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LARGE-SPAN SHELLS OF UNIQUE BUILDINGS CONSTRUCTED BY A COMBINED INSTALLATION METHOD

Annotation: The results of experimental and theoretical studies of the developed long-span reinforced concrete shells assembled from enlarged mounting elements are presented. The stress-strain state of the composite shell with a span of 48 and 96 m, its enlarged elements 3x18m and 3x24m, was studied on a model on a scale of 1:10 and 1:4. Studied with various options for mounting and unwinding the structure. Recommendations are given on rational methods for constructing shells for unique public buildings.

Key words: large-span shell, unique buildings.

Introduction. The development of design solutions for large-span unique buildings using reinforced concrete shells is associated with the tasks of improving the methods of their installation and unscrewing.

Installation of such shells can be carried out using solid scaffolding and conductors, or pre-enlarged arched-type installation elements, using a suspended method [1-3].

For flat shells, the optimal method is to use enlarged installation elements up to 24 m long [3-6]. In this case, each enlarged prefabricated element is a vaulted structure. [5, 6].

Effective design solutions have been developed and large-span shells of unique buildings have been studied using a combination of shell installation methods using solid scaffolding with sparse supports and methods of enlarging installation elements by testing a 4.8x4.8m and 12x12m model. Результаты моделирования работы shells.

The modeling of the assembly state of shells with a span of 48.96 m was carried out on models with a scale of M 1:10 and M 1:4. The shells were erected using a combined assembly method using prefabricated large-size assembly elements with a scale of M 1:1-M 1:10, with dimensions of 3x18 m, 0.75x8.5 m and 0.3x1.8 m.

On shell models in the area of linear work, loaded with a load of 1.7 kN/m², two main methods of unscrewing were studied. In the first unscrewing method, the assembly beams and supports (posts) were lowered first, and then the forces in the assembly ties were removed. In the second method, the assembly ties were removed first, and then the assembly beams and supports were

lowered.

With this method of roof assembly, large-size elements are installed directly on the diaphragms and on the shell stiffening mounting beams. After the seams are monolithically sealed, the temporary ties are dismantled.

The advantage of this installation method is the absence of temporary supports and reduced labor intensity of installation work.

The assessment of the strength, stability, rigidity, crack resistance, reliability and safety of various types of unique building roof shells at the stages of installation and transition to the operational state is a poorly studied area [5-7].

The study of the installation state of flat ribbed shells was carried out using the combined method proposed by the author of large-size assembly of elements on cross-beams-stiffeners located on four sides with a unified grid of 18x18 m, installed on mounting racks.

For this purpose, experimental studies were carried out in two stages.

At the first stage of experimental research In separate central and lateral shells of negative Gaussian curvature, loaded with a dead weight load of 1.7 kN/m², the stress-strain state of the entire roof was determined. After that, two methods of unscrewing were studied using the above-mentioned technique. The unscrewing options consisted of 7 consecutive cycles.

In the first unscrewing method, when lowering the mounting beams, the forces in the shell ties decreased by 21-34%, which significantly facilitates the dismantling of the ties. The deflection in the central shell was 2.9 mm, or 1/1155 of the span; in the lateral shell - 1.9 mm, or 1/1786 of the span. Further removal of forces in the mounting ties led to an increase in the initial deflections in the central and lateral shells, respectively, by 1.2 and 1.15 times. Thus, the proposal is that in order to perform the unscrewing of the shells, it is necessary to first lower the mounting posts and beams, after which it is necessary to remove the forces in the ties, which is the most rational method.

At the second stage of experimental research The stress-strain state of monolithically connected central and four lateral shells installed on four common arched diaphragms and loaded with a load of 1.7 kN/m² was studied.

A comparative analysis of studies on two variants of shell unscrewing showed that when using the first method of unscrewing, the deflections for the middle of the span of the shell and diaphragm were smaller, respectively, by 1.65 and 1.4 times. A similar phenomenon was observed for horizontal displacements of the shell, which decreased by 1.15-1.27 times for different sides of the contour structures of the lateral elements of the shells.

