Hyundai i10
- Toyota Aygo

## B-segment / Supermini / Subcompact

The next larger category small cars is called B-segment Europe, supermini in the United Kingdom and subcompact in the United States.

The size of a subcompact car is defined by the United States Environmental Protection Agency (EPA), as having a combined interior and cargo volume of between 85–99 cubic feet (2,410–2,800 L).[5] Since the EPA's smaller minicompact category is not as commonly used by the general public, A-segment cars are sometimes called subcompacts in the United States. In Europe and Great Britain, the B-segment and supermini categories do not have any formal definitions based on size.

Renault Clio

Early supermini cars in Great Britain include the 1977 Ford Fiesta and Vauxhall Chevette.

In the United States, the first locally-built subcompact cars were the 1970 AMC Gremlin, Chevrolet Vega, and Ford Pinto.[6]

Examples of B-segment / supermini / subcompact cars:

- Chevrolet Aveo (Chevrolet Sonic)
- Hyundai Accent
- Volkswagen Polo

## C-segment / Small family / Compact

The largest category of small cars is called *C-segment* or *small family car* in Europe, and *compact car* in the United States.

Volkswagen Golf

The size of a compact car is defined by the United States Environmental Protection Agency (EPA), as having a combined interior and cargo volume of 100–109 cu ft (2.8–3.1 $m^3$).[5]

Examples of C-segment / compact / small family cars:

- Honda Civic
- Toyota Corolla
- Renault Mégane

## D-segment / Large family / Mid-size

In Europe, the third-largest category for passenger cars is called *D-segment* or *large family car*.

Toyota Camry

In the United States, the equivalent term is *mid-size* or *intermediate* cars. The U.S. Environmental Protection Agency (EPA) defines a mid-size car as having a combined passenger and cargo volume of 110–119 cu ft (3.1–3.4 $m^3$).

Examples of D-segment / large family / mid-size cars:

- Chevrolet Malibu
- Ford Mondeo

- Kia K5

### E-segment / Executive / Full-size

Dodge Charger

In Europe, the second-largest category for passenger cars is E-segment / executive car, which are usually luxury cars.

In other countries, the equivalent terms are *full-size car* or *large car*, which are also used for relatively affordable large cars that are not considered luxury cars.

Examples of non-luxury full-size cars:

- Chevrolet Impala
- Tesla Model S
- Toyota Avalon[7]

### F-segment / Luxury saloon / Full-size luxury

*See Luxury saloon / full-size luxury section below.*

## Minivans / MPVs

Minivan is an American car classification for vehicles that are designed to transport passengers in the rear seating rows, have reconfigurable seats in two or three rows. The equivalent terms in British English are multi-purpose vehicle (MPV), people carrier, and people mover. Minivans are often of the "one-box" or "two-box" body configuration, high roofs, flat floors, sliding doors for rear passengers, and high H-point seating.

### Mini MPV


Opel Meriva (2011–2017)

Mini MPV is the smallest size of MPVs and the vehicles are often built on the platforms of B-segment hatchback models.

Examples of Mini MPVs:

- Fiat 500L
- Honda Freed
- Ford B-Max

### Compact MPV

Compact MPV is the middle size of MPVs. The compact MPV size class sits between the mini MPV and large MPV (minivan) size classes.

Compact MPVs remain predominantly a European phenomenon, although they are also built and sold in many Latin American and Asian markets.

Examples of Compact MPVs:

- Renault Scénic
- Volkswagen Touran
- Ford C-Max

Ford C-Max (2011–2019)

### Large MPV

The largest size of minivans is also referred to as "large MPV" and became popular following the introduction of the 1984 Renault Espace and Dodge Caravan. Since the 1990s, the smaller compact MPV and mini MPV sizes of minivans have also become popular. If the term "minivan" is used without specifying a size, it usually refers to a large MPV.

Renault Espace I (1984–1991)

Examples of Large MPVs:

- Chrysler Pacifica
- Ford S-Max
- Toyota Sienna

## Luxury vehicles

### Premium compact

The premium compact class (also called subcompact executive) is the smallest category of luxury cars. It became popular in the mid-2000s, when European manufacturers — such as Audi, BMW, and Mercedes-Benz — introduced new entry-level models that were smaller and cheaper than their compact executive models.[8]

2012–present Audi A3

Examples of premium compact cars:

- Acura ILX
- Mercedes-Benz CLA-Class
- Lexus CT200h

### Compact executive / luxury compact

A compact executive car or a compact luxury car is a premium car larger than a *premium compact* and smaller than an *executive car*. Compact executive cars are equivalent size to mid-size cars and are part of the D-segment in the European car classification.

2019 Lexus IS

In North American terms, close equivalents are "luxury compact"[9][10][11][12] and "entry-level luxury car",[13][14][15] although the latter is also used for the smaller *premium compact cars*.[16][17]

Examples of compact executive cars:

- Audi A4
- BMW 3 Series
- Volvo S60

### Executive / mid-size luxury


2018 BMW 5 Series

An executive car is a premium car larger than a *compact executive* and smaller than an *full-size luxury* car. Executive cars are classified as E-segment cars in the European car classification.

In the United States and several other countries, the equivalent categories are full-size car (not to be confused with the European category of "full-size luxury car") or *mid-size luxury* car.

Examples of executive cars:

- Mercedes-Benz E-Class
- Lexus GS
- Volvo S90

### Luxury saloon / full-size luxury


Mercedes-Benz S-Class

The largest size of a luxury car is known as a *luxury saloon* in the United Kingdom and a *full-size luxury car* in the United States. These cars are classified as F-segment cars in the European car classification.

Vehicles in this category are often the flagship models of luxury car brands.[18]

Examples of luxury saloons:

- BMW 7 Series
- Lincoln Continental
- Porsche Panamera

## Sports / performance cars

Cars that prioritize handling or straight-line acceleration are called sports cars or performance cars. However the term "sports car" is also sometimes used specifically for lightweight two-seat cars. Sports/performance cars can either be built on unique platforms or be upgraded versions of regular cars.

Common categories of sports/performance cars are:

- sports car
- sports sedan / sports saloon
- supercar

- hypercar
- hot hatch
- sport compact
- muscle car
- pony car
- grand tourer

The definitions for these categories are often blurred and a car may be a member of multiple categories.

## Sports car

Jaguar E-Type

Sports cars are designed to emphasize handling, performance, or the thrill of driving. Sports cars originated in Europe in the early 1900s, with one of the first recorded usages of the term "sports car" being in *The Times* newspaper in the United Kingdom in 1919.[19] Sports cars started to become popular during the 1920s.[20] The term was originally used for two-seat roadsters (cars without fixed roofs). However, since the 1970s the term has also been used for cars with fixed roofs (which were previously considered grand tourers).[21]

Examples of sports cars:

- Chevrolet Corvette
- Mazda MX-5
- Porsche 911

## Sports sedan / sports saloon

Holden (HSV) GTS

A *sports sedan* — also known as "sports saloon" — is a subjective term for a sedan/saloon car which is designed to have sporting performance or handling characteristics.

Examples of sports sedans:

- BMW M5
- Mazdaspeed6 / Mazda 6 MPS
- Dodge Charger

## Supercar / hypercar

Lamborghini Countach

A supercar – also called an exotic car – is a loosely-defined description of certain high-performance sportscars. Since the 1990s or 2000s, the term "hypercar" has come into use for the highest performing supercars.

Examples of supercars:

- McLaren P1
- Koenigsegg Agera R
- Bugatti Veyron 16.4

# SUVs / off-road vehicles

Passenger vehicles with off-road capability or styling features are often categorized as either off-road vehicles, sports utility vehicles, or crossover SUVs. There are no commonly agreed boundaries between these categories, and usage of the terms varies between countries.

## Off-road vehicle


Jeep Wrangler (2018–present)

The earliest type of passenger vehicle is called an "off-roader", "four-by-four" or "four-wheel drive". Off-road vehicles usually more focussed on off-road capability than SUVs and crossover SUVs (often compromising their on-road ride quality or handling).[22] Common features of off-road vehicles are four-wheel drive, high ground clearance, a body-on-frame (separate chassis) construction and low-range gearing.

Examples of off-road vehicles:

- Nissan Patrol
- Toyota Landcruiser
- Suzuki Jimny

## Sport utility vehicle


Ford Explorer (2020–present)

A sports utility vehicle (SUV) combines elements of road-going passenger cars with features from off-road vehicles, such as raised ground clearance and four-wheel drive.

There is no commonly agreed definition of an SUV, and usage varies between countries. Some definitions claim that an SUV must be built on a light-truck chassis. However, a broader definition considers any vehicle with off-road design features as an SUV. In some countries — such as the United States — SUVs have been classified as "light trucks", resulting in more lenient regulations compared to passenger cars.

The predecessors to SUVs date back to military and low-volume models from the late 1930s, and the four-wheel drive station wagons / carryalls that began to be introduced in 1949. The 1984 Jeep Cherokee (XJ) is considered to be the first SUV in the modern style. Most SUVs produced today use unibody construction (as per passenger cars). However, in the past, many SUVs used body-on-frame construction.

Examples of SUVs:

- Chevrolet Tahoe
- Mercedes-Benz M-Class

- Mitsubishi Pajero

### Crossover SUV

Skoda Kodiaq

A crossover SUV— also called crossover or CUV— is a type of sports utility vehicle (SUV) that uses a unibody construction. Crossovers are often based on a platform shared with a passenger car, as a result, they typically have better comfort and fuel economy, but less off-road capability (many crossovers are sold without all-wheel drive) than truck-based SUVs, though more so than passenger cars.

There are various inconsistencies about whether vehicles are considered crossovers or SUVs, therefore the term SUV is often used as a catch-all for both crossovers and SUVs.

Examples of crossover SUVs:

- Nissan Qashqai
- Tesla Model Y
- Volkswagen Tiguan

## Government classification methods

These classifications can be based on body style (e.g. sedan, coupe or hatchback), number of doors or seating capacity.[23]

Government departments often create classification schemes for the purposes of taxation or regulating vehicle usage (e.g. vehicles that require a specific licence or are restricted to certain roads). Some jurisdictions may determine vehicle tax based upon environmental principles, such as the user pays principle.[24]

### Australia

In Australia, the Federal Chamber of Automotive Industries publishes its own classifications.[25]

### Canada

A similar set of classes is used by the Canadian EPA.[26] The Canadian National Collision Database (NCDB) system defines "passenger car" as a unique class, but also identifies two other categories involving passenger vehicles—the "passenger van" and "light utility vehicle"—and these categories are inconsistently handled across the country with the boundaries between the vehicles increasingly blurred.[27]

### United Kingdom

In the United Kingdom, a vehicle is taxed according to the vehicle's construction, engine, weight, type of fuel and emissions, as well as the purpose for which it is used.[28]

## United States

In the United States, since 2010 the Insurance Institute for Highway Safety uses a scheme it has developed that takes into account a combination of both vehicle footprint (length times width) and weight.[29]

| US Highway Loss Data Institute classification | Definition |
|---|---|
| Regular two door | Two-door sedans and hatchbacks |
| Regular four door | Four-door sedans and hatchbacks |
| Station wagons | Four doors, a rear hatch, and four pillars |
| Minivans | Vans with sliding rear doors |
| Sports | Two seaters and cars with significant high-performance features |
| Luxury | Relatively expensive cars that are not classified as sports (price in USD to curb weight in pounds more than 9.0 in 2010) (small cars over $27,000, midsize cars over $31,500, large cars over $36,000, etc.) |

| US Insurance Institute for Highway Safety \| Highway Loss Data Institute 'Guide to car size groups' (includes minivans)[30] | | | | | |
|---|---|---|---|---|---|
| | Shadow (square footage of exterior length × width) | | | | |
| **Curb weight** | **70 to 80 sq ft (6.5–7.4 m$^2$)** | **81 to 90 sq ft (7.5–8.4 m$^2$)** | **91 to 100 sq ft (8.5–9.3 m$^2$)** | **101 to 110 sq ft (9.4–10.2 m$^2$)** | **>110 sq ft (10.2 m$^2$)** |
| 2,001 to 2,500 lb (900–1,150 kg) | Mini | Small | Small | Small | Midsize |
| 2,501 to 3,000 lb (1,150–1,350 kg) | Small | Small | Midsize | Midsize | Midsize |
| 3,001 to 3,500 lb (1,350–1,600 kg) | Small | Midsize | Midsize | Large | Large |
| 3,501 to 4,000 lb (1,600–1,800 kg) | Small | Midsize | Large | Large | Very large |
| >4,000 lb (1,800 kg) | Midsize | Midsize | Large | Very large | Very large |

| US IIHS\|HLDI Guide to SUV size groups[31] | |
|---|---|
| | **Curb weight** |
| Mini | <=3,000 lb (1,350 kg) and shadow <80 sq ft (7.4 m$^2$) |
| Small | 3,001 to 3,750 lb (1,350–1,700 kg) |
| Midsize | 3,751 to 4,750 lb (1,700–2,150 kg) |
| Large | 4,751 to 5,750 lb (2,150–2,600 kg) |
| Very large | >5,750 lb (2,600 kg) or shadow >115 sq ft (10.7 m$^2$) |

The United States National Highway Traffic Safety Administration (NHTSA) separates vehicles into classes by the curb weight of the vehicle with standard equipment including the maximum capacity of fuel, oil, coolant, and air conditioning, if so equipped.[32]

| US NHTSA classification | Code | Curb weight |
|---|---|---|
| Passenger cars: mini | PC/Mi | 1,500 to 1,999 lb (700–900 kg) |
| Passenger cars: light | PC/L | 2,000 to 2,499 lb (900–1,150 kg) |
| Passenger cars: compact | PC/C | 2,500 to 2,999 lb (1,150–1,350 kg) |
| Passenger cars: medium | PC/Me | 3,000 to 3,499 lb (1,350–1,600 kg) |
| Passenger cars: heavy | PC/H | 3,500 lb (1,600 kg) and over |
| Sport utility vehicles | SUV | – |
| Pickup trucks | PU | – |
| Vans | VAN | – |

The United States Federal Highway Administration has developed a classification scheme used for automatically calculating road use tolls. There are two broad categories depending on whether the vehicle carries passengers or commodities. Vehicles that carry commodities are further subdivided by number of axles and number of units, including both power and trailer units.[33]

The United States Environmental Protection Agency (US EPA) has developed a classification scheme used to compare fuel economy among similar vehicles. Passenger vehicles are classified based on a vehicle's total interior passenger and cargo volumes. Trucks are classified based upon their gross vehicle weight rating (GVWR). Heavy-duty vehicles are not included within the EPA scheme.[5]

| US EPA car class | Total passenger and cargo volume (cu. ft.) |
|---|---|
| Two-seaters | Any (designed to seat only two adults) |
| Minicompact | Less than 85 cu ft (2,400 L) |
| Subcompact | 85 to 99 cu ft (2,400–2,800 L) |
| Compact | 100 to 109 cu ft (2,850–3,100 L) |
| Mid-size | 110 to 119 cu ft (3,100–3,350 L) |
| Large | 120 cu ft (3,400 L) or more |
| Small station wagons | Less than 130 cu ft (3,700 L) |
| Mid-size station wagons | 130 to 159 cu ft (3,700–4,500 L) |
| Large station wagons | 160 cu ft (4,550 L) or more |

Certain cities in the United States in the 1920s chose to exempt electric-powered vehicles because officials believed those vehicles did not cause "substantial wear upon the pavements".[34]

# North American market segments

Several other segment descriptions, listed below, are used in North America. Cars from these segments may also be sold in other countries. However, usage of the terms is mostly specific to within North America.

### Muscle car

Muscle car is an American term for high-performance cars, usually rear-wheel drive and fitted with a large and powerful V8 engine. The term originated for the 1960s and early 1970s special editions of mass-production cars which were designed for drag racing.

1970 AMC The Machine[35][36]

Examples of muscle cars:

- Ford Torino
- Plymouth Road Runner
- Pontiac GTO

### Pony car

Pony car is an American class of automobile launched and inspired by the Ford Mustang in 1964. It broke all post-World War II automobile sales records, "creating the 'pony car' craze soon adopted by competitors." The term describes an affordable, compact, highly styled car with a sporty or performance-oriented image

Ford Mustang (1965–1973)

Examples of pony cars:

- AMC Javelin
- Chevrolet Camaro
- Dodge Challenger

### Personal luxury car

A personal luxury car is a North American market segment for premium coupé or convertible produced from 1952–2007. These two door cars prioritized comfort, styling and a high level of interior features.[37] Not prioritizing maximum interior space, interior volumes are equivalent size to mid-size cars and are part of the D-segment in the European car classification, and exterior dimensions can exceed F-segment.

1977 Chevrolet Monte Carlo

The segment rose to popularity following the success of the 1958-60 Ford Thunderbird, which sold 200,000 units.[38] Personal luxury cars from General Motors and Chrysler respectively include the Buick Riviera and Chrysler Cordoba.[39]

Examples of personal luxury cars:

- Ford Thunderbird

- Cadillac Eldorado
- Chrysler Cordoba

### Sport compact

A sporting version of an affordable compact car or a subcompact car. There is no precise definition and the description is applied for marketing purposes to a wide variety of models.

Dodge Neon SRT-4

Cars began to be marketed as sport compacts in the mid-1980s when it was used for option packages on American-built coupes. Since then, it has also been used for standalone sports car models and cars imported from Europe and Asia.

The European equivalent is a hot hatch. However, sport compacts are not restricted to just hatchback body styles.

Examples of sport compact cars:

- Chevrolet Cavalier Z24
- Ford Probe
- Honda Civic Si

## European market segments

Several other segment descriptions, listed below, are used in Europe. Cars from these segments may also be sold in other countries. However, usage of the terms is mostly specific to within Europe.

### Grand tourer

A grand tourer (GT) is a car that is designed for high speed and long-distance driving, due to a combination of performance and luxury attributes. The most common format is a front-engine, rear-wheel-drive two-door coupé with either a two-seat or a 2+2 arrangement.

Maserati GranTurismo

The term derives from the Italian language phrase *gran turismo* which became popular in the English language from the 1950s, evolving from fast touring cars and streamlined closed sports cars during the 1930s.

Examples of grand tourers:

- Aston Martin V8
- Lexus SC300/400
- Ferrari 612 Scaglietti

### Hot hatch

Hot hatch (shortened from hot hatchback) is a high-performance version of a mass-produced hatchback car.

Peugeot 205 GTI (1993–1998)

The term originated in the mid-1980s. However, factory high-performance versions of hatchbacks have been produced since the 1970s.

Front-mounted petrol engines, together with front-wheel drive, is the most common powertrain layout. However, all-wheel drive has become more commonly used since around 2010. Most hot hatches are manufactured in Europe or Asia.

Examples of hot hatches:

- Volkswagen Golf GTi
- Peugeot 205 GTi
- Honda Civic Type R

## See also

- ACRISS Car Classification Code
- Car body style
- Commercial vehicle
- Three-wheeler
- Truck classification
- Vehicle category
- Vehicle size class

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# Container Security Initiative

The **Container Security Initiative** (**CSI**) a.k.a. the **24-Hour Rule** was launched in 2002 by the U.S. Bureau of Customs and Border Protection (CBP), an agency of the Department of Homeland Security.[1] Its purpose was to increase security for container cargo shipped to the United States. As the CBP puts it, the intent is to "extend [the] zone of security outward so that American borders are the last line of defense, not the first."[2]

## Contents



## Rationale

Containerized shipping is a critical component of international trade. According to the CBP:

- About 90% of the world's trade is transported in cargo containers.
- Almost half of incoming U.S. trade (by value) arrives by containers onboard ships.
- Nearly seven million cargo containers arrive on ships and are offloaded at U.S. seaports each year.

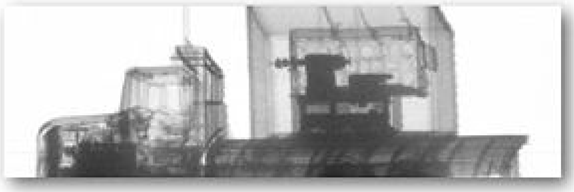
As terrorist organizations have increasingly turned to destroying economic infrastructure to make an impact on nations, the vulnerability of international shipping has come under scrutiny. Under the CSI program, the screening of containers that pose a risk for terrorism is accomplished by teams of CBP officials deployed to work in concert with their host nation counterparts.[3][4]

## CSI core elements

CSI consists of four core elements:[5]

- Using intelligence and automated information to identify and target containers that pose a risk for terrorism.

- Pre-screening those containers that pose a risk at the port of departure before they arrive at U.S. ports.
- Using detection technology to quickly pre-screen containers that pose a risk.
- Using smarter, tamper-evident containers.



Gamma-ray image of a truck with cargo container

The initial CSI program has focused on implementation at the top 20 ports shipping approximately two-thirds of the container volume to the United States. Smaller ports, however, have been added to the program at their instigation, and participation is open to any port meeting certain volume, equipment, procedural, and information-sharing requirements. Future plans include expansion to additional ports based on volume, location, and strategic concerns.

Much of the original idea behind the CSI program stemmed from the work of James Giermanski, who was an early proponent of Supply Chain Security.[6]

# Global impact

The CSI program offers its participant countries the reciprocal opportunity to enhance their own incoming shipment security. CSI partners can send their customs officers to major U.S. ports to target ocean-going, containerized cargo to be exported from the U.S. to their countries. Likewise, CBP shares information on a bilateral basis with its CSI partners. Japan and Canada are currently taking advantage of this reciprocity.

CSI has also inspired and informed global measures to improve shipping security. In June 2002, the World Customs Organization unanimously passed a resolution that will enable ports in all 161 of the member nations to begin to develop programs along the CSI model. On 22 April 2004, the European Union and the U.S. Department of Homeland Security signed an agreement that calls for the prompt expansion of CSI throughout the European Community.[7]

# Participating ports

## U.S. ports

- *NOTE: Information is needed here on ports participating in reciprocal agreements.*

## Foreign ports

47 foreign CSI ports are operational as of 2006-09-29. They include:

- Halifax, Montreal, and Vancouver, Canada (March 2002)
- Rotterdam, The Netherlands (2002-09-02)
- Le Havre, France (2002-12-02)
- Marseille, France (2005-01-07)
- Bremerhaven, Germany (2003-02-02)
- Hamburg, Germany (2003-02-09)
- Antwerp, Belgium (2003-02-23)
- Zeebrugge, Belgium (2004-10-29)

- Singapore (2003-03-10)
- Yokohama, Japan (2003-03-24)
- Tokyo, Japan (2004-05-21)
- Hong Kong, China (2003-05-05)
- Gothenburg, Sweden (2003-05-23)
- Felixstowe, United Kingdom (UK) (2003-05-24)
- Liverpool, Thamesport, Tilbury, and Southampton, UK. (2004-11-01)
- Genoa, Italy (2003-06-16)
- La Spezia, Italy (2003-06-23)
- Livorno, Italy (2004-12-30)
- Naples, Italy (2004-09-30)
- Gioia Tauro, Italy (2004-10-31)
- Pusan, Korea (2003-08-04)
- Durban, South Africa (2003-12-01)
- Port Klang, Malaysia (2004-03-08)
- Tanjung Pelepas, Malaysia (2004-08-16)
- Piraeus, Greece (2004-07-27)
- Algeciras, Spain (2004-07-30)
- Nagoya and Kobe, Japan (2004-08-06)
- Laem Chabang, Thailand (2004-08-13)
- Dubai, United Arab Emirates (UAE) (2005-03-26)
- Shanghai, China (2005-04-28)
- Shenzhen, China (2005-06-24)
- Kaohsiung, Republic of China (Taiwan) (2005-07-25)
- Santos, Brazil (2005-09-22)
- Colombo, Sri Lanka (2005-09-29)
- Buenos Aires, Argentina (2005-11-17)
- Lisbon, Portugal (2005-12-14)
- Port Salalah, Oman (2006-03-08)
- Puerto Cortes, Honduras (2006-03-25)
- Caucedo, Dominican Republic (2006)
- Kingston, Jamaica (2006)
- Freeport, Bahamas (2006)

There are currently 58 foreign ports participating in the Container Security Initiative, accounting for 85 percent of container traffic bound for the United States, according to the U.S. Department of Homeland Security.

Currently Operational Ports[8]

**In the Americas**

- Montreal, Vancouver, and Halifax, Canada (March 2002)
- Santos, Brazil
- Buenos Aires, Argentina
- Puerto Cortes*, Honduras
- Caucedo, Dominican Republic

- Kingston, Jamaica
- Freeport, The Bahamas
- Balboa, Colon, and Manzanillo, Panama
- Cartagena, Colombia

**In Europe:**

- Rotterdam, The Netherlands (2002-09-02)
- Bremerhaven and Hamburg, Germany
- Antwerp and Zeebrugge, Belgium
- Le Havre and Marseille, France
- Gothenburg, Sweden
- La Spezia, Genoa, Naples, Gioia Tauro, and Livorno, Italy
- Felixstowe, Liverpool, Thamesport, Tilbury, and Southampton, United Kingdom (U.K.)
- Piraeus, Greece
- Algeciras, Barcelona, and Valencia, Spain
- Lisbon, Portugal

**In Asia and the Middle East**

- Singapore*
- Yokohama, Tokyo, Nagoya, and Kōbe, Japan
- Hong Kong
- Busan* (Pusan), South Korea
- Port Klang and Tanjung Pelepas, Malaysia
- Laem Chabang, Thailand
- Dubai, United Arab Emirates (UAE)
- Shenzhen and Shanghai
- Kaohsiung and Chi-Lung
- Colombo, Sri Lanka
- Port Salalah*, Oman
- Port Qasim, Pakistan
- Ashdod, Israel
- Haifa, Israel

**In Africa:**

- Alexandria, Egypt
- Durban, South Africa

## See also

- Supply Chain Security
- List of seaports
- Port security
- SAFE Port Act 2006 (H.R. 4954)
- Ship transport

- Global Trade Exchange
- Denise Krepp
- James Giermanski

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8. Container Security Initiative Ports, U.S. Department of Homeland Security website | reviewed on Sept 25, 2011 (https://www.dhs.gov/files/programs/gc_1165872287564.shtm)


## External links

- European Commission: Taxation and Customs Union - Security cooperation with third countries (http://ec.europa.eu/taxation_customs/customs/policy_issues/customs_security/cooperation_3thcountries/index_en.htm)
- U.S. D.H.S.: Container Security Initiative (https://www.dhs.gov/files/programs/gc_1165872287564.shtm)
- World Customs Organization (https://web.archive.org/web/20040624065756/http://www.wcoomd.org/ie/index.html)
- American Association of Port Authorities (http://www.aapa-ports.org/)

*This article incorporates text from the U.S. Bureau of Customs and Border Protection's pages and documents on the Container Security Initiative, modified for a more global perspective.*

# Customs

**Customs** is an authority or agency in a country responsible for collecting tariffs and for controlling the flow of goods, including animals, transports, personal effects, and hazardous items, into and out of a country.[1][2] Traditionally, customs has been considered as the fiscal subject that charges customs duties (i.e. tariffs) and other taxes on import and export. In recent decades, the views on the functions of customs have considerably expanded and now covers three basic issues: taxation, security, and trade facilitation.[3]

A customs officer in Amsterdam Airport Schiphol checks the luggage of an incoming traveler.

Each country has its own laws and regulations for the import and export of goods into and out of a country, enforced by their respective customs authorities; the import/export of some goods may be restricted or forbidden entirely.[4] A wide range of penalties are faced by those who break these laws.[5]


Vienna Convention road sign for customs

## Contents

# Overview

## Taxation

Officers from US Customs and Border Protection boarding a ship

The traditional function of customs has been the assessment and collection of customs duties, which is a tariff or tax on the importation or, at times, exportation of goods. Commercial goods not yet cleared through customs are held in a customs area, often called a bonded store, until processed. Authorized ports are usually recognized customs areas.

## Trade facilitation

A more recent objective of customs has been trade facilitation, which is the streamlining of processing of import and export of goods to reduce trade transaction costs. The contemporary understanding of the "trade facilitation" concept is based on the Recommendation No. 4 of UN/CEFACT "National Trade Facilitation Bodies".[6] According to its provisions (para. 14),[6]

> facilitation covers formalities, procedures, documents and operations related to international trade transactions. Its goals are simplification, harmonization and standardization, so that transactions become easier, faster and more economical than before.

## Security


The Finnish police, customs and border guard working together in 2006.

The September 11, 2001 terrorist attacks in the United States has become the cardinal factor in prompting a significant strengthening of the security component of modern customs operations, after which security-oriented control measures for supply chains have been widely implemented for the aims of preventing risk identification. At airports today, customs functions as the point of no return for all passengers; once passengers have cleared customs, they cannot go back. Anyone arriving at an airport must also clear customs before they can officially enter a country. Those who breach the law will be detained by customs and likely returned to their original location.[7] The movement of people into and out of a country is normally monitored by migration authorities, under a variety of names and arrangements.

Immigration authorities normally check for appropriate documentation, verify that a person is entitled to enter the country, apprehend people wanted by domestic or international arrest warrants, and impede the entry of people deemed dangerous to the country.

The most complete guidelines for customs security functions implementation is provided in the World Customs Organization Framework of Standards to Secure and Facilitate Global Trade (SAFE),[8] which has had five editions in 2005, 2007, 2010, 2012, and 2018, respectively.

# Privatization of customs

Customs is part of one of the three basic functions of a government, namely: administration; maintenance of law, order, and justice; and collection of revenue. However, in a bid to mitigate corruption, many countries have partly privatised their customs. This has occurred by way of contracting pre-shipment inspection agencies, which examine the cargo and verify the declared value before importation occurs. The country's customs is obliged to accept the agency's report for the purpose of assessing duties and taxes at the port of entry.

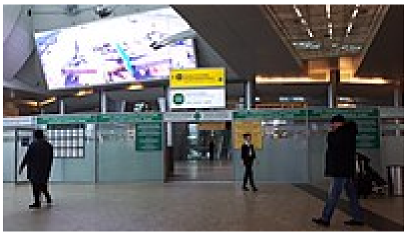
The customs-and-duty house at the port of Haifa, Israel

While engaging a pre-shipment inspection agency may appear justified in a country with an inexperienced or inadequate customs establishment, the measure has not been able to plug the loophole and protect revenue. It has been found that evasion of customs duty escalated when pre-shipment agencies took over.[9] It has also been alleged that involvement of such agencies has caused shipping delays.[4] Privatization of customs has been viewed as a fatal remedy.[9] In many countries, import and export data are issued on the basis of national laws (Transparency Laws / *Freedom of Information Act*).[10]

There has, however, been some speed bumps when transitioning customs over from the public to private sector. Factors such as an incompetent private sector, government's reluctance to change the traditional roles of customs, neglecting priority-setting and lack of transparency in the transition process have slowed the rate at which the public to private transition has taken place.[11]

# Red and green channels

In many countries, customs procedures for arriving passengers at many international airports, ports and some road crossings are separated into red and green channels.[12][13] Passengers with goods to declare (carrying goods above the permitted customs limits and/or carrying prohibited items) go through the red channel, while passengers with nothing to declare (carrying goods within the permitted customs limits and not carrying prohibited items) go through the green channel. However, entry into a particular channel constitutes a legal declaration, so that if a passenger going through the green channel is found to be carrying goods above the customs limits or prohibited items, he or she may be prosecuted for making a false declaration to customs, by virtue of having gone through the green channel. Each channel is a point of no return, once a passenger has entered a particular channel, they cannot go back.



Customs control zone at Sheremetyevo International Airport, Moscow Oblast, February 2019

Australia, Canada, New Zealand, and the United States do not officially operate a red and green channel system; however, some airports have adopted this layout.

### Blue channel

Airports in EU countries also have a blue channel. As the EU is a customs union, travellers between EU countries do not have to pay customs duties. Value-added tax (VAT) and excise duties may be applicable if the goods are subsequently sold, but these are collected when the goods are sold, not at the border. Passengers arriving from other EU countries go through the blue channel, where they may still be subject to checks for prohibited or restricted goods. Luggage tickets for checked luggage travelling within the EU are green-edged so they may be identified.[14][15] In the recent years usage of the blue channel has become limited mostly to flights between the Schengen Area member states of the EU and the remainder of EU member states, while flights which cross the border of neither the customs union nor the Schengen Area are in practice treated as domestic, and therefore, the people travelling on them do not go through customs channels at all.

### Red point phone

All airports in the United Kingdom operate a channel system; however, some airports do not have a red channel, instead having a red point phone which serves the same purpose.

## Summary of basic custom rules

### Europe

The basic customs law is harmonized across Europe within the European Union Customs Union. This includes customs duties and restrictions. Customs tax from €22 to €150. In addition, see regulations of each member state.

For customs declarations in the EU and in Switzerland, Norway and Iceland, the "Single Administrative Document" (SAD) is used as a basis.[16]

#### Germany

Up to €22, there are no taxes. From €22 up to €150, it is necessary to pay VAT (EUSt in Germany), which is 7% or 19% depending on the goods. From €150 it is necessary to pay VAT and customs.

#### Romania

Customs may be very strict, especially for goods shipped from anywhere outside the EU. Up to €10 goods/package.

#### Italy

Customs in Italy takes additional 22% VAT (Value-added tax) for goods imported from outside the European Union even if the VAT is already paid to the origin country sender.

### Czech Republic and Slovakia

Up to €22, there are no taxes. From €22 up to €150, it is necessary to pay VAT (DPH in Czech/Slovak), which is 21%. From €150, it is necessary to pay VAT and customs. Customs may range from zero to 10% depending on the type of imported goods.

### Ukraine

Ukraine has had 5 reforms of its customs authorities. The recent one, in 2019, reorganized State Fiscal Service into the State Customs Service. The reform attempt seeks to digitize customs procedures, get market-level wages, innovate customs checkpoints, integrate into EU customs community, open reference database of customs inspections.[17]

## The Americas

### Canada

In 2003, Canada replaced the Canada Customs and Revenue Agency with the current Canada Border Services Agency (CBSA). The CBSA performs searches at Canadian ports of entry and detains illegal immigrants, along with preventing contraband from entering the country.[18]

### United States

Every person arriving in the US is subject to inspection by Customs and Border Protection (CBP) officers for compliance with immigration, customs and agriculture regulations. This public service is administered on almost a million visitors who enter the US daily.[19] Travelers are screened for a number of prohibited items including; gold, alcoholic beverages, firearms and soil.[20] A wide range of penalties face those non-compliers.[21]

The United States imposes tariffs or "customs duties" on imports of goods, being 3% on average.[22] The duty is levied at the time of import and is paid by the importer of record. Individuals arriving in the United States may be exempt from duty on a limited amount of purchases, and on goods temporarily imported (such as laptop computers)

**Predicted US customs revenue**

| Year | Predicted revenue (billion USD) |
|---|---|
| 2017 | 35 |
| 2018 | 38 |
| 2019 | 41 |
| 2020 | 43 |
| 2021 | 46 |
| 2022 | 47 |
| 2023 | 49 |
| 2024 | 51 |
| 2025 | 52 |
| 2026 | 54 |
| 2027 | 56 |
| 2028 | 58 |

Source: Congressional Budget Office (April 9, 2018). The Budget and Economic Outlook: 2018 to 2028 (https://www.cbo.gov/system/files/2019-04/53651-outlook-2.pdf) (PDF) (Report). p. 72.

under the ATA Carnet system. Customs duties vary by country of origin and product, with duties ranging from zero to 81% of the value of the goods. Goods from many countries are exempt from duty under various trade agreements. Certain types of goods are exempt from duty regardless of source. Customs rules differ from other import restrictions. Failure to comply with customs rules can result in seizure of goods and civil and criminal penalties against involved parties. The CBP enforces customs rules. All goods entering the United States are subject to inspection by CBP prior to legal entry.

### Uruguay

Uruguayan Customs place a cap on the importation of personal packages to up to 3 packages of a nominal value of no more than US$200 which can be entered into the country without extra charge. For a package to be included in the 3 free slots, the addressee must register the package with the Uruguayan Postal Service linking the tracking code, their address, national ID number phone and email address. Should a package arrive prior to registration the package must pay the 60% tax and no less than US$10. Any personal package worth more than US$200 or after the 3 free packages, must pay a 60% tax. This severely limits the public's ability to buy products online. Due to Uruguay's small population and market, many popular and specialty products are unavailable in the regular marketplace, forcing Uruguayans to strategically pool several purchases together and max each one of their free slots.

### Argentina

Customs may be very strict. Goods valued up to US$500[23] brought in by plane and up to US$300 by sea or land are free of duties and taxes, cellphones and laptop computers are duty free regardless of their value only one per passenger, clothing and other personal use items are free of taxes. Above those values, tax is 50% of the value of all acquired goods summed up.

## International Customs Day

**International Customs Day** recognizes the role of agencies and customs officials in maintaining border security around the world. In focuses on the workers and their working conditions as well as the challenges that some customs officers face in their job.[24] Custom agencies hold employee appreciation events where custom officers are recognized for their work. Several agencies also hold events for the public where they explain their jobs and responsibilities in a transparent manner.[24]


Customs, Tolls or Duties of the Corporation of Kinsale (1788)

Each year, at the end of January is celebrated the International Customs Day with a particular theme, as follows:

- 2022, the chosen theme was 'Customs Digital Transformation by Embracing a Data Culture and Building a Data Ecosystem'.[25]
- 2021, the chosen theme was 'Customs bolstering Recovery, Renewal and Resilience for a sustainable supply chain'.[26]
- 2020, the chosen theme was 'Customs fostering Sustainability for People, Prosperity and the Planet'.[27]
- 2019, the chosen theme was 'SMART borders for

seamless Trade, Travel and Transport'.[28]

- 2018, the chosen theme was 'A secure business environment for economic development'.[29]
- Chosen theme for previous editions 2009 - 2018.[30]

## See also

- Customs Trade Partnership against Terrorism
- Duty (economics)
- Port authority
- *World Customs Journal*
- World Customs Organization

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## External links

- World Customs Organization (http://www.wcoomd.org)
- EU Customs (http://ec.europa.eu/taxation_customs/index_en.htm)

WIKIPEDIA

# DAT Solutions

**DAT Solutions, LLC,** often referred to as **DAT Freight & Analytics**, and originally known as **Dial-a-Truck**, is a US-based freight exchange service ("load board") and provider of transportation information serving North America. Freight exchange services are used to match material ("loads") that needs to be shipped with over-the-road carriers that can be hired to move those loads. DAT was established in 1978 and is part of Roper Technologies.[1][2] It's co-headquartered in Denver, Colorado and Beaverton, Oregon. Claude Pumilia is President and CEO, responsible for DAT's strategy and execution.

**DAT Freight & Analytics**

| | |
|---|---|
| **Type** | Subsidiary of Roper Technologies |
| **Industry** | Truckload shipping |
| **Founded** | 1978 |
| **Headquarters** | Beaverton, Oregon, United States |
| **Products** | Transportation management software, load board apps, load tracking, freight cost benchmarking |
| **Services** | Freight matching, Carrier verification, carrier on-boarding, asset management and compliance, invoice factoring and accounts receivable financing, operating authority, freight analytics, truckload rates |
| **Number of employees** | 275 (2017) |
| **Parent** | Roper Technologies |
| **Website** | dat.com (https://www.dat.com/) |

## Contents



## History

In 1958, Monroe 'Moe' Jubitz, opened Fleet Leasing, Inc., a truck leasing and maintenance company in Portland, Oregon. Jubitz later expanded to provide fuel, food, and accommodations to truckers on the road, the origin of Jubitz Truck Stop. The trucking industry was deregulated in the 1970s, encouraging independent truck drivers and small companies to find extra loads rather than returning empty. Jubitz noticed drivers hanging around his truck stop after the usual meal and shower, hoping to find a load. He decided to start signing up brokers and shippers who needed freight hauled from Portland. Before the service, truck drivers seeking loads left handwritten notes on a bulletin board at the Jubitz Truck Stop in Portland for shippers and freight brokers seeking truckers to move their freight. Jubitz began posting the loads on a monitor at the truck stop and charging drivers a fee for the phone number of the company wanting to move freight.[1][3]

in 1978, Jubitz's son, Albin Jubitz, founded Dial-A-Truck as a subsidiary of the Jubitz Corporation. By the 1980s, DAT monitors were located in hundreds of truck stops around the country, with thousands of truck drivers and shippers subscribing to the load board services. Dial-A-Truck was relabeled *DAT Services* in 1989.[4] In 2001, the DAT Network was used to mobilize trucks in support of the relief efforts in the wake of the September 11 attacks.[5]

## Services and products

The DAT Network hosts more than 270 million freight loads and trucks per year in the US and Canada.[6] The network consists of several load board subscription services for small to midsize carriers, freight brokers, and shippers.[1][7]

DAT provides real-time truckload freight rate service, which is based on $116 billion of transactions annually from actual "broker-buy" rates (what freight brokers pay carriers) and shipper-to-carrier contract rates. The company's lane and pricing analyses can be used to make truck routing decisions.[8]

DAT 's other products include carrier monitoring, transportation management software and tracking systems. Additional services include trucking authority services, a free truck driver app (DAT One), freight factoring carrier onboarding, and other fleet management services.[9]

## Ownership

Jubitz Corporation established DAT Services and maintained ownership through January 2001.[10] TransCore purchased DAT Services in February 2001.[11] (DAT's services were augmented by additional TransCore acquisitions of Viastar Services and DM Computing.) TransCore was acquired by Roper Technologies in 2004.[12][13] In February 2014, DAT split off from TransCore and officially changed its name to *DAT Solutions*.[14]

As of 2020, DAT has been re-branded as DAT Freight & Analytics to highlight the company's freight market intelligence offerings.[15] In 2020, DAT acquired the Freight Market Intelligence Consortium (FMIC),[16] a subscription-based benchmarking and analysis service, from Chainalytics.

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# External links

- DAT Solutions (http://dat.com/)
- Thesis paper: "Business-to-Business Marketplaces for Freight Transportation", Marc D. Boyle (https://dspace.mit.edu/bitstream/handle/1721.1/9159/45274627-MIT.pdf?sequence=2)

WIKIPEDIA

# Delivery (commerce)

Pizza delivery scooters in the Makati Business District, Manila, Philippines

**Delivery** is the process of transporting goods from a source location to a predefined destination. Cargo (physical goods) is primarily delivered via roads and railroads on land, shipping lanes on the sea, and airline networks in the air. Certain types of goods may be delivered via specialized networks, such as pipelines for liquid goods, power grids for electrical power and computer networks such as the Internet or broadcast networks for electronic information.[1] Car transport is a particular subgroup; a related variant is Autorack, which involves transport of autos by railroads.

Delivery is a fundamental component of commerce and trade, and involves transport and distribution. The general process of delivering goods is known as distribution, while the study of effective processes for delivery and disposition of goods and personnel is called logistics. Firms specializing in delivering commercial goods from the point of production or storage to their point of sale are generally known as distributors, while those that specialize in the delivery of goods to the consumer are known as delivery services. Postal, courier, and relocation services also deliver goods for commercial and private interests.

Delivery van under grape trellises outside Khotan, Xinjiang

## Contents



## Consumer goods delivery

Most consumer goods are delivered from a point of production (such as a factory or farm) through one or more points of storage (warehouses) to a point of sale (such as retail stores or online vendors), where the consumer buys the good and is responsible for its transportation to point of consumption. There are many variations on this model for specific types of goods and modes of sale. Products sold via catalogue or the

Internet may be delivered directly from the manufacturer or warehouse to the consumer's home, or to an automated delivery booth. Small manufacturers may deliver their products directly to retail stores without warehousing.

A Dairy Crest Smiths Elizabethan electric Milk float used to deliver fresh milk to people's doorsteps.

Some manufacturers maintain factory outlets which serve as both points of storage and points of sale, selling products directly to consumers at wholesale prices, although many retail stores falsely advertise as factory outlets. Building, construction, landscaping and like materials are generally delivered to the consumer by a contractor as part of another service. Some highly perishable or hazardous goods, such as radioisotopes used in medical imaging, are delivered directly from manufacturer to consumer.

The technique of tracing a courier delivery is known as courier tracking (https://www.couriertrackingz.com/). You have the option of doing this manually or digitally. Manual tracking entails periodically monitoring the courier's website or getting in touch with their customer care team to inquire about the status of the delivery.

Home delivery is often available for fast food and other convenience products, e.g. pizza delivery.[2] Sometimes home delivery of supermarket goods is possible.[3] A milk float[4] is a small battery electric vehicle (BEV), specifically designed for the delivery of fresh milk. A new form of delivery is emerging on the horizon of the internet age: Delivery by the crowd e.g. crowd delivery. In this concept, an individual not necessarily contracted by the vendor performs the delivery of goods to the destination. Sometimes, private courier companies will also deliver consumer goods on a regular basis for companies like E-commerce businesses.

In the 2010s and 2020s, a number of companies started using gig workers driving their own vehicles rather than permanent employees driving company vehicles to make deliveries of groceries, food, and general retail items. Drivers typically sign up and get work assignments using a smartphone app. Arrangements range from producers and deliveries made by separate companies (such as with Uber Eats, DoorDash and GrubHub) to in-house deliveries only (such as Amazon Flex, although Amazon also uses contracted delivery companies in Amazon-branded vehicles), to a mixture (such as Walmart Spark, which delivers both Walmart and third-party products).

# Delivery vehicles



Asda Mercedes-Benz Sprinter vans for delivering groceries to customers' doors

The consumer demand for supermarkets to deliver to their door created the need for a mixed temperature controlled vehicle on 3.5T chassis. These vehicle bodies were initially built with the traditional GRP sandwich panels but as more damage resistant lightweight materials with better insulation properties have become available companies have been developing Advanced Home Delivery Vehicles. The 2012 Commercial Vehicle Show in the UK saw the new JDC PolyBilt design, one of the latest of these "Plastic" bodies that can be recycled at the end of its service life, unlike the traditional GRP which ends up as landfill.

Vehicles are often specialized to deliver different types of goods. On land, semi-trailers are outfitted with various trailers such as box trailers, flatbeds, car carriers, tanks and other specialized trailers, while railroad trains include similarly specialized cars. Armored cars, dump trucks and concrete mixers are examples of vehicles specialized for delivery of specific types of goods. On the sea, merchant ships come in various forms, such as cargo ships, oil tankers and fishing boats. Freight aircraft are used to deliver cargo.

Delivery tricycle

Often, passenger vehicles are used for delivery of goods. These include buses, vans, pick-ups, cars (e.g., for mail or pizza delivery), motorcycles and bicycles (e.g., for newspaper delivery). A significant amount of freight is carried in the cargo holds of passenger ships and aircraft. Everyday travelers, known as a casual courier, can also be used to deliver goods.


A horse-drawn dairy delivery vehicle in Montreal, Quebec, Canada in 1942

Delivery to remote, primitive or inhospitable areas may be accomplished using small aircraft, snowmobiles, horse-drawn vehicles, dog sleds, pack animals, on foot, or by a variety of other transport methods.

Larger firms including Amazon, Google, and FedEx have been investing in using delivery drones that are capable of carrying light packages across short distances. Such firms may also use a Delivery Driver App (https://apps.apple.com/us/app/route4me-route-planner/id349853799) to plan efficient routes to help ensure they deliver items on time.[5]

# Periodic deliveries

Some products are delivered to consumers on a periodic schedule.[6] Historically, home delivery of many goods was much more common in urban centres of the developed world. At the beginning of the 20th century, perishable farm items such as milk, eggs and ice, were delivered weekly or even daily to customers by local farms. Milkmen delivered milk and other farm produce. With the advent of home refrigeration and better distribution methods, these products are today largely delivered through the same retail distribution systems as other food products. Icemen delivered ice for iceboxes until the popularization of home refrigerator rendered them obsolete in most places. Similarly, laundry was once picked up and washed at a commercial laundry before being delivered to middle-class homes until the appearance of the washing machine and dryer (the lower classes washed their own and the upper classes had live-in servants). Likewise deliveries of coal and wood for home heating were more common until they were replaced in many areas by natural gas, oil, or electric heating.[7] Some products, most notably home heating oil, are still delivered periodically. Human blood may be delivered to hospitals on a periodic schedule.[6]

Milk delivery continued until the mid-twentieth century across North America. For example, the last milk delivery by horse-and-wagon in Edmonton was in 1961.[8] Milkman jokes continue in circulation long after. Related lines of Jeannie C. Riley's 1968 hit song "Harper Valley PTA" say:

> *There's old Bobby Taylor sitting there, and seven times he's asked me for a date,*
> *And Mrs. Taylor sure seems to use a lot of ice whenever he's away.*

# Delivery process worldwide

Companies internationally don't have the same speed of delivery as the U.S. It can take up to 2-5 weeks to deliver small items through regular post. [9]

## See also

- Breaking bulk (law)
- Conversion van
- Cutaway van chassis
- Mail order
- Multi-stop truck
- Online food ordering
- Shipping
- Category:Shopping delivery services

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## External links

- Media related to Delivery at Wikimedia Commons

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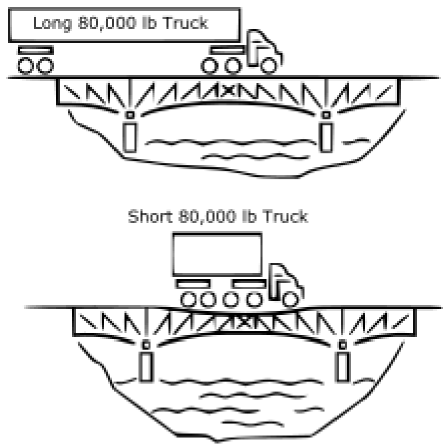
WIKIPEDIA

# Federal Bridge Gross Weight Formula

The **Federal Bridge Gross Weight Formula**, also known as **Bridge Formula B** or the **Federal Bridge Formula**, is a mathematical formula in use in the United States by truck drivers and Department of Transportation (DOT) officials to determine the appropriate maximum gross weight for a commercial motor vehicle (CMV) based on axle number and spacing. The formula is part of federal weight and size regulations regarding interstate commercial traffic (intrastate traffic is subject to state limits). The formula is necessary to prevent heavy vehicles from damaging roads and bridges. CMVs are most often tractor-trailers or buses, but the formula is of most interest to truck drivers due to the heavy loads their vehicles often carry.




This diagram illustrates the difference in weight concentration between a short and long wheelbase truck. The shorter truck causes more wear and tear because all of its weight is concentrated in a smaller area.[1]

Early 20th-century weight limits were enacted to protect dirt and gravel roads from damage caused by the solid wheels of heavy trucks. As time passed, truck weight limits focused primarily on gross weight limits (which had no prescribed limits on length). By 1974, bridges received special protection from increasing truck weight limits. The bridge formula law was enacted by the U.S. Congress to limit the weight-to-length ratio of heavy trucks, and to protect roads and bridges from the damage caused by the concentrated weight of shorter trucks. The formula effectively lowers the legal weight limit for shorter trucks, preventing them from causing premature deterioration of bridges and highway infrastructure.

Compliance with the law is checked when vehicles pass through a weigh station, often located at the borders between states or on the outskirts of major cities, where the vehicle may be weighed and measured. The one exception to the formula allows a standard five-axle semi-truck configuration to weigh the maximum legal gross weight. This exception was specifically requested by the American Trucking Associations to allow tank trucks to reach the maximum legal gross weight without violating the bridge formula law.

## Contents

External links

# History

The first truck weight limits were enacted by four states in 1913, ranging from 18,000 pounds (8,200 kg) in Maine to 28,000 pounds (13,000 kg) in Massachusetts. These laws were passed to protect earth and gravel-surfaced roads from damage caused by the steel and solid rubber wheels of early heavy trucks. By 1933, all states had some form of truck weight regulation. The Federal-Aid Highway Act of 1956 instituted the first federal truck weight regulation (set at 73,280 pounds or 33,240 kilograms) and authorized the construction of the Interstate Highway System.[2]

In the late 1950s, the American Association of State Highway and Transportation Officials (AASHTO) conducted a series of extensive field tests of roads and bridges to determine how traffic contributed to the deterioration of pavement materials. In 1964, the AASHTO recommended to Congress that a bridge formula table be used instead of a single gross weight limit for trucks. The Federal-Aid Highway Act Amendments of 1974 established the bridge formula as law, along with the gross weight limit of 80,000 pounds (36,000 kg). Current applications of the formula allow for up to 7 axles and 86 feet or more length between axle sets, and a maximum load of 105,500 lbs.[2]

# Usage

The back of the concrete mixer truck carries a 'booster axle', which can be lowered to extend the wheelbase of a fully loaded truck to comply with regulations.[3]

The formula was enacted as law to limit the weight-to-length ratio of a commercial motor vehicle (CMV).[4] The formula is necessary to prevent the concentrated truck's axles from overstressing pavements and bridge members (possibly causing a bridge collapse).[5] In simplified form, this is analogous to a person walking on thin ice. When standing upright, a person's weight is concentrated at the bottom of their feet, funneling all of their weight into a small area. When lying down, a person's weight is distributed over a much larger area. This difference in weight distribution would allow a person to cross an area of ice while crawling that might otherwise collapse under their body weight while standing up. For an overweight truck to comply with the formula, more axles must be added, the distance between axles must be increased, or weight must be removed.[1][6]

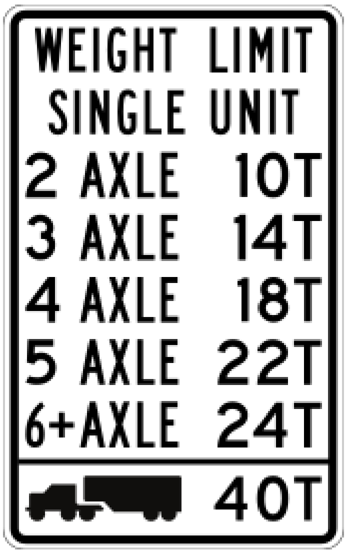
While the Federal Motor Carrier Safety Administration (FMCSA), regulates safety for the U.S. trucking industry.[7], the Federal Highway Administration (FHWA) oversees the State enforcement of truck the size and weight Federal limits set by Congress for the Federal Aid System as described in 23 CFR 658 (https://www.ecfr.gov/current/title-23/chapter-I/subchapter-G/part-658). The Federal size limits apply in all States to the National Network (NN) which is a network of Interstate Highways, U.S. Highways, and state highways. Provided the truck remains on the NN, in all States and a truck is not subject to State size limits.[8] In a similar fashion, the Federal weight limits and the Federal Bridge Formula apply to the Interstate System in all States. The State truck size and weight regulations apply to the Federal Aid System routes that do not have Federal limits.

The weight and size of CMVs are restricted for practical and safety reasons. CMVs are restricted by gross weight (total weight of vehicle and cargo), and by axle weight (i.e., the weight carried by each tire). The federal weight limits for CMVs are 80,000 pounds (36,000 kg) for gross weight (unless the bridge formula dictates a lower limit), 34,000 pounds (15,000 kg) for a tandem axle, and 20,000 pounds (9,100 kg) for a single axle.[9] A tandem axle is defined as two or more consecutive axles whose centers are spaced more than 40 inches (102 cm) but not more than 96 inches (244 cm) apart.[10] Axles spaced less than 40 inches (102 cm) apart are considered a single axle.[11]

In effect, the formula reduces the legal weight limit for shorter trucks with fewer axles (see table below). For example, a 25-foot (7.6 m) three-axle dump truck would have a gross weight limit of 54,500 pounds (24,700 kg), instead of 80,000 pounds (36,000 kg), which is the standard weight limit for 63-foot (19.2 m) five-axle tractor-trailer.[1] FHWA regulation §658.17 states: "The maximum gross vehicle weight shall be 80,000 pounds (36,000 kg) except where lower gross vehicle weight is dictated by the bridge formula."[9]

## Bridge collapse

The August 2007 collapse of the Interstate 35W Mississippi River bridge in Minneapolis brought renewed attention to the issue of truck weights and their relation to bridge stress.[12] In November 2008, the National Transportation Safety Board determined there had been several reasons for the bridge's collapse, including (but not limited to): faulty gusset plates, inadequate inspections, and the extra weight of heavy construction equipment combined with the weight of rush hour traffic.[13] The I-35 Trade Corridor Study reported that the Federal Highway Administration (FHWA) expressed concern over bridges on the I-35 corridor due to an expected increase of international truck traffic from Canada and Mexico, with the FHWA listing it as "high-priority" in 2005.[14]



A bridge weight limit sign that drivers must heed before crossing a bridge in Ohio. The weight limit increases with the number of axles for single-unit trucks. The weights are in short tons.

