Construction equipments like Cranes, Shovel, Backhoe, Bulldozer and Dragline etc. play an important role in construction technology. The duration of a construction project is very much reduced by the application of these equipments.

Crane is a lifting machine which is used to lift the material and move them from one place to other. Different types of cranes are jib crane, tower crane, crawler crane, floating cranes etc.

**BULLDOZER**

A **bulldozer** is a crawler (caterpillar tracked tractor), equipped with a substantial metal plate (known as a blade), used to push large quantities of soil, sand, rubble, etc., during construction work. The term "bulldozer" is often used to mean any heavy engineering vehicle (sometimes a loader and sometimes an excavator), but precisely, the term refers only to a tractor (usually tracked) fitted with a dozer blade or bucket. That is the meaning used here.

![A Liebherr bulldozer with a multi-shank ripper](image)

Caterpillar D9 "cable-rig" bulldozer in the museum at Sinsheim, Germany.

The first bulldozers were adapted from Holt farm tractors that were used to plough fields. Their versatility in soft ground for logging and road building led directly to their becoming the armoured tank in World War I.

**Description**

Most often, bulldozers are large and powerful tracked engineering vehicles. The tracks give them excellent ground hold and mobility through very rough terrain. Wide tracks help distribute the bulldozer’s weight over large area (decreasing pressure), thus preventing it from sinking in sandy or muddy ground. Extra wide tracks are known as ‘swamp tracks’. Bulldozers have excellent ground hold and a torque divider designed to convert the engine’s power into improved dragging ability. The Caterpillar D9, for
example, can easily tow tanks that weigh more than 70 tons. Because of these attributes, bulldozers are used to clear areas of obstacles, shrubbery, burnt vehicles, and remains of structures. Sometimes a bulldozer is used to push another piece of earthmoving equipment known as a "scraper". The towed Fresno Scraper, invented in 1883 by James Porteous, was the first design to enable this to be done economically, removing the soil from the cut and depositing it elsewhere on shallow ground (fill). Many dozer blades have a reinforced center section with this purpose in mind, and are called "bull blades."

The bulldozer's primary tools are the blade and the ripper.

**Ripper**

Multi-shank ripper

The ripper is the long claw-like device on the back of the bulldozer. Rippers can come singly (single shank/giant ripper) or in groups of two or more (multi shank rippers). Usually, a single shank is preferred for heavy ripping. The ripper shank is fitted with a replaceable tungsten steel alloy tip. Ripping rock lets the ground surface rock be broken into small rubble easy to handle and transport, which can then be removed so grading can take place. Agricultural ripping lets rocky or very hard earth (such as podzol hardpan) be broken up so otherwise unploughable land can be farmed. For example, much of the best land in the California wine country consists of old lava flows. With heavy bulldozers the lava is shattered, allowing agriculture. Also, hard earth can be ripped and decompacted to allow planting of orchards where trees could not otherwise grow.

**Blade**

Degelman Blade Degelman Industries Ltd.
The bulldozer blade is a heavy metal plate on the front of the tractor, used to push objects, and shoving sand, soil and debris. Dozer blades usually come in three varieties:

1. A Straight Blade ("S-Blade") which is short and has no lateral curve, no side wings, and can be used for fine grading.

2. A Universal Blade ("U-Blade") which is tall and very curved, and has large side wings to carry more material.

3. A "S-U" combination blade which is shorter, has less curvature, and smaller side wings. This blade is typically used for pushing piles of large rocks, such as at a quarry.

In military use, dozer blades are fixed on combat engineering vehicles and can optionally be fitted on other vehicles, such as artillery tractors like the Type 73 or M8 Tractor. Dozer blades can also be mounted on Main battle tanks, where it can be used to clear antitank obstacles, mines, and dig improvised shelters. Combat applications for dozer blades include clearing battlefield obstacles and preparing fire positions.

**Armored bulldozers**

An armored Caterpillar D9 Bulldozer used by Israel Defense forces

**LOADER (EQUIPMENT)**

Volvo L120E front loader
A loader is an engineering vehicle (often used in construction) that is primarily used to "load" material (asphalt, demolition debris, dirt, feed, gravel, logs, raw minerals, recycled material, rock, sand, wood chips, etc.) into or onto another type of machinery (dump truck, conveyor belt, feed-hopper, rail-car, etc.).

Close-up of articulated steering apparatus

Heavy equipment front loaders

A loader (also known as: **bucket loader**, **front loader**, **front end loader**, **payloader**, **scoop loader**, **shovel**, **skip loader**, and/or **wheel loader**) is a type of tractor, usually wheeled, sometimes on tracks, that has a front mounted square wide bucket connected to the end of two booms (arms) to scoop up loose material from the ground, such as dirt, sand or gravel, and move it from one place to another.
without pushing the material across the ground. A loader is commonly used to move a stockpiled material from ground level and deposit it into an awaiting dump truck or into an open trench excavation.

