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ROLE OF MONITORING A CONSTRUCTION PROJECT WITH THE APPLICATION OF THE GRAPHIC VISUALISATION METHOD

ROLA MONITORINGU W PROCESIE REALIZACJI PRZEDSIĘWZIĘCIA BUDOWLANEGO PRZY WYKORZYSTANIU METODY GRAFICZNEJ WIZUALIZACJI

Summary

The main goal of monitoring construction projects is to identify any negative deviations from the approved plan. Therefore, the possibility of the permanently monitoring the progress of construction work scope is an extremely important issue. The authors' main goal is to present a method of graphical visualization which can be used for tracking progress in relation to the time, progress as a supplement of the cyclograms.

Keywords: graphic method of visualization, monitoring of construction work, cyclograms

Abstract

Rolą monitoringu w procesie realizacji przedsięwzięcia jest wychwycenie wszelkich negatywnych odchyleń od przyjętego planu. Stąd tez możliwość permanentnej kontroli postępu wykonania zakresu rzeczowego jest niezwykle istotna. Celem autorów było przedstawienie metody graficznej wizualizacji postępu procesów w odniesieniu do postępu czasu jako uzupełnienie cyklogramów.

Słowa kluczowe: graficzna metoda wizualizacji, monitoring robót budowlanych, cyklogramy

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1. Introduction

The effective monitoring, as "an integral part of the daily management of any construction project", should be based on the systematic observation of the construction project progress in the planning phase as well as in the realization phase. The computer programs available for the management of the linear construction projects, currently used in the domestic market, base on the graphic form of a cyclogram, using interpretive possibilities contained in the process of the graphic visualization. Traditional forms of project management support systems present their results in the form of bar charts or network diagrams. However, the current forms of graphical visualization used for the planning and progress of construction work during a project realization (i.e. the Line of Balance – LOB), as well as the above mentioned computer programs for the management of construction projects, do not contain time lines for tracking progress on time-space diagrams with charts showing realized tasks. Therefore, the main goal of the authors was to present the idea of a graphical presentation for tracking progress in relation to the time, using line charts on a common space formed by:

- increasing construction realization progress, presented by the cyclogram of tasks;
- downward sloping line of the time progress during the construction project realization, as an objective benchmark for the estimation of progress of tasks realization in relation to the amount of remaining time.

The method presented complements the cyclograms of tasks, through the direct, visual reference of the progress of construction work to the line of time progress, which is in the charts space. Moreover, the method complements the elaboration of the knowledge base, organization, risk estimation and controlling and construction project realization, widely described in the following references [1–12].

2. Monitoring in process of construction project realization

One of the most important roles of monitoring is spotting the initial (very often difficult to monitor/observe) messages regarding potentially negative consequences for the success of a construction project. Therefore, the possibility to transform the collected data/information and the ability of full use of the results (with application of the programs supporting the project management processes) is very significant. Data resulting from the monitoring of tasks, processes and construction projects should be used in the subsequent procedures. From the analysis of different monitoring methods applied, the user can draw the following conclusions:

– The graphical method of presentation, on the one chart, the level of advancement and progress of the processes, which are "difficult to measure" (such as: the intensity of management processes and time progress) is applicable after inserting the common units for the all meters of processes.
– The controlling plays a leading role in the initiating and realization processes.
– In the remaining phases, the controlling influences simultaneous to the planning and realization processes as well as to the realization and closure processes.
– The mid-term evaluation progress results should be known and implemented at the beginning of the second half of the process realization.

– The concept of a graphical progress presentation (running in parallel or as independent tasks) processes, together with the visualization of the real declining time resource (intended for their realization), enables the possibility of comparing – in a natural way – the state of progress of the monitoring processes to the real amount of time required in order to complete the construction project.

3. Idea of method of graphical presentation of construction work progress

This paper aims to demonstrate the graphical presentation of interactions between the processes (which often goes in parallel way at the different levels of activity and which are at the phase of growth or closing). Then, the current state of their progress, at any time, can be directly compared on the chart, in relation to the time period remaining for completion of the construction project.

The authors have made the following assumptions:

1. The controlling (called: *Controlling Processes*), as a group of control actions, proceeds "from the earliest initiating actions";
2. The ordinates, at the selected points of the activity graph, are the measure of the working time expenditure, needed to reach the required level of activity in a particular phase of the process;
3. The period of time (called: *Time*) means the time period of construction project realization measured in weeks, months, years;
4. The time progress during the realization phase has a linear interdependence, such as the ordinates decreasing from "1" to "0" are placed on the axle marked at the point of completion of a project.

According to assumptions, the authors draw vertical sections corresponding to the ordinate axis (called: *Level of Activity*), characteristic for the levels of advancement in the particular phase of the analyzed processes. It can be noted (see Fig. 1), that the particular curves illustrate the separate processes running in parallel as well as the total amount of time required to achieve the correct level of project advancement in the particular phase.

