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# EXPERIMENTAL THEORETICAL INVESTIGATIONS OF REINFORCED CONCRETE SAMPLES UNDER THE INFLUENCE OF LONG (SHORT) TERM TEMPORARY LOAD

# ЭКСПЕРИМЕНТАЛЬНО-ТЕОРЕТИЧЕСКИЕ ИССЛЕДОВАНИЯ ЖЕЛЕЗОБЕТОННЫХ ОБРАЗЦОВ ПРИ ВОЗДЕЙСТВИИ ДЛИТЕЛЬНОЙ (КРАТКОВРЕМЕННОЙ) ВРЕМЕННОЙ НАГРУЗКИ

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**Annotion:***This article provides a method for checking the high-quality connection of old and new concrete layers when using the method proposed by us to increase the load-bearing capacity of bridges existing in operation in our republic. Also in this article are the structural models, concrete class Corrections and material consumption required to carry out these investigations.*

**Key words**: *Reinforced concrete, bridge, load-bearing capacity, structural models, proofing, calculus, old and new concrete layers, quality bonding*

## INTRODUCTION

Over the past 40-45 years, the problem of assessing the operational reliability and durability of reinforced concrete bridges has become relevant for many countries, including Uzbekistan.It should be noted that the intensity of cargo turnover, the weight of transport cargo on the highway networks of our country, is growing rapidly.This leads to increased stresses from temporary loads on motorway bridge construction elements designed and built over the years with various regulatory documents.At the same time, the increase in temporary loads from the established norms, the occurrence of defects and damage in waterproofing systems (various defects allowed in the installation technology) on bridges in the dam negatively affects the bridge load-bearing indicators.It is worth noting that increasing temporary loads affecting the facility by up to 50% causes the facility's life span to shrink by up to 30% [1].

At present, more than 7,000 highway bridges are being exploited on the nationwide roads of our Republic. According to the inventory, the total number of bridge structures on the highways of our country is 14331. Most of these bridge structures were put into operation in the 1960 - 1990 [2].

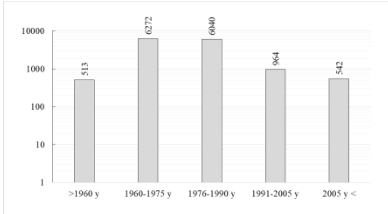



**Fig. 1.Construction dynamics of highway bridges in our Republic**

**Main part**: From practice, we know that all defects and damage to reinforced concrete bridges arise due to imperfect technical solutions, the influence of aggressive environments, design errors and failure to perform construction installation work on the basis of technological norms.

However, defects and damage in the first place occur due to the fact that the permanent and temporary loads affecting the structure exceed the established norm.

For this reason, conducting research aimed at assessing the impact of modern transport loads on the structures of highway bridges and roadways, including large gabarite and heavy-duty vehicles, is one of the pressing issues today.

Below is an experimental-theoretical research methodology of the method proposed by us in order to reduce the negative impact of temporary loads exceeding the established norms on the load-bearing capacity of the intermediate device, to adapt it to the transfer of modern loads [5].

The purpose of the research work is to assess the joint operation of the existing (old) concrete layer with a new concrete layer laid to increase the working height of the intermediate device.

To determine the bond quality of the old and new concrete layers, samples of reinforced concrete structures are prepared in 3 different ways. Prepared samples are dried in natural conditions for 28 days or 3 days in specially prepared steam chambers, providing the necessary moisture. The finished samples are examined in laboratory conditions using static and dynamic presses. With the help of the results obtained, engineering calculations are carried out and the quality of the connection is determined.

Under short-term variable load, the following tasks are set for the experimental study of the module of reinforced concrete structures, consisting of an old and sleeve concrete layer:

I. Through the method of similarity, the bridge is used to prepare scale-wise small modules of reinforced concrete structures with a sample of 3 different views (3 pieces from each sample) (Fig. 2÷4).

***Example 1:***

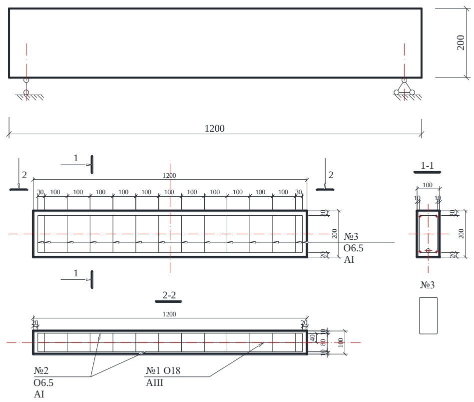



**Fig. 2. Reinforced concrete construction option 1**

To prepare the 1st option of the reinforced concrete construction module, the M-400 concrete mixture is poured into the framework, which is installed in the formwork with dimensions of 1200x100x200.

