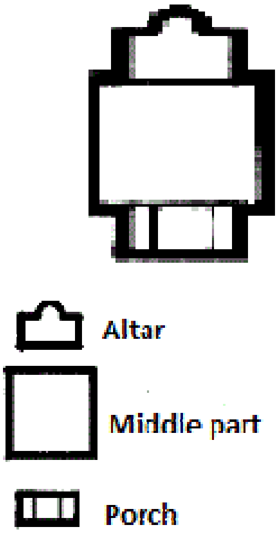

Fig. 2. Plan of the Church

Fig. 3. The modern view of the temple

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USE DEPENDENCE OF "STRENGTH-HARDNESS" AT INSPECTION OF REBAR WITH A PORTABLE HARDNESS TESTER

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Development and improvement of methods and means of control the technical condition of reinforced concrete constructions of residential and industrial buildings, as well as special constructions is one of the most important areas in the field of quality control of materials and products. So at detailed inspection of reinforced concrete elements of buildings and structures a priority is to determine the parameters of reinforcing steel.

The main task of this work was to analyze the possibility to practice the correct use of the method of control of reinforcement strength by measuring the hardness, definition, depending on the hardness of the transition to a class of reinforcing steel used in prestressed structures.

Most of the normative documents and technical literature that describe the rules of inspection buildings and constructions, offering advice on how to of control the parameters of reinforcing steel. But not all of the methods allow to reliably determine the unknown parameters. Some of the methods deprecated, some is practically not used because of the difficulties that accompany their use.

It is considered to be a promising nondestructive method that allows to determine the class of reinforcing steel for the measurement of hardness. A lot of work is devoted to the relationship between the strength and hardness of steel today. The fundamental relationship for steel is reflected in GOST 2276-77 "Metals and alloys. The method of measuring the strength of Brinell hardness testers static effect portable."

This method is applied based on the fact that the dependence of the parameters of the strength of steel and its hardness parameter. There is a wide choice portable instrumentation, which allow to determine the hardness of the steel at the facility. The samples do not need to extract when using this method, it reduces the volume of work to identify the class of reinforcing steel tensile, and to restore the damaged bearing capacity of the building structure.

The main methods that are used at the facility - a dynamic, ultrasonic and static. In the dynamic method is defined indirect characteristic - the ratio of the speed at impact and rebound of the indenter from the surface of the sample.

The oscillation frequency of the indenter when introducing the sample to a certain depth, the measuring parameter is the ultrasonic method. Values indirect characteristics in further transferred to the hardness value of the calibration dependence, embedded in the device.

Static hardness measuring method is one in which the indenter is slowly and continuously pressed into the metal to be tested with a certain force. For static methods include: measuring the hardness of Brinell, Rockwell and Vickers.

When using stationary hardness testers provide accurate measurements much easier. Because stationary devices and less error can properly prepare the surface of the selected samples. But the latter, plus the main drawback - the need to select the sample that requires a lot of labor costs, and can be done not always. Thus, despite the increased uncertainty, prefer to use portable measuring devices, which avoid the implementation of sampling. And in spite of the existing theoretical and instrument base, the correct execution of hardness measurements on reinforcing steel enclosed in concrete structures, and the implementation of a clear translation to measure the strength of the reinforcing steel is not easy.

Using any of the methods of non-destructive testing hardness requires compliance with certain requirements to the measurement site, and its surface. These requirements include:

– minimal surface for applying dynamic measurement method must be at least 10 mm, and the ultrasonic - 5 mm;

– roughness of the surface to be measured with most methods of measuring hardness (both portable and stationary devices) must be less than 0.32 mkm (Ra). [2]

Ensure the implementation of the above conditions can be by treatment with abrasive discs mounted on angle grinders (LBM). After the cut-off section of the reinforcement and the necessary creation of a platform the size and evenness of the surface post-treatment is performed with sandpaper and corresponding nozzles on angle grinders.

