

Research program: “Zukunft Bau”
funded by the “Bundesamt für Bauwesen und Raumordnung”

**„ Process based verifications of causality between cause and effect
due to obstructions”**

AZ.: Z6-10.08.18.7-08.01

Summary of the final report

Objective of this research project

Construction sequence obstructions and their resulting obstructions on the project as a whole are a major part of today’s developments in the construction sector, especially regarding larger projects. Construction sequence obstructions are unscheduled events in the course of the project execution, which occur in the sphere of a contractually fixed production flow schedule and that furthermore have negative effects for the contractually fixed production process schedule. The bottom of all disputes is the incident of unforeseen additional costs, as a result of a deficit in productivity, yet thereby not attaining a corresponding counter value for the service owed under the contract. The reasons for this are, amongst others, obstruction of the construction progress. Expenditures in form of unproductive working and/or only low productive efforts arise, as a consequence of this circumstance. These expenditures are to be taken by the initial underlying originator. Consequently, two elementary subjects have to be elucidated. On part of the contractor, meaning to provide analogical proof: on the basis of a cause and effect aspect (“haftungsbegründende Kausalität”) and on the basis of the ex post handling of occurred damage (“haftungsausfüllende Kausalität”). The awarding authority’s right to intervene in the scheduled process chain (due to the “Leistungsbestimmungsrecht”) in connection with the contractor’s obligation to take all necessary measures in order to minimize damage, leads to very complex systems for the project execution, in which cause and effect cannot be unambiguously detected. A certain cause, for instance, can have overlapping effects for different sub processes/activities. With increasing project size, these consequences as described before, amplify disproportionately.

This research project’s goal was to contribute to the development of a process based method for unambiguous verifications regarding the cause and effect problem (“haftungsbegründende Kausalität”). After all, the thesis of the “inherent problem” for the processes on the project level and on the business level of construction enterprises was examined. With the obtained results, possible solutions concerning the adaption of processes were made out and furthermore used to help develop a process based method in order to provide evidence in terms of cause and effect.

Approach and Method

Due to the complexity of this problem and the knowledge at present, the solution can only be found with a profound examination of a construction enterprise’s project processes and business processes. The prerequisite, in order to cope with the case law dealing with verification of cause and effect in context with construction sequence obstructions, is that one has to identify and overcome the inbuilt weak points of the construction enterprise’s processes – business processes and project processes.

The demand for a solution that finds implementation in the process dimension brings out indirect upgrades for the project processes and the business processes of the executing construction company. Such improvements are not exclusively beneficial for the contractor, instead are beneficial for the project course as a whole. For this reason, all project participants profit from the basic fact that the potential for conflicts, deriving from the scheduling aspect and costs aspect, are reduced.

After doing a sophisticated literature research on the topic of obstructions in construction sequences, numerous project analyses were made -of projects which were confronted with obstructions, in particular also regarding the corresponding verdicts of the German Federal Court of Justice (BGH). This was done in order to identify the reasons for the absence of enforceability of

claims deriving from construction sequence obstructions. In conclusion, the hypothesis of the “problem being inherent to the system” of the construction enterprise’s project processes and business processes was examined. From these acquired results, potential solutions concerning the adaptation of processes were analyzed and then used to help develop a verification procedure for cause and effect in this context. The verification method was established on the basis of the insight provided by the literature research and the research on construction operation appraisals. In doing so, the obstruction notifications were examined (which were issued during the realization of various building construction projects) in respect of depiction of the obstruction circumstances and their ensuing consequences. The outcome hereof was an evaluation of the claim eligibility with reference to extension of time and compensation. During the verification process deficiencies were identified, on the one hand, as result of incomplete statements in the obstruction notifications, on the other hand, due to insufficient documentation of the on site events. Hence, a check list was compiled, that with the utilization of additional instruments (e.g. schedule), would allow obstruction elements to be portrayed extensively and furthermore provide evidence for the causation analysis in accordance to the requirements of the BGH.

Core elements of verification

A precise verification of an obstruction and its consequences is possible, on condition that the contractor can argue, on which planning rudiments (organizational planning) his services rely on and what state, in point of fact owed by the obstruction, actually set in. Such a proceeding allows the contractor to prove which aberrations between target values and actual values eventuated. In addition to that, it is in this manner possible to check whether the contractor achieved his intended productivity, or whether the delay is caused by the contractor himself; because of a lacking capacity deployment as opposed to the planning.

Therefore, certain requirements for the documentation of planned/calculated targets and actually arrived results are needed, so that a process-orientated verification can be made. This approach enables a distinct depiction of causal relationships between cause and effect, therefore making it possible to trace back a specific claim to the corresponding cause. The BGH's demand for evident statements on the basis of the construction sequence is herewith given.

The verification concerning consequences which lead to an elongation of the time for completion is managed separately for each and every obstruction occurring during the project development: using the actual progress data up to the point where the hindering circumstances are omitted and a remaining target sequence plan which has to be updated and which is based on the actual progress.

