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PRODUCTIVITY OF EARTH MOVING EQUIPMENTS IN CONSTRUCTION INDUSTRIES

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ABSTRACT:

Construction industry is undoubtedly the backbone and propelling force behind our progress. In response to booming construction industry, utilization of earth moving equipment has increased considerably. Earthwork and earth moving appear to be the most elementary of engineering trades. They certainly are, when only. handful of earth is moved. But when it involves the movement of five to six million cubic meters of earth within a limited space of time they turn out to be highly organized and skillful trades. The most versatile machines of the earthmoving family are used for different purposes be it the projects like the Air ports, Docking yards, Dams, Railways, Roads, Residential Sites, Agricultural activities which involves earth movement. Earth moving work also includes clearing jungle, Dozing earth and rocks and hauling heavy loads over comparatively short distances. For hauling the most efficient are pneumatic tyred wagons. For loading there are draglines, shovels and elevating grades, each one having its advantages over the other. For spreading and grinding the bull dozer and motor grader are the best, for consolidating there is none to beat the sheep foot tamper. Through this project we have explained different types of earthmoving equipments, with regards on their applications and significances, operating methods, design aspects and their production estimates or working efficiency. Also, our focus on this project was to explain deeply the safety aspects of safe handling and operation of the earth moving equipments and tried to throw light on the new technology developments which have taken place in the field of earth moving operations recently. Construction people have to improve their productivity in order to survive in the highly competitive environment of the industry. Hence, productivity has been generating significant interest in both the construction industry and academia. Construction industry is considered as an industry that contributes significantly to the growth of the economics of the country.

INTRODUCTION:

❑ Construction people have to improve their productivity in order to survive in the highly competitive environment of the industry. Hence, productivity has been generating significant interest in both the construction industry and academia.

❑ Construction industry is considered as an industry that contributes significantly to the growth of the economics of the country. Construction is borne out of politico-socio-economic consideration and hence, they have an immeasurable influence on construction technology and management of project effectively and efficiently.

❑ The earthmoving and heavy equipment industry has always operated in a very competitive environment. For decades, cost effectiveness and productivity have been of paramount interest, and great strides have been made in these areas

❑ Large scale construction activities like road-making, construction of rail roads, canals, irrigation and power dams, development of building sites, airports and harbors are clear indicators of growth of a developing country.

❑ The utilization rate of construction equipment is concerned with identifying the total available time of the onsite equipment for production.

❑ In order to achieve the maximum equipment investment return, it is necessary to collect the utilization information of onsite equipment in a timely and accurate manner

- Equipment management is the portion of project management.
- Authentic management of assets in projects can create noteworthy investment funds in time and cost.
- Construction people have to improve their productivity in order to survive in the highly competitive environment of the industry.
- Construction industry is considered as an industry that contributes significantly to the growth of the economics of the country.
- For successful equipment management, it is essential to consider productivity of equipment.
- The efficient utilization of construction equipment plays an indispensable role on the success of a construction project. It could contribute not only to support the construction equipment management, but manage the project cost.

IMPORTANCE OF STUDY

The productivity of the construction industry worldwide has been declining over the past 40 years. One approach for improving the situation is using lean construction. Lean construction results from the application of a new form of production management to construction several problems were noticed regarding the construction equipment in Egypt, including hardships in operations and maintenance, and low productivity Generally, the writers suspected these problems were due to a lack in the ability to operate the construction equipment efficiently. The productivity considered in this study as a measurement dimension that sufficiently describes an operator's performance. The productivity in this context represents the volume of earth produced per operator-hour, and the number of work cycles performed per operator-minute. To judge the level of performance, the actual productivity must be compared against a desired productivity (estimated). The performance ability ratio (PAR) is given as the ratio of the estimated productivity to the current productivity, A PAR value close to 1 indicates that the current productivity is relatively good, while a PAR valse far greater than I indicates a poor productivity

OBJECTIVE OF STUDY

To study various parts of loader

To find the productivity of excavation equipment its maintenance and management.