As of 2007, federal estimates suggest truck traffic increased 216% since 1970, shortly before the federal gross weight limit for trucks was increased by 30,000 pounds (14,000 kg). This is also the period during which many of the existing interstate bridges were built. Research shows that increased truck traffic (and therefore, increased stress) shortens the life of bridges.[12] National Pavement Cost Model (NAPCOM) estimates indicate that one 80,000-pound (36,000 kg) truck does as much damage to roads as 750 3,800-pound (1,700 kg) cars.[15]

Some smaller bridges have a weight limit (or gross weight load rating) indicated by a posted sign (hence the reference to a "posted bridge"). These are necessary when the weight limit of the bridge is lower than the federal or state gross weight limit for trucks.[16][17] Driving a truck over a bridge that is too weak to support it usually does not result in an immediate collapse. The bridge may develop cracks, which over time can weaken the bridge and cause it to collapse. Most of these cracks are discovered during mandated inspections of bridges. Most bridge collapses occur in rural areas, result in few injuries or deaths, and receive relatively little media attention. While the number varies from year to year, as many as 150 bridges can collapse in a year. About 1,500 bridges collapsed between 1966 and 2007, and most of those were the result of soil erosion around bridge supports.[18][19] In 1987, the Schoharie Creek Bridge collapsed in upstate New York, due to erosion of soil around the foundation, which sparked renewed interest in bridge design in inspection procedures.[20]

In special cases involving unusually overweight trucks (which require special permits), not observing a bridge weight limit can lead to disastrous consequences. Fifteen days after the collapse of the Minneapolis bridge, a heavy truck collapsed a small bridge in Oakville, Washington.[21]

# Formula law

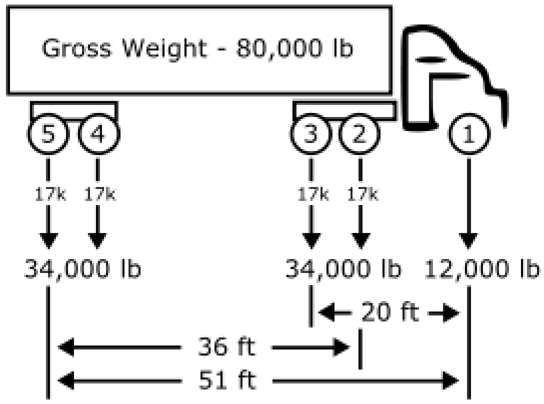
CMVs are required to pass through weigh stations at the borders of most states and some large cities. These weigh stations are run by state DOTs, and CMV weight and size enforcement is overseen by the FHWA. Weigh stations check each vehicle's gross weight and axle weight using a set of in-ground truck scales, and are usually where a truck's compliance with the formula is checked.[22]

FMCSA regulation §658.17 states:[9]

- No vehicle or combination of vehicles shall be moved or operated on any interstate highway when the gross weight on two or more consecutive axles exceeds the limitations prescribed by the following formula:

$$W = 500\left(\frac{LN}{N-1} + 12N + 36\right)$$

- *W* = the maximum weight in pounds that can be carried on a group of two or more axles to the nearest 500 pounds (230 kg).
- *L* = spacing in feet between the center of the outer axles of any two or more consecutive axles.
- *N* = number of axles being considered.



Truck axle groups are used to calculate compliance with the formula. Any two axles must comply with the results of the formula, but axle groups 1–5, 1–3, and 2–5 are most critical. This truck is not in violation of the formula.[1]

Two or more consecutive axles may not exceed the weight computed by the bridge formula, even the gross weight of the truck.[4] This means that the "outer group" or axles 1-5 which comprises the entire Gross Vehicle Weight (GVW) of truck and all interior combination of axles must also comply with the bridge formula. State may not issue less than four citations when a truck violate each of the Federal weight limits on the Interstate System which are: 1) Single axle 2) Tandem axle, 3) Gross Vehicle Weight (GVW), 4) Inner Group.[23][1]

Penalties for violating weight limits vary between states (bridge formula weight violations are treated as gross weight violations), as the states are responsible for enforcement and collection of fines. Some states, such as Connecticut, issue fines on a percentage basis (e.g. 20% overweight at $10 per 100 pounds or 45 kilograms), which means larger trucks pay higher fines. For example, a truck with a legal gross limit of 20,000 pounds (9,100 kg) that violates the limit by 5,000 pounds (2,300 kg) would pay a fine of $500, while a truck with a legal gross limit of 60,000 pounds (27,000 kg) that violates the limit by 5,000 pounds would pay a fine of $250. Other states, such as New York, issue fines on a per-pound basis (e.g., 5,000 pounds overweight equals a $300 fine). Others, such as Massachusetts, impose a less complicated fine schedule whereby a vehicle that violates the limits by less than 10,000 pounds (4,500 kg) is fined $40 per 1,000 pounds (450 kg), while a violation over 10,000 pounds (4,500 kg) pays $80 per 1,000 pounds (450 kg) (e.g. 5,000 pounds or 2,300 kilograms overweight equals a $200 fine).[24]

Some states require overweight trucks to offload enough cargo to comply with the limits. In Florida, any vehicle that exceeds the limits by more than 6,000 pounds (2,700 kg) is required to be unloaded until the vehicle is in compliance. Florida also includes a scale tolerance, which allows for violations of less than 10% to be forgiven, and no fine issued. Florida also allows for a load to be shifted (e.g., moved from the front towards the rear of the vehicle) for the vehicle to comply with axle weight limits, without penalty.[25]

# Exception

There is one exception to the formula: two consecutive sets of tandem axles may carry 34,000 pounds (15,000 kg) each if the overall distance between the first and last axles of these tandems is 36 feet (11 m) or more. For example, a five-axle truck may carry 34,000 pounds both on the tractor tandem axles (2 and 3) and the trailer tandem axles (4 and 5), provided axles 2 and 5 are spaced at least 36 feet (11 m) apart.[1]

This exception allows for the standard 5-axle semi-truck configuration to gross up to 80,000 pounds (36,000 kg) (the legal limit)[9] without being in violation of the bridge formula law. Without it, the bridge formula would allow an actual weight of only 66,000 pounds (30,000 kg) to 67,500 pounds (30,600 kg) on tandems spaced 36 feet (11 m) to 38 feet (11.6 m) apart; compared to 68,000 pounds (31,000 kg) with the exception. This exception was sought by the American Trucking Associations so trucking companies could use 40-foot (12.2 m) trailers and weigh 80,000 pounds (36,000 kg). It was the only way tank truck operators could reach 80,000 pounds without adding axles to their fleets of trailers already in operation.[26]

A CMV may exceed the bridge formula limits (or gross weight and its axle weight limits) by up to 550 pounds (249 kg) if the vehicle is equipped with an auxiliary power unit (APU) or idle reduction technology. This is permitted "in order to promote reduction of fuel use and emissions because of engine idling". To be eligible, the vehicle's operator must prove the weight of the APU with written certification, or —by demonstration or certification—that the idle reduction technology is fully functional at all times. Certification of the APU's weight must be available to law enforcement officers if the vehicle is found in violation of applicable weight laws. The additional weight allowed cannot exceed 550 pounds or the weight certified, whichever is less.[27]

# Issues

The bridge formula (also referred to as Formula B) is based on research into single-span bridges, and fails to consider multiple-span bridges. Two-span bridges may not be fully protected by Formula B, depending on the truck length, span length, and other factors.[28] Shorter wheelbase vehicles (usually specialized trucks such as garbage trucks and water trucks) have trouble complying with Formula B.[29]

In 1987, the U.S. Congress passed the Surface Transportation and Uniform Relocation Assistance Act, requesting the Transportation Research Board (TRB) to conduct a study to develop alternatives to Formula B. The study recommended several that were never implemented. It suggested that Formula B was too strict for trucks with shorter axle lengths. One of the alternative formulas (later known as the TTI HS-20 Bridge Formula) was developed in conjunction with the Texas Transportation Institute. TTI HS-20 allowed shorter trucks to have higher weight limits than Formula B. For a 3-axle truck with an axle length of 14 feet (4.3 m), the weight limit increased from 46,500 pounds (21,100 kg) to 54,000 pounds (24,000 kg).[29] TTI HS-20 also failed to address the problem of multiple-span bridges.[28]

| Distance in feet between any group of two or more axles [1] | Gross weight in pounds (kilograms) [2] | | | | | |
|---|---|---|---|---|---|---|
| | 2 axles | 3 axles | 4 axles | 5 axles | 6 axles | 7 axles |
| Less than 8 [3] | 34,000 lb (15,422 kg) | 34,000 lb (15,422 kg) | | | | |
| More than 8 [4] | 38,000 lb (17,237 kg) | 42,000 lb (19,051 kg) | | | | |
| 9 | 39,000 lb (17,690 kg) | 42,500 lb (19,278 kg) | | | | |
| 10 | 40,000 lb (18,144 kg)[5] | 43,500 lb (19,731 kg) | | | | |
| 11 | 40,000 lb (18,144 kg) | 44,000 lb (19,958 kg) | | | | |
| 12 | 40,000 lb (18,144 kg) | 45,000 lb (20,412 kg) | 50,000 lb (22,680 kg) | | | |
| 13 | 40,000 lb (18,144 kg) | 45,000 lb (20,412 kg) | 50,500 lb (22,906 kg) | | | |
| 14 | 40,000 lb (18,144 kg) | 46,500 lb (21,092 kg) | 51,500 lb (23,360 kg) | | | |
| 15 | 40,000 lb (18,144 kg) | 47,000 lb (21,319 kg) | 52,000 lb (23,587 kg) | | | |
| 16 | 40,000 lb (18,144 kg) | 48,000 lb (21,772 kg) | 52,500 lb (23,814 kg) | 58,000 lb (26,308 kg) | | |
| 17 | 40,000 lb (18,144 kg) | 48,500 lb (21,999 kg) | 53,500 lb (24,267 kg) | 58,500 lb (26,535 kg) | | |
| 18 | 40,000 lb (18,144 kg) | 49,500 lb (22,453 kg) | 54,000 lb (24,494 kg) | 59,000 lb (26,762 kg) | | |
| 19 | 40,000 lb (18,144 kg) | 50,500 lb (22,906 kg) | 54,500 lb (24,721 kg) | 60,000 lb (27,216 kg) | | |
| 20 | 40,000 lb (18,144 kg) | 51,000 lb (23,133 kg) | 55,500 lb (25,174 kg) | 60,500 lb (27,442 kg) | 66,000 lb (29,937 kg) | |
| 21 | 40,000 lb (18,144 kg) | 51,500 lb (23,360 kg) | 56,000 lb (25,401 kg) | 61,000 lb (27,669 kg) | 66,500 lb (30,164 kg) | |
| 22 | 40,000 lb (18,144 kg) | 52,500 lb (23,814 kg) | 56,500 lb (25,628 kg) | 61,500 lb (27,896 kg) | 67,000 lb (30,391 kg) | |
| 23 | 40,000 lb (18,144 kg) | 53,000 lb (24,040 kg) | 57,500 lb (26,082 kg) | 62,500 lb (28,350 kg) | 68,000 lb (30,844 kg) | |

| | | | | | | |
|---|---|---|---|---|---|---|
| 24 | 40,000 lb (18,144 kg) | 54,000 lb (24,494 kg) | 58,000 lb (26,308 kg) | 63,000 lb (28,576 kg) | 68,500 lb (31,071 kg) | 74,000 lb (33,566 kg) |
| 25 | 40,000 lb (18,144 kg) | 54,500 lb (24,721 kg) | 58,500 lb (26,535 kg) | 63,500 lb (28,803 kg) | 69,000 lb (31,298 kg) | 74,500 lb (33,793 kg) |
| 26 | 40,000 lb (18,144 kg) | 55,500 lb (25,174 kg) | 59,500 lb (26,989 kg) | 64,000 lb (29,030 kg) | 69,500 lb (31,525 kg) | 75,000 lb (34,019 kg) |
| 27 | 40,000 lb (18,144 kg) | 56,000 lb (25,401 kg) | 60,000 lb (27,216 kg) | 65,000 lb (29,484 kg) | 70,000 lb (31,751 kg) | 75,500 lb (34,246 kg) |
| 28 | 40,000 lb (18,144 kg) | 57,000 lb (25,855 kg) | 60,500 lb (27,442 kg) | 65,500 lb (29,710 kg) | 71,000 lb (32,205 kg) | 76,500 lb (34,700 kg) |
| 29 | 40,000 lb (18,144 kg) | 57,500 lb (26,082 kg) | 61,500 lb (27,896 kg) | 66,000 lb (29,937 kg) | 71,500 lb (32,432 kg) | 77,000 lb (34,927 kg) |
| 30 | 40,000 lb (18,144 kg) | 58,500 lb (26,535 kg) | 62,000 lb (28,123 kg) | 66,500 lb (30,164 kg) | 72,000 lb (32,659 kg) | 77,500 lb (35,153 kg) |
| 31 | 40,000 lb (18,144 kg) | 59,000 lb (26,762 kg) | 62,500 lb (28,350 kg) | 67,500 lb (30,617 kg) | 72,500 lb (32,885 kg) | 78,000 lb (35,380 kg) |
| 32 | 40,000 lb (18,144 kg) | 60,000 lb (27,216 kg)[5] | 63,500 lb (28,803 kg) | 68,000 lb (30,844 kg) | 73,000 lb (33,112 kg) | 78,500 lb (35,607 kg) |
| 33 | 40,000 lb (18,144 kg) | 60,000 lb (27,216 kg) | 64,000 lb (29,030 kg) | 68,500 lb (31,071 kg) | 74,000 lb (33,566 kg) | 79,000 lb (35,834 kg) |
| 34 | 40,000 lb (18,144 kg) | 60,000 lb (27,216 kg) | 64,500 lb (29,257 kg) | 69,000 lb (31,298 kg) | 74,500 lb (33,793 kg) | 80,000 lb (36,287 kg)[5] |
| 35 | 40,000 lb (18,144 kg) | 60,000 lb (27,216 kg) | 65,500 lb (29,710 kg) | 70,000 lb (31,751 kg) | 75,000 lb (34,019 kg) | 80,000 lb (36,287 kg) |
| 36 | 40,000 lb (18,144 kg) | 60,000 lb (27,216 kg) | 66,000 lb (29,937 kg)[6] | 70,500 lb (31,978 kg) | 75,500 lb (34,246 kg) | 80,000 lb (36,287 kg) |
| 37 | 40,000 lb (18,144 kg) | 60,000 lb (27,216 kg) | 66,500 lb (30,164 kg)[6] | 71,000 lb (32,205 kg) | 76,000 lb (34,473 kg) | 80,000 lb (36,287 kg) |
| 38 | 40,000 lb (18,144 kg) | 60,000 lb (27,216 kg) | 67,500 lb (30,617 kg)[6] | 71,500 lb (32,432 kg) | 77,000 lb (34,927 kg) | 80,000 lb (36,287 kg) |
| 39 | 40,000 lb (18,144 kg) | 60,000 lb (27,216 kg) | 68,000 lb (30,844 kg) | 72,500 lb (32,885 kg) | 77,500 lb (35,153 kg) | 80,000 lb (36,287 kg) |
| 40 | 40,000 lb (18,144 kg) | 60,000 lb (27,216 kg) | 68,500 lb (31,071 kg) | 73,000 lb (33,112 kg) | 78,000 lb (35,380 kg) | 80,000 lb (36,287 kg) |
| 41 | 40,000 lb (18,144 kg) | 60,000 lb (27,216 kg) | 69,500 lb (31,525 kg) | 73,500 lb (33,339 kg) | 78,500 lb (35,607 kg) | 80,000 lb (36,287 kg) |
| 42 | 40,000 lb (18,144 kg) | 60,000 lb (27,216 kg) | 70,000 lb (31,751 kg) | 74,000 lb (33,566 kg) | 79,000 lb (35,834 kg) | 80,000 lb (36,287 kg) |
| 43 | 40,000 lb (18,144 kg) | 60,000 lb (27,216 kg) | 70,500 lb (31,978 kg) | 75,000 lb (34,019 kg) | 80,000 lb (36,287 kg)[5] | 80,000 lb (36,287 kg) |
| 44 | 40,000 lb (18,144 kg) | 60,000 lb (27,216 kg) | 71,500 lb (32,432 kg) | 75,500 lb (34,246 kg) | 80,000 lb (36,287 kg) | 80,000 lb (36,287 kg) |

| | | | | | | |
|---|---|---|---|---|---|---|
| 45 | 40,000 lb (18,144 kg) | 60,000 lb (27,216 kg) | 72,000 lb (32,659 kg) | 76,000 lb (34,473 kg) | 80,000 lb (36,287 kg) | 80,000 lb (36,287 kg) |
| 46 | 40,000 lb (18,144 kg) | 60,000 lb (27,216 kg) | 72,500 lb (32,885 kg) | 76,500 lb (34,700 kg) | 80,000 lb (36,287 kg) | 80,000 lb (36,287 kg) |
| 47 | 40,000 lb (18,144 kg) | 60,000 lb (27,216 kg) | 73,500 lb (33,339 kg) | 77,500 lb (35,153 kg) | 80,000 lb (36,287 kg) | 80,000 lb (36,287 kg) |
| 48 | 40,000 lb (18,144 kg) | 60,000 lb (27,216 kg) | 74,000 lb (33,566 kg) | 78,000 lb (35,380 kg) | 80,000 lb (36,287 kg) | 80,000 lb (36,287 kg) |
| 49 | 40,000 lb (18,144 kg) | 60,000 lb (27,216 kg) | 74,500 lb (33,793 kg) | 78,500 lb (35,607 kg) | 80,000 lb (36,287 kg) | 80,000 lb (36,287 kg) |
| 50 | 40,000 lb (18,144 kg) | 60,000 lb (27,216 kg) | 75,500 lb (34,246 kg) | 79,000 lb (35,834 kg) | 80,000 lb (36,287 kg) | 80,000 lb (36,287 kg) |
| 51 | 40,000 lb (18,144 kg) | 60,000 lb (27,216 kg) | 76,000 lb (34,473 kg) | 80,000 lb (36,287 kg)[5] | 80,000 lb (36,287 kg) | 80,000 lb (36,287 kg) |
| 52 | 40,000 lb (18,144 kg) | 60,000 lb (27,216 kg) | 76,500 lb (34,700 kg) | 80,000 lb (36,287 kg) | 80,000 lb (36,287 kg) | 80,000 lb (36,287 kg) |
| 53 | 40,000 lb (18,144 kg) | 60,000 lb (27,216 kg) | 77,500 lb (35,153 kg) | 80,000 lb (36,287 kg) | 80,000 lb (36,287 kg) | 80,000 lb (36,287 kg) |
| 54 | 40,000 lb (18,144 kg) | 60,000 lb (27,216 kg) | 78,000 lb (35,380 kg) | 80,000 lb (36,287 kg) | 80,000 lb (36,287 kg) | 80,000 lb (36,287 kg) |
| 55 | 40,000 lb (18,144 kg) | 60,000 lb (27,216 kg) | 78,500 lb (35,607 kg) | 80,000 lb (36,287 kg) | 80,000 lb (36,287 kg) | 80,000 lb (36,287 kg) |
| 56 | 40,000 lb (18,144 kg) | 60,000 lb (27,216 kg) | 79,500 lb (36,061 kg) | 80,000 lb (36,287 kg) | 80,000 lb (36,287 kg) | 80,000 lb (36,287 kg) |
| 57 | 40,000 lb (18,144 kg) | 60,000 lb (27,216 kg) | 80,000 lb (36,287 kg)[5] | 80,000 lb (36,287 kg) | 80,000 lb (36,287 kg) | 80,000 lb (36,287 kg) |

- [1] Calculated values reflect FHWA policy of rounding down when distances fall exactly between 6-inch (15.24 cm) increments.[30]
- [2] Calculated values reflect FHWA policy of rounding down when weights fall exactly between 500-pound (227 kg) increments.[4]
- [3] Tandem axle by definition.[11]
- [4] Distances between 8 feet (2.44 m) to 8 feet 11 inches (2.72 m) may not be rounded down.[30]
- [5] Maximum legal weight limit based on number of axles. Increased axle lengths beyond these do not increase maximum legal weight.[11]
- [6] Exception to the formula: when the four axles under consideration are two tandem axles spaced at least 36 feet (10.97 m) apart, a gross weight of 68,000 pounds (30,844 kg) is allowed.[11]

- Upper blank areas represent unrealistic configurations.[4]

## See also

- Long combination vehicle

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# External links

- Bridge formula weights calculator (http://ops.fhwa.dot.gov/freight/sw/brdgcalc/calc_page.htm)

# Wikipedia

# Freight broker

A **freight broker** is an intermediary between a shipper and a freight service provider. Freight brokers can specialize in certain types of freight, such as equipment hauling on lowboys, oversize, bulk tanker, auto, or other types of freight transportation.

A freight broker in the United States must be licensed by the Federal Motor Carrier Safety Administration (FMCSA) (https://www.fmcsa.dot.gov/registration/broker-registration).

A freight broker, in freight transport (cargo), over land in the United States by truck[1] is often used as part of the logistics. This may be part of an overall shipbroking using a cargo broker, a freight forwarder, third party logistics broker (3PL), and even a fourth-party broker,[2] when outsourcing is needed (as opposed to in-house) for freight transportation. The brokering can be single mode or by multimodal transportation and can use specialized brokers on a permanent basis or as needed to ensure timely traffic management.

A load may be posted on a truck load board[3] by shippers, brokers, or agents.[4] This may occur with special orders, brokers and/or agents that do not have an established logistics base, or brokers and agents seeking a backhaul for a truck not in a high-traffic lane. Many brokers specialize in certain freight such as full truckload (FTL) or less than truckload, auto, boat or yacht, bulk tanker (liquid or dry goods), oversize, equipment hauling on lowboys, flatbed, drop deck, or any other mode of freight transportation with enough loads.[5]

## Co-brokering

Co-brokering is a legal practice used to ensure there is an available truck to transport freight. A 4PL may use a 3PL broker to match loads with trucks, with a shippers knowledge. The primary broker will take a lesser amount of the fee and the secondary broker will book the load for transport receiving a larger share of the same fee.[6]

### Concerns

Double-brokering or rebrokering is illegal in the United States of America and occurs when a broker charges a fee then contracts the load to a second broker who will reduce the freight charge also collecting a fee that can be up to 15%. For example, an $1,150 load going 400 miles would net a carrier $977.50, but the same load double-brokered might result in $875.00 to the carrier. This margin on the second booking would net the broker an *additional 14.3%*. The shipper may not be aware of this and the contracted truck will likely not be dispatched to pick up the load. This might have serious ramifications in case of an accident or incident, especially if there are operating issues with the carrier. Confusion on payment might lead to a possessory lien (as opposed to "freight charges held hostage."), a load not delivered, and lawsuits.[7]

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# Freight company

**Freight companies** are companies that specialize in the moving (or "forwarding") of freight, or cargo, from one place to another. These companies are divided into several variant sections. For example, international freight forwarders ship goods internationally from country to country, and domestic freight forwarders, ship goods within a single country.

There are thousands of freight companies in business worldwide, many of which are members of certain organizations. Such organizations include the IATA (International Air Transport Association), TIA (Transportation Intermediaries Association) the BIFA (British International Freight Association), or the FTA (Freight Transport Association) and various or other regional organisations.


An electric container freight train

There are various methods of shipping goods; by air, road, sea, or rail. Some companies offer multi-modal solutions, this means that they offer more than one service, in many cases air and sea and in other cases air, sea, and road. The most common multi-modal way of shipping is referred to as inter-modal meaning truck pickup to rail to truck delivery.

A shipping method is determined by evaluating three factors: time, cost, and product characteristics. While shipping by sea could take longer than shipping by air, the latter is generally more expensive. Shipping by rail could also be complemented by piggybacking the freight onto a truck so it can be delivered to the receiver.[1]

## Contents



## Couriers

Courier companies are usually spin-offs from freight forwarders. There are various types of courier companies, such as airfreight courier companies or road couriers.

## Logistics brokers

Freight brokers are federally regulated and bonded companies. Most commonly they have a vast network and access to a library of freight carriers and search for the right availability based on customer specifications. These brokers also offer various value-added services that encompass transportation, logistics, and distribution. Typically, freight brokers do not "fingerprint", or touch, the freight. They engage in helping shippers find the best price with the best carrier for any given load.

The proliferation of freight brokers called for an increase in financial integrity and liability of these companies, which has led to the passing of the Moving Ahead for Progress in the 21st Century Act (MAP-21).[2] In order to obtain a license to broker freight, a freight brokerage must purchase a surety bond or trust agreement with the Federal Motor Carrier Safety Administration (FMCSA).[3] Prior to June 2012 when the bill was signed by President Obama, the surety bond coverage required to hold a broker license was $10,000. Effective October 1, 2013, the surety bond requirement increased to $75,000. On December 12, 2015 the FMCSA brought into effect the United Registration System. Existing freight brokers with a USDOT, MC, or FF number could continue to do business until April 14, 2017 before they must switch to the electronic online URS system.

A recent trend is for freight brokers to specialize in offering automated platforms to shippers so that they can tender their own loads.[4]

Other logistics companies include 3rd-Party Logistics Providers. They offer a variety of supply chain and distribution-related practices and techniques in order to improve in-house logistics. The main difference between a traditional freight broker and most 3rd-Party Logistics Providers is that freight brokers do not actually touch (fingerprint) the freight, whereas 3rd-Party Logistics providers often do. This can happen, for example, when the 3rd-Party Logistics company handles outsourced manufacturing and/or warehousing.

# Third-party logistics software

Freight companies use specialized software to track the large numbers of shipments. Some freight companies specialize in certain parts of the market. If a freight company does not have its own negotiated carrier rates, there are other types of technology and partnerships that can be used in lieu of a transportation management system.

# Third-party broker liability

In Schramm, the Courts opened the door for freight brokers to be held legally liable in the case of a trucking accident, involving a carrier whom they hired to carry freight, that resulted in injury to a person. Many guidelines, most under the Federal Motor Carrier Safety Administration's SAFER System,[5] are available to freight brokers to screen potential carrier safety and, if it is proven that the broker did not utilize these government provided tools, liability can be transferred to or shared with them in the result of an injury accident. Another regulation that protects carriers and shippers is the freight broker bond - freight brokers must get bonded in order to operate legally. If a carrier files a claim, the bond would cover it.

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# Freight forwarder


The storefront of one of many freight forwarders located around Guangzhou's garment districts. The list of destinations indicates that this business serves importers of Chinese clothes to countries such as Russia and Azerbaijan.

A **freight forwarder**, or **forwarding agent**, is a person or company who, for a fee organizes shipments for individuals or corporations to get goods from the manufacturer or producer to a market, customer or final point of distribution.[1] Forwarders contract with a carrier or often multiple carriers to move the goods from one country to another.

A forwarder does not move the goods but acts as an expert in the logistics network. The carriers can use a variety of shipping modes, including ships, airplanes, trucks, and railroads, and often use multiple modes for a single shipment. For example, the freight forwarder may arrange to have cargo moved from a plant to an airport by truck, flown to the destination city and then moved from the airport to a customer's building by another truck.

International freight forwarders typically handle international shipments and have additional expertise in preparing and processing customs documentation and performing activities pertaining to international shipments.

Information typically reviewed by a freight forwarder includes the commercial invoice, shipper's export declaration, bill of lading and other documents required by the carrier or country of export, import, and/or transshipment.

The FIATA shorthand description of the freight forwarder as the "Architect of Transport" illustrates the commercial position of the forwarder relative to its client. In Europe,[2] some forwarders specialize in "niche" areas such as rail-freight, and collection and deliveries around a large port. Modern freight forwarders offer an end-to-end process i.e. shipping the goods from the place of origin to the final destination. Together with Freight Tracking Technology, freight forwarding agents can view real time freight information.[3]

## Contents



## History

One of the earliest freight forwarders was Thomas Meadows and Company Limited of London, England, established in 1835 . According to "Understanding the Freight Business," written and published by the executive staff of Thomas Meadows and Company in 1972, the advent of reliable rail transport and steamships created demand for the fledgling freight forwarding industry. Trade developed between Europe and North America, creating additional demand. The first international freight forwarders were innkeepers in London who held and re-forwarded the personal effects of their hotel guests.

The original function of the forwarder was to arrange for carriage by contracting with various carriers. Forwarder responsibilities included advice on documentation and customs requirements in the country of destination. His correspondent agent overseas looked after his customers' goods and kept him informed about matters that would affect the movement of goods.

In modern times, the forwarder accepts the same responsibilities. It operates either as a domestic carrier or otherwise with a corresponding agent overseas or with his own branch-office. In a single transaction, the forwarder may be acting as a carrier (principal) or as an agent for his customer or both.

# Document transfer fee/document handover fee

International freight forwarders, Non-Vessel-Operating Common Carriers (NVOCCs), and customs brokers often charge for transferring documents to another transportation company at the destination. This fee is a part of the ocean freight charges, being paid by the importer at the port of discharge in the International Commercial Term (incoterm) FOB (free on board), and by the exporter at the origin in the incoterms CFR (cost and freight), CIF (cost, insurance and freight) and DDP (Transportation cost from factory to delivery port, custom clearance at delivery port, freight, custom clearance at discharge port, transportation from discharge port to importer factory).[4] This fee is separate from documentation fees charged by carriers and NVOCCs as part of the freight charges on a bill of lading and is separate from other fees for document preparation or for the release of cargo.

# National variations

## Australia

In Australia most licensed Customs Clearance Agents (commonly referred to as Customs Brokers) operate under a freight forwarder.

## United Arab Emirates

UAE freight forwarders are well-versed in the complexities of shipping to and from the Emirates, and can provide a valuable resource for businesses looking to move goods in and out of the country. They can help to navigate the often-complex customs regulations in the UAE, and can also offer advice on the best shipping routes and carriers to use.

## Bangladesh

Freight forwarders must have a government license in Bangladesh.

## Canada

Transport Canada is the federal department responsible for implementing and enforcing transportation policies and programs. The Canada Border Services Agency is responsible for enforcing most regulations that affect international freight forwarders. International security measures are the dominant concern.

The Canadian International Freight Forwarders Association (CIFFA) was established in 1948 to support and protect the character, status, and interest of foreign freight forwarders by establishing uniform trade practice and regulations. CIFFA also plays an educational role by providing certificate and advanced certificate programs.

## India

Federation of Freight Forwarders' Associations in India (FFFAI) [5] is the Apex Body and the Sole Representative of 28 Member Associations from all over India representing 6,500 Custom House Agents (employing over 1.1 lakh people).

## Ireland

International merchandise trade is worth €148 billion to the Irish economy.[6] 82% of manufactured products are exported, further highlighting the importance of freight forwarders to the national economy. Associations including the Irish International Freight Association and FIATA help maintain the professionalism of this industry through educational and representative roles. FIATA offers a Diploma in Freight Forwarding.

## Kenya and Tanzania

In Kenya and Tanzania freight forwarders are commonly referred to as clearing and forwarding agents. A license is required, which can be acquired from Kenya Revenue Authority and Tanzania Revenue Authority respectively. Freight forwarders in Kenya and Tanzania are responsible for clearing consignments through Kenya and Tanzania customs, arranging transportation and forwarding the consignment to the consignee. Both exports and imports must clear customs in Kenya/ Tanzania.

## Nigeria

Freight-forwarding in Nigeria has been in place since the exporting of groundnut as a cash crop beginning in 1914, though not initially as freight forwarding but as the means of transportation of goods and services from one country to another. Following the method of their British forebears, agents were used to facilitating the transport of goods and services.

## Pakistan

Pakistan International Freight Forwarders Association PIFFA has more than 500 freight forwarding companies as members. The association is the local representative of FIATA and member association for Pakistan.

### United Kingdom

In the U.K., freight forwarders are not licensed, but many are members of BIFA (The British International Freight Association) (http://www.bifa.org). BIFA is the trade association for UK-registered companies engaged in the international movement of freight by all modes of transport, air, road, rail, and sea. BIFA has around 1500 corporate members, known generally as freight forwarders, who offer a wide range of services within these various modes.

### United States

Companies handling domestic US freight by road must be registered with the U.S. Department of Transportation's Federal Motor Carrier Safety Administration. Such forwarders are "carriers" who accept freight for transport and are liable for delivering the freight under their own bill of lading.[7]

International ocean freight forwarders arranging for shipments to and from the US must be licensed by the Federal Maritime Commission as *Ocean Transportation Intermediaries*.[8] An Ocean Transportation Intermediary is either an *ocean freight forwarder* or a *non-vessel-operating common carrier* (NVOCC). An *ocean freight forwarder* is "an individual or company in the United States that dispatches shipments from the United States via common carriers and books or otherwise arranges space for those shipments on behalf of shippers; ocean freight forwarders prepare and process documentation and perform related activities pertaining to shipments."[9] An *NVOCC* is "a common carrier that holds itself out to the public to provide ocean transportation, issues its own bills of lading or equivalent documents, but does not operate the vessels that transport cargo"; or, "a shipper in its relationship with the vessel-operating common carrier involved in the movement of cargo."[9]

## See also

- Logistics
- Physical inventory
- Standard trading conditions
- Supply chain

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# Goods

In economics, **goods** are items that satisfy human wants[1] and provide utility, for example, to a consumer making a purchase of a satisfying product. A common distinction is made between goods which are transferable, and services, which are not transferable.[2]

Tangible goods stacked in a warehouse

A good is an "economic good" if it is useful to people but scarce in relation to its demand so that human effort is required to obtain it.[3] In contrast, free goods, such as air, are naturally in abundant supply and need no conscious effort to obtain them. Private goods are things owned by people, such as televisions, living room furniture, wallets, cellular telephones, almost anything owned or used on a daily basis that is not food-related.

A consumer good or "final good" is any item that is ultimately consumed, rather than used in the production of another good. For example, a microwave oven or a bicycle that is sold to a consumer is a final good or consumer good, but the components that are sold to be used in those goods are intermediate goods. For example, textiles or transistors can be used to make some further goods.

Commercial goods are construed as tangible products that are manufactured and then made available for supply to be used in an industry of commerce. Commercial goods could be tractors, commercial vehicles, mobile structures, airplanes, and even roofing materials. Commercial and personal goods as categories are very broad and cover almost everything a person sees from the time they wake up in their home, on their commute to work to their arrival at the workplace.

Commodities may be used as a synonym for economic goods but often refer to marketable raw materials and primary products.[4]

Although common goods are tangible, certain classes of goods, such as information, only take intangible forms. For example, among other goods an apple is a tangible object, while news belongs to an intangible class of goods and can be perceived only by means of an instrument such as print or television.

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# Utility and characteristics of goods

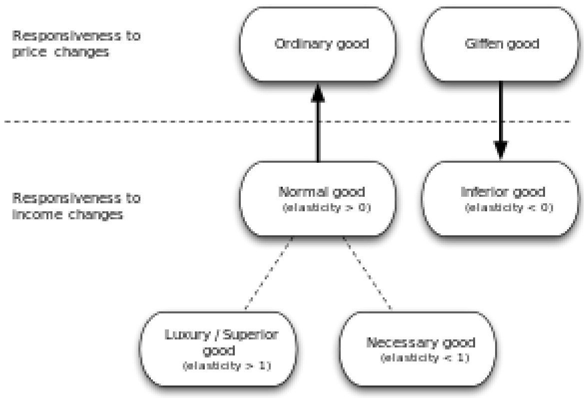
Goods may increase or decrease their utility directly or indirectly and may be described as having marginal utility. Some things are useful, but not scarce enough to have monetary value, such as the Earth's atmosphere, these are referred to as 'free goods'.

In normal parlance, "goods" is always a plural word,[5][6] but economists have long termed a single item of goods "a good".

In economics, a bad is the opposite of a good.[7] Ultimately, whether an object is a good or a bad depends on each individual consumer and therefore, not all goods are goods to all people.

# Types of goods

Goods' diversity allows for their classification into different categories based on distinctive characteristics, such as tangibility and (ordinal) relative elasticity. A tangible good like an apple differs from an intangible good like information due to the impossibility of a person to physically hold the latter, whereas the former occupies physical space. Intangible goods differ from services in that final (intangible) goods are transferable and can be traded, whereas a service cannot.



Types of goods in economics

Price elasticity also differentiates types of goods. An elastic good is one for which there is a relatively large change in quantity due to a relatively small change in price, and therefore is likely to be part of a family of substitute goods; for example, as pen prices rise, consumers might buy more pencils instead. An inelastic good is one for which there are few or no substitutes, such as tickets to major sporting events, original works by famous artists, and prescription medicine such as insulin. Complementary goods are generally more inelastic than goods in a family of substitutes. For example, if a rise in the price of beef results in a decrease in the quantity of beef demanded, it is likely that the quantity of hamburger buns demanded will also drop, despite no change in buns' prices. This is because hamburger buns and beef (in Western culture) are complementary goods. It is important to note that goods considered complements or substitutes are relative associations and should not be understood in a vacuum. The degree to which a good is a substitute or a complement depends on its relationship to other goods, rather than an intrinsic characteristic, and can be measured as cross elasticity of demand by employing statistical techniques such as covariance and correlation.

# Goods classified by exclusivity and competitiveness

## Fourfold model of goods

Goods can be classified based on their degree of excludability and rivalry (competitiveness). Considering excludability can be measured on a continuous scale, some goods would not be able to fall into one of the four common categories used.

There are four types of goods based on the characteristics of rival in consumption and excludability: Public Goods, Private Goods, Common Resources, and Club Goods.[8] These four types plus examples for anti-rivalry appear in the accompanying table.[9]

| | Excludable | Non-excludable |
|---|---|---|
| Rivalrous | **Private goods** food, clothing, cars, parking spaces | **Common-pool resources** fish stocks, timber, coal, free public transport |
| Non-rivalrous | **Club goods** cinemas, private parks, satellite television, public transport | **Public goods** free-to-air television, air, national defense, free and open-source software |

### Public goods

Goods that are both non-rival and non-excludable are called public goods. In many cases, renewable resources, such as land, are common commodities but some of them are contained in public goods. Public goods are non-exclusive and non-competitive, meaning that individuals cannot be stopped from using them and anyone can consume this good without hindering the ability of others to consume them. Examples in addition to the ones in the matrix are national parks, or firework displays. It is generally accepted by mainstream economists that the market mechanism will under-provide public goods, so these goods have to be produced by other means, including government provision. Public goods can also suffer from the Free-Rider problem.

### Private goods

Private goods are excludable goods, which prevent other consumers from consuming them. Private goods are also rivalrous because one good in private ownership cannot be used by someone else. That is to say, consuming some goods will deprive another consumer of the ability to consume the goods. Private goods are the most common type of goods. They include what you have to get from the store. For examples food, clothing, cars, parking spaces,etc. An individual who consumes an apple denies another individual from consuming the same one. It is excludable because consumption is only offered to those willing to pay the price.[10]

### Common-pool resources

Common-pool resources are rival in consumption and non-excludable. An example is that of fisheries, which harvest fish from a shared common resource pool of fish stock. Fish caught by one group of fishermen are no longer accessible to another group, thus being rivalrous. However, oftentimes, due to an absence of well-defined property rights, it is difficult to restrict access to fishermen who may overfish.[11]

### Club goods

Club goods are excludable but not rivalrous in the consumption. That is, not everyone can use the good, but when one individual has claim to use it, they do not reduce the amount or the ability for others to consume the good. By joining a specific club or organization we can obtain club goods; As a result, some people are excluded because they are not members. Examples in addition to the ones in the matrix are cable television, golf courses, and any merchandise provided to club members. A large television service provider would already have infrastructure in place which would allow for the addition of new customers without infringing on existing customers viewing abilities. This would also mean that marginal cost would be close to zero, which satisfies the criteria for a good to be considered non-rival. However, access to cable TV services are only available to consumers willing to pay the price, demonstrating the excludability aspect.[12]

Economists set these categories for these goods and their impact on consumers. The government is usually responsible for public goods and common goods, and enterprises are generally responsible for the production of private and club goods. But this pattern does not fit for all the goods as they can intermingle.

## History of the fourfold model of goods

In 1977, Nobel winner Elinor Ostrom and her husband Vincent Ostrom proposed additional modifications to the existing classification of goods so to identify fundamental differences that affect the incentives facing individuals. Their definitions are presented on the matrix.[13]

Elinor Ostrom proposed additional modifications to the classification of goods to identify fundamental differences that affect the incentives facing individuals[14]

1. Replacing the term "rivalry of consumption" with "subtractability of use".
2. Conceptualizing subtractability of use and excludability to vary from low to high rather than characterizing them as either present or absent.
3. Overtly adding a very important fourth type of good—common-pool resources—that shares the attribute of subtractability with private goods and difficulty of exclusion with public goods.

Forests, water systems, fisheries, and the global atmosphere are all common-pool resources of immense importance for the survival of humans on this earth.
4. Changing the name of a "club" good to a "toll" good since goods that share these characteristics are provided by small scale public as well as private associations.

### Expansion of Fourfold model: Anti-rivalrous

Consumption can be extended to include "Anti-rivalrous" consumption.

Types of goods based on consumption and excludability

| | Excludable | |
|---|---|---|
| | **yes** | **no** |
| **Rivalrous** | Private Good | Common-pool good |
| **Non-rivalrous** | Club / toll Good | Public Good |
| **Anti-rivalrous** | "network" good, e.g., data on the internet; good that improves public health | "symbiotic" good, e.g., language |

### Expansion of Fourfold model: Semi-Excludable

The additional definition matrix shows the four common categories alongside providing some examples of fully excludable goods, Semi-excludable goods and fully non-excludeable goods. Semi-excludable goods can be considered goods or services that a mostly successful in excluding non-paying customer, but are still able to be consumed by non-paying consumers. An example of this is movies, books or video games that could be easily pirated and shared for free.

| | Fully Excludable | Semi-Excludable | Fully Non-Excludable |
|---|---|---|---|
| Rivalrous | **Private Goods**<br>food, clothing, cars, parking spaces | Piracy of copyrighted goods<br>like movies, books, video games | **Common-pool Resources**<br>fish, timber, coal, free public transport |
| Non-Rivalrous | **Club Goods**<br>cinemas, private parks, television, public transport | Sharing pay television or streaming subscriptions<br>to more users than what is being paid for | **Public Goods**<br>free-to-air, air, national defense, free and open-source software |

# Trading of goods

Goods are capable of being physically delivered to a consumer. Goods that are *economic intangibles* can only be stored, delivered, and consumed by means of media.

Goods, both tangibles and intangibles, may involve the transfer of product ownership to the consumer. Services do not normally involve transfer of ownership of the service itself, but may involve transfer of ownership of goods developed or marketed by a service provider in the course of the service. For example, sale of storage related goods, which could consist of storage sheds, storage containers, storage buildings as tangibles or storage supplies such as boxes, bubble wrap, tape, bags and the like which are consumables, or distributing electricity among consumers is a service provided by an electric utility company. This service can only be experienced through the consumption of electrical energy, which is available in a variety of voltages and, in this case, is the *economic goods* produced by the electric utility company. While the service (namely, distribution of electrical energy) is a process that remains in its entirety in the ownership of the electric service provider, the goods (namely, electric energy) is the object of ownership transfer. The consumer becomes an electric energy owner by purchase and may use it for any lawful purposes just like any other goods.

## See also

- Bad (economics)
- Fast-moving consumer goods
- Final goods
- Goods and services
- Intangible asset
- Intangible good
- List of economics topics
- Property
  - Tangible property
- Service (economics)

## Notes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# External links

- Media related to Goods (economics) at Wikimedia Commons

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# Incoterms

The **Incoterms** or **International Commercial Terms** are a series of pre-defined commercial terms published by the International Chamber of Commerce (ICC) relating to international commercial law.[1] Incoterms define the responsiblities of exporters and importers in the arrangement of shipments and the transfer of liability involved at various stages of the transaction. They are widely used in international commercial transactions or procurement processes and their use is encouraged by trade councils, courts and international lawyers.[2] A series of three-letter trade terms related to common contractual sales practices, the Incoterms rules are intended primarily to clearly communicate the tasks, costs, and risks associated with the global or international transportation and delivery of goods. Incoterms inform sales contracts defining respective obligations, costs, and risks involved in the delivery of goods from the seller to the buyer, but they do not themselves conclude a contract, determine the price payable, currency or credit terms, govern contract law or define where title to goods transfers.

The Incoterms rules are accepted by governments, legal authorities, and practitioners worldwide for the interpretation of most commonly used terms in international trade. They are intended to reduce or remove altogether uncertainties arising from the differing interpretations of the rules in different countries. As such they are regularly incorporated into sales contracts worldwide.[3]

"Incoterms" is a registered trademark of the ICC.

The first work published by the ICC on international trade terms was issued in 1923, with the first edition known as Incoterms published in 1936. The Incoterms rules were amended in 1953,[4] 1967, 1976, 1980, 1990, 2000, and 2010, with the ninth version — **Incoterms 2020** [5] — having been published on September 10, 2019.

## Contents



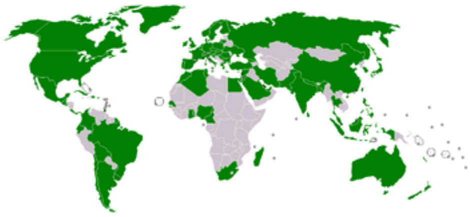
## Incoterms 2020

*Incoterms 2020* is the ninth set of international contract terms published by the International Chamber of Commerce, with the first set having been published in 1936. *Incoterms 2020* defines 11 rules, the same number as defined by *Incoterms 2010*.[6] One rule of the 2010 version ("Delivered at Terminal"; DAT)[7] was removed, and is replaced by a new rule ("Delivered at Place Unloaded"; DPU) in the 2020 rules.

The insurance to be provided under terms CIF and CIP has also changed, increasing from Institute Cargo Clauses(C) to Institute Cargo Clauses(A). Under the CIF Incoterms rule, which is reserved for use in maritime trade and is often used in commodity trading, the Institute Cargo Clauses (C) remains the default level of coverage, giving parties the option to agree to a higher level of insurance cover. Taking into account feedback from global users, the CIP Incoterms® rule now requires a higher level of cover, compliant with the Institute Cargo Clauses (A) or similar clauses.[8]

In prior versions, the rules were divided into four categories, but the 11 pre-defined terms of *Incoterms 2020* are subdivided into two categories *based only on method of delivery*. The larger group of seven rules may be used regardless of the method of transport, with the smaller group of four being applicable only to sales that solely involve transportation by water where the condition of the goods can be verified at the point of loading on board ship. They are therefore not to be used for containerized freight, other combined transport methods, or for transport by road, air or rail.

Incoterms 2020 also formally defines delivery. Previously, the term had been defined informally but it is now defined as the point in the transaction where "the risk of loss or damage [to the goods] passes from the seller to the buyer".[9]


National Incoterms chambers

## Incoterms in government regulations

In some jurisdictions, the duty costs of the goods may be calculated against a specific Incoterm: for example in India, duty is calculated against the CIF value of the goods,[10] and in South Africa the duty is calculated against the FOB value of the goods.[11] Because of this it is common for contracts for exports to these countries to use these Incoterms, even when they are not suitable for the chosen mode of transport. If this is the case then great care must be exercised to ensure that the points at which costs and risks pass are clarified with the customer.

## Defined terms in Incoterms

There are certain terms that have special meaning within Incoterms, and some of the more important ones are defined below:[12]

- Delivery: The point in the transaction where the risk of loss or damage to the goods is transferred from the seller to the buyer
- Arrival: The point named in the Incoterm to which carriage has been paid
- Free: Seller has an obligation to deliver the goods to a named place for transfer to a carrier
- Carrier: Any person who, in a contract of carriage, undertakes to perform or to procure the performance of transport by rail, road, air, sea, inland waterway or by a combination of such modes
- Freight forwarder: A firm that makes or assists in the making of shipping arrangements;
- Terminal: Any place, whether covered or not, such as a dock, warehouse, container yard or road, rail or air cargo terminal
- To clear for export: To file Shipper's Export Declaration and get export permit

## Variation of Incoterms

Parties adopting Incoterms should be wary about their intention and variations. The desire of the parties should be expressed clearly and casual adoption should be refrained. Also, making additions or variations to the meaning of a certain term should be carefully done as parties' failure to use any trade term at all can produce unexpected results.[2]

## Rules for any mode of transport

### EXW – Ex Works (named place of delivery)

The seller makes the goods available at their premises, or at another named place. This term places the maximum obligation on the buyer and minimum obligations on the seller. The Ex Works term is often used while making an initial quotation for the sale of goods without any costs included.

EXW means that a buyer incurs the risks of bringing the goods to their final destination. Either the seller does not load the goods on collecting vehicles and does not clear them for export, or if the seller does load the goods, they do so at buyer's risk and cost. If the parties agree that the seller should be responsible for the loading of the goods on departure and to bear the risk and all costs of such loading, this must be made clear by adding explicit wording to this effect in the contract of sale.

There is no obligation for the seller to make a contract of carriage, but there is also no obligation for the buyer to arrange one either - the buyer may sell the goods on to their own customer for collection from the original seller's warehouse. However, in common practice the buyer arranges the collection of the freight from the designated location, and is responsible for clearing the goods through Customs. The buyer is also responsible for completing all the export documentation, although the seller does have an obligation to obtain information and documents at the buyer's request and cost.

These documentary requirements may result in two principal issues. Firstly, the stipulation for the buyer to complete the export declaration can be an issue in certain jurisdictions (not least the European Union) where the customs regulations require the declarant to be either an individual or corporation resident within the jurisdiction. If the buyer is based outside of the customs jurisdiction, they will be unable to clear the goods for export, meaning that the goods may be declared in the name of the seller by the buyer, even though the export formalities are the buyer's responsibility under the EXW term.[13]

Secondly, most jurisdictions require companies to provide proof of export for tax purposes. In an EXW shipment, the buyer is under no obligation to provide such proof to the seller, or indeed to even export the goods. In a customs jurisdiction such as the European Union, this would leave the seller liable to a sales tax bill as if the goods were sold to a domestic customer. It is therefore of utmost importance that these matters are discussed with the buyer before the contract is agreed. It may well be that another Incoterm, such as FCA *seller's premises*, may be more suitable, since this puts the onus for declaring the goods for export onto the seller, which provides for more control over the export process.[14]

### FCA – Free Carrier (named place of delivery)

The seller delivers the goods, cleared for export, at a named place (possibly including the seller's own premises). The goods can be delivered to a carrier nominated by the buyer, or to another party nominated by the buyer.

In many respects this Incoterm has replaced FOB in modern usage, although the critical point at which the risk passes moves from loading aboard the vessel to the named place. The chosen place of delivery affects the obligations of loading and unloading the goods at that place.

If delivery occurs at the seller's premises, or at any other location that is under the seller's control, the seller is responsible for loading the goods on to the buyer's carrier. However, if delivery occurs at any other place, the seller is deemed to have delivered the goods once their transport has arrived at the named place; the buyer is responsible for both unloading the goods and loading them onto their own carrier.

### CPT – Carriage Paid To (named place of destination)

CPT replaces the C&F (cost and freight) and CFR terms for all shipping modes outside of non-containerized seafreight.

The seller pays for the carriage of the goods up to the named place of destination. However, the goods are considered to be delivered when the goods have been handed over to the first or main carrier, so that the risk transfers to buyer upon handing goods over to that carrier at the place of shipment in the country of Export.

The seller is responsible for origin costs including export clearance and freight costs for carriage to the named place of destination (either the final destination such as the buyer's facilities or a port of destination. This has to be agreed to by seller and buyer, however).

If the buyer requires the seller to obtain insurance, the Incoterm CIP should be considered instead.

### CIP – Carriage and Insurance Paid to (named place of destination)

This term is broadly similar to the above CPT term, with the exception that the seller is required to obtain insurance for the goods while in transit. CIP requires the seller to insure the goods for 110% of the contract value under Institute Cargo Clauses (A) of the Institute of London Underwriters (which is a change from Incoterms 2010 where the minimum was Institute Cargo Clauses (C)), or any similar set of clauses, unless specifically agreed by both parties. The policy should be in the same currency as the contract, and should allow the buyer, the seller, and anyone else with an insurable interest in the goods to be able to make a claim.

CIP can be used for all modes of transport, whereas the Incoterm CIF should only be used for non-containerized sea-freight.

### DPU – Delivered At Place Unloaded (named place of destination)

This Incoterm requires that the seller delivers the goods, unloaded, at the named place of destination. The seller covers all the costs of transport (export fees, carriage, unloading from main carrier at destination port and destination port charges) and assumes all risk until arrival at the destination port or terminal.

The terminal can be a port, airport, or inland freight interchange, but must be a facility with the capability to receive the shipment. If the seller is not able to organize unloading, they should consider shipping under DAP terms instead. All charges after unloading (for example, import duty, taxes, customs and on-carriage) are to be borne by buyer. However, it is important to note that any delay or demurrage charges at the terminal will generally be for the seller's account.

Some uncertainty has emerged since Incoterms 2020 were adopted as to the meaning of "unloaded" when goods are delivered in a container, usually by sea, as the removal of the container from the incoming vessel may suggest that it has been "unloaded", but the goods themselves are not yet "unloaded" while they remain in the container.[15]

### DAP – Delivered At Place (named place of destination)

Incoterms 2010 defines DAP as 'Delivered at Place' – the seller delivers when the goods are placed at the disposal of the buyer on the arriving means of transport ready for unloading at the named place of destination. Under DAP terms, the risk passes from seller to buyer from the point of destination mentioned in the contract of delivery.

Once goods are ready for shipment, the necessary packing is carried out by the seller at their own cost, so that the goods reach their final destination safely. All necessary legal formalities in the exporting country are completed by the seller at their own cost and risk to clear the goods for export.

After arrival of the goods in the country of destination, the customs clearance in the importing country needs to be completed by the buyer, e.g. import permit, documents required by customs, etc., including all customs duties and taxes.

Under DAP terms, all carriage expenses with any terminal expenses are paid by seller up to the agreed destination point. The necessary unloading cost at final destination has to be borne by buyer under DAP terms.[16][17]

### DDP – Delivered Duty Paid (named place of destination)

Seller is responsible for delivering the goods to the named place in the country of the buyer, and pays all costs in bringing the goods to the destination including import duties and taxes. The seller is not responsible for unloading. This term is often used in place of the non-Incoterm "Free In Store (FIS)". This term places the maximum obligations on the seller and minimum obligations on the buyer. No risk or responsibility is transferred to the buyer until delivery of the goods at the named place of destination.[18]

The most important consideration for DDP terms is that the seller is responsible for clearing the goods through customs in the buyer's country, including both paying the duties and taxes, and obtaining the necessary authorizations and registrations from the authorities in that country. Unless the rules and regulations in the buyer's country are very well understood, DDP terms can be a very big risk both in terms of delays and in unforeseen extra costs, and should be used with caution.

## Rules for sea and inland waterway transport

To determine if a location qualifies for these four rules, please refer to 'United Nations Code for Trade and Transport Locations (UN/LOCODE)'.[19]

The four rules defined by Incoterms 2020 for international trade where transportation is entirely conducted by water are as per the below. It is important to note that these terms are generally not suitable for shipments in shipping containers; the point at which risk and responsibility for the goods passes is when the goods are loaded on board the ship, and if the goods are sealed into a shipping container it is impossible to verify the condition of the goods at this point.

Also of note is that the point at which risk passes under these terms has shifted from previous editions of Incoterms, where the risk passed at the ship's rail.

## FAS – Free Alongside Ship (named port of shipment)

The seller delivers when the goods are placed alongside the buyer's vessel at the named port of shipment. This means that the buyer has to bear all costs and risks of loss of or damage to the goods from that moment. The FAS term requires the seller to clear the goods for export, which is a reversal from previous Incoterms versions that required the buyer to arrange for export clearance. However, if the parties wish the buyer to clear the goods for export, this should be made clear by adding explicit wording to this effect in the contract of sale. This term should be used only for non-containerized seafreight and inland waterway transport.

## FOB – Free on Board (named port of shipment)

Under FOB terms the seller bears all costs and risks up to the point the goods are loaded on board the vessel. The seller's responsibility does not end at that point unless the goods are "appropriated to the contract" that is, they are "clearly set aside or otherwise identified as the contract goods".[20] Therefore, FOB contract requires a seller to deliver goods on board a vessel that is to be designated by the buyer in a manner customary at the particular port. In this case, the seller must also arrange for export clearance. On the other hand, the buyer pays cost of marine freight transportation, bill of lading fees, insurance, unloading and transportation cost from the arrival port to destination. Since Incoterms 1980 introduced the Incoterm FCA, FOB should only be used for non-containerized seafreight and inland waterway transport. However, FOB is commonly used incorrectly for all modes of transport despite the contractual risks that this can introduce. In some common law countries such as the United States of America, FOB is not only connected with the carriage of goods by sea but also used for inland carriage aboard any "vessel, car or other vehicle."[21]

## CFR – Cost and Freight (named port of destination)

The seller pays for the carriage of the goods up to the named port of destination. Risk transfers to buyer when the goods have been loaded on board the ship in the country of Export. The seller is responsible for origin costs including export clearance and freight costs for carriage to the named port. The shipper is not responsible for delivery to the final destination from the port (generally the buyer's facilities), or for buying insurance. If the buyer requires the seller to obtain insurance, the Incoterm CIF should be considered. CFR should only be used for non-containerized seafreight and inland waterway transport; for all other modes of transport it should be replaced with CPT.

