Documentation management system for construction control at a transport construction site

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Abstract. The article shows the role of construction control in the construction of transport construction objects. The necessity of its implementation, starting from the early stages of construction, is justified. Reviewed a detailed list of accounting documents for carrying out construction supervision on objects of transport construction. For each document, the procedure for its preparation and frequency of submission to the customer or representatives of the contractor are described. A detailed list of reporting documents on construction supervision at transport construction facilities is considered, including conclusions on the verifiability of design and working documentation for the transport construction object, conclusion on the readiness of contractors to perform construction, reconstruction, capital repairs, conclusion on the readiness of the construction laboratory of the nondestructive testing laboratory, electrical laboratory, within the framework of the construction contractor's activities, when performing construction, reconstruction, capital repairs, conclusion on conformity assessment is made of the object and its willingness to carry out the work of the Commission, preparation of General journal and construction supervision, charting object, act, visual-measuring control, weekly and monthly reports, act of acceptance-transmission equipment (materials) on the project of the act on the identified equipment defects (materials), reference for the audit and approval of acts examination of the hidden works, draw conclusions about the dynamics of performance., preparation of a report on the actual time of rendering construction control services at the customer's facility. The article presents an algorithm for document management based on the assessment of the work of several enterprises, which allows for high-quality construction control on construction sites.

1. Introduction

The need for building control arise in the construction of all types of buildings and structures. Thanks to quality performance of construction control, the customer will be convinced that all works are executed in accordance with the design documentation, existing legal documents, compliance with deadlines, and current expenses for the construction correspond to the established estimates. Input control of materials and products will allow you to assess the quality of the incoming to the construction site construction materials and their compliance with the relevant standards.

This article is a summary of the research study the necessary information for the customer during construction and the provision of services and construction supervision. For this purpose a survey was conducted among the major organizations-developers. The number of organizations of developers in Moscow and the Moscow region has determined in the sampled population, a specific calculation.
2. Materials and methods

The process of conducting construction control consists of several stages that implement an approved manner of construction of the project. To contact the organization that perform services of construction supervision, can be in different stages of construction of the object, but the sooner the client will begin monitoring the stages of implementation of design solutions, the less financial expenses he will incur in the end. Possible and is not detected in time violations that may be committed performers at the initial stages of construction of a building or structure, often entail significant financial losses.

To prevent financial and other costs during construction, to start preparations for construction supervision is advisable in the initial stages, starting from the planning stage and end test activities after delivery of object in operation.

If a client company, providing services of construction supervision, after studying all the features of the upcoming collaboration between the customer and the contractor is a contract for the provision of services for construction supervision. This document should reflect the rights and obligations of the customer and the organization, carrying out construction supervision and stipulate deadlines.

In the process of implementation of construction supervision of the responsible specialist regularly provides the client with documentation on the results of the inspection. Because of this, the customer is able to gradually observe the quality of work performed on the object under construction [1].

Since the General set of organizations of developers is big enough (the total number of organizations of developers in Moscow and the Moscow region is 51402), study was not possible. Therefore, was conducted to study only the part of the population, called a sample [2]. With an acceptable margin of error 5%, sample size was 564 organizations [2]. It was assumed that the data is collected on all elements of the sample, the value of the confidence level of 95%.

The minimum number of organizations of developers for the research on the basis of predetermined reliability score (Δ=0.95) is determined by the formula:

\[ m = h^2 * r_a * \frac{r_0}{\Delta^2}, \]

where \( h \) - is the condence factor (0.95),
\( r_a \) – the proportion of sample elements with presence of specified trait (0.95),
\( r_0 \) – the proportion of sample elements with the absence of the specified trait (0.05),
\( \Delta \) - margin of error of (0.05).

\[ m = ((0.95)^2 * 0.95 * 0.05)/(0.05)^2 = 17.2 \approx 18 \text{ organizations} \]

In the result of the study appeared the proposed reporting forms to the customer.

Using practical experience in the field of construction control, and generalizing experience in the preparation of reporting forms, the authors attempted to compile a detailed list of reporting documents and construction supervision for the periodicity of providing the customer [3÷5]. The results of this work are presented in the flowchart 1.

