Integrated assessment of contractor’s building production culture during facade repair

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Abstract. The article deals with the methodology of assessing the culture of construction production of the contractor on the object of capital repairs, in particular repairs of facades of apartment buildings. Due to the fact that the culture of production is a mirror of labor relations, a mirror of human, political and economic maturity of managers, the quality of work performed will directly depend on this. For complex assessment 8 groups of criteria were determined, which, depending on the types of work, contain various controlled indicators, estimated by the linear function of the associated values.

1. Introduction
The first thing that attracts the eye of a person when he comes to another city is the city facades. They can be beautiful or just gray and nondescript, but they attract the eye [1-2].

In most European cities, the municipalities and their authorities are very strict about who is doing what on the main streets and on the facades of the buildings and monuments. This is not surprising, because in fact, these are the components of the face of the city and it needs to be cared for and maintained properly.

In Russia, the existing regulatory documents set an overhaul period for facades for 10 years. For buildings located in the Central part of the city or on the main highways, it is 5 years.

Works on the device of systems of external warming of facades of buildings are provided only in the presence of calculation about unsatisfactory thermal technical characteristics of enclosing designs of buildings made by the specialized organizations.

In the presence of a base overhaul of the property owners of premises located in an apartment house, at the General meeting decide on preparation and carrying out of capital repairs of property, which in accordance with Chapter 6 of the town planning code and with the requirements specified in Chapter 37, § 4 of the Civil code, determine the face on which lay the obligations on implementation of functions of technical customer and conclude a contract.

Mandatory document for the performance of works on major repairs, reconstruction, and restoration on the facades is the Passport of the color solution of the facades of buildings, structures, structures. [3]
Major repairs, reconstruction, restoration and restoration of buildings should be carried out on projects including the project of works (PWR), developed in accordance with the requirements of SP 48.13330.2011 “construction organization”. [3]

For objects that are architectural monuments or valuable historical buildings and projects, prior approval and agreement should be reached with the Committee on cultural heritage.

Control over the correct performance of repair work and compliance with their recommendations Passport, design documentation, current rules and regulations should carry out customer service supervision.

Contractors for work on finishing and repair of facades are determined on a competitive basis, through tenders. As a rule, the lowest price plays a decisive role in this issue, given that the lowest bidder often wins the contract. This, in turn, fuels the environment for poor performance by contractors to generate at least some profit.

Operational parameters of the facade directly depend on the qualification and integrity of contractors. The presence of a large number of repair facilities in the city and a large amount of hidden work, due to technology, makes it difficult to control the quality of work and check the compliance of the materials used during the overhaul, which can lead to deterioration of quality.

Construction facilities are most often exposed to various risks, the most dangerous of which are fire risks. Warehouse premises, pumping stations and tank farms have been and remain the most fire-hazardous facilities. [4-9]

In spite of introducing advanced fire extinguishing technologies, combating fire risks at capital construction warehouse facilities remains an urgent and very pressing problem. Recent years have shown that major fires and disasters cannot be prevented. [5-7]

Unsatisfactory quality is more facilitated by the low level of project documentation without reference to a specific object. At the same time, often the contractor is replacing expensive certified material with a cheap analogue. The appearance of defects [8-11] contributes to the low quality of installation works that do not ensure the evenness of the walls, the involvement of organizations that do not have special training and licenses for the production of facade works.

The technical customer is more interested in the scope and timing of work, because at the legislative level, a five-year warranty is established by the contractor. However, there is no guarantee that after a while this contractor will cease to exist, which is often practiced. Therefore, it is necessary to initially force the contractor to perform all the work efficiently.

The purpose of this work is to determine the precise controlled parameters necessary for a comprehensive assessment [4-7] of the contractor’s building production culture performing facade repair work.

2. Materials and Methods

For the integral assessment of the repair and construction organization performing facade repair work, it is necessary to determine a set of criteria that affect the quality of work performed [8-10]. Then normalization of values of indicators by means of linear function of belonging of values of an indicator to a standard interval [0, 1] is carried out.

The assessment of the quality of compliance with the requirements of a separate group of indicators is calculated by the formula:

$$K_i = \sum p_i,$$

where, $p_i$ — value indicator in the interval [0, 1];

The integral rating indicator of contractors performing facade repair works, taking into account all groups of quality indicators, is calculated by the formula:

$$K_z = \frac{\sum K_i}{n} \cdot 100,$$

where, $n$ – number of indicators.

We get a 100 point system of evaluation and ranking of contractors in three main groups:

- group 1 – from 80 to 100 points;
group 2 – from 50 to 79 points;
group 3 – from 0 to 49 points.

Group 1 contractors include responsible organizations whose activities contribute to the quality of repair work.

The contractors of group 2 are medium-sized organizations whose activities require corrective measures and additional inspection visits.

The contractors of group 3 include organizations with low responsibility, whose activities do not guarantee the quality of repair work. It is recommended that the third group of contractors be removed from the work with the subsequent transfer of objects to other contractors of the highest group.

In the proposed method of evaluation there is no ranking of indicators by significance [12-16].

All indicators are adopted in the standard interval [0-not met, 1-met], which allows you to quickly identify dishonest organizations and discipline contractors in groups 1 and 2. The weight of indicators in this work is determined by their number.

3. Results and Discussion

According to the normative and technical documentation, 8 main groups and 65 subgroup control criteria were defined [3]:

1. Brief analysis and evaluation of design, technical and executive documentation:
   - Set of working drawings,
   - The project of manufacture of works,
   - Technological regulation,
   - General journal of works,
   - Log of input control of building materials,
   - Other magazine,
   - Acts of examination of hidden works.

