Introduction

The selection of the appropriate type and size of construction equipment often affects the required amount of‟ time and effort and thus the job-site productivity of a project. It is therefore important for site managers and constructions p1anners to be familiar with the characteristics of the major types of equipment most commonly used construction. Construction equipments can be classified based on applications under the following heads:

- Excavation an Earthmoving equipments
- Concreting equipments
- Material handling Erection equipments
- Dewatering and Pumping equipments

Typically, construction equipments are used to perform essentially repetitive operations, and canbe broadly classified accord to two basic functions:

- Operators such as cranes, graders, etc. which stay within the construction site
- Haulers such as dump trucks, ready mixed concrete truck, etc. which transportmaterials to and from the site

In order to increase job-site productivity, it is beneficial to select equipment with proper characteristics and a size most suitable for the work conditions at the construction site

Excavation and Earthmoving equipment’s

Factors that could affect the selection of excavators include:

- Size of the job larger volumes of excavation will require larger excavators, or smallerexcavator in greater number
- Activity time constraints Shortage of time for excavation may force contractors to increase the size or numbers of equipment for activities related to excavation

1. Availability of equipment - Productivity of excavation activities will diminish if the equipment used performs them is available but not the most adequate.

2 Cost of transportation of equipment –

This cost depends on the size of the job, the distance of transportation and the means of transportation.

Type of excavation –

Principal types of excavation in building projects are cut and/or fill, excavation massive, and excavation for the elements of foundation

Soil characteristics

The type and condition of the soil is important when choosing the most adequate equipment since each piece of equipment has different outputs for different soils. Geometric characteristics of elements to be excavated - Functional characteristics of differenttypes of equipment make such considerations necessary.

Space constraints –

The performance of equipment is influenced by the spatial limitations for the movement of excavators.

Characteristics of haul units –

The size of an excavator will depend on the haul units if there is a constraint on the size and/or number of these units.

Location of dumping areas –

The distance between the construction site and dumping areas could be relevant not only for selecting the type and number of haulers, but also the type ofexcavators.

Normally there are three purposes of earth moving equipment's,

Excavation of soil from below or above the track/wheel level of the equipment Clearance of site at the track/wheel level of equipment Hauling of spoil out of site

A few types of equipment under this head are:

Bulldozers and Angle DozersGraders

Skimmers

Scrapers

Loaders

Face Shovels

Backaches

Draglines

Multipurpose excavators

3 Bulldozers and Angle Dozers

These machines consist of a track or wheel mounted power unit with a blade at the front, which is usually controlled by hydraulic rams and sometimes by wire cable operation. Many bulldozers have the capacity to adjust the mould blade to from angle dozers and the capacity to tilt the mould blade about a central swivel point. Some bulldozers can also be fitted with rear attachments such as rollers and scarifies.

The main uses of a bulldozer are:

Shallow excavations up to 300 nun deep either on levee, ground or side hill cutting of Clearance shrubs and small trees Clearance of trees by using raised mould blade as a

pusher arm Acting as a towing tractor Acting as a pusher to scraper machines Bulldozers push earth in front of the mould blade with some side spillage whereas angle dozers and cast spoil to one side of the mold blade.

4 Graders

These machines are similar in concept to bulldozers in that they have a long slender adjustable mould blade, which is hung, under the center of the machine. A grader is used to finish or grade the upper surface of a large area usually as a follow up operation to scraping or bulldozing. Theycan produce a fine and accurate finish but do not have the power of bulldozer. Therefore, they are not suitable for over site excavation work. The mould blade can be adjusted in both the horizontal and vertical planes through an angle of 360 the latter enabling it to be used for grading sloping banks as well.

Two basic types of graders are:

(i) Four Wheeled Graders

In this type of graders all wheels can be driven and steered. This facility gives the machine theability to offset and crab along its direction of travel.

(ii) Six Wheeled Graders

Six Wheeled Graders have four wheels in tandem drive at the rear and two front tilting idlerwheels giving it the ability to counteract side thrust.

Skimmers

These excavators are rigged using a universal power unit for surface stripping and

shallow excavation work up to 300 mm deep where a high degree of accuracy is required They usuallyrequire attendant haulage vehicles to remove the spoil and need to be transported between site on a low loader. Because of their limitations and the availability of alternative machines, they arerarely used today.

