Methods of inspection of industrial buildings and structures. Modern non-destructive material strength meters

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Inspection of buildings and structures is a multi-functional, complex, organized and responsible activity that requires precise compliance with the norms and standards of the availability of all permits. Access to all works, control and supervision of the technical condition of all building structures have organizations that work and operate officially and have legal relevant licenses. All this is a set of organized measures and actions to assess the entire technical condition of all building structures of buildings and structures for industrial purposes, all this is carried out in order to develop and develop solutions based on this assessment and further the need for various types of construction work repair, reconstruction or demolition.

The main set of work on the survey and study consists of several stages:

- completion and analysis of all existing project documentation provided, analysis of past and previous planned surveys;

- inspection of structures as well as individual nodal joints of the building with the help of devices and sensors, such as laser tape measure, strength gauge, crack gauge, UCS and methods for studying the monitoring of the technical condition of the structure, building;

- identification and spot and general photofixation of existing defects, destructions and damages of building structures;

- processing of all survey data, execution of defective building statements;

- preparation of a technical report, including a list of identified defects, supporting photographic materials, calculations, explanation of the causes of defects and the consequences to which they may lead, recommendations for the elimination of existing defects and damage;

There are several methods of inspection of buildings and structures:

— visual-used at the initial stage of the survey of the building for the purpose of visual identification

- ultrasonic-one of the special cases of the acoustic method. It is used to detect hidden material defects and determine the strength of concrete, as well as to determine the depth detection of cracks in concrete or masonry, analysis of the quality of welds and the thickness of metal structures;

- electromagnetic-used to study the structure, thickness and hidden defects of foundations, under-rail foundations of crane tracks;

- radiometric — used to determine the density of concrete, stone and bulk materials

-neutron — used to determine the density of concrete and stone;

- electro-optical-used to determine the vibration parameters of structures;

- the method of separation with chipping and the method of compression-are used to determine the strength of concrete;

- plastic deformation method-used to determine the strength and deformability of the material;

- neutron-used to determine the moisture content of concrete and stone;

- pneumatic-used to determine breathability;

- acoustic-in the narrow sense of this term, it is used to determine the sound conductivity of walls and floors;

- thermal imaging-used to determine the level of thermal protection of the building, to diagnose water supply and heating systems, to determine the zones of abnormal overheating of electrical appliances;

- leveling, theodolite survey and photogrammetry-used to determine the volumetric deformation of the building, as well as to determine the foundation sediment;

It should be noted that in some cases, to obtain the most accurate and reliable information, it is necessary to use methods with partial destruction of the body of structures. For example, the most complete information about the strength of concrete can be obtained by taking cores for laboratory studies.

Tests of building structures are used to confirm their sufficient load-bearing capacity, and can be:

- carried out until the complete destruction of structures (allows you to determine the maximum load-bearing capacity of this building structure);

- carried out before the calculated loading (in order to determine the sufficient load-bearing capacity for the design loads);

Based on the results of the survey, a technical conclusion is drawn up, including:

- a description of the identified defects and violations with reference to the object, a description of the causes of damage;

- explanatory photo materials;

- graphic materials of the survey (plans, sections, diagrams of structures);

- references to the requirements of building codes;

- the settlement part;

- conclusions and recommendations;

- recommended schemes for strengthening structures; All survey methods are divided into:

- non-destructive;

— with partial destruction of the structure body;

At the stage of inspection of structures, it is necessary to determine the exact values of the strength characteristics of building structures. To do this, it is necessary to use devices for quality control of building materials during the survey of buildings and structures. Let's look at some of them:

1.The ONYX2. 6 shock-pulse strength meter is designed to determine the strength of cement concretes, mortars and other composite materials by the shock pulse method according to GOST 22690 during technological control of products and structures, inspection of buildings and structures, on construction sites and hydraulic structures.

The device can be used to determine the strength of bricks, hardness, uniformity, density and plasticity of various composite materials. [1] The device is available in two versions:

- ONYX-2.6-a device with a two-parameter measurement of the strength of the impact pulse and rebound in the range from 1 to 100 MPa.

