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FACADE STUDY METHODS

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Abstarct:
This article discusses the work on the study of modern means of monitoring the condition of buildings and structures, load-bearing structural elements and facades. The principles of operation of the device are analyzed.

Key points: facades, decoration, monitoring, construction, structures, thermal imager. scanner.

Introduction

The present time is the time of advanced innovative technologies. The rhythm of life requires the pursuit of innovations capable of making living conditions simpler, better and safer. Innovations in measurement technologies are very important because the lives of millions of people depend on the accuracy of these calculations, and all technologies that reduce measurement errors are among the most demanded.

Today, one of the biggest problems in the whole country is the technical condition of buildings and structures built ten years ago and relatively recently. This is, in particular, layering and migration of the plaster layer, failure of ventilated facade structures, failure of facade cassettes, which causes many injuries and even death every year.

Many buildings and structures in all cities of our country need constant monitoring during operation. In addition, during repair, reconstruction, and restoration, it is necessary to comprehensively study the finishing layer, as well as the lifting structures, because their damage poses a serious problem and threat to people's lives and health. Currently, the construction of many preserved structures is being restored, and their foundations and load-bearing structures must also be carefully examined.

When examining the facade of the building, the expert has to perform the tasks of determining the volume, quality, materials used and the price of the completed works. The adopted technical decisions were evaluated in terms of compliance with the requirements of the applicable standards. Various normative documents are used in conducting the expertise: GOSTs, construction rules, methodologies, among which the following can be distinguished:

- A.Y. Butirin methodology "Determining the types, size, quality and cost of construction, assembly and special works on construction, repair (reconstruction) of construction objects".
- BRR 1.04.01-22 "Inspection and monitoring of the technical condition of buildings and structures [1].

- BRR 3.01.08-99 "Organization of capital repair of residential and public buildings and structures" [2].

- BRR 3.01.09-97 "Rules for acceptance into use of capital renovated residential and public buildings and structures" [3].

When performing facade work, depending on the tasks to be solved, experts should perform the following:

- study of all existing technical and permits, assessment of compliance with all modern legislation and technological requirements;

- carrying out all measurements and observations directly at the object, if the buildings are very high, special workers are invited, which allows monitoring the condition of the facade elements throughout the area;

- determination of costs by making calculations with the existing nomenclature of estimate norms in accordance with the information available to experts of the project, working and executive documents;

- after the instrumental inspection, final documents are prepared, including a full report on the actions taken and the results obtained.

Reasons for premature deterioration of the facades of houses and buildings:

- Air temperature instability and sharply changing amplitude.
- Improper selection of materials for facade parts and constructions.
- Violation of technological process rules during restoration, reconstruction, repair or reconstruction of buildings and facade parts.
- High relative humidity not taken into account in the project.
- Mistakes made by designers and builders when performing thermal insulation of the facade.
- Improper execution of assembly seams on the facade.
- Risk of failure of connection between different parts of the facade.
- Cases of gross violations of building and facade usage rules and regulations.
- And, of course, when it is necessary to determine the level of correctness of the work, there are widespread cases of disputes between the customer and the contractor.

During construction, due to the above-mentioned mistakes, the original perfect appearance of the building may be lost. If the damage continues, the integrity of the building may be lost and there is a risk of collapse.

Therefore, inspection of the facade is one of the mandatory studies for many types of houses and buildings. It is also performed when there are visually detectable cracks in facades or walls. As with many other investigations of construction materials, structures and buildings, the study of walls and facades is carried out by the method of "non-destructive testing". At the same time, no changes will be made to the integrity of materials, coatings, structures and their condition.

The study of facades, walls and other elements is carried out as follows:

- Visual inspection of external parts and coatings, identification of specific defects;
- Non-destructive testing of the facade system and testing of samples in the laboratory;
- Carrying out measurement works;
- Technical monitoring with the installation of beacons in identified cracks;
- Analysis of the quality of waterproofing works.
- Analysis of the quality of work on the performance of thermal insulation.
- Analysis of their actual situation.
- Inspections - whether the necessary technologies have been implemented in the construction of facades and walls.

