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PREDICTABILITY OF ACTIVITIES SPECIFIC TO THE QUALITY OF CONSTRUCTION WORKS

BY

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Abstract. The provisions of Law no.*10*/1995 on quality in constructions, republished with the subsequent modifications and completions, corroborated with the provisions of the Procedure regarding the state control in the implementation phases determining the mechanical strength and stability of constructions - indicative PCF 002/25.07.2014 and the Procedure on the exercise of state quality control in constructions through controls to the factors involved in the execution process - indicative PCE 001/25.07.2014 stipulate that the designer draws up the control program. Once accepted by the investor, the certified project verifier and the endorsement by I.J.C./I.C.M.B. of the work control program, the document becomes a component of the quality system. According to the approved inspection program, the contractor has the obligation to summon the responsible individuals on the site to carry out the verifications and to authorize the continuation of the construction works. Incorrect inspection of the control program may lead to nonconformities. This paper proposes to determine the types of documents that have to be drawn up so as to prove the carrying out of the verifications leading to the obtaining of construction works that meet the quality requirements established by the project in accordance with the norm, and active legislation. The implementation of a program for the control of construction works in accordance with the requirements of the Procedure for conducting state control in the execution phases determining the mechanical

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strength and stability of the constructions, from the legislation, norms and norms in force should have the following minimum content. This program is not restrictive. All the checks and documents required by the legislation, norms and applicable norms for all categories of works, whether or not included in the content of this program, will be made on the site. Documents drawn up will explicitly refer, in accordance with the legislation, the norms and active legislation, to the verification made. The control program that meets the minimum requirements previously set out as part of quality management provides assurance that quality requirements will be met.

Keywords: score; quality; investor; beneficiary; inspection.

1. Introduction

Construction works train to meet the investor's expectations. By reporting the performance of the product to the investor's expectations, we obtain the quality of construction works. In legislation, quality in construction is defined as *"the result of all the performance of their behaviour in exploitation, in order to satisfy the requirements of users and collectivities throughout the lifetime"* (law nr.10/1995).

With the construction of a building, on the construction site, following the requirements of the control program, we will identify the following types of documents:

– minutes of handover - reception of site and landmarks;
– minutes of work drafting;
– minutes for verification of the foundation quota;
– verification of the nature of the foundation ground;
– minutes for verifying the quality of the work that is hidden;
– verification report for the appearance of concrete after deformation and positioning of technological and installation holes;
– qualitative reception report;
– containment for the evidence of cast concrete;
– single job report on the results of tests on concrete samples taken at the site;
– infrastructure reception report;
– minutes of reception of the structure;
– minutes of reception at the end of the works;
– minutes of final acceptance.

These documents contain information about: executor, date of preparation of the document, object/work, phase of the work to be verified, identification elements (sector, part, ax, quota, etc.), project provisions,

conclusions. Documents shall be signed, as required, by the representative of the contractor, the investor and the designer.

In order to fulfil the essential requirements, according to the provisions of the *Procedure for conducting the state control in the execution phases determining the mechanical strength and stability of constructions - indicative PCF 002 / 25.07.2014*, the designer establishes the verification stages *by fields and categories of works* (PCF 002/25.07.2014).

Do the above documents prove that all areas and categories of work have been verified?

Does the content of these documents prove that by the enclosed content the essential requirements have been met?

2. Argumentation of the Proposed Topic

By various criteria we can make several classifications of buildings:

– category A – exceptional, category B – special, category C – normal, category D – reduced – by category of importance.

– civil constructions, social-cultural constructions, industrial constructions, agrozootechnical constructions – by destination);

– masonry, concrete and reinforced concrete constructions, wooden constructions, metal constructions, mixed constructions – according to the basic structure-material;

– permanent constructions, semi-permanent constructions, temporary constructions – by durability;

For this study, taking into account the criteria listed above, we chose the buildings with the infrastructure made up of concrete, reinforced concrete, superstructure of masonry, reinforced concrete frame or mixed structure (masonry and reinforced concrete), for which we identified the following categories of works:

– Earthworks
– Improve the foundation ground
– Foundations
– Concrete, reinforced concrete and prestressed concrete
– Boxing
– Masonry
– Lime
– Plywood
– Painting and painting
– Floors
– Insulation
– Joinery