- ONYX-2.6 LB-a device with a two-parameter measurement of the strength of the impact pulse and rebound in the range from 1 to 30 MPa for the control of light concrete and various materials (brick, plaster, composites, etc.).

For high-quality concrete, the device is used

ONYX-2.6 WB with two-parameter measurement of the impact and rebound strength in the range from 1 to 150 MPa.

The device is designed to operate at ambient temperatures from minus 10 °C to +40 °C and a maximum humidity of 90 % at a temperature of +25 °C.

Fig. 1. General view of the ONYX — 2.6 device [1]

The device corresponds to the ordinary design of products of the third order according to GOST R 52931-08.

2. ONYX-1 material strength meter. The OS is designed to determine the strength of concrete by the method of separation with chipping in accordance with GOST 22690-88 during technological quality control of monolithic and precast concrete, inspection of buildings, structures and structures.

The device can be used to establish and correct the calibration characteristics and dependencies of shock-pulse and ultrasonic strength meters of non-destructive testing.

The devices are available in two versions:

- version 1-ONYX-1. Os. 050 - with a load measurement range from 5.0 to 50.0 kN;

- version 2-ONYX-1. Os. 100 - with a load measurement range from 5.0 to 100.0 kN;

Operating conditions — temperature range from minus 10 ° C to plus 40 ° C, relative humidity at plus 25 ° C and 4 below without moisture condensation up to 90 %, atmospheric pressure from 84 to 106.7 kPa.

3. The ONYX-SR device is a modification of the ONYX strength meter and is designed to measure the strength of concrete by chipping a rib in accordance with GOST 22690-88 during technological quality control of monolithic and precast concrete, inspection of buildings, structures and structures. [1]

The device can be used to establish and correct the calibration characteristics and dependencies of shock-pulse and ultrasonic strength meters of non-destructive testing.

Operating conditions — temperature range from minus 10 to plus 40 °C, relative humidity at +25 °C and below without moisture condensation up to 90 %, atmospheric pressure from 84 to 106.7 kPa. The device corresponds to the ordinary design of third-order products according to GOST 12997-84.

3. The Pulsar-2 ultrasound propagation time and speed meter, modification Pulsar-2.2, is designed to evaluate the properties and flaw detection of solid materials by the time and speed of propagation, and the shape of the received ultrasonic (ultrasonic) pulses during surface and through sounding.

The device allows you to detect defects, determine the strength, density and modulus of elasticity of building materials, as well as the sound index of abrasives according to the pre-established calibration dependences of these parameters on the speed of propagation of ultrasonic pulses.

Main applications:

determination of concrete strength according to GOST 17624-87 " Concrete. Ultrasonic method for determining strength " for technological control, inspection of buildings and structures, including in combination with the method of separation with chipping (ONYX-OS device) and the method of chipping edges (ONYX-SR device).

- search for defects in concrete structures by abnormal speed reduction and by the shape of visualized signals of ultrasonic pulses;

- assessment of the depth of cracks;

- assessment of porosity, fracturing and anisotropy of composite materials and rocks;

