B. ARCHITECTURE

CONSTRUCTION TECHNOLOGY (AR6013)

CONTRUCTION METHODS & EQUIPMENTS

Lecture – 5

Classification of Construction Equipments:

1. Earth Moving equipment
2. Hauling equipment
3. Hoisting equipment
4. Conveying equipment
5. Aggregate and concrete production equipment
6. Pile driving equipment
7. Tunneling and rock drilling equipment
8. Pumping and dewatering equipment
9. Dredging equipment

Earth Moving Equipments:

The equipment which perform excavation, digging of large quantities of earth, moving them to distances, placement, compacting, leveling, oozing, grading, hauling etc., are called earth moving equipment.

These Earth Moving Equipments are classified into two parts

1. Excavating Equipment
2. Excavating and earth Moving equipment

The Equipments which fall into the earth excavation equipment categories are

- Power Shovel
- Black hoe
- Drag Line
- Clam Shell

Power Shovel

- It is long lasting
- It can excavate all types of earth except hard rock

There are two types of Power Shovel

1. Wheel Mounted that is high speed firm ground
2. Crawler Mounted that is low speed which are used for unstable soil

Wheel mounted power shovel are used for firm ground and Crawler mounted power shovel are used for unstable soil. Wheel mounted power shovel have high speed and crawler mounted power shovel have low speed. As we can see here, this is the diagram of a power shovel; in this diagram what we see is the power shovel is supported by the crawler. The Crawler facilitates movement of the vehicle to an fro, then the housing is fixed top of the crawler, so this is the housing is the place that holds all the lever arms, support cables, the booms etc. together and this is the space where the operator sits and operates. The A Frame is attached to the housing, the A Frame in turns connect the support cable and which in turn connects the boom, the boom has a poly and which in turn operates the bucket. So here we see this bucket facilitates as excavation of earth and this is the hoist connected to the poly and in turn connected to the housing which facilitate movement of the bucket along this axis, this is called the crowd cable that is also connected to the saddle block which in turn connected to the boom, so this operates like an arm and that facilitate the excavation action of the bucket. So this is the power shovel, this one is the hoist cable, this is called as stick and this can move from one place to another and this can be fixed, the power shovel of two types one is fixed and other one is moving kind.

Black Hoe

- Black Hoe which is also termed as hoe, back shovel and pull shovel
- It is used to excavate below the surface of equipment – it caves into the ground
- It is very similar to shovel but except it makes inward strokes while digging

Application

- It is used for digging below the machine level like trenches, footings, basements etc.
- It is also used to trim the surface that is called dressing

Now this is the black hoe as you can see in the picture

Drag Line

- 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 diffing below its track level and handling softer materials.
- Dragging softer materials are below it track level
- It is very useful for excavating trenches with the sides are permitted to establish their angle of repose without shoring
- It has long reaches
- It is used for excavation for canals and depositing on the embankment without hauling units

As we can see this is the line diagram of a drag line as the power shovel, this also operates the same principles, this is the crawler or the base and the base supports the machinery or the housing units which in turn supports the frame, the suspension rope and the boom, the boom is connected with the hoist ropes and which in turn as connected to the buckets. So the entire assembly operates like a lever arm which moves the boom along this axis and then the suspension ropes and the boom points and the bucket and the hoist ropes act like a lever arm and the bucket it ensures that excavation happens through the bucket and this part is called the Rigging. So this one is the line diagram of a drag line

Clam Shell

- This is so named due to resemblance of its bucket to a calm which is like a shell fish with highed double shell
- The front end is essentially a crane boom with a specially designed bucket loosely attached at the end through cables as in a drag line
- The capacity of a calm shell bucket is usually given in cubic meters

- The basic parts of clam shell bucket are the closing line, hoist line, sheaves, brackets, tagline, shell and hinge

Application of Clam Shell

- Clam Shell are used for handling loose material such as crushed stone, sand, gravel, coal etc.
- Its main feature is vertical lifting of material from one location to another
- It is mainly used for removing material from coffer dam, sewer main holes, well foundations etc.