– Windows
– Covers
– Boilers

Subject to the provisions of *C56/1985*, *NE012/2-2010*, *P100-1/2013*, *CR 6-2013*,... etc, the following activities and checks should be carried out on the site:

– delivery and receipt of site
– check the tracing as a whole and for each item;
– verification of the nature of the land under the foundation quota by static or dynamic penetration;
– check pads of earth, sand, ballast, gravel, crushed stone (if applicable);
– checking the Foundation's withdrawal;
– verifying digging;
– checking the quality of reinforcing concrete components in foundations;
– checking reinforcing foundations;
– checking foundations;
– verification of formwork and reinforcement, precast concrete casting in foundations;
– checking the quality of the concrete, before casting into foundations;
– verification of concrete from foundations after decoking;
– reception of waterproofing materials on the site, after checking the geometric dimensions, humidity, etc. in accordance with the provisions of the technical regulations in force (product standards, technical standards ...);
– verification of the substrate to which the waterproofing applies, if it is in accordance with the provisions of the design and the technical prescriptions, each time this type of work is being carried out;
– verification for each of the successive layers of waterproofing;
– checking the quality of the reinforced concrete components in the structural elements on the ground floor;
– verification of slab reinforcement, belts, squares –0.05;
– verification of sheet formwork, belts, squares –0.05;
– verification of the quality of the concrete, before casting in the slab, belts, squares –0.05;
– verification of concrete from the slab, belts, beams at the level of –0.05 after decoking;
– Infrastructure Reception;
– site verification of masonry materials;
– checking reinforcement of vertical structural elements on the ground floor;

– checking the vertical structural elements on the ground floor;

– formwork and reinforcement verification, pre-cast concrete casting in the vertical structural elements on the ground floor;

– checking the quality of the concrete, before casting into the vertical structural elements on the ground floor;

– verification of concrete from the vertical structural elements on the ground floor after decoking;

– checking the quality of the reinforcing concrete components from the floor above the ground floor;

– verification of slab reinforcement, belts and beams above the ground floor;

– verification of the formwork, belts and beams above the ground floor;

– checking the quality of the concrete, before casting into the slab, belts and beams above the ground floor;

– verification of concrete from the slab, belts and beams above the ground after decoking;

– checking cover support;

– checking the cover;

– resistance structure reception (including interpretation of laboratory test results for concrete put into operation);

– site inspection of plastering materials;

– checking the quality of the substrate;

– inspection of materials for painting, wallpaper;

– checking the quality of the plywood support;

– verification of the quality of the plywood materials;

– checking the quality of the materials in the flooring;

– verification of the quality of thermal and sound insulation works;

– meeting of the commission appointed by the investor/beneficiary for the reception at the end of the works;

– investor/beneficiary's decision to reject or admit the reception.

For multi-storey buildings, all downstairs checks will be resumed at each level.

3. Quantitative, Qualitative and Interpretative Results

The implementation of a program for the control of construction works in accordance with the requirements of the Procedure for conducting state control in the execution phases determining the mechanical strength and stability of the constructions, from the legislation, norms and norms in force should have the following minimum content.

Example control program Type the second section of your paper in here (Table 1).

Table 1
Control Program for Building Works in Determinant Phase

Designer.....
CIF..... Advised,
County Inspectorate in
Address..... Construction
Phone Number.....
Project no.....

CONTROL PROGRAM FOR BUILDING WORKS IN DETERMINANT PHASE

Building Permit (AC) No ..... on ....
Designation of construction works (according to AC): .....
Address of investment: ....
Investor / Beneficiary: ....
Investor Address: ....
Investor telephone no: ....

