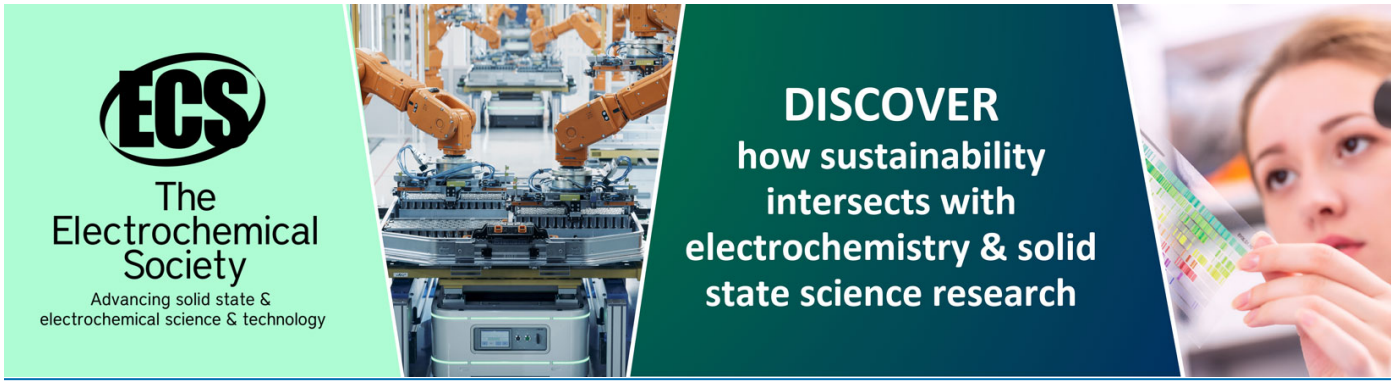
Quality of Project Documentation



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Quality of Project Documentation

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Abstract. The article deals with the issue of the checking of project documentation and the quality of project documentation. The analyzes of expert reports, which are created in expert institutions in Czech Republic, point to the fact, that a large proportion of defects in construction projects often have roots in the defects of the project documentation. The cause of the defect is often already in the design concept itself. The analyzes of expert reports show the need to pay attention to the checking of project documentation of construction projects before the actual realization. The proposal for a method of the checking of project documentation is based on the principle of continuous improvement of quality. The principle of continuous improvement of quality is often described in the PDCA diagram. In this article I deal with the checking of project documentation in connection with the analysis of the claimed defects. The data obtained by monitoring the claimed defects form good basis for the creation of the documents for the following checking of project documentation. In order to make effective use of information come from the claimed defects, we have to set properly the criteria, which we will evaluate in the context of the monitoring of claimed defects. When selecting a suitable method for analyzing data obtained by monitoring claimed defects, the choice of the Failure Mode and Effect Analysis method (FMEA) was made. In the beginning, it is necessary to choose appropriate expert ratings for the monitoring of claimed defects from the point of view of the cause of the defect, the financial difficulty to eliminate the defect and others. FMEA method is a multi-criteria analysis, so it is up to the author how many expert ratings he chooses to obtain the necessary input data. Expert analysis of input data will provide risk areas and technologies, that need to be dealt with in more detail and which should be followed in the checking of project documentation. My goal is to create a system, that will prevent the recurrent occurrence of identical claimed defects. By eliminating of claimed defects it is possible to achieve considerable financial savings within building companies. Based on the obtained data, tools for the effective checking of project documentation are created. During the initial checking of project documentation before the actual realization of construction project, it is possible to successfully prevent future defects and eliminate the ever-increasing costs of defects removal.

1. Introduction

More and more increasing emphasis is putted on the quality of construction projects. In order for the construction companies to deliver the resulting product of the required quality, the quality of the partial inputs must also be respected. The project documentation can be seen as a basic document for the realization of the construction process. Its completeness, correctness and coordination gives the basic premise of the quality of the resulting product. As it is shown in the following mentioned analysis of expert reports of expert constitutions in the Czech Republic, the project documentation often suffers from poor quality. [1] During the realization according to defective project documentation may

subsequently arise errors. The removal of defects/errors generates considerable costs and reduces the quality of use. In the article I review the checking of project documentation in interaction with the database of claimed defects. Based on the analyzes described below, the materials and tools for more effective checking of project documentation of construction projects are created.

2. Analysis of expert reports - the proof of the poor project documentation

In my current practice, I deal with the project documentation of construction projects every single day. Unfortunately, the quality of project documentation shows a steadily declining tendency. It is difficult to show one specific cause of this status. According to my opinion, it is also the fault of selection of the contractor and also the author of the project documentation, with respect to the lowest price. The design companies, logically, do not have the financial resources to do so with the care it is required.

The above-described and well-known fact among the professional public was, however, necessary to document in some way. Below are shown the results of expert reports analyzes created by expert institutions, which, thanks to their activities, often come into contact with the settlement of disputes in determining the cause of the defect.

The following figures (no. 1, 2) show the results of analyses of these expert institutions. The first graph represents an analysis of 362 expert reports of the first expert institution in 2007 - 2014. 73% of reports of this expert institution show the main cause of defects in the draft concept or in the bad design itself.