## CIF – Cost, Insurance & Freight (named port of destination)

### Use preceding Incoterms

The term "cost, insurance, freight" or "c.i.f." predates the introduction of Incoterms. Craighill noted in a 1919 article that in "earlier times" the initials were usually written "C. F. & I.": he quotes the phrase "C. F. & I. by steamer to N.Y." used in a shipping contract addressed in the New York State case of Mee v. McNider (1886).[22][23]

The first English court case which referred to c.i.f. was Tregelles v. Sewell (1862),[24] where the court established that under c.i.f. terms, risk passes to the buyer on shipment.[25] In the case of E. Clemens Horst Co. v. Biddell Brothers, the UK House of Lords ruled in 1911 that "the sellers in a c.i.f. contract were entitled to payment of the price upon tender of the bill of lading and insurance policy. The purchasers' intent to wait for satisfactory delivery and inspection was overruled.[26] Shortly afterwards in 1915-16, the case of Arnhold Karberg & Co. v. Blythe, Green, Jourdain & Co. in the High Court and Court of Appeal showcased judicial debate about whether a c.i.f. bill of lading could evidence a sale of goods, Scrutton J ruling in the High Court that it did not, because a c.i.f. sale is "not a sale of goods, but a sale of documents relating to goods".[27] The Court of Appeal upheld his decision but Bankes LJ and Warrington LJ argued that "a c.i.f. contract is a contract for the sale of goods to be performed by the delivery of the documents".[28]

### Incoterms usage

As an Incoterm, CIF is broadly similar to the term CFR, with the exception that the seller is required to obtain insurance for the goods while in transit. CIF requires the seller to insure the goods for 110% of the contract value under Institute Cargo Clauses (A) of the Institute of London Underwriters (which is a change from Incoterms 2010 where the minimum was Institute Cargo Clauses (C)), or any similar set of clauses, unless specifically agreed by both parties. The policy should be in the same currency as the contract. The seller must also turn over documents necessary, to obtain the goods from the carrier or to assert claim against an insurer to the buyer. The documents include (as a minimum) the invoice, the insurance policy, and the bill of lading. These three documents represent the cost, insurance, and freight of CIF. The seller's obligation ends when the documents are handed over to the buyer. Then, the buyer has to pay at the agreed price. Another point to consider is that CIF should only be used for non-containerized sea freight; for all other modes of transport it should be replaced with CIP.

## Allocations of costs to buyer/seller according to Incoterms 2020

| Incoterm 2020 | Loading at origin | Export customs declaration | Carriage to port of export | Unloading of truck in port of export | Loading on vessel/airplane in port of export | Carriage (sea/air) to port of import | Insurance | Unloading in port of import | Loading on truck in port of import | Carriage to place of destination | Import customs clearance | Import duties and taxes | Unl dest |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| EXW | Buyer | Buyer | Buyer | Buyer | Buyer | Buyer | Buyer | Buyer | Buyer | Buyer | Buyer | Buyer | B |
| FCA | Seller | Seller | Buyer/Seller | Buyer | Buyer | Buyer | Buyer | Buyer | Buyer | Buyer | Buyer | Buyer | B |
| FAS | Seller | Seller | Seller | Seller | Buyer | Buyer | Buyer | Buyer | Buyer | Buyer | Buyer | Buyer | B |
| FOB | Seller | Seller | Seller | Seller | Seller | Buyer | Buyer | Buyer | Buyer | Buyer | Buyer | Buyer | B |
| CPT | Seller | Seller | Seller | Seller | Seller | Seller | Buyer | Buyer/Seller | Buyer/Seller | Seller | Buyer | Buyer | B |
| CIP | Seller | Seller | Seller | Seller | Seller | Seller | Seller | Buyer/Seller | Buyer/Seller | Seller | Buyer | Buyer | B |
| CFR | Seller | Seller | Seller | Seller | Seller | Seller | Buyer | Buyer | Buyer | Buyer | Buyer | Buyer | B |
| CIF | Seller | Seller | Seller | Seller | Seller | Seller | Seller | Buyer | Buyer | Buyer | Buyer | Buyer | B |
| DAP | Seller | Seller | Seller | Seller | Seller | Seller | Seller | Seller | Seller | Seller | Buyer | Buyer | B |
| DPU | Seller | Seller | Seller | Seller | Seller | Seller | Seller | Seller | Seller | Seller | Buyer | Buyer | S |
| DDP | Seller | Seller | Seller | Seller | Seller | Seller | Seller | Seller | Seller | Seller | Seller | Seller | B |

With all Incoterms beginning with D there is no obligation to provide insurance, however the insurable risk is for the seller's account.

## Allocations of risks to buyer/seller according to Incoterms 2020

The risk and the cost is not always the same for Incoterms. In many cases, the risk and cost usually goes together but it is not always the case. The below represents the transfer of risk.

Rules for sea and inland waterway transport

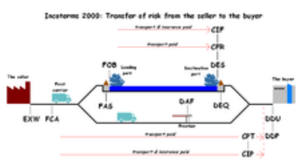
| Incoterm 2020 | Seller | Carrier | Port | Loading at Port | Onboard | Unloading at Port | Port |
|---|---|---|---|---|---|---|---|
| FAS | Seller | Seller | Seller | Buyer | Buyer | Buyer | Buyer |
| FOB | Seller | Seller | Seller | Seller | Buyer | Buyer | Buyer |
| CFR | Seller | Seller | Seller | Seller | Buyer | Buyer | Buyer |
| CIF | Seller | Seller | Seller | Seller | Buyer | Buyer | Buyer |

Rules for any modes of transport

| Incoterm 2020 | Seller | Carrier | Port | Ship | Port | Terminal | Named place | Unloading at destination |
|---|---|---|---|---|---|---|---|---|
| EXW | Seller | Buyer | Buyer | Buyer | Buyer | Buyer | Buyer | Buyer |
| FCA | Seller | Seller | Buyer | Buyer | Buyer | Buyer | Buyer | Buyer |
| CPT | Seller | Buyer | Buyer | Buyer | Buyer | Buyer | Buyer | Buyer |
| CIP | Seller | Buyer | Insurance | Insurance | Insurance | Insurance | Insurance | Buyer |
| DAP | Seller | Seller | Seller | Seller | Seller | Seller | Seller | Buyer |
| DPU | Seller | Seller | Seller | Seller | Seller | Seller | Seller | Buyer |
| DDP | Seller | Seller | Seller | Seller | Seller | Seller | Seller | Seller |

## Previous Incoterms

While these terms do not feature in the current version of Incoterms it is possible that they may be seen in sales order contracts. Care must be taken to ensure that both parties agree on their obligations in this case.



Incoterms - Transfer of risk from the seller to the buyer (diagram created in 2011)

### DAF – Delivered at Frontier (named place of delivery)

This term can be used when the goods are transported by rail and road. The seller pays for transportation to the named place of delivery at the frontier. The buyer arranges for customs clearance and pays for transportation from the frontier to their factory. The passing of risk occurs at the frontier.

### DAT – Delivered at Terminal

This term means that the seller delivers the goods to the buyer to the named terminal in the contract of sale, unloaded from the main carriage vehicle. The seller is responsible for making a safe delivery of goods to the named terminal, paying all transportation and export and transit customs clearance expenses. The seller bears the risks and costs associated with supplying the goods to the delivery terminal and unloading them, where the buyer becomes responsible for paying the duty and taxes, as well as any further carriage to a destination.

### DES – Delivered Ex Ship

Where goods are delivered ex ship, the passing of risk does not occur until the ship has arrived at the named port of destination and the goods made available for unloading to the buyer. The seller pays the same freight and insurance costs as they would under a CIF arrangement. Unlike CFR and CIF terms, the seller has agreed to bear not just cost, but also Risk and Title up to the arrival of the vessel at the named port. Costs for unloading the goods and any duties, taxes, etc. are for the Buyer. Until 2011,[29] DES was a commonly used term in shipping bulk commodities, such as coal, grain, dry chemicals; and where the seller either owned or had chartered their own vessel.

### DEQ – Delivered Ex Quay (named port of delivery)

This is similar to DES, but the passing of risk does not occur until the goods have been unloaded at the port of discharge.

### DDU – Delivered Duty Unpaid (named place of destination)

This term means that the seller delivers the goods to the buyer to the named place of destination in the contract of sale. A transaction in international trade where the seller is responsible for making a safe delivery of goods to a named destination, paying all transportation and export and transit customs clearance expenses. The seller bears the risks and costs associated with supplying the goods to the delivery location, where the buyer becomes responsible for paying the duty and taxes.

### FOR - Free on rail and FOT - Free on truck

These two terms were both included in Incoterms 1953, in each case specifying a named departure point.[4]

## See also

- Commercial law
- Customs declaration
- International trade
- International trade law
- Uniform Commercial Code
- United Nations Convention on Contracts for the International Sale of Goods

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- Export.gov: Incoterms® (https://www.export.gov/article?id=Incoterms-Overview)
- United Nations Code for Trade and Transport Locations (UN/LOCODE) (http://www.unece.org/cefact/locode/service/location.html)

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# Intermodal container


A 40-foot long (12.2 m) shipping container. Each of its eight corners has an essential corner casting for hoisting, stacking, and securing

An **intermodal container**, often called a shipping container, is a large standardized shipping container, designed and built for intermodal freight transport, meaning these containers can be used across different modes of transport – from ship to rail to truck – without unloading and reloading their cargo.[1] Intermodal containers are primarily used to store and transport materials and products efficiently and securely in the global containerized intermodal freight transport system, but smaller numbers are in regional use as well. These containers are known under a number of names. Based on size alone, up to 95% of intermodal containers comply with ISO standards,[2] and can officially be called **ISO containers**. Many other names are simply: **container**, **cargo** or **freight** container, **shipping, sea** or **ocean** container, **container van** or **sea van**, **sea can** or **C can**, or **MILVAN**,[3][4] **SEAVAN**, or **RO/RO**.[5] The also used term **CONEX (Box)** is technically incorrect carry-over usage of the name of an important predecessor of the international ISO containers, namely the much smaller prior steel CONEX boxes used by the U.S. Army.


Containers stacked on a large ship.

Intermodal containers exist in many types and a number of standardized sizes, but ninety percent of the global container fleet are so-called "dry freight" or "general purpose" containers[2][6] – durable closed rectangular boxes, made of rust-retardant Corten steel; almost all 8 feet (2.44 m) wide, and of either 20 or 40 feet (6.10 or 12.19 m) standard length, as defined by International Organization for Standardization (ISO) standard 668:2020.[2][7] The worldwide standard heights are 8 feet 6 inches (2.59 m) and 9 feet 6 inches (2.90 m) – the latter are known as **High Cube** or **Hi-Cube** (**HC** or **HQ**) containers.[8]

First invented in the early 20th century, modern 40-foot intermodal containers proliferated during the 1960s and 1970s under the containerization innovations of the American shipping company SeaLand. Just like cardboard boxes and pallets, these containers are a means to bundle cargo and goods into larger, unitized loads, that can be easily handled, moved, and stacked, and that will pack tightly in a ship or yard. Intermodal containers share a number of key construction features to withstand the stresses of intermodal shipping, to facilitate their handling and to allow stacking, as well as being identifiable through their individual, unique ISO 6346 reporting mark.

In 2012, there were about 20.5 million intermodal containers in the world of varying types to suit different cargoes.[7][nb 1] Containers have largely supplanted the traditional break bulk cargo – in 2010 containers accounted for 60% of the world's seaborne trade.[10][11] The predominant alternative methods of transport carry bulk cargo whether gaseous, liquid, or solid; e.g., by bulk carrier or tank ship, tank car, or truck. For air freight, the lighter weight IATA-defined unit load devices are used.

## Contents

# History

## Origins

Transferring freight containers on the London, Midland and Scottish Railway (LMS; 1928)

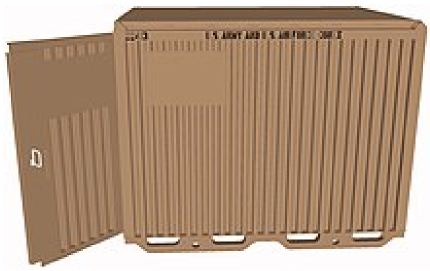
By the 1830s, railways across several continents were carrying containers that could be transferred to other modes of transport. The Liverpool and Manchester Railway in the United Kingdom was one of these. "Simple rectangular timber boxes, four to a truck, they were used to convey coal from the Lancashire collieries to Liverpool, where they were transferred to horse-drawn carts by crane."[13] Early versions of standardized containers were used in Europe before World War II. Construction of these containers had a steel frame with wooden walls, floor, roof and doors.

## Creation of international standards

Freight car in railway museum Bochum-Dahlhausen, showing four different UIC-590 pa-containers

The first international standard for containers was established by the Bureau International des Containers et du Transport Intermodal (B.I.C.) in 1933, and a second one in 1935, primarily for transport between European countries. American containers at this time were not standardized, and these early containers were not yet stackable – neither in the U.S. nor Europe. In November 1932, the first container terminal in the world was opened by the Pennsylvania Rail Road Company in Enola, Pennsylvania. Containerization was developed in Europe and the US as a way to revitalize rail companies after the Wall Street Crash of 1929, in New York, which resulted in economic collapse and a drop in all modes of transport.[14]

## Mid 20th century innovations



Side of Vietnam era U.S. Army steel 'CONEX' box container (3D)

In April 1951 at Zürich Tiefenbrunnen railway station, the Swiss Museum of Transport and the *Bureau International des Containers* (BIC) held demonstrations of container systems for representatives from a number of European countries, and from the United States. A system was selected for Western Europe, based on the Netherlands' system for consumer goods and waste transportation called *Laadkisten* (lit. "Loading chests"), in use since 1934. This system used roller containers for transport by rail, truck and ship, in various configurations up to 5,500 kg (12,100 lb) capacity, and up to 3.1 by 2.3 by 2 metres (10 ft 2 in × 7 ft $6\frac{1}{2}$ in × 6 ft $6\frac{3}{4}$ in) in size.[15][16] This became the first post World War II European railway standard of the International Union of Railways – *UIC-590*, known as "pa-Behälter". It was implemented in the Netherlands, Belgium, Luxembourg, West Germany, Switzerland, Sweden and Denmark.[17]

The use of standardized steel shipping containers began during the late 1940s and early 1950s, when commercial shipping operators and the US military started developing such units.[18] In 1948 the U.S. Army Transportation Corps developed the "Transporter", a rigid, corrugated steel container, able to carry 9,000 pounds (4,100 kg). It was 8 ft 6 in (2.59 m) long, 6 ft 3 in (1.91 m) wide, and 6 ft 10 in (2.08 m) high, with double doors on one end, was mounted on skids, and had lifting rings on the top four corners.[19] After proving successful in Korea, the Transporter was developed into the Container Express (CONEX) box system in late 1952. Based on the Transporter, the size and capacity of the Conex were about the same,[nb 2] but the system was made modular, by the addition of a smaller, half-size unit of 6 ft 3 in (1.91 m) long, 4 ft 3 in (1.30 m) wide and 6 ft 10½ in (2.10 m) high.[22][23][nb 3] CONEXes could be stacked three high, and protected their contents from the elements.[20] By 1965 the US military used some 100,000 Conex boxes, and more than 200,000 in 1967,[22][26] making this the first worldwide application of intermodal containers.[20] Their invention made a major contribution to the globalization of commerce in the second half of the 20th century, dramatically reducing the cost of transporting goods and hence of long-distance trade.[27][28]

In 1975, many containers still featured riveted aluminum sheet-and-post wall construction, instead of welded, corrugated steel.[12]

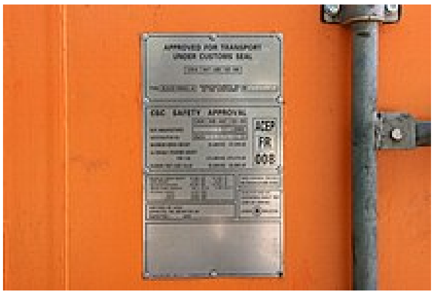
From 1949 onwards, engineer Keith Tantlinger repeatedly contributed to the development of containers, as well as their handling and transportation equipment. In 1949, while at Brown Trailers Inc. of Spokane, Washington, he modified the design of their stressed skin aluminum 30-foot trailer, to fulfil an order of two-hundred 30 by 8 by 8.5 feet (9.14 m × 2.44 m × 2.59 m) containers that could be stacked two high, for Alaska-based *Ocean Van Lines*. Steel castings on the top corners provided lifting and securing points.[29]

In 1955 trucking magnate Malcom McLean bought Pan-Atlantic Steamship Company, to form a container shipping enterprise, later known as Sea-Land. The first containers were supplied by Brown Trailers Inc, where McLean met Keith Tantlinger, and hired him as vice-president of engineering and research.[30] Under the supervision of Tantlinger, a new 35 ft (10.67 m) x 8 ft (2.44 m) x 8 ft 6 in (2.59 m) Sea-Land container was developed, the length determined by the maximum length of trailers then allowed on Pennsylvanian highways. Each container had a frame with eight corner castings that could withstand stacking loads.[31] Tantlinger also designed automatic spreaders for handling the containers, as well as the twistlock mechanism that connects with the corner castings.

## Modern form

Containers in their modern 21st-century form first began to gain widespread use around 1956. Businesses began to devise a structured process to utilize and to get optimal benefits from the role and use of shipping containers. Over time, the invention of the modern telecommunications of the late 20th century made it highly beneficial to have standardized shipping containers and made these shipping processes more standardized, modular, easier to schedule, and easier to manage.[32]

Two years after McLean's first container ship, the *Ideal X*, started container shipping on the US East Coast,[33] Matson Navigation followed suit between California and Hawaii. Just like Pan-Atlantic's containers, Matson's were 8 ft (2.44 m) wide and 8 ft 6 in (2.59 m) high, but due to California's different traffic code Matson chose to make theirs 24 ft (7.32 m) long.[34] In 1968, McLean began container service to South Vietnam for the US military with great success.



Every international shipping container must have a "CSC-Plate"

## Modern ISO standards

ISO standards for containers were published between 1968 and 1970 by the International Maritime Organization. These standards allow for more consistent loading, transporting, and unloading of goods in ports throughout the world, thus saving time and resources.[35]

The International Convention for Safe Containers is a 1972 regulation by the Inter-governmental Maritime Consultative Organization on the safe handling and transport of containers. It decrees that every container travelling internationally be fitted with a CSC Safety-approval Plate.[36][37] This holds essential information about the container, including age, registration number, dimensions and weights, as well as its strength and maximum stacking capability.

### Impact of industry changes on workers

Longshoremen and related unions around the world struggled with this revolution in shipping goods.[38][39] For example, by 1971 a clause in the International Longshoremen's Association (ILA) contract stipulated that the work of "stuffing" (filling) or "stripping" (emptying) a container within 50 miles (80 km) of a port must be done by ILA workers, or if not done by ILA, that the shipper needed to pay royalties and penalties to the ILA. Unions for truckers and consolidators argued that the ILA rules were not valid work preservation clauses, because the work of stuffing and stripping containers away from the pier had not traditionally been done by ILA members.[38][39] In 1980 the Supreme Court of the United States heard this case and ruled against the ILA.[38][39]

### Impact in worldwide supply shortage of 2020 to present

Some experts have said that the shipping containers have proven to have a downside, as exacerbating some of the economic and societal damage from the 2021 global supply chain crisis of 2020 and 2021, and the resulting shortages related to the COVID-19 pandemic. One problem is that the centralized, continuous shipping process made possible by the containers has now proven to be a liability of sorts; the reason is that if there is just one bottleneck, delay, or other breakdown at any point in the process, it can easily cause major delays everywhere up and down the supply chain.[32]

In January 2021, a shortage of shipping containers at ports caused shipping to be backlogged.[40][41][42]

Marc Levinson, author of *Outside the Box: How Globalization Changed from Moving Stuff to Spreading Ideas* and *The Box: How the Shipping Container Made the World Smaller and the World Economy Bigger*, noted in an interview:[32]

> "Because of delays in the process, it’s taking a container longer to go from its origin to its final destination where it’s unloaded, so the container is in use longer for each trip. You’ve just lost a big hunk of the total capacity because the containers can’t be used as intensively. We've had in the United States an additional problem, which is that the ship lines typically charge much higher rates on services from Asia to North America than from North America to Asia. This has resulted in complaints, for example, from farmers and agricultural companies, that it’s hard to get containers in some parts of the country because the ship lines want to ship them empty back to Asia, rather than letting them go to South Dakota and load over the course of several days. So we’ve had exporters in the United States complaining that they have a hard time finding a container that they can use to send their own goods abroad."[32]

# Description

Ninety percent of the global container fleet consists of "dry freight" or "general purpose" containers – both of standard and special sizes.[2][6] And although lengths of containers vary from 8 to 56 feet (2.4 to 17.1 m), according to two 2012 container census reports[nb 4] about 80% of the world's containers are either twenty or forty foot standard length boxes of the dry freight design.[7] These typical containers are rectangular, closed box models, with doors fitted at one end, and made of corrugated weathering steel (commonly known as CorTen)[nb 5] with a plywood floor.[44] Although corrugating the sheet metal used for the sides and roof contributes significantly to the container's rigidity and stacking strength, just like in corrugated iron or in cardboard boxes, the corrugated sides cause aerodynamic drag, and up to 10% fuel economy loss in road or rail transport, compared to smooth-sided vans.[45]


Forty foot (12.2 m) containers make up 70% of the world's container volume, which is measured in TEUs[7]

Standard containers are 8 feet (2.44 m) wide by 8 ft 6 in (2.59 m) high,[nb 6] although the taller "High Cube" or "hi-cube" units measuring 9 feet 6 inches (2.90 m) have become very common in recent years. By the end of 2013, high-cube 40 ft containers represented almost 50% of the world's maritime container fleet, according to Drewry's Container Census report.[47]


The standard casting that is located on each of the eight corners of a container. The twistlocks fit through the larger oval hole on the bottom castings. Top casting ovals hold twistlock fittings used to secure another container on top.

About 90% of the world's containers are either nominal 20-foot (6.1 m) or 40-foot (12.2 m) long,[7][48] although the United States and Canada also use longer units of 45 ft (13.7 m), 48 ft (14.6 m) and 53 ft (16.15 m). ISO containers have castings with openings for twistlock fasteners at each of the eight corners, to allow gripping the box from above, below, or the side, and they can be stacked up to ten units high.[49]


Twistlock on the corner of a road trailer

Although ISO standard 1496 of 1990 only required nine-high stacking, *and only* of containers rated at 24,000 kg (53,000 lb),[50] current Ultra Large Container Vessels of the Post New Panamax and Maersk Triple E class are stacking them ten or eleven high.[51][52] Moreover, vessels like the Marie Maersk no longer use separate stacks in their holds, and other stacks above deck – instead they maximize their capacity by stacking continuously from the bottom of the hull, to as much as twenty-one high.[53] This requires automated planning, whereby heavy containers are systematically kept at the bottom of the stack, and light ones on top – not only to stabilize the ship, but also to prevent overloading and collapsing the bottom containers.

Regional intermodal containers, such as European, Japanese and U.S. domestic units however, are mainly transported by road and rail, and can frequently only be stacked up to two or three laden units high.[49] Although the two ends are quite rigid, containers flex somewhat during transport.[54]

Container capacity is often expressed in twenty-foot equivalent units (**TEU**, or sometimes *teu*). A twenty-foot equivalent unit is a measure of containerized cargo capacity equal to one standard 20-foot (6.1 m) long container. This is an approximate measure, wherein the height of the box is not considered. For example, the 9 ft 6 in (2.9 m) tall high-cube, as well as 4-foot-3-inch half-height (1.3 m) 20-foot (6.1 m) containers are equally counted as one TEU. Similarly, extra long 45 ft (13.72 m) containers are commonly counted as just two TEU, no different than standard 40 feet (12.19 m) long units. Two TEU are equivalent to one forty-foot equivalent unit (FEU).[55][56]

In 2014 the global container fleet grew to a volume of 36.6 million TEU, based on Drewry Shipping Consultants' Container Census.[57][nb 7] Moreover, in 2014 for the first time in history 40-foot High-Cube containers accounted for the majority of boxes in service, measured in TEU.[57] In 2019 it was noted by global logistics data analysis startup Upply[58] that China's role as 'factory of the world' is further incentivizing the use of 40-foot containers, and that the computational standard 1 TEU boxes only make up 20% of units on major east–west liner routes, and demand for shipping them keeps dropping.[59] In the 21st century, the market has shifted to using 40-foot high-cube dry and refrigerated containers more and more predominantly. Forty-foot units have become the standard to such an extent that the sea freight industry now charges less than 30% more for moving a 40-ft unit than for a 1 TEU box. Although 20-ft units mostly have heavy cargo, and are useful for stabilizing both ships and revenue,[nb 8] carriers financially penalize 1 TEU boxes by comparison.[59]

For container manufacturers, 40-foot High-Cubes now dominate market demand both for dry and refrigerated units.[59] Manufacturing prices for regular dry freight containers are typically in the range of $1750–$2000 U.S. per CEU (container equivalent unit),[57] and about 90% of the world's containers are made in China.[48] The average age of the global container fleet was a little over 5 years from end 1994 to end 2009, meaning containers remain in shipping use for well over 10 years.[9]

**Bottom structure features**

The typical *gooseneck tunnel* is clearly visible in the underside of a toppled-over, long container (first picture), as well as in a container's interior, where it takes the space otherwise covered by wood flooring. Gooseneck container trailer showing twistlock couplings for forty-foot boxes at its four corners. Twenty foot containers, on the other hand, frequently have forklift pockets, accessible from the sides (last picture).[nb 9]

## Gooseneck tunnel

A *gooseneck tunnel*, an indentation in the floor structure, that meshes with the *gooseneck* on dedicated container semi-trailers, is a mandatory feature in the bottom structure of 1AAA and 1EEE (40- and 45-ft high-cube) containers, and optional but typical on standard height, forty-foot and longer containers.[62]

## Types

Other than the standard, general purpose container, many variations exist for use with different cargoes. The most prominent of these are refrigerated containers (also called *reefers*) for perishable goods, that make up 6% of the world's shipping boxes.[6][48] Tanks in a frame, for bulk liquids, account for another 0.75% of the global container fleet.[6]

Forty foot High-Cube actively refrigerated container – refrigerating equipment visible on the front end.

Although these variations are not of the standard type, they mostly are *ISO standard* containers – in fact the ISO 6346 standard classifies a broad spectrum of container types in great detail. Aside from different size options, the most important container types are:[63][nb 10]


A spine car with a 20 ft tank container and an open-top 20 ft container with canvas cover


A flat-rack container loaded with a small vessel loaded by a reach stacker.

- General-purpose dry vans, for boxes, cartons, cases, sacks, bales, pallets, drums, etc., Special interior layouts are known, such as:
  - rolling-floor containers, for difficult-to-handle cargo
  - garmentainers, for shipping garments on hangers (GOH)[65][66]
- Ventilated containers. Essentially dry vans, but either passively or actively ventilated. For instance for organic products requiring ventilation.
- Temperature controlled – either insulated, refrigerated, and/or heated containers, for perishable goods
- Tank containers, for liquids, gases, or powders. Frequently these are dangerous goods, and in the case of gases one shipping unit may contain multiple gas bottles
- Bulk containers (sometimes *bulktainers*), either closed models with roof-lids, or hard or soft open-top units for top loading, for instance for bulk minerals. Containerized coal carriers and "bin-liners" (containers designed for the efficient road and rail transportation of rubbish from cities to recycling and dump sites) are used in Europe.
- Open-top and open-side containers, for instance for easy loading of heavy machinery or oversize pallets. Crane systems can be used to load and unload crates without having to disassemble the container itself.[67] Open sides are also used for ventilating hardy perishables like apples or potatoes.
- Log cradles for cradling logs[68]
- Platform based containers such as:
  - flat-rack and bolster containers, for barrels, drums, crates, and any heavy or bulky out-of-gauge cargo, like machinery, semi-finished goods or processed timber. Empty flat-racks can either be stacked or shipped sideways in another ISO container
  - collapsible containers, ranging from flushfolding flat-racks to fully closed ISO and CSC certified units with roof and walls when erected.[69]
- trash containers, for carrying trash bags and cans to and from Recycling factories and landfills.

Containers for offshore use have a few different features, like pad eyes, and must meet additional strength and design requirements, standards and certification, such as the DNV2.7-1 by Det Norske Veritas, LRCCS by Lloyd's Register, Guide for Certification of Offshore Containers by American Bureau of Shipping and the International standard ISO10855: *Offshore containers and associated lifting sets*, in support of IMO MSC/Circ. 860[70]

A multitude of equipment, such as generators, has been installed in containers of different types to simplify logistics – see § Containerized equipment for more details.

Swap body units usually have the same bottom corner fixtures as intermodal containers, and often have folding legs under their frame so that they can be moved between trucks without using a crane. However they frequently do not have the upper corner fittings of ISO containers, and are not stackable, nor can they be lifted and handled by the usual equipment like reach-stackers or straddle-carriers. They are generally more expensive to procure.[71]

# Specifications

Basic terminology of globally standardized intermodal shipping containers is set out in standard:

- ISO 830:(1999) *Freight containers – Vocabulary*, 2nd edition; last reviewed and confirmed in 2016.

From its inception, ISO standards on international shipping containers, consistently speak of them sofar as 'Series 1' containers – deliberately so conceived, to leave room for another such series of interrelated container standards in the future.[nb 11]

40 foot high-cube container. The one foot extra height is indicated by the black and yellow markers near the top corners.

Basic dimensions and permissible gross weights of intermodal containers are largely determined by two ISO standards:

- ISO 668:2013–2020 Series 1 freight containers—Classification, dimensions and ratings
- ISO 1496-1:2013 Series 1 freight containers—Specification and testing—Part 1: General cargo containers for general purposes

Weights and dimensions of the most common (standardized) types of containers are given below.[nb 12] Forty-eight foot and fifty-three foot containers have not yet been incorporated in the latest, 2020 edition of the ISO 668.[73] ISO standard maximum gross mass for all standard sizes except 10-ft boxes was raised to 36,000 kg or 79,000 lb per Amendment 1 on ISO 668:2013, in 2016.[74] Draft Amendment 1 of ISO 668: 2020 – for the eighth edition – maintains this.[75] Given the average container lifespan, the majority of the global container fleet have not caught up with this change yet. Moreover, U.S. highways cannot handle such heavy fully laden containers yet, including the mass of truck (and trailer).

Values vary slightly from manufacturer to manufacturer, but must stay within the tolerances dictated by the standards. Empty weight (*tare weight*) is not determined by the standards, but by the container's construction, and is therefore indicative, but necessary to calculate a net load figure, by subtracting it from the maximum permitted gross weight.

The bottom row in the table gives the legal maximum cargo weights for U.S. highway transport, and those based on use of an industry common tri-axle chassis. Cargo must also be loaded evenly inside the container, to avoid axle weight violations.[76] The maximum gross weights that U.S. railroads accept or deliver are

52,900 lb (24,000 kg) for 20-foot containers, and 67,200 lb (30,500 kg) for 40-foot containers,[77] in contrast to the global ISO-standard gross weight for 20-footers having been raised to the same as 40-footers in the year 2005.[78] In the U.S., containers loaded up to the rail cargo weight limit cannot move over the road, as they will exceed the U.S. 80,000 lb (36,000 kg) highway limit.[77]

| Container by common name (imperial) | | ISO (global) standard containers [79][80] | | | | Common North American containers[81] | |
|---|---|---|---|---|---|---|---|
| | | 20 foot standard height | 40 foot standard height | 40 foot high-cube | 45 foot high-cube | 48 foot high-cube | 53 foot high-cube [82] |
| External dimensions | Length | 19 ft 10½ in<br>6.058 m | 40 ft<br>12.192 m | | 45 ft<br>13.716 m | 48 ft<br>14.630 m | 53 ft<br>16.154 m |
| | Width | 8 ft<br>2.438 m | | | | 8 ft 6 in<br>2.591 m | |
| | Height | 8 ft 6 in<br>2.591 m | | 9 ft 6 in<br>2.896 m | | 9 ft 6 in<br>2.896 m | |
| Minimal interior dimensions | Length | 5.867 m<br>19 ft 3 in | 11.998 m<br>39 ft 4⅜ in | | 13.542 m<br>44 ft 5⅛ in | 47 ft 5 in<br>14.453 m | 52 ft 5 in<br>15.977 m |
| | Width | 2.330 m<br>7 ft 7¾ in | | | | 8 ft 2 in<br>2.489 m | |
| | Height | 2.350 m<br>7 ft 8½ in | | 2.655 m<br>8 ft 8½ in | | 8 ft 11 in<br>2.718 m | |
| Minimum door aperture | Width | 2.286 m<br>7 ft 6 in | | | | 8 ft 2 in<br>2.489 m | |
| | Height | 2.261 m<br>7 ft 5 in | | 2.566 m<br>8 ft 5 in | | 8 ft 10 in<br>2.692 m | |
| Internal volume | | 1,169 cu ft<br>33.1 m$^3$ | 2,385 cu ft<br>67.5 m$^3$ | 2,660 cu ft<br>75.3 m$^3$ | 3,040 cu ft<br>86.1 m$^3$ | 3,454 cu ft<br>97.8 m$^3$ | 3,830 cu ft<br>108.5 m$^3$ |
| Common maximum gross weight | | 30,480 kg<br>67,200 lb | | | 33,000 kg<br>73,000 lb | 30,480 kg<br>67,200 lb | |
| Empty (tare) weight (approximate) | | 2,200 kg<br>4,850 lb | 3,800 kg<br>8,380 lb [83] | 3,935 kg<br>8,675 lb<br>[81][83] | 4,500 kg<br>10,000 lb<br>[81] | 4,920 kg<br>10,850 lb | 5,040 kg<br>11,110 lb |
| Common net load (approximate) | | 28,280 kg<br>62,350 lb | 26,680 kg<br>58,820 lb | 26,545 kg<br>58,522 lb | 28,500 kg<br>62,800 lb | 25,560 kg<br>56,350 lb | 25,440 kg<br>56,090 lb |
| ISO maximum gross mass | | 36,000 kg<br>79,000 lb<br>per ISO 668:2013, amendment 1 (2016) [74][75] | | | | *Not standardized* | |
| U.S. maximum legal truck weights | | 80,000 lb (36,000 kg) overall maximum on Interstate highways /<br>84,000 lb (38,000 kg) (6 or more axles) on non-Interstate highways [84] | | | | | |
| | | Triaxle chassis:<br>44,000 lb<br>(20,000 kg)<br>[76][77] | Triaxle chassis:<br>44,500 lb (20,200 kg) [76][77] | | | | |

## Tests

Here are examples of tests from ISO 1496-1:2013 (Stacking, Lifting, Restraint, wall, roof and floor Strength, Rigidity).[85]

| # | Tests | |
|---|---|---|
| 1 | Stacking | C500 |
| 2 | Lifting from appropriate set of four top corner fittings | C600 |
| 3 | Lifting from the four bottom corner fittings | C700 |
| 4 | Restaint longitudinal | C800 |
| 5 | Strength of ends walls | C900 |
| 6 | Strength of side walls | Only if designed |
| 7 | Strength of the roof (where provided) | C1100 |
| 8 | Floor strength | C1200 |
| 9 | Rigidity (transverse) | C1300 |
| 10 | Rigidity (longitudinal) | C1400 |
| 11 | Lifting from fork-lift pokets (where fitted) | C1500 |
| 12 | Shoring slots | Only if designed |
| 13 | Weatherproofness | |

# Other sizes

## 'Pallet wide' containers

### Europe

Two 45-foot 'High-cube' containers on a roll-on/roll-off (RoRo) tractor. The text in the yellow arrow on the top unit indicates its extra 2.50 metre (8'2½") width.

European *pallet wide* (or 'PW') containers are minimally wider, and have shallow side corrugation, to offer just enough internal width, to allow common European *Euro-pallets* of 1.20 m ($47\frac{1}{4}$ in) long by 0.80 m ($31\frac{1}{2}$ in) wide,[86] to be loaded with significantly greater efficiency and capacity. Having a typical internal width of 2.44 m ($96\frac{1}{8}$ in),[87] (a gain of ~10 centimetres ($3\frac{15}{16}$ in) over the ISO-usual 2.34 m ($92\frac{1}{8}$ in),[88] gives *pallet-wide* containers a usable internal floor width of 2.40 m ($94\frac{1}{2}$ in), compared to 2.00 m ($78\frac{3}{4}$ in) in standard containers, because the extra width enables their users to either load two Euro-pallets end on end across their width, or three of them side by side (providing the pallets were neatly stacked, without overspill), whereas in standard ISO containers, a strip of internal floor-width of about 33 centimetres (13 in) cannot be used by Euro-pallets.

As a result, while being virtually interchangeable:[87]

- A 20-foot PW can load 15 Euro-pallets – four more, or 36% better than the normal 11 pallets in an ISO-standard 20-foot unit
- A 40-foot PW can load 30 Euro-pallets – five more, or 20% better than the 25 pallets in a standard 40-foot unit, and
- A 45-foot PW can load 34 Euro-pallets – seven more, or 26% better than 27 in a standard 45-foot container.

Some *pallet-wides* are simply manufactured with the same, ISO-standard floor structure, but with the side-panels welded in, such that the ribs/corrugations are embossed outwards, instead of indenting to the inside.[89] This makes it possible for some *pallet-wides* to be just 2.462 m (96⁷⁄₈ in) wide,[87] but others can be 2.50 m (98³⁄₈ in) wide.[90]

Forty-five-foot containers can be seen sticking out 2.5 feet (0.76 m), as part of the forty foot container stacks at the back of this ship.

Many sea shipping providers in Europe allow these on board, as their external width overhangs over standard containers are sufficiently minor that they fit in the usual interlock spaces in ship's holds,[89] as long as their corner-castings patterns (both in the floor and the top) still match with regular 40-foot units, for stacking and securing.

#### 45-foot containers

The 45 ft (13.72 m) pallet-wide high-cube container has gained particularly wide acceptance, as these containers can replace the 13.6 m (44 ft 7³⁄₈ in) swap bodies that are common for truck transport in Europe. The EU has started a standardization for pallet wide containerization in the European Intermodal Loading Unit (EILU) initiative.[91]

#### Australia

Australian RACE containers are also slightly wider to optimise them for the use of Australia Standard Pallets, or are 41 ft (12.5 m) long and 2.5 m (8 ft 2 in) wide to be able to fit up to 40 pallets.[92][93]

Although the below described sizes are not exclusively used in the U.S. (they are also used in cargo traffic across the borders, into Canada and Mexico), they are predominantly United States initiatives.

Container "Toplifter" forklift moving two empty 53-foot boxes by their 40-foot posts

# North America domestic containers

### 48-foot containers

The 48’ shipping container is a Very Uncommon High Cube container in that it is 9 ft 6 in (2.90 m) tall on the exterior. It is 8 ft 6 in (2.59 m) wide which makes it 6 inches (15 cm) wider than ISO-standard containers.[94] This size was introduced by container shipping company APL (formerly American President Lines) in 1986, and is used domestically in North America on road and rail,[95] but can only be transported on deck by ships. This size being 8 feet (2.44 m) longer and 6 inches (15 cm) wider has 29% more volume capacity than the standard 40-ft High-Cube,[96] yet costs of moving it by truck or rail are almost the same.

### 53-foot containers

General purpose 53’ containers were introduced in the United States in 1989, and are used both in the US and Canada, mainly for domestic road and rail transport.[95] They are considered High-Cubes, based on their 9 ft 6 in (2.90 m) ISO-standard height. Their width of 8 ft 6 in (2.59 m) however makes them 6 inches (15 cm) wider than ISO-standard containers.[94] These large boxes have 60% more capacity than 40’ containers, enabling shippers to consolidate more cargo into fewer containers. [96][97][98]

Swift 53 ft intermodal container

Generally, North American 53-foot containers were not constructed strong enough to endure the rigors of ocean transport, but in 2007 container carrier American President Lines introduced the first 53-foot ocean-capable containers. All new, reinforced 53-foot boxes were built specifically for international trade and designed to withstand ocean voyages on its South China-to-Los Angeles service.[95] In 2013 however, APL stopped offering vessel space for 53-foot containers on its trans-Pacific ships.[99] Nevertheless, In 2015 both Crowley and TOTE Maritime each announced the construction of their respective second combined container and roll-on/roll-off ships for Puerto Rico trade, with the specific design to maximize cubic cargo capacity by carrying 53-foot, 102-inch wide (2,591 mm) containers.[100] [101] Within Canada, Oceanex offers 53-foot-container ocean service to and from Newfoundland.[102] Fifty-three-foot containers are also being used on some Asia Pacific international shipping routes.[72]

### 60-foot containers

In May 2017, Canadian Tire and Canadian Pacific Railway announced deployment of the first **60-foot** intermodal containers in North America. The containers allow Canadian Tire to increase the volume of goods shipped per container by 13%.[103]

# Small containers

The ISO 668 standard has so far never standardized 10 ft (3 m) containers to be the same height as so-called "Standard-height", 8 ft 6 in (2.59 m), 20- and 40-foot containers. By the ISO standard, 10-foot (and previously included 5-ft and $6\frac{1}{2}$-ft boxes) are only of unnamed, 8-foot (2.44 m) height. But industry makes 10-foot units more frequently of 8 ft 6 in (2.59 m) height,[88] to mix, match (and stack) better in a fleet of longer, 8 ft 6 in tall containers. Smaller units, on the other hand, are no longer standardized, leading to deviating lengths, like 8 ft (2.44 m) or $6\frac{1}{2}$ ft (1.98 m), with non-standard widths of 2.20 m / 86.6 in and 1.95 m / 76¾ in respectively, and non-standard heights of 2.26 m / 7 ft 5 in and 1.91 m / 6 ft 3.2 in respectively,[88] for storage or off-shore use.

## U.S. military

The United States military continues to use small containers, strongly reminiscent of their Transporter and Conex boxes of the 1950s and 1960s. These mostly comply with (previous) ISO standard dimensions, or are a direct derivative thereof. Current terminology of the United States armed forces calls these small containers Bicon, Tricon and Quadcon, with sizes that correspond with (previous) ISO 668 standard sizes 1D, 1E and 1F respectively. These containers are of a standard 8 ft (2.44 m) height, and with a footprint size either one half (Bicon), one third (Tricon) or one quarter (Quadcon) the size of a standard 20-foot, one TEU container.[104][105][106] At a nominal length of 10 feet (3.05 m), two Bicons coupled together lengthwise match one 20-foot ISO container, but their height is 6 inches (152 mm) shy of the more commonly available 10-foot ISO containers of so-called 'standard' height, which are 8 ft 6 in (2.59 m) tall. Tricons and Quadcons however have to be coupled transversely – either three or four in a row – to be stackable with twenty foot containers.[107] Their length of 8 ft (2.44 m) corresponds to the width of a standard 20-foot container, which is why there are forklift pockets at their ends, as well as in the sides of these boxes, and the doors only have one locking bar each. The smallest of these, the Quadcon, exists in two heights: 96 in (2.44 m) or 82 in (2.08 m).[108] Only the first conforms to ISO-668 standard dimensions (size 1F).

### Japan: 12-foot containers

In Japan's domestic freight rail transport, most of the containers are 12 ft (3.66 m) long in order to fit Japan's unique standard pallet sizes.[109]

**Gallery: Small container size examples**

12-foot (3.66 m) the 19D-type container used by JR Freight in Japan

U.S. Navy tractor moves Quadcon containers at Kin Red Port in Okinawa (2005)

U.S. Navy load Tricon containers into a Lockheed C-5 Galaxy transport aircraft (2006)

U.S. Navy moving a Bicon box. Note the forklift pockets only in the sides, not at the ends.

## Reporting mark

Each container is allocated a standardized ISO 6346 reporting mark (ownership code), four letters long ending in either U, J or Z, followed by six digits and a check digit.[110] The ownership code for intermodal containers is issued by the Bureau International des Containers (International container bureau, abbr. B.I.C.) in France, hence the name "BIC-Code" for the intermodal container reporting mark. So far there exist only four-letter BIC-Codes ending in "U".

The placement and registration of BIC Codes is standardized by the commissions TC104 and TC122 in the JTC1 of the ISO which are dominated by shipping companies. Shipping containers are labelled with a series of identification codes that includes the manufacturer code, the ownership code, usage classification code, UN placard for hazardous goods and reference codes for additional transport control and security.

Following the extended usage of pallet-wide containers in Europe the EU started the Intermodal Loading Unit (ILU) initiative. This showed advantages for intermodal transport of containers and swap bodies. This led to the introduction of ILU-Codes defined by the standard EN 13044 which has the same format as the earlier BIC-Codes. The International Container Office BIC agreed to only issue ownership codes ending with U, J or Z. The new allocation office of the UIRR (International Union of Combined Road-Rail Transport Companies) agreed to only issue ownership reporting marks for swap bodies ending with A, B, C, D or K – companies having a BIC-Code ending with U can allocate an ILU-Code ending with K having the same preceding letters. Since July 2011 the new ILU codes can be registered, beginning with July 2014 all intermodal ISO containers and intermodal swap bodies must have an ownership code and by July 2019 all of them must bear a standard-conforming placard.[111]

Various markings on the rear end of a MOL container

# Handling

Containers are transferred between rail, truck, and ship by container cranes at container terminals. Forklifts, reach stackers, straddle carriers, container jacks and cranes may be used to load and unload trucks or trains outside of container terminals. Swap bodies, sidelifters, tilt deck trucks, and hook trucks allow transfer to and from trucks with no extra equipment.

ISO-standard containers can be handled and lifted in a variety of ways by their corner fixtures, but the structure and strength of 45-foot (type E) containers limits their tolerance of side-lifting, nor can they be forklifted, based on ISO 3874 (1997).[112]


A cargo container being transferred from a rail car to a flat-bed truck, lifted by a reach stacker

# Transport

Containers can be transported by container ship, truck and freight trains as part of a single journey without unpacking. Units can be secured in transit using "twistlock" points located at each corner of the container. Every container has a unique BIC code painted on the outside for identification and tracking, and is capable of carrying up to 20–25 tonnes. Costs for transport are calculated in twenty-foot equivalent units (TEU).

## Rail

When carried by rail, containers may be carried on flatcars or well cars. The latter are specially designed for container transport, and can accommodate double-stacked containers. However, the loading gauge of a rail system may restrict the modes and types of container shipment. The smaller loading gauges often found in European railroads will only accommodate single-stacked containers. In some countries, such as the United Kingdom, there are sections of the rail network through which high-cube containers cannot pass, or can pass through only on well cars. On the other hand, Indian Railways runs double-stacked containers on flatcars under 25 kV overhead electrical wires. The wires must be at least 7.45 metres (24 ft 5 in) above the track. China Railway also runs double-stacked containers under overhead wires, but must use well cars to do so, since the wires are only 6.6 metres (21 ft 8 in) above the track.[113]

A portion of a "double stack" container train operated by Union Pacific Railroad, the containers are owned by Pacer Stacktrain, the well cars by TTX.

### Sea

About 90% of non-bulk cargo worldwide is transported by container, and the largest container ships can carry over 19,000 TEU (Twenty-Foot Equivalent, or how many 20 foot containers can fit on a ship). Between 2011 and 2013, an average of 2,683 containers were reported lost at sea.[114] Other estimates go up to 10,000; of these 10% are expected to contain chemicals toxic to marine life.[115] Various systems are used for securing containers on ships.[116][117] Losses of containers at sea are low.[118]

### Air

Containers can also be transported in planes, as seen within intermodal freight transport. However, transporting containers in this way is typically avoided due to the cost of doing such and the lack of availability of planes which can accommodate such awkwardly sized cargo.

There are special aviation containers, smaller than intermodal containers, called unit load devices.

## Securing and security

### Securing containers and contents

There are many established methods and materials for stabilizing and securing intermodal containers loaded on ships, as well as the internal cargo inside the boxes. Conventional restraint methods and materials such as steel strapping and wood blocking and bracing have been around for decades and are still widely used. Polyester strapping and lashing, and synthetic webbings are also common today. Dunnage bags (also known as "air bags") are used to keep unit loads in place.

Flexi-bags can also be directly loaded, stacked in food-grade containers. Indeed, their standard shape fills the entire ground surface of a 20 ft ISO container.

**Methods of securing containers or internal loads**

Containers can be horizontally connected with lashing bridge fittings

Dockworkers securing containers on a ship with steel lashing bars and turnbuckles

Polyester lashing application

Polyester strapping and dunnage bag application

Application in container

### Security

Intermodal containers which contain valuables can be the target of break-ins and burglary when left unattended. In these cases, the container may be fitted with a security system consisting of a motion detector and panel inside the container. The panel can trigger a siren, strobe, or light to deter intruders, or use a radio signal to alert security guards.

Items that were packed incorrectly may come loose and cause a false response from an inside motion detector. If criminals break in by cutting through a wall of the container, the obstructed motion detector becomes useless. Tomographic motion detectors work well in intermodal containers because they do not require a line of sight to detect motion. The entire container is covered by a volumetric sensing mesh that is not blocked by equipment or inventory. Tomographic motion detection is not prone to misdetection due to dirt buildup as is the case for beams and infrared sensors.

## Non-shipping uses

### Containerized equipment

Container-sized units are also often used for moving large pieces of equipment to temporary sites. Specialised containers are particularly attractive to militaries already using containerisation to move much of their freight around. Shipment of specialized equipment in this way simplifies logistics and may prevent identification of high value equipment by enemies. Such systems may include command and control facilities, mobile operating theatres[120] or even missile launchers[121] (such as the Russian 3M-54 Klub surface-to-surface missile).

Complete water treatment systems can be installed in containers and shipped around the world.[122]

Electric generators can be permanently installed in containers to be used for portable power.[123]

Hammelmann diesel unit[119] built into container

### Repurposing

Half the containers that enter the United States leave empty.[124] Their value in the US is lower than in China, so they are sometimes used for other purposes. This is typically but not always at the end of their voyaging lives. The US military often used its Conex containers as on-site storage, or easily transportable housing for command staff and medical clinics.[125] Nearly all of the more than 150,000 Conex containers shipped to Vietnam remained in the country, primarily as storage or other mobile facilities.[26] Permanent or semi-permanent placement of containers for storage is common. A regular forty-foot container has about 4,000 kg (8,818 lb) of steel, which takes 8,000 kWh (28,800 MJ) of energy to melt down. Repurposing used shipping containers is increasingly a practical solution to both social and ecological problems.

Container City in Cholula, Mexico uses fifty old sea containers for 4,500 m$^2$ (48,000 sq ft) of workshops, restaurants, galleries, etc., as well as some homes.

Shipping container architecture employs used shipping containers as the main framing of modular home designs, where the steel may be an integrated part of the design, or be camouflaged into a traditional looking home. They have also been used to make temporary shops, cafes, and computer datacenters, e.g. the Sun Modular Datacenter.

Intermodal containers are not strong enough for conversion to underground bunkers without additional bracing, as the walls cannot sustain much lateral pressure and will collapse. Also, the wooden floor of many used containers could contain some fumigation residues, rendering them unsuitable as confined spaces, such as for prison cells or bunkers. Cleaning or replacing the wood floor can make these used containers habitable, with proper attention to such essential issues as ventilation and insulation.

## See also

- BBC Box
- Boxpark – Food/retail park made from shipping containers Mall
- Conflat
- Container chassis
- Container ship – Ship that carries cargo in intermodal containers
- Containerization – Intermodal freight transport system
- Container port design process
- Customs Convention on Containers – 1956 United Nations and International Maritime Organization treaty
- Double-stack rail transport
- GWR Container
- Inter-box connector
- Intermediate bulk container – Industrial-grade storage and transport container for fluids and solids
- Logistics Vehicle System
- MIL-STD-129
- New York Central container
- RACE
- Re:START Mall
- Re-use – Heavy duty container used for shipping
- Roller container
- Roll trailer
- SECU

- Shipping container – Heavy duty container used for shipping
- Stowage plan for container ships
- Unit load – Size of assemblage into which individual items are combined for ease of storage & handling

# International standards

Tamper seal on the door locking bar handles of an ISO container

- ASTM D5728-00 Standard Practices for Securement of Cargo in Intermodal and Unimodal Surface Transport
- ISO 668:2013 Series 1 freight containers – Classification, dimensions and ratings
- ISO 830:1999 Freight containers – Vocabulary
- ISO 1161:1984 Series 1 freight containers – Corner fittings – Specification
- ISO 1496 – Series 1 freight containers – Specification and testing
  - ISO 1496-1:2013 – Part 1: General cargo containers for general purposes
  - ISO 1496-2:2008 – Part 2: Thermal containers
  - ISO 1496-3:1995 – Part 3: Tank containers for liquids, gases, and pressurized dry bulk
  - ISO 1496-4:1991 – Part 4: Non-pressurized container for dry bulk
  - ISO 1496-5:1991 – Part 5: Platform and platform based containers
- ISO 2308:1972 Hooks for lifting freight containers of up to 30 tonnes capacity – Basic requirements
- ISO 3874:1997 Series 1 freight containers – Handling and securing
- ISO 6346:1995 Freight containers – Coding, identification and marking
- ISO 9897:1997 Freight containers – Container equipment data exchange (CEDEX) – General communication codes
- ISO/TS 10891:2009 Freight containers – Radio frequency identification (RFID) – Licence plate tag
- ISO 14829:2002 Freight containers – Straddle carriers for freight container handling – Calculation of stability
- ISO 17363:2007 Supply chain applications of RFID – Freight containers
- ISO/PAS 17712:2006 Freight containers – Mechanical seals
- ISO 18185-2:2007 Freight containers – Electronic seals

# Notes

1. Up from an estimated 18.6 million in 2011[9]
2. 8 ft 6 in length, 6 ft 3 in width and 6 ft 10½ in height, and 9000 lb capacity[20][21]
3. Some sources also mention a 12-foot version.[24][25]
4. The Containerisation International Market Analysis Report: World Container Census 2012, and the Drewry Maritime Research report: Container Census 2012[43]
5. Originally "COR-TEN", a trademark of U.S. Steel Corporation
6. Using "standard" to mean "standard height", as intended within the ISO 668 standard,[46] as opposed to meaning "dry van" or "general purpose" container.[7]
7. Up from an estimated 34.5 million TEU in 2013[6]

8. Heavy 1 TEU containers are habitually stacked low in a vessel, both for the stability of a ship (keep the center of gravity low), as well as being often used under long term contracts, providing *financial* stability.[59]
9. Infrequently there are two sets,[60] an outer set which may be used for loaded handling, and an inner set only for unloaded handling, by smaller forklifts.[61]
10. Frequently used abbreviations for the most common ISO 6346 types are: **GP** (General Purpose), **HC** / **HQ** (High Cube), **OT** (Open Top), **RF** (Refrigerated), **RK** (Rack) and **TK** (Tank).[64]
11. The term "Series 1" in the standards' names expresses the interrelated nature of the standards, leaving room for another such series in the future. In 2012, Michel Hennemand, president of the International Container Bureau (BIC), and chair of ISO Technical committee 104, subcommittee SC 1: *General purpose containers*, asked whether the time has come to develop a new series of standards on containers (Series 2), to accommodate new sizes like American 53-foot and European Pallet-wide containers. A new series which, given the significant investments required by the industry, would replace the current series of standards (series 1) in the next 20 or 25 years.[72]
12. Forty-five-foot containers were not standardized by the ISO until the 2005 Amendment No. 2 to the ISO 668:1995 standard.[46]

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# External links

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# Intermodal freight transport


Containers being transferred to a cargo ship at the container terminal of Bremerhaven.

**Intermodal freight transport** involves the transportation of freight in an intermodal container or vehicle, using multiple modes of transportation (e.g., rail, ship, aircraft, and truck), without any handling of the freight itself when changing modes. The method reduces cargo handling, and so improves security, reduces damage and loss, and allows freight to be transported faster. Reduced costs over road trucking is the key benefit for inter-continental use. This may be offset by reduced timings for road transport over shorter distances.

Intermodal ship-to-rail transfer of containerized cargos at APM terminals in Portsmouth, Virginia.

## Contents

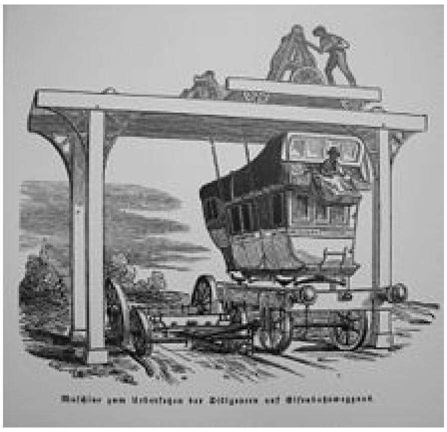


## Origins

Intermodal transportation has its origin in 18th century England and predates the railways. Some of the earliest containers were those used for shipping coal on the Bridgewater Canal in England in the 1780s. Coal containers (called "loose boxes" or "tubs") were soon deployed on the early canals and railways and were used for road/rail transfers (road at the time meaning horse-drawn vehicles).

Wooden coal containers were first used on the railways in the 1830s on the Liverpool and Manchester Railway. In 1841, Isambard Kingdom Brunel introduced iron containers to move coal from the vale of Neath to Swansea Docks. By the outbreak of the First World War the Great Eastern Railway was using wooden containers to trans-ship passenger luggage between trains and sailings via the port of Harwich.

The early 1900s saw the first adoption of covered containers, primarily for the movement of furniture and intermodal freight between road and rail. A lack of standards limited the value of this service and this in turn drove standardisation. In the U.S. such containers, known as "lift vans", were in use from as early as 1911.