When using mechanical treatment by grinding properties and structure of the surface layer are changed steel reinforcement. This is mainly due to the influence of two factors: high temperature and hardening due to plastic deformation of the metal surface layer.

When grinding small-sized devices such as angle grinders in operation intermittently, the heating temperature reaches the steel 100-200℃. When working without interruption, and the periodic cooling of the surface temperature can reach 300℃ or more. At achievement of specified temperature steel may be low temperature and medium temperature tempering. At this strength, ductility and hardness of the surface layer may be changed. [4]

In addition to the high temperatures in the cutting zone (grinding) the surface metal layer undergoes a substantial plastic deformation, which are residual after treatment. These deformations lead to the formation of residual stresses in the surface layer of the element, and to modify the strength and hardness due to work hardening. The depth of the modified layer depends on the cutting speed, tool feed force, the direction of grinding, abrasive grain, and other factors. It is known that the thickness of these variations can vary from tens to hundreds of microns.

Thus, using portable devices with low penetration depth of the indenter (static, ultrasonic), the measurement result can be obtained with a significant difference from the truth. On the other hand, these methods are characterized by greater flexibility for application on site, since the measurements can be performed on the elements smaller in size and thickness, lower mass and greater curvature.

For the application of portable hardness on the side of the reinforcing bar is necessary to investigate the effect of treatments on rebar and choose the optimal appearance and behavior. After solving the problems with the preparation of the surface measurement and control method of choice arises the important question: what kind of relationship used to determine the strength of the steel hardness.

Most publications listed depending obtained in the study of steel rolled profiles (channels, I-beams, and others.) used for structural steel elements. These steels are characterized by a relatively narrow range of strength, a small variety of brands and simple way to improve the thermal.

While there are no definitive results about the impact of various types of steel, which are produced rebars as well as types of thermomechanical hardening fixtures, the state of stress and other factors on the existing relationship. In the work, the essence of which is set out in the article, an attempt to find the relation between the hardness of rebar and its class. As the prototypes were considered construction of prestressed reinforced rods classes AIIIB, AIV, AV.

Also, the effect of the testimony has hardness depth of cut surface, as the cross section of the reinforcing bar hardness is not uniformly distributed, near the surface of the sample values are higher compared to other readings.

Measurement of hardness were performed on the side of the pre-polished specimens of different diameters. Each rod was made of 10 individual measurements and then averaging the hardness values. To determine the hardness, depending on the size of the slice samples thin sections were made of different depths. The thickness of the shear layer was administered - 1 mm, 2 mm, 3 mm. The experimental results are shown in Table.

Indications static hardness depending on the depth of reinforcing steel

Class of reinforcing steel	AIIIB			AIV			AV		
The diameter of the rod	20			12			10		
Slice thickness	1mm	2mm	3mm	1mm	2mm	3mm	1mm	2mm	3mm
Results	12,4	11	10,7	16,8	22,7	22,7	29,7	30,8	30,7
	14,6	13,7	12,4	27,5	23,8	26,2	35,3	31,1	31,6
	15,2	14,3	12,7	27,7	24,9	26,8	36,5	31,9	31,7
	19,2	15,1	13,1	30,2	27,5	26,9	36,5	32,7	33,1
	19,7	16,1	13,1	30,5	28,5	28,5	37,4	32,7	34
	21,1	19,3	16,1	30,7	28,6	29,2	37,6	33	34,2
	21,9	20	16,7	30,8	29	30,5	38,3	33,6	34,8
	22,1	20,3	16,9	32,8	29,9	30,5	39,4	34,4	36
	27,7	20,5	16,9	33,7	31,2	30,6	39,9	35,8	38,4
	29,4	21,6	17,2	36,1	34,7	31,1	40,2	36,3	41,3
The average values	20,33	17,19	14,48	29,68	28,08	28,3	37,08	33,23	34,58

According to the data of Table 1 clearly that the testimony of the strength of the valve is not uniform in cross-section and have a maximum value at the outer surface, so when tested at the facility must take into account the magnitude of the shear layer of the surface treatment.

