

BULETINUL INSTITUTULUI POLITEHNIC DIN IAȘI
Publicat de
Universitatea Tehnică „Gheorghe Asachi” din Iași
Volumul 65 (69), Numărul 1, 2019
Secția
CONSTRUCȚII. ARHITECTURĂ

STUDIES ON PREDICTABILITY AND QUANTIFICATION OF QUALITY SPECIFIC ACTIVITIES IN BUILDING – CONCRETE

BY

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Received: January 28, 2019

Accepted for publication: February 27, 2019

Abstract. In order to obtain and exploit appropriate quality constructions, we must have the documents attesting to the quality of the construction works that are executed in the Construction Log Book. All existing documents are a vector of quality argumentation. Starting from the comparison of the existing situation on the site regarding the execution and verification of the concrete works with the content of the documents drawn up, with the situation established by the project, according to the norms, norms and legislation in force, this paper proposes the establishment of documents with known content before the start of the works of construction, so that verification activities are predictable. On the basis of the forms drawn up at the time of the checks, a score can be established to ensure quantification. The score obtained may be an indicator of the quality of construction works executed for the investor (and not only).

Keywords: score; quality; concrete; investor.

1. Introduction

Throughout the life of a building, satisfying user requirements for all in-service performance is mandatory. We can define the quality of construction

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works executed as the ratio between the performance of the product and the investor's expectations.

Obtaining quality constructions implies the existence of our own Quality Assurance System.

The quality system in construction is differentiated according to the importance of the construction.

Throughout the lifetime of construction, the essential mandatory requirements that must be met according to the legislation in force are:

- "(a) mechanical strength and stability;*
- b) fire safety;*
- c) hygiene, health and the environment;*
- d) safety in service;*
- e) protection against noise;*
- f) energy saving and thermal insulation "(1).*

The factors involved in constructing a building, following the checks made, complete the Construction Log Book. with the following documents:

- minutes for verifying the quality of the work that is hidden;
- qualitative reception report;
- minutes of reception of the infrastructure;
- minutes of reception of the structure.

Proof of fulfilling the requirements of the project, of the norms, norms and legislation in force, is the existence of the document signed by the involved parties (executor, investor and, as the case may be, designer) in the Construction Log Book. It has been found that these documents refer to:

- identification of the contractor
- the date of the document
- object/work
- the phase of the work subject to verification
- identifying elements (sector, part, ax, quota, etc.)
- project provisions
- conclusions.

In Fig.1 an example of the verbal process for the verification found on the site is shown. The Introduction should establish the field and the problem to be tackled, should summarize previous research and introduce present research. The paper will be written in English. The text appearing in figures and tables should be in English. For the text of the paper use Times New Roman, 11 pts.

As can be seen, it is deduced from the content of this document that checks have been made. The submitted document does not record whether dimensional or constructive deviations have been found in relation to the normative, normative or project specifications.

PUNCT DE LUCRU: ALFA DO... IASI
 OBIECTUL: CONSTRUIRE IMOBIL L...
 ADRESA: A... IASI

PROCES VERBAL PENTRU VERIFICARE ASPECTULUI BETONULUI DUPA DECOFRARE SI A POZITIONARII GOLURILOR TEHNOLOGICE

NR. DATA: ... 2018

„ CONSTRUIRE IMOBIL L...
 ADASTRAL

Elementele verificate sunt urmatoarele:

STALPI PARTER

Turnarea a fost facuta in data: ... 2018

Aspectul betoanelor dupa decofrare:

Betonul turnat nu prezinta fisuri, microfisuri, segregari, sau exfolieri si corespunde dimensiunilor prevazute si clasa de rezistenta (C20/25) prevazuta in proiect DTAC nr. ... si Pth+DDE nr. ...

Existenta si pozitionarea golurilor tehnologice sunt verificate dupa proiectul DTAC nr. ... si Pth+DDE nr. ... si corespund cerintelor acestora.

