transmission warmth lost by the heated room, for heating of the in-coming external air in the interglass space of a double-glazed window.

According to technical specifications the ratio of the area of a ventilated window double-glazed window of $F_{ок}$ to the area of a floor of F_n of the heated room has to be $F_{ок}/ F_n > 1/5$ since heat losses through windows are completely excluded and the pressure on the heating system is also decreased.

Orientation of the building has to be by the short facade to the north for the greater use of the natural component of solar radiation for the purpose of additional heating of the incoming external air through the ventilated double-glazed windows located on facades of the building, lit by the sun.

The comparative analysis of the research done on the assessment of the efficiency of recuperative heat exchange during infiltration of air through ventilated double-glazed windows of various designs shows that external air heats up most effectively and intensively through two-layer BI, three-layer BV and three-layer with vacuum in the interglass space of BIV double-glazed windows. According to technical specifications the three options are similar, but because of complexity of production and the greater cost of the materials used for three-layer glazed windows a two-layer glazed window BI should be preferred. It is economically correct both in terms of the simplicity of design and moderately cold climate of Belarus.

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MEANS OF IMPROVING THE QUALITY OF THE SURFACE OF CONCRETE PRODUCTS

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The article discusses the main ways to improve the quality of the surface of concrete products, in particular, the solution of the problem by adjusting the composition of concrete with special additives, lubricant selection, and the selection of modes of ramming concrete mixture.

Not always the quality of the finished surface of the concrete product complies with the requirements prescribed in the Standard. In order to achieve the desired surface quality of the finished product additional finishing is required which results in a major expenditure of time and resources, and increases the cost of concrete products. The provision of the full operational readiness of the surface of finished products in the process of forming contributes significantly to the reduction in labor intensity.

The task of improving the quality of the surface of concrete products is solved by means of various methods. The most commonly used methods are as follows:

- The selection of concrete mixtures with special additives;
- The choice of special grease;
- The use of a polymer coating forms;
- The selection of mode of ramming concrete mixture.

The requirements for a high degree of accuracy in the process of manufacturing concrete constructions, surface quality and appearance requirements of structures are prescribed in GOST 13015.0. [1] Concrete surface designs are divided into categories A1 to A7. There should be no shells, rolls and depressions on the surface of A1 category. The surface is glossy and it does not require a topcoat on site. Individual shells of no more than 2mm are allowed for the category of concrete surface A2. But in this case the manufacturer must prepare the surface for improved color (that does not require filling at the construction site) by means of additional operations.

There is a certain specificity of selection of concrete with chemical additives depending on the type of additive and the function of concrete [2]. The method of selection of concrete with chemical additives provides

for an adjustment to the initial composition of the concrete to obtain the required quality parameters. Generally, the adjustment of concrete with additives is produced in accordance with the results of experimental verification of the performance properties of the concrete mix and concrete.

In the first step the optimal composition of concrete is set. The second step is the ascertainment of the minimum amount of the additive, which when added to the composition of concrete results in the maximum effect of the action.

In a number of publications among the additives improving the surface quality of concrete products it's recommended to use "The plasticizer C3", Defomiks, Reomax PC3031FL, and a number of complex additives.

One of the operations in the manufacture of concrete products in the form is mold release. The poor quality of the surface of concrete products could be caused by the use of low-quality lubricants, as well as the uneven application of grease on the surface of the mold.

At present, the lubrication Emulsol has received wide application in our country [3]. However, a perfect lubrication has not been developed so far. Any lubrication, together with positive effects, has drawbacks. Many lubricants that have been used before, do not meet modern requirements. So Emulsol is quite often replaced by more efficient lubricants.

Shatov A.V. has made a review of new lubricants providing the highest quality to products [4]. The paper presents data on the group of lubricants "Polyplast". Lubricants "Polyplast" are divided into two groups-the universal oily lubricant "Polyplast Form" and the emulsion lubrication "Polyplast EM". The grease "Polyplast Form" in its turn is subdivided into Polylayer Form 1 and Form 3. Polylayer Form type 1 is perfect for use on vertical surface; it does not flow when applied. It prevents jamming of air bubbles at the interface of surfaces, reducing or eliminating the formation of shells.

The results of the analysis of the use of the group of lubricants made it possible to conclude the effectiveness of using lubrication "Polyplast Form Type 3". In particular, when determining the lubricity of the grease it was found that the extraction of products from the mold took place without effort, the side walls and the bottom of the form were clean and there were no defects on the surface such as shells, vials and exfoliation. The grease did not leave stains on the product.