These are the photographs of Clam shells, so you can clearly see this look like clams and this take earth and it is pulled, it is vertically lifted up from one place to the other place.

Excavating and Earth Moving Equipments

It can be classified into four categories

1. Motor Graders
2. Scrapers
3. Bull dozers
4. Tractors

All these equipments are not only excavate but they move the place A to place B.

Motor Graders

- Motor graders are either towed or motorized
- They are usually self-propulsive

What are the uses of Motor Graders:

- It is used for Gravel road repairing
- It is used for road shoulder reshaping
- It is used for bank cutting
- It is used for ditch filling
- It is used for base course spreading
- It is used for material mixing
- It is used for snow, land clearance
- It is used for frozen top soil and also for asphalt breaking

This in the picture is the typical motor graders.

Scrapers

- Scrapers are compromise between best loading and best hauling machines
- They are unique for long distance hauling
- It itself digs, hauls, deposit the materials in uniform thick layers

So there are two types of Scrapers

1. Crawler tractor pulled scraper
2. Wheel tractor pulled scraper

This is the typical Scraper as you can see the picture

Bulldozers

Bulldozers are versatile equipment essentially a heavy steel blade mounted on the front of tractor

The Uses of Bulldozers

1. Spreading earth fill
2. Clearing, opening up pilot roads
3. It is used for Back filling trenches
4. It is used for clearing construction sites

This you can see is the typical bulldozer, this part is used for carrying materials from one place to another and also to excavate the earth, this is the crawler with which moves from one place to another and this is the house this is where the driver sits and operate the entire machine

Tractors

The tractors are multipurpose machines mainly used for pulling and pushing other machines for agricultural purposes

These tractors are used for two applications

1. Clearing and excavating machinery
2. Hauling and conveying machinery

In this image you can see the typical tractor, moving to earth compaction equipment's, so there are three kinds of earth compaction equipment's

1. Smooth – Wheel rollers
2. Sheep – foot rollers
3. Pneumatic tyred rollers

Smooth – Wheel Rollers

- They are plain steel rollers
- They are self-propelled up to 5 to 25 tonnes
- They are no deep compaction
- They are rear wheels are larger in diameter and the front ones are wider
- They have diesel engine type
- There is a compaction is by static weight of roller

Suitability

- These are suitable for Granular soils
- These are suitable for Sandy soil
- These are suitable areas weather a lot of Gravel
- These are also suitable in areas where there are Crushed stones

These are called smooth wheel rollers.

Sheep Foot Rollers

- Sheep Foot Rollers are the ones with hollow steel drum with protected feet mounted at 100 to 200 mmc/c
- They weight around 15 tonnes
- The speed is around 25 km/hr
- The operate with the theory of compaction is by kneading action
- They are attached with in convertible rollers the foot plate can be removed
- In turn foot rollers the individual sheep foot can be changed. So every individual sheep foot can be changed and replaced

Suitability they suitable in clay soil predominantly cohesive and impervious soil. This is the typical image of the sheep foot Rollers.

Pneumatic Rollers

- Consists of a base platform mounted between two axles
- Tracks of the rear wheel lie in between the tracks of the front wheel
- Compaction is by controlling the ground contact pressure
- Weight or width of the wheel can be suitably increased

Suitability: The best suitable for fine grained and well graded sands. This is the Pneumatic Rollers

Pile Driving Rigs

Pile driving rigs provide basic operation of lifting the pile holding the pile in position, hammering it into the ground or of pilling it out of the ground and guiding the pile in the desired direction of movements. Now what is the pile driving rig is an pile driving rig is an instrument takes the pile to a proper position as per the drawings and it hammer site into the ground or pull side out of the ground. The construction of the pile driving rig is like it as a boom and it has a wench and it has a driving hammer and it has all the platforms for mounting the auxiliary equipment's is jet pumps, drilling auger etc. So it supports the boom, the wench, the wench mechanism driving hammer, the guiding leaders and the platform of mounting the auxiliary equipment's such as jet pumps, drilling auger etc.