Masuri de remediere/refacere a lucrarilor:

..... NU ESTE CAZUL

| | BENEFICIAR | DIRIGINTA DE SANTIER | EXECUTANT | RTEA | PROIECTANT |
|-----------|---------------|----------------------|-----------|------|------------|
| NUME | S... P... SRL | ... | ... | ... | ... |
| PRENUME | | | | | |
| SEMNETURA | | | | | |

Atestam refacerea/ remedierea lucrarilor conform prevederilor proiectului si a modificarilor impuse prin dispozitiile de santier (dupa caz):

| | BENEFICIAR | DIRIGINTA DE SANTIER | EXECUTANT | RTEA | PROIECTANT | CUMPARATOR |
|-----------|------------|----------------------|-----------|------|------------|------------|
| NUME | - | - | - | - | - | |
| PRENUME | - | - | - | - | - | |
| SEMNETURA | | | | | | |

Fig. 1 – Minutes to check the quality of the works that are hidden.

If there were deviations in the execution of the construction works, at the end of the execution of the works we find that these are not found in the documents. Documents in the current format only record the "accepted" version. The investor can not form an objective view of the quality of the construction work he has executed. For this reason, as the construction works were executed, the investor, the designer, the performer could set a "score".

This work, for concrete works, proposes to draw up documents which, through the content of the project, lead to the achievement of quantifiable construction works.

When doing the checks we can do the quantification by setting the scores from 1 to 10. The minimum score is 1, representing very bad, and the maximum score is 10, representing very good.

For all categories of works, a general score, obtained by the weighted sum of the scores obtained for each category of works, will be established. Investor reflects the quality of construction works.

2. Argumentation of the Proposed Topics

With few exceptions, there are virtually no construction works where no concrete work is required. In most cases we encounter concrete works at foundations. Concrete works can also be found in the superstructure of buildings made of masonry blocks (making pillars, belts, floors), diaphragm and/or frames (pillars, walls, beams and floors).

The documents drawn up during the concrete works lead to the identification of the following activities / checks to be carried out on site:

- the contractor of the construction works, when receiving the concrete, will receive qualitatively the material;
- if the material meets the requirements of the project and the technical prescriptions is to be put into operation;
- after decoking, check the quality of the concrete.

On the construction site, following the verifications made by the stakeholders, the following types of completed documents, which attest the quality of the concrete works executed, were identified:

- minutes for verifying the quality of the work that is hidden;
- verification of the appearance of the concrete after decoking and positioning of technological and installation holes;
- qualitative reception report;
- containment for the evidence of cast concrete;
- unique bulletin on work on test results on concrete samples taken at the site;

- minutes of reception of the infrastructure;
- minutes of reception of the structure;

From the point of view of the correct execution and verification of the works there are no explicit records regarding:

- the appearance of the elements, indicating if inadequate concrete areas (uncompacted concrete, segregated concrete, gaps, concrete joints, etc.) are encountered;
- the cross-sectional dimensions of the elements;
- the distances between the various elements;
- position of the vertical elements (pillars, diaphragms, walls in relation to the corresponding ones located at the immediately lower level);
- the position of the reinforcements to be embedded in subsequent pouring elements;
- the position of the voids.

In the Construction Log Book, the reports on the site, for all of the above checks, do not have records, do not record the deviations found and do not establish a score that shows the investor the quality of the work performed as a reference function.

3. Results and Discussion

The construction works must meet the requirements established by the project without breaching the norms, norms and legislation in force. For this reason, the designer should establish through the project the level of quality to be achieved, defining the deviations of each type of work.

By filling in a sheet with the minimum content shown in Fig. 2, we can obtain quantification of the actual performance/quality of the works executed for the concrete works, taking into account the above.

Building Permit No of the date.....
 Designation of construction works (according to AC):
 Address of investment:
 Investor / Beneficiary:
 Investor Address:
 Nr. phone investor:
 Executor:.....
 Execution address:.....
 Nr. executing phone:.....