- Visual analysis and control of the condition of facades and walls.
- Checking the compliance of all studied constructions with the project, drawings, schemes.
- Checking compliance of all used materials with GOST, BRR.
- Analysis and determination of structures in terms of strength.
- Other actions that may be required.

Facade studies conducted by experts in many cases face difficulties due to the impossibility of determining their condition during in-kind inspections, because often these works are types of work that are closed. During construction and technical examination of facades, it is necessary to consider some defects encountered by the facade system.

Some of the most common causes of defects found during facade inspections are:

- skin is characterized by the use of materials with different levels of durability, strength, moisture and cold resistance;
- non-uniform load-bearing walls in terms of the degree of influence of deformations;
- insufficient resistance of constructions;
- Violation of harvesting technology and temperature regime in winter;
- freezing of the mixture, the main part of defects (at least 70%) will not appear immediately.

Mainly during the warranty period. This period is usually 1-2 years. The main method of monitoring and identifying problem areas is physical inspection, as well as "hitting" with a hammer. This method is very inefficient and time-consuming, and such an assessment is subjective and depends on the characteristics of the researcher's professional experience and approaches. A list of defects is drawn up during visual inspection; drawings of defects with specified areas and sizes of damage; constructive, technical, artistic or other cases are given.

Today, modern technologies based on the use of visual methods, the latest advances in the field of 3D laser technologies for surface scanning are accepted. All this allows you to quickly collect objective data on the size of problem areas and dangerous zones to assess the condition of various types of facade systems.

Modern technologies of laser 3D scanning are widely used in various fields of human activity. The construction industry is no exception. During the technical inspection of buildings and structures, it is necessary to choose the most effective method depending on the situation and the assigned tasks. The article considers the expediency of using laser 3D scanning technology in the production of construction and technical expertise.

Methods: 3D laser scanning of building facades is based on determining the spatial coordinates of the building surface with the help of a laser range that measures the distance at all detectable points. The scanner beam passes through a scanning matrix with an adjustable number of columns and rows. The survey is carried out at a speed of 1000 measurements per second, and the higher the density of the scanning grid, the higher the density of points on the surface of the object.

The result of the device is a set of 3D coordinates (scanners) points. Their number can reach several million. This allows you to find changes in the facade during repeated inspections with an accuracy of 1-1.5 mm. In order to prevent the load-bearing elements of individual structures of buildings and structures from losing their load-bearing capacity, the main measures of seasonal monitoring of facades from accidents are necessary:

As research methods, visual inspection of external parts and coatings of facades, photo fixation, identification of visible defects and inspection of the facade system using thermovision inspection methods, as well as for dangerous zones of the plaster layer, water saturation and heat loss zones, etc. measures for thermograms are used. Thermovision control methods are used in conditions of stable low outside temperature, rain, snow and calm weather. When conducting this study, the building must

be connected to central heating systems for at least two weeks, and the barrier structures must not be exposed to sunlight for at least twelve hours. All this is presented in ISO 6781-83 "Thermal insulation. Qualitative determination of thermal engineering defects in barrier constructions. Requirements of the international standard "Infrared method".

Thermal imager device and principle of operation. The principle of operation of the equipment is to receive infrared radiation from any surface located in front of the reading matrix of the device. With the help of special miniature thermoresistors sensitive to even the slightest heat, the device analyzes the temperature of the object and gives the result. The matrix in the thermal imager is a microcircuit with a set of special diodes, characterized by the property of changing resistance depending on the intensity of infrared rays.

