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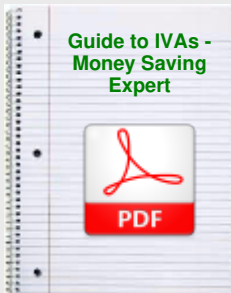



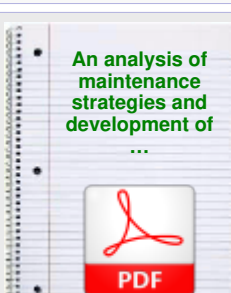



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# Truck

A truck (United States, Canada, Australia, New Zealand, Puerto Rico and Pakistan; also called a lorry in the United Kingdom, Ireland, South Africa, Malaysia, Singapore, and India) is a motor vehicle designed to transport cargo. Trucks vary greatly in size, power, and configuration; smaller varieties may be mechanically similar to some automobiles. Commercial trucks can be very large and powerful, and may be configured to mount specialized equipment, such as in the case of fire trucks and concrete mixers and suction excavators.

Modern trucks are largely powered by diesel engines, although small to medium size trucks with gasoline engines exist in the US. In the European Union, vehicles with a gross combination mass of up to 3.5 t (7,700 lb) are known as light commercial vehicles, and those over as large goods vehicles.

## 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-1800s. 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.

## Internal combustion

In 1895 Karl Benz designed and built the first truck in history using the internal combustion engine. Later that year some of Benz's trucks were modified to become the first bus by the Netphener, the first motorbus company in history. A year later, in 1896, another internal combustion engine truck was built by Gottlieb Daimler. 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 optional 5 or 8 horsepower motors.

Trucks of the era mostly used two-cylinder engines and had a carrying capacity of 3,300 to 4,400 lb (1.5 to 2 t). In 1904, 700 heavy trucks were built in the United States, 1000 in 1907, 6000 in 1910, and 25000 in 1914.

After World War I, several advances were made: pneumatic tires replaced the previously common full rubber versions. Electric starters, power brakes, 4, 6, and 8 cylinder engines, closed cabs, and electric lighting followed. The first modern semi-trailer trucks also appeared. Touring car builders such as Ford and Renault entered the heavy truck market.

## Diesel engines

Although it had been invented in 1890, the diesel engine was not common in trucks in Europe until the 1930s. In the United States, it took much longer for diesel engines to be accepted: gasoline engines were still in use on heavy trucks in the 1970s.

## Etymology

The word "truck" might come from a back-formation of "truckle", meaning "small wheel" or "pulley", from Middle English trokell, in turn from Latin trochlea. Another possible source is the Latin trochus, meaning "iron hoop". In turn, both sources emanate from the Greek trokhos (??????), meaning "wheel", from trekhein (???????, "to run").

The first known usage of "truck" was in 1611, when it referred to the small strong wheels on ships' cannon carriages. 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.

"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 probably derives from the verb lurry (to pull, tug) of uncertain origin. Its expanded meaning, "self-propelled vehicle for carrying goods", has been in usage since 1911. Before that, the word "lorry" was used for a sort of big horse-drawn goods wagon.



## International variance

### Ultra light trucks

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 manufacturers 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 trucks

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. 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. These vehicles have found uses in construction, large campuses (government, university, and industrial), agriculture, cattle ranches, amusement parks, and replacements for golf carts.

Major mini truck manufacturers and their brands:

- Daihatsu Hijet
- Honda Acty
- Tata Havy
- Mazda Scrum
- Mitsubishi Minicab
- Subaru Sambar
- Suzuki Carry

### Light trucks

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 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 trucks

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.

### Heavy trucks

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 6x4 tractor units. 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 97,000 lb (44 t) or more.

## Off-road trucks

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 (138,000 lb) and be 25 m (82 ft) long, and road trains used in the outback can weigh 172 tonnes (379,000 lb) and be 53.5 m (176 ft) long.

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.

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. Each State determines the maximum permissible vehicle, combination, and axle weight on state and local roads.

## Anatomy

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

The cab is an enclosed space where the driver is seated. A "sleeping" is a compartment attached to or integral with the cab where the driver can rest while not driving, sometimes seen in semi-trailer trucks.

There are several possible 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, but also widely used in the rest of the world as well. 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 follow the layout of much more ancient paths and trackways which require the additional turning capability given by the short wheelbase of the cab over engine type. The COE design was invented by Viktor Schreckengost.
- Conventional cabs are the most common in North America and Australia, and are known in the UK as "American cabs" and in the Netherlands as "torpedo cabs". The driver is seated behind the engine, as in most passenger cars or pickup trucks. Many new cabs are very streamlined, with a sloped hood and other features to lower drag.
- Cab beside engine designs also exist, but are rather rare and are mainly used inside shipping yards, or other specialist uses that require the vehicle to carry long loads such as pipes, metal rods, flat iron and other construction materials. This type is often custom made from a regular cabover truck that gets the upper half of its cab removed on the passenger side and replaced by an extended section of the 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.

## Engine

North American manufactured highway trucks often use an engine built by a third party, such as CAT, Cummins, or Detroit Diesel, but both Mack and Navistar offer their own engines.

In the European Union, all new truck engines must comply with Euro 5 emission regulations.

## Drivetrain

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.

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 required engine speed.

Although this is a relatively fast movement, perhaps a second or so while 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 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 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 semi-automatic 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 manual transmission, while automatic or semi-automatic 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 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.

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 trucks 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.

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.

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.

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.

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.

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.

- Box truck
- Concrete mixer
- Dump truck
- Flatbed
- Semi-tractor
- Tank truck
- Wrecker

## Driving

In many countries, driving a truck requires a special driving license. The requirements and limitations vary with each different jurisdiction.