The results of the test can determine the relationship between the strength of samples and a strength that will help us in determining the class of reinforcing steel.

$$\sigma_B = 34 \cdot HR + 50. \quad (1)$$

To determine the dependence of the above sampling was made, six for each of the test of classes. For each sample were carried out on a tensile testing machine and hardness using a portable hardness tester Constant K5U. Test results are plotted in Fig. 1.

After receiving the experimental depending on the hardness of the transition to a class of valves, turn to the use of this method directly on the site.

Examination performed on the prestressed slab, which reinforcement can of classes: A-IIIB or A-IV (Fig. 2).

Testing performed on the real object repurchased by the CM to change the purpose of the administrative building in the category of production. In accordance with the technical project for intermediate floor plans to install machines for the production of glass fiber. When using valves class S540 (A-IIIB) plates bearing capacity is only sufficient for the perception of its own weight and live load of 200 kg / m3, therefore, was required to clarify the reinforcement class.

To begin with we define the position of the valve design using electromagnetic device PPE 10H. Showdown refine diameter valves.

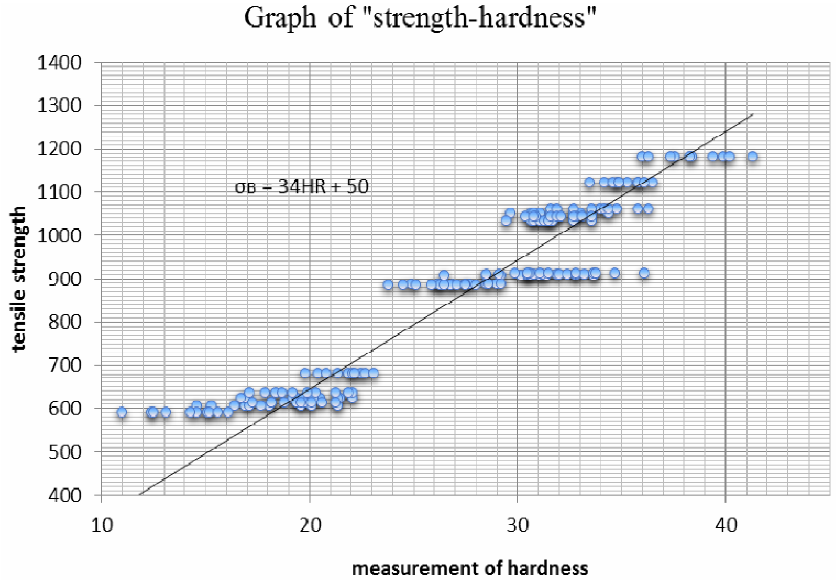

Fig. 1. The linear dependence of the strength of the of reinforcing steel hardness.

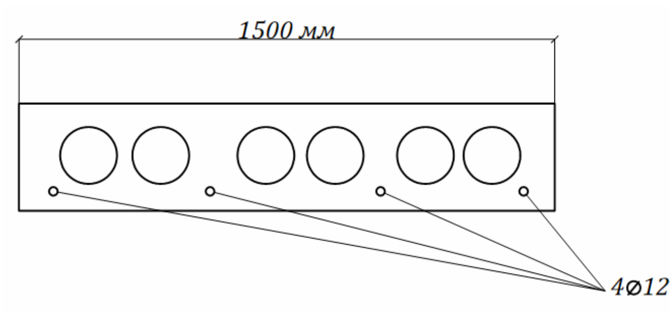

Fig. 2. Prestressed plate

Area opening fixtures is finished to the size needed to determine the strength of the hardness constant K5U.

The width of the open area must be not less than the diameter of the nozzle hardness, the length should allow to produce at least 5 measurements. According to GOST 22761-77 "Metals and alloys. Method for measuring Brinell hardness portable hardness static effect" the distance between centers of two adjacent prints should not be less than six diameters footprint that is approximately 10 to 15 mm. Since for each sample was carried out five measurements: receive region opening size of from 65 to 95 mm in length and from 12 to 16 mm in width.