A stagecoach transferred to a railroad car with a simple gantry crane, an example of early intermodal freight transport by the French Mail, 1844. The drawing is exhibited in Deutsches Museum Verkehrszentrum, Munich, Germany.

# Intermodal container

## Early containers

In the United Kingdom containers were first standardised by the Railway Clearing House (RCH) in the 1920s, allowing both railway-owned and privately-owned vehicles to be carried on standard container flats. By modern standards these containers were small, being 1.5 or 3.0 meters (4.9 or 9.8 ft) long, normally wooden and with a curved roof and insufficient strength for stacking. From 1928 the London, Midland & Scottish Railway offered "door to door" intermodal road-rail services using these containers. This standard failed to become popular outside the United Kingdom.

Transferring freight containers on the London, Midland & Scottish Railway (LMS; 1928).

Pallets made their first major appearance during World War II, when the United States military assembled freight on pallets, allowing fast transfer between warehouses, trucks, trains, ships, and aircraft. Because no freight handling was required, fewer personnel were needed and loading times were decreased.

Truck trailers were first carried by railway before World War II, an arrangement often called "piggyback", by the small Class I railroad, the Chicago Great Western in 1936. The Canadian Pacific Railway was a pioneer in piggyback transport, becoming the first major North American railway to introduce the service in 1952. In the United Kingdom, the big four railway companies offered services using standard RCH containers that could be craned on and off the back of trucks. Moving companies such as Pickfords offered private services in the same way.

## Containerization

In 1933 in Europe, under the auspices of the International Chamber of Commerce, The International Container Bureau (French: Bureau International des Conteneurs, BIC) was established. In June 1933, *Bureau International des Containers et du Transport Intermodal* (B.I.C.) decided about obligatory parameters for container use in international traffic. Containers handled by means of lifting gear, such as cranes, overhead conveyors, etc. for traveling elevators (group I containers), constructed after July 1, 1933. Obligatory Regulations:

- Clause 1 — Containers are, as regards form, either of the closed or the open type, and, as regards capacity, either of the heavy or the light type.
- Clause 2 — The loading capacity of containers must be such that their total weight (load, plus tare) is: 5 tonnes (4.92 long tons; 5.51 short tons) for containers of the heavy type; 2.5 tonnes (2.46 long tons; 2.76 short tons) for containers of the light type; a tolerance of 5 percent excess on the total weight is allowable under the same conditions as for wagon loads.

Obligatory norms for European containers since 1 July 1933

| Category | Length [m (ft in)] | [m (ft in)] | [m (ft in)] | Total mass [tons] |
|---|---|---|---|---|
| **Heavy types** | | | | |
| Close type 62 | 3.25 m (10 ft 8 in) | 2.15 m (7 ft $\frac{5}{8}$ in) | 2.20 m (7 ft 2$\frac{5}{8}$ in) | 5 t (4.92 long tons; 5.51 short tons) |
| Close type 42 | 2.15 m (7 ft $\frac{5}{8}$ in) | 2.15 m (7 ft $\frac{5}{8}$ in) | 2.20 m (7 ft 2$\frac{5}{8}$ in) | |
| Open type 61 | 3.25 m (10 ft 8 in) | 2.15 m (7 ft $\frac{5}{8}$ in) | 1.10 m (3 ft 7$\frac{1}{4}$ in) | |
| Open type 41 | 2.15 m (7 ft $\frac{5}{8}$ in) | 2.15 m (7 ft $\frac{5}{8}$ in) | 1.10 m (3 ft 7$\frac{1}{4}$ in) | |
| **Light Type** | | | | |
| Close type 22 | 2.15 m (7 ft $\frac{5}{8}$ in) | 1.05 m (3 ft 5$\frac{3}{8}$ in) | 2.20 m (7 ft 2$\frac{5}{8}$ in) | 2.5 t (2.46 long tons; 2.76 short tons) |
| Close type 201 | 2.15 m (7 ft $\frac{5}{8}$ in) | 1.05 m (3 ft 5$\frac{3}{8}$ in) | 1.10 m (3 ft 7$\frac{1}{4}$ in) | |
| Open type 21 | 2.15 m (7 ft $\frac{5}{8}$ in) | 1.05 m (3 ft 5$\frac{3}{8}$ in) | 1.10 m (3 ft 7$\frac{1}{4}$ in) | |

In April 1935 BIC established a second standard for European containers:[1]

Obligatory norms for European containers since 1 April 1935

| Category | Length [m (ftin)] | Width [m (ftin)] | High [m (ftin)] | Total mass [tons] |
|---|---|---|---|---|
| **Heavy types** | | | | |
| Close 62 | 3.25 m (10 ft 8 in) | 2.15 m (7 ft $\frac{5}{8}$ in) | 2.55 m (8 ft 4$\frac{3}{8}$ in) | 5 t (4.92 long tons; 5.51 short tons) |
| Close 42 | 2.15 m (7 ft $\frac{5}{8}$ in) | 2.15 m (7 ft $\frac{5}{8}$ in) | 2.55 m (8 ft 4$\frac{3}{8}$ in) | |
| Open 61 | 3.25 m (10 ft 8 in) | 2.15 m (7 ft $\frac{5}{8}$ in) | 1.125 m (3 ft 8$\frac{5}{16}$ in) | |
| Open 41 | 2.15 m (7 ft $\frac{5}{8}$ in) | 2.15 m (7 ft $\frac{5}{8}$ in) | 1.125 m (3 ft 8$\frac{5}{16}$ in) | |
| **Light Type** | | | | |
| Close 32 | 1.50 m (4 ft 11 in) | 2.15 m (7 ft $\frac{5}{8}$ in) | 2.55 m (8 ft 4$\frac{3}{8}$ in) | 2.5 t (2.46 long tons; 2.76 short tons) |
| Close 22 | 1.05 m (3 ft 5$\frac{3}{8}$ in) | 2.15 m (7 ft $\frac{5}{8}$ in) | 2.55 m (8 ft 4$\frac{3}{8}$ in) | |

In the 1950s, a new standardized steel Intermodal container based on specifications from the United States Department of Defense began to revolutionize freight transportation. The International Organization for Standardization (ISO) then issued standards based upon the U.S. Department of Defense standards between 1968 and 1970.

Highway semi-trailers in piggyback service at Albuquerque, New Mexico.

The White Pass & Yukon Route railway acquired the world's first container ship, the *Clifford J. Rogers*, built in 1955, and introduced containers to its railway in 1956. In the United Kingdom the modernisation plan, and in turn the Beeching Report, strongly pushed containerization. British Railways launched the Freightliner service carrying 8-foot (2.4 m) high pre-ISO containers. The older wooden containers and the pre-ISO containers were rapidly replaced by 10-and-20-foot (3.0 and 6.1 m) ISO standard containers, and later by 40-foot (12 m) containers and larger.

In the U.S., starting in the 1960s, the use of containers increased steadily. Rail intermodal traffic tripled between 1980 and 2002, according to the Association of American Railroads (AAR), from 3.1 million trailers and containers to 9.3 million. Large investments were made in intermodal freight projects. An example was the US$740 million Port of Oakland intermodal rail facility begun in the late 1980s.[2][3]

Since 1984, a mechanism for intermodal shipping known as double-stack rail transport has become increasingly common. Rising to the rate of nearly 70% of the United States' intermodal shipments, it transports more than one million containers per year. The double-stack rail cars design significantly reduces damage in transit and provides greater cargo security by cradling the lower containers so their doors cannot be opened. A succession of large, new, domestic container sizes was introduced to increase shipping productivity. In Europe, the more restricted loading gauge has limited the adoption of double-stack cars. However, in 2007 the Betuweroute, a railway from Rotterdam to the German industrial heartland, was completed, which may accommodate double-stacked containers in the future. Other countries, like New Zealand, have numerous low tunnels and bridges that limit expansion for economic reasons.

Since electrification generally predated double-stacking, the overhead wiring was too low to accommodate it. However, India is building some freight-only corridors with the overhead wiring at 7.45 m above rail, which is high enough.[4]

## Containers and container handling

Containers, also known as intermodal containers or ISO containers because the dimensions have been defined by ISO, are the main type of equipment used in intermodal transport, particularly when one of the modes of transportation is by ship. Containers are 8-foot (2.4 m) wide by 8-foot (2.4 m) or 9-foot-6-inch (2.90 m) high. Since introduction, there have been moves to adopt other heights, such as 10-foot-6-inch (3.20 m). The most common lengths are 20 feet (6.1 m), 40 feet (12 m), 45 feet (14 m), 48 and 53 feet (15 and 16 m), although other lengths exist. The three common sizes are:

Intermodal ship-to-rail transfer of containerized cargos at the Port in Long Beach, California.

- one TEU – 20-by-8-foot (6.1 m × 2.4 m) × 8-foot-6-inch (2.59 m)
- two TEU – 40-by-8-foot (12.2 m × 2.4 m) × 8-foot-6-inch (2.59 m)
- highcube−40-by-8-foot (−12.2 m × 2.4 m) × 9-foot-6-inch (2.90 m).

In countries where the railway loading gauge is sufficient, truck trailers are often carried by rail. Variations exist, including open-topped versions covered by a fabric curtain are used to transport larger loads. A container called a *tanktainer*, with a tank inside a standard container frame, carries liquids. Refrigerated containers (reefer) are used for perishables. Swap body units have the same bottom corners as intermodal containers but are not strong enough to be stacked. They have folding legs under their frame and can be moved between trucks without using a crane.

Handling equipment can be designed with intermodality in mind, assisting with transferring containers between rail, road and sea. These can include:

- container gantry crane for transferring containers from seagoing vessels onto either trucks or rail wagons. A spreader beam moves in several directions allowing accurate positioning of the cargo. A container crane is mounted on rails moving parallel to the ship's side, with a large boom spanning the distance between the ship's cargo hold and the quay.[5]
- Straddle carriers, and the larger rubber tyred gantry crane are able to straddle container stacks as well as rail and road vehicles, allowing for quick transfer of containers.[5]
- Grappler lift, which is very similar to a straddle carrier except it grips the bottom of a container rather than the top.
- Reach stackers are fitted with lifting arms as well as spreader beams for lifting containers to truck or rail and can stack containers on top of each other.[5]
- Sidelifters are a road-going truck or semi-trailer with cranes fitted at each end to hoist and transport containers in small yards or over longer distances.
- Forklift trucks in larger sizes are often used to load containers to/from truck and rail.
- Flatbed trucks with special chain assemblies such as QuickLoadz can pull containers onto or off of the bed using the corner castings.[6]

## Load securing in intermodal containers

According to the European Commission Transportation Department “it has been estimated that up to 25% of accidents involving trucks can be attributable to inadequate cargo securing”.[7] Cargo that is improperly secured can cause severe accidents and lead to the loss of cargo, the loss of lives, the loss of vehicles, ships and airplane; not to mention the environmental hazards it can cause. There are many different ways and materials available to stabilize and secure cargo in containers used in the various modes of transportation. Conventional Load Securing methods and materials such as steel banding and wood blocking & bracing have been around for decades and are still widely used. In the last few years the use of several, relatively new and unknown Load Securing methods have become available through innovation and technological advancement including polyester strapping and -lashing, synthetic webbings and Dunnage Bags, also known as air bags.

**Load securing in intermodal containers**

Application in container.

Polyester strapping and dunnage bag application.

Polyester lashing application.

# Transportation modes

## Container ships


The 300-meter (984-foot) long container ship CMA CGM *Balzac*

Container ships are used to transport containers by sea. These vessels are custom-built to hold containers. Some vessels can hold thousands of containers. Their capacity is often measured in TEU or FEU. These initials stand for "twenty-foot equivalent unit," and "forty-foot equivalent unit," respectively. For example, a vessel that can hold 1,000 40-foot containers or 2,000 20-foot containers can be said to have a capacity of 2,000 TEU. After the year 2006, the largest container ships in regular operation are capable of carrying in excess of 15,000 TEU.[8][9]

Onboard ships they are typically stacked up to seven units high.

A key consideration in the size of container ships is that larger ships exceed the capacity of important sea routes such as the Panama and Suez canals. The largest size of container ship able to traverse the Panama canal is referred to as Panamax, which is presently around 5,000 TEU. A third set of locks is planned as part of the Panama Canal expansion project to accommodate container ships up to 12,000 TEU in future, comparable to the present Suezmax.[10]

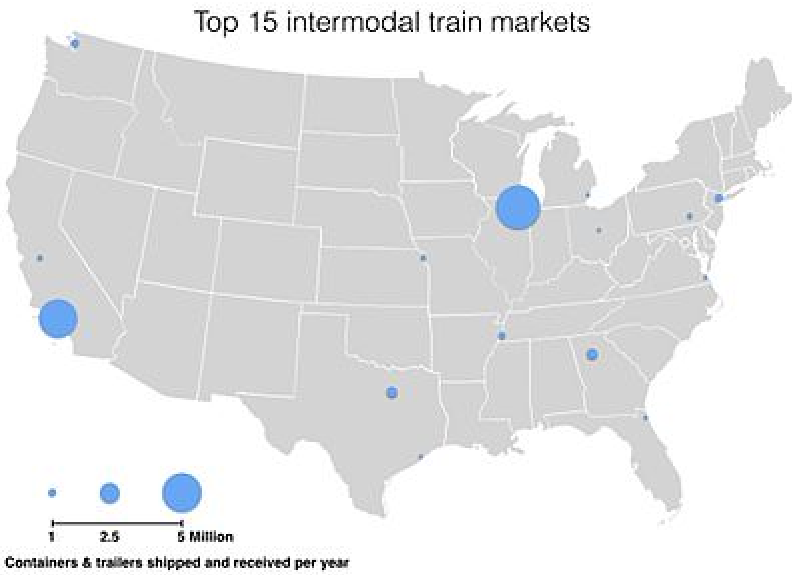
Very large container ships also require specialized deep water terminals and handling facilities. The container fleet available, route constraints, and terminal capacity play a large role in shaping global container shipment logistics.[11][12]

## Railways

A P&O Nedlloyd intermodal container in a Tiphook well wagon at Banbury station in the UK in 2001

A portion of a "double stack" container train operated by Union Pacific Railroad; the containers are owned by Pacer Stacktrain, the cars by TTX.

In North America, containers are often shipped by rail in container well cars. These cars resemble flatcars but the newer ones have a container-sized depression, or well, in the middle (between the bogies or "trucks") of the car. This depression allows for sufficient clearance to allow two containers to be loaded in the car in a "double stack" arrangement. The newer container cars also are specifically built as a small articulated "unit", most commonly in components of three or five, whereby two components are connected by a *single* bogie as opposed to two bogies, one on each car. Double stacking is also used in parts of Australia. On some older railways, particularly in the United Kingdom, the use of well cars is necessary to carry single stacked large containers within the loading gauge.




It is also common in North America to transport semi-trailers on railway flatcars or spine cars, an arrangement called "piggyback" or TOFC *(trailer on flatcar)* to distinguish it from *container on flatcar* (COFC). Some flatcars are designed with collapsible trailer hitches so they can be used for trailer or container service.[13] Such designs allow trailers to be rolled on from one end, though lifting trailers on and off flatcars by specialized loaders is more common. TOFC terminals typically have large areas for storing trailers pending loading or pickup.[14]

If the rail line has been built with sufficient vertical clearance then double-stack rail transport can be used. Where lines are electrified with overhead electric wiring double stacking is normally not possible. The mandatory requirement to fit under overhead wire for the traction engine electrical power supply sets the height limit for the railcars to allow for trailer transport. This requires a certain low building height which led to a minor size of wheels for the railcars. Hence increased degradation of bogeys by wheel wear-out is a cost disadvantage for the system.

When carried by rail, containers can be loaded on flatcars or in container well cars. In Europe, stricter railway height restrictions (smaller loading gauge and structure gauge) and overhead electrification prevent containers from being stacked two high, and containers are hauled one high either on standard flatcars or other railroad cars. Taller containers are often carried in well wagons (not stacked) on older European railway routes where the loading gauge (especially with the reduced gauge for UK lines) is particularly small.

Narrow gauge railways of 610 mm (2 ft) gauge have smaller wagons that do not readily carry ISO containers, nor do the 30-foot (9.14 m) long and 7-foot (2.13 m) wide wagons of the 762 mm (2 ft 6 in) gauge Kalka-Shimla Railway. Wider narrow gauge railways of e.g. 914 mm (3 ft) and 1,000 mm (3 ft 3⅜ in) gauge can take ISO containers, provided that the loading gauge allows it.

## Trucks

A truck transporting a container on Interstate 95 in South Florida.

Trucking is frequently used to connect the "linehaul" ocean and rail segments of a global intermodal freight movement. This specialized trucking that runs between ocean ports, rail terminals, and inland shipping docks, is often called drayage, and is typically provided by dedicated drayage companies or by the railroads.[15] As many rail lines in the United States terminate in or around Chicago, Illinois, the area serves as a common relay point for containerized freight moving across the country. Many of the motor carriers call this type of drayage “crosstown loads” that originate at one rail road and terminate at another. For example, a container destined for the east coast from the west will arrive in Chicago either via the Union Pacific or BNSF Railway and have to be relayed to one of the eastern railroads, either CSX or Norfolk Southern.

## Barges

Barges utilising ro-ro and container-stacking techniques transport freight on large inland waterways such as the Rhine/Danube in Europe and the Mississippi River in the U.S.[5]

## Land bridges

The term *landbridge* or *land bridge* is commonly used in the intermodal freight transport sector. When a containerized ocean freight shipment travels across a large body of land for a significant distance, that portion of the trip is referred to as the "land bridge" and the mode of transport used is rail transport. There are three applications for the term.

- *Land bridge* – An intermodal container shipped by ocean vessel crosses an entire body of land/country/continent before being reloaded on a cargo ship. For example, a container shipment from China to Germany is loaded onto a ship in China, unloads at a Los Angeles port, travels via rail transport to a New York/New Jersey port, and loads on a ship for Hamburg. Also see Eurasian Land Bridge.
- *Mini land bridge* – An intermodal container shipped by ocean vessel from country A to country B passes across a large portion of land in either country A or B. For example, a container shipment from China to New York is loaded onto a ship in China, unloads at a Los Angeles port and travels via rail transport to New York, the final destination.
- *Micro land bridge* – An intermodal container shipped by ocean vessel from country A to country B passes across a large portion of land to reach an interior inland destination. For example, a container shipment from China to Denver, Colorado, is loaded onto a ship in China, unloads at a Los Angeles port and travels via rail transport to Denver, the final destination.[16][17]

The term *reverse land bridge* refers to a *micro land bridge* from an east coast port (as opposed to a west coast port in the previous examples) to an inland destination.

Image of a land bridge.

Image of a mini land bridge.

Image of a micro land bridge.


Image of a reverse land bridge.

## Planes

Generally modern, bigger planes usually carry cargo in the containers. Sometimes even the checked luggage is first placed into containers, and then loaded onto the plane.[18] Of course because of the requirement for the lowest weight possible (and very important, little difference in the viable mass point), and low space, specially designed containers made from lightweight material are often used. Due to price and size, this is rarely seen on the roads or in ports. However, large transport aircraft make it possible to even load standard container(s), or use standard sized containers made of much lighter materials like titanium or aluminium.

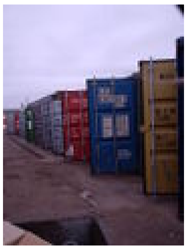
## Biggest shipping liner companies by TEU capacity

Top 20 container shipping companies in order of TEU capacity, 6 January 2016

| Company | TEU capacity[19] | Number of ships[20] |
|---|---|---|
| A.P. Moller-Maersk Group | 2,996,188 | 585 |
| Mediterranean Shipping Company | 2,678,779 | 496 |
| CMA CGM | 1,819,351 | 460 |
| Evergreen Marine Corporation | 931,849 | 195 |
| Hapag-Lloyd | 930,398 | 174 |
| COSCO | 870,222 | 162 |
| CSCL | 684,640 | 134 |
| Hamburg Süd | 645,889 | 136 |
| Hanjin Shipping | 626,217 | 104 |
| OOCL | 561,522 | 104 |
| MOL | 554,425 | 98 |
| Yang Ming Marine Transport Corporation | 538,912 | 102 |
| APL | 535,007 | 86 |
| UASC | 512,785 | 57 |
| NYK Line | 495,723 | 104 |
| K Line | 386,265 | 66 |
| Hyundai Merchant Marine | 379,392 | 57 |
| Pacific International Lines | 362,131 | 147 |
| Zim | 358,264 | 82 |
| Wan Hai Lines | 215,244 | 85 |

## Gallery

Containers at Kuantan Port



ISO-code and dimension/load table on several newly washed containers

Straddle carriers in operation at the Port of Melbourne, Australia

The former Asahi liner train running through Tuam railway station.

## See also

- Combined transport
- Co-modality (by the European Commission)
- Container numbering
- Containerization
- CargoBeamer
- Customs Convention on Containers
- Dunnage Bags
- Double-stack car
- Dry port
- Haulage
- Inland port
- Intermodal container
- Intermodal flatcars
- Konkan Railway Corporation
- Less-Than-Truckload (LTL) Shipping
- Load securing
- Merchant ship
- Modalohr
- Piggy-back
- Roadrailer
- Rolling highway
- Shipping
- Sidelifter
- Swap body
- Tanktainer
- Transloading
- Top intermodal container companies list
- Well car

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# External links

- IANA: The Intermodal Association of North America (http://www.intermodal.org/)
- EIA: European Intermodal Association (http://webarchive.loc.gov/all/20121224203105/http://www.eia-ngo.com/) at the Library of Congress Web Archives (archived 2012-12-24)
- World Transportation Organization (https://web.archive.org/web/20130604022027/http://www.transport.org/) The world transportation organization (The Non-Profit Advisory Organization)

# List of cargo types

## Primary maritime cargo types

| Primary maritime cargo types | | | | |
|---|---|---|---|---|
| **Cargo type** | **Countable** | **Packaging** | **Container** | **Remarks** |
| Break bulk cargo or general cargo | Countable | Yes | No | **Break bulk cargo** or **general cargo** are goods that must be loaded individually, and not in intermodal containers nor in bulk as with oil or grain. Ships that carry this sort of cargo are called general cargo ships. The term *break bulk* derives from the phrase **breaking bulk**—the extraction of a portion of the cargo of a ship or the beginning of the unloading process from the ship's holds. These goods may not be in shipping containers. Break bulk cargo is transported in bags, boxes, crates, drums, or barrels. Unit loads of items secured to a pallet or skid are also used.[1] |
| Bulk cargo (bulk dry cargo) | Weighable | No | No | **Bulk cargo** is commodity cargo that is transported unpackaged in large quantities. It refers to material in either liquid or granular, particulate form, as a mass of relatively small solids, such as petroleum/crude oil, grain, coal, or gravel. This cargo is usually dropped or poured, with a spout or shovel bucket, into a bulk carrier ship's hold, railroad car/railway wagon, or tanker truck/trailer/semi-trailer body. Smaller quantities (still considered "bulk") can be boxed (or drummed) and palletised. Bulk cargo is classified as liquid or dry. |
| Bulk liquid cargo | Weighable | No | No | A **tanker** (or **tank ship** or **tankship**) is a ship designed to transport or store liquids or gases in bulk. Major types of tankship include the oil tanker, the chemical tanker, and gas carrier. Tankers also carry commodities such as vegetable oils, molasses and wine. In the United States Navy and Military Sealift Command, a tanker used to refuel other ships is called an oiler (or replenishment oiler if it can also supply dry stores) but many other navies use the terms tanker and replenishment tanker. A wide range of products are carried by tankers, including:<br>• Hydrocarbon products such as oil, liquefied petroleum gas (LPG), and liquefied natural gas (LNG)<br>• Chemicals, such as ammonia, chlorine, and styrene monomer<br>• Fresh water<br>• Wine<br>• Molasses<br>• Citrus juice |
| Container cargo | Countable | Yes | Yes | **Containerization** is a system of intermodal freight transport using intermodal containers (also called **shipping containers** and **ISO containers**).[2] The containers have standardized dimensions. They can be loaded and unloaded, stacked, transported efficiently over long distances, and transferred from one mode of transport to another—container ships, rail transport flatcars, and semi-trailer trucks—without being opened. The handling system is completely mechanized so that |

| | | | | |
|---|---|---|---|---|
| | | | | all handling is done with cranes [3] and special forklift trucks. All containers are numbered and tracked using computerized systems. |
| Neo-bulk cargo | Weighable | Yes | No | In the ocean shipping trade, **neo-bulk cargo** is a type of cargo that is a subcategory of general cargo, alongside the other subcategories of break-bulk cargo and containerized cargo.[4] (Gerhardt Muller, erstwhile professor at the United States Merchant Marine Academy and Manager of Regional Intermodal Planning of the Port Authority of New York and New Jersey, promotes it from a subcategory to being a third major category of cargo in its own right, alongside general and bulk cargo.[5][6]) It comprises goods that are prepackaged, counted as they are loaded and unloaded (as opposed to bulk cargo where individual items are not counted), not stored in containers, and transferred as units at port.[4] Types of neo-bulk cargo goods include heavy machinery, lumber, bundled steel, scrap iron, bananas, waste paper, and cars.[4][7][6] The category has only become recognized as a distinct cargo category in its own right in recent decades.[5][6] |
| Passenger cargo | Countable | No | No | A **passenger ship** is a merchant ship whose primary function is to carry passengers on the sea. |
| Project cargo | Weighable | Yes | No | **Project cargo** is a term used to broadly describe the national or international transportation of large, heavy, high value, or critical (to the project they are intended for) pieces of equipment. Also commonly referred to as *heavy lift*, this includes shipments made of various components which need disassembly for shipment and reassembly after delivery. |
| Refrigerated cargo | Weighable | Yes | Yes/no | A **reefer ship** is a refrigerated cargo ship, typically used to transport perishable commodities which require temperature-controlled transportation, such as fruit, meat, fish, vegetables, dairy products and other foods. |
| Roll-on/roll-off cargo | Countable | No | No | **Roll-on/roll-off** (**RORO** or **ro-ro**) ships are vessels designed to carry wheeled cargo, such as cars, trucks, semi-trailer trucks, trailers, mafi roll trailers and railroad cars, that are driven on and off the ship on their own wheels or using a platform vehicle, such as a self-propelled modular transporter. This is in contrast to lift-on/lift-off (LOLO) vessels, which use a crane to load and unload cargo. |

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# Load securing

**Load securing**, also known as **cargo securing**, is the securing of cargo for transportation. According to the European Commission Transportation Department "it has been estimated that up to 25% of accidents involving trucks can be attributable to inadequate cargo securing".[1] Cargo that is improperly secured can cause severe accidents and lead to the loss of cargo, lives, and vehicles, or cause environmental hazards.

Cargo damage because of improperly secured cargo

## Contents



## Background

Because of globalization, the subsequent flow of goods that are transported over greater distances, containerization and new regulatory measures [2] has led to a greater demand for efficient, cost effective and environmentally friendly cargo restraint products.

Many types of cargo such as corrugated fiberboard boxes are often formed into a unit load. This often consists of items on a pallet unitized by stretch wrap, shrink wrap, pressure-sensitive tape, or strapping. Larger shipping containers such as crates are often on skids and are ready for loading. These unit loads are placed in intermodal containers, trucks, or railroad cars for shipment. Some large bundled items or large machinery are placed directly into or onto the transport vehicle for shipment.

Load securing functions to hold the unit pallet loads, crates, or other items immobile and secure. An unsecured load can shift in transit and create dangerous dynamics, damaging the cargo and the structure of the vehicle or intermodal container.

## Methods

There are many different ways and materials available to stabilize and secure cargo in vehicles and intermodal containers.[3] Often combinations of load securing methods are use. For example a load can be blocked against the headboard of the truck and have webbing restraints tying it down.

## Blocking and bracing

Blocking and bracing is a load securement method using lumber and metal bars to reduce or inhibit front to rear shifting of freight/cargo. Plastic forms are also used.

## Fasteners

Blocking and Bracing with timber

Depending on the type of load and the particular vehicle, large bolts and nails may be used. These may be on the load itself or on wood blocks used to brace the load. Fasteners rely on the constructional strength of the Cargo Transport Unit (CTU).

## Dunnage

Dunnage for securing cargo includes scrap wood to fill voids in cargo, wooden boards forming "cribs", blocking and bracing, and modern mechanical, spring-loaded post-and-socket systems, Dunnage segregates cargo in the hold and prevents shifting of the cargo in response to ship or vehicle motions. Dunnage stresses the constructional strength of the Cargo Transport Unit (CTU).

## Strapping

Polyester strapping and dunnage bag application

Strapping is used to create a transportable unit. Types of strapping include steel, polyester, polypropylene, nylon, paper, and composites. The type of strap used depends on the requirements, for example, strength, elasticity, ability to withstand various environments, ease of use, safety, and cost. Strapping methods and limits should be according to valid standard, for example EN12195.

All types of tensioned strapping, particularly steel, need to be handled carefully because of potential injury.

## Lashing

Polyester Lashing application

Lashing is the securing of cargo for transportation with the goal of minimizing shifting. Items used for lashing include ropes, cables, wires, chains, strapping, and nets. These items are anchored to the Cargo Transport Unit (CTU) and tensioned against the cargo. Another form of lashing used four devices attached to the top of each corner of a container.[4][5] Lashing products and methods are governed by various authorities such as the Association of American Railroads (AAR) for rail transportation in North

America, the international Maritime Organization (IMO) for ocean transportation, and the National Motor Freight Traffic Association (NMFTA) and European Union standard EN12195.

### Dunnage bags

Dunnage bag application in container

Whereas strapping and lashing is often used to secure odd-shaped cargo such as machinery, structures, and vehicles. Dunnage bags are mostly used for homogeneous shaped cargo such as food & beverage products, electronics and appliances and roll paper. Often, strapping/lashing and dunnage bags are used in combination to secure chemical products. Dunnage Bags are not approved for rail transportation of hazardous materials in the United States.

Dunnage bags, also known as air bags, were introduced some 40 years ago as a convenient, fast and cost effective alternative to secure and stabilize cargo in ISO sea containers, closed rail cars, trucks and (ocean-going) vessels. The purpose of dunnage bags is often misunderstood when they are considered as a void filler only to prevent lateral movement of cargo. When properly applied however, dunnage bags form a 3-dimensional bulkhead of the cargo itself preventing both lateral and longitudinal movement. Dunnage bags rely on the Cargo Transport Unit (CTU) construction, which is to be noted when planning. All cargo movements will therefore stress the construction.

### Tie downs

Chains used on logging truck

Heavy loads are sometimes secured to vehicles with tie down straps, heavy duty strapping, or tensioned chains. Heavy objects with round shape like paper rolls can be difficult to secure. Strong woven tarpaulins manufactured to this purpose can then be used. They work in several ways: first of all the ends of the tarpaulin can be used to block the horizontal movement in longitudinal direction as direct spring lashing, secondly the mid part of the tarpaulin work as a top over lashing where the surface pressure caused by tensioning the strapping is evenly distributed over the entire load and thirdly the tarpaulin forms itself according to the cargo form and prohibits horizontal movements of single cargo items.

## See also

- Break bulk cargo
- Haulage
- Intermodal freight transport
- Stevedore
- Unit Load Device

## Standards

- ASTM D3953 Standard Specification for Strapping, Flat Steel and Seals
- ASTM D3950 Standard Specification for Strapping, Nonmetallic (and Joining Methods)

- ASTM D4649 Guide for Selection and Use of Stretch Wrap Films
- ASTM D4675 Standard Guide for Selection and Use of Flat Strapping Materials
- ASTM D5728 Standard Practices for Securement of Cargo in Intermodal and Unimodal Surface Transport
- EN 12195-1:2010 en - Load restraining on road vehicles - Safety - Part 1: Calculation of securing forces
- EN 12195-2:2000 en - Load restraint assemblies on road vehicles - Safety - Part 2: Web lashing made from man-made fibres
- EN 12195-3:2001 en - Load restraint assemblies on road vehicles - Safety - Part 3: Lashing chains
- EN 12195-4:2004 en - Load restraint assemblies on road vehicles - Safety - Part 4: Lashing steel wire ropes
- EN 12195-1:2010/C1:2013 en - Load restraining on road vehicles - Safety - Part 1: Calculation of securing forces
- EN 12195-1:2010/C2:2014 en - Load restraining on road vehicles - Safety - Part 1: Calculation of securing forces

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# Mail carrier

A **mail carrier**, **mailman**, **mailwoman**, **postal carrier**, **postman**, **postwoman**,[1] or **letter carrier** (in American English), sometimes colloquially known as a **postie** (in Australia,[2] Canada,[3] New Zealand,[4] and the United Kingdom[5]), is an employee of a post office or postal service, who delivers mail and parcel post to residences and businesses. The term "mail carrier" came to be used as a gender-neutral substitute for "mailman" soon after women began performing the job. In the Royal Mail, the official name changed from "letter carrier" to "postman" in 1883,[6] and "postwoman" has also been used for many years.[7]

19th-century English postman

## Contents



20th-century mounted postman in Buenos Aires

## United States

In the United States, there are three types of mail carriers: City Letter Carriers, who are represented by the National Association of Letter Carriers; Rural Carriers, who are represented by the National Rural Letter Carriers' Association; and Highway Contract Route carriers, who are independent contractors. While union membership is voluntary, city carriers are organized nearly 70 percent nationally.[8]

21st-century postman in London delivering mail from a modern mail cart

Letter carriers are paid hourly with the potential for overtime. Letter carriers are also subject to "pivoting" on a daily basis. When a carrier's assigned route will take less than 8 hours to complete, management may "pivot" the said carrier to work on another route to fill that carrier up to 8 hours. It is a tool that postal management uses to redistribute and eliminate overtime costs, based on consultation with the carrier about his/her estimated workload for the day and mail volume projections from the DOIS (Delivery Operations Information System) computer program. Routes are adjusted and/or eliminated based on information (length, time, and overall workload) also controlled by this program, consultations with the carrier assigned to the route, and a current PS Form 3999 (street observation by a postal supervisor to determine accurate times spent on actual delivery of mail).

Rural carriers are under a form of salary called "evaluated hours", usually with overtime built into their pay. The evaluated hours are created by having all mail counted for a period of two or four weeks, and a formula used to create the set dollar amount they will be paid for each day worked until the next time the route is counted.

Highway Contract Routes are awarded to the lowest bidder,[9] and that person then either carries the route themselves or hires carriers to fulfill their contract to deliver the mail.

Letter carriers typically work urban routes that are high density and low mileage. Such routes are classified as either "mounted" routes (for those that require a vehicle) or "walking" routes (for those that are done on foot). When working a mounted route, letter carriers usually drive distinctive white vans with the logo of the United States Postal Service on the side and deliver to curbside and building affixed mailboxes. Carriers who walk generally also drive postal vehicles to their routes, park at a specified location, and carry one "loop" of mail, up one side of the street and back down the other side, until they are back to their vehicle. This method of delivery is referred to as "park and loop". Letter carriers may also accommodate alternate delivery points if "extreme physical hardship" is confirmed.[10] In cases where mail carriers do not have assigned vehicles, they may also get undelivered mail from relay boxes placed along their routes.[11]

Rural carriers typically work routes that have a lower density and higher mileage than those of letter carriers.[12] They all work mounted routes, leaving their vehicles only to deliver to group mailboxes or to deliver an article that must be taken to a customer's door. However, now that former rural areas are being urbanized, their routes are growing very similar to mounted "city routes." Rural carriers often use their own vehicles and are not required to wear a uniform. Because of urbanization around cities and because rural carriers deliver mail at less cost to the Postal Service, the rural carrier craft is the only craft in the Postal Service that is growing.

Highway Contract Route carriers work routes that were established with a density of less than one customer per mile driven (some later become denser and can then be converted to rural delivery). They are only mounted routes, and all HCR carriers use their own vehicle. These routes are typically found in outlying areas, or around very small communities.

The three types of mail carriers are also hired quite differently. A new letter carrier begins as a City Carrier Assistant (CCA).[13] Rural carriers are hired as Rural Carrier Associate (RCA) carriers, without benefits. There is normally an RCA assigned to each rural route and they usually work less frequently than city CCAs. As a result, there are thousands of RCA positions that go unfilled for a lack of applicants and so are covered by other RCAs until the hiring improves[14] for the hiring process explained). Highway Contract Route carriers are hired by the winning bidder for that route. They are not United States Postal Service employees and normally receive lower pay than carriers on city or rural routes.

## Female carriers

Women have been transporting mail in the United States since the late 1800s. According to the United States Post Office archive, "the first known appointment of a woman to carry mail was on 3 April 1845, when Postmaster General Cave Johnson appointed Sarah Black to carry the mail between Charlestown Md P.O. & the Rail Road "daily or as often as requisite at $48 per annum". For at least two years Black served as a mail messenger, ferrying the mail between Charlestown's train depot and its post office."[15]

At least two women, Susanna A. Brunner in New York and Minnie Westman in Oregon, were known to be mail carriers in the 1880s. Mary Fields, nicknamed "Stagecoach Mary", was the first black woman to work for the USPS, driving a stagecoach in Montana from 1895 until the early 1900s.[16] When aviation introduced airmail, the first woman mail pilot was Katherine Stinson who dropped mailbags from her plane at the Montana State Fair in September 1913.[17]

The first women city carriers were appointed in World War I and by 2007, about 59,700 women served as city carriers and 36,600 as rural carriers representing 40 per cent of the carrier force.[18]

Female auxiliary mail carrier collecting mail in Paris during World War I about 1915

# Famous carriers

Famous real-life letter carriers include:

- Berry van Aerle, Dutch football player (35 caps)
- Raymond van Barneveld, who worked as a postman before becoming a professional darts player
- Olivier Besancenot, candidate for the French presidential elections in 2002 and 2007
- Peter Bonetti, English goalkeeper who played for Chelsea F.C.
- Charles Bukowski, novelist and poet
- Allan B. Calhamer, the inventor of board game Diplomacy
- Jean Cameron, Scottish World War 2 postwoman who changed the uniform to allow trousers.[19]
- Steve Carell, American actor[20]
- Ferdinand Cheval, who spent 33 years building an "ideal castle"
- Ace Frehley, original guitarist for the rock band Kiss, worked as a mailman before he became the "Spaceman"
- Domingo French, mailman of the Viceroyalty of the Río de la Plata, turned into revolutionary and soldier during the May Revolution
- Vic Godard, English punk musician, founder of the Subway Sect, became a postman midway through his music career
- Terry Griffiths, a former postman who became a world-champion snooker player
- David Harvey, a goalkeeper who became a postman after leaving football
- Rudolph Hass, developer of the Hass avocado
- Gladys Hillier, English postwoman, inspiration for the title of an album by Fairport Convention
- Brad Hogg, an Australian cricketer who is a former Perth postman
- Alan Johnson, the former UK Shadow Chancellor of the Exchequer[21]
- Kimeru, a famous Japanese pop singer, worked as a mailman before he pursued his singing career
- Keith Knox, a Scottish footballer who also worked as a postman throughout his 25-year career

Postmen homage in Rosario, Argentina; opus by Erminio Blotta, Palace General Post Office

- Tom Kruse, MBE (28 August 1914 – 30 June 2011) was a former mailman on the Birdsville Track in the border area between South Australia and Queensland
- Stephen Law, philosopher. Expelled from school and worked as a postman until being accepted to Trinity College, Oxford to study philosophy
- Jan Nyssen (1957) was a mailman (1977-1997) in Liège (Belgium) and became a Professor of Geography.
- John Prine, Grammy winning folk singer
- Bon Scott, former lead singer of AC/DC was once a 'postie' in Australia
- Allan Smethurst, English singer known as "The Singing Postman"
- Steve Taylor, a footballer who played for Crystal Palace F.C.
- Snowshoe Thompson, mail delivery on skis
- Neil Webb, English footballer who became a postman after leaving professional football

## Fictional carriers


Mister McFeely delivering a letter.

- Cliff Clavin (John Ratzenberger) was a main character on the NBC series *Cheers*
- Gordon Krantz as *The Postman*, main character in the novel and film adaptation (Kevin Costner)
- Newman (Wayne Knight) was a recurring character on the NBC series *Seinfeld*
- Mister McFeely (David Newell) on the PBS series *Mister Rogers' Neighborhood*
- Mister Sprinkles (William Newman (actor)) in the 1993 film *Mrs. Doubtfire*
- Reba the Mail Lady (S. Epatha Merkerson) from the children's TV series *Pee-Wee's Playhouse*
- Tom Tipper, from *The Railway Series* book *Really Useful Engines*, then season 4 of *Thomas & Friends* episode "Mind That Bike"
- Postman Pat, a fictional postman and the title character of the British children's television series, famed for delivering letters in his "bright red van" with Jess, his "black and white cat".

## In heraldry

The coat of arms of Daugailiai, Lithuania features a postman playing post horn.

## See also

- Balloon mail
- Jewish letter carriers
- List of fictional postal employees
- Mail delivery by animal
- Mail satchel

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# External links

- National Association of Letter Carriers (http://www.nalc.org/)
- National Rural Letter Carriers' Association (http://www.nrlca.org/)

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# Outline of transport

The following outline is provided as an overview of and topical guide to transport:

**Transport** or **transportation** – movement of people and goods from one place to another.

## Contents



## Essence of transport

- Driving involves controlling a vehicle, usually a motor vehicle such as a truck, bus, or automobile. For motorcycles, bicycles and animals, it is called riding.
- Shipping, transporting of goods and cargo, by land, sea, and air
- Travel, movement of people, by land, sea, and air

## Types of transport

### By availability

- Private transport
- Public transport (public transit)

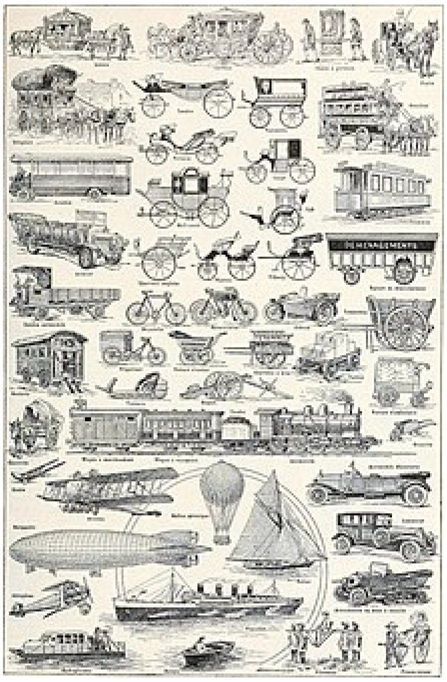
### Modes and vehicles

- Intermodal passenger transport

#### Aviation

Aviation

- Fixed-wing aircraft
- Airship (dirigible)
- Autogyro
- Balloon
- Blimp
- Helicopter
- Human-powered aircraft
- Parachute (downward air transport only)
- Rocket
- Projectile (goods only, normally explosives) / Human cannonball
- Supersonic transport
- Zeppelin



### Animal-powered transport

Animal-powered transport

### Animals domesticated for transport

- Camel
- Dog
- Donkey (burro)
- Elephant
- Homing pigeon
- Horse
- Mule
- Llama
- Ox
- Pigeon (goods only)
- Reindeer
- Yak

### Animal-powered vehicles

- Carriage
- Chariot
- Horse-drawn boat
- Sled
- Stagecoach

### Cable transport

Cable transport

- Aerial tramway

- Cable car (railway)
- Chairlift
  - Detachable chairlift
- Elevator
- Funicular (inclined plane)
- Gondola lift
- List of aerial lift manufacturers
- Paternoster lift
- chain ferry

### Conveyor transport

Conveyor transport

- Conveyor belt
- Escalator
- Moving walkway (moving sidewalk, travelator, and the inclined moving sidewalk, a moving ramp)

### Human-powered transport

Human-powered transport

- Baby transport
- Bicycle
- Boda-boda
- Buggy (cart)
- Filanzane
- Human-powered aircraft
- Ice skate
- Heelies
- Kick scooter
- Litter
- Punt (boat)
- Rickshaw
- Roller skates
- Shopping cart
- Skateboard
- Ski
- Snakeboard
- Swimming
- Tricycle
- Unicycle
- Walking
  - Walking bus

- Watercraft rowing
- Wheelbarrow
- Wheelchair

### Hybrid transport

- Amphibious vehicle
- Hybrid vehicle
- Moped
- Motorized bicycle

### Military transport

#### Air force transport

- Military aircraft

#### Army transport

- Armoured fighting vehicle
- Armoured personnel carrier
- Jeep
- Landing craft
- Limbers and caissons (military)
- Mega Tank
- Mini-Tank
- German Panzer

#### Navy transport

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  - Escort carrier
- Naval ship
- PT boat
- Submarine
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### Ground transportation

Ground transportation

### Motorized road transport

Road transport

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  - Car body styles
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Off-road transport

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### Rail transport

Rail transport

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- High-speed rail
- Locomotive

- Maglev (transport)
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- Multiple unit
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### Pipeline transport

Pipeline transport

- Natural gas
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- Pneumatic tube
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  - Narrowboat
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- Ferry

- Cable ferry
- Horse-drawn boat
- Hydrofoil
- Sailing
- Ship
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### Space transport

Space transport

- Interplanetary spaceflight
- Rocket
- Space Shuttle
- Space station
- Spacecraft
  - Spacecraft propulsion

### Transport on the Moon and Mars

- Lunar rover (various, crewed and robotic, Moon, 1971–1973)
- Lunokhod programme
- Nomad rover (robotic test vehicle, has not been in space, 1997)
- Opportunity rover (MER-B – robotic, Mars, 2004)
- Sojourner (robotic, Mars, 1997)
- Spirit rover (MER-Arobotic, Mars, 2004)

### Space transport launched from the surface of the Moon

- Ascent stage of Apollo Lunar Module, crewed, six times, 1969-1972 (return to Earth in the Apollo program)

### Transmission

Transmission

- Power transmission
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- Transmission (telecommunications)

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# External links

- Institute of Transportation Studies, University of California, Berkeley (http://www.its.berkeley.edu/)
- "Friedrich List" Faculty of Transportation and Traffic Sciences, Dresden - Germany (http://tu-dresden.de/die_tu_dresden/fakultaeten/vkw?set_language=en&cl=en)
- Northwestern University Transportation Library (http://www.library.northwestern.edu/transportation/)

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# Panel van


2001 Citroën Berlingo

A **panel van**, also known as a **blind van**, **car-derived van** (United Kingdom) or **sedan delivery** (United States), is a small cargo vehicle with a passenger car chassis, typically with a single front bench seat and no side windows behind the B-pillar.[1] Panel vans are smaller than panel trucks or cargo vans, both of which use body-on-frame truck chassis.[1]


Austin 35 panel van

As they are derived from passenger cars, the development of panel vans is typically closely linked with the passenger car models upon which they depend. North American panel vans were initially based upon the two-door station wagon models, while Europe's narrower roads dictated that panel vans utilize the smaller donor chassis of subcompact cars in that market. In Australia, panel vans were a development of the ute, a small pickup truck based on a passenger car chassis, e.g. Holden Ute, often using the longer wheelbase of a station wagon chassis.[2][3]

## Contents



## Origins


1931 Ford Model A Sedan Delivery

Panel vans were a well-established body type by the end of the 1920s.[4]

Panel vans have experienced divergent evolution in America, Europe, and Australia, as a result of the different passenger car platforms upon which panel vans are based in each region.

## North America

1940 Ford De Luxe Sedan Delivery

2015 Ram ProMaster City Tradesman Cargo Van

A panel van is often known as a "delivery" or "sedan delivery" in North America. It's an older term that usually only applies to station wagon-based vehicles (sedan deliveries/delivery wagons) such as the Chevrolet Delray and Ford Courier,[5] or pickup-based vans (panel deliveries).[6] Large, boxy unibody vans based on truck platforms (such as the Ford Transit,[7] Ram ProMaster,[8] and Chevrolet Express[9]) as well as smaller unibody vans (like the Ford Transit Connect[10] and Ram Promaster City[11]) are usually referred to as cargo vans or just panel vans. Larger vehicles built on a chassis cab with a custom cargo box are usually called box trucks or moving vans.

In the late 1920s, Ford produced "Town Car Delivery" and "Wood Panel Delivery" as part of the Ford Model A model range.[12] Later Plymouth produced a sedan delivery from 1935 until 1941.[13] Pontiac produced deliveries until 1953 in the U.S. and until 1958 in Canada based on the Pontiac Pathfinder.[14] Sedan delivery models were usually produced in small quantities of 200 or less, for example 449 Canadian Pontiac sedan deliveries were built in 1958.

1971 Chevrolet Vega Panel Express

From 1959 on, the sedan delivery was no longer practical; it was phased out in 1960 as a Chevrolet model, so the requisite Chevrolet body was no longer available.[15] With the growing sales of the Volkswagen Type 2 and the introduction of compact vans, sedan deliveries faded from the scene. Chevrolet dropped the body type after 1960, while Ford moved it to the Falcon line-up until 1965.[16]

In the 1970s, Chevrolet and Ford offered subcompact sedan deliveries with the Chevrolet Vega Panel Express and the Ford Pinto Panel Wagon. The Vega Panel Express was introduced in September 1970 and it was Chevy's first sedan delivery in ten years since the final full-size model was offered in 1960.[17] The Vega Panel Express body style accounted for less than 2% of the total Chevrolet Vegas produced during the 1971 through 1975 model years.[16] First-year sales of the Vega Panel Express peaked at 7,800 units and after leveling off to 4,000 units per year, only 1,525 were sold in 1975.[18] The Pontiac Astre Panel, Pontiac's version of the Vega Panel Express, was available in Canada in the 1973–75 model years and in the US for 1975.[14] The Pinto Panel Wagon was introduced in 1976 and was offered in both a commercial and a "factory customized" Pinto Cruising Wagon version that featured a round porthole style window on each side.[16] The Ford Courier name, previously used for Ford sedan delivery vans, began to be used with Ford's import pickup truck line.[19]

In 2002, Chrysler showed a concept car edition of a panel van based on the PT Cruiser at the North American International Auto Show, but it was not manufactured. In 2007 Chevrolet released a panel van version of the HHR, marketed as the HHR Panel.[20]

The small cargo vans currently sold by American manufacturers are from their overseas divisions, for example, the Ford Transit Connect and Ram ProMaster City; however, both vehicles are planned to be discontinued by their respective manufacturers by 2023 due to lackluster sales.[21]

## Europe

European panel vans of the 20th century include the Citroën 2CV Fourgonnette, Citroën H Van, Citroën C15, Ford Escort, Morris Minor, Renault Estafette, SEAT Inca[22] and more recently the Renault Kangoo and the Opel Combo.[23]

1958 Morris Minor 1000 panel van

2017 Ford Fiesta Delivery

2021 Volkswagen Caddy

From the 1950s onwards, a larger alternative to the panel van was the van (based on a commercial vehicle chassis instead of a passenger car chassis), such as the Volkswagen Type 2, the DKW van and the first-generation Ford Transit in 1965.[24][25][26]

In the United Kingdom, panel vans benefit from having lower taxes than station wagons[27] and do not have the speed restrictions which apply to larger vans.[28] This has given rise to some anomalies. Authorities and dealers are not always certain on what qualifies as a car-derived van.[29] SUVs and crossovers are also popularly turned into light commercial vehicles without rear seats.[30]

Examples of panel vans from the last 30 years are the Renault Kangoo (1997), the Fiat Doblò (2001), Opel Combo (2001), Ford Transit Connect (2002) or the Volkswagen Caddy (2004). They are also purpose-designed to be utilitarian base model MPVs / people carriers, for a range of such vehicles. Since the 1980s, most manufacturers have offered light van versions of their small hatchbacks, sharing bodywork with the regular passenger version. These versions have the rear seats removed and may have blanked rear windows, depending on local regulations.

As of 2019, the market consists of the following models and many more:

- Citroën Berlingo
- Dacia Dokker
- Fiat Fiorino
- Fiat Doblò
- Ford Fiesta Sport Van
- Ford Transit Courier
- Ford Transit Custom
- Mercedes-Benz Citan
- Nissan NV200
- Opel/Vauxhall Combo
- Peugeot Partner
- Renault Kangoo
- Toyota ProAce City
- Volkswagen Caddy

## Australia

The first Holden panel van produced in Australia was the FJ Holden, which was released in December 1953,[31] although many manufacturers offered panel vans in their range prior to this.[32][33][34][35][36][37][38][39] Like many Australian panel vans, it was based on a corresponding ute and station wagon models. In May 1961, Ford Australia released a panel van version of the XK Falcon, marketed as the "sedan delivery" body style.[40] The first panel van by Chrysler Valiant was part of the CL Valiant model range and was introduced in April 1977.[41]


1940 Chevrolet Pullman panel van

1980 Holden HZ Sandman panel van


1998 Ford XH Falcon panel van

Panel vans' combination of cargo space and customisable interior in a relatively compact vehicle made them attractive to painters, electricians, general labourers and film crews.[42] Australian police forces also used panel vans (nicknamed "divvy vans" or "paddywagons").[43]


1953 Holden FJ panel van

Early Australian panel vans used swing-down and -up tailgates and a standard roof height, indicative of their ute and station wagon/sedan delivery origins. In the mid 60s first Holden, then Ford introduced unique rooflines to their panelvan models. These were higher than the previous stagion wagon based roof, giving greater cargo space and functionality. In the early 70s, Ford introduced horizontally opening rear doors (nicknamed "barn doors")

By the early 1970s, when panel vans were in decline in America, they had become cultural icons in Australia.[44] The most popular model was the Holden Sandman, which was marketed to surfing lifestyle.[45][46] The first Sandman was built in small quantities in 1974 in the HQ model range, but the model's popularity greatly increased in the subsequent HJ generation, which was released in October 1974.[47][48] In the 1979 movie *Mad Max*, a modified 1975 HJ Sandman model was one of the vehicles driven by the lead character (played by Mel Gibson).[49]

Ford's competitor to the Sandman was the Surferoo, which was introduced into the XB Falcon model range in 1973.[50][51] In 1977, the Surferoo was replaced by the more popular Sundowner, in the XC Falcon range.[47][45] The traditional tailgate style doors were also reintroduced as an option with the XC range.

In 1976, Chrysler released a similar model called the Drifter, which was part of the Chrysler CL Valiant product range. The Drifter ceased production in 1978.

Younger drivers were especially attracted to panel vans, not least because of the ease with which a mattress could be installed within the cargo bay. Consequently, panel vans also attracted nicknames such as "sin bins," and "shaggin' wagons".[52][53] During the 1970s many Australian panel van owners took to applying airbrush mural art to the sides of their vans, paralleling a similar trend in America.[54] Along with Volkswagen Kombi micro-busses, panel vans were popular with surfers, who could sleep in the cargo bay while carrying surfboards on the roof.

1977 Chrysler CL Valiant Drifter panel van

By the end of 1979, the Sandman had largely lost its place in the contemporary Australian youth culture – order figures were down and many of the vehicles were now being sold with the stripes and tailgate logos deleted. The final Sandman was in the Holden HZ series and featured V8 engines only, along with a four-headlight grille and under bumper front spoiler. In 1979, a basic HZ Holden panel van was priced at A$6,076, with the Sandman option package an additional A$1,700. If a buyer selected every Sandman extra, which would cost in excess of 50% more than a basic HZ panel van, Holden would include a velvet mattress with the Holden logo embroidered. The Sandman ute and panel van were phased out in October 1979, with the end of the HZ series.[55]

Panel vans generally declined in popularity through the 1980s. Holden's last panel van, the WB, ceased production in 1984.[56] Ford was the last manufacturer of Australian panel vans, until production of the XH Falcon, ceased in 1999.

In 2000, Holden unveiled a retro-styled Sandman show car based on the Holden VU Ute. While this Sandman was never released, an canopy or "camper shell" featuring the same styling was made available as an A$6,150 accessory for Holden utes from 2003 through 2006. Installation was complicated, however, and the rear window and cab wall of the ute were retained, preventing movement between the cargo bay and the passenger cab as was possible in purpose-built panel vans.[57]

## See also

- Car body style
- Coupé utility
- Light commercial vehicle
- Panel truck, built on a truck chassis, a panel truck is usually larger than a panel van
- Pickup truck

## Notes

1.^ The Holden Panel van is an exception to the Unibody rule of panel vans, however is not excluded as its ladder chassis is an adaptation of a Unibody passenger car design, and size, towing and ride height classifications to suit.

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# Pickup truck

A **pickup truck** or **pickup** is a light-duty truck that has an enclosed cabin, and a back end made up of a cargo bed that is enclosed by three low walls with no roof (this cargo bed back end sometimes consists of a tailgate and removable covering).[1] In Australia and New Zealand, both pickups and coupé utilities are called **utes**, short for utility vehicle. In South Africa, people of all language groups use the term ***bakkie***, a diminutive of *bak*, Afrikaans for "basket".