Nr. crt.	Work done	Document type	Who participates and signs	Nr. and document date
0	1	2	3	4
1	*Teaching receiving site* (conf. C56/1985, Caiet II, pct 2.1)	PV	B+P+E	
2	*Check the tracing as a whole and for each object* (conf. C56/1985, Caiet II, pct 2.2)	PV	B(DS)+P+E	
3	*Verification of ground nature under basement by static or dynamic penetration, 1 sample per 200m2 excavation, minimum 3 samples for each object* (conf.C56/1985, cap.I, pct 1.2)	PVLA	B(DS)+P+E	
4	*Checking fillings (pillows) of earth, sand, ballast, gravel, crushed stone* (conf.C56/1985, cap.I, pct 1.4)	PVLA	B(DS)+P+E	

5	*Check Foundation Retirement* (conf.C56/1985, Caietul IV, pct 2.1)	PVLA	B(DS)+E	
6	*Checking the excavation* (conf.C56/1985, Caiet IV, pct 2.1)	PVLA	B(DS)+E	
7	*Verifying the quality of reinforced concrete components in foundations* (conf.C56/1985, Caiet V, pct 2.1)	PVRC	E	
8	*Verification reinforcement foundations* (conf.C56/1985, Caiet V, pct 2.2)	PVRC	B(DS)+E+P	
9	*Check foundation foundations* (conf.C56/1985, Caiet V, pct 2.2)	PVRC	B(DS)+E	
10	***Verification of formwork and reinforcement, precast concrete casting in foundations* (conf.NE012/2-2010)**	**FD**	**B(DS)+P+E**	
11	*Checking the quality of concrete, before casting into foundations* (conf.C56/1985, Caiet V, pct.2.1 si NE 012/2-2010)	PVRC	E	
12	*Verification of concrete from foundations after decapping* (conf.C56/1985, Caiet V, pct 2.7)	PVRC	B(DS)+E	
13	*Reception of waterproofing materials on the site, after checking the geometric dimensions, humidity, etc. in accordance with the provisions of the technical regulations in force (product standards, technical standards ...)* (conf.C56/1985, pct.2.1, caiet XIV)	PVRC	E	
14	*Verification of the substrate to which the waterproofing applies, if it complies with the provisions of the project and the technical prescriptions, each time this type of work is being carried out* (conf.C56/1985, pct.2.2, Caiet XIV)	PVLA	B(DS)+E	
15	*Verification for each of the successive layers of waterproofing* (conf.C56/1985, pct.2.4, Caiet XIV)	PVLA	B(DS)+E	
16	*Verification of the quality of reinforcing concrete components from structural elements on the ground floor* (conf.C56/1985, Caiet V, pct 2.1)	PVRC	E	
17	*Verification of slab reinforcement, belts, squares -0.05* (conf.C56/1985, Caiet V, pct 2.2)	PVRC	B(DS)+E+P	

18	*Verification of concrete quality, pre-casting in slabs, belts, squares -0.05* (conf.C56/1985, Caiet V, pct.2.1 and NE 012/2-2010)	PVRC	E	
19	*Verification of concrete in the slab, belts, squares -0,05 after unloading* (conf.C56/1985, Caiet V, pct 2.7)	PVRC	B(DS)+E	
20	**Infrastructure Reception**	**PVR**	**B(DS)+P+E**	
21	*Site verification of masonry materials* (conf.C56/1985, Caiet VIII, pct 2.1)	PVR	E	
22	*Verification of the support over which masonry is executed complies with the provisions of the project and the technical prescriptions* (conf.C56/1985, pct.2.5, Caietul VIII)	PVLA	B(DS)+E	
23	*Checking the quality of masonry and walls on the ground floor* (conf.C56/1985, Caiet VIII, pct 2.3)	PVLA	B(DS)+E	
24	*Check reinforcement of vertical structural elements on the ground floor* (conf.C56/1985, Caiet V, pct 2.2)	PVRC	B(DS)+E+P	
25	*Vertical Structure Verification on Ground Floor* (conf.C56/1985, Caiet V, pct 2.2)	PVRC	B(DS)+E	
26	***Verification of formwork and reinforcement, pre-cast concrete casting in the vertical structural elements on the ground floor* (conf.NE012/2-2010)**	**FD**	**B(DS)+P+E**	
27	*Checking the quality of the concrete before casting into the vertical structural elements on the ground floor* (conf.C56/1985, Caiet V, pct.2.1 and NE 012/2-2010)	PVRC	E	
28	*Verification of concrete from the vertical structural elements on the ground floor after decoking* (conf.C56/1985, Caiet V, pct 2.7)	PVRC	B(DS)+E	
29	*Verify the quality of the reinforcing concrete components from the floor above the ground floor* (conf.C56/1985, Caiet V, pct 2.1)	PVRC	E	
30	*Verify reinforcement rails, belts and beams above the ground floor* (conf.C56/1985, Caiet V, pct 2.2)	PVRC	B(DS)+E+P	

