

Scheduling of building projects taking into account the time buffers determined on the basis of risk analysis

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Abstract: The methodology of development of building project schedules, proposed in the article, is based on an attempt to combine two independent approaches in order to increase the probability of fulfillment of time limits planned in the CPM schedules during performance of construction works. Analysis of the risk associated with the building project planned [6,7,8] will allow for determine those tasks, which are most threatened by exceeding of the planned duration time. Application of time buffers [1,2,3], their proper location in the schedule and determination of their duration, taking into account the expected risk of delays, allows to develop schedules that contain the appropriate time reserves to compensate for the possible delays. Such schedule may serve as a relevant basis for determination of the expected deadline for completion of construction works, as well as for management of these works during performance. In the article, selected components of MOCRA [9] and MP-KP [5] methods have been proposed.

Keywords: CPM schedule, project buffer, risk analysis, Goldratt's method, critical path, progress work monitoring.

1. The assumptions of the method proposed

The proposed mode of development of the schedule, which includes both the risk assessment and compensation of the risk impact upon the progress of works, is based on the following assumptions:

- The basis and final result of the analysis is a CPM schedule (developed by using the ADM or PDM method) of the building project
- The risk analysis will be developed as a function of time,
- The final schedule will contain the time buffers which are components that secure compliance with the planned completion deadline,
- Depending on the planning stage and the needs and requirements of the planner, it is possible to change the critical path in the final schedule in relation to the preliminary schedule,
- The types of buffers included in the schedule will be applied on the basis of the MP-KP method, with possible changes due to the possibility of the critical path modification [4,5],
- Location of the buffers will be accepted on the basis of the MP-KP method with possible changes due to the possibility of the critical path modification,
- Possible shortening of the preliminary task duration times will be conducted, depending on the available data, on the basis of the optimistic assessment (in the case of a three-parameter assessment of the task duration – optimistic, pessimistic and most probable), the assumed task duration distribution or expert assessment
- In the case of planned shortening of the preliminary task duration, such shortening will take into account the technological and organizational capabilities with regard to performance of a given task,
- In the case of existence of a baseline deadline for completion of the undertaking, it will be treated as compulsory while shortening the duration of tasks in correlation with the buffer sizes,
- The overall time reserve (SRC) which can be reserved for buffers along the critical path may be, depending on the specific conditions of the undertaking analyzed, cal-

culated on the basis of the MP-KP method or risk assessment for the undertaking with regard to the potential baseline deadline,

- The duration times of individual buffers will be calculated on the basis of the studies on the risk analysis for the protected series, determined by using the MOCRA method,
- The total time for the critical path buffers will be equal to the determined overall time reserve (SRC).

Developing the assumptions of the proposed method, the following aspects were taken into account:

- The objective of the schedule: the determination of the undertaking completion deadline, development of a schedule which is to serve as a basis for day-to-day management of the facility or performance of a risk assessment for the planned undertaking,
- The stage of preparation of the facility for construction and the materials that are at the disposal of the planner at the stage of development of the schedule according to the proposed method,
- Possibility of the modification of the critical path at the stage of planning and during implementation of works,
- Existence of a baseline deadline for completion of works (duration of the performance period),
- Method of estimation of the task duration time (deterministic, based on three parameters according to Beta distribution, other task duration distribution and its parameters, e.g. normal, log normal triangular etc.),
- The possibility of assuming shortened task duration times while locating the time buffers, taking into account the existing technological and organizational limitations.

The article provides the algorithm for the development of a schedule which can serve as a basis for construction management, including determined time buffers; the buffers and task duration times will be determined on the basis of the risk analysis results. The deadline for completion of the entire undertaking will be established taking into account the existing baseline deadline, if any, and the overall time that can be designated as buffers will depend on the approved completion deadline and the possibility of shortening of tasks, mainly along the critical path.

2. References

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