Ford F-150 Supercrew with tonneau, four doors, sidestep, and wind deflectors

Once a work or farming tool with few creature comforts, in the 1950s U.S. consumers began purchasing pickups for lifestyle reasons, and by the 1990s, less than 15% of owners reported use in work as the pickup truck's primary purpose.[2] In North America, the pickup is mostly used as a passenger car[3] and accounts for about 18% of total vehicles sold in the United States.[4] Full-sized pickups and SUVs are an important source of revenue for major car manufacturers such as GM, Ford, and Stellantis, accounting for more than two-thirds of their global pretax earnings, though they make up just 16% of North American vehicle production. These vehicles have a high profit margin and a high price tag; in 2018, Kelley Blue Book cited an average cost (including optional features) of US$47,174 for a new Ford F-150.[5]

The term pickup is of unknown origin. It was used by Studebaker in 1913 and by the 1930s, "pick-up" (hyphenated) had become the standard term.[6]

## Contents



## History

In the early days of automobile manufacturing, vehicles were sold as a chassis only, and third parties added bodies on top.[7] In 1902, the Rapid Motor Vehicle Company was founded by Max Grabowsky and Morris Grabowsky who built one-ton carrying capacity trucks in Pontiac, Michigan. In 1913, the Galion Allsteel Body Company, an early developer of the pickup and dump truck, built and installed hauling boxes on slightly modified Ford Model T chassis,[8] and from 1917 on the Model TT. Seeking part of this market share, Dodge introduced a 3/4-ton pickup with cab and body constructed entirely of wood in 1924.[9] In 1925, Ford followed up with a Model T-based, steel-bodied, half-ton with an adjustable tailgate and heavy-duty rear springs.[10] Billed as the "Ford Model T Runabout with Pickup Body", it sold for US$281; 34,000 were built. In 1928, it was replaced by the Model A, which had a closed-cab, safety-glass windshield, roll-up side windows, and three-speed transmission.

A 1922 Ford Model T pickup

In 1931, GM introduced light-duty pickups for both GMC and Chevrolet targeted at private ownership. These pickup trucks were based on the Chevrolet Master. In 1940, GM introduced the dedicated light-truck platform, separate from passenger cars, which GM named the AK series.[11] Ford North America continued to offer a pickup body style on the Ford Model 51, and the Ford Australian division produced the first Australian "ute" in 1932.[12] In 1940, Ford offered a dedicated light-duty truck platform called the Ford F100, then upgraded the platform after World War II to the Ford F-Series in 1948.

A 1961 International Travelette

Dodge at first assumed heavier truck production from Graham-Paige, while the company produced their own light (pickup) trucks, initially on their sufficiently sturdy passenger car frames. But after switching to distinct, dedicated truck frames in 1936, Dodge/Fargo launched an extensive own truck range for 1939, marketed as the 'Job-Rated' trucks. These Art-Deco styled trucks were again continued after WW II.

International Harvester offered the International K and KB series, which were marketed towards construction and farming and did not have a strong retail consumer presence, and Studebaker also manufactured the M-series truck. At the beginning of World War II, the United States government halted the production of privately owned pickup trucks, and all American manufacturers built heavy duty trucks for the war effort.[11]

In the 1950s, consumers began purchasing pickups for lifestyle rather than utilitarian reasons.[11] Car-like, smooth-sided, fenderless trucks were introduced, such as the Chevrolet Fleetside, the Chevrolet El Camino, the Dodge Sweptline, and in 1957, Ford's purpose-built Styleside. Pickups began to feature comfort items such as power options and air conditioning.[2] During this time, pickups with four doors, known as a crew cab, started to become popular. These pickup trucks were released in 1954 in Japan with the Toyota Stout,[13][14] in 1957 in Japan with the Datsun 220, and in 1957 in America with the International Travelette.[15] Other manufactures soon followed, including the Hino Briska in 1962, Dodge in 1963,[16] Ford in 1965, and General Motors in 1973.[17]

In 1963, the U.S. chicken tax directly curtailed the import of the Volkswagen Type 2, distorting the market in favor of U.S. manufacturers.[18] The tariff directly affected any country seeking to bring light trucks into the United States and effectively "squeezed smaller Asian truck companies out of the American pickup market."[19] Over the intervening years, Detroit lobbied to protect the light-truck tariff,[18] thereby reducing pressure on Detroit to introduce vehicles that polluted less and that offered increased fuel economy.[18]

The U.S. government's 1973 Corporate Average Fuel Economy (CAFE) policy set higher fuel-economy requirements for cars than pickups. CAFE led to the replacement of the station wagon by the minivan, the latter of which belonged in the truck category, which allowed it compliance with less strict emissions standards. Eventually, CAFE led to the promotion of sport utility vehicles (SUVs).[20][21] Pickups, unhindered by the emissions controls regulations on cars, began to replace muscle cars as the performance vehicle of choice. The Dodge Warlock appeared in Dodge's "adult toys" line,[2] along with the Macho Power Wagon and Street Van. The 1978 gas guzzler tax, which taxed fuel-inefficient cars while exempting pickup trucks, further distorted the market in favor of pickups. Furthermore, until 1999, light trucks were not required to meet the same safety standards as cars[22] and 20 years later most still lagged behind cars in the adoption of safety features.[23]

In the 1980s, the compact Mazda B-series, Isuzu Faster, and Mitsubishi Forte appeared. Subsequently, U.S. manufacturers built their own compact pickups for the domestic market, including the Ford Ranger, and the Chevrolet S-10. Minivans make inroads into the pickups' market share.[2] In the 1990s, pickups' market share was further eroded by the popularity of SUVs.[2]

Mid-sized electric trucks had been tried early in the 20th century[24] but soon lost out to gasoline and diesel vehicles. In 1997 the Chevrolet S-10 EV was released, but few were sold, and those were mostly to fleet operators.[25]

# International markets

While the Ford F-150 has been the best-selling vehicle in the United States since 1982,[26] the Ford F-150, or indeed any full-sized pickup truck, is a rare sight in Europe, where high fuel prices and narrow city roads make it difficult to use daily.[27] In the United States, pickups are favored by a cultural attachment to the style, low fuel prices, and taxes and regulations that distort the market in favor of domestically built trucks.[18] As of 2016, the IRS offers tax breaks for business use of "any vehicle equipped with a cargo area ... of at least six feet in interior length that is not readily accessible from the passenger compartment".[28]

In Europe, pickups represent less than 1% of light vehicles sold,[29] the most popular being the Ford Ranger with 27,300 units sold in 2015.[30] Other models include the Renault Alaskan (a rebadged Nissan Navara), and the Toyota Hilux.

The NOx law and other differing regulations prevent pickups from being imported to Japan, but the Japanese Domestic Market Mitsubishi Triton was available for a limited time. The most recent pickup truck on sale in Japan is the Toyota Hilux.

In China (where it is known by the English loanword as 皮卡车 pí kǎ chē), the Great Wall Wingle is manufactured domestically and exported to Australia.[31] In Thailand, pickups manufactured for local sale and export include the Isuzu D-Max and the Mitsubishi Triton. In Latin and South America, the Toyota Hilux, Ford Ranger, VW Amarok, Dodge Ram, Chevrolet S-10, Chevrolet D-20, and Chevrolet Montana are sold.

In South Africa, pickups account for about 17% of the passenger and light commercial vehicle sales, mostly the Toyota Hilux, Ford Ranger, and Isuzu KB (Isuzu D-Max).[32] The Volkswagen Amarok and Nissan Navara are also sold.

# Design and features

In the United States and Canada, nearly all new pickups are sold with automatic transmissions. Only the Jeep Gladiator and the Toyota Tacoma are available with manual transmissions.[33]

A regular cab has a single row of seats and a single set of doors, one on each side. Extended or super cab pickups add an extra space behind the main seat, sometimes including smaller "jump" seats. The first extended cab truck in the United States was called the Club Cab and was introduced by Chrysler in 1973 on Dodge pickup trucks. Modern extended cab trucks have a set of small rear doors that are rear-hinged, such as the Ford F-series and Nissan Titan, and they can only be opened after the front doors are open. Other modern extended-cab trucks have small conventional rear doors such as the Ram Pickup and Toyota Tundra. A crew cab, or double cab, seats five or six and has four full-sized, front-hinged doors. The first crew cab truck in the United States was made by International Harvester in 1957, and was later followed by Dodge in 1963, Ford in 1965, and Chevrolet in 1973.

A "Dually:" Ford F-350 with four rear wheels

Cab-over or cab forward designs have the cab sitting above the front axle. This arrangement allows a longer cargo area for the same overall length. An early cab-forward, drop-sided pickup was the Volkswagen Transporter, introduced in 1952. This configuration is more common among European and Japanese manufacturers than in North America. The design was more popular in North America in the 1950s and '60s, with examples including the Chevrolet Corvair Rampside and Loadside, Dodge A-100 and A-108, Ford Econoline, and Jeep FC-150 and FC-170.

The cargo bed can vary in size according to whether the vehicle is optimized for cargo utility or passenger comfort. Most have fixed side walls and a hinged tailgate. Cargo beds are normally found in two styles: step side or fleet side. A step-side bed has fenders that extend on the outside of the cargo area. A fleet-side bed has wheel wells inside the bed. The first fleet-sided truck was the 1955 Chevrolet Cameo Carrier. Early trucks had wood-plank beds, which were largely replaced by steel by the 1960s. Some European-style trucks use a drop-sided bed with a flat tray with hinged panels rising up on the sides and the rear.

A "dually" is a North American colloquial term for a pickup with four rear wheels instead of two, able to carry more weight over the rear axle. Vehicles similar to the pickup include the coupé utility, a car-based pickup, and the larger sport utility truck (SUT), based on a sport utility vehicle (SUV).

The terms half-ton and three-quarter-ton are remnants from a time when the number referred to the maximum cargo capacity by weight.[34]

The last time Chevrolet and GMC used the Stepside style was on the 2007 Silverado and Sierra Classic models. Ford last used the Flareside style mostly in the 2009 F-150, but it continues on the Raptor variant.

## Uses

In the United States and Canada, pickups are used primarily for passenger transport. Pickup trucks are often marketed and used for their hauling (utilizing cargo bed) and towing (utilizing body on frame design and long wheelbase) capabilities.

Pickup trucks are also used by many journeymen, tradesmen, and outdoor enthusiasts. They are also used to move or transport large goods. For example, in the U.S., a homeowner can rent a pickup truck to transport a large appliance from a home supply store.

1974 Dodge D200 with camper

Equipping pickup trucks with camper shells provides a small living space for camping. Slide-in truck campers, though, give a pickup truck the amenities of a small motorhome, but still allow the operator the option of removal and independent use of the vehicle.[35]

Modified pickups can be used as improvised, unarmoured combat vehicles called technicals.

Pickup trucks are used to carry passengers in parts of Africa and Southeast Asia. In Thailand, most songthaews are converted pickup trucks and flatbed trucks. In Haiti, tap taps are also converted pickup trucks.

## Gallery

Early compact Datsun Truck

Volkswagen Type 2 with single cab over and a dropside bed with the left panel folded down.

1961 Chevrolet Apache with a stepside bed

Dually Chevrolet flatbed with dual wheels on the rear axle for improved towing.

Ford F-250, which was originally sold as a chassis cab, fitted with an aftermarket utility bed.

Songthaew conversion

1990 Suzuki Carry, a Kei truck

2006 Holden Ute, a car-based coupé utility

Double cab Ford Ranger in French National Gendarmerie livery

Flat sided pickup truck showing wheel well intrusion into bed.

## See also

- Coupe utility
- Flatbed truck
- Kei truck

- List of pickup trucks
- Panel van
- Pickup truck racing, a form of auto racing using modified versions of pickups mostly on oval tracks
- Roadster utility
- Rolling coal: some pickups are modified to produce more diesel exhaust.[36] Modifications may cost from $2,000 to $5,000.[37][38]
- Self-driving truck
- Truck classification
- Ute

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# External links

- Media related to Pickup trucks at Wikimedia Commons

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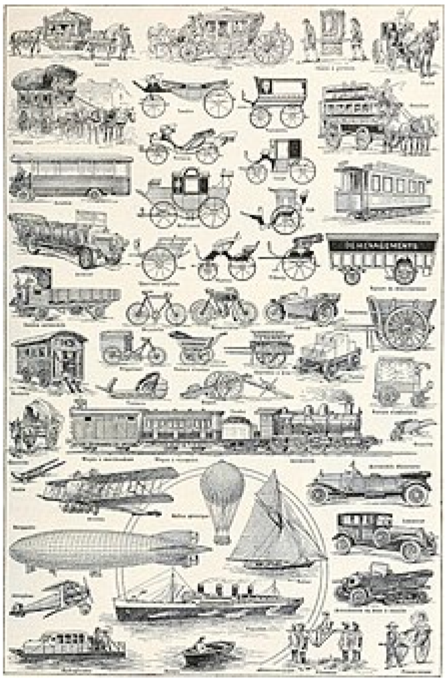
# Private transport

**Private transport** (as opposed to public transport) is the personal or individual use of transportation which are not available for use by the general public.

Compared to public transport, typically the user faces fewer constraints on time and route of transit ('choice rider' vs. 'captive rider'[1]). In some cases, public transportation systems are hardened to extreme weather conditions to a level difficult to achieve with private transport: a green water or blue water public ferry service can continue to operate in blustery maritime conditions unsuitable for the vast majority of private watercraft. Additionally, public transport is often safer than private transport, because the drivers and pilots in most modes public transport are professional trained and certified, with deep organizational and institutional support to handle any operational contingency. On the other side, public transport is often more expensive, less flexible, less convenient, less private (more crowded), and less flamboyant (rarely wins on style points, with some notable exceptions, such as the Trans-Siberian Railway, the *Orient Express*, the RMS *Titanic*, the Concorde and rigid airships).

Cars, such as this Chevrolet Suburban SUV, are a common method of private transport.



1922 illustration. Private transport depicted; automobile, bicycle, biplane, caravan, coupe, cabriolet, half-track, horse-drawn carriage, horse-drawn cart, hot-air balloon, rowing boat, limousine, motorcycle, truck, wheelbarrow, yacht.
Public transport depicted; ambulance, charabanc, horsecar, mailcoach, motorbus, rickshaw, stagecoach, steam locomotive, streetcar

Private transport involves vehicles and conveyances such as: private car, company car, bicycle, dicycle, self-balancing scooter, motorcycle, scooter, aircraft, boat, snowmobile, carriage, horse, etc., or recreational equipment such as roller skates, inline skates, sailboat, sailplane, skateboard etc.

A park and ride incentive sign in the United Kingdom, for people heading into a city centre to transition between private and public transport

# Contents



# Definition

Private transport is in contrast to public transport, and commercial non-public transport. While private transportation may be used alongside nearly all modes of public transportation, private railroad cars are rare (e.g. royal train), although heritage railways are not. Unlike many forms of public transportation, which may be government subsidized or operated by privately owned commercial organizations for mass or general public use, the entire cost of private transportation is born directly or indirectly by the individual user(s). However some scholars argue that it is inaccurate to say that the costs are covered by individual user because big (and often dominant) part of cost of private transportation is the cost of infrastructure on which individual trips rely. They therefore work also with model of quasi-private mobility.[2]

## Personal transport

Private transportation includes both non-motorized methods of private transit (pedestrians, cyclists, skaters, etc.) and all forms of self-propelled transport vehicles.

### Shared personal transport

Non-public passenger transport in vehicles owned by the driver or passenger or operated by the driver.

### Commercial transport

#### Shared vehicle fleets without driver

Self driven transport in vehicles not owned by either the passengers or driver.

#### Shared vehicle fleets with driver

Non-scheduled transit vehicles, taxicabs and rickshaws, which are rented or hired in the short-term on-demand with driver, belong, even if the user can freely decide on the time and route of transit, to the special forms of 'public transport'.

#### Shared individual vehicle journeys

Means of transport are fixed route and fixed schedule passenger services, for example, excursion riverboats, tourist cable cars, resort ski lifts.

## Usage

Private transport is the dominant form of transportation in most of the world. In the United States, for example, 86.2% of passenger miles are by passenger vehicles, motorcycles, and trucks.[3]

## Examples of private transport

Bus, cars and bicycles

- Motorized:
  - Automobile
  - Motorboat
  - Electric bicycle
  - Electric skateboard
  - Hovercraft
  - Moped
  - Motorcycle
  - Motorized wheelchair
  - Private aviation
  - Private jet
  - Motor ship
  - Submarine
  - Electric scooter
  - Electric Unicycle
  - Mobility scooter
- Non-motorized:
  - Bicycle

- Horse-drawn vehicle
- Hot air balloon
- Ice skates
- Inline skates
- Pack animal
- Roller skates
- Scooter
- Skateboard
- Walking
- Wheelchair

## Sustainability

Cycling and walking, above all, have been recognized as the most sustainable transport systems. In general, all muscle-driven mobility will have a similar energy efficiency while at the same time being almost emission-free (apart from the CO2 exhaled during breathing).

The negative environmental impact of private transport can be alleviated by choosing the optimal modal share for a given environment and transport requirements.

## Dedicated infrastructure

- Automobile repair shop
- Controlled-access highway
- Diner
- Drive-thru
- Drive-in theater
- Filling station
- Garage (residential)
- Motel
- Parking lot
- Rest area
- Retail park
- Roadside zoo
- Safari park

## See also

- Auto rickshaw
- Air travel
- Chauffeur
- Taxicab
- Ridesharing company
- Vehicle for hire
- Peak car
- Car sharing

- Hitchhiking
- Mobilities
  - Individual mobility
- Personal rapid transit

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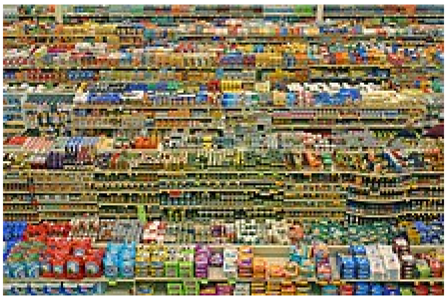
# Product (business)



Products on shelves at a Fred Meyer hypermarket superstore

In marketing, a **product** is an object, or system, or service made available for consumer use as of the consumer demand; it is anything that can be offered to a market to satisfy the desire or need of a customer.[1] In retailing, products are often referred to as *merchandise*, and in manufacturing, products are bought as raw materials and then sold as finished goods. A service is also regarded as a type of product.

In project management, products are the formal definition of the project deliverables that make up or contribute to delivering the objectives of the project.

A related concept is that of a sub-product, a secondary but useful result of a production process.

Dangerous products, particularly physical ones, that cause injuries to consumers or bystanders may be subject to product liability.

## Contents



## Product classification

A product can be classified as tangible or intangible. A tangible product is an actual physical object that can be perceived by touch such as a building, vehicle, gadget, or clothing. An intangible product is a product that can only be perceived indirectly such as an insurance policy. Services can be broadly classified under intangible products, which can be durable or nondurable.

## By use

In its online product catalog, retailer Sears, Roebuck and Company divides its products into "departments", then presents products to potential shoppers according to (1) function or (2) brand.[2] Each product has a Sears item number and a manufacturer's model number. Sears uses the departments and product groupings with the intention of helping customers browse products by function or brand within a traditional department-store structure.[3]

## By association

A product line is "a group of products that are closely related, either because they function in a similar manner, are sold to the same customer groups, are marketed through the same types of outlets, or fall within given price ranges."[4] Many businesses offer a range of product lines which may be unique to a single organisation or may be common across the business's industry. In 2002 the US Census compiled revenue figures for the finance and insurance industry by various product lines such as "accident, health and medical insurance premiums" and "income from secured consumer loans".[5] Within the insurance industry, product lines are indicated by the type of risk coverage, such as auto insurance, commercial insurance and life insurance.[6]

## National and international product classifications

Various classification systems for products have been developed for economic statistical purposes. The NAFTA signatories are working on a system that classifies products called NAPCS as a companion to the North American Industry Classification System (NAICS).[7] The European Union uses a "Classification of Products by Activity" among other product classifications.[8] The United Nations also classifies products for international economic activity reporting.[9]

The **Aspinwall Classification System** [10][11] classifies and rates products based on five variables:

1. Replacement rate (How frequently is the product repurchased?)
2. Gross margin (How much profit is obtained from each product?)
3. Buyer goal adjustment (How flexible are the buyers' purchasing habits with regard to this product?)
4. Duration of product satisfaction (How long will the product produce benefits for the user?)
5. Duration of buyer search behavior (How long will consumers shop for the product?)

The National Institute of Governmental Purchasing (NIGP)[12] developed a commodity and services classification system for use by state and local governments, the NIGP Code.[13] The NIGP Code is used by 33 states within the United States as well as thousands of cities, counties and political subdivisions. The NIGP Code is a hierarchical schema consisting of a 3 digit class, 5 digit class-item, 7 digit class-item-group, and an 11 digit class-item-group-detail.[14] Applications of the NIGP Code include vendor registration, inventory item identification, contract item management, spend analysis, and strategic sourcing.

# Product model

A manufacturer usually provides an identifier for each particular type of product they make, known as a **model**, **model variant**, or **model number** (often abbreviated as **MN**, **M/N** or **model no.**, and sometimes as M- or Mk). For example, Dyson Ltd, a manufacturer of appliances (mainly vacuum cleaners), requires customers to identify their model in the support section of the website.[15] Brand and model can be used together to identify products in the market. The model number is not necessarily the same as the manufacturer part number (MPN).[16]

Because of the huge amount of similar products in the automotive industry, there is a special kind of defining a car with options (marks, attributes) that represent the characteristics features of the vehicle. A model of a car is defined by some basic options like body, engine, gearbox, and axles. The variants of a model (often called the **trim levels**) are built by some additional options like color, seats, wheels, mirrors, other trims, entertainment and assistant systems, etc. Options, that exclude each other (pairwise) build an option family. That means that you can choose only one option for each family and you have to choose exactly one option.

In addition, a specific unit of a product is often (and in some contexts must be) identified by a serial number, which is necessary to distinguish products with the same product definition. In the case of automotive products, it is called the vehicle identification number (VIN), an internationally standardised format.

# Product information

Product information, beyond currency price information, can include:[17]

- Product description – typically on a label on or packaging of the product or in a online shopping website for it
- Certificates – including related to sustainability and for unobservable quality attributes[18]
- Various types of ratings, comparisons, third-party information, and customer reviews – including user reviews
- Labels[19][20][21] – such as energy rating labels
- Information about ingredients
- Visual content
- Place/region and company of origin
- Estimated expiration date
- Safety information
- Nutrition information, mainly contained macronutrients

Many of these types of product information are regulated to some degree, such as to some degree prohibiting false or misleading product information or requiring sellers or manufacturers to specify various information such as ingredients of food-, pharmaceutical- and hygiene-products. There also is standardization. Marketing to entice the shopper[17] is often prioritized over accurate, high-quality or extensive and relevant information.

Product information is often a key element in the buyer decision process. Relevant factors include trust in the accuracy of the information and social normative pressure.[22][23] Easily accessible and up-to-date medicinal product information can contribute to the health literacy.[24] Online shopping is usually more informationally rich than shopping at physical stores traveled to and usually has higher comparability and customizability.[17]

Production information-related developments can be useful for enabling, facilitating, or shifting towards sustainable consumption and support more sustainable products. Environmental life-cycle assessment (LCA) has been widely used for to assess environmental impacts across the life cycle of products.[25] There are LCA datasets that assess all products in some supermarkets in a standardized way.[26][27] Consumers may seek reliable information to evaluate relevant characteristics of products such as durability and reliability.[28] Development of 'transparency by design' scenarios have been suggested to "complement the physical product with layers of digital information", improving transparency and traceability (T&T).[29] The app CodeCheck gives some smartphone users some capability to scan products for assessed ingredients.[30][31] Many labels are considered to be flawed and few have the time to "study the true environmental impact of every purchase". Full product transparency is a concept of making the full life-cycle impacts public.[32] An important element that is required for various product information is supply chain transparency, which relates to human rights and supply chain sustainability.[33][34]

## Produce traceability

Produce traceability makes it possible to track produce from its point of origin to a retail location where it is purchased by consumers.

Produce traceability is an important link in protecting public health since it allows health agencies to more quickly and accurately identify the source of contaminated fruit or vegetables believed to be the cause of an outbreak of foodborne illness, remove them from the marketplace, and communicate to the supply chain.

## Product passports

In the EU, under the renewed Sustainable Product Policy Initiative, the inclusion of a Digital Product Passport has been proposed.[35][36] A material passport is a document consisting of all the materials that are included in a product or construction. It consists of a set of data describing defined characteristics of materials in products, useful for recovery, recycling, re-use and various evaluations. They may contribute to a more circular economy.

## Product information management

Product information management (PIM) is the process of managing all the information required to market and sell products through distribution channels. This product data is created by an internal organization to support a multichannel marketing strategy. A central hub of product data can be used to distribute information to sales channels such as e-commerce websites, print catalogues, marketplaces such as Amazon and Google Shopping, social media platforms like Instagram and electronic data feeds to trading partners. Moreover, the significant role that PIM plays is reducing the abandonment rate by giving better product information.[37]

- wide array of products and/or complex product data set
- frequently changing product characteristics
- increasing number of sales channels
- non-uniform information technology infrastructure (plethora of data sources and formats)
- online business and electronic ordering
- various locales and localization requirements

- support SEO strategies of business

## See also

- Builder's plate
- List of fastest-selling products
- Manufacturer part number
- Product teardown

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# Further reading

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# External links

- Quotations related to Merchandise at Wikiquote
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# Public transport

Examples of types of public transport. Clockwise from top left: a bus in England, a ferry in the United States, a tram in the Czech Republic, and a passenger train in Japan.

**Public transport** (also known as **public transportation**, **public transit**, **mass transit**, or simply **transit**) is a system of transport for passengers by group travel systems available for use by the general public unlike private transport, typically managed on a schedule, operated on established routes, and that charge a posted fee for each trip.[1][2] There is no rigid definition; the *Encyclopædia Britannica* specifies that public transportation is within urban areas,[3] and air travel is often not thought of when discussing public transport—dictionaries use wording like "buses, trains, etc."[4] Examples of public transport include city buses, trolleybuses, trams (or light rail) and passenger trains, rapid transit (metro/subway/underground, etc.) and ferries. Public transport between cities is dominated by airlines, coaches, and intercity rail. High-speed rail networks are being developed in many parts of the world.

Most public transport systems run along fixed routes with set embarkation/disembarkation points to a prearranged timetable, with the most frequent services running to a headway (e.g.: "every 15 minutes" as opposed to being scheduled for any specific time of the day). However, most public transport trips include other modes of travel, such as passengers walking or catching bus services to access train stations.[5] Share taxis offer on-demand services in many parts of the world, which may compete with fixed public transport lines, or complement them, by bringing passengers to interchanges. Paratransit is sometimes used in areas of low demand and for people who need a door-to-door service.[6]

Urban public transit differs distinctly among Asia, North America, and Europe. In Asia, profit-driven, privately owned and publicly traded mass transit and real estate conglomerates predominantly operate public transit systems.[7][8] In North America, municipal transit authorities most commonly run mass transit operations. In Europe, both state-owned and private companies predominantly operate mass transit systems.

For geographical, historical and economic reasons, differences exist internationally regarding use and extent of public transport. While countries in the Old World tend to have extensive and frequent systems serving their old and dense cities, many cities of the New World have more sprawl and much less comprehensive public transport. The International Association of Public Transport (UITP) is the international network for public transport authorities and operators, policy decision-makers, scientific institutes and the public transport supply and service industry. It has 3,400 members from 92 countries from all over the globe.

In recent years, some high-wealth cities have seen a decline in public transport usage. A number of sources attribute this trend to the rise in popularity of remote work, ride-sharing services, and car loans being relatively cheap across many countries. Major cities such as Toronto, Paris, Chicago, and London have seen this decline and have attempted to intervene by cutting fares and encouraging new modes of transportation, such as e-scooters and e-bikes.[9] Because of the reduced emissions and other environmental impacts of using public transportation over private transportation, many experts have pointed to an increased investment in public transit as an important climate change mitigation tactic.[10]

## Contents

# History

Early trolley car in Newton, Massachusetts

Conveyances designed for public hire are as old as the first ferries, and the earliest public transport was water transport: on land people walked (sometimes in groups and on pilgrimages, as noted in sources such as the Bible and *The Canterbury Tales*) or (at least in Eurasia and Africa) rode an animal.[11] Ferries appear in Greek mythology—corpses in ancient Greece were buried with a coin underneath their tongue to pay the ferryman Charon to take them to Hades.[12]

Some historical forms of public transport include the stagecoach, traveling a fixed route between coaching inns, and the horse-drawn boat carrying paying passengers, which was a feature of European canals from their 17th-century origins. The canal itself as a form of infrastructure dates back to antiquity – ancient Egyptians certainly used a canal for freight transportation to bypass the Aswan cataract – and the Chinese also built canals for water transportation as far back as the Warring States period[13] which began in the 5th century BCE. Whether or not those canals were used for-hire public transport remains unknown; the Grand Canal in China (begun in 486 BCE) served primarily for shipping grain.

The omnibus, the first organized public transit system within a city, appears to have originated in Paris, France, in 1662,[14] although the service in question, Carrosses à cinq sols, failed a few months after its founder, Blaise Pascal, died in August 1662; omnibuses are next known to have appeared in Nantes, France, in 1826. The omnibus was introduced to London in July 1829.[15]

The first passenger horse-drawn railway opened in 1806: it ran between Swansea and Mumbles in southwest Wales in the United Kingdom.[16] In 1825 George Stephenson built the *Locomotion* for the Stockton and Darlington Railway in northeast England, the first public steam railway in the world. The world's first steam-powered underground railway opened in London in 1863.[17] In the following hundred years, the transportation and technical equipment provided by industrial development for the city have been continuously updated, which has accelerated the process of modernization of urban public transportation, and the transportation with backward performance has gradually been eliminated. The stagecoach and railcar were successively replaced by trams, trolleybuses and buses.

The first successful electric streetcar was built for 11 miles of track for the Union Passenger Railway in Tallahassee, Florida in 1888. Electric streetcars could carry heavier passenger loads than predecessors, which reduced fares and stimulated greater transit use. Two years after the Richmond success, over thirty two thousand electric streetcars were operating in America. Electric streetcars also paved the way for the first subway system in America. Before electric streetcars, steam powered subways were considered. However, most people believed that riders would avoid the smoke filled subway tunnels from the steam engines. In 1894, Boston built the first subway in the United States, an electric streetcar line in a 1.5-mile tunnel under Tremont Street's retail district. Other cities quickly followed, constructing thousands of miles of subway in the following decades.[18]

Since the 1960s, maritime transport has diminished in significance, but traditional ships and hydrofoils remain in use.

In March 2020, Luxembourg abolished fares for trains, trams and buses and became the first country in the world to make all public transport free.[19]

## Types

- Aerial lift
  - Aerial tramway
    - Funifor
  - Chairlift
    - Detachable chairlift
  - Funitel
  - Gondola lift
- Maritime transport
  - Ferry
    - Cable ferry
      - Reaction ferry
  - Water taxi
- Land transport
  - Personal public transport
    - Bicycle-sharing system
    - Scooter-sharing system
    - Carsharing
    - Personal rapid transit
  - Rail transport
    - Inter-city rail
      - High-speed rail
        - Maglev
    - Urban rail transit
      - Airport rail link
      - Atmospheric railway
      - Automated guideway transit
      - Cable car
      - Cable railway
      - Commuter rail
      - Elevated railway
      - Funicular
        - Inclined elevator

    - Light rail
    - Medium-capacity rail system
    - Monorail
      - Slope car
      - Suspension railway
    - People mover
    - Railway electrification system
    - Rapid transit
      - Rubber-tyred metro
    - Tram
      - Heritage streetcar
      - Tram-train
- Road transport
  - Public transport bus service
    - Transit bus
      - Articulated bus
        - Bi-articulated bus
        - Trailer bus
          - Trackless train
            - Autonomous Rail Rapid Transit
      - Rigid bus
        - Airport bus
        - Bus rapid transit
        - Double-decker bus
        - Express bus service
        - Guided bus
          - Rubber-tyred trams
        - High-floor
        - Low-floor bus
        - Midibus
        - Single-deck bus
        - Tourist trolley
        - Trolleybus
    - Intercity bus service
      - Coach
    - Minibus
      - Paratransit
  - Taxicab
    - Hackney carriage

- Share taxi

## Comparing modes

Passenger Capacity of different Transport Modes

Seven criteria estimate the usability of different types of public transport and its overall appeal. The criteria are speed, comfort, safety, cost, proximity, timeliness and directness.[20] Speed is calculated from total journey time including transfers. Proximity means how far passengers must walk or otherwise travel before they can begin the public transport leg of their journey and how close it leaves them to their desired destination. Timeliness is how long they must wait for the vehicle. Directness records how far a journey using public transport deviates from a passenger's ideal route.

In selecting between competing modes of transport, many individuals are strongly motivated by direct cost (travel fare/ ticket price to them) and convenience, as well as being informed by habit. The same individual may accept the lost time and statistically higher risk of accident in private transport, together with the initial, running and parking costs. Loss of control, spatial constriction, overcrowding, high speeds/accelerations, height and other phobias may discourage use of public transport.

Actual travel time on public transport becomes a lesser consideration when predictable and when travel itself is reasonably comfortable (seats, toilets, services), and can thus be scheduled and used pleasurably, productively or for (overnight) rest. Chauffeured movement is enjoyed by many people when it is relaxing, safe, but not too monotonous. Waiting, interchanging, stops and holdups, for example due to traffic or for security, are discomforting. Jet lag is a human constraint discouraging frequent rapid long-distance east–west commuting, favoring modern telecommunications and VR technologies.

## Airline

An airline provides scheduled service with aircraft between airports. Air travel has high speeds, but incurs large waiting times before and after travel, and is therefore often only feasible over longer distances or in areas where a lack of surface infrastructure makes other modes of transport impossible. Bush airlines work more similarly to bus stops; an aircraft waits for passengers and takes off when the aircraft is full.

## Bus and coach


Transperth bus operating in Perth, Western Australia

Bus services use buses on conventional roads to carry numerous passengers on shorter journeys. Buses operate with low capacity (compared with trams or trains), and can operate on conventional roads, with relatively inexpensive bus stops to serve passengers. Therefore, buses are commonly used in smaller cities, towns, and rural areas, and for shuttle services supplementing other means of transit in large cities.

Bus rapid transit is an ambiguous term used for buses operating on dedicated right-of-way, much like a light rail.

Coach services use coaches (long-distance buses) for suburb-to-CBD or longer-distance transportation. The vehicles are normally equipped with more comfortable seating, a separate luggage compartment, video and possibly also a toilet. They have higher standards than city buses, but a limited stopping pattern.

### Electric buses

A trolley bus in front of the Baltic railway station in Tallinn, Estonia

Trolleybuses are electrically powered buses that receive power from overhead power line by way of a set of trolley poles for mobility. Online Electric Vehicles are buses that run on a conventional battery, but are recharged frequently at certain points via underground wires.[21]

Certain types of buses, styled after old-style streetcars, are also called trackless trolleys, but are built on the same platforms as a typical diesel, CNG, or hybrid bus; these are more often used for tourist rides than commuting and tend to be privately owned.

## Train


A Sydney Trains A Set arriving to Flemington, New South Wales

Passenger rail transport is the conveyance of passengers by means of wheeled vehicles specially designed to run on railways. Trains allow high capacity at most distance scales, but require track, signalling, infrastructure and stations to be built and maintained resulting in high upfront costs.

### Intercity and high-speed rail


A Chinese HSR train en route from Nanning East to Beijing West

Intercity rail is long-haul passenger services that connect multiple urban areas. They have few stops, and aim at high average speeds, typically only making one of a few stops per city. These services may also be international.

High-speed rail is passenger trains operating significantly faster than conventional rail—typically defined as at least 200 kilometres per hour (120 mph). The most predominant systems have been built in Europe and East Asia, and compared with air travel, offer long-distance rail journeys as quick as air services, have lower prices to compete more effectively and use electricity instead of combustion.[22]

### Urban rail transit

Urban rail transit is an all-encompassing term for various types of local rail systems, such as these examples trams, light rail, rapid transit, people movers, commuter rail, monorail, suspension railways and funiculars.

### Commuter rail

A SEPTA Regional Rail train in Cheltenham, Pennsylvania, a form of commuter rail

Commuter rail is part of an urban area's public transport; it provides faster services to outer suburbs and neighboring towns and villages. Trains stop at stations that are located to serve a smaller suburban or town center. The stations are often combined with shuttle bus or park and ride systems. Frequency may be up to several times per hour, and commuter rail systems may either be part of the national railway or operated by local transit agencies.

Common forms of commuter rail employ either diesel electric locomotives, or electric multiple unit trains. Some commuter train lines share a railway with freight trains.[23]

### Rapid transit

The SkyTrain in Vancouver is the longest rapid transit system in Canada.

A rapid transit railway system (also called a metro, underground, heavy rail, or subway) operates in an urban area with high capacity and frequency, and grade separation from other traffic.[24][25] Heavy rail is a high-capacity form of rail transit, with 4 to 10 units forming a train, and can be the most expensive form of transit to build. Modern heavy rail systems are mostly driverless, which allows for higher frequencies and less maintenance cost.[23]

Systems are able to transport large numbers of people quickly over short distances with little land use. Variations of rapid transit include people movers, small-scale light metro and the commuter rail hybrid S-Bahn. More than 160 cities have rapid transit systems, totalling more than 8,000 km (4,971 mi) of track and 7,000 stations. Twenty-five cities have systems under construction.

### People mover

People movers are a special term for grade-separated rail which uses vehicles that are smaller and shorter in size.[23] These systems are generally used only in a small area such as a theme park or an airport.

### Tram

Trams (also known as streetcars) are railborne vehicles that run in city streets or dedicated tracks. They have higher capacity than buses, but must follow dedicated infrastructure with rails and wires either above or below the track, limiting their flexibility.

In the United States, trams were commonly used prior to the 1930s, before being superseded by the bus. In modern public transport systems, they have been reintroduced in the form of the light rail.[23]

A streetcar in Toronto, which operates the largest tramway in North America

### Light rail

Light rail is a redevelopment (and use) of the tram, with dedicated right-of-way not shared with other traffic, (often) step-free access and increased speed. Light rail lines are, thus, essentially modernized interurbans. Unlike trams, light rail systems are longer and have one to four cars per train.[23]

### Monorail

A monorail from Chiba, Japan

Somewhere between light and heavy rail in terms of carbon footprint, monorail systems usually use overhead single tracks, either mounted directly on the track supports or put in an overhead design with the train suspended.

Monorail systems are used throughout the world (especially in Europe and east Asia, particularly Japan), but apart from public transit installations in Las Vegas and Seattle, most North American monorails are either short shuttle services or privately owned services (With 150,000 daily riders, the Disney monorail systems used at their parks may be the most famous in the world).[26]

## Personal rapid transit

People mover vehicle of Morgantown Personal Rapid Transit

Personal rapid transit is an automated cab service that runs on rails or a guideway. This is an uncommon mode of transportation (excluding elevators) due to the complexity of automation. A fully implemented system might provide most of the convenience of individual automobiles with the efficiency of public transit. The crucial innovation is that the automated vehicles carry just a few passengers, turn off the guideway to pick up passengers (permitting other PRT vehicles to continue at full speed), and drop them off to the location of their choice (rather than at a stop). Conventional transit simulations show that PRT might attract many auto users in problematic medium-density urban areas. A number of experimental systems are in progress. One might compare personal rapid transit to the more labor-intensive taxi or paratransit modes of transportation, or to the (by now automated) elevators common in many publicly accessible areas.

## Cable-propelled transit

Cable-propelled transit (CPT) is a transit technology that moves people in motor-less, engine-less vehicles that are propelled by a steel cable.[27] There are two sub-groups of CPT – gondola lifts and cable cars (railway). Gondola lifts are supported and propelled from above by cables, whereas cable cars are supported and propelled from below by cables.

Gulmarg Gondola in Gulmarg, India

While historically associated with usage in ski resorts, gondola lifts are now finding increased consumption and utilization in many urban areas – built specifically for the purposes of mass transit.[28] Many, if not all, of these systems are implemented and fully integrated within existing public transportation networks. Examples include Metrocable (Medellín), Metrocable (Caracas), Mi Teleférico in La Paz, Portland Aerial Tram, Roosevelt Island Tramway in New York City, and the London Cable Car.

## Ferry

A ferry is a boat used to carry (or *ferry*) passengers, and sometimes their vehicles, across a body of water. A foot-passenger ferry with many stops is sometimes called a water bus. Ferries form a part of the public transport systems of many waterside cities and islands, allowing direct transit between points at a capital cost much lower than bridges or tunnels, though at a lower speed. Ship connections of much larger distances (such as over long distances in water bodies like the Mediterranean Sea) may also be called ferry services.

Water bus (*vaporetto*) at bus stop in Venice, Italy

## Cycleway network

A report published by the UK National Infrastructure Commission in 2018 states that "cycling is mass transit and must be treated as such." Cycling infrastructure is normally provided without charge to users because it is cheaper to operate than mechanised transit systems that use sophisticated equipment and do not use human power.[29]

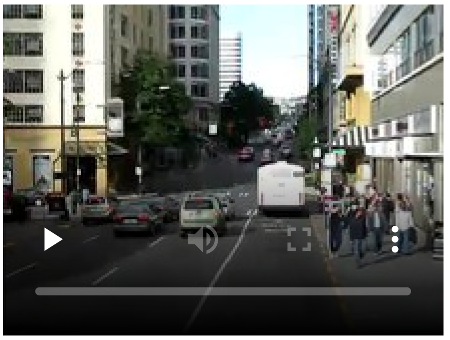
Cycle Superhighway CS6 is part of Central London's Cycle Network mass transit infrastructure

## Electric bikes and scooters

Many cities around the world have introduced electric bikes and scooters to their public transport infrastructure. For example, in the Netherlands many individuals use e-bikes to replace their car commutes. In major American cities, start-up companies such as Uber and Lyft have implemented e-scooters as a way for people to take short trips around the city.[30]

# Operation

## Infrastructure



Timelapse video of Downtown Seattle from atop a Community Transit double-decker bus

All public transport runs on infrastructure, either on roads, rail, airways or seaways. The infrastructure can be shared with other modes, freight and private transport, or it can be dedicated to public transport. The latter is especially valuable in cases where there are capacity problems for private transport. Investments in infrastructure are expensive and make up a substantial part of the total costs in systems that are new or expanding. Once built, the infrastructure will require operating and maintenance costs, adding to the total cost of public transport. Sometimes governments subsidize infrastructure by providing it free of charge, just as is common with roads for automobiles.

## Interchanges

Interchanges are locations where passengers can switch from one public transport route to another. This may be between vehicles of the same mode (like a bus interchange), or e.g. between bus and train. It can be between local and intercity transport (such as at a central station or airport).

## Timetables

Timetables (or 'schedules' in North American English) are provided by the transport operator to allow users to plan their journeys. They are often supplemented by maps and fare schemes to help travelers coordinate their travel. Online public transport route planners help make planning easier. Mobile apps are available for multiple transit systems that provide timetables and other service information and, in some cases, allow ticket purchase, some allowing to plan your journey, with time fares zones e.g.

Services are often arranged to operate at regular intervals throughout the day or part of the day (known as clock-face scheduling). Often, more frequent services or even extra routes are operated during the morning and evening rush hours. Coordination between services at interchange points is important to reduce the total travel time for passengers. This can be done by coordinating shuttle services with main routes, or by creating a fixed time (for instance twice per hour) when all bus and rail routes meet at a station and exchange passengers. There is often a potential conflict between this objective and optimising the utilisation of vehicles and drivers.

## Financing

The main sources of financing are ticket revenue, government subsidies and advertising. The percentage of revenue from passenger charges is known as the farebox recovery ratio. A limited amount of income may come from land development and rental income from stores and vendors, parking fees, and leasing tunnels and rights-of-way to carry fiber optic communication lines.

### Fare and ticketing

A contactless ticket validator used in Moscow, Russia

Most—but not all—public transport requires the purchase of a ticket to generate revenue for the operators. Tickets may be bought either in advance, or at the time of the journey, or the carrier may allow both methods. Passengers may be issued with a paper ticket, a metal or plastic token, or a magnetic or electronic card (smart card, contactless smart card). Sometimes a ticket has to be validated, e.g. a paper ticket has to be stamped, or an electronic ticket has to be checked in.

Tickets may be valid for a single (or return) trip, or valid within a certain area for a period of time (see transit pass). The fare is based on the travel class, either depending on the traveled distance, or based on zone pricing.

The tickets may have to be shown or checked automatically at the station platform or when boarding, or during the ride by a conductor. Operators may choose to control all riders, allowing sale of the ticket at the time of ride. Alternatively, a proof-of-payment system allows riders to enter the vehicles without showing the ticket, but riders may or may not be controlled by a ticket controller; if the rider fails to show proof of payment, the operator may fine the rider at the magnitude of the fare.


The SmartRider is a smart card for public transportation tickets in Perth, Western Australia

Multi-use tickets allow travel more than once. In addition to return tickets, this includes period cards allowing travel within a certain area (for instance month cards), or to travel a specified number of trips or number of days that can be chosen within a longer period of time (called *carnet* ticket). Passes aimed at tourists, allowing free or discounted entry at many tourist attractions, typically include zero-fare public transport within the city. Period tickets may be for a particular route (in both directions), or for a whole network. A free travel pass allowing free and unlimited travel within a system is sometimes granted to particular social sectors, for example students, elderly, children, employees (*job ticket*) and the physically or mentally disabled.

Zero-fare public transport services are funded in full by means other than collecting a fare from passengers, normally through heavy subsidy or commercial sponsorship by businesses. Several mid-size European cities and many smaller towns around the world have converted their entire bus networks to zero-fare. The only European capital with free public transport is Tallinn. Local zero-fare shuttles or inner-city loops are far more common than city-wide systems. There are also zero-fare airport circulators and university transportation systems.

### Revenue, profit and subsidies

Governments frequently opt to subsidize public transport for social, environmental or economic reasons. Common motivations include the desire to provide transport to people who are unable to use an automobile[31] and to reduce congestion, land use and automobile emissions.[32]

Subsidies may take the form of direct payments for financially unprofitable services, but support may also include indirect subsidies. For example, the government may allow free or reduced-cost use of state-owned infrastructure such as railways and roads, to stimulate public transport's economic competitiveness over private transport, that normally also has free infrastructure (subsidized through such things as gas taxes). Other subsidies include tax advantages (for instance aviation fuel is typically not taxed), bailouts if companies that are likely to collapse (often applied to airlines) and reduction of competition through licensing schemes (often applied to taxis and airlines). Private transport is normally subsidized indirectly through free roads and infrastructure,[33] as well as incentives to build car factories[34] and, on occasion, directly via bailouts of automakers.[35][36]

Land development schemes may be initialized, where operators are given the rights to use lands near stations, depots, or tracks for property development. For instance, in Hong Kong, MTR Corporation Limited and KCR Corporation generate additional profits from land development to partially cover the cost of the construction of the urban rail system.[37]

Some supporters of mass transit believe that use of taxpayer capital to fund mass transit will ultimately save taxpayer money in other ways, and therefore, state-funded mass transit is a benefit to the taxpayer. Some research has supported this position,[38] but the measurement of benefits and costs is a complex and controversial issue.[39] A lack of mass transit results in more traffic, pollution,[40][41][42] and road construction[43] to accommodate more vehicles, all costly to taxpayers;[44] providing mass transit will therefore alleviate these costs.[45] (Perhaps,[46][47][48][49] although others disagree[50][51])

A study found that there is a strong link between support for public transport spending is much higher among conservatives who have high levels of trust in government officials than conservatives who do not.[52]

### Safety and security


A police officer and a police dog patrol a Moscow Metro platform

Relative to other forms of transportation, public transit is safe (with a low crash risk) and secure (with low rates of crime).[53] The injury and death rate for public transit is roughly one-tenth that of automobile travel.[53] A 2014 study noted that "residents of transit-oriented communities have about one-fifth the per capita crash casualty rate as in automobile-oriented communities" and that "Transit also tends to have lower overall crime rates than automobile travel, and transit improvements can help reduce overall crime risk by improving surveillance and economic opportunities for at-risk populations."[53]

Although relatively safe and secure, public perceptions that transit systems are dangerous endure.[53] A 2014 study stated that "Various factors contribute to the under-appreciation of transit safety benefits, including the nature of transit travel, dramatic news coverage of transit crashes and crimes, transit agency messages that unintentionally emphasize risks without providing information on its overall safety, and biased traffic safety analysis."[53]

Some systems attract vagrants who use the stations or trains as sleeping shelters, though most operators have practices that discourage this.[54]

## Impact

### Accessibility

Public transport is means of independent transport for individuals (without walking or bicycling) such as children too young to drive, the elderly without access to cars, those who do not hold a drivers license, and the infirm such as wheelchair users. Kneeling buses, low-floor access boarding on buses and light rail has also enabled greater access for the disabled in mobility. In recent decades low-floor access has been incorporated into modern designs for vehicles. In economically deprived areas, public transport increases individual accessibility to transport where private means are unaffordable.

## Environmental

The pink bus rapid transit of Metz uses a diesel-electric hybrid driving system, developed by Belgian Van Hool manufacturer.[55]

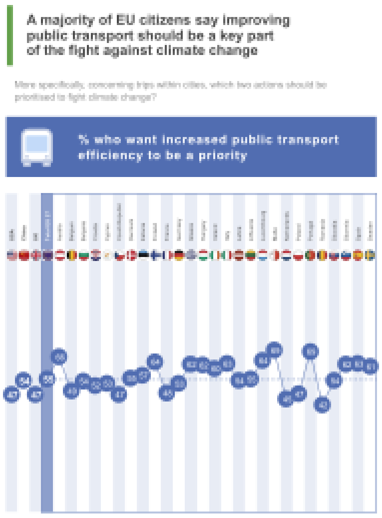
Although there is continuing debate as to the true efficiency of different modes of transportation, mass transit is generally regarded as significantly more energy efficient than other forms of travel. A 2002 study by the Brookings Institution and the American Enterprise Institute found that public transportation in the U.S uses approximately half the fuel required by cars, SUVs and light trucks. In addition, the study noted that "private vehicles emit about 95 percent more carbon monoxide, 92 percent more volatile organic compounds and about twice as much carbon dioxide and nitrogen oxide than public vehicles for every passenger mile traveled".[56]

Studies have shown that there is a strong inverse correlation between urban population density and energy consumption per capita, and that public transport could facilitate increased urban population densities, and thus reduce travel distances and fossil fuel consumption.[57]

Supporters of the green movement usually advocate public transportation, because it offers decreased airborne pollution compared to automobiles. A study conducted in Milan, Italy, in 2004 during and after a transportation strike serves to illustrate the impact that mass transportation has on the environment. Air samples were taken between 2 and 9 January, and then tested for methane, carbon monoxide, non-methane hydrocarbons (NMHCs), and other gases identified as harmful to the environment. The figure below is a computer simulation showing the results of the study "with 2 January showing the lowest concentrations as a result of decreased activity in the city during the holiday season. 9 January showed the highest NMHC concentrations because of increased vehicular activity in the city due to a public transportation strike."[58]

Based on the benefits of public transport, the green movement has affected public policy. For example, the state of New Jersey released *Getting to Work: Reconnecting Jobs with Transit*.[59] This initiative attempts to relocate new jobs into areas with higher public transportation accessibility. The initiative cites the use of public transportation as being a means of reducing traffic congestion, providing an economic boost to the areas of job relocation, and most importantly, contributing to a green environment by reducing carbon dioxide ($CO_2$) emissions.

Using public transportation can result in a reduction of an individual's carbon footprint. A single person, 20-mile (32 km) round trip by car can be replaced using public transportation and result in a net $CO_2$ emissions reduction of 4,800 pounds (2,200 kg) per year.[60] Using public transportation saves $CO_2$ emissions in more ways than simply travel as public transportation can help to alleviate traffic congestion as well as promote more efficient land use. When all three of these are considered, it is estimated that 37 million metric tons of $CO_2$ will be saved annually.[60] Another study claims that using public transit instead of private in the U.S. in 2005 would have reduced $CO_2$ emissions by 3.9 million metric tons and that the resulting traffic congestion reduction accounts for an additional 3.0 million metric tons of $CO_2$ saved.[61] This is a total savings of about 6.9 million metric tons per year given the 2005 values.




A survey by the European Development Bank found that a majority of Europeans wanted to prioritize public transit in Climate change mitigation policies.

In order to compare energy impact of public transportation to private transportation, the amount of energy per passenger mile must be calculated. The reason that comparing the energy expenditure per person is necessary is to normalize the data for easy comparison. Here, the units are in per 100 p-km (read as person kilometer or passenger kilometer). In terms of energy consumption, public transportation is better than individual transport in a personal vehicle.[62] In England, bus and rail are popular methods of public transportation, especially in London. Rail provides rapid movement into and out of the city of London while busing helps to provide transport within the city itself. As of 2006–2007, the total energy cost of London's trains was 15 kWh per 100 p-km, about 5 times better than a personal car.[63] For busing in London, it was 32 kWh per 100 p-km, or about 2.5 times that of a personal car.[63] This includes lighting, depots, inefficiencies due to capacity (i.e., the train or bus may not be operating at full capacity at all times), and other inefficiencies. Efficiencies of transport in Japan in 1999 were 68 kWh per 100 p-km for a personal car, 19 kWh per 100 p-km for a bus, 6 kWh per 100 p-km for rail, 51 kWh per 100 p-km for air, and 57 kWh per 100 p-km for sea.[63] These numbers from either country can be used in energy comparison calculations or life-cycle assessment calculations.

Public transportation also provides an arena to test environmentally friendly fuel alternatives, such as hydrogen-powered vehicles. Swapping out materials to create lighter public transportation vehicles with the same or better performance will increase environmental friendliness of public transportation vehicles while maintaining current standards or improving them. Informing the public about the positive environmental effects of using public transportation in addition to pointing out the potential economic benefit is an important first step towards making a difference.

## Land use

Traffic jam in São Paulo, Brazil

Dense areas with mixed-land uses promote daily public transport use while urban sprawl is associated with sporadic public transport use. A recent European multi-city survey found that dense urban environments, reliable and affordable public transport services, and limiting motorized vehicles in high density areas of the cities will help achieve much needed promotion of public transport use.[64]

Urban space is a precious commodity and public transport utilises it more efficiently than a car dominant society, allowing cities to be built more compactly than if they were dependent on automobile transport.[65] If public transport planning is at the core of urban planning, it will also force cities to be built more compactly to create efficient feeds into the stations and stops of transport.[5][66] This will at the same time allow the creation of centers around the hubs, serving passengers' daily commercial needs and public services. This approach significantly reduces urban sprawl. Public land planning for public transportation can be difficult but it is the State and Regional organizations that are responsible to planning and improving public transportation roads and routes. With public land prices booming, there must be a plan to using the land most efficiently for public transportation in order to create better transportation systems. Inefficient land use and poor planning leads to a decrease in accessibility to jobs, education, and health care.[67]

### Societal

> A developed country is not a place where the poor have cars; it's where the rich use public transport —Enrique Penalosa, former mayor of Bogotá[68]

The consequences for wider society and civic life, is public transport breaks down social and cultural barriers between people in public life. An important social role played by public transport is to ensure that all members of society are able to travel without walking or cycling, not just those with a driving license and access to an automobile—which include groups such as the young, the old, the poor, those with medical conditions, and people banned from driving. Automobile dependency is a name given by policy makers to places where those without access to a private vehicle do not have access to independent mobility.[69] This dependency contributes to the transport divide. A 2018 study published in the Journal of Environmental Economics and Management concluded that expanded access to public transit has no meaningful impact on automobile volume in the long term.[70]

Above that, public transportation opens to its users the possibility of meeting other people, as no concentration is diverted from interacting with fellow-travelers due to any steering activities. Adding to the above-said, public transport becomes a location of inter-social encounters across all boundaries of social, ethnic and other types of affiliation.

## Social issues

Because night trains or coaches can be cheaper than motels, homeless persons sometimes use these as overnight shelters, as with the famous Line 22 ("Hotel 22") in Silicon Valley.[71][72]

### Impact of COVID-19 pandemic

The COVID-19 pandemic had a substantial effect on public transport systems, infrastructures and revenues in various cities across the world.[73] The pandemic negatively impacted public transport usage by imposing social distancing, remote work, or unemployment in the United States. It caused a 79% drop in public transport riders at the beginning of 2020. This trend continued throughout the year with a 65% reduced ridership as compared to previous years.[74] Similarly in London, at the beginning of 2020, ridership in the London Underground and buses declined by 95% and 85% respectively.[75] A 55% drop in public transport ridership as compared to 2019 was reported in Cairo, Egypt after a period of mandatory halt. To reduce covid-spread through cash contact, in Nairobi, Kenya, cashless payment systems were enforced by National Transport and Safety Authority (NTSA). Public transport was halted for three months in 2020 in Kampala, Uganda with people resorting to walking or cycling. Post-quarantine, upon renovating public transport infrastructure, public transport such as minibus taxis were assigned specific routes. The situation was difficult in cities where people are heavily dependent on the public transport system. In Kigali, Rwanda social distancing requirements led to fifty percent occupancy restrictions, but as the pandemic situation improved, the occupancy limit was increased to meet popular demands. Addis Ababa, Ethiopia also had inadequate bus services relative to demand and longer wait times due to social distancing restrictions and planned to deploy more buses. Both Addis Ababa and Kampala aim to improve walking and cycling infrastructures in the future as means of commuting complementary to buses.[76]

## See also

- 3D Express Coach
- 9-Euro-Ticket
- Finnish models of public transport
- Free public transport
- Hitchhiking
- International Association of Public Transport
- List of urban transit advocacy organisations
- Passenger load factor
- Patronage (transport)
- Private transport
- Public transport bus service
- Public transport route planner
- Public transport timetable
- Sustainable transport
- Transit district
- Transit pass
- Transit police
- Transit watchdog
- Transport divide
- Transportation engineering

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# External links

- International Association of Public Transport (http://www.uitp.org/)

- https://adventureix.com/ How to fly with camping gear]
- US High-Speed Rail Association (http://www.ushsr.com/)
- Transit Standards (http://www.transitstandards.com/) - Knowledge base on branding, digital strategy, and graphic standards for public transit, compiled by Stewart Mader. Contains over 100 resources and examples, including 30 graphics standards manuals from transit agencies worldwide.