31	*Verify the formwork, belts and beams above the ground floor* (conf.C56/1985, Caiet V, pct 2.2)	PVRC	B(DS)+E	
32	*Checking the quality of the concrete, before casting into the floor, belts and beams above the ground floor* (conf.C56/1985, Caiet V, pct.2.1 and NE 012/2-2010)	PVRC	E	
33	*Verification of concrete from the slab, belts and beams over the ground after decoking* (conf.C56/1985, Caiet V, pct 2.7)	PVRC	B(DS)+E	
34	*Verification of the support over which masonry is executed complies with the provisions of the project and the technical prescriptions* (conf.C56/1985, pct.2.5, Caietul VIII) -If it is the case at every next level	PVLA	B(DS)+E	
35	*Verify the quality of masonry and upstairs walls* (conf.C56/1985, Caiet VIII, pct 2.3) -If it is the case at every next level	PVLA	B(DS)+E	
36	*Verify reinforcement of upright vertical structural elements* (conf.C56/1985, Caiet V, pct 2.2) -If it is the case at every next level	PVRC	B(DS)+E+P	
37	*Vertical Structure Vertical Upstairs Verification* (conf.C56/1985, Caiet V, pct 2.2) -If it is the case at every next level	PVRC	B(DS)+E	
38	***Formwork and reinforcement verification, pre-cast concrete casting in upright vertical structural elements* (conf.NE012/2-2010)** -If it is the case at every ~~next~~ level	**FD**	**B(DS)+P+E**	
39	*Checking the quality of the concrete before casting into the upright vertical structural elements* (conf.C56/1985, Caiet V, pct.2.1 and NE 012/2-2010) - if applicable at each subsequent level	PVRC	E	
40	*Verification of concrete from vertical structural elements upstairs, after demolding* (conf.C56/1985, Caiet V, pct 2.7) - if applicable at each subsequent level	PVRC	B(DS)+E	

41	*Checking the quality of the reinforcing concrete components from the floor above the floor* (conf.C56/1985, Caiet V, pct 2.1) -If it is the case at every next level	PVRC	E	
42	*Verify reinforcement of the floor, belts and beams above the floor* (conf.C56/1985, Caiet V, pct 2.2) -If it is the case at every next level	PVRC	B(DS)+E+P	
43	*Verify the formwork, belts and beams above the floor* (conf.C56/1985, Caiet V, pct 2.2) -If it is the case at every next level	PVRC	B(DS)+E	
44	*Checking the quality of the concrete, before casting into the floor, belts and beams above the floor* (conf.C56/1985, Caiet V, pct.2.1 and NE 012/2-2010) - if applicable at each subsequent level	PVRC	E	
45	*Verification of concrete from the slab, belts and beams above the floor after decoking* (conf.C56/1985, Caiet V, pct 2.7) -If it is the case at every level	PVRC	B(DS)+E	
46	*Verifying Covers Support* (conf. pct.3.1, caietul XVII din Normativul C56/85)	PVRC	B(DS)+E	
47	*Checking the cover* (conform C56/85, caietul XVII, pct.3.2.)	PVRC	B(DS)+E	
48	**Resistance Structure Reception (including interpretation of laboratory test results for concrete put into operation, conf.C56/1985, cap.6, pct.2.13 and NE 012/2-2010, 15.5)**	**PVR**	B(DS)+E+P	
49	*Inspection of plaster materials on site* (conf.C56/1985, Caiet IX, pct 3.1)	PVR	E	
50	*Checking the quality of the substrate for plasters* (conf.C56/1985, Caiet IX, pct 2.2)	PVLA	B(DS)+E	
51	*Inspection of materials for painting, painting, wallpaper* (conf.C56/1985, Caiet XI, pct 2.5)	PVR	E	
52	*Checking the quality of the plywood support* (conf.C56/1985, Caiet X, pct 2.2)	PVLA	B(DS)+E	