The proposed system and document the abbreviation (CCDWCO, CCHRRCO, CCHRNTL etc.) is not normative or conventional in construction. Transmission system to the customer reporting documentation for the construction of the control is seen by the authors as standard in the construction of facilities for the energy industry of the Russian Federation [6].
Figure 1. Flowchart. A detailed algorithm work construction supervision contract with the construction organization and the customer.

The list of the accepted reductions to the Figure 1:
CCDWCO – conclusion on the controllability of design and working documentation for the construction object.
CCHRCO – Conclusion on checking the readiness of construction organizations to perform construction, reconstruction, and major repairs.
CCHRNTL – Conclusion on checking the readiness of the nondestructive testing laboratory of a
construction contractor to carry out construction, reconstruction, and major repairs.
CCHRCL – Conclusion on checking the readiness of construction laboratories of a construction
organization to perform construction, reconstruction, and major repairs.
CCHREL – Conclusion on checking the readiness of the electrotechnical laboratory of a construction
contractor to carry out construction, reconstruction, and major repairs.
CACCC – Conclusion on the assessment of compliance with the completed construction of the object
and its readiness for the working Commission.
PGLCC – Preparation of a General log of construction control.
DUCCO – Drawing up a control card of the object (monthly).
DUAVMC – Drawing up an act of visual and measuring control.
PRWR – Preparing a weekly report.
PRMR – preparing a monthly report.
DUAIC – drawing up the act of input control of receipt (receipt) of equipment (materials) by title.
DURCDEQ – drawing up a report on completed defects in equipment (materials).
VACIHW – verification and approval of the certificate of inspection of hidden works.
VAEXD – Verification and approval of Executive documentation.
VACLINRS – verification and approval of the certificate of inspection of responsible structures.
VAPADWA – verification and approval of the primary accounting documentation for work
accounting.
VRGJP – validation of reference of the General journal papers, technical journals.
DUODW – drawing up an opinion on the dynamics of work (monthly).
PRATRCS – preparation of a report on the actual time of rendering construction control services at the
customer's site.
PD – design and estimate documentation, project of work production.

3. Results
In the study there is a list of required documents that must be checked by the specialists of the
construction control. Below are the procedure for drawing up each document, the frequency of its
provision to the customer, the representatives of the Contracting organization.

3.1. The act of visually-measuring control
The act of visually-measuring control is made by the specialist construction control daily. In the
subsequent data for daily control of executed works at the construction site contained in the act of
visually-measuring control is transferred to a weekly report, monthly reports, General journal for
building control.

3.2. Act-prescription.
Act-the prescription is made in two copies in case of violations or observations from controlled types
(areas) of work. Compiled and handed to the representative of the contractor as of violations at the
facility.

3.3. Notice on the implementation of the act-prescriptions.
The notice shall be prepared by the contractor and sent to the address of the person who issued the
order, upon the removal of comments. Based on the received notification, a representative building
control carries out the re-survey of the facility to eliminate comments.

3.4. Weekly report.
A weekly report is compiled on the basis of performance of works on construction supervision during
the working week and is sent to the Customer on Friday.
3.5. **Monthly report.**
A monthly report is prepared at the end of the reporting period (month). The period of reporting is stipulated in the Contract for the construction supervision. As a rule, during the period of reporting was adopted 1 month. Materials for compiling a monthly report weekly reports are.

3.6. **The card object.**
The object starts at the beginning of the execution of works in building control and is updated weekly based on the weekly reports. The object window is provided to the customer upon request.

3.7. **The register control correction.**
All revealed defects in the construction of the construction facility and issued in the form of acts the provisions, with the purpose of objective control needs to be organized in the appropriate register. The registry controls the removal of comments is provided to the customer, representatives of contractor organizations upon request.

3.8. **Conclusion on the dynamics of the work.**
Conclusion on the dynamics of works shall be drawn up by specialist building control once a month and attached to the monthly report sent to the customer.

3.9. **General journal building control.**
The results of conducting the work construction supervision daily shall be entered in the General journal and construction supervision. Information will be logged for each day of the execution of the works construction supervision on the day of documentation for the control.

3.10. **Conclusion to test the readiness of the construction contractor to perform work.**
In fact the readiness of the Contracting organization issued a Conclusion on the readiness check construction contractor to perform work. Inspection shall be conducted at the time of commencement of works contractor.