2. Brief analysis and evaluation of technical decisions on the organization of work:
   - Plinth,
   - Slopes,
   - Blind area,
   - Entrance group,
   - Facade (Walls, parapet),
   - Facade (an Enclosure of loggias, balconies),
   - Parapet grilles on the roof,
   - Roof,
   - Window units in common areas.

3. A brief analysis and assessment of the conditions of storage and accounting of materials used at the facility:
   - Dry mixes (adhesive and plaster compositions),
   - Alkali-resistant reinforcing mesh,
   - PVC-profile,
   - Varnish,
   - Antifungal protection of structures,
   - Primer mixtures (emulsions),
   - Foam-polyethylene gaskets.

4. A brief analysis and evaluation of the organization of quality control of works on major repairs from the contractor:
   - Availability of a contract with an accredited construction laboratory,
   - Availability of an accredited construction laboratory at the facility,
   - Availability of test equipment on site,
• Qualification of the working personnel of the laboratory,
• Availability of laboratory test protocols for input control,
• Availability of laboratory test protocols for operational control,
• Availability of protocols of laboratory tests on acceptance control.

5. A brief analysis and evaluation of the preparatory work before production and during the production of capital repairs:
   • Arrangement (installation) of special auxiliary structures and devices,
   • Performance control of all mechanisms on the front lift,
   • Technology care for freshly placed repair the line.

6. Control over observance of technology of preparation of the basis of the designs which are subject to repair:
   • Performance control of all mechanisms on the front lift,
   • Technologies of care of freshly laid repair structures,
   • Preparatory work for the protection of window units,
   • Preparatory work for the protection of outdoor air conditioning units,
   • Surface preparation of facade panels,
   • Preparation of panel seams,
   • Surface preparation of window slopes,
   • Device (filling) of the inter-panel seam,
   • Priming of chips and corners of plates under repair plaster,
   • Repair and restoration of plate and seam edges, installation of beacon liner,
   • Technology of preparation of a solution for restoration of geometry of corners of a plate and a seam,
   • Restoration of the geometry of the corners of the plate and seam solution.

7. A brief analysis and evaluation of the technology of preparation at the site and the conditions of delivery to the place of installation of repair trains:
   • Technologies of care of freshly laid repair structures,
   • Organization of quality control of works,
   • Priming of slopes of Windows and doorways,
   • Preparation of adhesive solution for reinforcement of slope angles,
   • Application of adhesive composition on slopes,
   • Embedding of the angle protection profile in the adhesive composition,
   • Priming of window slopes,
   • Painting the slopes,
   • Moistening the surface of the facade plates,
   • Preparation of adhesive solution for reinforcement of slope angles,
   • Application of adhesive composition on the plane of the facade,
   • Embedding alkali-resistant basalt mesh in the adhesive solution,
   • Priming of reinforced surface for subsequent application and decorative plaster,
   • Application of protective and decorative layer,
   • Priming the surface of the facade for painting,
   • Painting of the facade surface,
   • Sealing of panel joints.

8. A brief analysis and evaluation of the technology of care for freshly laid repair compounds:
   • Shelter construction grid or screens scaffolding and scaffolding after installation,
   • Application of covering material (polyethylene film) for the period of work,
   • Application of covering material (polyethylene film) for the period of strength set by facade materials.

9. Quality control and minimization of risks in the organization of work [14-17,23].
Depending on the content and nature of the consequences taken into account, it is customary to consider risk as a multidimensional category: financial, category of deviation from the goal, probabilistic, and also used individually or together collectively [18-20].

Thus, the risks penetrate deeper into the activities of construction production, associated not only with the format of interaction with contractors, but also with the costs of attracting and retaining the client [17-23].

Table 1 illustrates the assessment form of repair construction activities for contractors performing repair work.

**Table 1. Assessment form of repair construction activity for Contractor work.**

| No | Subgroup criterion | List of controlled parameters in the group | IC* | IC №1 | IC №2 | IC №3 | IC №4 | Average score for the analyzed period | Evaluation for the analyzed period in the criterion subgroup |
|----|--------------------|-------------------------------------------|-----|-------|-------|-------|-------|--------------------------------------|----------------------------------------------------------|
|    | subgroup criterion quality control in the framework of the inspection visit | Assessment [0/1] | IC* | IC №1 | IC №2 | IC №3 | IC №4 |                                      |                                                          |

IC* - inspection control

The inspector and the representative of the Contracting organization sign the form. After signature, the data is entered into a spreadsheet to calculate the final evaluation of the contractor. For the convenience of information presentation, it is proposed to build diagrams with proper visualization of the level of responsibility of contractors.

Figures 1 and 2 show examples of the results of four inspection visits to the capital repair facility.
Figure 2. Final assessment of the contractor activity on the construction production at the capital repair facility.

In this example, the contractor received 53 points, which is assigned to group 2. The technical customer has the right to hold a final meeting directly at the inspection site to determine further actions [24-25] to eliminate violations and comments. During the meeting, it is necessary to agree on the timing of the development of corrective measures and their implementation.

4. Conclusions

Industrial culture is a part of the general culture of each resident of the country. To solve the problems of lack of culture of construction production, it is necessary to share the desire to keep your country clean and tidy. Strict norms and the absence of determining factors (all parameters must be equivalent) assessment are the key to discipline. We have a lot of work to do, first of all, on our own internal culture.

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