Loaders are used mainly for uploading materials into trucks, laying pipe, clearing rubble, and digging. A loader is not the most efficient machine for digging as it cannot dig very deep below the level of its wheels, like a backhoe can. Their deep bucket can usually store about 3-6 cubic meters (exact number varies with the model) of earth. The front loader’s bucket capacity is much bigger than a bucket capacity of a backhoe loader. Loaders are not classified as earthmoving machinery, as their primary purpose is other than earthmoving.

Unlike most bulldozers, most loaders are wheeled and not tracked, although track loaders are common. They are successful where sharp edged materials in construction debris would damage rubber wheels, or where the ground is soft and muddy. Wheels provide better mobility and speed and do not damage paved roads as much as tracks, but provide less traction.

In construction areas loaders are also used to transport building materials – such as bricks, pipe, metal bars, and digging tools – over short distances.

Loaders are also used for snow removal, using their bucket or a snowbasket, but usually using a snowplow attachment. They clear snow from streets, highways and parking lots. They sometimes load snow into dump trucks for transport.

High-tip buckets are suitable for light materials such as chip, peat and light gravel and when the bucket is emptied from a height.

Tractor front loaders

These loaders are a popular addition to tractors from 50 to 200hp. It’s current ‘drive-in’ form was originally designed and developed in 1958 by a company called Quicke A history of Quicke loader development. They were developed to perform a multitude of farming tasks, and are popular due to their relatively low cost (compared to Telehandler) and high versatility. Tractor loaders can be fitted with many attachments such as hydraulic grabs and spikes to assist with bale and silage handling, forks for pallet work, and buckets for more general farm activities.

Compact front end loaders
Semi-curved Compact Loader on a John Deere compact utility tractor

Compact Utility Tractor with a Front Loader showing 2 different measurement points for loader capacities

Skid loaders & track loaders

A skid loader is a small loader utilizing four wheels with hydraulic drive that directs power to either, or both, sides of the vehicle. Very similar in appearance and design is the track loader, which utilizes a continuous track on either side of the vehicle instead of the wheels. Since the expiration of Bobcat’s patent on its quick-connect system, newer tractor models are standardizing on that popular format for front end attachments.

**Backhoe loader**

The archetypal backhoe loader, a restored JCB 3C MkII, showing the conventional arrangement of front loader (left) and backhoe (right)

A typical European backhoe-loader; these usually have a side-shift rather than stabilizer legs.

A backhoe with a snow plow attachment clearing snow
A worker attaches a lifting cable to a concrete sewer pipe section. Note the retracted stabilizers on this Case backhoe.

Pipe transported using a lifting cable

**Backhoe loader**, also called a **loader backhoe**, and commonly shortened to **backhoe**, is an engineering vehicle, which consists of a tractor, fitted with a shovel/bucket on the front and a small backhoe on the back. Due to its (relatively) small size and versatility, backhoe loaders are very common in urban engineering and small construction projects (such as building a small house, fixing city roads etc).

Backhoe loaders are very common and can be used for a wide variety of tasks: construction, small demolitions, light transportation of building materials, powering building equipment, digging holes/excavation, landscaping, breaking asphalt, and paving roads.

A **backhoe**, also called a **rear actor** or **back actor**, is a piece of excavating equipment or digger consisting of a digging bucket on the end of a two-part articulated arm. They are typically mounted on the back of a tractor or front loader. The section of the arm closest to the vehicle is known as the boom, and the section which carries the bucket is known as the dipper or dipperstick (the terms ‘boom’ and ‘dipper’ having been used previously on steam shovels). The boom is attached to the vehicle through a pivot known as the kingpost, which allows the arm to slew left and right, usually through a total of around 200 degrees. Modern backhoes are powered by hydraulics.

Characteristics
A skid loader with its bucket replaced by backhoe attachment

A **backhoe loader** is a tractor-like vehicle with an arm and bucket mounted on the back and a front loader mounted on the front. This type of vehicle is often known colloquially as a **JCB** in Europe and simply a Backhoe or a Tractor Loader Backhoe, or TLB, in North America. In North American terms, a Backhoe includes both a front bucket and a rear hoe, on a chassis originally derived from farm tractors. A dedicated hoe on its own chassis is more properly referred to as an excavator.

**Backhoe fade**

**Backhoe fade** or **JCB fade** is a humorous term coined by the telecommunications industry, referring to the accidental severing of a cable by a backhoe or similar construction activity.

**Compactor**

**Refurbished Soil Compactor**

**Landfill compactor**

A sheepsfoot compactor/roller operated by U.S. Navy Seabees
A compactor is a machine or mechanism used to reduce the size of waste material or soil through compaction. A trash compactor is often used by homes and businesses to reduce the volume of trash. Normally powered by hydraulics, compactors take many shapes and sizes. In landfill sites for example, a large bulldozer with spiked wheels called a landfill compactor is used to drive over waste deposited by waste collection vehicles (WCVs).