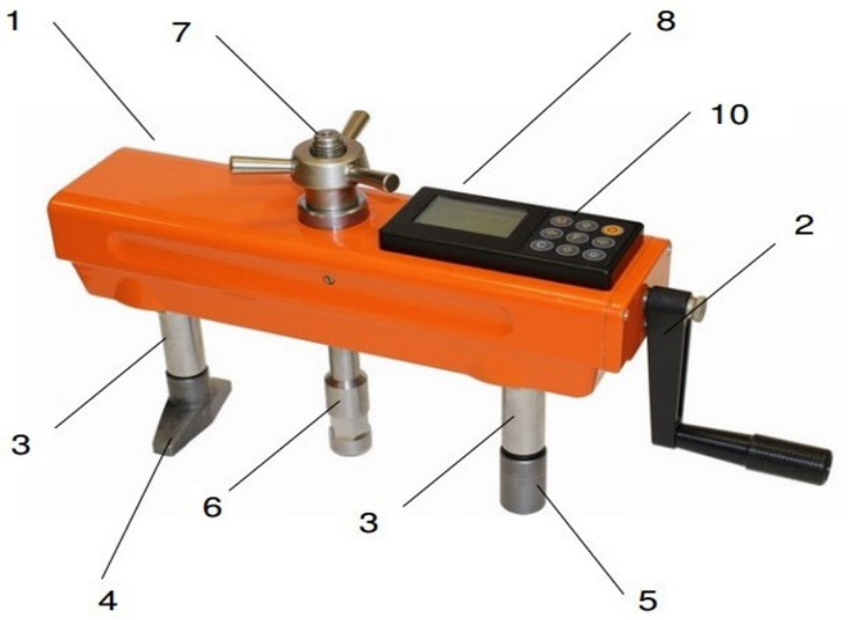

Fig. 2. General view of ONYX-1. Os. 050, ONYX-1. Os. 100 devices [1]: 1-housing; 2-drive handle; 3-hydraulic cylinders; 4, 5-supports; 6-traction; 7-steering wheel; 8-electronic unit; 9-USB connector

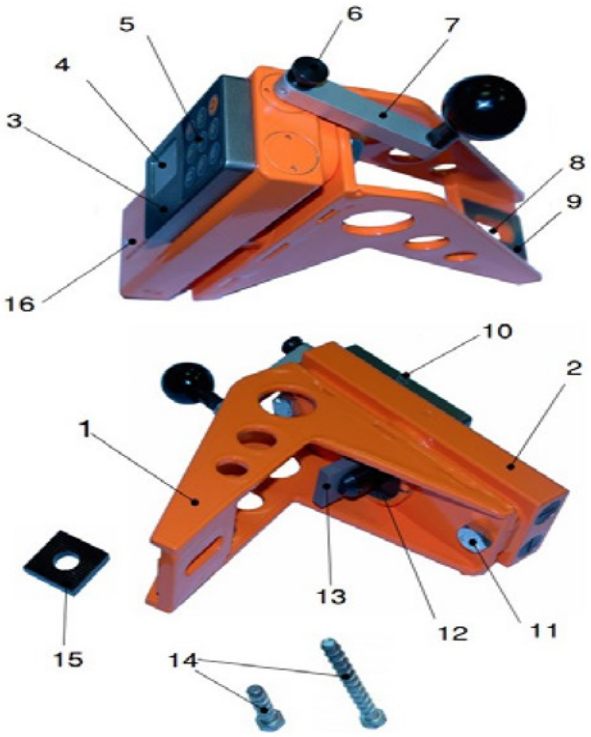

Fig. 3. General view of the ONYX-SR device [1]: 1-L-shaped power bracket; 2-housing; 3-electronic unit; 4-graphic display; 5-keyboard; 6-screw; 7-drive handle; 8-adjustment groove; 9-platform; 10-USB connector; 11-mounting bolts; 12-power piston; 13-chipping element; 14 - screws on concrete; 15-pressure plate; 16-battery compartment cover

Fig. 4. General view of the PULSAR-2.2 device [1]: 1-electronic unit; 2-through-sounding sensors; 3-surface-sounding sensors; 4-keyboard; 5-graphic display; 6-connectors for the surface-sounding sensor; 7-USB connector

- determination of the elastic modulus and density of materials.

The device is available with a basic setting, focused on heavy concrete of medium grades. For other brands and materials, calibration and adjustment in the user's conditions is required in accordance with GOST 17624, GOST 24332 and the methodological recommendations of MDS 62-2.01 of the State Unitary Enterprise "NIIZHB" for the control of the strength of concrete of monolithic structures by the ultrasonic method of surface sounding.

The device provides operation:

- for surface sounding with a surface sounding sensor assembly on a fixed base (120 ± 1) mm with a dry contact;

— for end-to-end sounding with end-to-end sounding sensors on an arbitrary base with contact lubrication, or for surface and angular sounding with dry contact (cone nozzles).

Operating conditions: temperature range-from minus 10 °C to plus 40 °C, relative humidity up to 80 % without condensation, atmospheric pressure 84 ... 106.7 kPa. [1]

Thus, devices for measuring the strength of building materials by the non-destructive method are only a means for determining the main characteristics of materials, which should be the basis for modeling the processes occurring during the operation of buildings and structures .

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