Documentation of the target sequencing

Initially, originating from the organizational planning, a complete time scheduling and sequential plan for the entire construction progress can be obtained, by developing process chains that express the causal and capacitive constraints. Beyond that, a detailed appendage regarding performance factors, resources and capacities has to find implementation. These process chains expose the quota, not only for all the construction work that has to be done, but also for the design delivery dates, for sampling and tendering dates and for other important events (e.g. issuing of the building permit). Such causations that are found in the sequential planning are of great significance for the verification of the consequences owed by certain obstructions. Like so, the frequently reoccurring problem dealing with the question whether final plans are on hand in time or not and which impacts they have for the construction progress, can be only clarified by formulating a causal alignment. The sequential planning is an essential information and control system: on the one hand, the contractor can read out when which work has to be executed according to his plan, on the other hand it becomes evident for the awarding authority to which point of time he is obliged to cooperate (e.g. supply contractor with designs) The sequential planning is a fundamental aspect for the quantity survey, because deriving from it, the necessary capacities as well as the activity durations (for equipment and human resources) can be revealed.

Documentation of the contractual basis

In addition to the aspect of exposing the target specifications associated with the chronological progress of the construction works, the contractual cost estimations - that later on accumulate according to plan, as well as assigning these costs to the correspondent initiator, are to be verifiably documented. This requirement refers specifically to the performance processes (EKT: single unit price) and control processes (PGK: project overheads) which are both embedded in the organizational planning. Furthermore, this means that the organizational chart of the enterprise's structure or the building site equipment schedules have to be always documented and updated.

Documentation of the actual progress

In the course of the schedule controlling process, the actual schedule is portrayed by means of referring to the theoretically targeted schedule, in which continuously the durations and events that transpired in reality are updated. With such documentation, it is in addition possible, for instance, to ascertain the target/actual productivity values, to an extent where for any arrived obstruction the resulting aftereffects can be clearly depicted.

Documentation of the actual costs

Within the scope of the adjusting cost forecast process, the actual production costs are calculated for the reference date. From the cost controlling point of view, this process is of pivotal importance. Yet it is also essential in order to prove de facto which damage emerged from an obstruction -in this respect, if evidently evoked from the client side.

Target-performance comparison

Target-performance comparisons are to be done on a regular basis, using common control processes such as "assessment" and "controlling". The data, which can be gained by going through a checklist of unscheduled events, serve as a general structure in for displaying circumstances of the case in the obstruction notification and subsequently for asserting claims in the verification process. The target-performance comparison incorporates the following:

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| • Schedule control | based on targeted sequential plan (performance processes) |
| • Organizational control | based on contractual organization (control processes) |
| • Quality control | based on work contract (construction volume as planned) |
| • Payment control | based on contractual calculation |
| • Cost control | based on cost forecast |

Process-orientated verification / Determining the extended construction period and remuneration

An evaluation of the factual aftermaths, deriving from detaining conditions (presumption here: immediate obstruction notification) is only possible for the contractor to make, unless the awarding authority has tangible options for action. As opposed to the qualitative statements that are made in the obstruction notification, for the precise verifications concerning claims for remuneration or entitlements for extension of the construction period, every single effect has to be quantified. This cannot be, by any means, attained by inspecting the effected process for itself, instead must be viewed holistically: in conjunction with the construction sequences and the contractor's readiness to perform.

Certainly, the contractor is not entitled to compensating remunerations if he himself lacks of readiness to perform. Readiness to perform is not given, if the contractor (main contractor) failed to assign the subcontractors appropriately to each trade and is incapable of executing the service by his own establishment.

According to the German construction contract procedures (VOB), the contractor is obliged to point out and reason when, where and which activities cannot be carried out / cannot be carried out as anticipated. In order to enable a comprehensive and consistent report of the situation, a parallel analysis of both processes and construction sequencing induced for the affected process or process chain is to be made.

Within the framework of the analysis on the subject of the construction sequencing, a closer look at the relationships between processes has to be taken, for the purpose of verifying which processes are to be stringently maintained - due to their causal nature, and which relationships, where appropriate, can be broken down into single processes that can be shifted along the time axis. Consequently, it is therefore possible to display the after effects of an obstruction, so that a potential claim for an extended construction period can be formulated. Using such an approach facilitates the determination of a possible construction period extension while taking the actual progress, which is not solely based upon the intended target schedule, into account. This updated remaining target sequencing schedule finds implementation as a schedule controlling instrument for the further project developments.

Claim for remuneration

Extra costs deriving within the field of the EKT are to be computed on a process level (performance process) and in comparison to the contract calculation. Overtime premiums, and thus a claim for remuneration, only arise when an increasing number of crews do not lead to a corresponding (linear) rise of the value performance. The calculation of the PGK cost overruns require an analysis related to the construction sequencing, since they are assigned to various performance processes. The contract calculation and the contract organization, i.e. the assignment of work packages in the project structure plan, represent the basis in order to verify claims for remuneration. One has to prove that changes made in the performance processes and/or as a result of changes of the building circumstances originating from the domain of the employer, lead to deviations between the project's organization and contractual organization. As a result, entitlements for claims regarding the remuneration of additional project overhead costs arise.

Corrective measures

In order to quantify the effects of counteracting measures in context of the damage reduction obligation, initially a process-referred, followed by a construction sequence-referred analysis is recommended. The durations of the affected processes can be redesigned according to the changed parameters. These measures as well as their underlying estimations are to be again documented and embedded into the remaining target-performance comparison schedule. The remuneration of these services has to be agreed upon by the contractor and awarding authority. The total remuneration sum can be determined via calculation of the extra costs, which emerge from the costs for planning and execution compared to the originally planned costs as stated in the contract calculation.