53	*Checking the quality of plywood materials* (conf.C56/1985, Caiet X, pct 2.4)	PVRC	E	
54	*Check the flooring quality* (conf.C56/1985, Caiet XII, pct 2.1)	PVLA	B(DS)+E	
55	*Checking the quality of the materials in the floor* (conf.C56/1985, Caiet XII, pct 2.3)	PVRC	E	
56	*Verification of the quality of thermal and acoustic insulation work* (conf.C56/1985, Caiet VIII, pct 2.12)	PVLA	B(DS)+E	
57	*Meeting of the commission appointed by the investor / beneficiary for the reception at the end of the works.*	PVRTL	Comisia	
58	**Investor / Beneficiary's decision on rejection, acceptance of reception**		**I/B**	

Note: B = beneficiary/investor, DS = site master, P = designer, E = executor, I = representative I.S.C./I.R.C./I.J.C.

The contractor of the construction works will summon the factors that must participate in the quality check of the construction works according to the provisions of this program at least 48 hours ahead, specifying the works to be verified, the place, date and time of the meeting.

Beneficiary/ Investor Name-surname, signature	Designer Name-Surname, Signature	Project Verifier Name-Surname, signature	I got to know, Executor Name-surname, signature

This program is not restrictive. All the checks and documents required by the legislation, norms and applicable norms for all categories of works, whether or not included in the content of this program, will be made on the site. Documents drawn up will explicitly refer, in accordance with the legislation, the norms and active legislation, to the verification made.

4. Conclusions

The control program that meets the minimum requirements previously set out as part of quality management provides assurance that quality requirements will be met.

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REFERENCES

Velicu C., *Clădiri*, Edit. Experților Tehnici, 2007.
* * * *Codul de proiectare pentru structuri din zidărie*, CR 6-2013.
* * * *Codul de proiectare seismic*, P 100-1/2013.
* * * *Legea nr.10/1995 privind calitatea în construcții*, republicată, cu modificările şi completările ulterioare, www.lege5.ro.
* * * *Legea nr.50/1991 privind autorizarea lucrărilor de construcții*, republicată, cu modificările şi completările ulterioare, www.lege5.ro.
* * * *Normativ pentru producerea betonului şi executarea lucrărilor din beton, beton armat şi beton precomprimat - executarea lucrărilor din beton*, NE012/2-2010, MO, 2010.
* * * *Normativ pentru verificarea calității şi recepția lucrărilor de construcții şi instalații aferente*, C56/1985, ICCPDC, 1986.
* * * *Procedura privind efectuarea controlului de stat în faze de execuție determinante pentru rezistența mecanică şi stabilitatea construcțiilor*, PCF 002/25.07.2014, MDRAP, Monitorul Oficial, Partea I nr. *576* din 01.08. 2014.

PREDICTIBILITATEA ACTIVITĂȚILOR SPECIFICE CALITĂȚII LA CONSTRUCȚIA CLĂDIRILOR
Program de control

(Rezumat)

Prevederile Legii nr.*10*/1995 privind calitatea în construcții, republicată cu modificările şi completările ulterioare, coroborate cu prevederile Procedurii privind efectuarea controlului de stat în faze de execuție determinante pentru rezistența mecanică şi stabilitatea construcțiilor – indicativ PCF 002/ 25.07.2014 şi a Procedurii privind exercitarea controlului de stat al calității în construcții prin controale la factorii implicați în procesul de execuție – indicativ PCE 001/25.07.2014 stabilesc obligativitatea întocmiri de către proiectant a programului de control. Odată cu acceptarea de către investitor, de către verificatorul de proiecte atestat şi avizarea de către I.J.C./I.C.M.B. a programului de control al lucrărilor, documentul devine o componentă a sistemului calității. În conformitate cu programul de control avizat, executantul are obligația de a convoca în şantier factorii responsabili în vederea efectuării verificărilor şi autorizării continuării execuției lucrărilor de construcții. Întocmirea incorectă a programului de control poate duce la apariția unor neconformități. Această lucrare propune stabilirea tipurilor de documente care trebuiesc întocmite aşa încât să dovedească efectuarea verificărilor care să conducă la obținerea unor lucrări de construire care să îndeplinească cerințele de calitate stabilite prin proiect în conformitate cu normele, normativele, legislația în vigoare.