Nilachal Polytechnic

Bhubaneswar

[redacted]

Sem. : 4th Subject : Highway Engg.

Branch: Civil Engineering

Name of the Faculty : Sweta Sarangi

Text Book to be followed by Student / Faculty

Book- : Khana & Justo

Chapter- 8 : Construction Equpiment

1.Learning Objectives

Student will learn –

About the various types of equipments used in the construction work.

About the hot mixing plant and its componenet.

About the modern construction equipments

2. Essential Questions

Explain the various types of construction equipments?

Write about Hot mixing Plant

What are the modern construction equipments?

3. Hours Required

Theory	3 hours
Problems	nil
Question & Answer Theory	1 hr
Total	**4 Hrs**

4. Question for Teaching / Assignment / Self Practice

Question sets	**02 Marks**	**05 Marks**	**10Marks**
Teaching	3	1	1
Assignment	1	1	1
Self Practice	1	1	1
Total	**5no.s**	**3 no.s**	**3 no.s**

Lesson Description:-

Construction equipments are one of the very important resources of modern-day construction, especially in infrastructure projects.

Such projects utilize equipments for most of the works including earthmoving operations, aggregate production, concrete production and its placement, and so on.

In fact, one cannot think of any major construction activity without the involvement of construction equipment.

There are different types of construction equipments suitable for different activities in a construction project.

The choice of construction equipment defines the construction method, which in a way leads to the determination of time and cost for the project.

Course Material

CHAPTER - 8
Construction Equipment

Preliminary ideas of the following plant and equipment:

Hot mixing plant :

Asphaltic concrete is a mixture of asphalt, coarse aggregates, fine aggregates & filler material.

After mixing, we are heating them up to final product called “HOT MIX”.

There are two basic types of plants used to manufacture hot mix asphalt: Batch type plant, Drum(continuous) type plant

The various parts of Batch mix plant are given below as per flow of material:

Cold aggregate four-bin feeder.

Cold conveyor.

Aggregate dryer.

Mixing Chamber

Asphalt tank.

Mineral filler unit.

Load-out conveyor.

8. Centralized control panel.

Tipper, tractors (wheel and crawler) scraper, bulldozer, dumpers, shovels, graders, roller dragline

Tipper

A truck or lorry the rear platform of which can be raised at the front end to enable the load to be discharged by gravity also called tip truck.

Tippers are suited for the rough and tumble of mining & quarrying operations, as well as for carrying bulk loads in construction and infrastructure industries. Complete manoeuvrability, high performance and long-term endurance are common to all trucks, resulting in lower operating costs.



Fig. Tipper Truck

Tractors (Wheel And Crawler)

Multi-purpose machines used mainly for pulling and pushing the other equipment.

Tractors may be classified as

Crawler type tractor- Used to move bull dozers, scrapers. The crawler has a chain by which these tractors can be very effective even in the case of loose or muddy soils. The speed of this type dose not exceed 12 kmph normally.

Wheel type tractor- The engine is mounted on four wheels. The main advantage is higher speed, sometimes exceeding 50 kmph it is used for longdistance hauling and good roads.



Fig. Crawler type tractor and Wheel type tractor

Scraper

In civil engineering, a wheel tractor-scraper is a piece of heavy equipment used for earthmoving.

The rear part has a vertically moveable hopper (also known as the bowl) with a sharp horizontal front edge.

The hopper can be hydraulically lowered and raised. When the hopper is lowered, the front edge cuts into the soil or clay like a plane and fills the hopper.

When the hopper is full it is raised, and closed with a vertical blade (known as the apron).

The scraper can transport its load to the fill area where the blade is raised, the back panel of the hopper, or the ejector, is hydraulically pushed forward and the load tumbles out.

Then the empty scraper returns to the cut site and repeats the cycle.