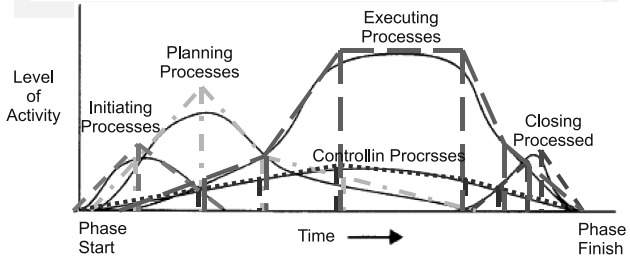

Fig. 1. The intensity dependence of project management processes from the phase of its realization

Assuming that the area under the curves proportionally reflect expenditure or activities which have to be completed at particular phases of the construction project, one can calculate the value of working time expenditures required in each process. For the analysis, the authors have made the following assumptions:

1. The advancement degree of the analyzed process in the particular phase of the construction project realization – the ordinate of the obtained level in the examined period (e.g. the number of working hours "w-h") will be marked on the vertical axis of the working time expenditure on a scale from "0" (at the start of the construction project) to the value obtained, which is the actual amount of working time expenditure required to achieve the current level in the examined period;
2. The progress of time is a constant value (in a given period of the construction project duration), which represents a straight line connecting two zero points of time in the project duration – the starting point and the point on the vertical axis inserted at the point of project completion, indicating use of the whole period of time.

As a result of such procedure, the authors have obtained a graphic picture of monitored activity progress of particular processes and the total chart of the amount of working time expenditure necessary to ensure the realization of the whole construction project with respect to parameters of time progress for the duration of realization of the analyzed processes.

The comparison of many different variables course, such as elements of construction works scope or the financial works scope in relation to the real passage of time, have the same units and location on the surface defined by the vertical axis located at the start of the construction project. In the vertical axis the increasing values of the working time expenditures progress and the other vertical axis located at the end of the construction project are marked, where (in the decreasing scheme) the ordinates of the time progress during the construction project realization are determined.

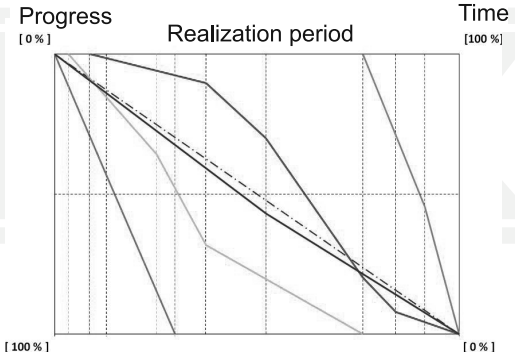

Fig. 2. The monitoring processes progress in relation to the time progress

In Fig. 2, the graphical presentation of individual process realization progress is presented. The innovation of such a graphical presentation method, showing the relationship course between different elements of the processes (taking place during a construction project realization) and its duration is a result of the corresponding graphical approach on the chart elements: the rate of processes with the rate of time passage. This practical property has a few methods, which are applied for the current monitoring of the selected elements progress in the project management process, both in the planning phase and in the realization phase.

4. Basic features of graphical presentation of construction work progress

The concept presented (in the form of line graphs) for the construction progress work scope against the time progress elapsed in a non-custom layout of ordinate axis (for the assumed parameters of progress) and is distinguished by the following basic features:

- at the start of the construction project, progress for the entire construction project (which require carrying out during the scope of processes creating the construction project) is 0%, and the planned amount of time assumed by the project realization period is 100%;
- after the start of realization, the level of tasks advancement (within the individual processes) is growing and transforming directly as project elements come closer to realization, to 100 % of the construction work scope,
- for the duration of project realization, the passage of time is shown by the straight line, connecting the start point (which is the beginning for the construction work scope) and which is also the beginning of the realization period, with the end point of the graph, meaning the realization of the planned phases and the use of 100% of time for the project realization;
- the progress, shown in a graphical way, which takes place in relation to the visualization of time progress, enables a rapid and clear estimation of the current state at the realization phase of the construction project as well as enabling a diagnosis of potential risks and the identification of measures to be used (e.g. the additional resources);
- the line of time progress at any point is the reference level for the specified (also in [%]) completion of the monitored elements in periods specific to the selected project or established for the purpose of monitoring;
- preparation (at the planning phase) of the graphs of realization for each element creating the construction project on the background of the graph of time progress during the planned or required realization time, enable the user to make adjustments in the length of the realization period or in the rate of achieving the required level of activity (called: *Level of Activity*). The increasing rate of construction work is presented in the chart as the increasing angle of the progress chart segment moves towards the timeline;
- the course of the project element progress line located above the line of time progress shows the realization of this process with delays in relation to the current progress of the time project.

5. Conclusions

In summary, the elaborated version of the schedule in the form of line graphs, due to the properties of the method of graphical presentation of the construction work progress against the contract time progress discussed above, meets the criteria to be the tool which allows the user to control the entire task and monitor progress of the contract. At the same time, it could helpful for the participants in the investment process (in decision-making process) in emergency situations which may affect the completion of the contract in time. The proposed method of the graphical presentation of the construction work expenditure progress in relation to the time progress (as the basic tool for monitoring) has no equivalent in any previously used methods of supporting the project management.

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