Hauling Equipment:

Hauling equipments

- The Hauling equipment is defined as the movement of materials from one place to another place
- The equipment's used for this process are called as hauling Equipment's

There are two types that are

- Dump Trucks
- Dumpers

So what we do is the construction process we also require such equipment's to take one place to another apart from excavation. So the hauling equipment's perform this function, the trucks that we used are divided into two parts one is dump trucks and other one is dumpers. The dump tracks again in turn are classified into two types, one is side dump truck and other one is the bottom dump truck. So in this case the entire philosophy, the

entire principle of dump truck is that it carries the equipment and then at the particular position, it tills the dumpers which takes the content out. The side dump truck is done the dumping happens to the side of the truck and it suitable for hauling wet clay, sand, gravel and the quarry rocks. So it basically takes the materials with huge volumes like gravel, quarry rocks, wet clay etc which are very easy to dump sideways. In the bottom dump truck the entire dumper lifts up and the entire material comes out of the truck by the act of gravity. The dumping is done by the opening of the bottom of the truck, so it is suitable for free flowing material such as sand, gravel, dry earth and hot clay. So the bottom dump track and side dump track are both useful and used for dumping for conveying materials, excavating materials from one place to another and dumping it, it can also be used for example of earth fill, the earth that we take out from excavation can be again dumped into the excavated hole by the dump trucks. This is the typical example of a Side dump track. In this figure I illustrate are bottom dump truck.

Cranes

Cranes are used in construction projects, shipping, industries etc. They may be electrically operated, diesel operated or diesel electric drive.

There are various classifications of Cranes

- Derrick Cranes
- Mobile Cranes
- Overhead or gantry Cranes
- Traveller Cranes
- Tower Cranes

Conveyor Belt

Conveyor belt are most popular and this consist of a belt running over a pair of end drums supported by a series of rollers called idlers. The middle sag is provided to prevent the spilling of materials

The Advantages of Conveyor Belt

- They can handle light, heavy, dry, wet, soft, coarse materials
- They can move in a high speed
- They can carry horizontally and inclined fashion also

- They are very light in weight
- They have a controlled discharge

They are various kinds of Conveyor belts

Screw Conveyor

- Screw Conveyor are used for handling granular or pulvarised materials
- Produced the quantity is transported by a screw conveyor is less compared to a belt conveyor
- It is low in cost
- It consists of a helix mounted on a bearing at the ends and at intermediate points
- It can exist upto 65m with an inclination upto 35 degrees

Bucket Conveyor

In this conveyor belt the material is transferred through series of buckets

- The length is limited to 25m
- The weight depends upon the strength of chains carrying the bucket
- It is mainly used for handling coal

Areal transportation

Now in the construction industry, it is also very important that materials are transported in a aerial way. To facilitate this there are various equipment's

1. Cableways
    - They are used in excavation work of dams, quarries, construction etc.,
    - They can load, the loads are hoisted and moved vertically
    - There also used in transporting concrete over a large area
2. Ropeways
    - Ropeways facilitate long distance movement
    - There are endless ropes there basically the construction is like there are endless ropes with two en towers and supported by series of pulley mounted on intermediate tower
    - There are Separate handling and support ropes

Batchers

The Batchers are used for proportionating the ingredients of concrete for a particular mix. The batchers also can be used for weighing the batching and they are commonly used for generating concrete for particular weight.

There are three types of Batchers

1. Manual Batching
2. Semi-automatic batching
3. Automatic batching

This is the typical illustration of the batching

Concrete Mixers

- Mixing all the ingredients of concrete to make a mix of specified consistency

Factors governing mixing are

- Correct setting of the machine
- Proper cleaning of blades
- Sequence of material charged
- Timely supply of water
- Direction of in – flow
- Speed and time of mixing

There are two kinds of concrete mixtures

- Drum type mixers that is tilting and non- tilting function
- Pan type mixers

This is the typical example of concrete mixture; this is again the typical example of a concrete mixture.