

MECHANIZATION AND AUTOMATION OF THE CONSTRUCTION OPERATIONS

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ABSTRACT

Modernizing operating technologies is the major goal of the construction engineering in order to reduce or eliminate manual labor. The increase of operating efficiency of the construction industry is related to the operating mechanization. The mechanized construction operations are supported by specialized or multifunctional equipments.

1. Introduction

The technical efficiency improvement is achieved by utilizing complex mechanized and automated operating resources.

The simple mechanization responds to the basic operations of the work process. The complex one is involved in all technological processes of various projects and auxiliary operations.

The way the mechanization's improvement could be achieved:

- Ø Improvement of the construction equipment;
- Ø Improvement of the way the equipment is operated;
- Ø Increasing mechanization;

The technical standard of the construction operations can be enhanced by the increased number of high tech machines and equipments and high performance management.

Efficiency improvement can be achieved by developing and using unique construction equipments, implementing digital technology in order to optimize the technological process. Computer assisted maneuvering, utilizing flexible software and high tech mechanical devices can lead to a better management of requested operating parameters.

Better results can be reached by increasing the number and quality of the machines used in construction industry, especially when it comes to high tech orders or highly mechanized operations. Construction plant management improvement leads to better organized chain of diversified operations (transportation, production, etc).

The automation of the technological operations could be hard to reach because of various conditions:

- structure, shape, dimensions, diversity of elements and objectives and the way they are located within the construction plant, etc – in this case it is very difficult to attain financial efficiency because of the common characteristics of the repeated operations
- fragmentation of the technological operations that leads to long breaks, making the investment unbeneficial
- weather conditions (wind, rain, snow, etc) and vibrations as large margins variable parameters
- variable and extended locations

The efficiency of the automation can be improved only when it comes to complex static installations. The automation, in this case, can be implemented using linear programming.

The automation of the construction operations is the result of the increased quality, dimensional precision, productivity, improved operational time, lower costs, reducing labor, better work conditions and safer work environment.

2. The mechanization scheme of the construction operations

Basically, the construction operations are not completely automated. The worker interferes to perform various transitional activities, in order to complete the machine operation. The area of the required manual operation is not as extended as the mechanized one.

The mechanization of the construction and assembling operations is simple when only basic operations of the technological processes are performed, using specific equipment. The complex mechanization is required when all the

operations of the technological process are performed using systems of required equipments.

A mechanical system consists of diverse construction machines performing the mechanized operations of the technological processes.

The construction machines, as part of the mechanical construction system, are distributed according to the logical and technological operational schedule.

Each machine is part of the construction mechanical system and, according to the links between parts, we can three types: serial components systems, parallel components systems and both, serial and parallel components systems.

We have analyzed a paving technological process. Different operations succeed as shown bellow:

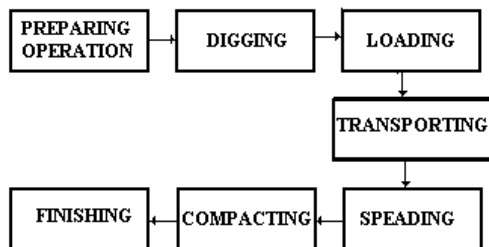


Figure 1

Every activity of the technological process can be performed using different specialized machines according to certain economic criteria.

The exploiting of certain equipments is related to the technological requirements, working site

and, the most important, the highest amount of work to be performed.

3.

4. The calculus of the mechanization level

The following mathematical relation can be used:

$$G_m = \frac{V_m}{V_t} \quad (1)$$

V_m - volume of the mechanized operations [m^3];

V_t - total amount of manual and mechanized operations [m^3].

The mechanization level of the paving operations on the construction plants is situated between 95% and 100%. The last generation equipments provide 100% mechanical operational support. The level of mechanization is inferior when it comes to finishing operations.

5. Conclusions

The economic efficiency of the construction mechanized operations consists of: reducing labor on the construction plants, shorter operating time, minimal traffic disturbing, better management of urban construction plants, lower construction costs and higher construction quality.

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