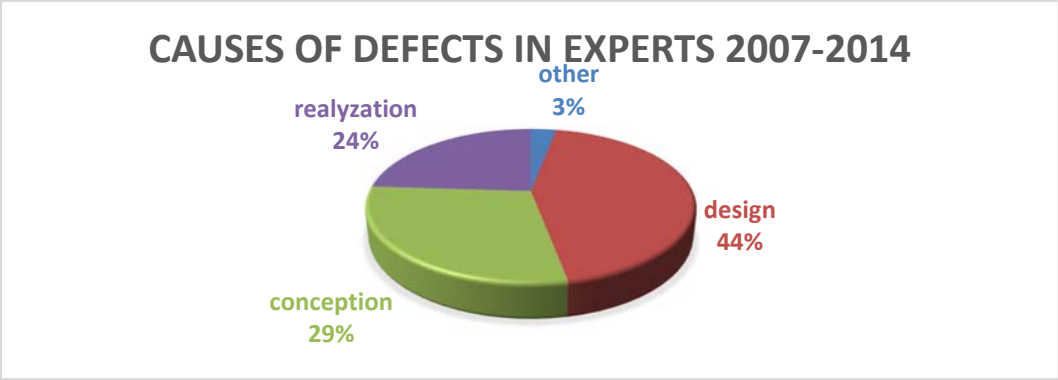

Figure 1. The analysis results of the first expert institution [1]

The results of the analysis of the second expert institution, which includes 175 reports in the period 2013-2015, show the context between defect and project documentation in 46% of cases.

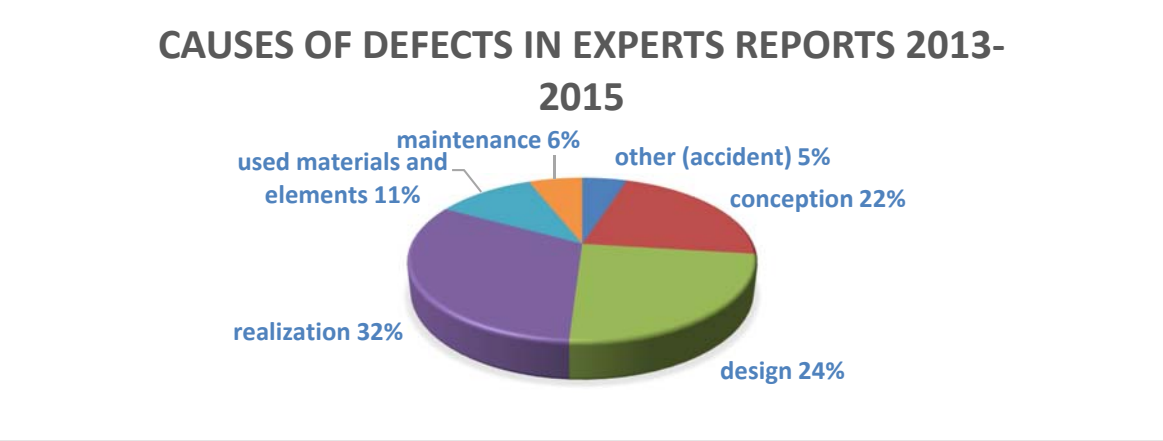

Figure 2. The analysis results of the second expert institution [2]

As the conclusions of the analyzes of these expert institutions show, the proportion of the cause of the defects in the design is considerable. For this reason, it is necessary to do the checking of project documentation in the various phases of its creation. [1] [2]

3. Quality of project documentation and its control

The quality of the checking of project documentation depends on its professional implementation. The first level of the checking of project documentation is its completeness according to valid regulations. This part is fairly simple, does not require too high demands on the expertise of the person who make the checking.

The second level is about to check the correctness of the individual parts of the project documentation. This level of checking already requires a certain degree of knowledge and expertise of the project documentation. To facilitate this level of checking, it can be successfully used the outputs of the described analysis of the claimed defects. Based on this analysis, tools for the checking of project documentation were created.

3.1. Continuous quality improvement process

The principle of continuous improvement of quality is familiar in the manufacturing sector and can be also successfully applied to obtain materials for the checking of project documentation. The process of continuous improvement of quality is illustrated by the PDCA cycle (Figure 3). Under the individual letters are hidden passwords Plan, Do, Check, Act. [3] I have modified this universal diagram for the purpose of my work to illustrate the course of the information collection during the life cycle of the construction project.