An analysis of the effectiveness of the developed design solutions of the proposed method of installation of precast monolithic roof shells with a span of 96 m, ensures structural reliability and safety, indicates a reduction in labor costs during installation by 26%. The weight of the assembly equipment set is reduced by 2.4 times, compared to the assembly jig of a 36x36 m shell. When using solid scaffolding, labor costs are reduced by 33%, and the weight of the assembly equipment is reduced by 2.25 times.

A numerical study was carried out to verify the possibility of using the results of the studies to assess the performance of roof shells of various geometric shapes for unique large-span buildings with

spans of 48-96 m and more.

The results of this study indicate the feasibility of using this technique in design and construction practice.

Conclusions

1. A rational type of covering for unique public buildings is reinforced concrete shells blackened along a circular surface, made of unified cylindrical panels, developed by combining methods of assembling solid scaffolds with sparse supports and methods of enlarging assembly elements.

At the same time, labor costs during assembly are reduced by 26%, the weight of the assembly equipment set for the developed 96x96 m shell is reduced by 2.4 times, compared to the assembly conductor of a 36x36 m shell.

2. Based on modern modeling methods, a research methodology has been developed, models of new effective design solutions for precast-monolithic shells on a scale of M 1:10, 1:4 and 1:1, their stress-strain states have been studied at the stages of assembly and dismantling, taking into account changing design parameters and ensuring high accuracy and reliability of the phenomena under study, especially when assessing their strength, rigidity, stability and safety.

3. Experimental studies performed using the modeling method allowed us to analyze various installation options and identify a rational method for unscrewing the shells. It was found that it is necessary to first lower the mounting posts and beams, and then remove the forces in the temporary ties. With this sequence of unscrewing, the panel ribs operate in more favorable conditions; lowering the posts leads to a decrease in the forces in the ties by an average of 27.5%, which facilitates their dismantling.

4. For composite shells, it was found that it is rational to perform unscrewing first for the central shells, and then for the adjacent side shells. With this sequence of unscrewing, the deflections in the middle of the span of the model of the central shells and arched diaphragms decreased, respectively, by 1.65 and 1.5 times. In conclusion, it should be noted that the use of the studied rational options for installation and unscrewing, as well as the proposed calculation method, allows the introduction of effective roof shells in unique large-span buildings with different geometric shapes of the plan and regulation of minimum efforts during the transition to the operational stage.

REFERENCES:

1. Krivoschapko S.N., Hanging cable structures and covering structures. Construction of unique buildings and structures. ISSN 2304-6295.7(34). 2015. 51-70.
2. Razzakov S.R., Fridman G.S., Razzakov N.S. 2018 Evolution of dynamic parameters of composite spatial structures during operation Collection of reports of the International Scientific and Practical Conference A F Loleit (MISSI-MGSU) pp 356-361/
3. Eremeev P., Vedyakov I., & Zvezdov A. (2021). Suspension large span roofs structures in Russia. International Journal for Computational Civil and Structural Engineering, 17(2), 34-42.
4. Tusnin A.R., Postarnak M.V. Membrane structures: application experience and development prospects // Bulletin of MGSU. 2023. Vol. 18. Issue. 3. pp. 401-415. DOI: 10.22227.1997-0935.2023.3.401-415.
5. Razzakov S.R., Razzakov K.H.S., Razzakov J.S., Limit state of steel reinforced concrete round plates in the operational stage / Modeling and methods of structural analysis JOP Conf.

Series: Journal of physics: Conf: Series: 1425(2020) 012101 doi: 10.1088/1742-6596/1425/1/012101.