***Example 2:***

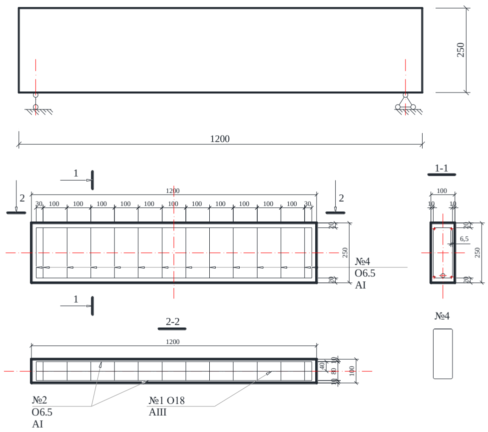



**Fig.3. Reinforced concrete construction option 2**

To prepare the 2st option of the reinforced concrete construction module, the M-400 concrete mixture is poured into the framework, which is installed in the formwork with dimensions of 1200x100x250.

***Example 3:***

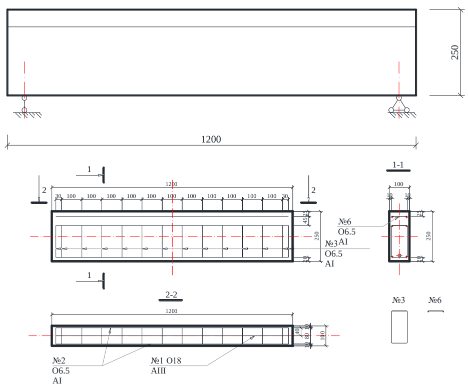



**Fig. 4. Reinforced concrete construction option 3**

To prepare the 3st option of the reinforced concrete construction module, the M-400 concrete mixture is poured into the framework, which is installed in the formwork with dimensions of 1200x100x200.After this reinforced concrete structure is dried under natural conditions for 28 days, an additional M-400 concrete mixture is poured from the upper surface of the structure into a mold with dimensions of 1200x100x50.

Concrete screed proofing for making Bridge reinforced concrete structures is provided by Quality Control Laboratories.

**Quantity of metal and concrete products for samples (about material consumption for samples)**

Table 1

| № | Designation | Unit | Samples | | |
|---|---|---|---|---|---|
| | | | For1st option | For 2st option | For 3st option |
| 1 | Concrete M-400 | $m^3$ | 0,024 | 0,031 | 0,031 |
| 2 | Armature A I Ø6,5 | kg | 1,240 | 1,240 | 1,865 |
| 3 | Armature A I Ø3 | kg | 0,353 | 0,421 | 0,400 |
| 4 | Armature A III Ø18 | kg | 2,384 | 2,384 | 2,384 |
| 5 | Crosslinking wire | kg | 0,119 | 0,121 | 0,139 |
| 6 | Emulsion oil | l | 0,001 | 0,001 | 0,001 |

**The material consumption shown in this table is given taking into account losses of up to 2% under ShNK 2.05.03-12*

**Composition of concrete for a mixture of 1 $m^3$ (calculation )**

Table 2

| *Designation* | *Unit* | *B-20 (M-250)* | *B-25 (M-350)* | *B-30 (M-400)* |
|---|---|---|---|---|
| | | *Regulatory cost* | *Regulatory cost* | *Regulatory cost* |
| *Cement* | t | 0,380 | 0,480 | 0,530 |
| *Sand* | $m^3$ | 0,679 | 0,629 | 0,728 |
| *Sheben* | $m^3$ | 0,507 | 0,499 | 0,365 |
| *Water* | $m^3$ | 0,147 | 0,160 | 0,186 |

The finished reinforced concrete is sent to the laboratory to carry out test experimental work on the structures.

II. Determination of the value of voltages in samples under the influence of an increasing force.

III. Determination of strength and deformation properties of samples (modulus of elasticity, prism strength, final compression).

**Research task and methods** - This research work was tasked with investigating the effects of long - term temporary loads on the stress-deformation state of reinforced concrete structures consisting of layers of old and new concrete. The composition of concrete ShNK 2.05.03-12 “bridges and pipes” and special reinforced concrete structures were adopted with the correction of regulatory documents of the laboratories of the quality control department. Samples of reinforced concrete construction prepared for experimental studies are taken by reducing the actual dimensions of bridge intermediate devices in a similar way.