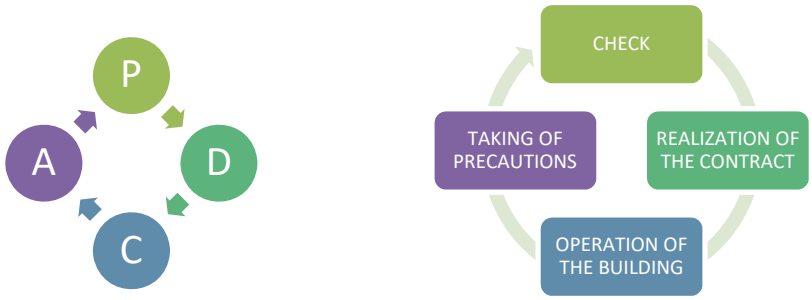

Figure 3. a) PDCA diagram - universal [3]; b) Modified PDCA diagram for the purpose of work

3.2. Database of Claimed Defects - Information source

The best source for obtaining information for future checking of project documentation is the database of claimed defects. There is a list of claimed defects on a particular project for the duration of the warranty period. As part of the described PDCA cycle, feedback is provided in the life cycle of the building. The existing database of claimed defects serves well for system testing and setup. At the same time, it offers a suitable opportunity to set criteria for recording new defects to ensure expected outcomes.

3.3. FMEA Method - The Analysis Tool

"The FMEA method is a verbal-numerical, qualitative and quantitative rating method used to assess the failure of planned projects in risk analysis, quality management, and many other areas. The method systematically estimates possible failures in processes and their possible consequences. "[4]

What exactly does FMEA mean? FMEA are the initial letters of Failure Mode and Effect Analysis. This method uses the so-called Risk Priority Index, abbreviated RPN. After initial testing, the FMEA method was chosen as the most appropriate method for the need of my work. The universal rule for determining the risk number of RPN is explain at the rule 1.

$$RPN = R_{t1}E \times R_{t2}E \times \ldots \times R_{tm}E \quad (1)$$

Where: Universal Prescription - IPR (Risk Priority Number) [5]

By multiplying expert ratings marked as RtjE, I get the risk priority index. At the start of preparation is the decision of the expert team, which determines how many expert ratings will be needed for the relevant analysis.

For the needs of my work, I developed an IPV - defect priority index and selected expert ratings. Afterthat I modified the universal rule as follows:

$$IPV = S_v \times R_m \quad (2)$$

Where**:** IPV (Defect Priority Index) - Universal Prescription

Sv – the cost of removing the defect see table 1; Rm – difficulty in removing the defect see table 2 For the needs of my work, I chose expert ratings which take values from one to four. Evaluation can be perceived as the assignment of penalty points. The higher the rating value, the higher the risk the aspect creates. The higher the value, the higher the risk.

Table 1. The cost of removing the defect - SV

The cost of removing the defect (CZK)	*Sv*
0 – 20.000	4
20.000 – 40.000	3
40.000 - 60.000	2
> 60.000	1

Table 2. Difficulty in removing the defect - RM

Difficulty in removing the defect	*Rm*
Practically impossible	4
Difficult to remove (time and financial side)	3
Easy (but time realization)	2
Unpretentious (time and realization)	1

3.4. Analysis of claimed defects - evaluation

The modified FMEA method creates the IPV, which is the result of an assessment of the claimed defect. If I only evaluate individual claimed defects, I would not get many suitable outcomes. Claimed defect, however, are divided into groups according to the type of construction. This sorting gives me the ability to determine in which structures the most serious defects occur. For this case, I have developed the so-called IPV tot (total defect priority index). IPV tot is the average value of claimed defects of the category. This makes it possible to identify the group of defects, which represents the greatest risk from the point of view of the occurrence of claimed defects and to deal with it.

$$IPV_{tot} = \sum_{K=1}^{K=M} IPV_k / M \quad (3)$$

Where: Total defect priority index – IPV tot [5]

By sorting the individual categories according to IPV tot, it is possible to point to groups of defects, which are most risky from the point of view of complaints. This creates a group of defects that are generally worth paying attention to (Table 3). By checking the groups of defects in the project documentation it is possible to partially prevent the future occurrence of defects.

Table 3. Groups of defects with the highest risk according to IPV

	Groups of defects with the highest IPV
1	insulation against water and humidity – over ground
2	surface treatments - external
3	insulation against water and humidity - underground
4	filling of openings - windows, doors and storage
5	surface treatments - internal (plaster)

4. Knowledge of the results of analyzes and applications for the checking of project documentation

The above-described procedures and analyzes create the current overview for the analysis of claimed defects, with the ability to focus on the most pressing issues or areas of problems with defects. The obtained data creates the necessary basis for creating tools to help with the checking of project documentation. It is possible to define tools that can now be included in the checking of project documentation:

- Check-lists
- Check forms
- Risk technology database
- Database of risk materials
- Instructional sheets

5. Conclusion

Removing of claimed defects in construction projects means significant financial costs for building companies. In extreme case and for a greater range of defects, the reputation of the supplier company may also be impaired. However, the cause of the defect is often not only on the side of the contractor, but often in the design documentation or in the design concept itself. Extensive financial resources can be saved by the checking of project documentation before the actual realization! At the same time, it is also advisable to use the database of claimed defects to facilitate the checking of project documentation and eliminate the repetition of the same defects. For this purpose, the article uses the principle of continuous improvement of quality called PDCA and the FMEA analytical method for processing of claimed defects. The tools for checking claimed defects include check-lists, check forms, database of risky technologies, materials and procedures.

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