Realization Processes of Road-building Projects in the Czech Republic: Necessary Information to Execute Processes

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Abstract. Road buildings projects are unique for their typical aspects. These typical aspects are the long-term preparation process (app. 16 years) and the construction phase (app. 4 years). Construction of the road building influences a large area in the country and has a big impact on the environment. Construction road building projects very often suffer from project delays and increasing budget because of many causes. Paper analyses process of obtaining information and other conditions for realization of the road-building projects. This paper describes the main road building project actors and main time schedule delays. After that, the process is analyzed and necessary information are identified. Finally, other necessary conditions for realization process are identified. Realization of the road-building process diagram (focused on documentation) was created and verbally evaluated.

1. Introduction
The road-buildings projects are unique for the territorial overlap, linear characteristic, crossing other transportation construction, preparation and realization process last approximately 20 years. Another characteristic is that the construction project is multilateral project in nature. Authors described management organization of the road-building projects within causes of time delays and cost over-run. Moreover, there were described and analyzed the necessary information and condition to execute realization processes of construction objects.

2. Description of Road-building Construction project
As described above the road-building project has typical aspects by nature. Below, structure of the project (according to roles) and causes of delays are described.

To the process of the road-building development mainly these parties are involved:

- Client (Investor)
- Contractor
- Engineer (Technical management of construction project)
- Technical Supervision
- Designer (Author of project)
- Designer (Creator of realization documentation. Mostly it is supplier of Contractor.)
- Building authorities (different objects are authorized by different authorities e.g. ministry, local building authority, environment authority, traffic authority etc.)
• Landowners (land used for objects of road-building and neighboring land used during development – access roads).
• Other construction intentions around (typically – completion of agricultural routes, highway rests, cycle paths etc.)

For realization of construction project is finally the most important relation between Client (together with Engineer) and Contractor. This relation is regulated by Contract, Terms and Conditions and Tender Documentation. There are standardized contract conditions FIDIC in the Czech Republic [1].

After Handover of the construction site Contractor must hand over the Time schedule (in 28 days) with the marked critical path and time relations among the construction objects. The Time schedule is based on all the information which are available to Contractor (Building permit and secured agreement with landlords).

There are typical minor deviations from the Time schedule that are consumed by the time reserves in the Time schedule during the construction. If the conditions of the project are changed, then the Time schedule has to be changed (sometimes within critical path) and handovered to be confirmed by a Client and an Engineer. The problem is the distinction of the reasons for updating the Time schedule. These reasons are force majeure, risks of client or risks of contractor.

3. Typical Reasons of the Time schedule Delays (a list of main ones)

3.1 Force majeure
• Bad weather conditions (defined in Terms and condition)
• Unpredictable state of subsoil (defined in Terms and condition)

3.2 Risks of Client:
• Not secured building permit
• Not secured agreements with landlords
• Changes of project (implementation of technology innovation, new requirements of downstream transport network)

3.3 Risks of Contractor
• Insufficient production capacity
• Unsecured access roads (Contractor has to discuss with local authorities)

Reasons of delays should be thoroughly evaluated and assign to the party of Construction contract in every update of the time schedule. If the reasons are assigned to risk of contractor then update of the time schedule is not approved and the valid time schedule is the last one. If the reasons are assigned to the risk of client or force majeure then update of the time schedule is approved. If the delay has an influence on the critical path then the delay changes the final contract terms. Delays have to be thoroughly justified and explained, because the final terms of contracts have an influence on the financial claims of the contractor and overall price of the project.

Financial claims are mostly joined with the time claim (final term of contract). The cases when the financial claim is not joined with the time claim are e.g. other subsoil than expected in the tender documentation, the necessity of coordination with other contractors (which weren’t in the tender documentation), the different position of pipelines (or cables) intersect highway route.

4. Necessary Information to Execute Realization Process
For the right description of necessary information to execute realization processes analysis of realization processes and identification of key activities is needed. Then it is possible to describe the necessary
information for these processes. The described information is that one which we want to know. The ideal process of obtaining the documentation (and included information) for realization of the construction object in a road building project is shown in Figure 1.