6. Ageeva E.Y. Design features of hanging coverings in public buildings: / E.Yu. Ageeva, V.A. Tishkov, A.E. Filimonova; Nizhne Novgorod. state architecture-builds. University - Nizhny Novgorod: NNGASU, 2015. - 87 p. ISBN.
7. Kolesov A.I. Fundamentals of the layout and calculations of rod, hanging and membrane steel structures of covering of large-span buildings [Text]: / A.I. Kolesov; Nizhegorod state architecture-builds. University – N. Novgorod: NNGASU, 2021. – 159 p. ISBN 978-5-528-00447-1.
8. Timchenko R., Popov S., Krishko D., Rajeshwar G., & Aniskin A. (2021). Cable-stayed coverings for large-span public buildings. In E3S Web of Conferences (Vol. 280, p. 07008). EDP Sciences.
9. Sayfiddinov S., Akhmediyrov U., Ways of enhancing energy efficiency within renovation of apartment houses in the republic of Uzbekistan. International Journal of Scientific and Technology Research 2020 |Jornal article EID: 2-s2.0-85079622649 Part of ISSN: 22778616.
10. Kolchunov V.I., Aydrosova N.B., Klyueva N.V., Bukhtiyarova A.S. Vitality of buildings and structures under beyond-design influences / M.: ASV Publishing House. 2014.-208 p.
11. Large-span structures of industrial and civil buildings and structures: / V.D. Taratuta, A.M. Begeldiev. – Krasnodar: KubGAU, 2018 – 187 p.
12. Mirsayapov I.T. New methods for calculating reinforced concrete structures for endurance under the combined action of bending moments and shear forces. Concrete and reinforced concrete – a look into the future: scientific works. V.1 M.: MGSU, 2014. P.335-342.
13. Perelmutter A.V., Kabantsev O.V. Analysis of structures with a changing design scheme. M. ASB. 2015. 148 p.
14. Frontini G., Argentini T., Rosa L., & Rocchi D. (2022) Advances in the application of the Principal Static Wind Loads: A large-span roof case. Engineering Structures, 262, 114314.
15. Sayfiddinov S., Akhmediyrov U., Razzakov N.S., Akhmedov P.S. // Optimization of modeling while increasing energy efficiency of building structures of public buildings// International Scientific Journal ISJ Theoretical/ Applied Science Philadelphia, USA. 2020
16. Musa A.E., Al-Shugaa M.A., & AL-Gahtani H.J. (2023). The Buckling Strength of Axially Thin Circular Shells Subjected to Dent Imperfection. Arabian Journal for Science and Engineering, 48(4), 5481-5492.
17. Kabantsev O.V. Tamrazyan A.G. Accounting for changes in the calculation scheme when analyzing the work of the structure // Civil Engineering and construction journal, 2014, No. 5. - P. 15-26.
18. Volmir A.S. Stability of deformable systems in 2 parts / A.S. Volmir. – 3rd edition, stereotyped. -Moscow: Yurayt Publishing House, 2020. -526 p.
19. Razzakov J.S., Razzakov N.S., Hamrokulov U.D.// Consideration of the boundary effect in calculation of pavilion shells.// Conference proceedings International Azarbayjan-Ukraine “BUILDINGS INNOVATION-2018” P-186-188, BAKI-POLMTU.
20. Atarov N.M., Bogopolsky V.G. Calculation of rings plates using spreadsheets. -Moscow. MGSU. 2015. 72 p.
21. Egamova, M., & Matyokubov, B. (2023). Improving the energy efficiency of the external walls of residential buildings being built on the basis of a new model project. Евразийский журнал академических исследований, 3(3), 150-155.

22. Salomovich, T. E., Samariddinovich, S. U., & Pulatovich, M. B. (2023). Improving the Heat Preservation Properties of the Exterior Walls of Brick Buildings. *International Journal of Culture and Modernity*, 28, 15-20.
23. Матёкубов, Б. П., & Саидмуродова, С. М. (2022, August). КАМ СУВ ТАЛАБЧАН БОҒЛОВЧИ АСОСИДАГИ ВЕРМИКУЛИТЛИ ЕНГИЛ БЕТОНЛАР ТЕХНОЛОГИЯСИНИ ҚЎЛЛАНИЛИШИ. In *INTERNATIONAL CONFERENCES* (Vol. 1, No. 15, pp. 103-109).
24. Turakulovna, E. M. U., & Pulatovich, M. B. (2024). Characteristics of Materials that Increase the Heat Resistance of Walls. *Innovative: International Multidisciplinary Journal of Applied Technology* (2995-486X), 2(2), 36-39.
25. Matyokubov, B. P., & Rustamova, D. B. Perspective constructive solutions of modern composite external walls of sandwich type. *International Journal For Innovative Engineering and Management Research*.