A STUDY ON PRODUCTIVITY LEVELS IN CONSTRUCTION MACHINERY

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ABSTRACT

The productivity in construction means the output of construction goods and services per unit input. One of the major tools for improving construction productivity is work improvement, that is , the scientific study and optimization of work methods. Such techniques like Motion and Time Study is applied to for few heavy construction units such as haulers, graders, and dozers. The concept developed performing basically repetitive or cyclic operations.

Since, most major contracts start with an earthmoving job, the way this goes will affect the entire construction programme. Delays could lead the project running way behind schedule. Choice of the right plant for the job and a good judgement of its capability will made all the difference. Many factors influence each job. A contractor needs to know as much as possible about the job before he can successfully bid on it.

The research is devoted to analyze the components of cycle time namely load, haul, dump and spot time. It is important to note that these functions will exist on every job, although each will vary in length and description from one job to another.

The choice of equipment to be used on a construction project has major influence on the efficiency and profitability of project. A careful evaluation of economic consequences will yield more productive and more profitable solution. Some of the constraints on contractors to maximise the contractors' profit or return on investment , are capability of the equipment to perform the required work, time available to complete the work etc.

When planning an earthmoving operation, the operation should be viewed as a system. The major steps involved include excavating, loading, hauling, placing, compacting and finishing. There are many possible combinations of equipment and methods which may be employed to obtain desired results.

Once the earthmoving project is laid out and is in operation, it is fairly simple matter to estimate the cycle time of any particular unit on the job by timing several complete cycles of the machines and then taking average. However, the job hasn't started yet the estimator will find it difficult to estimate if such data is not available.

An estimate must indicate sustained or average earthmoving production over a long period of time. An estimate which is too optimistic on hourly productive ability of each earthmoving unit will result in failure to maintain forecasted production, and an insufficient number of units assigned to job. It is necessary to allow for unavoidable delays encountered on all operations.

The success of the job depend on many factors which continue to provide the needed efficiency. Job efficiency is one of the most complex elements of estimating production. Since it is influenced by factors such as operator skills, minor repair and adjustments,personnel delays, and delays and delays caused by job layout. Correction factors are need to modify production limits to fit a particular job and local conditions. They will vary for each type of machine used on the job. When such factors are not available, in Manufacturer's Performance Handbook, productive estimates must be modified based on experience and local conditions. Impact on such factors will be accounted on Time Study on each cycle component.

The three objectives used to analyze operation of equipment are

1. to determine the average time required for each element and for a cycle.

2. to reduce the cycle time by eliminating or decreasing unnecessary delays, and thus to increase production.

3. to compare results obtained from theoretical calculation, performance data etc., with the results obtained from Time Study.

4. to identify the most economical number of hauling units required to produce lowest cost per unit of earth considering the cost of loading and hauling units.

The studies made by the observer using the stop watch with designed forms on which appropriate time elements will be recorded as they are observed. A break point is selected for the beginning and end of each element.

The Time Study done on individual machinery were extended to data collected on projects subject to varying conditions to analyze the productivity of machinery.

Time Study data was collected from actual usage of machinery in various construction projects. Time Study data on deployment of crawler tractors for cutting of earth for road construction; ripping, cross ripping and harrowing operation for sugar cane plantation projects; medium jungle clearing, basic land levelling, graded bench levelling, ripping and construction of broader bunds for irrigation project were compared with theoretical output and the results were useful for future estimation purpose.

Time Study on motor grader for basic land levelling operation, cutting operation and edge cutting operation showed that the actual output is less than the theoretical output.

The results of Time Study on transportation of earth in highway where heavy traffic was involved and the transportation of earth for irrigation rehabilitation project is useful for future estimation purpose as such data is not available.

Time Study on excavation, lifting and laying of pipes using back hoe excavator is useful for future estimation purpose as such data is not given in manufacturer's performance guide. Time Study was done on excavation of different types of material and it was observed that actual output obtained in Time Study data is less than the theoretical output.

In estimating procedures of scrapers are based on the assumption that on adequate number of pushers will be provided. Since the scraper is the productive element of the system, every effort must be made to minimise delay to the scraper. If fewer than the required number of pusher is provided, system production estimates should be based on pusher productions.

The results of Time Study on motorised scrapers used in canal excavation, and stripping and common excavation in distributary and field canal formation showed that the actual production is very much less than the theoretical values. Constraints of restriction of movement of scrapers and delay on compaction of earth spread on the bund has affected the output.

Time Studies were used to collect data relating to construction activity for the purpose of either statistical analysis or determining the level of work activity. The number of observations required for statistical validity depends as the type of study being made.

Mathematical techniques based on Queuing Theory was used to develop solutions for situations where the random arrival of trucks to the loader can be postulated. In order to make the system amenable to mathematical solution it is necessary to make certain assumption about the characteristics of the system that are not typical, field construction operations.

The production of excavation/haul unit system is similar in many respects to that of scraper system. However, the excavator is now the productive element of the system. The basic approach is to provide enough trucks so that, mathematically, the excavator will never have to wait for a truck. In actual practice this condition is never attained and that there is always some loss of time while excavation waits for a truck.