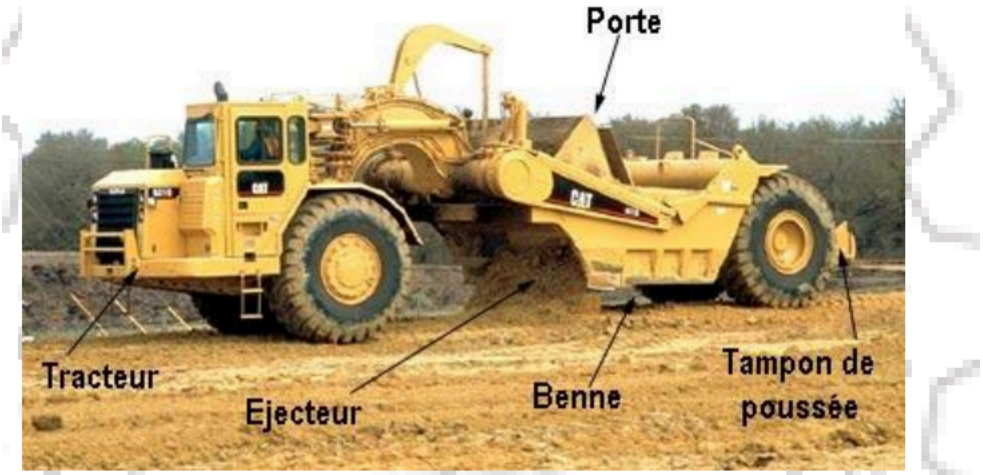


Fig. Scraper

Bulldozer

A bulldozer is a crawler (continuous tracked tractor) equipped with a substantial metal plate (known as a blade) used to push large quantities of soil, sand, rubble, or other such material during construction or conversion work and typically equipped at the rear with a claw-like device (known as a ripper) to loosen densely-compacted materials.

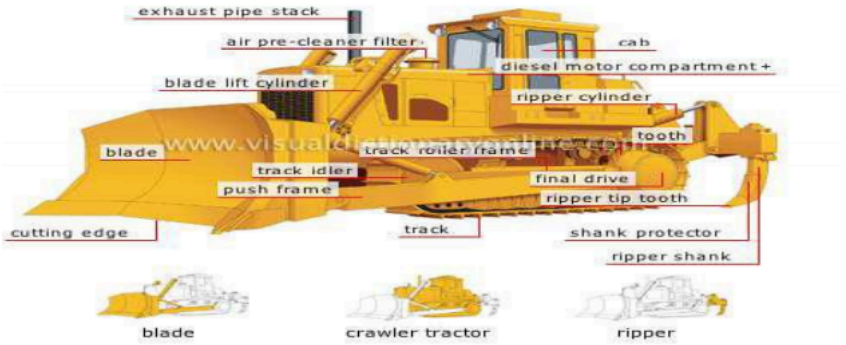


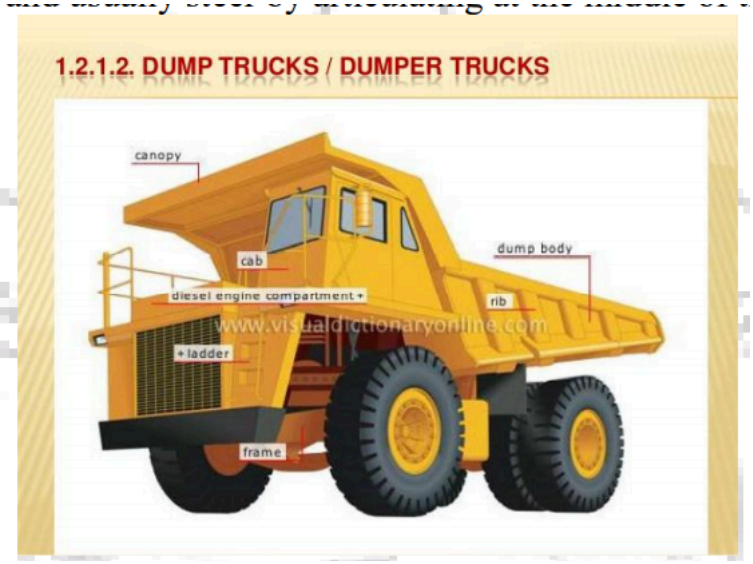
Fig. Bulldozer

Dumpers ☂

A dumper is a vehicle designed for carrying bulk material, often on building sites. Dumpers are distinguished from dump trucks by configuration: a dumper is usually an open 4-wheeled vehicle with the load skip in front of the driver, while a dump truck has its cab in front of the load. ☂

The skip can tip to dump the load; this is where the name "dumper" comes from. They are normally diesel powered. A towing eye is fitted for secondary use as a site tractor.