Scrappers

Scrapers are multiple-units of tractor-truck and blade-bucket assemblies with various combinations to facilitate the loading and hauling of earthwork. Major types of scrapers include single engine two-axle or three aide scrapers, twin-engine all-wheel-drive scrapers, elevating scrapers, and push-pull scrapers. Each type has different characteristics of rolling resistance, maneuverability stability, and speed in operation. These machines consist of a scraper bowl, which is lowered to cut, and collect soil where site stripping and leveling operations are required involving large volume of earth, when the scraper bowl is full, the apron at the cutting edge is closed to retain the earth and the bowl is raised to the disposal area. On arrival of disposal area, the bowl is lowered, the apron opened and the spoil pushed out by the tailgate as the machine moves forwards.

(i) Towed scrapers

It consists of a four wheeled scraper bowl with a power unit such as a crawler tractor. They tendto be slower than other forms of scrapers but are useful for small capacities with haul distances up to 300 m.

(ii) Two Axle scrapers

These have a two-wheeled scraper bowl with an attached two wheeled power unit. They are verymaneuverable with low rolling resistance and very good fraction.

(iii) Three Axle scrapers

It consists of a two-wheeled scraper bowl that may have a rear engine to assist the four-wheeled traction engine. Generally, these machines have a greater capacity than other scrapers, are easier to control and have a faster cycle time.

(a) Loaders

These machines are sometimes called tractor shovels. They are used to scoop up loose materials in the front mounted bucket, elevate the bucket and maneuver into a position to deposit the loose material into an attendant transport vehicle. Tractor shovels are driven towards the heap of loose material with the bucket lowered. The speed and power of the machine will enable the bucket to be filled. To increase their versatility tractor shovels can be fitted with a 4 in 1 bucket enabling then to car out bulldozing as well. Both crawler mounted and wheel mounted types are available. The tracked loader being more suitable for wet and uneven ground conditions than the wheeled one, which has greater speed, and maneuvering capacities.

Face Shovels

The primary function of face shovels is to excavate above its own track or wheel level. They are available as a universal power unit based machine or as a hydraulic purpose designed unit. These machines can usually excavate any type of soil except that which needs to be loosened, usually by blasting, before excavation. Face shovels generally require attendant haulage vehicles for the removal of spoil and a low ladder transport long for travel between sites. Most of these machines have a limited capacity of between 0.3 m and 0.4 m for excavation below their own track or wheel level.

Backaches

These machines are suitable for trench, foundation and basement excavations and are available as a Universal power unit base machine or Purpose designed hydraulic unit. They can be use with or without attendant haulage vehicles since the soil can be placed alongside the excavation for the use in back filling. These machines will require a low loader transport vehicle to be transported from one site to another. Backaches used in trenching operations with a bucket width equal to the trench width can be very accurate with a high output rating.

6. Draglines

Draglines are based on the universal power unit with basic crane rigging to which is attached a drag bucket. The machine is primarily designed for bulk excavation in loose soils up to 3 m below its own track level by swinging the bucket out to the excavation position and haunting or dragging it back towards the power unit. Dragline machines can also be fitted with a grab or clamshell bucket for excavating in very soils.

Mu1tIpurpose Excavators

These machines are usually based on the agricultural tractor with 2 or 4-wheel drive and are intended mainly for use in conjunction with small excavation works such as foundation excavations, pipe laying and drainage trenches. Most multi-purpose excavators are fitted with a loading/excavating front bucket and a rear backwater hoe bucket both being hydraulically controlled. When in operation using the backwater bucket, the machine is raised off its axles by rear mounted hydraulic outriggers or jacks and in some models by placing the front bucket on the ground. The choice of the type and size of haulers is based on the consideration that the number of haulers selected must be capable of disposing of the excavated materials expeditiously.

Factorswhich affect this selection include:

1. Output of excavators - The size and characteristics of the excavators selected will determinethe output volume excavated per day.

2. Distance to dump site - Sometimes part of the excavated materials nay be piled in a corner atthe job site for use as backfill

3. Probable average speed - The average speed of the haulers to and from the dumping site willdetermine the cycle time for each hauling trip.

4. Volume of excavated materials - The volume of excavated materials including the part to bepiled up should be hauled away as soon as possible.

5. Spatial and weight constraints - The size and weight of the haulers must be feasible at the jobsite and over the route from the construction site to the dumping area.

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