With the angle grinder or drilling machines with a special nozzle grinding is performed at the site of action of minimal bending moments without compromising the anchoring.

The surface of the product at the place of the test is finished to a desired roughness using a small nozzle grain. Roughness should be no more than Ra = 0.32 micrometers.

In view of the prior measurement readings are taken at a depth of 3mm thin sections.

Tests have been conducted hardness Constant K5U. The results obtained are processed with subsequent averaging.

Hardness is defined as the arithmetic mean of the five measurements performed, based on the previously obtained relation:

$$\sigma_в = 34 \cdot 26 + 50 = 934 \text{ МПа}.$$

This value falls within the range of values for the class A-IV (A600).

In parallel with the hardness test was carried out controlling the sampling valves in place of the projected performance of the opening process, the procedure for the test GOST 12004.

Tensile strength $\sigma_в$=950,85 MPa.

Accuracy of measurements is 1.8%, which suggests the possibility of using this method in practice.

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CHEMICAL ADDITIVES IN MONOLITHIC CONSTRUCTION

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Application of precast concrete construction gives more flexibility in a variety of architectural design projects under construction. Designing of objects in this case is carried out taking into account the actual operating loads, which allows us to differentiate the class of concrete reinforcement and height of the building. But to continuous use subject to stringent requirements for concrete mixes, the properties of which can be controlled by inputting various chemical additives.

Today the main material for the construction of high-rise buildings is a reinforced concrete. The potential of reinforced concrete as an excellent structural material allowing to build bright buildings with sophisticated architecture, not used to the full.

Over the years the way of constructing buildings using precast concrete could not compete with precast concrete on the two most important indicators - labor costs and construction time. An important problem is the management and the concrete work on the construction site in winter. Now there are developments that give the opportunity to build solid houses with rates comparable to or even greater than, the use of precast concrete. Construction of monolithic concrete advisable for individual projects for buildings and complexes that perform the role of urban accents, the historic center, for buildings in the complex development of monolithic houses neighborhoods in cities and towns, as well as for the building of combined systems that provide a combination of monolithic structures with teams, brick and others. Possibilities of implementing complex plans depend on the structural formwork systems. Thanks to the advent of various formwork systems of the building, constructed in situ reinforced concrete, are becoming increasingly complex architectural outlines. One could argue that developed the formwork system can solve a variety of tasks.

Effective methods of curing concrete in winter conditions, allows to erect concrete and reinforced concrete structures in virtually all outdoor temperatures without compromising their quality.

Compared to the precast concrete monolithic concreting has several advantages. The advantages of this technology is the high pace of construction works. Designing of objects in this case is carried out taking into account the actual operating loads, which allows us to differentiate the class of concrete reinforcement and height of the building. No need for inserts and lifting lugs for mounting designs. This allows to reduce material of construction, in particular to reduce the consumption of concrete and metal. Preparation of concrete at the construction site to reduce transport costs to a minimum. The area does not include the building of special areas foreseen for equipment and storage of concrete products and is limited to the construction site. One of the advantages precast concrete is a good job on the dynamic and alternating loads.

However, reinforced concrete has its drawbacks. For a continuous supply and laying of concrete mix requires precision and highly skilled workers. Tough requirements apply to concrete mixes that, on the one hand, need to be easily moldable, and on the other - have a sufficiently rapid fixation patterns for rhythmic lifting sealed, light and mobile formwork. Mark used concrete, usually well below the factory due to the smaller capacity of improvement of production technology.

The main problems associated with the expansion of the construction of monolithic buildings can be classified:

– danger of technology cracks in the monolithic structures of temperature and shrinkage deformation of concrete in the process of curing, depending on the composition of the concrete, curing conditions and the size of plots concrete structures;

– a reliable estimate of the strength of hardening concrete at the time of stripping and transfer the load from the overlying elements in the design, in which the concrete has reached its design strength;