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EXPERIMENTAL METHODS FOR STUDYING THE INSTALLATION CONDITION OF LARGE-SPAN UNIQUE BUILDINGS

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Abstract: The results of experimental-theoretical studies of precast monolithic reinforced concrete shells of complex geometry assembled from enlarged elements are given. The studies were carried out on full-scale composite shells 48x48 m and diameter 96m, its enlarged elements 3x18m and 3x24m as well as on the shell model on a scale of 1:10 and 1: 4. The stress-strain state of shells of a similar type was studied with different mounting and splitting designs. Recommendations are given on rational methods for the construction of shells from enlarged elements for public buildings.

Keywords: stress-strain, deformed state, shell mounting state.

The use of large-span unique buildings is associated with the tasks of improving the methods of their installation and unloading (Fig. 1).

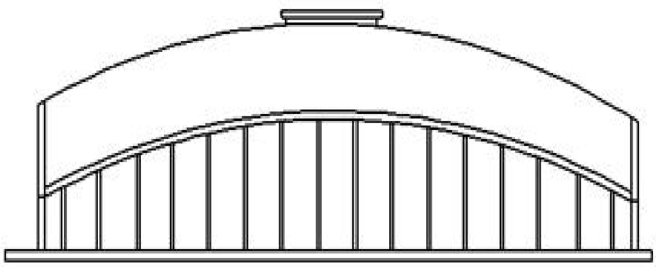

Fig. 1. Structural diagrams of shells withfalse geometry examined in the mounting state.
Installation of these shells can be carried out with the use of solid scaffolding and conductors, or pre-enlarged arch-type mounting sections, by a mounted method [1-4]. Currently, the optimal method of installation for flat shells is the use of enlarged mounting elements up to 24 m long [2, 4,7]. In this case, each enlarged prefabricated element is a vaulted structure with a temporary installation delay [3, 7].
We also study the possibilities of applying an effective installation method for composite and conjugate shells of unique buildings with a square or arbitrary plan (Fig. 1).
To solve this problem, we have studied the stress-strain state of prefabricated monolithic composite shells at the stages of installation, unloading,and transition during operation.
Table 1.

Characteristics of the studied types of shells and models

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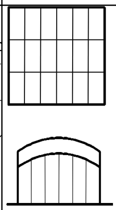
№ Item no	. Test shells, marking of elements	Sketch	Scale, dimensions B	Appointment
3	Flat ribbed shells of positive Gaussian curvature with a square plan H-1		60x60 m	Study of the stress-strain state at various levels and combinations of installation load. Identification of rational methods for mounting and dismantling the shell.

The analysis of the test results of composite shells of curvature with dimensions of 4.8 x 4.8 m,12 x 12 m; and 18 x 36 m is performed. To identify a rational method of mounting and unloading composite shells, the removal of tightening forces was performed with the mounting racks lowered and raised.

Sequences of their influence on the operation of the entire coating were studied.

Static operation of the shell during installation and operation was analyzed in three types of connections of the central and side shells:

The stress-strain state was determined on models of free-standing shells in the linear operation area loaded with a load of 1.7 kN /^{m2}. After that, we studied two main ways of unloading. In the first method, the mounting beams were first lowered, then the forces in the mounting puffs were removed, in the second method, the mounting puffs were first removed, then the mounting beams were lowered. The unraveling options were repeated three times.

The separation of the mounting equipment from the coating occurred first at the edges of the mounting beams with a 4 mm draft of the racks, then in the middle zone of the shell with a 15 mm draft of the racks. The separation of all mounting equipment from the shell occurred when the racks were drained by 20 mm. The initial tightening forces of the central and side shells when lowering the mounting beams were reduced by 20-35%. This made it much easier to dismantle puffs. At the same time, a more favorable character of the stress state in the ribs of the shell panels was observed.

When lowering the mounting beams, the greatest deflection in the central shell was 2.85 mm, or 1/1174 span, in the side shell-2.2 mm, or 1/1542 span. Further removal of forces in the installation puffs led to an increase in the deflections of the central and lateral shells by 1.2 and 1.15 times, respectively.

In composite shells with side elements of negative and positive curvature measuring 12x12 m, their stress-strain state was studied by experimental methods at the stages of installation, long-term operation, and transition from the installation stage to the operational one. Installation of the shell was carried out from enlarged arched elements. The enlarged element at the stage of installation was a self-supporting structure. Before sealing the joints, the enlarged elements worked as a system of separate vaulted structures that were not connected to each other.

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