The author evaluated the suitability of the lubricant for products that do not require additional finishing. It was found that the surface quality was good; air pores of more than 3 mm in diameter were absent, additional finishing was not required. The lubricant is recommended to obtain products with the categories of surface A1-A2. The tests have shown that the lubricant does not slip, allowing its use on vertical surface.

The effectiveness of the second group (emulsion lubricant "Polyplast EM") is characterized by the following features:

- Improvement in the quality of the surface of products (by uniform application of the emulsified composition);
- Economical use (achieved by creating a thin separation layer between the mold and the concrete).

It is also known that in order to facilitate the form removal of reinforced concrete structures polymeric cladding material, mounted on the assembled shuttering panels, is used. The lining of the roll or tile polymeric material mounted on the deck point seat is also used. [5]

The application of polymer surface coating formworks that are in contact with the concrete mixture provides:

- Improvement in the quality of outer surface of the monolithic structures;
- The exception of cleaning and lubrication of the molding surfaces of formwork;
- Reduction in the complexity and improvement in the culture of form removal works;
- Improvement in durability of shuttering boards.

Modes used in the production of sealing concrete may play an important role in ensuring aporose surface. Often the discrepancy between workability of the concrete mix and the mode that is set in laying and compaction can reduce the quality of the surface of the concrete products.

In the paper by Gritsyuk T.V. [6] a lot of attention is paid to low-frequency modes of molding, which allow obtaining finished products with the necessary density, strength and uniformity, and getting the surface of not less than A1 and A2 categories.

The study examined the effect of acceleration of vibration exposure on the quality of the surface of articles formed under different conditions. The surface quality was evaluated in accordance with porosity of the side and bottom surfaces. Optimal results were obtained with a low-frequency compacting brands R1-R2 with acceleration Ag = 2,5-3,5g and mixtures marks MW1-MW3 with acceleration Ag = 1,5-2,0g.

In order to determine the optimal regimes of ramming concrete mixes by means of symmetric vibration Gritsyuk T.V. investigated the influence of parameters of oscillations and the workability of the mixture on the

surface porosity of the product. The dependence obtained indicates that it's necessary to use acceleration Ag = 3,5g for mixes with rigidity R = 10s and low-frequency vibration to obtain high quality surfaces of products, for mobile mixes CS = 7cm - acceleration Ag = 2,0g. The effect of producing higher-quality surface is better in molding wet concrete CS = 5-8 cm with acceleration 2, 0-2,5g.

Symmetric and asymmetric modes of molding are compared in the article [7]. Vibrocompaction was carried out at a frequency of between 15 and 25 Hz during acceleration for symmetric modes of Ag and Ag = 2,0g = 3,5g, for asymmetric Agin = 2,5g, Agout = 4,5g.

These results indicate that low-frequency modes of asymmetrical forming provide high quality surfaces of products made from rigid concrete mixtures. Surface porosity is reduced by 1, 3-1, 9 times with use of asymmetric modes as compared with symmetric vibration. It was found that asymmetric modes are considered optimal sealing:

- For mixtures of rigidity R = 20-60s- shock vibration;
- For mixtures of rigidity R = 10-25s -without drums.

Symmetric vibration is used to seal the wet concrete.

An interesting result that was obtained is presented in the article [8]. It was found that the change in the angle of inclination to a horizontal surface under investigation increases the surface porosity. The distribution of pores on the surface of the product is closely connected with their distribution in the body of concrete. It was also found that low-frequency asymmetric modes of vibration compaction provide reduced capillary of open porosity by14-20%, and conditionally closed - by 10-15%, which indicates a more dense and homogeneous distribution of the pores in the concrete structure, than with use of symmetric vibrational excitation.

The summary of the studies carried out in the article [9] allows you to set the relationship between the internal pore structure of the product and the quality of the surface. The distribution of pores on the surface of the products is closely linked to their distribution in the body of concrete.

The executed research makes it clear that regimes that provide high surface quality guarantee the achievement of dense and efficient porous structure of concrete.

To ensure the high quality of the surface of concrete products the use of a number of methods is required:

- the use of plasticizers, such as C-3, Defomiks;
- the use of special lubricants, such as "Polyplast" Nometol-9;
- the use of low-frequency modes of acceleration for compacting mixtures: acceleration Ag = 2,5-3,5g for brands R1-R2, and acceleration Ag = 1,5-2,0g - for mixtures of marks MW1-MW3;
- the use of asymmetric compression mode for hard mixtures (for mixtures of rigidity R = 20-60s – shock-vibration, for mixtures of rigidity R = 10-25s - without drums).

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