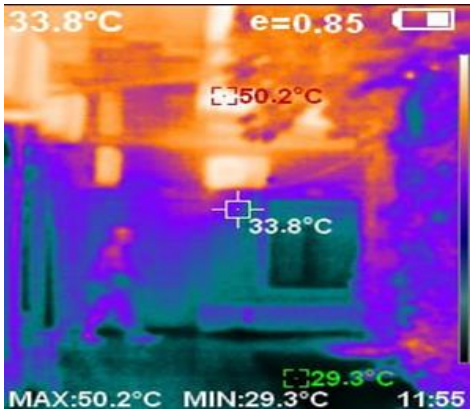
Accurate information about heat loss in the building can be obtained through the 3D model obtained with the help of thermal imagers. For several years, with the participation of professors-teachers of the "Construction of Buildings and Structures" department of the Fergana Polytechnic Institute, research is being conducted on the assessment of the technical condition of buildings and structures located in the Fergana Valley. Below are examples of research conducted.

Figure 1. The results of the study of heat loss in the apartment using a thermal

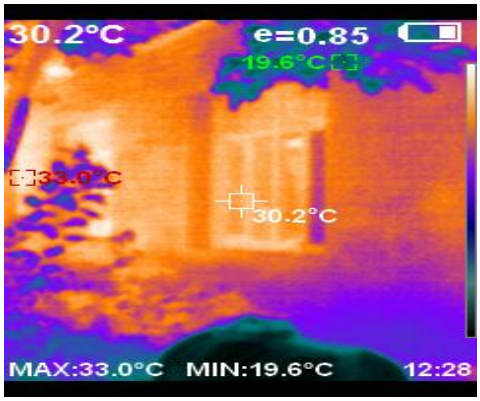
Figure 1 shows the cold paths indicated by the device with arrows. Dark gamma means low temperature, and yellow and red mean high temperature. All information is provided to the monitor in true real-time mode. A photo or image displayed by the device is called a thermal card. A scale is noticeable in the photo, which allows you to estimate the exact temperature of a certain object, as well as the date of the survey.

a)

b)



v)



g)

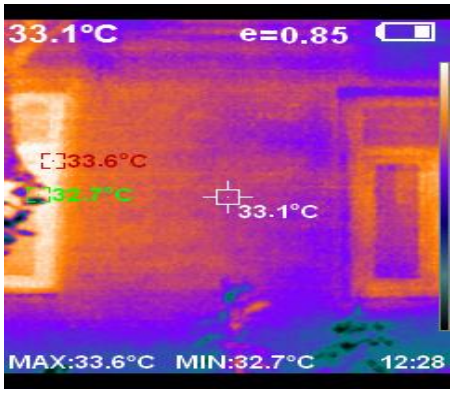


Figure 2. As a result of laser scanning: a- "Aqshom" teahouse building located in Andijan city; b - measurement results obtained from the building of "Aqshom" teahouse located in Andijan city: v and g - measurement results obtained from 50 school buildings in Andijan city.

A high-resolution 3D model obtained by laser scanning allows you to obtain reliable images and dimensions of any facade, room, structure or part without leaving the workplace (Fig. 2).

Thus, seasonal monitoring of the emergency condition of building facades is carried out using one of the main methods of building expertise - building thermography. A comprehensive inspection of the facade is carried out in relation to the load-bearing elements of the facade; decorative and functional layers; devices for fastening various components; drainage systems; thermal insulation, if any.

Summary. A technical report will be drawn up based on the results of the conducted research, in which the obtained data will be recorded and reasonable conclusions will be drawn. Such a conclusion can be the basis of the technical assignment, firstly, for urgent emergency work; secondly, for instrumental contact studies; thirdly, for the facade system reconstruction or capital repair project. If the conclusions of the experts reveal that the building or facade cannot be used any further, the responsible persons should immediately take appropriate decisions. The use of laser 3D scanning in the inspection of small-scale structures is not very economical, since the duration of the work is the same as that of traditional inspection methods. But if more complex objects are checked, then it is possible to save a lot of time and this will certainly bring additional income.

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