Wikipedia

# Rail freight transport

**Rail freight transport** is the use of railroads and trains to transport cargo as opposed to human passengers.

A Class 92 hauled container freight train on the West Coast Main Line, United Kingdom

A freight train, cargo train, or goods train is a group of freight cars (US) or goods wagons (International Union of Railways) hauled by one or more locomotives on a railway, transporting cargo all or some of the way between the shipper and the intended destination as part of the logistics chain. Trains may haul bulk material, intermodal containers, general freight or specialized freight in purpose-designed cars.[1] Rail freight practices and economics vary by country and region.

A long grain train of the Union Pacific Railroad crossing a bridge in Washington state, United States

When considered in terms of ton-miles or tonne-kilometers hauled per unit of energy consumed, rail transport can be more efficient than other means of transportation. Maximum economies are typically realized with bulk commodities (e.g., coal), especially when hauled over long distances. However, shipment by rail is not as flexible as by the highway, which has resulted in much freight being hauled by truck, even over long distances. Moving goods by rail often involves transshipment costs, particularly when the shipper or receiver lack direct rail access. These costs may exceed that of operating the train itself, a factor that practices such as containerization, trailer-on-flatcar or rolling highway aim to minimize.

Freight trains wait for departure in Zhengzhou, China

## Contents

## Overview

**Average external costs of freight transport (EU-28, 2016) per transport mode[2]**

| Mode | eurocent per tonne-kilometre |
|---|---|
| Road (LCV) | 35.6 |
| Road (HGV) | 4.2 |
| Rail (diesel) | 1.8 |
| Rail (electric) | 1.1 |
| Inland vessel | 1.9 |

Traditionally, large shippers build factories and warehouses near rail lines and have a section of track on their property called a *siding* where goods are loaded onto or unloaded from rail cars. Other shippers have their goods hauled (drayed) by wagon or truck to or from a goods station (freight station in US). Smaller locomotives transfer the rail cars from the sidings and goods stations to a classification yard, where each car is coupled to one of several long-distance trains being assembled there, depending on that car's destination. When long enough, or based on a schedule, each long-distance train is then dispatched to another classification yard. At the next classification yard, cars are resorted. Those that are destined for stations served by that yard are assigned to local trains for delivery. Others are reassembled into trains heading to classification yards closer to their final destination. A single car might be reclassified or *switched* in several yards before reaching its final destination, a process that made rail freight slow and increased costs. Many freight rail operators are trying to reduce these costs by reducing or eliminating switching in classification yards through techniques such as unit trains and containerization.[3] In many countries, railroads have been built to haul one commodity, such as coal or ore, from an inland point to a port.

Rail freight uses many types of goods wagon (UIC) or freight car (US). These include box cars (US) or covered wagons (UIC) for general merchandise, flat cars (US) or flat wagons (UIC) for heavy or bulky loads, well wagons or "low loader" wagons for transporting road vehicles; there are refrigerator vans for transporting food, simple types of open-topped wagons for transporting bulk material, such as minerals and coal, and tankers for transporting liquids and gases. Most coal and aggregates are moved in hopper wagons or gondolas (US) or open wagons (UIC) that can be filled and discharged rapidly, to enable efficient handling of the materials.

A major disadvantage of rail freight is its lack of flexibility. In part for this reason, rail has lost much of the freight business to road transport. On the other hand, rail transport is very energy-efficient, and much more environmentally friendly than road transport.[2][4] Compared to road transport which employs the use of trucks (lorries), rail transportation ensures that goods that could otherwise be transported on a number of trucks are transported in a single shipment. This saves a lot as far as cost connected to the transportation are concerned.[5] Rail freight transport also has very low external costs.[2] Therefore, many governments have been stimulating the switch of freight from trucks onto trains, because of the environmental benefits that it would bring.[2][4] Railway transport and inland navigation (also known as 'inland waterway transport' (IWT) or 'inland shipping') are similarly environmentally friendly modes of transportation, and both form major parts of the 2019 European Green Deal.[2]

In Europe (particularly Britain), many manufacturing towns developed before the railway. Many factories did not have direct rail access. This meant that freight had to be shipped through a goods station, sent by train and unloaded at another goods station for onward delivery to another factory. When lorries (trucks) replaced horses it was often economical and faster to make one movement by road. In the United States, particularly in the West and Midwest, towns developed with railway and factories often had a direct rail connection. Despite the closure of many minor lines carload shipping from one company to another by rail remains common.

Railroads were early users of automatic data processing equipment, starting at the turn of the twentieth century with punched cards and unit record equipment.[6] Many rail systems have turned to computerized scheduling and optimization for trains which has reduced costs and helped add more train traffic to the rails.

Freight railroads' relationship with other modes of transportation varies widely. There is almost no interaction with airfreight, close cooperation with ocean-going freight and a mostly competitive relationship with long distance trucking and barge transport. Many businesses ship their products by rail if they are shipped long distance because it can be cheaper to ship in large quantities by rail than by truck; however barge shipping remains a viable competitor where water transport is available.[7]

Freight trains are sometimes illegally boarded by individuals who do not have the money or the desire to travel legally, a practice referred to as "hopping". Most hoppers sneak into train yards and stow away in boxcars. Bolder hoppers will catch a train "on the fly", that is, as it is moving, leading to occasional fatalities, some of which go unrecorded. The act of leaving a town or area, by hopping a freight train is sometimes referred to as "catching-out", as in catching a train out of town.[8]

# Bulk

Bulk cargo constitutes the majority of tonnage carried by most freight railroads. Bulk cargo is commodity cargo that is transported unpackaged in large quantities. These cargo are usually dropped or poured, with a spout or shovel bucket, as a liquid or solid, into a railroad car. Liquids, such as petroleum and chemicals, and compressed gases are carried by rail in tank cars.[9]

Freight wagons filled with limestone await unloading, at sidings in Rugby, Warwickshire, England

Bulk freight car scales at the MMA Mack Point yard, Searsport, Maine

Hopper cars are freight cars used to transport dry bulk commodities such as coal, ore, grain, track ballast, and the like. This type of car is distinguished from a gondola car (US) or open wagon (UIC) in that it has opening doors on the underside or on the sides to discharge its cargo. The development of the hopper car went along with the development of automated handling of such commodities, with automated loading and unloading facilities. There are two main types of hopper car: open and covered; Covered hopper cars are used for cargo that must be protected from the elements (chiefly rain) such as grain, sugar, and fertilizer. Open cars are used for commodities such as coal, which can get wet and dry out with less harmful effect. Hopper cars have been used by railways worldwide whenever automated cargo handling has been desired. Rotary car dumpers simply invert the car to unload it, and have become the preferred unloading technology, especially in North America; they permit the use of simpler, tougher, and more compact (because sloping ends are not required) gondola cars instead of hoppers.

## Heavy-duty ore traffic

The heaviest trains in the world carry bulk traffic such as iron ore and coal. Loads can be 130 tonnes per wagon and tens of thousands of tonnes per train. Daqin Railway transports more than 1 million tonnes of coal to the east sea shore of China every day and in 2009 is the busiest freight line in the world[10] Such economies of scale drive down operating costs. Some freight trains can be over 7 km long.

# Containerization

Containerization is a system of intermodal freight transport using standard shipping containers (also known as 'ISO containers' or 'isotainers') that can be loaded with cargo, sealed and placed onto container ships, railroad cars, and trucks. Containerization has revolutionized cargo shipping. As of 2009 approximately 90% of non-bulk cargo worldwide is moved by containers stacked on transport ships;[11] 26% of all container transshipment is carried out in China.[12] As of 2005, some 18 million total containers make over 200 million trips per year.

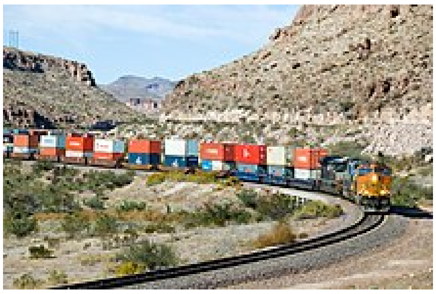
A container train in Germany

Use of the same basic sizes of containers across the globe has lessened the problems caused by incompatible rail gauge sizes in different countries by making transshipment between different gauge trains easier.[13]

While typically containers travel for many hundreds or even thousands kilometers on the railway, Swiss experience shows that with properly coordinated logistics, it is possible to operate a viable intermodal (truck + rail) cargo transportation system even within a country as small as Switzerland.[14]

## Double-stack containerization

Most flatcars (flat wagons) cannot carry more than one standard 40-foot (12.2 m) container on top of another because of limited vertical clearance, even though they usually can carry the weight of two. Carrying half the possible weight is inefficient. However, if the rail line has been built with sufficient vertical clearance, a double-stack car can accept a container and still leave enough clearance for another container on top. This usually precludes operation of double-stacked wagons on lines with overhead electric wiring. China runs double-stack trains with overhead wiring, but does not allow two maximum height containers to be stacked.[15]



Train in Arizona, with 20-, 40- and-53 foot containers double stacked in well cars

In the United States, Southern Pacific Railroad (SP) with Malcom McLean came up with the idea of the first double-stack intermodal car in 1977.[16][17] SP then designed the first car with ACF Industries that same year.[18][19] At first it was slow to become an industry standard, then in 1984 American President Lines started working with the SP and that same year, the first all "double stack" train left Los Angeles, California for South Kearny, New Jersey, under the name of "Stacktrain" rail service. Along the way the train transferred from the SP to Conrail. It saved shippers money and now accounts for almost 70 percent of intermodal freight transport shipments in the United States, in part due to the generous vertical clearances used by U.S. railroads. These lines are diesel operated with no overhead wiring.

Double stacking is also used in Australia between Adelaide, Parkes, Perth and Darwin. These are diesel only lines with no overhead wiring. Saudi Arabian Railways use double-stack in its Riyadh-Dammam corridor. Double stacking is used in India for selected freight-only lines.[15]

### Rolling highways and piggy back service

In some countries rolling highway, or rolling road,[20] trains are used; trucks can drive straight onto the train and drive off again when the end destination is reached. A system like this is used on the Channel Tunnel between the United Kingdom and France, as well as on the Konkan Railway in India. In other countries, the tractor unit of each truck is not carried on the train, only the trailer. *Piggy back* trains are common in the United States, where they are also known as *trailer on flat car* or TOFC trains, but they have lost market share to containers (COFC), with longer, 53-foot containers frequently used for domestic shipments. There are also roadrailer vehicles, which have two sets of wheels, for use in a train, or as the trailer of a road vehicle.

## Special cargo

Several types of cargo are not suited for containerization or bulk; these are transported in special cars custom designed for the cargo.

Steel train,
western New South Wales, Australia

- Automobiles are stacked in open or closed autoracks, the vehicles being driven on or off the carriers.
- Coils of steel strip are transported in modified gondolas called coil cars.
- Goods that require certain temperatures during transportation can be transported in refrigerator cars (reefers, US), or refrigerated vans (UIC), but refrigerated containers are becoming more dominant.
- Center beam flat cars are used to carry lumber and other building supplies.
- Extra heavy and oversized loads are carried in Schnabel cars

## Less than carload freight

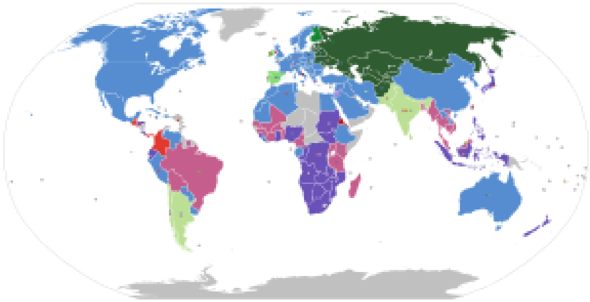
Less-than-carload freight is any load that does not fill a boxcar or box motor or less than a Boxcar load.

Historically in North America, trains might be classified as either **way freight** or through freight. A way freight generally carried less-than-carload shipments to/from a location, whose origin/destination was a rail terminal yard. This product sometimes arrived at/departed from that yard by means of a through freight.

At a minimum, a way freight comprised a locomotive and caboose, to which cars called pickups and setouts were added or dropped off along the route. For convenience, smaller consignments might be carried in the caboose, which prompted some railroads to define their cabooses as way cars, although the term equally applied to boxcars used for that purpose. Way stops might be industrial sidings, stations/flag stops, settlements, or even individual residences.

With the difficulty of maintaining an exact schedule, way freights yielded to scheduled passenger and through trains.[21] They were often mixed trains that served isolated communities. Like passenger service generally, way freights and their smaller consignments became uneconomical. In North America, the latter ceased,[22] and the public sector took over passenger transportation. Good roads and trucking have replaced way freights in most parts of the world.

# Regional differences



A map of the world showing regions by principal rail track gauge.

Railroads are subject to the network effect: the more points they connect to, the greater the value of the system as a whole. Early railroads were built to bring resources, such as coal, ores and agricultural products from inland locations to ports for export. In many parts of the world, particularly the southern hemisphere, that is still the main use of freight railroads. Greater connectivity opens the rail network to other freight uses including non-export traffic. Rail network connectivity is limited by a number of factors, including geographical barriers, such as oceans and mountains, technical incompatibilities, particularly different track gauges and railway couplers, and political conflicts. The largest rail networks are located in North America and Eurasia. Long distance freight trains are generally longer than passenger trains, with greater length improving efficiency. Maximum length varies widely by system. (*See* longest trains for train lengths in different countries.)

Generally trucking moves the most tonnage of all traffic in most large economies. Many countries are moving to increase speed and volume of rail freight in an attempt to win markets over or to relieve overburdened roads and/or speed up shipping in the age of online shopping. In Japan, trends towards adding rail freight shipping are more due to availability of workers rather than other concerns.

Rail freight tonnage as a percent of total moved by country:

- Russia: about 12% in 2016[23] up 11%
- Japan: 5% in 2017[24]
- USA: 40% in 2009[25]
- China: 8% in 2016[26]
- EU28: less than 20% of all "inland traffic" in 2014[27]

## Eurasia

Coal awaiting shipment to an electric generating plant in Germany

There are four major interconnecting rail networks on the Eurasian land mass, along with other smaller national networks.

Most countries in the European Union participate in an auto-gauge network. The United Kingdom is linked to this network via the Channel Tunnel. The Marmaray project connects Europe with eastern Turkey, Iran, and the Middle East via a rail tunnel under the Bosphorus. The 57-km Gotthard Base Tunnel improved north–south rail connections when it opened in 2016. Spain and Portugal are mostly broad gauge, though Spain has built some standard gauge lines that connect with the European high-speed passenger network. A variety of electrification and signaling systems is in use, though this is less of an issue for freight; however, overhead electrification prevents double-stack service on most lines. Buffer-and-screw couplings are generally used between freight vehicles, although there are plans to develop an automatic coupler compatible with the Russian SA3. *See* Railway coupling conversion.

Freight train on the Suihua–Jiamusi Railway in Yichun, Heilongjiang

The countries of the former Soviet Union, along with Finland and Mongolia, participate in a Russian gauge-compatible network, using SA3 couplers. Major lines are electrified. Russia's Trans-Siberian Railroad connects Europe with Asia, but does not have the clearances needed to carry double-stack containers. Numerous connections are available between Russian-gauge countries with their standard-gauge neighbors in the west (throughout Europe) and south (to China, North Korea, and Iran via Turkmenistan). While the USSR had important railway connections to Turkey (from Armenia) and to Iran (from Azerbaijan's Nakhchivan enclave), these have been out of service since the early 1990s, since a number of frozen conflicts in the Caucasus region have forced the closing of the rail connections between Russia and Georgia via Abkhazia, between Armenia and Azerbaijan, and between Armenia and Turkey.

China has an extensive standard-gauge network. Its freight trains use Janney couplers. China's railways connect with the standard-gauge network of North Korea in the east, with the Russian-gauge network of Russia, Mongolia, and Kazakhstan in the north, and with the meter-gauge network of Vietnam in the south.

India and Pakistan operate entirely on broad gauge networks. Indo-Pakistani wars and conflicts currently restrict rail traffic between the two countries to two passenger lines. There are also links from India to Bangladesh and Nepal, and from Pakistan to Iran, where a new, but little-used, connection to the standard-gauge network is available at Zahedan.

The four major Eurasian networks link to neighboring countries and to each other at several break of gauge points. Containerization has facilitated greater movement between networks, including a Eurasian Land Bridge.

## North America

Mixed freight running downhill in Caliente, California

Canada, Mexico and the United States are connected by an extensive, unified standard gauge rail network. The one notable exception is the isolated Alaska Railroad, which is connected to the main network by rail barge.

Rail freight is well standardized in North America, with Janney couplers and compatible air brakes. The main variations are in loading gauge and maximum car weight. Most trackage is owned by private companies that also operate freight trains on those tracks. Since the Staggers Rail Act of 1980, the freight rail industry in the U.S. has been largely deregulated. Freight cars are routinely interchanged between carriers, as needed, and are identified by company reporting marks and serial numbers. Most have computer readable automatic equipment identification transponders. With isolated exceptions, freight trains in North America are hauled by diesel locomotives, even on the electrified Northeast Corridor.

Ongoing freight-oriented development includes upgrading more lines to carry heavier and taller loads, particularly for double-stack service, and building more efficient intermodal terminals and transload facilities for bulk cargo. Many railroads interchange in Chicago, and a number of improvements are underway or proposed to eliminate bottlenecks there.[28] The U.S. Rail Safety Improvement Act of 2008 mandates eventual conversion to Positive Train Control signaling. In the 2010s, most North American Class I railroads have adopted some form of precision railroading.[29]

## Central America

The Guatemala railroad is currently inactive, preventing rail shipment south of Mexico. Panama has freight rail service, recently converted to standard gauge, that parallels the Panama Canal. A few other rail systems in Central America are still in operation, but most have closed. There has never been a rail line through Central America to South America.

## South America

Brazil has a large rail network, mostly metre gauge, with some broad gauge. It runs some of the heaviest iron ore trains in the world on its metre gauge network.

Argentina have Indian gauge networks in the south, standard gauge in the east and metre gauge networks in the north. The metre gauge networks are connected at one point, but there has never been a broad gauge connection. (A metre-gauge connection between the two broad gauge networks, the Transandine Railway was constructed but is not currently in service. *See also Trans-Andean railways.*) Most other countries have few rail systems. The standard gauge in the east, connect with Paraguay and Uruguay.

## Africa

The railways of Africa were mostly started by colonial powers to bring inland resources to port. There was little regard for eventual interconnection. As a result, there are a variety of gauge and coupler standards in use. A 3 ft 6 in (1,067 mm) gauge network with Janney couplers serves southern Africa. East Africa uses metre gauge. North Africa uses standard gauge, but potential connection to the European standard gauge network is blocked by the Arab–Israeli conflict.

Iron ore train in Mauritania

## Australia


Pacific National intermodal service from Perth in Western Australia

Rail developed independently in different parts of Australia and, as a result, three major rail gauges are in use. A standard gauge Trans-Australian Railway spans the continent.

# Statistics

Rail freight by network, billion tonne-km 2019[30]

| Network | Gt-km | Countries |
|---|---|---|
| North America | 2863 | U.S., Canada, Mexico |
| China | 4389 | [31] |
| Russia | 2351 | CIS, Finland, Mongolia |
| India | 607 | |
| European Union | 400 | 27 member countries[32] |
| Brazil | 269 | includes Bolivia (1) |
| South Africa | 115 | includes Zimbabwe (1.6) |
| Australia | 64 | |
| Japan | 20 | |
| South Korea | 10 | |

In 2011, North American railroads operated 1,471,736 freight cars and 31,875 locomotives, with 215,985 employees, They originated 39.53 million carloads (averaging 63 tons each) and generated $81.7 billion in freight revenue. The largest (Class 1) U.S. railroads carried 10.17 million intermodal containers and 1.72 million trailers. Intermodal traffic was 6.2% of tonnage originated and 12.6% of revenue. The largest commodities were coal, chemicals, farm products, nonmetallic minerals and intermodal. Coal alone was 43.3% of tonnage and 24.7% of revenue. The average haul was 917 miles. Within the U.S. railroads carry 39.9% of freight by ton-mile, followed by trucks (33.4%), oil pipelines (14.3%), barges (12%) and air (0.3%).[33]

Railways carried 17.1% of EU freight in terms of tonne-km,[34] compared to road transport (76.4%) and inland waterways (6.5%).[35]

# Named freight trains

- *Super C*
- "Juice Train"
- Coke Express

Unlike passenger trains, freight trains are rarely named.

## Gallery

A typical U.S. classification yard in Denver, Colorado. Intermodal terminal is on the right

Freight train in Rostov Oblast, Russia

Old type of steam-hauled freight train in 1964

A container train passing through Jacksonville, Florida, with 53 ft (16.15 m) containers used for shipments within North America

A M250 series, multiple unit freight train running in Japan.

## See also

- Demurrage
- Great Western Railway wagons
- Interchange
- Intermodal freight transport
- Piggyback (transportation)
- Rolling highway
- Unit train
- Wagonload freight

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# Semi-trailer truck

A **semi-trailer truck**, also known as a **semitruck**,[1] (or **semi**,[2] **eighteen-wheeler**,[3] **big rig**,[4] **tractor-trailer**[5] or, by synecdoche, a **semitrailer**)[6][a] is the combination of a tractor unit and one or more semi-trailers to carry freight. A semi-trailer attaches to the tractor with a type of hitch called a fifth wheel.

Conventional style cab tractor

A cab over semi-trailer

Tractor with an end-dump trailer

A FAW semi-trailer truck in China

## Contents

# Regional configurations

## Europe


A semi-trailer truck (Renault Magnum) of Ninatrans in London, England

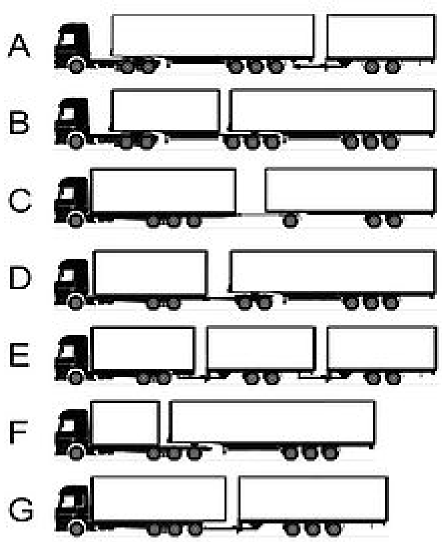
The noticeable difference between tractor units in Europe and North America is that almost all European models are cab over engine (called "forward control" in the UK[11]), while the majority of North American trucks are "conventional" (called "normal control" or "bonneted" in the UK[12]).[13] European trucks, whether straight trucks or fully articulated, have a sheer face on the front. This allows shorter trucks with longer trailers (with larger freight capacity) within the legal maximum total length. Furthermore, it offers greater maneuverability in confined areas, a more balanced weight-distribution, and better overall view for the driver. The major disadvantage is that for repairs on COE trucks, the entire cab has to hinge forward to allow maintenance access.

In Europe, usually only the driven tractor axle has dual wheels, while single wheels are used for every other axle on the tractor and the trailer. The most common combination used in Europe is a semi tractor with two axles and a cargo trailer with three axles, one of which is sometimes a lift axle, giving 5 axles and 12 wheels in total. This format is now common across Europe as it is able to meet the EU maximum weight limit of 40,000 kg (88,000 pounds) without overloading any axle. Individual countries have raised their own weight limit. The U.K., for example, has a 44,000 kg (97,000 pounds) limit, an increase achieved by adding an extra axle to the tractor, usually in the form of a middle unpowered lifting axle (midlift) with a total of 14 wheels. The lift axles used on both tractors and trailers allow the trucks to remain legal when fully loaded (as weight per axle remains within the legal limits); on the other hand, these axle set(s) can be raised off the roadway for increased maneuverability or for reduced fuel consumption and tire wear when carrying lighter loads. Although lift axles usually operate automatically, they can be lowered manually even while carrying light loads, in order to remain within legal (safe) limits when, for example, navigating back-road bridges with severely restricted axle loads. For greater detail, see the United Kingdom section, below.

When using a dolly, which generally has to be equipped with lights and a license plate, rigid trucks can be used to pull semi-trailers. The dolly is equipped with a fifth wheel to which the trailer is coupled. Because the dolly attaches to a pintle hitch on the truck, maneuvering a trailer hooked to a dolly is different from maneuvering a fifth wheel trailer. Backing the vehicle requires the same technique as backing an ordinary truck/full trailer combination, though the dolly/semi setup is probably longer, thus requiring more space for maneuvering. The tractor/semi-trailer configuration is rarely used on timber trucks since they use the two major advantages of having the weight of the load on the drive wheels, and the loader crane used to lift the logs from the ground can be mounted on the rear of the truck behind the load, allowing a short (lightweight) crane to reach both ends of the vehicle without uncoupling. Also, construction trucks are more often seen in a rigid + midaxle trailer configuration instead of the tractor/semi-trailer setup.

### Continental Europe

The maximum overall length in the EU and EEA member states was 18.75 m (61.5 ft) with a maximum weight of 40 or 44 tonnes (39.4 or 43.3 long tons; 44.1 or 48.5 short tons) if carrying an ISO container.[14] However, rules limiting the semi-trailers to 16.5 m (54 ft) and 18.75 m are met with trucks carrying a standardized 7.82 m (26 ft) body with one additional 7.82 m body on tow as a trailer.[15] 25.25-metre (83 ft) truck combinations were developed under the branding of *EcoCombi* which influenced the name of *EuroCombi* for an ongoing standardization effort where such truck combinations shall be legal to operate in all jurisdictions of the European Economic Area. With the 50% increase in cargo weight, the fuel efficiency increases with an average of 20% with a corresponding relative decrease in carbon emissions and with the added benefit of one third fewer trucks on the road.[14] The 1996 EU regulation defines a Europe Module System (EMS) as it was implemented in Sweden. The wording of EMS combinations and EuroCombi are now used interchangeably to point to truck combinations as specified in the EU document; however, apart from Sweden and Finland, the EuroCombi is only allowed to operate on specific roads in other EU member states. Since 1996 Sweden and Finland formally won a final exemption from the European Economic Area rules with 60 tonne and 25.25-metre (83 ft) combinations. From 2006, 25.25 m truck trailer combinations are to be allowed on restricted routes within Germany, following a similar (on-going) trial in The Netherlands. Similarly, Denmark has allowed 25.25 m combinations on select routes. These vehicles will run a 60-tonne (59.1-long-ton; 66.1-short-ton) weight limit. Two types are to be used: 1) a 26-tonne truck pulling a dolly and semi-trailer, or 2) an articulated tractor unit pulling a B-double, member states gained the ability to adopt the same rules. In Italy the maximum permitted weight (unless exceptional transport is authorized) is 44 tonnes for any kind of combination with five axles or more. Czech Republic has allowed 25.25 m combinations with a permission for a selected route.



All EuroCombi variants being considered for Europe-wide adoption

### Nordic countries

Denmark and Norway allow 25.25 m (83 ft) trucks (Denmark from 2008, and Norway from 2008 on selected routes). In Sweden, the allowed length has been 24 m (79 ft) since 1967. Before that, the maximum length was unlimited; the only limitations were on axle load. What stopped Sweden from adopting the same rules as the rest of Europe, when securing road safety, was the national importance of a competitive forestry industry.[14][16] Finland, with the same road safety issues and equally important forestry industry, followed suit. The change made trucks able to carry three stacks of cut-to-length logs instead of two, as it would be in a short


A truck with a swap body pulling a trailer using a dolly; the overall length is 25.25 m (83 ft)

combination. They have one stack together with a crane on the 6×4 truck, and two additional stacks on a four axle trailer. The allowed gross weight in both countries is up to 60 t (59 long tons; 66 short tons) depending on the distance between the first and last axle.

In the negotiations starting in the late 1980s preceding Sweden and Finland's entries to the European Economic Area and later the European Union, they insisted on exemptions from the EU rules citing environmental concerns and the transportation needs of the logging industry. In 1995, after their entry to the union, the rules changed again, this time to allow trucks carrying a standard CEN unit of 7.82 m (26 ft) to draw a 13.6 m (45 ft) standard semi-trailer on a dolly, a total overall length of 25.25 m. Later, B-double combinations came into use, often with one 6 m (20 ft) container on the B-link and a 12 m (40 ft) container (or two 6 m containers) on a semi-trailer bed. In allowing the longer truck combinations, what would take two 16.5 m (54 ft) semi-trailer trucks and one 18.75 m (62 ft) truck and trailer to haul on the continent now could be handled by just two 25.25 m trucks – greatly reducing overall costs and emissions. Prepared since late 2012 and effective in January 2013, Finland has changed its regulations to allow total maximum legal weight of a combination to be 76 t (75 long tons; 84 short tons). At the same time the maximum allowed height would be increased by 20 cm (8 in); from current maximum of 4.2 m (13.8 ft) to 4.4 m (14.4 ft). The effect this major maximum weight increase would cause to the roads and bridges in Finland over time is strongly debated.

However, longer and heavier combinations are regularly seen on public roads; special permits are issued for special cargo. The mining company Boliden AB have a standing special permit for 76-tonne (75-long-ton; 84-short-ton) combinations on select routes between mines in the inland and the processing plant in Boliden, taking a 50-tonne (49-long-ton; 55-short-ton) load of ore. Volvo has a special permit for a 32 m (105 ft), steering B-trailer-trailer combination carrying two 12 m (40 ft) containers to and from Gothenburg harbour and the Volvo Trucks factory, all on the island of Hisingen.[17] Another example is the ongoing project *En Trave Till* (lit. *One more pile/stack*) started in December 2008. It will allow even longer vehicles to further rationalize the logging transports. As the name of the project points out, it will be able to carry four stacks of timber, instead of the usual three. The test is limited to Norrbotten county and the European route E4 between the timber terminal in Överkalix and the sawmill in Munksund (outside Piteå). The vehicle is a 30 m (98 ft) long truck trailer combination with a gross weight exceeding 90 tonnes (89 long tons; 99 short tons). It is estimated that this will give a 20% lower cost and 20-25% $CO_2$ emissions reduction compared to the regular 60-tonne (59-long-ton; 66-short-ton) truck combinations. As the combination spreads its weight over more axles, braking distance, road wear and traffic safety is believed to be either the same or improved with the 90-tonne (89-long-ton; 99-short-ton) truck-trailer. In the same program two types of 76-tonne (75-long-ton; 84-short-ton) combinations will be tested in Dalsland and Bohuslän counties in western Sweden: an enhanced truck and trailer combination for use in the forest and a b-double for plain highway transportation to the mill in Skoghall. In 2012, the Northland Mining company received permission for 90-tonne (89-long-ton; 99-short-ton) combinations with normal axle load (an extra dolly) for use on the 150 km (93 mi) Kaunisvaara-Svappavaara route, carrying iron ore.[18][19][20]

As of 2015, the longest and heaviest truck in everyday use in Finland is operated by transport company Ketosen Kuljetus as part of a pilot project studying transport efficiency in the timber industry. The combined vehicle is 33 metres (108 ft) long, has 13 axles, and weighs a total of 104 tonnes (102 long tons; 115 short tons).[21][22]

Starting from Jan 21 2019 the Government of Finland changed the maximum allowed length of truck from 25.25 to 34.50 meters (82.8 to 113.2 ft). New types of vehicle combinations that differ from the current standards may also be used on the road. The requirements for combinations also include camera systems for side visibility, an advanced emergency braking and lane detector system, electronic driving stability system and electronically controlled brakes. [1] (https://valtioneuvosto.fi/en/article/-/asset_publisher/ajoneuvoyhdistelmien-enimmaispituudeksi-34-5-metria) [2] (https://www.lvm.fi/-/maximum-length-of-a-vehicle-combination-34.5-metres-995264)

### United Kingdom


Semi-trailer trucks with extended tents, representing Renault at Silverstone

In the United Kingdom, a semi-trailer truck is known as an 'articulated lorry' (or colloquially as an 'artic'). The maximum permitted gross weight of a semi-trailer truck without the use of a Special Type General Order (STGO) is 44,000 kg (97,000 lb). In order for a 44,000 kg semi-trailer truck to be permitted on UK roads the tractor and semi-trailer must have three or more axles each. Lower weight semi-trailer trucks can mean some tractors and trailer having fewer axles.[23] In practice, as with double decker buses and coaches in the UK, there is no legal height limit for semi-trailer trucks; however, bridges over 16.5 ft (5.03 m) do not have the height marked on them. Semi-trailer trucks in continental Europe have a height limit of 13.1 ft (4.0 m). Vehicles heavier than 44,000 kg are permitted on UK roads but are indivisible loads, which would be classed as abnormal (or oversize). Such vehicles are required to display an STGO (Special Types General Order) plate on the front of the tractor unit and, under certain circumstances, are required to travel by an authorized route and have an escort.

Most UK trailers are 45 ft (13.7 m) long and, dependent on the position of the fifth wheel and kingpin, a coupled tractor unit and trailer will have a combined length of between 50 and 55 ft (15.25 and 16.75 m). Although the Construction and Use Regulations allow a maximum rigid length of 60 ft (18.2 m), this, combined with a shallow kingpin and fifth wheel set close to the rear of the tractor unit, can give an overall length of around 75 ft (22.75 m).[24]

In January 2012, the Department for Transport began conducting a trial of longer semi-trailers. The trial involves 900 semi-trailers of 48 ft (14.6 m) in length (i.e. 3 ft [1 m] longer than the current maximum), and a further 900 semi-trailers of 51 ft (15.65 m) in length (i.e. 7 ft [2.05 m] longer). This will result in the total maximum length of the semi-trailer truck being 57 ft (17.5 m) for trailers 48 ft in length, and 61 ft (18.55 m) for trailers 51 ft long. The increase in length will not result in the 97,000 lb weight limit being exceeded and will allow some operators to approach the weight limit which may not have been previously possible due to the previous length of trailers. The trial will run for a maximum of 10 years. Providing certain requirements are fulfilled, a Special Types General Order (STGO) allows for vehicles of any size or weight to travel on UK roads. However, in practice, any such vehicle has to travel by a route authorized by the Department of Transport and move under escort. The escort of abnormal loads in the UK is now predominantly carried out by private companies, but extremely large or heavy loads that require road closures must still be escorted by the police.

In the UK, some semi-trailer trucks have eight tires on three axles on the tractor; these are known as six-wheelers or "six leggers," with either the center or rear axle having single wheels which normally steer as well as the front axle and can be raised when not needed (i.e. when unloaded or only a light load is being carried; an arrangement known as a TAG axle when it is the rear axle, or mid-lift when it is the center axle). Some trailers have two axles which have twin tires on each axle; other trailers have three axles, of which one axle can be a lift axle which has super-single wheels. In the UK, two wheels bolted to the same hub are classed as a single wheel, therefore a standard six-axle articulated truck is considered to have twelve wheels, even though it has twenty tires. The UK also allows semi-trailer truck which have six tires on two axles; these are known as four-wheelers.

In 2009, the operator Denby Transport designed and built a 83 ft long (25.25 m) B-Train (or B-Double) semi-trailer truck called the Denby Eco-Link to show the benefits of such a vehicle, which were a reduction in road accidents and result in fewer road deaths, a reduction in emissions due to the one tractor unit still being used and no further highway investment being required. Furthermore, Denby Transport asserted that two Eco-Links would replace three standard semi-trailer trucks while, if limited to the current UK weight limit of 97,000 lb, it was claimed the Eco-Link would reduce carbon emissions by 16% and could still halve the number of trips needed for the same amount of cargo carried in conventional semi-trailer trucks. This is based on the fact that for light but bulky goods such as toilet paper, plastic bottles, cereals and aluminum cans, conventional semi-trailer trucks run out of cargo space before they reach the weight limit. At 97,000 lb, as opposed to 132,000 lb usually associated with B-Trains, the Eco-Link also exerts less weight per axle on the road compared to the standard six-axle 97,000 lb semi-trailer truck.

The vehicle was built after Denby Transport believed they had found a legal-loophole in the present UK law to allow the Eco-Link to be used on the public roads. The relevant legislation concerned the 1986 Road Vehicles Construction and Use Regulations. The 1986 regulations state that "certain vehicles" may be permitted to draw more than one trailer and can be up to 85 ft (25.9 m). The point of law reportedly hinged on the definition of a "towing implement", with Denby prepared to argue that the second trailer on the Eco-Link was one. The Department for Transport were of the opinion that this refers to recovering a vehicle after an accident or breakdown, but the regulation does not explicitly state this.

During BTAC performance testing the Eco-Link was given an "excellent" rating for its performance in maneuverability, productivity, safety and emissions tests, superseding ordinary semi-trailer trucks in many respects. Reportedly, private trials had also shown the Denby vehicle had a 20% shorter stopping distance than conventional semi-trailer trucks of the same weight, due to having extra axles. The active steer system meant that the Eco-Link had a turning circle of 41 ft (12.5 m), the same as a conventional semi-trailer truck.

Although the Department for Transport advised that the Eco-Link was not permissible on public roads, Denby Transport gave the Police prior warning of the timing and route of the test drive on the public highway, as well as outlining their position in writing to the Eastern Traffic Area Office. On 1 December 2009 Denby Transport were preparing to drive the Eco-Link on public roads, but this was cut short because the Police pulled the semi-trailer truck over as it left the gates in order to test it for its legality "to investigate any... offenses which may be found". The Police said the vehicle was unlawful due to its length and Denby Transport was served with a notice by the Vehicle and Operator Services Agency (VOSA) inspector to remove the vehicle from the road for inspection. Having returned to the yard, Denby Transport was formally notified by Police and VOSA that the semi-trailer truck could not be used. Neither the Eco-Link, nor any other B-Train, have since been permitted on UK roads. However, this prompted the Department for Transport to undertake a desk study into semi-trailer trucks, which has resulted in the longer semi-trailer trial which commenced in 2012.

## North America

In North America, the combination vehicles made up of a powered semi-tractor and one or more semitrailers are known as "semis", "semitrailers",[25] "tractor-trailers", "big rigs", "semi-trucks", "eighteen-wheelers", or "semi-tractor-trailers".

Tractor unit hauling tractor units in Idaho

The tractor unit typically has two or three axles; those built for hauling heavy-duty commercial-construction machinery may have as many as five, some often being lift axles.

The most common tractor-cab layout has a forward engine, one steering axle, and two drive axles. The fifth-wheel trailer coupling on most tractor trucks is movable fore and aft, to allow adjustment in the weight distribution over its rear axle(s).

Ubiquitous in Europe but less common in North America since the 1990s, is the cabover engine configuration, where the driver sits next to or over the engine. With changes in the US to the maximum length of the combined vehicle, the cabover was largely phased out of North American over-the-road (long-haul) service by 2007. Cabovers were difficult to service; for a long time, the cab could not be lifted on its hinges to a full 90-degree forward tilt, severely limiting access to the front of the engine.

As of 2016, a truck could cost US$100,000, while the diesel fuel cost could be $70,000 per year.[26] Trucks average from 4 to 8 miles per US gallon (59 to 29 L/100 km), with fuel economy standards requiring better than 7 miles per US gallon (34 L/100 km) efficiency by 2014.[27] Power requirements in standard conditions are 170 hp at 55 mph (89 km/h) or 280 hp at 70 mph (113 km/h), and somewhat different power usage in other conditions.[28]

The cargo trailer usually has tandem axles at the rear, each of which has dual wheels, or eight tires on the trailer, four per axle. In the US it is common to refer to the number of wheel hubs, rather than the number of tires; an axle can have either single or dual tires with no legal difference.[29][30] The combination of eight tires on the trailer and ten tires on the tractor is what led to the moniker *eighteen wheeler*, although this term is considered by some truckers to be a misnomer (the term "eighteen-wheeler" is a nickname for a five-axle over-the-road combination). Many trailers are equipped with movable tandem axles to allow adjusting the weight distribution.


Rocky Mountain Double


STAA double pup 28.5-foot trailers

To connect the second of a set of doubles to the first trailer, and to support the front half of the second trailer, a converter gear known as a "dolly" is used. This has one or two axles, a fifth-wheel coupling for the rear trailer, and a tongue with a ring-hitch coupling for the forward trailer. Individual states may further allow longer vehicles, known as "longer combination vehicles" (or LCVs), and may allow them to operate on roads other than Interstates.

Long combination vehicle types include:

- Doubles (officially "STAA doubles", known colloquially as "a set of joints"): Two 28.5 ft (8.7 m) trailers.
- B-Doubles: Twin 33 ft (10.1 m) trailers in B-double configuration (very common in Canada but rarely used in the United States).
- Triples: Three 28.5 ft (8.7 m) trailers.
- Turnpike Doubles: Two 48 ft (14.6 m) trailers.
- Rocky Mountain Doubles: One 40 to 53 ft (12.2 to 16.2 m) trailer (though usually no more than 48 ft (14.6 m)) and one 28.5 ft (8.7 m) trailer (known as a "pup").
- In Canada, a Turnpike Double is two 53 ft (16.2 m) trailers, and a Rocky Mountain Double is a 50 ft (15.2 m) trailer with a 24 ft (7.3 m) "pup".[31][32][33]

Future long combination vehicles under consideration and study for the US MAP-21 transportation bill are container doubles. These combinations are under study for potential recommendation in November 2014:

- 40 ft (12 m) trailer Turnpike Doubles, 142,000 lb (64,000 kg) GVWR

- 40 ft (12 m) and 20 ft (6.1 m) trailer Rocky Mountain Doubles, 144,000 lb (65,000 kg) GVWR
- Double 20 ft (6.1 m) trailers.

The US federal government, which only regulates the Interstate Highway System, does not set maximum length requirements (except on auto and boat transporters), only minimums. Tractors can pull two or three trailers if the combination is legal in that state. Weight maximums are 20,000 lb (9,100 kg) on a single axle, 34,000 lb (15,000 kg) on a tandem, and 80,000 lb (36,000 kg) total for any vehicle or combination. There is a maximum width of 8.5 ft (2.6 m) and no maximum height.[34][35]

Roads other than Interstates are regulated by individual states, and laws vary widely. Maximum weight varies between 80,000 lb (36,000 kg) to 171,000 lb (78,000 kg), depending on the combination.[36] Most states restrict operation of larger tandem trailer setups such as triple units, turnpike doubles, and Rocky Mountain doubles. Reasons for limiting the legal trailer configurations include 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. In general, these configurations are restricted to the Interstates. Except for these units, double setups are not restricted to certain roads any more than a single setup. They are also not restricted by weather conditions or "difficulty of operation". The Canadian province of Ontario, however, does have weather-related operating restrictions for larger tandem trailer setups.[37]

## Oceania

### Australia

Australian road transport has a reputation for using very large trucks and road trains. This is reflected in the most popular configurations of trucks generally having dual drive axles and three axles on the trailers, with four tires on each axle. This means that Australian single semi-trailer trucks will usually have 22 tires, which is generally more than their counterparts in other countries. Super single tires are sometimes used on tri-axle trailers. The suspension is designed with travel limiting, which will hold the rim off the road for one blown or deflated tyre for each side of the trailer, so a trailer can be driven at reduced speed to a safe place for repair. Super singles are also often used on the steer axle in Australia to allow greater loading over the steer axle. The increase in loading of steer tires requires a permit.

Long haul transport usually operates as B-doubles with two trailers (each with three axles), for a total of nine axles (including steering). In some lighter duty applications only one of the rear axles of the truck is driven, and the trailer may have only two axles. From July 2007, the Australian Federal and State Governments allowed the introduction of B-triple trucks on a specified network of roads.[38] B-Triples are set up differently from conventional road trains. The front of their first trailer is supported by the turntable on the prime mover. The second and third trailers are supported by turntables on the trailers in front of them. As a result, B-Triples are much more stable than road trains and handle exceptionally well. True road trains only operate in remote areas, regulated by each state or territory government.

In total, the maximum length that any articulated vehicle may be (without a special permit and escort) is 53.5 m (176 ft), its maximum load may be up to 164 tonnes gross, and may have up to four trailers. However, heavy restrictions apply to the areas where such a vehicle may travel in most states. 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 daytime, especially four-trailer road trains.

Articulated trucks towing a single trailer or two trailers (commonly known as "short doubles") with a maximum overall length of 19 m (62 ft) are referred to as "General access heavy vehicles" and are permitted in all areas, including metropolitan. B-doubles are limited to a maximum total weight of

62.5 tonnes and overall length of 25 m (82 ft), or 26 m (85 ft) if they are fitted with approved FUPS (Front Underrun Protection System) devices. B-doubles may only operate on designated roads, which includes most highways and some major metropolitan roads. B-doubles are very common in all parts of Australia including state capitals and on major routes they outnumber single trailer configurations.

Maximum width of any vehicle is 2.5 m (8.2 ft) and a height of 4.3 m (14 ft). In the past few years, allowance has been made by several states to allow certain designs of heavy vehicles up to 4.6 m (15 ft) high but they are also restricted to designated routes. In effect, a 4.6 meter high B-double will have to follow two sets of rules: they may access only those roads that are permitted for B-doubles *and* for 4.6 meter high vehicles.

In Australia, both conventional prime movers and cabovers are common, however, cabovers are most often seen on B-doubles on the eastern seaboard where the reduction in total length allows the vehicle to pull longer trailers and thus more cargo than it would otherwise.

An Australian prime mover Kenworth and B double trailer combination

A road train in Australia

B-double truck on the Sturt Highway

### New Zealand

New Zealand legislation governing truck dimensions falls under the Vehicle Dimensions and Mass Rules, published by NZ Transport Agency.[39] New rules were introduced effective 1 February 2017,[40] which increased the maximum height, width and weight of loads and vehicles, to simplify regulations, increase the amount of freight carried by road, and to improve the range of vehicles and trailers available to transport operators.

Common combinations in New Zealand are a standard semi-trailer, a B-double, or a rigid towing vehicle pulling a trailer with a drawbar, with a maximum of nine axles. Standard maximum vehicle lengths for trailers with one axle set are:

- Semi-trailer: 19 m (62 ft)
- Simple: 22 m (72 ft)
- Pole: 20 m (66 ft)

Trailers with two axle sets can be 20 m (66 ft) long, including heavy rigid vehicles towing two trailers. Oversized loads require, at minimum, a permit, and may require one or more pilot vehicles.[41]

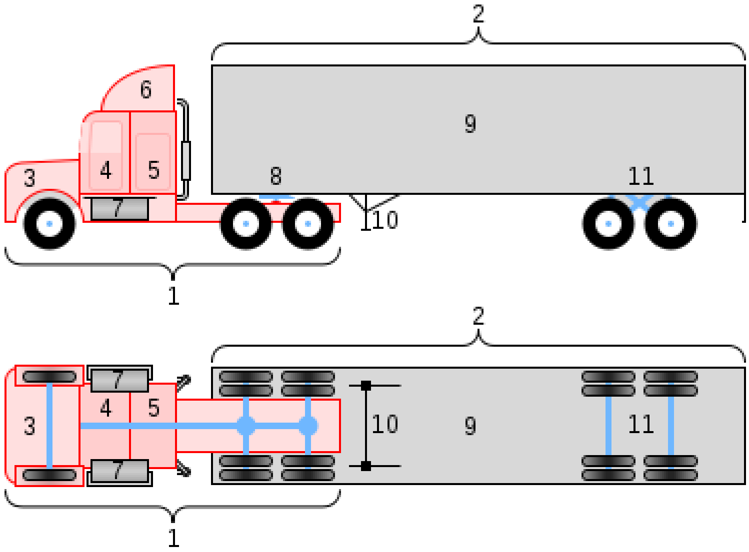
**High-productivity motor vehicle** (HPMV) permits are issued for vehicles exceeding 44 tonnes, or the above dimensions.[42] Trucks up to 62 tonnes were allowed, with an initial bridge strengthening program costing $12.5m.[43]

# Construction

## Types of trailers

There are many types of semi-trailers in use, designed to haul a wide range of products.

- Box, or dry van
- Bus
- Car hauler
- Intermodal chassis
- Dry bulk
- Dump
- Flatbed
- Hopper-Bottom
- Lowboy
- Refrigerator
  - Reefer
- Tanker




Side view and underside view of a **conventional 18-wheeler semi-trailer truck** with an enclosed cargo space. The underside view shows the arrangement of the 18 tires (wheels). Shown in blue in the underside view are the axles, drive shaft, and differentials. The legend for labeled parts of the truck is as follows:

1. tractor unit
2. semi-trailer (detachable)
3. engine compartment
4. cabin
5. sleeper (not present in all trucks)
6. air dam (not present in all trucks)
7. fuel tanks
8. fifth wheel coupling
9. enclosed cargo space
10. landing gear - legs for when semi-trailer is detached
11. tandem axles

## Coupling and uncoupling

The cargo trailer is, by means of a king pin, hooked to a horseshoe-shaped quick-release coupling device called a fifth wheel or a turntable hitch at the rear of the towing engine that allows easy hook up and release. The truck trailer cannot move by itself because it only has wheels at the rear end: it requires a forward axle, provided by the towing engine, to carry half the load weight. When braking hard at high speeds, the vehicle has a tendency to fold at the pivot point between the towing vehicle and the trailer. Such a truck accident is called a "trailer swing", although it is also commonly described as a "jackknife."[44] Jackknifing is a condition where the tractive unit swings round against the trailer, and not vice versa.

## Braking

Semi trucks use air pressure, rather than hydraulic fluid, to actuate the brake. The use of air hoses allows for ease of coupling and uncoupling of trailers from the tractor unit. The most common failure is *brake fade*, usually caused when the drums or discs and the linings of the brakes overheat from excessive use.


A pair of semi-trailer "Suzies" at the back of an Australian prime mover, red line for emergency/supply and blue for control

The parking brake of the tractor unit and the emergency brake of the trailer are spring brakes that require air pressure in order to be released. They are applied when air pressure is released from the system, and disengaged when air pressure is supplied. This is a fail-safe design feature which ensures that if air pressure to either unit is lost, the vehicle will stop to a grinding halt, instead of continuing without brakes and becoming uncontrollable. The trailer controls are coupled to the tractor through two *gladhand 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 hose connectors, 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 if they are pulled, as may happen when the tractor and trailer are separated without first uncoupling the air lines. These connectors are similar in design to the ones used for a similar purpose between railroad cars. Two air lines typically connect to 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 during normal operation.

In the UK, male/female quick release connectors (*red line* or emergency), have a female on the truck and male on the trailer, but a *yellow line* or service has a male on the truck and female on the trailer. This avoids coupling errors (causing no brakes) plus the connections will not come apart if pulled by accident. The three electrical lines will fit one way around a primary black, a secondary green, and an ABS lead, all of which are collectively known as *suzies* or *suzie coils*.

Another braking feature of semi-trucks is engine braking, which could be either a compression brake (usually shortened to *Jake brake*) or exhaust brake or combination of both. However, the use of compression brake alone produces a loud and distinctive noise, and to control noise pollution, some local municipalities have prohibited or restricted the use of engine brake systems inside their jurisdictions, particularly in residential areas. The advantage to using engine braking instead of conventional brakes is that a truck can descend a long grade without overheating its wheel brakes. Some vehicles can also be equipped with hydraulic or electric retarders which have an advantage of near silent operation.

## Transmission

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. However, all truck manufacturers now offer automated manual transmissions (manual gearboxes with automated gear change), as well as conventional hydraulic automatic transmissions.

Semi-truck transmissions can have as few as three forward speeds or as many as 18 forward speeds (plus 2 reverse speeds). A large number of transmission ratios means the driver can operate the engine more efficiently. Modern on-highway diesel engines are designed to provide maximum torque in a narrow RPM range (usually 1200-1500 RPM); having more gear ratios means the driver can hold the engine in its optimum range regardless of road speed (drive axle ratio must also be considered).

Traditional manual transmissions have 4-5 ratios on main shift and 3–4 on the auxiliary: pictured is a *5×3* with five main ratios and three auxiliaries

A ten-speed manual transmission, for example, is controlled via a six-slot H-box pattern, similar to that in five-speed cars — five forward and one reverse gear. Gears six to ten (and high-speed reverse) are accessed by a Lo/High range splitter; gears one to five are Lo range; gears six to ten are High range using the same shift pattern. A Super-10 transmission, by contrast, has no range splitter; it uses alternating "stick and button" shifting (stick shifts 1-3-5-7-9, button shifts 2-4-6-8-10). The 13-, 15-, and 18-speed transmissions have the same basic shift pattern but include a splitter button to enable additional ratios found in each range. Some transmissions may have 12 speeds.

Another difference between semi-trucks and cars is the way the clutch is set up. On an automobile, the clutch pedal is depressed full stroke to the floor for every gear shift, to ensure the gearbox is disengaged from the engine. On a semi-truck with constant-mesh transmission (non-synchronized), such as by the Eaton Roadranger series, not only is double-clutching required, but a clutch brake is required as well. The clutch brake stops the rotation of the gears and allows the truck to be put into gear without grinding when stationary. The clutch is pressed to the floor only to allow a smooth engagement of low gears when starting from a full stop; when the truck is moving, the clutch pedal is pressed only far enough to break torque for gear changes.

Theoretically, semi-trucks could have diesel-electric transmission, as electric motors have better torque at 0 RPM than diesel engines, but this would increase the weight of the cabin itself, at the expense of the cargo weight.[45]

## Lights

An electrical connection is made between the tractor and the trailer through a cable often referred to as a *pigtail*. This cable is a bundle of wires in a single casing. Each wire controls one of the electrical circuits on the trailer, such as running lights, brake lights, turn signals, etc. A straight cable would break when the rig went around corners, so a coiled cable is used which retracts these coils when not under tension. It is these coils that cause the cable to look like a pigtail.

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 (amber; red optional in North America. May be combined with a brake light in North America)
- 2 marking lights behind if wider than certain specifications (red; plus a group of 3 red lights in the middle in North America)
- 2 marking lights front if wider than the truck or wider than certain specifications (white; amber in North America)

## Wheels and tires

Although dual wheels are the most common, use of two single, wider tires, known as *super singles*, on each axle is becoming popular among bulk cargo carriers and other weight-sensitive operators. With increased efforts to reduce greenhouse gas emissions, the use of the super-single tire is gaining popularity. There are several advantages to this configuration. The first of these is that super singles reduce fuel consumption. In 1999, tests on an oval track showed a 10% fuel savings when super singles were used. These savings are realized because less energy is wasted flexing fewer tire sidewalls. Second, the lighter overall tire weight allows a truck to be loaded with more freight. The third advantage is that the single wheel encloses less of the brake unit, which allows faster cooling and reduces brake fade.

One of the major disadvantages of the super singles is that they are currently not as widely available as a standard tire. In addition, if a tire should become deflated or be destroyed, there is not another tire attached to the same hub to maintain the dynamic stability of the vehicle, as would be the case with dual wheels. With dual wheels, the remaining tire may be overloaded, but it will typically allow the vehicle to be safely stopped or driven to a repair facility.

In Europe, super singles became popular when the allowed weight of semitrailer rigs was increased from 38 to 40 tonnes.[46] In this reform the trailer industry replaced two 10-tonne (22,000 lb) axles with dual wheels, with three 8-tonne (18,000 lb) axles on wide-base single wheels. The significantly lower axle weight on super singles must be considered when comparing road wear from single versus dual wheels. The majority of super singles sold in Europe have a width of 385 mm (15.2 in). The standard 385 tires have a legal load limit of 4,500 kg (9,900 lb). (Note that expensive, specially reinforced 385 tires approved for 5,000 kg (11,000 lb) do exist. Their market share is tiny, except for mounting on the steer axle.)

## Skirted trailers

An innovation rapidly growing in popularity is the skirted trailer. The space between the road and the bottom of the trailer frame was traditionally left open until it was realized that the turbulent air swirling under the trailer is a major source of aerodynamic drag. Three split skirt concepts were verified by the United States Environmental Protection Agency (EPA) to provide fuel savings greater than 5%, and four split skirt concepts had EPA-verified fuel savings between 4% and 5%.[47]

Skirted trailers are often combined with Underrun Protection Systems (*underride guards*), greatly improving safety for passenger vehicles sharing the road.