### Australia

In Australia, a truck driver's license is required for any motor vehicle with a Gross Vehicle Mass (GVM) exceeding 4.5 t (9,900 lb). The motor vehicles classes are further expanded as:

- HC: Heavy Combination, a typical prime mover plus semi-trailer combination.
- MC: Multi Combination, e.g., B Doubles/road trains
- LR: Light rigid: a rigid vehicle with a GVM of more than 4.5 t (9,900 lb) but not more than 8 t (17,600 lb). Any towed trailer must not weigh more than 9 t (20,000 lb) GVM.
- MR: Medium rigid: a rigid vehicle with 2 axles and a GVM of more than 8 t (17,600 lb). Any towed trailer must not weigh more than 9 t (20,000 lb) 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 (18,000 lb). Any towed trailer must not weigh more than 9 t (20,000 lb) GVM. Also includes articulated buses and vehicles in class MR.

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).

### Europe

Driving licensing has been harmonized throughout the European Union (and practically all European non-member states), so that common, albeit complex rules apply within Europe (see European driving licence). As an overview, to drive a vehicle weighing more than 7.5 t (16,500 lb) 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 (7,700 lb), not including trailers.

### India

There are around 50 lakhs (5 million) truck drivers in India.

### South Africa

To drive any vehicle with a GVM exceeding 3.5 t (7,700 lb), a code C1 drivers license is required. Furthermore, if the vehicle exceeds 16 t (35,300 lb) a code C license becomes necessary.

To drive any vehicle in South Africa towing a trailer with a GVM more than 7.5 t (16,500 lb), 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 on, 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. 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 (11.8 t) or more. 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 ) 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.

## Environmental effects

Trucks contribute to air, noise, and water pollution similarly to automobiles. Trucks may emit lower air pollution emissions than cars per equivalent vehicle mass, although the absolute level per vehicle distance traveled is higher, and diesel particulate matter is especially problematic for health. EPA measures pollution from trucks. 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. 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.

Concerns have been raised about the effect of trucking on the environment, particularly as part of the debate on global warming. In the period from 1990 to 2003, carbon dioxide emissions from transportation sources increased by 20%, despite improvements in vehicle fuel efficiency.

In 2005, transportation accounted for 27% of U.S. greenhouse gas emission, increasing faster than any other sector. Between 1985 and 2004, in the U.S., energy consumption in freight transportation grew nearly 53%, while the number of ton-miles carried increased only 43%.

According to a 1995 U.S. government estimate, the energy cost of carrying one ton of freight a distance of one kilometer averages 337 kJ for water, 221 kJ for rail, 2,000 kJ for trucks, and nearly 13,000 kJ for air transport. Many environmental organizations favor laws and incentives to encourage the switch from road to rail, especially in Europe.

The European Parliament is moving to ensure that charges on heavy-goods vehicles should be based in part on the air and noise pollution they produce and the congestion they cause, according to legislation approved by the Transport Committee. The Eurovignette scheme has been proposed, whereby new charges would be potentially levied against things such as noise and air pollution and also weight related damages from the lorries themselves.

## 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. 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, 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.

## 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.

## 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:

- 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 HGVs. These signs are directed against a common type of accident which 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 launched in March 2012, advocate extra care when passing a large vehicle on the nearside.

## Truck shows

In the UK, three truck shows are popular – Shropshire Truck Show in Oswestry Showground during May, The UK Truck Show held in June at Santa Pod Raceway, and FIA European Drag Racing Championships from the home of European Drag-Racing. The UK Truck Show features drag-racing with 6-tonne trucks from the British Truck Racing Association, plus other diesel-powered entertainment.

In Mexico, the ANPACT Autotransporte – Truck Show is well known as one of the biggest of the region; 2013 edition features trucker celebrity Lisa Kelly.

Truck shows provide operators with an opportunity to win awards for their trucks.

## Comparison by country

Showing semi-tractor, large truck, and medium truck by the same manufacturer when possible.

- Algeria SNVI TC260
- Australia Mack Granite chassis
- Belarus MAZ semi-tractor
- Belarus MAZ-MAN dump
- Belarus MAZ dump
- China FAW semi-tractor
- China FAW dump
- Finland Sisu SM260 semi-tractor
- Finland Sisu dump
- Finland Sisu SL171 dump
- France Renault AGV 6 semi-tractor
- France Renault Kerax 410 mixer
- France Renault Midlum box
- Germany Mercedes-Benz Actros semi-tractor
- Germany Mercedes-Benz Actros dump truck
- Germany Mercedes-Benz Antos refer box
- Italy IVECO Strais semi-tractor
- Italy IVECO Trakker dump
- Italy IVECO flatbed
- India Tata Prima semi-tractor
- India Tata Novus Altra dump
- India Tata TPGL box
- Japan Hino Profia ASV semi-tractor
- Japan Hino Profia dump
- Japan Hino Dutro 130MD-L box
- Netherlands DAF XF semi-tractor
- Netherlands DAF CF dump
- Netherlands DAF LF box
- Russia Kamaz 65117 flatbed
- Russia Kamaz 55111 dump
- Russia Kamaz 43255 tanker
- Russia Kamaz 4308 flatbed with crane
- Russia GAZ 3310 Valdai dump
- Serbia FAP 2026 military truck
- Ukraine KrAZ-65032 dump (red) KrAZ-6140 semi-tractor
- USA International semi-tractor
- International dump truck
- USA International box

## Gallery

- Ashok Leyland Truck Stand in NCR, India
- A truck on Grand Trunk Road, Gakkhar, Pakistan
- BharatBenz Dump truck at exhibition Mumbai 2014 in New Mumbai, India.
- Mercedes-Benz truck
- UD Nissan truck
- TOR Truck Corporation's Trojan 996 displayed at ADIPEC 2013.
- SNVI Military truck, Algeria

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