When conducting experimental research, the following tasks are performed:

a) determination of deformation of reinforced concrete structural samples in bending under the influence of temporary load

b) determination of the characteristics of reinforced concrete structural samples in the flexion and compression zones

c) study of the nature of long-term deformations in samples consisting of and without a layer of old and new concrete

When checking modules for strength and crack resistance, the control load is assumed to be equal to the normative load. In laboratory and research work, the size of the load and the speed (time) of increasing loads when applying it are determined in accordance with the established regulatory documents [4].

*Before starting the tests, the following preparatory work should be carried out:*

it is checked whether the construction samples installed on the presses are installed on non-slip supports;

it is checked that long (short) term temporary loads are evenly distributed on the structure;

the smooth state of the Measuring Instruments is checked;

**Expected results**: *After the start of the tests, the following work should be carried out:*

preliminary pre-load indicators of structural modules (cracks and defects) are checked;

step-by-step loading of long (short) term temporary loads is carried out;

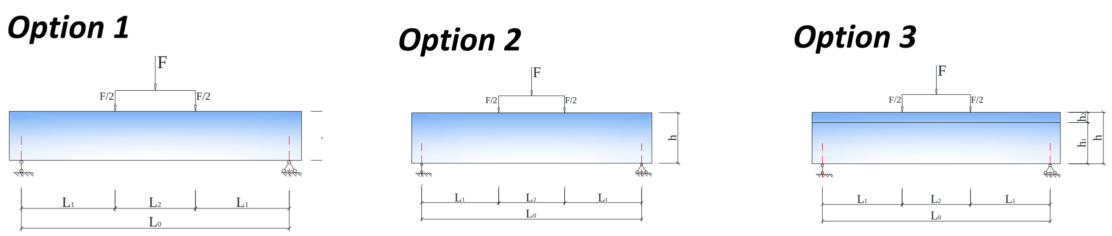
at each stage of loading, temporary loads are held for at least 10 (ten) minutes;

cracks appearing on structural surfaces are numbered and its dimensions are recorded in a table;

indicators of measuring instruments are recorded in the experimental test table;

the process of loading a construct will continue until the module is broken.

It is checked that the old and new concrete are connected in good quality. During the testing of reinforced concrete structural samples, bending and resistance moments of the cross section of the barrier are determined. Also, the height of the compressed area of the barrier sample is compared with each other by determining the working height of the barrier in the bath, giving an appropriate description and conclusions (fig. 5).



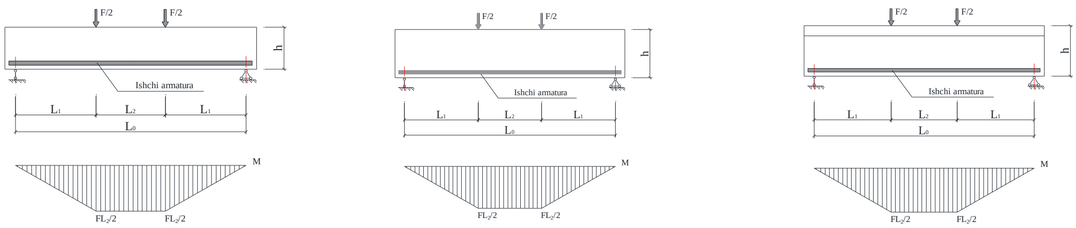



**Fig. 5. Loading scheme of reinforced concrete construction samples**

cross section bending moment

$$M_{0.5l} = \gamma_f \cdot (F/2 \cdot y_1 + F/2 \cdot y_2) + q_{v1} \cdot \gamma_{f1} \cdot \Omega$$

concrete compacted area height

$$x = R_S \cdot A_S / (m_{b9} \cdot R_b \cdot b)$$

estimated working height of cross section

$$h_0 \approx 0{,}85h$$

cross section boundary bending moment

$$M_{cheg} = m_{b9} \cdot R_b \cdot b \cdot x \cdot (h_0 - 0.5 \cdot x)$$

**Conclusion**: The bond quality of old and new concrete is considered important in the fulfillment of the conditions of strength and durability of concrete structures. The effectiveness of the bond depends on several factors such as its age, composition, surface conditions, and environmental exposure. There are various methods to improve the quality of the bond. Quality control and methods of its assessment ensure the perfect connection of concrete layers, and also prevent defects and damage. In order to develop more reliable and cost-effective methods of connecting old and new concrete, it is advisable to conduct a large-scale additional research.

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