| CONCRETE | | | | | | |
|--|---|------------------------|------------------------------|--|--|---|
| VERIFIED ELEMENT | | | | Date of verification and document preparation | Who attended verification (surname first) | Score obtained when the requirement was met |
| Verification / Document to be drawn up | Deviation according to the norm | Deviation found | Meets the requirement | | | |
| Verified reinforced concrete (sampling) | At least one sample per each concrete, batch, exchange at least 100 cc (\leq C16 / 20) / 50 mc ($>$ C16 / 20), NE 012 / 2-2010, Annex H | | | | | A score of 10 is awarded to meet the requirement, if 0 is not assured |
| <i>a) A sampling report has been drawn up</i> | Required | | | | Construction-site responsible Contractor | A score of 10 is awarded to meet the requirement, if 0 is not assured |
| <i>b) There is a border of evidence transmission</i> | Required | | | | Construction-site responsible Contractor | A score of 10 is awarded to meet the requirement, if 0 is not assured |
| <i>c) Laboratory results for tests performed on samples taken</i> | Required | | | | Laboratory Leader | A score of 10 is awarded to meet the requirement, if 0 is not assured |
| Concrete conditioner complete | Required | | | | Construction-site responsible Contractor | A score of 10 is awarded to meet the requirement, if 0 is not assured |
| Qualitative reception reports have been presented after the deformation which must contain: | | | | | Construction-site responsible Contractor | |
| <i>a) the appearance of the elements, indicating if incomplete concrete areas (uncompacted concrete, segregated concrete, gaps, concrete joints, etc.)</i> | Required | | | | | A score of 10 is awarded to meet the requirement, if 0 is not assured |
| <i>b) the dimensions of the cross sections of the elements</i> | Required | | | | | A score of 10 is awarded to meet the requirement, if 0 is not assured |

| | | | | | | |
|---|----------|--|--|--|--|---|
| c) the distances between the different elements | Required | | | | | A score of 10 is awarded to meet the requirement, if 0 is not assured |
| d) position of the vertical elements (poles, diaphragms, walls relative to the corresponding ones located at the immediately lower level) | Required | | | | | A score of 10 is awarded to meet the requirement, if 0 is not assured |
| e) position of the reinforcements to be embedded in subsequent pouring elements | Required | | | | | A score of 10 is awarded to meet the requirement, if 0 is not assured |
| f) the position of passes | Required | | | | | A score of 10 is awarded to meet the requirement, if 0 is not assured |

Note (arithmetic mean)

Conclusions according to the achieved grade: The concrete cast in this element meets the requirements, it is possible to proceed to the next stage.

Fig. 2 – Concrete inspection sheet.

The data sheet as an example in Fig. 2, together with all the documents proving the quality of the works executed, can be found in the Construction Log Book. If we consider the default score of 5, after completion of the concrete work, based on the score obtained, we can declare these categories of works to be appropriate or inappropriate.

Determining the scores for each category of works can be done using the calculation formula:

$$P = \left(\sum_{i=1}^n K_i \times P_i \right) / i,$$

where: P – total score for each category of works; K_i – the weight of verification/work within each category of works; P_i – the score set for each verification/work within a category of works; i – the number of criteria taken as representative for each category of works.

4. Conclusions

The designer should establish through the project the level of quality to be achieved, defining the deviations in which each type of work must fit.

The quantification of the actual performance/quality of the works executed for reinforcement, taking into account the above, is to be achieved by completing the works with the fine exemplary contents as they are executed.

For all the above-mentioned checks, we do not find any records in the Construction Log Book and the reports drawn up on the site do not record the deviations found and do not establish a score that shows the investor the quality of the work performed as a reference function.

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STUDII PRIVIND PREDICTIBILITATEA ȘI CUANTIFICAREA ACTIVITĂȚILOR SPECIFICE CALITĂȚII LA CONSTRUCȚIA CLĂDIRILOR – BETON

(Rezumat)

Pentru a obține și a exploata construcții de calitate corespunzătoare, la Cartea tehnică a construcției trebuie să avem documentele care atestă calitatea lucrărilor de construire executate. Totalitatea documentelor existente constituie un vector de argumentare a calității. Pornind de la compararea situației existente în șantier privind execuția și verificarea lucrărilor de beton cu conținutul documentelor întocmite, cu situația stabilită prin proiect, în conformitate cu normativele, normele și legislația în vigoare, prezenta lucrare propune instituirea unor documente cu conținut cunoscut înainte de începerea lucrărilor de construire, astfel ca activitățile de verificare să fie predictibile. În baza formularelor întocmite în momentul efectuării verificărilor se poate stabili un punctaj care să asigure cuantificarea. Punctajul obținut poate constitui un indicator al calității lucrărilor de construire executate, pentru investitor (și nu numai).