To improve equipment productivity with suitable suggestions and recommendation

PRODUCTIVITY IMPROVEMENT TECHNIQUE

1. Arrangement of skilled staff for operation and maintenance: To get optima output from any equipment, it is essential to handle the equipment by a skilled staff. The skilled staff includes the operator, the mechanic etc. The working hours of any equipment depends upon the Maintenace period & the rest period of the engine. If the equipment is working in shifts La first, second, third, the operator shall be separate for each shift.
2. Establishment of Service and Repair Facilities Selection of equipment noels careful thought to ensure efficient and effective performance. Though the actual selection would depend on factors like type of work and its magnitude, location etc. The equipment requires regular maintenance during the work. Every equipment has its own unique features. This requires skillset mechanic, store of spare parts lubricants etc.
3. Maintenance of spare parts inventory: This is a job, which needs the balance between availability of spares and loss inventory coz on one hand it should provide proper assurance for availability of desired spare parts in proper time and quantity. And on her hand result in excessive mocking or blocking up of capital Proper planning is very essential to git the best result
4. Decision regarding number of shifts per operation: The shifts depend on the volume of

the work to be done in the specified time limit, availability of skilled operators working conditions, location of site. The decision of number of shifts shall be taken by the project engineer by considering the above factors

Hydraulic Excavators

This is a basic earthmoving machine which can be used for different works with different types of front & back attachments.

Basic component providing locomotion and power.

Revolving superstructure and mounting.

the excavator is a big, have powerful arm or finger.

This arrangement is very similar to our arm. Our arm has three segments upper arm, forearm and hand. In an excavator, the boom is bent upward to make it easier to dig with obstacles in the way. This design also provides extra space for the bucket when the operator curls it in with a full load.

Front Shovel

In case the digging motion of the bucket is upward, the excavator is known as the "Front Shovel". It can be used to excavate at its own level or at levels higher enough for crowding action. The size of the front shovel is determined by the size of the dipper, expressed in cum. Dumpers are needed with this equipment for disposing the excavated material.

Method of operation

With a shovel in correct position, near the face of the earth to be excavated, the dipper is lowered to the floor of the pit, with the teeth pointing into the face. A crowding force is applied through the dipper shaft, and at the same time tension is applied to the hoisting line to pull the dipper up the face of the pit. If the depth of the face is just right, considering the type of the soil and the size of the dipper, the dipper will be filled as it reaches the top of the face. If the depth of the face, referred to as the depth of the cut, is too shallow, it will not be possible to fill the dipper completely without excessive crowding and hoisting tension, and possibly not at all. This subjects the equipment to excessive strains and reduces the output of the unit. If the depth of the face is greater than is required to fill the dipper when operating under favourable crowd and hoist, it will be necessary to reduce the depth of penetration of the dipper into the face if the full face is to be excavated or to start the excavation above the floor of the pit. The material left near the floor of the pit will be excavated after the upper portion of the face is removed.

The general operations of a hydraulically controlled shovel differ from those of a cable-operated shovel primarily in those pistons instead of produce the operating forces of the former by cables.

Backhoe

Backhoes are used primarily to excavate below the surface of the ground on which the machine rests. The downward movement of the bucket is known as the "hoe". Backhoes are adept at excavating trenches and pits for basements, and the smaller machines can handle general grading work. Because of their positive bucket control they are superior to drag lies in operating on close range work and loading into haul units. They can dig very hard material.

Method of operation

Start loading the bucket with the stick in a nearly vertical position. The bucket digs best at this point. The bucket tends to ride out of the material if the bucket is not in the vertical position. Don't swing into ditch walls. Clear bank or ditch walls before attempting to swing. On returning to digging position, step the swing before dropping the attachment in the ditch or excavation. When dumping into truck the boom is always raised simultaneously while extending the dipper arm. If dumping into trucks is attempted without raising the boom, the boom will lower as dipper arm is extended and the

dipper may hit the truck and cause damage to the tuck and the boom.

As a rule, the optimum depth of cut for a hoe is usually in the range of 30 to 60% machine's maximum digging depth. On many sewer jobs an excavator must lift and swing heavy pipe and manholes and unload material from trucks.

OUTPUT OF LOADERS

Hourly production in m^3/hr (Q)= q 3600/C×Efficiency

q=production per cycle (m^3)

= Heaped Capacity * Swell factor x Bucket factor

C= Cycle time (in secs)

Bucket Factor

Bucket factor vary from 1.0 to 0,4 depending upon the height of bench, nature of fragmentation, efficiency of the bucket mechanisms, operator's skill. Loading conditions affect the bucket factor as mentioned in the table given below:

	Loading conditions	Bucket factor
Easy	Digging and loading from stockpiles or from where no-digging power is required and the material which can be heaped in bucket. Sand, sandy soil with a moderate moisture.	1.0 to 0.8
Average	Digging and leading from stock piles which is more difficult to penetrate and scoop but which make nearly a fully heaped bucket. Dry sand or only soil. clayey soil, clay, unscreened gravels or digging and leading of soft gravels directly from hill.	0.8 to 0.6
Difficult	Digging and loading of finely crushed stones, hard clay, gravelly sand, clay with high moisture content. It is difficult to fill the bucket with these materials.	0.6 to 0.5
Very Difficult	Leading of bulky, irregular shaped enraged rocks, blasted rocks, boulders, sand mixed boulders, soils which cannot be scooped up into the bucket	0.5 to 0.4