## Underride guard

Crash test of an underride guard at 30–40 km/h (19–25 mph); the truck platform at head height has been prevented from slicing through the windshield

Underride protection systems can be installed at the rear, front and sides of a truck and the rear and sides of a trailer. A Rear Underrun Protection System (RUPS) is a rigid assembly hanging down from trailer's chassis, which is intended to provide some protection for passenger cars which collide with the rear of the trailer. Public awareness of this safeguard was increased in the aftermath of the accident that killed actress Jayne Mansfield on 29 June 1967, when the car she was in hit the rear of a tractor-trailer, causing fatal head trauma. After her death, the NHTSA recommended requiring a rear underride guard, also known as a *Mansfield bar*, an *ICC bar*, or a *DOT bumper*.[48][49]

The bottom rear of the trailer is near head level for an adult seated in a car, and without the underride guard, the only protection for such an adult's head in a rear-end collision would be the car's windshield and A pillars. The front of the car goes under the platform of the trailer rather than making contact via the passenger car bumper, so the car's protective crush zone becomes irrelevant and air bags are ineffective in protecting the passengers. The underride guard provides a rigid area for the car to contact that is lower than the lip of the bonnet/hood, preventing the vehicle from squatting and running under the truck and ensuring that the vehicle's crush zones and engine block absorb the force of the collision.

In addition to rear underride guards, truck tractor cabs may be equipped with a Front Underrun Protection System (FUPS) at the front bumper of the truck, if the front end is not low enough for the bumper to provide the adequate protection on its own. The safest tractor-trailers are also equipped with side underride guards, also called Side Underrun Protection System (SUPS). These additional barriers prevent passenger cars from skidding underneath the trailer from the side, such as in an oblique or side collision, or if the trailer jackknifes across the road, and helps protect cyclists, pedestrians and other vulnerable road users.[50]

In Europe, side and rear underrun protection are mandated on all lorries and trailers with a gross weight of 3,500 kilograms (7,700 lb) or more.[51] Several US states and cities have adopted or are in the process of adopting truck side guards, including New York City, Philadelphia, and Washington DC. The NTSB has recommended that the National Highway Traffic Safety Administration (NHTSA) develop standards for side underride protection systems for trucks, and for newly manufactured trucks to be equipped with technology meeting the standards.[52]

In addition to safety benefits, these underride guards may improve fuel mileage by reducing air turbulence under the trailer at highway speeds. Another benefit of having a sturdy rear underride guard is that it may be secured to a loading dock with a hook to prevent "trailer creep", a movement of the trailer away from the dock, which opens up a dangerous gap during loading or unloading operations.[53]

## Semi-truck manufacturers

Current semi-truck manufacturers include:

## Asia-Pacific

- Asia MotorWorks (India)
- C&C Trucks (China)
- CAMC Star (China)
- China National Heavy Duty Truck Group (China)
- FAW Group (China)
- Foton Motor (China)
- Hino Motors (Japan)
- Hyundai (South Korea)
- Isuzu (Japan)
- Mahindra Truck and Bus Division (India)
- Mitsubishi Fuso Truck and Bus Corporation (Japan)
- SAIC Iveco Hongyan (China)
- Tata Daewoo (South Korea-India)
- Tata Motors (India)
- UD Trucks (Japan)

## Canada and United States

- Crane Carrier Company
- Freightliner
- Hino Motors (Canadian plant)
- Hyundai Translead
- Kenworth
- Mack
- Navistar International
- Oshkosh
- Peterbilt
- Caterpillar
- Volvo
- Wabash National
- Western Star
- Tesla[54]

## Europe

- ADR Group Trailer
- DAF Trucks
- Iveco
- Kamaz
- KrAZ
- MAN
- MAZ

- Mercedes-Benz
- Renault Trucks
- Roman
- Scania
- Sisu
- Tatra
- Volvo
- ZiL
- Jelcz

### Other locations

- Al Kowary Industries (Bahrain)
- Ashok Leyland (India)
- BharatBenz (India)
- BMC (Turkey)
- Eicher Motors (India)
- Ford Otosan (Turkey)
- Volkswagen Caminhões e Ônibus (Latin America, South Africa)

## Driver's license

A special driver's license is required to operate various commercial vehicles.

View of a truck's interior dashboard

### Australia

Truck drivers in Australia require an endorsed license. These endorsements are gained through training and experience. The minimum age to hold an endorsed license is 18 years, and/or must have held open (full) driver's license for minimum 12 months.

The following are the heavy vehicle license classes in Australia:

- LR (Light Rigid) – Class LR covers a rigid vehicle with a GVM (gross vehicle mass) of more than 4.5 tonnes but not more than 8 tonnes. Any towed trailer must not weigh more than 9 tonnes GVM. Also includes vehicles with a GVM up to 8 tonnes which carry more than 12 adults including the driver and vehicles in Class C.
- MR (Medium Rigid) – Class MR covers a rigid vehicle with two axles and a GVM of more than 8 tonnes. Any towed trailer must not weigh more than 9 tonnes GVM. Also includes vehicles in Class LR.
- HR (Heavy Rigid) – Class HR covers a rigid vehicle with three or more axles and a GVM of more than 15 tonnes. Any towed trailer must not weigh more than 9 tonnes GVM. Also includes articulated buses and vehicles in Class MR.
- HC (Heavy Combination) – Class HC covers heavy combination vehicles like a prime mover towing a semi-trailer, or rigid vehicles towing a trailer with a GVM of more than 9 tonnes. Also includes vehicles in Class HR.

- MC (Multi Combination) – Class MC covers multi-combination vehicles like road trains and B-double vehicles. Also includes vehicles in Class HC.

In order to obtain an HC License the driver must have held an MR or HR license for at least 12 months. To upgrade to an MC License the driver must have held a HR or HC license for at least 12 months. From licenses MR and upward there is also a B Condition which may apply to the license if testing in a synchromesh or automatic transmission vehicle. The B Condition may be removed upon the driver proving the ability to drive a constant mesh transmission using the clutch. *Constant mesh transmission refers to* crash box *transmissions, predominantly Road Ranger eighteen-speed transmissions in Australia.*

## Canada

Regulations vary by province. A license to operate a vehicle with air brakes is required (i.e., normally a Class I, II, or III commercial license with an "A" or "S" endorsement in provinces other than Ontario). In Ontario, a "Z" endorsement[55] is required to drive any vehicle using air brakes; in provinces other than Ontario, the "A" endorsement is for air brake operation only, and an "S" endorsement is for both operation and adjustment of air brakes. Anyone holding a valid Ontario driver's license (i.e., excluding a motorcycle license) with a "Z" endorsement can legally drive any air-brake-equipped truck-trailer combination with a registered- or actual-gross-vehicle-weight (i.e., including towing- and towed-vehicle) up to 11 tonnes, that includes one trailer weighing no more than 4.6 tonnes if the license falls under the following three classes: Class E (school bus—maximum 24-passenger capacity or ambulance), F (regular bus—maximum 24-passenger capacity or ambulance) or G (car, van, or small-truck).

A Class B (any school bus), C (any urban-transit-vehicle or highway-coach), or D (heavy trucks other than tractor-trailers) license enables its holder to drive any truck-trailer combination with a registered- or actual-gross-vehicle-weight (i.e., including towing- and towed-vehicle) greater than 11 tonnes, that includes one trailer weighing no more than 4.6 tonnes.[56] Anyone holding an Ontario Class A license (or its equivalent) can drive any truck-trailer combination with a registered- or actual-gross-vehicle-weight (i.e., including towing- and towed-vehicles) greater than 11 tonnes, that includes one or more trailers weighing more than 4.6 tonnes.

## Europe

A category CE driving licence is required to drive a tractor-trailer in Europe. Category C (Γ in Greece) is required for vehicles over 7,500 kg (16,500 lb), while category E is for heavy trailers, which in the case of trucks and buses means any trailer over 750 kg (1,650 lb). Vehicles over 3,500 kg (7,700 lb)—which is the maximum limit of B license—but under 7,500 kg can be driven with a C1 license. Buses require a D (Δ in Greece) license. A bus that is registered for no more than 16 passengers, excluding the driver, can be driven with a D1 license.

## New Zealand

In New Zealand, drivers of heavy vehicles require specific licenses, termed as classes. A Class 1 license (*car license*) will allow the driving of any vehicle with Gross Laden Weight (GLW) or Gross Combination Weight (GCW) of 6,000 kg (13,000 lb) or less. For other types of vehicles the classes are separately licensed as follows:

- Class 2 – Medium Rigid Vehicle: Any rigid vehicle with GLW 18,001 kg (39,685 lb) or less with light trailer of 3,500 kg (7,700 lb) or less, any combination vehicle with GCW 12,001 kg

(26,458 lb) or less, any rigid vehicle of any weight with no more than two axles, or any Class 1 vehicle.
- Class 3 – Medium Combination Vehicle: Any combination vehicle of GCW 25,001 kg (55,118 lb) or less, or any Class 2 vehicle.
- Class 4 – Heavy Rigid Vehicle: Any rigid vehicle of any weight, any combination vehicle which consists of a heavy vehicle and a light trailer, or any vehicle of Class 1 or 2 (but not 3).
- Class 5 – Heavy Combination Vehicle: Any combination vehicle of any weight, and any vehicle covered by previous classes.
- Class 6 – Motorcycle.

Further information on the New Zealand licensing system for heavy vehicles can be found at the New Zealand Transport Agency (https://www.nzta.govt.nz/driver-licences/getting-a-licence/licences-by-vehicle-type/what-you-can-drive/).

### Taiwan


Taiwanese sign prohibiting heavy trailers

The Road Traffic Security Rules (道路交通安全規則) require a combination vehicle driver license (Chinese: 聯結車駕駛執照) to drive a combination vehicle (Chinese: 聯結車). These rules define a combination vehicle as a motor vehicle towing a heavy trailer, i.e., a trailer with a gross weight of more than 750 kilograms (1,653 lb).

### United States

Drivers of semi-trailer trucks generally require a Class A commercial driver's license (CDL) to operate any combination vehicles with a gross combination weight rating (or GCWR) in excess of 26,000 lb (11,800 kg) if the gross vehicle weight rating (GVWR) of the towed vehicle(s) is in excess of 10,000 lb (4,500 kg). Some states (such as North Dakota) provide exemptions for farmers, allowing non-commercial license holders to operate semis within a certain air-mile radius of their reporting location. State exemptions, however, are only applicable in intrastate commerce; stipulations of the Code of Federal Regulations (CFR) may be applied in interstate commerce. Also a person under the age of 21 cannot operate a commercial vehicle outside the state where the commercial license was issued. This restriction may also be mirrored by certain states in their intrastate regulations. A person must be at least 18 in order to be issued a commercial license.

In addition, *endorsements* are necessary for certain cargo and vehicle arrangements and types;

- H – Hazardous Materials (HazMat or HM) – necessary if materials require HM placards.
- N – Tankers – the driver is acquainted with the unique handling characteristics of liquids tankers.
- X – Signifies Hazardous Materials and Tanker endorsements, combined.
- T – Doubles & Triples – the licensee may pull more than one trailer.
- P – Buses – Any Vehicle designed to transport 16 or more passengers (including the driver).
- S – School Buses – Any school bus designed to transport 11 or more passengers (including the driver).
- W – Tow Truck

# Role in trade

Modern day semi-trailer trucks often operate as a part of a domestic or international transport infrastructure to support containerized cargo shipment.

Various types of rail flat bed train cars are modified to hold the cargo trailer or container with wheels or without. This is called *Intermodal* or *piggyback*. The system allows the cargo to switch from highway to railway or vice versa with relative ease by using gantry cranes.

The large trailers pulled by a tractor unit come in many styles, lengths, and shapes. Some common types are: vans, reefers, flatbeds, sidelifts 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.

# Media

## Television

- 1960s TV series *Cannonball*
- NBC ran two popular TV series about truck drivers in the 1970s featuring actor Claude Akins in major roles:
  - *Movin' On* (1974–1976)
  - *B. J. and the Bear* (1978–1981)
- *The Highwayman* (1987-1988), a semi-futuristic action-adventure series starring Sam Jones, featuring hi-tech, multi-function trucks.
- *Knight Rider*, an American television show featured a semi-trailer truck called The Semi, operated by the Foundation for Law & Government (F.L.A.G.) as a mobile support facility for KITT. Also, in two episodes KITT faced off against an armored semi called Goliath.
- *The Transformers*, a 1980s cartoon featuring tractor-trailers as the Autobots' leader Optimus Prime (*Convoy* in Japanese version), their second-in-command Ultra Magnus, and as the Stunticons' leader Motormaster. Optimus Prime returned in the 2007 film.
- *Trick My Truck*, a CMT show features trucks getting 'tricked out' (heavily customized).
- *Ice Road Truckers*, a History Channel show charts the lives of drivers who haul supplies to remote towns and work sites over frozen lakes that double as roads.
- *18 Wheels of Justice*, featuring Federal Agent Michael Cates (Lucky Vanous) as a crown witness for the mafia who goes undercover, when forced into it, to fight crime.
- *Eddie Stobart: Trucks & Trailers*, a UK television show showing the trucking company Eddie Stobart and its drivers.
- *Highway Thru Hell*, a Canadian reality TV show that follows the operations of Jamie Davis Motor Trucking, a heavy vehicle rescue and recovery towing company based in Hope, British Columbia.

## Films

- *Duel*, Steven Spielberg's 1971 film, features a Peterbilt 281 tanker truck as the villain
- *White Line Fever*, a 1975 Columbia Pictures film, starring Jan-Michael Vincent
- *Smokey and the Bandit*, a 1977 film featuring a number of trucks on the side of the bandit
- *Convoy*, a 1978 film directed by Sam Peckinpah, starring Kris Kristofferson

- *Maximum Overdrive*, Stephen King's 1986 film, featured big rigs as its primary homicidal villains
- *Over the Top (1987 film)*, a 1987 film directed by Menahem Golan, starring Sylvester Stallone
- *Black Dog*, a 1998 film directed by Kevin Hooks, starring Patrick Swayze
- *Primemover*, a 2008 film directed by David Caesar
- *Joy Ride*, a 2001 film directed by John Dahl, starring Paul Walker and Steve Zahn
- *Big Rig*, a 2008 documentary film directed by Doug Pray

## Music

- "Convoy", a pop song by C. W. McCall, spurred sales of CB radios with an imaginary trucking story.
- The eighteen-wheeled truck was immortalized in numerous country music songs, such as the Red Sovine titles "Giddyup Go", "Teddy Bear" and "Phantom 309", and Dave Dudley's "Six Days on the Road".
- The thrash metal band, BigRig, was named after these trucks.
- Country song "Eighteen Wheels and a Dozen Roses", made popular in 1987 by singer-songwriter Kathy Mattea.
- "Roll On (Eighteen Wheeler)" by Alabama tells the story of a trucker who calls home to his family every night while out on the road.
- "Papa Loved Mama" by Garth Brooks is about a trucker and his wife.
- "Truck Drivin' Song" by "Weird Al" Yankovic tells the story of a female trucker, sung by a male with a deep voice.
- "Cold Shoulder" by Garth Brooks is about a trucker stuck on the side of the highway during a blizzard, fantasizing about being home with his wife.

- "Drivin' My Life Away" by Eddie Rabbitt, a former trucker, co-written with Even Stevens and David Malloy, sings of the life on the road.

### Video games and truck simulators

- *18 Wheels of Steel* series
- *American Truck Simulator*
- *Big Rigs: Over the Road Racing* (2003)
- *Euro Truck Simulator*
- *Euro Truck Simulator 2*
- *Hard Truck* (1998)
- *MotorStorm* and *MotorStorm: Pacific Rift*
- *Rig 'n' Roll* (2009)
- *Rigs of Rods*[57]

### Podcasts

- Over the Road, a podcast series by Radiotopia on truck driving the North America / US

## See also

- Air brake (road vehicle)
- Articulated lorries
- Articulated vehicle
- Brake
- Bus
- Cab over
- Containerization
- DAT Solutions (a.k.a. Dial-a-truck)
- Dolly (trailer)
- Drayage
- Dump truck
- Gladhand connector
- Hybrid vehicle
- Jackknifing
- List of trucks
- Loader crane
- Loading dock
- Lockrod
- Logging truck
- Long combination vehicle
- Oversize load
- Progressive shifting
- Refrigerator truck ("reefer")
- Road train
- Roll trailer
- Semi-trailer
- Terminal tractor
- Tank truck
- Tractor unit
- Trailer (vehicle)
- Trailer bus
- Train
- Truck
- Truck driver
- Truck sleeper

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## Notes

a. Also known in the United States as a **big rig**,[7] **tractor trailer**, or **tractor-trailer**,[8] and in the UK as an **artic**[9] or **juggernaut**.[10] It is variously known as an articulated lorry (UK), articulated truck, semi-tractor, semi-tractor-trailer truck, semi-tractor-trailer, semi-tractor truck, semi-trailer truck, single truck, tractor, tractor-trailer truck, tractor truck, trailer, trailer truck, transfer truck, or transport truck, depending on the country and region.

## External links

- TruckNetUK.com (http://www.trucknetuk.com), dedicated to trucking information in UK and Europe
- Ol' Blue, USA (http://www.olblueusa.org), safety and education in and around trucking in the US
- natm.com/ (https://www.natm.com/) Promote trailer safety and the success of the trailer manufacturing industry through education and advocacy.
- Semitrailer truck dimensions (https://www.google.com/search?q=dimensions+of+semi+trailers&tbm=isch&source=iu&ictx=1&fir=AJEb64yLvtMoIM%252C8gba_rhrCY2YHM%252C_&vet=1&usg=AI4_-kSIDNQf1mx_7qrmbN0F9UqWPLHt_A&sa=X&ved=2ahUKEwiMr-Xnh6_qAhXZmHIEHd2OCYMQ9QEwAXoECAoQIg&biw=1366&bih=625)

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# Trailer (vehicle)

A **trailer** is an unpowered vehicle towed by a powered vehicle. It is commonly used for the transport of goods and materials.

Utility trailer

A boat on a single-axle trailer

Sometimes recreational vehicles, travel trailers, or mobile homes with limited living facilities where people can camp or stay have been referred to as trailers. In earlier days, many such vehicles were towable trailers.

## Contents

# United States


A truck pulling a semi-trailer using a trailer dolly


Indian auto-rickshaw adapted with *trailer*

In the United States, the term is sometimes used interchangeably with travel trailer and mobile home, varieties of trailers and manufactured housing designed for human habitation. Their origins lay in utility trailers built in a similar fashion to horse-drawn wagons. A trailer park is an area where mobile homes are placed for habitation.

In the United States trailers ranging in size from single-axle dollies to 6-axle, 13-foot-6-inch (4.11 m) high, 53-foot (16.15 m) long semi-trailers are commonplace. The latter, when towed as part of a tractor-trailer or "18-wheeler", carries a large percentage of the freight that travels over land in North America.

# Types


ACP Backtracking genset trailer

Some trailers are made for personal (or small business) use with practically any powered vehicle having an appropriate hitch, but some trailers are part of large trucks called semi-trailer trucks for transportation of cargo.

Enclosed toy trailers and motorcycle trailers can be towed by commonly accessible pickup truck or van, which generally require no special permit beyond a regular driver's license. Specialized trailers like open-air motorcycle trailers, bicycle trailers are much smaller, accessible to small automobiles, as are some simple trailers, have a drawbar and ride on a single axle. Other trailers, such as utility trailers and travel trailers or campers come in single and multiple axle varieties, to allow for varying sizes of tow vehicles.

There also exist highly specialized trailers, such as genset trailers, pusher trailers and other types that are also used to power the towing vehicle. Others are custom-built to hold entire kitchens and other specialized equipment used by carnival vendors. There are also trailers for hauling boats.

## Trackless train

## Utility

A **utility trailer** is an all purpose trailer to carry almost anything. It can be open or completely closed.

Touristic road train in Nantes, France. It has three trailers

## Fixed Plant

A **Fixed Plant Trailer** is a special purpose trailer built to carry units which usually are immobile such as large generators & pumps

## Bicycle

A bicycle trailer is a motor less wheeled frame with a hitch system for transporting cargo by bicycle.

Bicycle trailer of Japan

## Construction

Construction trailer

Toilets are usually provided separately.[1]

Construction trailers are mobile structures (trailers) used to accommodate temporary offices, dining facilities and storage of building materials during construction projects. The trailers are equipped with radios for communication.

## Travel

A custom-made popup camper trailer

Popular campers use lightweight trailers, aerodynamic trailers that can be towed by a small car, such as the BMW Air Camper. They are built to be lower than the tow vehicle, minimizing drag.

Others range from two-axle campers that can be pulled by most mid-sized pickups to trailers that are as long as the host country's law allows for drivers without special permits. Larger campers tend to be fully integrated recreational vehicles, which often are used to tow single-axle dolly trailers to allow the users to bring small cars on their travels.

### Teardrop

## Semi

A **semi-trailer** is a trailer without a front axle. A large proportion of its weight is supported either by a road tractor or by a detachable front axle assembly known as a dolly. A semi-trailer is normally equipped with legs, called "landing gear", which can be lowered to support it when it is uncoupled. In the United States, a single trailer cannot exceed a length of 57 ft 0 in (17.37 m) on interstate highways (unless a special permit is granted), although it is possible to link two smaller trailers together to a maximum length of 63 ft 0 in (19.20 m).

Semi-trailers vary considerably in design, ranging from open-topped grain haulers through Tautliners to normal-looking but refrigerated 13 ft 6 in (4.11 m) x 53 ft 0 in (16.15 m) enclosures ("reefers"). Many semi-trailers are part of semi-trailer trucks. Other types of semi-trailers include dry vans, flatbeds and chassis.

Many commercial organizations choose to rent or lease semi-trailer equipment rather than own their own semi-trailers, to free up capital and to keep trailer debt from appearing on their balance sheet.


Semi tank trailer in Japan

SinoTruk HOWO with flatbed trailer

LKW Kipper dump trailer


Sainsburys lorry refrigerated trailer

A car carrier trailer

## Full

Full trailer with steered axle

A **full trailer** is a term used in the United States and New Zealand[2] for a freight trailer supported by front and rear axles and pulled by a drawbar. In Europe this is known as an *A-frame drawbar trailer*, and in Australia it is known as a *dog trailer*. Commercial freight trailers are produced to length and width specifications defined by the country of operation. In America this is 96 or 102 in (2.44 or 2.59 m) wide and 35 or 40 ft (10.67 or 12.19 m) long. In New Zealand, the maximum width is 2.55 m (100.39 in) while the maximum length is 11.5 m (37.73 ft), giving a 22-pallet capacity.

As per AIS 053, full trailer is a towed vehicle having at least two axles, and equipped with a towing device which can move vertically in relation to the trailer and controls the direction of the front axle(s), but which transmits no significant static load to the towing vehicle. Common types of full trailers are flat deck, hardside/box, curtainside or bathtub tipper style with axle configurations up to two at the drawbar end and three at the rear of the trailer.

This style of trailer is also popular for use with farm tractors.

## Close-coupled

A close-coupled trailer is fitted with a rigid towbar which projects from its front and hooks onto a hook on the tractor. It does not pivot as a drawbar does.

A close-coupled trailer

## Motorcycle


Interior of an enclosed motorcycle trailer

A motorcycle trailer may be a trailer designed to haul motorcycles behind an automobile or truck. Such trailers may be open or enclosed, ranging in size from trailers capable of carrying several motorcycles or only one. They may be designed specifically to carry motorcycles, with ramps and tie-downs, or may be a utility trailer adapted permanently or occasionally to haul one or more motorcycles.

Another type of motorcycle trailer is a wheeled frame with a hitch system designed for transporting cargo by motorcycle. Motorcycle trailers are often narrow and styled to match the appearance of the motorcycle they are intended to be towed behind. There are two-wheeled versions and single-wheeled versions. Single-wheeled trailers, such as the Unigo or Pav 40/41, are designed to allow the bike to have all the normal flexibility of a motorcycle, usually using a universal joint to enable the trailer to lean and turn with the motorcycle. No motorcycle manufacturer recommends that its motorcycles be used to tow a trailer because it results in additional safety hazards for motorcyclists.

## Livestock


A horse trailer

There are a number of different styles of trailers used to haul livestock such as cattle, horses, sheep and pigs. The most common is the stock trailer, a trailer that is enclosed on the bottom, but has openings at approximately the eye level of the animals to allow ventilation. The horse trailer is a more elaborate form of stock trailer. Because horses are usually hauled for the purpose of competition or work, where they must be in peak physical condition, horse trailers are designed for the comfort and safety of the animals. They usually have adjustable vents and windows as well as suspension designed to provide a smooth ride and less stress on the animals. In addition, horse trailers have internal partitions that assist the animal in staying upright during travel and protect horses from injuring each other in transit. Larger horse trailers may incorporate additional storage areas for horse tack and may even include elaborate living quarters with sleeping areas, bathroom and cooking facilities, and other comforts.

Both stock trailers and horse trailers range in size from small units capable of holding one to three animals, able to be pulled by a pickup truck, SUV or even a quad bike; to large semi-trailers that can haul a significant number of animals.

## Boat

## Water

A Swiss water trailer

## Roll trailer

Maritime shipping Roll trailer

## Baggage trailer

A single trailer for an aircraft cargo unit load device, next to a group of trailers for loose luggage.

**Baggage trailers** are used for the transportation of loose baggage, oversized bags, mail bags, loose cargo carton boxes, etc. between the aircraft and the terminal or sorting facility. Dollies for loose baggage are fitted with a brake system which blocks the wheels from moving when the connecting rod is not attached to a tug. Most dollies for loose baggage are completely enclosed except for the sides which use plastic curtains to protect items from weather. In the US, these dollies are called baggage carts, but in Europe *baggage cart* means passenger baggage trolleys.

## Hydraulic modular trailer

A hydraulic modular trailer (HMT) is a special platform trailer unit which feature swing axles, hydraulic suspension, independently steerable axles, two or more axle rows, compatible to join two or more units longitudinally and laterally and uses power pack unit (PPU) to steer and adjust height. These trailer units are used to transport oversized load, which are difficult to disassemble and are overweight. These trailers are manufactured using high tensile steel, which makes it  possible to bear the weight of the load with the help of one or more ballast tractors which push and pull these units via drawbar or gooseneck together making a heavy hauler unit.

Typical loads include oil rig modules, bridge sections, buildings, ship sections, and industrial machinery such as generators and turbines. There is a limited number of manufacturers who produce these heavy-duty trailers because the market share of oversized loads is very thin when we talk about transportation industry. There are self powered units of hydraulic modular trailer which are called SPMT which are used when the ballast tractors can not be applied.

### Bus trailer

A bus trailer is for transporting passengers hauled by a tractor unit similar like that of a truck. These trailers have become obsolete due to the issue of the communication between the driver and the conductor and traffic jams.

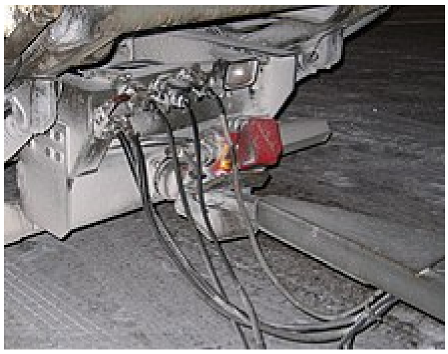
Camel bus in Havana

Karosa NO 80 trailer bus


Bus trailer

## Hitching

A trailer hitch, fifth-wheel coupling or other type of tow hitch is needed to draw a trailer with a car, truck or other traction engine.



Trailer-hitch on a large vehicle

### Ball and socket

A trailer coupler is used to secure the trailer to the towing vehicle. The trailer coupler attaches to the trailer ball. This forms a ball and socket connection to allow for relative movement between the towing vehicle and trailer while towing over uneven road surfaces. The trailer ball is mounted to the rear bumper or to a draw bar, which may be removable. The draw bar is secured to the trailer hitch by inserting it into the hitch receiver and pinning it. The three most common types of couplers are straight couplers, A-frame couplers, and adjustable couplers. Bumper-pull hitches and draw bars can exert tremendous leverage on the tow vehicle making it harder to recover from a swerving situation.

### Fifth wheel and gooseneck

Tandem axle dually pickup truck with gooseneck trailer

These are available for loads between 10,000 and 30,000 pounds (4.5–13.6 t; 5.0–15.0 short tons; 4.5–13.4 long tons).[3][4] Both the hitches are better than a receiver hitch and allow a more efficient and central attachment of a large trailer to the tow vehicle. They can haul large loads without disrupting the stability of the vehicle. Traditional hitches are connected to the rear of the vehicle at the frame or bumper, while fifth wheel and gooseneck trailers are attached to the truck bed above the rear axle. This coupling location allows the truck to make sharper turns and haul heavier trailers. They can be mounted in the bed of a pickup truck or any type of flatbed. A fifth-wheel coupling is also referred to as a kingpin hitch and is a smaller version of the semi-trailer "fifth wheel". Though a fifth wheel and a gooseneck trailer look much the same, their method for coupling is different. A fifth wheel uses a large horseshoe-shaped coupling device mounted 1 foot (0.30 m) or more above the bed of the tow vehicle. A gooseneck couples to a standard $2\frac{5}{16}$-inch (59 mm) ball mounted on the bed of the tow vehicle. The operational difference between the two is the range of movement in the hitch. The gooseneck is very maneuverable and can tilt in all directions, while the fifth wheel is intended for level roads and limited tilt side to side. Gooseneck mounts are often used for agricultural and industrial trailers. Fifth-wheel mounts are often used for recreational trailers. Standard bumper-hitch trailers typically allow a 10% or 15% hitch load while a fifth wheel and gooseneck can handle 20% or 25% weight transfer.

A gooseneck trailer attached to a pickup truck

Steam locomotive on hydraulic modular trailer

## Jacks

The basic function of a trailer jack is to lift the trailer to a height that allows the trailer to be hitched or unhitched to and from the towing vehicle. Trailer jacks are also used for leveling the trailer during storage. The most common types of trailer jacks are A-frame jacks, swivel jacks, and drop-leg jacks. Some trailers, such as horse trailers, have a built-in jack at the tongue for this purpose.

## Electrical components

Many older cars took the feeds for the trailer's lights directly from the towing vehicle's rear light circuits. As bulb-check systems were introduced in the 1990s "by-pass relays" were introduced. These took a small signal from the rear lights to switch a relay which in turn powered the trailer's lights with its own power feed. Many towing electrical installations, including vehicle-specific kits incorporate some form of bypass relays.

In the US, trailer lights usually have a shared light for brake and turn indicators. If such a trailer is to be connected to a car with separate lamps for turn indicator and brake a trailer light converter is needed.

Nowadays some vehicles are being fitted with CANbus networks, and some of these use the CANbus to connect the tow bar electrics to various safety systems and controls. For vehicles that use the CANbus to activate towing-related safety systems, a wiring kit that can interact appropriately must be used. Without such a towbar wiring kit the vehicle cannot detect the presence of a trailer and can therefore not activate safety features such as trailer stability program which can electronically control a snaking trailer or caravan.

By-pass systems are cheap, but may not be appropriate on cars with interactive safety features.

### Brakes

Larger trailers are usually fitted with brakes. These can be either electrically operated, air operated, or overrun brakes.

Bus and trailer in Saskatchewan, Canada

## Stability

Trailer stability can be defined as the tendency of a trailer to dissipate side-to-side motion. The initial motion may be caused by aerodynamic forces, such as from a cross wind or a passing vehicle. One common criterion for stability is the center of mass location with respect to the wheels, which can usually be detected by tongue weight. If the center of mass of the trailer is behind its wheels, therefore having a negative tongue weight, the trailer will likely be unstable. Another parameter which is less commonly a factor is the trailer moment of inertia. Even if the center of mass is forward of the wheels, a trailer with a long load, and thus large moment of inertia, may be unstable.[5]

Some vehicles are equipped with a Trailer Stability Program that may be able to compensate for improper loading.

## See also

- Electric vehicle battery
- ISO 3833
- Towing
- Towing capacity
- Tractor unit
- Trailer Brake Controller
- Vehicle category
- Walking floor

### List of types of trailers

- Bicycle trailer
- Boat trailer
- Bus trailer
- Compressed hydrogen tube trailer

- Construction trailer
- Dolly
- Dump trailer
- Enclosed cargo trailer
- Flat deck trailer
- Frac Tank
- Genset trailer
- Horse trailer
- Hydraulic modular trailer
- Jeep trailer
- Liquid hydrogen trailer
- Lowboy (trailer)
- Mafi roll trailer
- Mobile home
- Motorcycle trailer
- Popup camper
- Pusher trailer
- Roll trailer
- Semi-trailer
- Solar trailer (for solar vehicles)
- Tautliner
- Tank trailer
- Travel trailer

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# External links

- Trailers (https://curlie.org//Business/Automotive/Parts_and_Accessories/Trailers/) at Curlie
- Trailer manufacturers (https://curlie.org/Business/Transportation_and_Logistics/Trucking/Trailers/Manufacturers/) at Curlie

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# Transport hub

A **transport hub** is a place where passengers and cargo are exchanged between vehicles and/or between transport modes. Public transport hubs include railway stations, rapid transit stations, bus stops, tram stops, airports and ferry slips. Freight hubs include classification yards, airports, seaports and truck terminals, or combinations of these. For private transport by car, the parking lot functions as a unimodal hub.

Penn Station in Midtown Manhattan, New York City, the busiest transportation hub in the Western Hemisphere

## Contents



## History

Underground bus and coach terminal and metro station are located underneath the Kamppi Center in Helsinki, Finland

Historically, an **interchange service** in the scheduled passenger air transport industry involved a "through plane" flight operated by two or more airlines where a single aircraft was used with the individual airlines operating it with their own flight crews on their respective portions of a direct, no-change-of-plane multi-stop flight. In the U.S., a number of air carriers including Alaska Airlines, American Airlines, Braniff International Airways, Continental Airlines, Delta Air Lines, Eastern Airlines, Frontier Airlines (1950-1986), Hughes Airwest, National Airlines (1934-1980), Pan Am, Trans World Airlines (TWA), United Airlines and Western Airlines previously operated such cooperative "through plane" interchange flights on both domestic and/or international services with these schedules appearing in their respective system timetables.[1][2]

Szczecin: Port of Szczecin, motorway, expressway and railway connections, an inter-city public transport, a city bus and electric trams network and "Solidarity" Szczecin–Goleniów Airport, Poland

Delta Air Lines pioneered the hub and spoke system for aviation in 1955 from its hub in Atlanta, Georgia, United States,[3] in an effort to compete with Eastern Air Lines. FedEx adopted the hub and spoke model for overnight package delivery during the 1970s. When the United States airline industry was deregulated in 1978, Delta's hub and spoke paradigm was adopted by several airlines. Many airlines around the world operate hub-and-spoke systems facilitating passenger connections between their respective flights.

## Public transport

South Station, an MBTA, Amtrak, and Greyhound transportation hub in Boston, Massachusetts, United States

Intermodal passenger transport hubs in public transport include bus stations, railway stations and metro stations, while a major transport hub, often multimodal (bus and rail), may be referred to as a **transport centre** or, in American English, as a **transit center**.[4] Sections of city streets that are devoted to functioning as transit hubs are referred to as transit malls. In cities with a central station, that station often also functions as a transport hub in addition to being a railway station.

DHL hub Leipzig/Halle Airport, Germany

Journey planning involving transport hubs is more complicated than direct trips, as journeys will typically require a transfer at the hub. Modern electronic journey planners for public transport have a digital representation of both the stops and transport hubs in a network, to allow them to calculate journeys that include transfers at hubs.

## Airports

In suburban Toronto, Finch Station connects underground train, local, regional, and interregional bus services.

Airports have a twofold hub function. First they concentrate passenger traffic into one place for onward transportation. This makes it important for airports to be connected to the surrounding transport infrastructure, including roads, bus services, and railway and rapid transit systems. Secondly some airports function as intra-modular hubs for the airlines, or airline hubs. This is a common strategy among network airlines who fly only from limited number of airports and usually will make their customers change planes at one of their hubs if they want to get between two cities the airline doesn't fly directly between.

Airlines have extended the hub-and-spoke model in various ways. One method is to create additional hubs on a regional basis, and to create major routes between the hubs. This reduces the need to travel long distances between nodes that are close together. Another method is to use focus cities to implement point-to-point service for high traffic routes, bypassing the hub entirely.

## Freight

There are usually three kinds of freight hubs: sea-road, sea-rail and road-rail, though they can also be sea-road-rail. With the growth of containerization, intermodal freight transport has become more efficient, often making multiple legs cheaper than through services—increasing the use of hubs.

## See also

- Central station

- Infrastructure security
- Intermodal journey planner
- Junction (traffic)
- Layover
- Spoke-hub distribution paradigm
- Transit desert
- Transit mall

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# Transshipment

**Transshipment**, **trans-shipment** or **transhipment** is the shipment of goods or containers to an intermediate destination, then to another destination.

Typical small transshipment station platform and warehouse - rail to road transport (abandoned) (2016)

One possible reason for transshipment is to change the means of transport during the journey (e.g., from ship transport to road transport), known as transloading. Another reason is to combine small shipments into a large shipment (consolidation), or the opposite: dividing a large shipment into smaller shipments (deconsolidation). Transshipment usually takes place in transport hubs. Much international transshipment also takes place in designated customs areas, thus avoiding the need for customs checks or duties, otherwise a major hindrance for efficient transport.

An item handled (from the shipper's point of view) as a single movement is not generally considered transshipped, even if it changes from one mode of transport to another at several points. Previously, it was often not distinguished from transloading, since each leg of such a trip was typically handled by a different shipper.

Transshipment is normally fully legal and an everyday part of world trade. However, it can also be a method used to disguise intent, as is the case with illegal logging, smuggling, or grey-market goods.

## Contents



## Transshipment at container ports or terminals

The transshipment of containers at a container port or terminal can be defined as the number (or proportion) of containers, possibly expressed in TEU, of the total container flow that is handled at the port or terminal and, after temporary storage in the stack, transferred to another ship to reach their destinations. The exact definition of transshipment may differ between ports, mostly depending on the inclusion of inland water transport (barges operating on canals and rivers to the hinterland). The definition of transshipment may:

- include only seaborne transfers (a change to another international deep-sea container ship); or
- include both seaborne and inland waterway ship transfers (sometimes called *water-to-water* transshipment). Most coastal container ports in China have a large proportion of riverside "transshipment" to the hinterland.

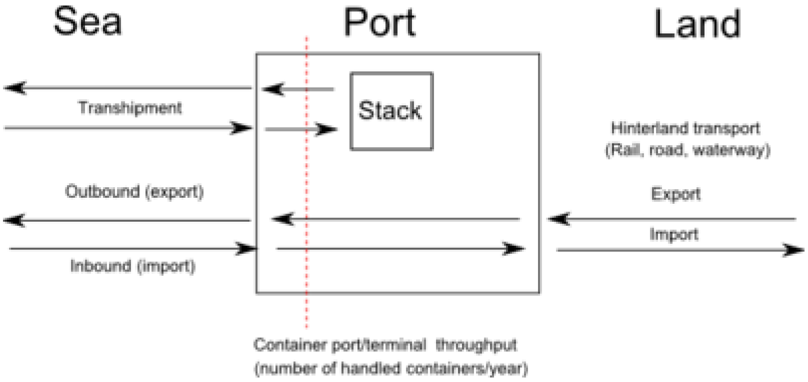
Mechanisation associated with standardised containers revolutionised rail, road and sea freight handling.

In both cases, a single, unique, transshipped container is counted twice in the port performance, since it is handled twice by the waterside container cranes (separate unloading from arriving ship A, waiting in the stack, and loading onto departing ship B).

# Transshipment at sea

Transshipment at sea is done by transferring goods from one ship to another.

## Fisheries



Scheme describing the possible container flows at a container port/terminal

In global fisheries transshipment is used to transfer catch to refrigerated cargo vessels that also supply fishing vessels with fuel, food, equipment and personnel allowing them to stay at sea for months or even years.[1] This guarantees that fish quickly find their way to the market without a decrease in quality.

Since transshipment at sea encounters often happen on the high seas, in regions with poor regulation and oversight, they are also used to disguise criminal activities such as illegal, unreported and unregulated fishing, forced labor, human trafficking and drug smuggling.[2] Several states and regional fishery management organizations have therefore prohibited the practice for certain vessel types or issued a complete ban within their zone of jurisdiction.[3]

## Bulk products

Transshipment at sea also occurs in the export of bulk products. Choosing to transship reduces capital costs for port developers and can overcome problems arising from limited access to deep water. Loading barges typically specify 4 to 7 meters of draft. Since at least 2011, transshipment has been used in northern Australia in the export of bulk minerals including bauxite, iron ore and potash from mines in Queensland, Western Australia and the Northern Territory.[4] Companies providing at-sea transshipping services in Australia include the CSL Group and Transshipment Services Australia (TSA).

# Transshipment at a break-of-gauge

At a break-of-gauge, cargo is transloaded from boxcars or covered goods wagons on one track to wagons on another track of a different rail gauge, or else containers are transloaded from flatcars on one track to flatcars on another track of a different gauge.

## See also

- Cross-docking
- Customs area
- *Entrepôt*
- List of free ports
- Milk run
- Transshipment problem

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# Truck

A **truck** or **lorry** is a motor vehicle designed to transport cargo, carry specialized payloads, or perform other utilitarian work. Trucks vary greatly in size, power, and configuration, but the vast majority feature body-on-frame construction, with a cabin that is independent of the payload portion of the vehicle. Smaller varieties may be mechanically similar to some automobiles. Commercial trucks can be very large and powerful and may be configured to be mounted with specialized equipment, such as in the case of refuse trucks, fire trucks, concrete mixers, and suction excavators. In American English, a commercial vehicle without a trailer or other articulation is formally a "straight truck" while one designed specifically to pull a trailer is not a truck but a "tractor".[1]

Freightliner M2 dump truck

The majority of trucks currently in use are still powered by diesel engines, although small- to medium-size trucks with gasoline engines exist in the US, Canada, and Mexico. The market-share of electrically powered trucks is growing rapidly, expected to reach 7% globally by 2027, and electric motive force already predominates among both the largest and smallest trucks.[2] In the European Union, vehicles with a gross combination mass of up to 3.5 t (3.4 long tons; 3.9 short tons) are known as light commercial vehicles, and those over as large goods vehicles.


A Mack Titan road train in Australia


Liebherr T 282B hybrid electric mining truck

## Contents

A Mitsubishi Minicab MiEV battery-electric truck.

# History

## Steam wagons

Trucks and cars have a common ancestor: the steam-powered *fardier* Nicolas-Joseph Cugnot built in 1769. However, steam wagons were not common until the mid-19th century. The roads of the time, built for horse and carriages, limited these vehicles to very short hauls, usually from a factory to the nearest railway station. The first semi-trailer appeared in 1881, towed by a steam tractor manufactured by De Dion-Bouton.

Steam-powered wagons were sold in France and the United States until the eve of World War I, and 1935 in the United Kingdom, when a change in road tax rules made them uneconomic against the new diesel lorries.

A Sentinel steam wagon

## Internal combustion

In 1895 Karl Benz designed and built the first internal combustion truck. Later that year some of Benz's trucks were modified to become busses by *Netphener*. A year later, in 1896, another internal combustion engine truck was built by Gottlieb Daimler, the Daimler Motor Lastwagen.[3] Other companies, such as Peugeot, Renault and Büssing, also built their own versions. The first truck in the United States was built by Autocar in 1899 and was available with 5 or 8 horsepower (4 or 6 kW) engines.[4] Trucks of the era mostly used two-cylinder engines and had a carrying capacity of 1.5 to 2 t (3,300 to 4,400 lb). After World War I, several advances were made: electric starters, and 4, 6, and 8 cylinder engines.


Daimler Motor-Lastwagen from 1898

## Diesel engines

Although it had been invented in 1897, the diesel engine did not appear in production trucks until Benz introduced it in 1923.[5] The diesel engine was not common in trucks in Europe until the 1930s. In the United States, Autocar introduced diesel engines for heavy applications in the mid-1930s. Demand was high enough that Autocar launched the "DC" model (diesel conventional) in 1939. However, it took much longer for diesel engines to be broadly accepted in the US: gasoline engines were still in use on heavy trucks in the 1970s.[6][7]

## Electric Motors

Electrically powered trucks predate internal combustion ones and have been continuously available since the mid-19th-century. In the 1920s Autocar Trucks was the first of the major truck manufacturers to offer a range of electric trucks for sale.[8] Electric trucks were successful for urban delivery roles and as specialized work vehicles like forklifts and pushback tugs. The higher energy density of liquid fuels soon led to the decline of electric-powered trucks in favor of, first, gasoline, and then diesel and CNG-fueled engines until battery technology advanced in the 2000s when new chemistries and higher-volume production broadened the range of applicability of electric propulsion to trucks in many more roles. Today, manufacturers are electrifying all trucks ahead of national regulatory requirements, with long-range over-the-road trucks being the most challenging.[9][10]


President Joe Biden test driving the Ford F-150 Lightning all-electric pick up at Ford's Rouge Electric Vehicle Center

## Etymology

*Truck* is used in American English, and is common in Canada, Australia, New Zealand, Pakistan and South Africa, while *lorry* is the equivalent in British English, and is the usual term in countries like Ireland, Malaysia, Singapore and India.


Mannesmann Mulag truck at the Finlayson factory in Tampere, Finland in 1921

The first known usage of "truck" was in 1611 when it referred to the small strong wheels on ships' cannon carriages, and comes from "Trokhos" (Greek) = "wheel". In its extended usage, it came to refer to carts for carrying heavy loads, a meaning known since 1771. Its expanded application to "motor-powered load carrier" has been in usage since 1930, shortened from "motor truck", which dates back to 1901.[11][12]

"Lorry" has a more uncertain origin, but probably has its roots in the rail transport industry, where the word is known to have been used in 1838 to refer to a type of truck (a goods wagon as in British usage, not a bogie as in the American), specifically a large flat wagon. It might derive from the verb *lurry* (to carry or drag along, or to lug) which was in use as early as 1664, but that association is not definitive.[13] The expanded meaning of *lorry*, "self-propelled vehicle for carrying goods", has been in usage since 1911.[14][15]

### International variance


A Japanese concrete mixer

In the United States, Canada, and the Philippines, "truck" is usually reserved for commercial vehicles larger than regular passenger cars, but includes large SUVs, pickups, and other vehicles with an open load bed. In Australia, New Zealand and South Africa, the word "truck" is mostly reserved for larger vehicles. In Australia and New Zealand, a pickup truck is frequently called a *ute* (short for "utility" vehicle),[16] while in South Africa it is called a *bakkie* (Afrikaans: "small open container"). In the United Kingdom, India, Malaysia, Singapore, Ireland, and Hong Kong *lorry* is used instead of *truck*, but only for the medium and heavy types, while *truck* is used almost exclusively to refer to pickups.

## Types by size

### Ultra light


Might-E Truck from Canadian Electric Vehicles

Often produced as variations of golf cars, with internal combustion or battery electric drive, these are used typically for off-highway use on estates, golf courses, and parks. While not suitable for highway use some variations may be licensed as slow speed vehicles for operation on streets, generally as a body variation of a neighborhood electric vehicle. A few manufactures produce specialized chassis for this type of vehicle, while Zap Motors markets a version of their Xebra electric tricycle (licensable in the U.S. as a motorcycle).

## Very light

A Piaggio Porter

Popular in Europe and Asia, many mini-trucks are factory redesigns of light automobiles, usually with monocoque bodies. Specialized designs with substantial frames such as the Italian Piaggio shown here are based upon Japanese designs (in this case by Daihatsu) and are popular for use in "old town" sections of European cities that often have very narrow alleyways.

Tata Super Ace in Indonesia

Regardless of name, these small trucks serve a wide range of uses. In Japan, they are regulated under the Kei car laws, which allow vehicle owners a break in taxes for buying a smaller and less-powerful vehicle (currently, the engine is limited to 660 cc displacement). These vehicles are used as on-road utility vehicles in Japan. These Japanese-made mini trucks that were manufactured for on-road use are competing with off-road ATVs in the United States, and import regulations require that these mini trucks have a 25 mph (40 km/h) speed governor as they are classified as low-speed vehicles.[17] These vehicles have found uses in construction, large campuses (government, university, and industrial), agriculture, cattle ranches, amusement parks, and replacements for golf carts.[18]

**Major mini truck manufacturers and their brands:**

- Daihatsu Hijet
- Honda Acty
- Tata Ace
- Mazda Scrum
- Mitsubishi Minicab
- Subaru Sambar
- Suzuki Carry

SML truck on the road in Accra

## Light

Light trucks are car-sized (in the US, no more than 13,900 lb (6.3 t)) and are used by individuals and businesses alike. In the EU they may not weigh more than 3.5 t (7,700 lb) and are allowed to be driven with a driving licence for cars. Pickup trucks, called utes in Australia and New Zealand, are common in North America and

A Ford Ranger pickup truck

some regions of Latin America, Asia, and Africa, but not so in Europe, where this size of commercial vehicle is most often made as vans.

### Medium


Fuso Canter, 8th Generation in Taiwan.

Medium trucks are larger than light but smaller than heavy trucks. In the US, they are defined as weighing between 13,000 and 33,000 lb (5.9 and 15.0 t). For the UK and the EU the weight is between 3.5 to 7.5 t (7,700 to 16,500 lb). Local delivery and public service (dump trucks, garbage trucks and fire-fighting trucks) are normally around this size.


Seddon Atkinson Stratos refuse compactor

### Heavy

A cement mixer is an example of a Class 8 heavy truck

Heavy trucks are the largest on-road trucks, Class 8. These include vocational applications such as heavy dump trucks, concrete pump trucks, and refuse hauling, as well as ubiquitous long-haul 4x2 and 6×4 tractor units.[19]

Road damage and wear increase very rapidly with the axle weight. The number of steering axles and the suspension type also influence the amount of the road wear. In many countries with good roads a six-axle truck may have a maximum weight of 44 t (97,000 lb) or more.


In Pakistan the majority of trucks are colorful and decorated

### Off-road


ALMA antenna transporters are 20 m ($65\frac{2}{3}$ ft) long, 10 m ($32\frac{7}{9}$ ft) wide, weigh 130 t (127.9 long tons; 143.3 short tons) and drive on 28 tires.[20]

Off-road trucks include standard, extra heavy-duty highway-legal trucks, typically outfitted with off-road features such as a front driving axle and special tires for applications such as logging and construction, and purpose-built off-road vehicles unconstrained by weight limits, such as the Liebherr T 282B mining truck.

### Maximum sizes by country

Australia has complex regulations over weight and length, including axle spacing, type of axle/axle group, rear overhang, kingpin to rear of trailer, drawbar length, ground clearance, as well as height and width laws. These limits are some of the highest in the world, a B-double can weigh 62.5 t (61.5 long tons; 68.9

short tons) and be 25 m (82 ft) long, and road trains used in the outback can weigh 172 t (169.3 long tons; 189.6 short tons) and be 53.5 m (176 ft) long.[21][22]

The European Union also has complex regulations. The number and spacing of axles, steering, single or dual tires, and suspension type all affect maximum weights. Length of a truck, of a trailer, from axle to hitch point, kingpin to rear of trailer, and turning radius are all regulated. In additions, there are special rules for carrying containers, and countries can set their own rules for local traffic.[23]

The United States Federal Bridge Law deals with the relation between the gross weight of the truck, the number of axles, the weight on and the spacing between the axles that the truck can have on the Interstate highway system.[24] Each State determines the maximum permissible vehicle, combination, and axle weight on state and local roads.

| Country | Maximum with three axles | With one trailer | Maximum combination |
|---|---|---|---|
| Australia[21][22] | 23 t (22.6 long tons; 25.4 short tons) | 12 m (39 ft) | 172 t (169.3 long tons; 189.6 short tons) 53.5 m (176 ft) |
| China[25] | 25 t (24.6 long tons; 27.6 short tons) 12 m (39 ft) | 49 t (48.2 long tons; 54.0 short tons) 16.5 m (54 ft) | 55 t (54.1 long tons; 60.6 short tons) 18.75 m (62 ft) |
| EU[23] | 26 t (25.6 long tons; 28.7 short tons) 12 m (39 ft) | 16.5 m (54 ft) | 44 t (43.3 long tons; 48.5 short tons) 18.75 m (62 ft) |
| Finland[26] | 28 t (27.6 long tons; 30.9 short tons) 13 m (43 ft) | 76 t (74.8 long tons; 83.8 short tons) 34.5 m (113 ft 2 in) | 76 t (74.8 long tons; 83.8 short tons) 34.5 m (113 ft) |
| Ireland[27] | 26 t (25.6 long tons; 28.7 short tons) 12 m (39 ft) | 30 t (29.5 long tons; 33.1 short tons) 16.5 m (54 ft 2 in) | 44 t (43.3 long tons; 48.5 short tons) 22 m (72 ft) |
| Sweden[28] | 26 t (25.6 long tons; 28.7 short tons) 24 m (79 ft) | 74 t (72.8 long tons; 81.6 short tons) 25.25 m (82 ft 10 in) | 74 t (72.8 long tons; 81.6 short tons) 25.25 m (82.8 ft) |
| UK[29] | 26 t (25.6 long tons; 28.7 short tons) 12 m (39 ft) | 44 t (43.3 long tons; 48.5 short tons) 16.5 m (54 ft) | 44 t (43.3 long tons; 48.5 short tons) 18.75 m (62 ft) |
| USA[30][31] (Interstate) | 54,000 lb (24 t) 45 ft (13.7 m) | 80,000 lb (36 t) none | 80,000 lb (36 t) none |

Uniquely, the State of Michigan has a gross vehicle weight limit of 164,000 lb (74 t), which is twice the U.S. federal limit.[32][33][34] A measure to change the law was defeated in the Michigan Senate in 2019.[35][36][37][38][39]

# Design

Almost all trucks share a common construction: they are made of a chassis, a cab, an area for placing cargo or equipment, axles, suspension and roadwheels, an engine and a drivetrain. Pneumatic, hydraulic, water, and electrical systems may also be present. Many also tow one or more trailers or semi-trailers.

## Cab

A cabover truck

The "cab", or "cabin" is an enclosed space where the driver is seated. A "sleeper" is a compartment attached to or integral with the cab where the driver can rest while not driving, sometimes seen in semi-trailer trucks.

Streamlined conventional cab

There are several cab configurations:

- "Cab over engine" (COE) or "flat nose"; where the driver is seated above the front axle and the engine. This design is almost ubiquitous in Europe, where overall truck lengths are strictly regulated, and is widely used in the rest of the world. They were common in North American heavy-duty trucks but lost prominence when permitted length was extended in the early 1980s. Nevertheless, this design is still popular in North America among medium- and light-duty trucks. To reach the engine, the whole cab tilts forward, earning this design the name of "tilt-cab". This type of cab is especially suited to the delivery conditions in Europe where many roads require the short turning radius afforded by the shorter wheelbase of the cab over engine layout.[40]

Cab beside engine

- "Conventional" cabs seated the driver behind the engine, as in most passenger cars or pickup trucks. Many new cabs are very streamlined, with a sloped hood (bonnet) and other features to lower drag. Conventional cabs are the most common in North America, Australia, and China, and are known in the UK as "American cabs" and in the Netherlands as "torpedo cabs".
- "Cab beside engine" designs are used for terminal tractors at shipping yards and for other specialist vehicles carrying long loads such as pipes. This type is often made by replacing the passenger side of a cab-over truck with an extended section of the load bed.

A further step from this is the side loading forklift that can be described as a specially fabricated vehicle with the same properties as a truck of this type, in addition to the ability to pick up its own load.

## Engines and motors

Most small trucks such as sport utility vehicles (SUVs), vans or pickups, and even light medium-duty trucks in North America, China, and Russia use gasoline engines (petrol engines), but many diesel engined models are now being produced. Most of the heavier trucks use four-stroke diesel engines with a turbocharger and intercooler. Huge off-highway trucks use locomotive-type engines such as a V12 Detroit Diesel two stroke engine. A large proportion of refuse trucks in the United States employ CNG (compressed natural gas) engines for their low fuel cost and reduced carbon emissions.

Cummins ISB 6.7L medium-duty truck diesel engine

A significant proportion of North American manufactured trucks use an engine built by the last remaining major independent engine manufacturer (Cummins) but most global OEMs such as Volvo Trucks and Daimler AG promote their own "captive" engines.[41]

In the European Union, all new truck engines must comply with Euro VI emission regulations.[42]

As of 2019 several alternative technologies are competing to displace the use of diesel engines in heavy trucks. CNG engines are widely used in the US refuse industry and in concrete mixers, among other short-range vocations, but range limitations have prevented their broader uptake in freight hauling applications. Heavy electric trucks and hydrogen-powered trucks are new to the market in 2021,[43][44] but major freight haulers are interested.[45][46] Although cars will be first the phase-out of fossil fuel vehicles includes trucks.[47] According to The Economist magazine "Electric lorries will probably run on hydrogen, not batteries, which are too expensive."[48] Other researchers say that once faster chargers are available batteries will become competitive against diesel for all, except perhaps the heaviest, trucks.[49]

## Drivetrain

A truck rear suspension and drive axles overview

Small trucks use the same type of transmissions as almost all cars, having either an automatic transmission or a manual transmission with synchromesh (synchronizers). Bigger trucks often use manual transmissions without synchronizers, saving bulk and weight, although synchromesh transmissions are used in larger trucks as well. Transmissions without synchronizers, known as "crash boxes", require double-clutching for each shift, (which can lead to repetitive motion injuries), or a technique known colloquially as "floating", a method of changing gears which doesn't use the clutch, except for starts and stops, due to the physical effort of double-clutching, especially with non-power-assisted clutches, faster shifts, and less clutch wear.