Soil Compaction

Increasing the density of soil, along with its side effects of increased strength and decreased permeability, is usually desirable in earthwork construction and below building foundations. Compaction is accomplished by use of heavy equipment. In sands and gravels, the equipment usually vibrates, to cause re-orientation of the soil particles into a denser configuration. In silts and clays, a sheepsfoot roller is frequently used, to create small zones of intense shearing, which drives air out of the soil.

The result of soil compaction is measured by determining the bulk density of the compacted soil and comparing it to a maximum density, for example, obtained from a Proctor compaction test, to determine the relative compaction.
Road roller

A road roller (sometimes called a roller-compactor, or just roller) is a compactor type engineering vehicle used to compact soil, gravel, concrete, or asphalt in the construction of roads and foundations. In some parts of the world, road rollers are still known colloquially as steam rollers, regardless of their method of propulsion. This typically only applies to the largest examples (used for road-making).

Roller Types

- Manual walk-behind
- Powered walk-behind (electric or diesel/gas powered)
- Trench roller (manual units or radio-frequency remote control)
- Ride-on
- Ride-on with knock-down bar
- Ride-on articulating-swivel
- Vibratory
- Pneumatic-tyre
- Tractor mounted and powered (this may be a "one-off" – see gallery picture below)

A Caterpillar CS-533E pneumatic roller for initial compaction mounted on a tractor from Rural India Road roller, museum, Tenterfield, NSW

**Drum types**

- Single-drum sheeps/pad-foot (soil)
- Single-drum smooth (asphalt)
- Double-drum (duplex) sheeps/pad-foot (soil)
- Double-drum (duplex) smooth (asphalt)
- 3-wheel cleat with bulldozing blade (landfills)

**Variations and features**

- On some machines, the drums may be filled with water on site to achieve the desired weight. When empty, the lighter machine is easier and cheaper to transport between work sites.
- Additional compaction may be achieved by vibrating the roller drums, making a small, light machine perform as well as a much heavier one. Vibration is typically caused by a free-spinning hydrostatic motor inside the drum to whose shaft eccentric weights have been attached.
- Water lubrication may be provided to the drum surface to avoid hot asphalt (for example) sticking to the drum.
- Hydraulic transmission permits greater design flexibility – early examples were direct mechanical drive – and reduces the number of moving parts exposed to contamination.
- Human-propelled rollers may only have a single roller drum.
Self-propelled rollers may have two drums, mounted one in front of the other (format known as "duplex"), or three rolls, or just one, with the back rollers replaced with treads pneumatic tyres for increased traction.

Front Shovel Excavator

The Bucket on the RB 110 at the Vintage Excavator Trusts Site at Threlkeld in Cumbria. This is the largest working "Face Shovel" in preservation in the UK.

110 RB at the VET site at Threlkeld, Cumbria

Also called a "Face Shovel" These have a shorter boom fitted with a large bucket facing away from the machine on a Arm mounted in a pivot in the boom. The bucket arm is pulled back to drive the bucket into the loose rock or Coal face then lifted up by the boom and the machine then swings and dumps the load usually into a large Dump truck sat at the side by opening the back of the bucket which is a hinged flap on the back, then swinging back and digging in again. usually the trucks are sized such that 3 or for buckets fill them.

Power shovel
A **Power shovel** (also **stripping shovel** or **Front Shovel** or **Electric Mining Shovel**) is a bucket equipped machine, usually electrically powered, used for digging and loading earth or fragmented rock, and mineral extraction. [1]

**Use**

Shovel digging overburden

Power shovels are used principally for excavation and removal of overburden in open-cut mining operations, though it may include loading of minerals, such as coal. They are the modern equivalent of steam shovels, and operate in a similar fashion.

**Operation**

The shovel operates using several main motions:

- hoist – pulling the bucket up through the bank (i.e. the bank of material being dug)
- crowd – moving the dipper handle out or in to control the depth of cut and when positioning to dump
- swing – rotating the shovel between digging and dumping
- propel – moving the shovel unit to different locations or dig positions

A shovel’s work cycle, or digging cycle, consists of four phases:
The **digging** phase consists of crowding the dipper into the bank, hoisting the dipper to fill it, then retracting the full dipper from the bank. The **swinging** phase occurs once the dipper is clear of the bank both vertically and horizontally. The operator controls the dipper through a planned swing path and dump height until it is suitably positioned over the haul unit (e.g. truck). **Dumping** involves opening the dipper door to dump the load, while maintaining the correct dump height. **Returning** is when the dipper swings back to the bank, and involves lowering the dipper into the tuck position to close the dipper door.