From Figure 1, there is obvious the key activity Creation of realization documentation. For realization of every object is the same standard administration process of creating realization documentation in Czech Highway agency. Process can be changed in terms of contract.

- Contractor organizes production committee – Realization documentation is discussed with all stakeholders of project.
- Contractor handovers the concept of realization documentation
- Discussion of the concept of realization documentation with all the participants of the projects according to the contract terms and conditions or other legislation. From this discussion changes of the technical solution may arise. During the discussion typical
consequences of the insufficient information in the construction industry are removed. [2]
BIM may be helpful in eliminating failures in documentation. [3, 4] Nevertheless, the
construction practice shows that most of the failures come from the wrong basic input data
(e.g. incorrect building site terrain measurement, incorrect position of the technical
infrastructure).

- Contractor handovers fair copy of the realization documentation. If client agrees with the
  fair copy then the realization is initiated. In standardized process realization can’t start
  without an approved fair copy of the realization documentation.

Change of the standardized process is possible (e.g. by directive of Engineer). It is often done due to
the lack of time. The change of the standardized process can accelerate a start of the realization process
(in this case it has to be consistently thought out not to cause any technical problems during the
realization). The process model for this case is shown in Figure 2. Before the start of the process, few
administrative steps must be done, according to the contract terms.

**Figure 2. Diagram of the realization process of the road building (alternative)**

Furthermore, there exists another necessary condition to realization (table 1). There are different
conditions for realizing different types of construction objects.
Table 1. Necessary information and conditions according to the type of construction object

| Type of construction object | Necessary information                                           | Necessary condition                                                                 |
|-----------------------------|-----------------------------------------------------------------|-------------------------------------------------------------------------------------|
| Landscaping                 | Agreed fair copy of the realization documentation                | The initial survey of the field.                                                     |
| Road objects                | Properly prepared subsoil of road objects. Provided valid control tests (or proof examinations) of subsoil. |                                                                                      |
| Relocations of the utility networks – electro cable, gas pipe line, water pipe line, sewer, relocations of creeks or rivers or cables for highway. | Valid expression of owners of the utility networks and the valid contemporary position of utility. |                                                                                      |
| Relocations of the roads that intersect the highway route | Prepared outbound routes                                          |                                                                                      |
| Highway bridges             | Prepared previous objects                                        |                                                                                      |

From Table 1 it is obvious that the necessary information for realization process is always the Agreed fair copy of the realization documentation. It is caused by the standard administration process that can be accelerated (in justified cases e.g. time pressure). During the discussion of the realization documentation concept, most of the typical problems of information insufficiency in the construction projects should be removed (Never will be removed variability of subsoil and generally environment.). Lack of information from realization documentation may also negatively influence the maintenance processes [5].

In column Necessary condition, there are listed processes that must be completed before the start of realizing the specific construction object. It is obvious that the existing few times demanding and costly precautions needed to be provided before the start of the realization. If the condition is not accomplished, it is not an insuperable obstacle to start realization, but it can stop realization during the process of development (without the condition it will not be possible to continue e.g. initial surveying is important for first billing).

5. Conclusion

As was described above Creation of realization documentation within discussion are the key activities for realization. Without completing the realization documentation it is not possible to start realization of any construction object. An exception can be given by the Engineer of the project, but documentation must be completed during the realization according to the reality.

After description and analysis of information, three types of necessary information to execute realization processes were classified.

- **Unconditionally necessary information (Building permit, agreement with landlord)**
  Legislation does not allow these pieces of information not to be provided.

- **Necessary information with condition/exception**
  This class includes fair copy of the realization documentation that can be skipped in exceptional cases and piece out later.

- **Necessary information for realization, but not unconditionally necessary for the start realization**
  Information must be added during the realization or to success finishing of the construction object (e.g. the initial survey of the field, prepared outbound routes).
In follow-up research, necessary information for realization will be analyzed in detail according to the relevance of impacts in case of the lack of necessary information. For the research the process modeling will be used. Process models will be benchmarked by various scenarios of realization. Duration, material and personal sources and needs will be observed.

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