CALCULATION OF PRODUCTIVITY

1. Materials = Sandy soil with moderate Moisture
2. Rated Heaped Bucket Capacity = $3yd^3$
3. Bucket fill factor For Sandy Soil with moderate moisture = 1 - 0.8

Use an Average of 0.9

4. Cycle time for $3yd^3$ wheel loader= 0.45 - 5.0
   Use an average of 0.475 (minutes)

Maximum production rate = $\frac{3\times0.9\times60}{0.475}$

= 341 Lcy/hr

Or 261 m^3/hr

Net production rate = $341\times\frac{50}{60}$

= 284 lcy/hr

Or = 217 m^3/hr

CONCLUSION:

1. The development in the infrastructure mechanization is the only alternate to cope sup w the competitive needs and demands of the construction market. The main quantity k productivity estimates quality and speed with safety measures for the successful completion of the project are the needs of the day in the construction industry.

2. The job of earthwork being the first of the basic tasks involved and the effects of climates making it more complex demands from the project manager the use of the best possible expertise and resources in accomplishing the task successfully

3. In lighted above, our project assists in studying various types of earthing equipments available in the global market with their capabilities in terms of their design productivity, efficiency and safety measures the project manager has to base their decisions on sound data inputs of latest versions while choosing the

appropriate type of equipment from the industrial market such that the equipment is not outdated early in the competitive global market

4. With each and every advancing day new trends and technologies are being developed in view with the increasing demands in the market, so in the near future we can expect to see more advanced and sophisticated earth moving equipments which would be able to withstand the entire short comes of the present equipments in terms of Productivity, Efficiency and Safety

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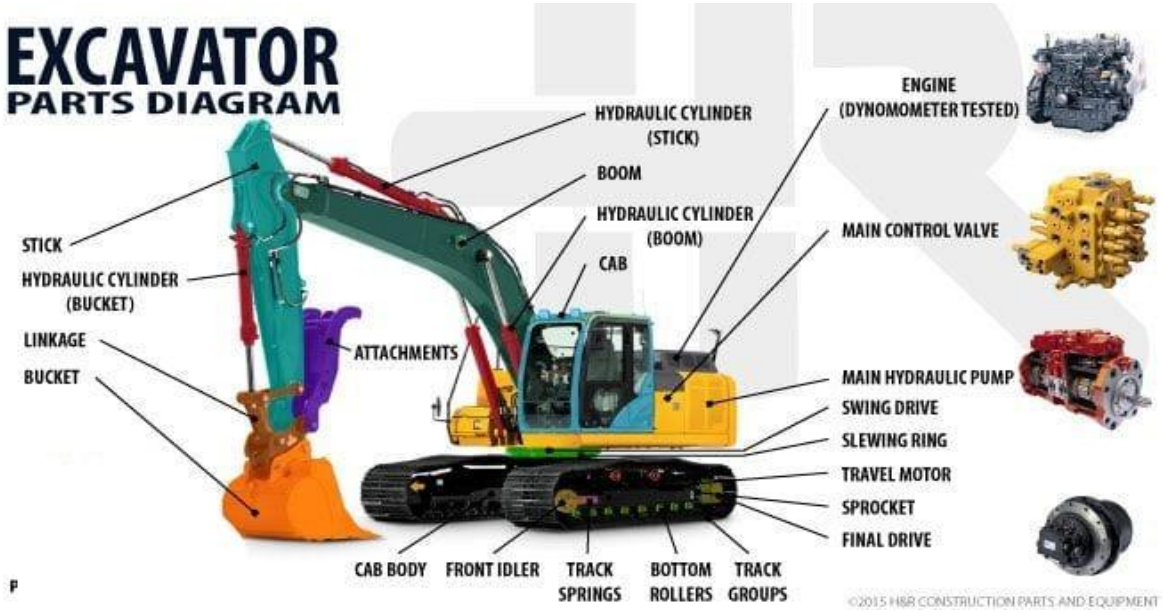
Table-1: Average Cycle times for wheel loaders

	Loader Size, Heaped- Bucket Capacity (cubic yard)	Wheel loader Cycle time (mintues)
1	1.0 - 3.75	0.45 - 0.50
2	4.00 -5.50	0.50 -0.55

Table 2: -Performance Factor / Efficency factor

Working minutes (min/hr)	Efficency factor
60	1
55	0.92
50	0.83
45	0.75
40	0.67



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