3.11. **An opinion on the readiness of non-destructive testing laboratory and construction contractor for the works.**
In fact the readiness of non-destructive testing laboratory issued an opinion on the readiness of non-destructive testing laboratory and construction contractor for the works. In the absence of the construction contractor's own laboratory of nondestructive testing, provided the contract with the third party laboratory as well as documents confirming the right of non-destructive testing laboratory measurements. Inspection shall be conducted at the time of commencement of works contractor.

3.12. **An opinion on the readiness of the testing laboratory and construction contractor for the works.**
In fact the readiness of the testing laboratory issued an opinion on the readiness of the testing laboratory and construction contractor for the works.

In the absence of the construction contractor's own testing laboratory, provided the contract with the third party laboratory as well as documents confirming the right testing laboratory to perform measurements. Inspection shall be conducted at the time of commencement of works contractor.

3.13. **An opinion on the readiness of the electrical testing laboratory and construction contractor for the works.**
Upon checking the readiness of the electrical testing laboratories issued an opinion on the readiness of electrical testing laboratory and construction contractor for the works.

In the absence of the construction contractor's own electrical testing laboratory, provided the contract with the third party laboratory as well as documents confirming the right electrical testing
laboratory to perform measurements. Inspection shall be conducted at the time of commencement of works contractor.

3.14. Conclusion on the assessment of compliance of the completed project and its readiness for presentation to the working Committee.

Upon presentation by the contractor over the construction of the facility is issued a conclusion on the assessment of readiness for presentation of the working Committee.

3.15. The conclusion drawn after the notice of contractor's construction organization on readiness of object to the presentation of the working Committee.

The conclusion about the suitability of control design and working documentation for facility construction.

At the beginning of production work on a study of project documentation representative of the construction control is made the Conclusion about the suitability of control design and working documentation for facility construction. Conclusion is updated in case of making any changes in the project design.

3.16. Making the act of entrance control reception (receipt) of the equipment (materials) for the project, act on the revealed defects of the equipment (materials).

According to the results of the visual-measuring control quality of incoming equipment (materials) together with representatives of the contractor and the customer shall be drawn input control acceptance (receipt) of the equipment (materials) for the title. Thus, in the process of carrying out input control of concrete products, using measuring devices checking the geometric dimensions, surface quality, position fixings, non-destructive methods to determine the strength characteristics of concrete.

In case of detection of defects and discrepancies in the parameters of the equipment (materials) in comparison with the project observations are recorded in the statement of the revealed defects of the equipment (materials) and confirmed by representatives of the Contracting organization, construction control and customer.

In some controversial cases, there is the necessity of calling a representative of the manufacturer, the construction and examination to determine the extent of the destruction, damage and defects in products, and to assess their further used in the construction of the facility.

The acceptance control certificate of acceptance (receipt) of the equipment (materials) in the title and statement of the revealed defects of the equipment (materials) are entered as defects in the supplied equipment and materials.

3.17. The compilation of a list of observations (of reference) according to the results of the test kit documentation.

A set of Executive documentation is required at the stage of payment of individual stages of work performed, input of object in operation. The Executive documentation includes all Executive schemes, the acts of the hidden works, passports and certificates on the equipment supplied, etc. and is formed throughout the entire construction process. Without providing a full set of Executive documentation input of object in operation is legally impossible. Important is that the lack of documentation makes it difficult for future operation of the building and complicates the process for future transactions with the property. The construction control engineers assume control over the formation of Executive documentation: without a complete set of as-built documentation during the reporting period, building control will not accept from the contractor the work performed.

The results of the inspection and approval of a set of Executive documentation representative of the construction control consists of a list of observations (information). The list of observations (information) is forwarded for information and taking action to correct the deficiencies of contractor and customer.
3.18 Reporting on actual time services for construction supervision at the customer's site.
Report on the actual time of rendering services shall be drawn up by representative of building control once a month and is coordinated by the customer. The report is the basis for submission of invoices for payment for the provision of construction supervision at the customer's site. The report shall be entered the names of all professionals (in their specialization) involved in the procedure of construction control in the reporting period.

4. Conclusion
Thus, based on the results of the study to study the necessary information for the customer during the erection of the construction, the authors attempted to systematize the workflow system in the field of building control. The system is tested as standard in the construction of facilities for the energy industry.

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