LARGE-SPAN OF UNIQUE BUILDINGS FROM ENLARGED ELEMENTS

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Abstract: Currently, in the world practice of construction, reinforced concrete shells of unique buildings are one of the leading places. Of the types of large-span coatings used, reinforced concrete shells are widely used. With the development of the industrial base, the republics with the expansion of the field of construction, the solution of the problem of designing unique buildings of large spans, the introduction of architectural and expressive forms of shells, ensuring the issues of their economy and operational qualities, the development of the theory and methods for calculating spatial systems at the construction stages acquire important national economic significance.

Keywords: large-span coverings, unique buildings, development, structural solutions, shell, spatial structures, installation and dismantling, enlarged elements.

1. Introduction

Conducted research on the design and construction of shells, analysis performed by the Moscow Research Institute of Concrete and Reinforced Concrete (NIIZHB), the Central Research Institute of Building Structures(TSNIISK), the Research Institute of Standard and Experimental Design (MNIITEP), the Research and Productionым Association "ПSpatial structures earthquake Resistance of Buildings and Structures" (PKSZIS, c. Zhambay, Uzbekistan), showed that among all possible structural solutions for covering unique buildings, a special place is occupied by shells – thin-walled spatial systems [1-4]. The use of building cladding shells as one of the most effective structures can successfully contribute to achieving the goals set in the construction sector [5, 6, 11-14].

The development of these structural solutions for large-span uniqueabuildings using reinforced concrete shells is associated with the tasks ofpimproving the methods of their installation and unloading.

The installation of such shells can be carried out using flatscaffoldingand conductors, or pre-enlargedэлементоваro-type mounting elementsного типа and mounted method [4, 6, 18-20].

Currently, the assemblyof shells by the second method is being developed[2, 3].

For shallow shells, the use ofнных монтажнlarger mounting elements up to 24 m long is optimal [17-20]. In this case, eachкreinforced prefabricated element is a vaulted structure with a temporary installation delayж[6, 7]. With the development of this method, the installation method, we have developed design solutions for large-span shells of building coverings with a span of up to 60 m [6, 14, 16].

РазработаныEffectivee designe solutionsя forтных large-span shells covering unique buildings with a span of 60-100 m or more than 100 meters комбинацей меhave been developed using a combination of methods for mounting shells using solid scaffolding with sparse supports with methodsами уfor compactingрупнения монthe installation elements (Fig. 1).

When using this method of installation, cross beams of rigidity with a span of 12-36 m remain and serve to increase the stability of spatial systems (Fig. 2).

Currently, shell mechanics has reached such a level of mathematization that the calculation of spatial structures has become the privilege of some highly qualified specialists [1, 3, 7, 8]. Paying tribute to the exact methods of calculating shells using computer technology, we should note the very high responsibility and complexity of compiling and debugging a program for each type of shell [1-3, 9-12]. Practical methods for calculating spatial systems based on experimental modeling methods for estimating various stages of the stress-strain state become important [1-3, 5-6, 18-20].

In recent years, methods have been developed for calculating shells in elastic stages for static and dynamic loads, which do not sufficiently take into account the conditions of construction and operation of structures [1, 3, 5-7]. The current regulatory documents "Reinforced concrete spatial structures of coverings and overlappings" and the manual to the "Code of Rules" do not sufficiently reflect the consideration of actual installation and operational conditions. The most important factors associated with aging, heredity of the construction material, and the conditions of their operation at various stages of construction and transition to operational conditions are not sufficiently taken into account .[3, 4, 10, 14, 19].

Stress-strain states are investigated н, ande состояние, a method for calculating a rational methoda for constructing cover shellsis developed[6,8, 10, 15]. To solve this problemбыли , the stress-strain state of prefabricated monolithic composite shells was studied at the stages of installation, unloading, and transition тою путём испытаниятhe operational stage of testing composite shells with side elements of negative and positive curvature размерof 4,8x4,8 m and 12x12 m plan sizes, as well as the implementation of the research results on full-scale shells of various structural solutions with a span of 96 m (Fig. 1, 2)

The aim of the work is to develop effective design solutions for large-span unique buildings of covering shells with a span of up to 60 meters, using the method of enlarging installation elements, spans of 60-100 meters and over 100 meters by combining shell installation methods using solid forests with sparse supports with methods of enlarging installation elements.

Investigation of their stress-strain state, development ofcalculation methods, and rational methods for constructing coating shells.

The object of research is unique large-span buildings with the use of precastx reinforcedx concrete shells of coatings.

The subject of research is the stress-strain state of the developed effective structural solutions for unique large-span reinforced concrete shell structures of buildings under construction conditions.

The objectives of the study are:

investigation of the stress-strain state of beam and shell systems in the construction stages;

application of the modeling method for research and evaluation and effectiveness of the rational technology of building shells of public buildings; assessment of the stage-by-stage operation, rationality of installation methods, and dismantling of shells; ensuring the structural safety of spatial systems in installation states.

development of a method for calculating shells, taking into account the stages of construction;

ensuring stability and load-bearing capacity in the eventof local damage; calculation ofeconomic efficiency in the installation impacts of unique large-span buildings.

2. Methodology for modeling the workof obolocs

To develop aorational method for mounting composite shells, modelingofthe mounting state with spans of 48 and 96 m was carried out on modelsях with a scale of M 1: 10 and M 1: 4. The shells were constructed using a combinedinstallation methodusing prefabricated enlarged mounting elements 3x18 m and their models 0.75 x8.5,5 m and 0.3 x1.8,8 m . The installation sequences and their effect on changing the operation of the entire coating were studied.

3. Results and discussion

Assessment of the strength, stability, rigidity, crackresistance,areliability and safety of various typesof coatingsof unique buildings (Fig. 1) in the stages of installation and transitiona в эксплуатационное состояние,to operational states is a poorly studied area. In this regard проведены, experimental studies were carried out on large models with subsequent application of the results in full-scale objects.

In the study construction of these structures, specifictaskswere solved for the designof проектированию shells, operating under conditions of installation and operationalтimpacts, as well разработаны as recommendations were developedи for the widespread implementation of these coating structures in construction.

The author summarizes and develops the experience of research of reinforcedconcrete artificial structures onfullнатурных -scale structures and models.

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