Modern dumpers have payloads of up to 10 tones and usually steer by articulating at the middle of the chassis.



Shovels

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 for mineral extraction.

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.

A shovel's work cycle, or digging cycle, consists of four phases: Digging Swinging Dumping Returning.



Fig. Old Power Shovel



Fig. New Power Shovel

Graders

A grader, also commonly referred to as a road grader, a blade, a maintainer, or a motor grader, is a construction machine with a long blade used to create a flat surface.

Typical models have three axles, with the engine and cab situated above the rear axles at one end of the vehicle and a third axle at the front end of the vehicle, with the blade in between.

In civil engineering, the grader's purpose is to "finish grade" (refine, set precisely) the "rough grading" performed by heavy equipment or engineering vehicles such as scrapers and bulldozers.

Graders are commonly used in the construction and maintenance of dirt roads and gravel roads.



Fig. Grader

In the construction of paved roads they are used to prepare the base course to create a wide flat surface for the asphalt to be placed on.

Graders are also used to set native soil foundation pads to finish grade prior to the construction of large buildings.

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, similar rollers are used also at landfills or in agriculture.



Fig. Roller

Dragline

The drag line is so name because of its prominent operation of dragging the bucket against the material to be dug.

Unlike the shovel, it has a long light crane boom and the bucket is loosely attached to the boom through cables.

Because of this construction, a dragline can dig and dump over larger distances than a shovel can do.

Drag lines are useful for digging below its track level and handling softer materials.

The basic parts of a drag line including the boom, hoist cable, drag cable, hoist chain, drag chain and bucket.