Eaton Roadranger 18 speed "crash box" with automated gearshift

Double-clutching allows the driver to control the engine and transmission revolutions to synchronize so that a smooth shift can be made; for example, when upshifting, the accelerator pedal is released and the clutch pedal is depressed while the gear lever is moved into neutral, the clutch pedal is then released and quickly pushed down again while the gear lever is moved to the next higher gear. Finally, the clutch pedal is released and the accelerator pedal pushed down to obtain the required engine speed. Although this is a relatively fast movement, perhaps a second or so while the transmission is in neutral, it allows the engine speed to drop and synchronize engine and transmission revolutions relative to the road speed. Downshifting is performed in a similar fashion, except the engine speed is now required to increase (while the transmission is in neutral) just the right amount in order to achieve the synchronization for a smooth, non-collision gear change. "Skip changing" is also widely used; in principle, the operation is the same as double-clutching, but it requires neutral be held slightly longer than a single-gear change.

Common North American setups include 9, 10, 13, 15, and 18 speeds. Automatic and automated manual transmissions for heavy trucks are becoming more and more common, due to advances both in transmission and engine power. In Europe, 8, 10, 12, and 16 gears are common on larger trucks with a manual transmission, while conventional automatic or automated manual transmissions would have anything from 5 to 12 gears. Almost all heavy truck transmissions are of the "range and split" (double H shift pattern) type, where range change and so-called half gears or splits are air operated and always preselected before the main gear selection.

## Frame


A truck rear frame (chassis) section view

A truck frame consists of two parallel boxed (tubular) or C-shaped rails, or beams, held together by crossmembers. These frames are referred to as ladder frames due to their resemblance to a ladder if tipped on end. The rails consist of a tall vertical section (two if boxed) and two shorter horizontal flanges. The height of the vertical section provides opposition to vertical flex when weight is applied to the top of the frame (beam resistance). Though typically flat the whole length on heavy-duty trucks, the rails may sometimes be tapered or arched for clearance around the engine or over the axles. The holes in rails are used either for mounting vehicle components and running wires and hoses or measuring and adjusting the orientation of the rails at the factory or repair shop.


Pickup truck frame (right rear view)

The frame is usually made of steel, but can be made (whole or in part) of aluminum for a lighter weight. A tow bar may be found attached at one or both ends, but heavy tractors almost always make use of a fifth wheel hitch.

## Body types

**Box trucks** ("tilts" in the UK) have walls and a roof, making an enclosed load space. The rear has doors for unloading; a side door is sometimes fitted.[50]

**Chassis cab** trucks have a fully-enclosed cab at the front, with bare chassis frame-rails behind, suitable for subsequent permanent attachment of a specialized payload, like a fire-truck or ambulance body.

**Concrete mixers** have a rotating drum on an inclined axis, rotating in one direction to mix, and in the other to discharge the concrete down chutes. Because of the weight and power requirements of the drum body and rough construction sites, mixers have to be very heavy duty.[51][52]

**Dump trucks** ("tippers" in the UK) transport loose material such as sand, gravel, or dirt for construction. A typical dump truck has an open-box bed, which is hinged at the rear and lifts at the front, allowing the material in the bed to be unloaded ("dumped") on the ground behind the truck.[53][54]

**Flatbed trucks** have an entirely flat, level platform body. This allows for quick and easy loading but has no protection for the load. Hanging or removable sides are sometimes fitted.[55]

**Refrigerator trucks** have insulated panels as walls and a roof and floor, used for transporting fresh and frozen cargo such as ice cream, food, vegetables, and prescription drugs. They are mostly equipped with double-wing rear doors, but a side door is sometimes fitted.

**Refuse trucks** have a specialized body for collecting and, often, compacting trash collected from municipal, commercial, and industrial sites. This application has the widest use of the cab-over configuration in North America, to provide better maneuverability in tight situations. They are also among the most severe-duty and highest GVWR trucks on public roads.

**Semi-tractors** ("artics" in the UK) have a fifth wheel for towing a semi-trailer instead of a body.

**Tank trucks** ("tankers" in the UK) are designed to carry liquids or gases. They usually have a cylindrical tank lying horizontally on the chassis. Many variants exist due to the wide variety of liquids and gases that can be transported.[56]

**Wreckers** ("recovery lorries" in the UK) are used to recover and/or tow disabled vehicles. They are normally equipped with a boom with a cable; wheel/chassis lifts are becoming common on newer trucks.[57][58][59]

# Sales and sales issues

## Manufacturers

### Truck market worldwide

Largest truck manufacturers in the world as of 2015.

| Pos. | Make | Units |
|---|---|---|
| 1 | Daimler AG (Mercedes-Benz, Freightliner, Unimog, Western Star, Fuso, BharatBenz) | 506,663[60] |
| 2 | Navistar International | 359,000[61] |
| 3 | Dongfeng | 336,869[62] |
| 4 | Tata | 317,780[63] |
| 5 | Volvo Group (Volvo, Mack, Renault, UD Nissan) | 207,475[64] |
| 6 | Volkswagen Group (MAN, Scania, Caminhões e Ônibus) | 179,035[65] |
| 7 | Hino | 162,870[66] |
| 8 | Paccar (DAF, Kenworth, Peterbilt, Leyland) | 154,700[67] |
| 9 | Iveco | 140,200[68] |

# Driving

In many countries, driving a truck requires a special driving license. The requirements and limitations vary with each different jurisdiction.

## Australia


Inside a Mack truck

In Australia, a truck driver's license is required for any motor vehicle with a Gross Vehicle Mass (GVM) exceeding 4.5 t (4.4 long tons; 5.0 short tons). The motor vehicles classes are further expanded as:

### Combination

- **HC**: Heavy Combination, a typical prime mover plus semi-trailer combination.
- **MC**: Multi Combination, e.g., B Doubles/road trains

### Rigid

- **LR**: Light rigid: a rigid vehicle with a GVM of more than 4.5 t (4.4 long tons; 5.0 short tons) but not more than 8 t (7.9 long tons; 8.8 short tons). Any towed trailer must not weigh more than 9 t (8.9 long tons; 9.9 short tons) GVM.
- **MR**: Medium rigid: a rigid vehicle with 2 axles and a GVM of more than 8 t (7.9 long tons; 8.8 short tons). Any towed trailer must not weigh more than 9 t (8.9 long tons; 9.9 short tons) GVM. Also includes vehicles in class *LR*.
- **HR**: Heavy Rigid: a rigid vehicle with three or more axles and a GVM of more than 8 t (7.9 long tons; 8.8 short tons). Any towed trailer must not weigh more than 9 t (8.9 long tons; 9.9 short tons) GVM. Also includes articulated buses and vehicles in class *MR*.

### Heavy vehicle transmission

There is also a heavy vehicle transmission condition for a license class *HC*, *HR*, or *MC* test passed in a vehicle fitted with an automatic or synchromesh transmission; a driver's license will be restricted to vehicles of that class fitted with a synchromesh or automatic transmission. To have the condition removed, a person needs to pass a practical driving test in a vehicle with non-synchromesh transmission (constant mesh or crash box).[69]

## Europe


Inside a Mercedes-Benz truck

Driving licensing has been harmonized throughout the European Union and the EEA (and practically all European non-member states), so that common rules apply within Europe (see European driving licence). As an overview, to drive a vehicle weighing more than 7.5 t (7.4 long tons; 8.3 short tons) for commercial purposes requires a specialist license (the type varies depending on the use of the vehicle and number of seats). For licenses first acquired after 1997, that weight was reduced to 3.5 t (3.4 long tons; 3.9 short tons), not including trailers.

Since 2013, the C1 license category allows driving vehicles over 3.5 and up to 7.5 tonnes. The C license category allows driving vehicles over 3.5 tonnes with a trailer up to 750 kg, and the CE category allows driving category C vehicles with a trailer over 750 kg.

## South Africa

To drive any vehicle with a GVM exceeding 3.5 t (3.4 long tons; 3.9 short tons), a code C1 drivers license is required. Furthermore, if the vehicle exceeds 16 t (15.7 long tons; 17.6 short tons) a code C license becomes necessary.

To drive any vehicle in South Africa towing a trailer with a GVM more than 7.5 t (7.4 long tons; 8.3 short tons), further restrictions apply and the driver must possess a license suitable for the GVM of the total combination as well as an articulated endorsement. This is indicated with the letter "E" prefixing the license code.

In addition, any vehicle designed to carry goods or passengers may only be driven by a driver possessing a Public Driver's Permit, (or PrDP) of the applicable type. This is an additional license that is added to the DL card of the operator and subject to annual renewal unlike the five-year renewal period of a normal license.

The requirements for obtaining the different classes are below.

- "G": Required for the transport of general goods, requires a criminal record check and a fee on issuing and renewal.
- "P": Required for the transport of paying passengers, requires a more stringent criminal record check, additionally the driver must be over the age of 21 at time of issue. A G class PrDP will be issued at the same time.
- "D": Required for the transport of dangerous materials, requires all of the same checks as class P., and in addition the driver must be over 25 at time of issue.

## United States

In the United States, a commercial driver's license is required to drive any type of commercial vehicle weighing 26,001 lb (11,794 kg) or more.[70] The federal government regulates how many hours a driver may be on the clock, how much rest and sleep time is required (e.g., 11 hours driving/14 hours on-duty followed by 10 hours off, with a maximum of 70 hours/8 days or 60 hours/7 days, 34 hours restart )[71] Violations are often subject to significant penalties. Instruments to track each driver's hours must sometimes be fitted. In 2006, the US trucking industry employed 1.8 million drivers of heavy trucks.[72]


Inside a Navistar 9000

There is a shortage of willing trained long-distance truck drivers.[73] Part of the reason for this is the economic fallout from deregulation of the trucking industry. Michael H. Belzer, associate professor, in the economics department at Wayne State University and co-author of *Sweatshops on Wheels: Winners and Losers in Trucking Deregulation*, argues that low pay, bad working conditions and unsafe conditions have been a direct result of deregulation.[74][75] The book cites poor working conditions and an unfair pay system as responsible for high annual employee turnover in the industry.[76][77]

In 2018, in the US, 5,096 large trucks and buses were involved in fatal crashes:

- The number of large trucks involved in fatal crashes is 4,862,

- The number of large trucks involved in injury crashes is 112,000,
- The number of large trucks involved in property damage only crashes is 414,000.[78]

## Environmental effects


Exhaust fumes from a small truck

Like cars, trucks contribute to air, noise, and water pollution.[79] Unlike cars, as of 2022, most trucks run on diesel, and diesel exhaust is especially dangerous for health.[80] Some countries have different vehicle emission standards for trucks and cars.[81][82]

NOx and particulates emitted by trucks are very dangerous to health,[83][84] causing thousands of early deaths annually in the US alone.[85] As older trucks are usually the worst,[86] many cities have banned 20th century trucks.[87] Air pollution also threatens professional truck drivers.[88]

Over a quarter of global transport $CO_2$ emissions are from road freight,[89] in 2021 over 1700 million tonnes from medium and heavy trucks,[90] so many countries are further restricting truck $CO_2$ emissions to help limit climate change.[91] Many environmental organizations favor laws and incentives to encourage the switch from road to rail, especially in Europe.[92] Several countries have pledged that 30% of sales of trucks and buses will be zero emission by 2030.[93]

With respect to noise pollution, trucks emit considerably higher sound levels at all speeds compared to typical cars; this contrast is particularly strong with heavy-duty trucks.[94] There are several aspects of truck operations that contribute to the overall sound that is emitted. Continuous sounds are those from tires rolling on the roadway and the constant hum of their diesel engines at highway speeds. Less frequent noises, but perhaps more noticeable, are things like the repeated sharp-pitched whistle of a turbocharger on acceleration, or the abrupt blare of an exhaust brake retarder when traversing a downgrade. There has been noise regulation put in place to help control where and when the use of engine braking retarders are allowed.

## Operator health and safety


Truck cab filter housing using a contiguous series of pre-, HEPA, and charcoal panel filters

A truck cab is a hazard control that protects the truck operator from hazardous airborne pollutants. As an enclosure, it is an example of an engineering control. Enclosed operator cabs have been used on agriculture, mining, and construction vehicles for several decades. Most modern-day enclosed cabs have heating, ventilation, and air conditioning (HVAC) systems for primarily maintaining a comfortable temperature and providing breathable air for their occupants. Various levels of filtration can be incorporated into the HVAC system to remove airborne pollutants such as dusts, diesel particulate matter (DPM), and other aerosols.[95]

Two key elements of an effective environmental enclosure are a good filtration system and an enclosure with good integrity (sealed isolation from the outside environment). It is recommended that a filtration system filter out at least 95% or greater of airborne respirable aerosols from the intake airflow, with an additional recirculation filtering component for the inside air. Good enclosure integrity is also needed to achieve positive pressure to prevent wind-driven aerosol penetration into the enclosure, as well as to minimize air leakage around the filtration system. Test methods and mathematical modeling of environmental enclosures are also beneficial for quantifying and optimizing filtration system designs, as well as maintaining optimum protection factor performance for enclosure occupants.[95]

# Operations issues

## Taxes

Commercial trucks in the US pay higher road use taxes on a state level than other road vehicles and are subject to extensive regulation.[96] A few reasons commercial trucks pay higher road use taxes: they are bigger and heavier than most other vehicles, and cause more wear and tear per hour on roadways; and trucks and their drivers are on the road for more hours per day. Rules on use taxes differ among jurisdictions.

## Damage to pavement

The life of a pavement is measured by the number of passes of a vehicle axle. It may be evaluated using the Load Equivalency Factor,[97] which states that the damage by the pass of a vehicle axle is proportional to the 4th power of the weight, so a ten-ton axle consumes 10,000 times the life of the pavement as a one-ton axle. For that reason, loaded trucks cost the same as thousands of cars in pavement costs, and are subject to higher taxes and highway tolls.[36][37]

## Commercial insurance

Primary liability insurance coverage protects the truck from damage or injuries to other people as a result of a truck accident. This truck insurance coverage is mandated by U.S. state and federal agencies, and proof of coverage is required to be sent to them. Interstate trucks in the U.S. are required to have a minimum of $75,000 in liability insurance. This includes motor carriers operating vehicles with a gross weight rating in excess of 10,000 lb (4.5 t) (which transport non-hazardous materials). All motor carriers operating vehicles transporting materials classified as hazardous, and which have a gross weight rating in excess of 10,000 lb (4.5 t) must have a minimum of $1,000,000 in liability insurance. All motor carriers operating vehicles such as hopper-type cargo vehicles or tankers with a capacity in excess of 3,500 US gal (13,000 L) must have a minimum of $5,000,000 in liability insurance. Pricing is dependent on region, driving records, and history of the trucking operation.

Motor truck cargo insurance protects the transporter for his responsibility in the event of damaged or lost freight. The policy is purchased with a maximum load limit per vehicle. Cargo insurance coverage limits can range from $10,000 to $100,000 or more. Pricing for this insurance is mainly dependent on the type of cargo being hauled.

# Safety

## Trucking accidents

In 2002 and 2004, there were over 5,000 fatalities related to trucking accidents in the United States. The trucking industry has since made significant efforts in increasing safety regulations. In 2008, the industry had successfully lowered the fatality rate to just over 4,000 deaths, but trucking accidents are still an issue that causes thousands of deaths and injuries each year. Approximately 6,000 trucking accident fatalities occur annually in the United States. Fatalities are not the only issue caused by trucking accidents. Here are some of the environmental issues that arise with trucking accidents:


Trucking accident

- 14.4% of trucking accidents cause cargo to spill
- 6.5% cause open flames

Following increased pressure from *The Times* "Cities Fit For Cycling" campaign and from other media in Spring 2012, warning signs are now displayed on the backs of many heavy goods vehicles (HGV). These signs are directed against a common type of accident that occurs when the large vehicle turns left at a junction: a cyclist trying to pass on the nearside can be crushed against the HGV's wheels, especially if the driver cannot see the cyclist. The signs, such as the winning design of the InTANDEM road safety competition (http://www.intandemcompetition.com) launched in March 2012, advocate extra care when passing a large vehicle on the nearside.

## HGV safety in the EU

In-vehicle speed limitation is required applying a 90 km/h limit to commercial vehicles over 3.5 tonnes.[98]

Front, side, and rear underrun protection is required on commercial vehicles over 3.5 tonnes.[98]

Trucks must be fitted with blind-spot mirrors that give drivers a wider field of vision than conventional mirrors.[99]

## See also

- Air brake
- Animal transporter
- Articulated hauler
- Autonomous truck
- Ballast tractor
- Campervan
- Cutaway van chassis
- Dekotora, Japanese decorated trucks
- Food truck
- Glossary of the American trucking industry
- Great West Truck Show
- Hand truck
- Kei truck
- Haul truck
- Large goods vehicle
- List of military trucks
- List of pickup trucks
- List of trucks
- Logging truck
- Multi-stop truck
- Roll-off truck
- Tail lift
- Traffic congestion
- Truck art in South Asia
- Truck classification
- Truck hijacking
- Truck scale
- Truck stop

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# External links

- Truck (https://curlie.org/Business/Transportation_and_Logistics/Trucking/) at Curlie
- Federal Motor Carrier Safety Administration (http://www.fmcsa.dot.gov/)
- Different sizes and classes of trucks in the UK (http://www.returnloads.net/Industry-Info/General/Haulage-Courier-vehicle-types-and-weights)
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# Truck classification

**Truck classifications** are typically based upon the maximum loaded weight of the truck, typically using the gross vehicle weight rating (GVWR) and sometimes also the gross trailer weight rating (GTWR), and can vary among jurisdictions.

## Contents



## United States

In the United States, commercial truck classification is determined based on the vehicle's gross vehicle weight rating (GVWR). The classes are numbered 1 through 8.[1][2] Trucks are also classified more broadly by the Federal Highway Administration (FHWA), which groups classes 1 and 2 as *light duty*, 3 through 6 as *medium duty*, and 7 and 8 as *heavy duty*. The Environmental Protection Agency (EPA) has a separate system of emissions classifications for trucks.[1][3] The United States Census Bureau also assigned classifications in its now-discontinued Vehicle Inventory and Use Survey (VIUS) (formerly Truck Inventory and Use Survey (TIUS)).[4]

United States federal law requires drivers to have a commercial driver's license (CDL) to operate heavy-duty vehicles (Class 7 and 8) in commerce, with the exception of emergency vehicles and vehicles strictly used for recreational and/or agricultural purposes, though it allows states to require a CDL for these vehicles under their discretion.[5] A CDL is also required to operate any vehicle that transports at least 16 passengers (including the driver) or hazardous materials requiring placards under federal and state law regardless of the weight of the vehicle.[6] [1][7][8] States may extend CDL requirements for additional vehicles, for example, New York requires a CDL to operate a stretched limousine and California requires a CDL for any vehicle with three or more axles that has a gross vehicle weight rating of over 6,000 pounds.[9][10]

## Table of US GVWR classifications

| US truck class | Duty classification | Weight limit [1][11] | Examples |
|---|---|---|---|
| Class 1 | Light duty | 0–6,000 pounds (0–2,722 kg) | Chevrolet Colorado/GMC Canyon, Ford Ranger, Honda Ridgeline FWD[12], Jeep Gladiator, Nissan Frontier, Toyota Tacoma |
| Class 2a | Light duty | 6,001–8,500 pounds (2,722–3,856 kg) | Chevrolet Silverado/GMC Sierra 1500, Ford F-150, Honda Ridgeline AWD[12][13][14], Ram 1500, Nissan Titan, Toyota Tundra |
| Class 2b | Light duty | 8,501–10,000 pounds (3,856–4,536 kg) | Chevrolet Silverado/GMC Sierra 2500, Ford F-250, Nissan Titan XD, Ram 2500[12][13][14] |
| Class 3 | Medium duty | 10,001–14,000 pounds (4,536–6,350 kg) | Chevrolet Silverado/GMC Sierra 3500, Ford F-350, Ford F-450 (pickup only), Ram 3500, Isuzu NPR[15] |
| Class 4 | Medium duty | 14,001–16,000 pounds (6,351–7,257 kg) | Chevrolet Silverado 4500HD/International CV, Ford F-450 (chassis cab only), Ram 4500[12], Isuzu NPR-HD,[15] |
| Class 5 | Medium duty | 16,001–19,500 pounds (7,258–8,845 kg) | Chevrolet Silverado 5500HD/International CV, Ford F-550, Ram 5500, Isuzu NRR,[15] Freightliner Business Class M2 106, Kenworth T170, Peterbilt 325 |
| Class 6 | Medium duty | 19,501–26,000 pounds (8,846–11,793 kg) | Chevrolet Silverado 6500HD/International CV, Ford F-650, Freightliner Business Class M2 106, International MV[16], Kenworth T270, Peterbilt 330, Mack MD |
| Class 7 | Heavy duty | 26,001–33,000 pounds (11,794–14,969 kg) | Autocar ACMD,[17] Freightliner Business Class M2 106, Ford F-750[18], Hino 338, International MV, Kenworth K370, Kenworth T370 and T440/470, Mack MD, Peterbilt 220 and 337/348 |
| Class 8 | Heavy duty | 33,001 pounds (14,969 kg) and above | Autocar ACX and DC; Volvo Truck VNL; Freightliner Cascadia, Business Class M2 112, 118SD, and EconicSD; Ford F-750; Hino XL8; International LT, HV, and RH; Kenworth T680, T880, and W990; Mack Anthem, Granite, Tesla Semi, Nikola TRE, Pinnacle, and TerraPro; Peterbilt 389,[19] 579, and 520; Western Star 4800, 4900 and 5700; Pierce, E-One, Spartan, Ferrara, KME custom fire apparatus. |

## Notes on weight classes

### "Ton" rating

When light-duty trucks were first produced in the United States, they were rated by their payload capacity in tons: $^{1}\!/_{2}$ (1000 pounds), $^{3}\!/_{4}$ (1500 pounds) and 1-ton (2000 pounds). Ford had introduced the "One-Tonner" in 1938 to their line of trucks.[20] The "Three-quarter-tonner" appeared in the Ford truck lineup in 1939.[20] Over time, payload capacities for most domestic pickup trucks have increased while the ton titles have stayed the same. The 1948 Ford F-1 had a Gross Vehicle Weight Rating (GVWR) of 4700 pounds.[21] The truck was marketed with a "Nominal Tonnage Rating: Half-Ton."[21] The actual cargo capacity had increased to 1450 pounds.[21] Ford adopted this promotional nomenclature in 1948 to assist buyers, sellers, and users.[20] The now-imprecise ton rating has continued since the post World War II era to compare standard sizes, rather than actual capacities.[22][23] In 1975, a change in U.S. emission laws required any vehicle under 6000 pounds GVWR to burn unleaded fuel. U.S. pickup truck manufacturers responded with a "heavy half" pickup of over 6000 pounds GVWR.[20] The F-150 had a capacity of over 2000 pounds, compared to 1500 pounds for the F-100.[24]

This has led to categorizing trucks similarly, even if their payload capacities are different. The Chevrolet Silverado/GMC Sierra 1500, Ford F-150, Nissan Titan, Ram 1500, and Toyota Tundra are called "half-ton" pickups ($^{1}\!/_{2}$-ton). The Chevrolet Silverado/GMC Sierra 2500, Ford F-250, and Ram 2500 are called "three-quarter-ton" pickups. The Chevrolet Silverado/GMC Sierra 3500, Ford F-350, and Ram 3500 are known as "one ton" pickups.[23]

Similar schemes exist for vans and SUVs (e.g. a 1-ton Dodge Van or a $^{1}\!/_{2}$-ton GMC Suburban), medium duty trucks (e.g. the $1^{1}\!/_{2}$-ton Ford F-550) and some military vehicles, like the ubiquitous deuce-and-a-half.

### Class 8

The Class 8 truck gross vehicle weight rating (GVWR) is a vehicle with a GVWR exceeding 33 000 lb (14 969 kg).[1][25] These include tractor trailer tractors, single-unit dump trucks of a GVWR over 33,000 lb, as well as non-commercial chassis fire trucks; such trucks typically have 3 or more axles. The typical 5-axle tractor-trailer combination, also called a "semi" or "18-wheeler", is a Class 8 vehicle. Standard trailers vary in length from 8 ft (2.4 m) containers to 57 ft (17 m) van trailers, with the most common length being the 53 ft (16 m) trailer. Specialized trailers for oversized loads can be considerably longer. Commercial operation of a Class 8 vehicle in the United States requires either a Class-B CDL for non-combination vehicles, or a Class-A CDL for combination vehicles (tractor-trailers).

# Canada

Vehicle classifications vary among provinces in Canada, due to "differences in size and weight regulations, economic activity, physical environment, and other issues".[26]: 3 While several provinces use their own classification schemes for traffic monitoring, Manitoba, Ontario, Prince Edward Island and Saskatchewan have adopted the 13-class system from the United States' Federal Highway Administration—sometimes with modifications, or in Ontario's case, for limited purposes.[26]: 3–4 British Columbia and Ontario also distinguish between short- and long-combination trucks.[26]: 3–4 In accident reporting, eight jurisdictions subdivide trucks by GVWR into light and heavy classes at approximately 4 500 kg (9 921 lb).[26]: 6

# European Union and United Kingdom

Vehicle categories on a European driving licence include (among others) **B** for general motor vehicles, **C** for large goods vehicles, **D** for large passenger vehicles (buses), and are limited by the Gross Vehicle Weight Rating and number of passenger seats.

The general categories are further divided as follows:

1. appending the number **1** to the licence class C or D denotes the "light" versions of said class (e.g., Minibus, or medium truck).
2. appending the letter **E** allows for trailers of larger Gross Trailer Weight Rating (GTWR) than permitted by the standard licence category.

For the "trailer" categories, a separate driving test is generally required (e.g., "C", and "CE" require separate tests).

The classifications used on the International Driving Permit are similar to the European model.

The licence categories that deal with trucks are B and C:

**Class B** permits the use of vehicles with GVWRs of not more than 3 500 kg plus a trailer with GTWR not exceeding 750 kg; or, a trailer above this limit so long as the combined gross weight of car and trailer does not exceed 3 500 kg (in some jurisdictions a higher combined weight limit of 4 250 kg is permitted after a theoretical and practical course of seven hours, but this permission is not transferable between EU countries). Class B covers both standard passenger cars of all sizes as well as vehicles that are specifically designed for transport of goods. The latter are commonly known as light commercial vehicles (LCVs), and include vans such as the Ford Transit, Mercedes-Benz Sprinter and Fiat Ducato, as well as pickup trucks such as the Ford Ranger or Mitsubishi Triton.

**Class BE** allows a trailers of up to 3 500 kg GTWR to be used while driving a class B vehicle.

**Class C1** raises the GVWR limit to 7 500 kg and permits a trailer with GTWR not exceeding 750 kg.

**Class C** removes the GVWR limit of Class C1, but the GTWR limit for the trailer of 750 kg remains. (This often referred to as a "Rigid Heavy Goods Vehicle" or "Rigid truck" licence)

**Class C1E** allows for a class B or C1 vehicle and a trailer of more than 750 kg GTWR, so long as the combined gross weight does not exceed 12 000 kg.

**Class CE** removes all weight limits for a Class C vehicle with trailer. (known as an "Articulated Heavy Goods Vehicle", or often simply "HGV", licence )

# List of truck types

Truck (Lorry) See List of truck types

- Box truck
- Cab over
- Chassis cab
- Concrete mixer
- Conversion van
- Dump truck
- Flatbed truck
- Fire truck
- Logging truck
- Panel van
- Platform truck
- Pickup truck
- Refuse truck

- Semi tractor
- Sport utility vehicle
- Tow truck
- Van

# Gallery

Class 1 Light duty Toyota Tacoma

Class 2 2001 Ford Excursion 4×4 (GVWR: 8,600 pounds (3.9 t)

Class 3 Ford F-350

Class 4 2008 Ford F-450 4×4 pick-up truck (GVWR: 14,500 pounds (6.6 t))

Class 5 2005 Chevy Kodiak 4×4 (GVWR: 17,500 pounds (7.9 t))

Class 6 2002 Ford F-650 in front (GVWR: 26 000 lb), 1989 Ford F-600 in back (GVWR: 20,200 pounds (9.2 t)

Class 7 Peterbilt 330 dump truck.

Class 8 Kenworth W900 tractor with spread-axle 48-foot (14.63 m) refrigerated trailer.

Western Star 6900XD tractor.

## See also

- Car classification
- Corporate Average Fuel Economy (CAFE)
- Commercial vehicle
- Curb weight
- Driver's license
- Fifth wheel
- Gross weight:
  - Gross axle weight rating (GAWR)
  - Gross combined weight rating (GCWR)
  - Gross trailer weight rating (GTWR)
  - Gross vehicle weight rating (GVWR)
- Large goods vehicle
- List of truck types
- Semi-trailer
- Tow hitch
- Trailer
- Vehicle category

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3. Vehicle Weight Classifications (http://www.epa.gov/otaq/standards/weights.htm) from the United States Environmental Protection Agency
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# External links

- Reducing $CO_2$ emissions from Heavy-Duty Vehicles (http://ec.europa.eu/clima/policies/transport/vehicles/heavy/index_en.htm) (European Union)
- Führerscheinklassen (Klassen der Lenkberechtigung) (https://www.help.gv.at/Portal.Node/hlpd/public/content/4/Seite.040150.html) (in German) (trans.: Driving license classes)

WIKIPEDIA

# Truckload shipping

**Truckload shipping** is the movement of large amounts of homogeneous cargo, generally the amount necessary to fill an entire semi-trailer or intermodal container. A **truckload carrier** is a trucking company that generally contracts an entire trailer-load to a single customer. This is as opposed to a **less-than truckload** (LTL) company that generally mixes freight from several customers in each trailer. One advantage Full Truckload (FTL) carriers have over Less than Truckload carriers is that the freight is never handled en route, whereas an LTL shipment will typically be transported on several different trailers. Truckload shipments are typically run on 48' or 53'dry van trailers which will hold 24 or 26 pallets respectively.

## Contents



## Responsibilities

Truckload is used for larger shipments of freight. If the number of items is large, a 48’ or 53’ capacity trailer will not be enough for shipping products. In such a case, truckload shipping is the best method to reduce cost, transport goods quicker and reduce damage. The shipment will be cost-effective if it is large enough to require the use of the space of the trailer. Truckload shipping will also be more beneficial than booking multiple LTL (less than truckload) shipments.

There are three types of truckload shipment — dry van, flatbed, and refrigerated. During the time of filling the entire trailer, "full truckload" should be selected. This is ideal for large shipments. If the freight does not need the entire space of a truck, it is called LTL. On the other hand, the entire space or weight limit of a trailer is required for a full truckload (FTL) shipments. Efficiency and productivity of the package can also be improved in truckload shipping. Compared to LTL, selecting full truckload will be cost-effective when the weight is high. Full-truckload freight is very fast because it is sent to the chosen destination directly. Thus transit time is less.

## Packaging

Freight is usually loaded onto pallets for unit loads. Sturdy shipping containers such as crates or corrugated fiberboard boxes are commonly used. Carriers have published tariffs that provide some guidance for packaging. Packaging engineers design and test packaging to meet the specific needs of the logistics system and the product being shipped.

Truckload shipments are sometimes broken down into individual containers and further shipped by LTL or express carriers. Packaging for TL often needs to withstand the more severe handling of individual shipments. A typical full truckload for a dry van trailer consists of 24 standard pallets of cargo that weighs up to 45,000 lbs. (or more).

# History

When the US Interstate Highway System expanded in the 1950s, the trucking industry took over a large market share of transportation of goods throughout the country. Before this era, railroads had transported the bulk of goods country wide. The Interstate Highway System allowed merchandise to travel door to door much more easily. Since then, truckload carriers have utilized the interstate system to transport merchandise across the country. They typically will bring the merchandise from the distribution center in one area of the country to a distribution center in a different part of the country. The increase in truckload freight transportation has reduced the amount of time taken to transport goods where the freight was manufactured or produced to the different areas around the nation.

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# External links

- Mirriam Webster definition of truckload (http://www.m-w.com/dictionary/truckload)

Wikipedia

# Vehicle

A **vehicle** (from Latin: *vehiculum*[1]) is a machine that transports people or cargo. Vehicles include wagons, bicycles, motor vehicles (motorcycles, cars, trucks, buses, mobility scooters for disabled people), railed vehicles (trains, trams), watercraft (ships, boats, underwater vehicles), amphibious vehicles (screw-propelled vehicles, hovercraft), aircraft (airplanes, helicopters, aerostats) and spacecraft.[2]


Buses are a common form of vehicles used for public transport.

Land vehicles are classified broadly by what is used to apply steering and drive forces against the ground: wheeled, tracked, railed or skied. ISO 3833-1977 is the standard, also internationally used in legislation, for road vehicles types, terms and definitions.[3]

## Contents



# History

- The oldest boats found by archaeological excavation are logboats, with the oldest logboat found, the Pesse canoe found in a bog in the Netherlands, being carbon dated to 8040 - 7510 BC, making it 9,500–10,000 years old,[4][5][6][7]
- a 7,000-year-old seagoing boat made from reeds and tar has been found in Kuwait.[8]
- Boats were used between 4000 -3000 BC in Sumer,[9] ancient Egypt[10] and in the Indian Ocean.[9]
- There is evidence of camel pulled wheeled vehicles about 4000–3000 BC.[11]

A Slavic dugout boat from the 10th century

- The earliest evidence of a wagonway, a predecessor of the railway, found so far was the 6 to 8.5 km (4 to 5 mi) long *Diolkos* wagonway, which transported boats across the Isthmus of Corinth in Greece since around 600 BC.[12][13] Wheeled vehicles pulled by men and animals ran in grooves in limestone, which provided the track element, preventing the wagons from leaving the intended route.[13]

- In 200 CE, Ma Jun built a south-pointing chariot, a vehicle with an early form of guidance system.[14]
- Railways began reappearing in Europe after the Dark Ages. The earliest known record of a railway in Europe from this period is a stained-glass window in the Minster of Freiburg im Breisgau dating from around 1350.[15]
- In 1515, Cardinal Matthäus Lang wrote a description of the Reisszug, a funicular railway at the Hohensalzburg Fortress in Austria. The line originally used wooden rails and a hemp haulage rope and was operated by human or animal power, through a treadwheel.[16][17]

Automobiles are among the most commonly used engine-powered vehicles

- 1769 Nicolas-Joseph Cugnot is often credited with building the first self-propelled mechanical vehicle or automobile in 1769.[18]
- In Russia, in the 1780s, Ivan Kulibin developed a human-pedalled, three-wheeled carriage with modern features such as a flywheel, brake, gear box and bearings; however, it was not developed further.[19]
- 1783 Montgolfier brothers first balloon vehicle
- 1801 Richard Trevithick built and demonstrated his *Puffing Devil* road locomotive, which many believe was the first demonstration of a steam-powered road vehicle, though it could not maintain sufficient steam pressure for long periods and was of little practical use.
- 1817 Push bikes, draisines or hobby horses were the first human means of transport to make use of the two-wheeler principle, the draisienne (or *Laufmaschine*, "running machine"), invented by the German Baron Karl von Drais, is regarded as the forerunner of the modern bicycle (and motorcycle). It was introduced by Drais to the public in Mannheim in summer 1817.[20]
- 1885 Karl Benz built (and subsequently patented) the first automobile, powered by his own four-stroke cycle gasoline engine in Mannheim, Germany
- 1885 Otto Lilienthal began experimental gliding and achieved the first sustained, controlled, reproducible flights.
- 1903 Wright brothers flew the first controlled, powered aircraft
- 1907 First helicopters Gyroplane no.1 (tethered) and Cornu helicopter (free flight)[21]
- 1928 Opel RAK.1 rocket car
- 1929 Opel RAK.1 rocket glider
- 1961 Vostok vehicle carried the first human, Yuri Gagarin, into space
- 1969 Apollo Program first crewed vehicle landed on the moon
- 2010 The number of road motor vehicles in operation worldwide surpassed the 1 billion mark – roughly one for every seven people.[22]

# Types of vehicles

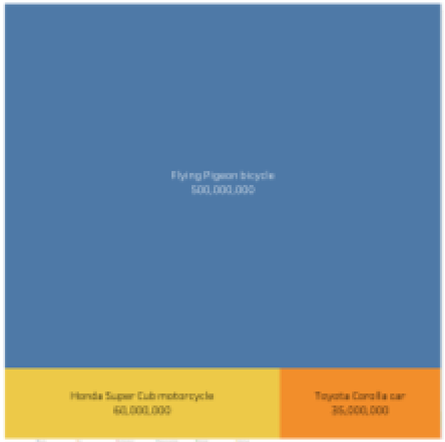
There are over 1 billion bicycles in use worldwide.[23] In 2002 there were an estimated 590 million cars and 205 million motorcycles in service in the world.[24][25] At least 500 million Chinese Flying Pigeon bicycles have been made, more than any other single model of vehicle.[26][27] The most-produced model of motor vehicle is the Honda Super Cub motorcycle, having passed 60 million units in 2008.[28][29] The most-produced car model is the Toyota Corolla, with at least 35 million made by 2010.[30][31] The most common fixed-wing airplane is the Cessna 172, with about 44,000 having been made as of 2017.[32][33]

The Soviet Mil Mi-8, at 17,000, is the most-produced helicopter.[34] The top commercial jet airliner is the Boeing 737, at about 10,000 in 2018.[35][36][37] At around 14,000 for both, the most produced trams are the KTM-5 and Tatra T3.[38] The most common trolleybus is ZiU-9.

The most common model of vehicle in the world, the Flying Pigeon bicycle. (2011)

# Locomotion

Locomotion consists of a means that allows displacement with little opposition, a power source to provide the required kinetic energy and a means to control the motion, such as a brake and steering system. By far, most vehicles use wheels which employ the principle of rolling to enable displacement with very little rolling friction.




Treemap of the most common vehicles ever made, with total number made shown by size, and type/model labelled and distinguished by color. Fixed-wing airplanes, helicopters, and commercial jetliners are visible in the lower right corner at maximum zoom.

## Energy source

It is essential that a vehicle have a source of energy to drive it. Energy can be extracted from external sources, as in the cases of a sailboat, a solar-powered car, or an electric streetcar that uses overhead lines. Energy can also be stored, provided it can be converted on demand and the storing medium's energy density and power density are sufficient to meet the vehicle's needs.

Human power is a simple source of energy that requires nothing more than humans. Despite the fact that humans cannot exceed 500 W (0.67 hp) for meaningful amounts of time,[39] the land speed record for human-powered vehicles (unpaced) is 133 km/h (83 mph), as of 2009 on a recumbent bicycle.[40]

The most common type of energy source is fuel. External combustion engines can use almost anything that burns as fuel, whilst internal combustion engines and rocket engines are designed to burn a specific fuel, typically gasoline, diesel or ethanol.

An electric bike in China (2011)

Another common medium for storing energy is batteries, which have the advantages of being responsive, useful in a wide range of power levels, environmentally friendly, efficient, simple to install, and easy to maintain. Batteries also facilitate the use of electric motors, which have their own advantages. On the other hand, batteries have low energy densities, short service life, poor performance at extreme temperatures, long charging times, and difficulties with disposal (although they can usually be recycled). Like fuel, batteries store chemical energy and can cause burns and poisoning in event of an accident.[41] Batteries also lose effectiveness with time.[42] The issue of charge time can be resolved by swapping discharged batteries with charged ones;[43] however, this incurs additional hardware costs and may be impractical for larger batteries. Moreover, there must be standard batteries for battery swapping to work at a gas station. Fuel cells are similar to batteries in that they convert from chemical to electrical energy, but have their own advantages and disadvantages.

Electrified rails and overhead cables are a common source of electrical energy on subways, railways, trams, and trolleybuses. Solar energy is a more modern development, and several solar vehicles have been successfully built and tested, including Helios, a solar-powered aircraft.

Nuclear power is a more exclusive form of energy storage, currently limited to large ships and submarines, mostly military. Nuclear energy can be released by a nuclear reactor, nuclear battery, or repeatedly detonating nuclear bombs. There have been two experiments with nuclear-powered aircraft, the Tupolev Tu-119 and the Convair X-6.

Mechanical strain is another method of storing energy, whereby an elastic band or metal spring is deformed and releases energy as it is allowed to return to its ground state. Systems employing elastic materials suffer from hysteresis, and metal springs are too dense to be useful in many cases.

Flywheels store energy in a spinning mass. Because a light and fast rotor is energetically favorable, flywheels can pose a significant safety hazard. Moreover, flywheels leak energy fairly quickly and affect a vehicle's steering through the gyroscopic effect. They have been used experimentally in gyrobuses.

Wind energy is used by sailboats and land yachts as the primary source of energy. It is very cheap and fairly easy to use, the main issues being dependence on weather and upwind performance. Balloons also rely on the wind to move horizontally. Aircraft flying in the jet stream may get a boost from high altitude winds.

Compressed gas is currently an experimental method of storing energy. In this case, compressed gas is simply stored in a tank and released when necessary. Like elastics, they have hysteresis losses when gas heats up during compression.

Gravitational potential energy is a form of energy used in gliders, skis, bobsleds and numerous other vehicles that go down hill. Regenerative braking is an example of capturing kinetic energy where the brakes of a vehicle are augmented with a generator or other means of extracting energy.[44]

## Motors and engines

When needed, the energy is taken from the source and consumed by one or more motors or engines. Sometimes there is an intermediate medium, such as the batteries of a diesel submarine.[45]

Most motor vehicles have internal combustion engines. They are fairly cheap, easy to maintain, reliable, safe and small. Since these engines burn fuel, they have long ranges but pollute the environment. A related engine is the external combustion engine. An example of this is the steam engine. Aside from fuel, steam engines also need water, making them impractical for some purposes. Steam engines also need time to warm up, whereas IC engines can usually run right after being started, although this may not be recommended in cold conditions. Steam engines burning coal release sulfur into the air, causing harmful acid rain.[46]


A modern scooter in Taiwan.

While intermittent internal combustion engines were once the primary means of aircraft propulsion, they have been largely superseded by continuous internal combustion engines: gas turbines. Turbine engines are light and, particularly when used on aircraft, efficient. On the other hand, they cost more and require careful maintenance. They can also be damaged by ingesting foreign objects, and they produce a hot exhaust. Trains using turbines are called gas turbine-electric locomotives. Examples of surface vehicles using turbines are M1 Abrams, MTT Turbine SUPERBIKE and the Millennium. Pulse jet engines are similar in many ways to turbojets, but have almost no moving parts. For this reason, they were very appealing to vehicle designers in the past; however their noise, heat and inefficiency has led to their abandonment. A historical example of the use of a pulse jet was the V-1 flying bomb. Pulse jets are still occasionally used in amateur experiments. With the advent of modern technology, the pulse detonation engine has become practical and was successfully tested on a Rutan VariEze. While the pulse detonation engine is much more efficient than the pulse jet and even turbine engines, it still suffers from extreme noise and vibration levels. Ramjets also have few moving parts, but they only work at high speed, so that their use is restricted to tip jet helicopters and high speed aircraft such as the Lockheed SR-71 Blackbird.[47][48]

Rocket engines are primarily used on rockets, rocket sleds and experimental aircraft. Rocket engines are extremely powerful. The heaviest vehicle ever to leave the ground, the Saturn V rocket, was powered by five F-1 rocket engines generating a combined 180 million horsepower[49] (134.2 gigawatt). Rocket engines also have no need to "push off" anything, a fact that the New York Times denied in error. Rocket engines can be particularly simple, sometimes consisting of nothing more than a catalyst, as in the case of a hydrogen peroxide rocket.[50] This makes them an attractive option for vehicles such as jet packs. Despite their simplicity, rocket engines are often dangerous and susceptible to explosions. The fuel they run off may be flammable, poisonous, corrosive or cryogenic. They also suffer from poor efficiency. For these reasons, rocket engines are only used when absolutely necessary.

Electric motors are used in electric vehicles such as electric bicycles, electric scooters, small boats, subways, trains, trolleybuses, trams and experimental aircraft. Electric motors can be very efficient: over 90% efficiency is common.[51] Electric motors can also be built to be powerful, reliable, low-maintenance and of any size. Electric motors can deliver a range of speeds and torques without necessarily using a gearbox (although it may be more economical to use one). Electric motors are limited in their use chiefly by the difficulty of supplying electricity.

Compressed gas motors have been used on some vehicles experimentally. They are simple, efficient, safe, cheap, reliable and operate in a variety of conditions. One of the difficulties met when using gas motors is the cooling effect of expanding gas. These engines are limited by how quickly they absorb heat from their surroundings.[52] The cooling effect can, however, double as air conditioning. Compressed gas motors also lose effectiveness with falling gas pressure.

Ion thrusters are used on some satellites and spacecraft. They are only effective in a vacuum, which limits their use to spaceborne vehicles. Ion thrusters run primarily off electricity, but they also need a propellant such as caesium, or more recently xenon.[53][54] Ion thrusters can achieve extremely high speeds and use little propellant; however they are power-hungry.[55]

## Converting energy to work

The mechanical energy that motors and engines produce must be converted to work by wheels, propellers, nozzles, or similar means. Aside from converting mechanical energy into motion, wheels allow a vehicle to roll along a surface and, with the exception of railed vehicles, to be steered.[56] Wheels are ancient technology, with specimens being discovered from over 5000 years ago.[57] Wheels are used in a plethora of vehicles, including motor vehicles, armoured personnel carriers, amphibious vehicles, airplanes, trains, skateboards and wheelbarrows.

Nozzles are used in conjunction with almost all reaction engines.[58] Vehicles using nozzles include jet aircraft, rockets and personal watercraft. While most nozzles take the shape of a cone or bell,[58] some unorthodox designs have been created such as the aerospike. Some nozzles are intangible, such as the electromagnetic field nozzle of a vectored ion thruster.[59]

Continuous track is sometimes used instead of wheels to power land vehicles. Continuous track has the advantages of a larger contact area, easy repairs on small damage, and high maneuverability.[60] Examples of vehicles using continuous track are tanks, snowmobiles and excavators. Two continuous tracks used together allow for steering. The largest vehicle in the world,[61] the Bagger 288, is propelled by continuous tracks.

Propellers (as well as screws, fans and rotors) are used to move through a fluid. Propellers have been used as toys since ancient times, however it was Leonardo da Vinci who devised what was one of the earliest propeller driven vehicles, the "aerial-screw".[62] In 1661, Toogood & Hays adopted the screw for use as a ship propeller.[63] Since then, the propeller has been tested on many terrestrial vehicles, including the Schienenzeppelin train and numerous cars.[64] In modern times, propellers are most prevalent on watercraft and aircraft, as well as some amphibious vehicles such as hovercraft and ground-effect vehicles. Intuitively, propellers cannot work in space as there is no working fluid, however some sources have suggested that since space is never empty, a propeller could be made to work in space.[65]

Similarly to propeller vehicles, some vehicles use wings for propulsion. Sailboats and sailplanes are propelled by the forward component of lift generated by their sails/wings.[66][67] Ornithopters also produce thrust aerodynamically. Ornithopters with large rounded leading edges produce lift by leading-edge suction forces.[68] Research at the University of Toronto Institute for Aerospace Studies [69] lead to a flight with an actual ornithopter on July 31, 2010.

Paddle wheels are used on some older watercraft and their reconstructions. These ships were known as paddle steamers. Because paddle wheels simply push against the water, their design and construction is very simple. The oldest such ship in scheduled service is the Skibladner.[70] Many pedalo boats also use paddle wheels for propulsion.

Screw-propelled vehicles are propelled by auger-like cylinders fitted with helical flanges. Because they can produce thrust on both land and water, they are commonly used on all-terrain vehicles. The ZiL-2906 was a Soviet-designed screw-propelled vehicle designed to retrieve cosmonauts from the Siberian wilderness.[71]

### Friction

All or almost all of the useful energy produced by the engine is usually dissipated as friction; so minimising frictional losses is very important in many vehicles. The main sources of friction are rolling friction and fluid drag (air drag or water drag).

Wheels have low bearing friction and pneumatic tyres give low rolling friction. Steel wheels on steel tracks are lower still.[72]

Aerodynamic drag can be reduced by streamlined design features.

Friction is desirable and important in supplying traction to facilitate motion on land. Most land vehicles rely on friction for accelerating, decelerating and changing direction. Sudden reductions in traction can cause loss of control and accidents.

## Control

### Steering

Most vehicles, with the notable exception of railed vehicles, have at least one steering mechanism. Wheeled vehicles steer by angling their front[56] or rear[73] wheels. The B-52 Stratofortress has a special arrangement in which all four main wheels can be angled.[74] Skids can also be used to steer by angling them, as in the case of a snowmobile. Ships, boats, submarines, dirigibles and aeroplanes usually have a rudder for steering. On an airplane, ailerons are used to bank the airplane for directional control, sometimes assisted by the rudder.

### Stopping

With no power applied, most vehicles come to a stop due to friction. But it is often required to stop a vehicle faster than by friction alone: so almost all vehicles are equipped with a braking system. Wheeled vehicles are typically equipped with friction brakes, which use the friction between brake pads (stators) and brake rotors to slow the vehicle.[44] Many airplanes have high performance versions of the same system in their landing gear for use on the ground. A Boeing 757 brake, for example, has 3 stators and 4 rotors.[75] The Space Shuttle also uses frictional brakes on its wheels.[76] As well as frictional brakes, hybrid/electric cars, trolleybuses and electric bicycles can also use regenerative brakes to recycle some of the vehicle's potential energy.[44] High-speed trains sometimes use frictionless Eddy-current brakes; however widespread application of the technology has been limited by overheating and interference issues.[77]

Aside from landing gear brakes, most large aircraft have other ways of decelerating. In aircraft, air brakes are aerodynamic surfaces that provide braking force by increasing the frontal cross section thus aerodynamic drag of the aircraft. These are usually implemented as flaps that oppose air flow when extended and are flush with aircraft when retracted. Reverse thrust is also used in many aeroplane engines. Propeller aircraft achieve reverse thrust by reversing the pitch of the propellers, while jet aircraft do so by redirecting their engine exhaust forwards.[78] On aircraft carriers, arresting gears are used to stop an aircraft. Pilots may even apply full forward throttle on touchdown, in case the arresting gear does not catch and a go around is needed.[79]

Parachutes are used to slow down vehicles travelling very fast. Parachutes have been used in land, air and space vehicles such as the ThrustSSC, Eurofighter Typhoon and Apollo Command Module. Some older Soviet passenger jets had braking parachutes for emergency landings.[80] Boats use similar devices called sea anchors to maintain stability in rough seas.

To further increase the rate of deceleration or where the brakes have failed, several mechanisms can be used to stop a vehicle. Cars and rolling stock usually have hand brakes that, while designed to secure an already parked vehicle, can provide limited braking should the primary brakes fail. A secondary procedure called forward-slip is sometimes used to slow airplanes by flying at an angle, causing more drag.

# Legislation

Motor vehicle and trailer categories are defined according to the following international classification:[81]

- Category M: passenger vehicles.
- Category N: motor vehicles for the carriage of goods.
- Category O: trailers and semi-trailers.

### European Union

In the European Union the classifications for vehicle types are defined by:[82]

- Commission Directive 2001/116/EC of 20 December 2001, adapting to technical progress Council Directive 70/156/EEC on the approximation of the laws of the Member States relating to the type-approval of motor vehicles and their trailers[83][84]
- Directive 2002/24/EC of the European Parliament and of the Council of 18 March 2002 relating to the type-approval of two or three wheeled motor vehicles and repealing Council Directive 92/61/EEC

European Community, is based on the Community's WVTA (whole vehicle type-approval) system. Under this system, manufacturers can obtain certification for a vehicle type in one Member State if it meets the EC technical requirements and then market it EU-wide with no need for further tests. Total technical harmonization already has been achieved in three vehicle categories (passenger cars, motorcycles, and tractors) and soon will extend to other vehicle categories (coaches and utility vehicles). It is essential that European car manufacturers be ensured access to as large a market as possible.

While the Community type-approval system allows manufacturers to benefit fully from internal market opportunities, worldwide technical harmonization in the context of the United Nations Economic Commission for Europe (UNECE) offers a market beyond European borders.

## Licensing

In many cases, it is unlawful to operate a vehicle without a license or certification. The least strict form of regulation usually limits what passengers the driver may carry or prohibits them completely (e.g., a Canadian ultra-light license without endorsements).[85] The next level of licensing may allow passengers, but without any form of compensation or payment. A private driver's license usually has these conditions. Commercial licenses that allow the transport of passengers and cargo are more tightly regulated. The most strict form of licensing is generally reserved for school buses, hazardous materials transports and emergency vehicles.

The driver of a motor vehicle is typically required to hold a valid driver's license while driving on public lands, whereas the pilot of an aircraft must have a license at all times, regardless of where in the jurisdiction the aircraft is flying.

## Registration

Vehicles are often required to be registered. Registration may be for purely legal reasons, for insurance reasons or to help law enforcement recover stolen vehicles. Toronto Police Service, for example, offers free and optional bicycle registration online.[86] On motor vehicles, registration often takes the form of a vehicle registration plate, which makes it easy to identify a vehicle. In Russia, trucks and buses have their licence plate numbers repeated in large black letters on the back. On aircraft, a similar system is used where a tail number is painted on various surfaces. Like motor vehicles and aircraft, watercraft also have registration numbers in most jurisdictions, however the vessel name is still the primary means of identification as has been the case since ancient times. For this reason, duplicate registration names are generally rejected. In Canada, boats with an engine power of 10 hp (7.5 kW) or greater require registration,[87] leading to the ubiquitous "9.9 hp (7.4 kW)" engine.

Registration may be conditional on the vehicle being approved for use on public highways, as in the case of the UK[88] and Ontario.[89] Many US states also have requirements for vehicles operating on public highways.[90] Aircraft have more stringent requirements, as they pose a high risk of damage to people and property in event of an accident. In the US, the FAA requires aircraft to have an airworthiness certificate.[91][92] Because US aircraft must be flown for some time before they are certified,[93] there is a provision for an experimental airworthiness certificate.[94] FAA experimental aircraft are restricted in operation, including no overflights of populated areas, in busy airspace or with unessential passengers.[93] Materials and parts used in FAA certified aircraft must meet the criteria set forth by the *technical standard orders*.[95]

### Mandatory safety equipment

In many jurisdictions, the operator of a vehicle is legally obligated to carry safety equipment with or on them. Common examples include seat belts in cars, helmets on motorcycles and bicycles, fire extinguishers on boats, buses and airplanes and life jackets on boats and commercial aircraft. Passenger aircraft carry a great deal of safety equipment including inflatable slides are rafts, oxygen masks, oxygen tanks, life jackets, satellite beacons and first aid kits. Some equipment such as life jackets has led to debate regarding their usefulness. In the case of Ethiopian Airlines Flight 961, the life jackets saved many people but also led to many deaths when passengers inflated their vests prematurely.

## Right-of-way

There are specific real-estate arrangements made to allow vehicles to travel from one place to another. The most common arrangements are public highways, where appropriately licensed vehicles can navigate without hindrance. These highways are on public land and are maintained by the government. Similarly, toll routes are open to the public after paying a toll. These routes and the land they rest on may be government or privately owned or a combination of both. Some routes are privately owned but grant access to the public. These routes often have a warning sign stating that the government does not maintain the way. An example of this are byways in England and Wales. In Scotland, land is open to un-motorised vehicles if the land meets certain criteria. Public land is sometimes open to use by off-road vehicles. On US public land, the Bureau of Land Management (BLM) decides where vehicles may be used. Railways often pass over land not owned by the railway company. The right to this land is granted to the railway company through mechanisms such as easement. Watercraft are generally allowed to navigate public waters without restriction as long as they do not cause a disturbance. Passing through a lock, however, may require paying a toll. Despite the common law tradition *Cuius est solum, eius est usque ad coelum et ad inferos* of owning all the air above one's property, the US Supreme Court ruled that aircraft in the US have the right to use air above someone else's property without their consent. While the same rule generally applies in all jurisdictions, some countries such as Cuba and Russia have taken advantage of air rights on a national level to earn money.[96] There are some areas that aircraft are barred from overflying. This is called prohibited airspace. Prohibited airspace is usually strictly enforced due to potential damage from espionage or attack. In the case of Korean Air Lines Flight 007, the airliner entered prohibited airspace over Soviet territory and was shot down as it was leaving.

## Safety

For a comparison of transportation fatality rates, see: Air safety statistics.

Several different metrics used to compare and evaluate the safety of different vehicles. The main three are *deaths per billion passenger-journeys*, *deaths per billion passenger-hours* and *deaths per billion passenger-kilometers*.

## See also

- Automotive acronyms and abbreviations

- ISIRI 6924
- Narrow-track vehicle
- Outline of vehicles
- Personal transporter
- Propulsion
- Single-track vehicle
- Vehicular dynamics
- Vehicular metrics

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