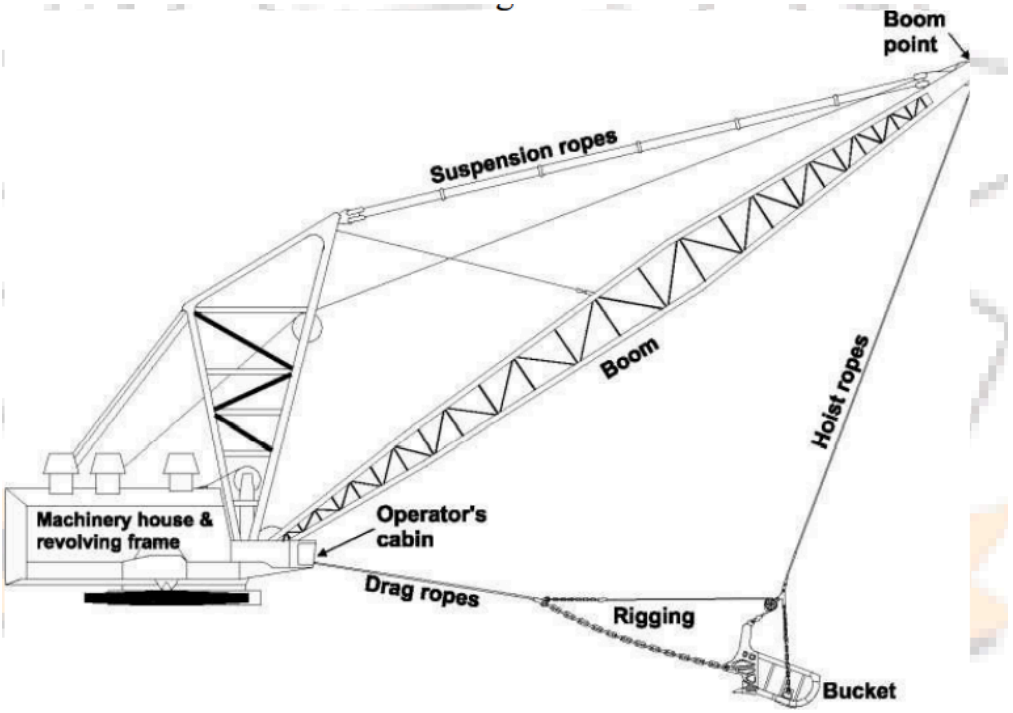


Fig. Dragline

Application

It is the most suitable machine for dragging softer material and below its track level

It is very useful for excavating trenches when the sides are permitted to establish their angle of repose without shoring.

It has long reaches.

It is mostly used in the excavation for canals and depositing on the embankment without hauling units

Road pavers

A paver (paver finisher, asphalt finisher, paving machine) is an engineering vehicle used to lay asphalt on roadways.

It is normally fed by a dump truck.

A separate machine, a roller, is then used to press the hot asphalt mix, resulting a smooth, even surface.

The sub-base being prepared by use of a grader to trim crushed stone to profile after rolling.



Fig. Road Paver

Modern construction equipments for roads

Excavators

Excavators are heavy construction equipment consisting of a boom, stick, bucket and cab on a rotating platform (known as the "house"). house sits a top an undercarriage with tracks or wheels.

Digging of trenches, holes,

foundations

Material handling

Brush cutting with hydraulic attachments

Forestry work

Demolition

General grading/landscaping

Heavy lift, e.g. lifting and placing of pipes

Mining, especially, but not only open-pit mining

River dredging

Driving piles, in conjunction with a pile drive



Fig. Excavator

Loaders

A loader is a heavy equipment machine often used in construction, primarily used to Load material (such as asphalt, demolition debris, dirt, snow, feed, gravel, logs, raw minerals, recycled material, rock, sand, and woodchips) into or onto another type of machinery (such as a dump truck, conveyor belt, feed hopper, or railcar).

Skid steer loaders

A skid loader or skid-steer loader is a small rigid frame, engine-powered machine with lift arms used to attach a wide variety of labour-saving tools or attachments.

Though sometimes they are equipped with tracks, skid steer loaders are typically four wheel vehicles with the wheels mechanically locked in synchronization on each side, and the left-side drive wheels can be driven independently of the right-side drive wheels.



Fig. Skid steer loader

Backhoe

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 dipper stick (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.



Fig. Backhoe

Compactors

A compactor is a machine or mechanism used to reduce the size of waste material or soil through compaction.

In construction, there are three main types of compactor: the plate compactor, the "Jumping Jack" and the road roller.

The roller type compactors are used for compacting crushed rock as the base layer underneath concrete or stone foundations or slabs.

The plate compactor has a large vibrating base plate and is suited for creating a level grade, while the jumping jack compactor has a smaller foot.

The jumping jack type is mainly used to compact the backfill in narrow trenches for water or gas supply pipes etc. Road rollers may also have vibrating rollers.



Fig. Compactor

Question set

Classroom Teaching

Group A

Name 4 highway construction equipments. [2018S(n)]

What is Bulldozer and also write down its uses?

What is tractor and what are the types of it?

Group-B

1. Write short notes on
   a) Road pavers and dumpers.
   (2015w)
   b) Rollers [2012S(n)]
   c) Tipper and bulldozer
   d) Power shovel

Group-C

1.Describe about the equipment used in construction.
[2017S(n)]

Assignment Questions

Group-A

What is backhoe and also explain its uses?

Group-B

1. Mention the types of equipments used for excavation and compaction of soil for embankment. [2017W(n)]

Group-C

Write about Hot Mixing Plant and also explain its parts.

Self Practice

Group-A

Explain the uses of Roller.

Group_B

Expalin Grader and loader.

Group_C

Expalin the modern construction equipments

Faculty **HOD** **Principal**