BIM MODELING FOR DESIGN TESTING METHOD

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One of the main types of testing is modeling. This type of test is carried out for research purposes. It is believed that complete information about the operation of the structure is obtained through full-scale testing. But such tests entail large material costs, labor costs and difficulties in achieving, under full-scale conditions, the required measurement accuracy or elimination of influencing factors.

Modeling is understood as a method for researching a building structure and structure on its model using the laws of similarity of processes and phenomena occurring in a full-scale structure and in its model. Modeling is a method of experimental and theoretical research.

Testing on a model by different methods will allow you to quickly and comprehensively, as well as financially more profitable, to obtain the necessary information.

In modeling, only similar phenomena are considered, and is based on the theory of similarity. The parameters characteristic of such phenomena are interconnected by certain transformations, allowing from the effects researched on the model to go to the phenomena under study in full-scale.

In mechanical modeling, the laws of mechanical similarity of processes occurring in rigid-deformed bodies of the same scale are used. There are three directions in mechanical modeling. The first is to test the model for the purpose of validity of the calculation methods, by which the model is designed [1]. In this case, it is only important that the dimensions correspond to the calculation during its manufacture. The second is the study of the structure, by testing the model, regularities, limiting states are distinguished. The third is the study of processes on the model for transferring the test results to full-scale construction. In this case, the scale of the model, elements, mechanical characteristics are selected according to certain similarity laws [1]. In physical modeling, well-known analogies are used that are observed in the mathematical description of processes of different physical nature. In mathematical modeling, the study proceeds on a full-scale structure according to a certain loading scheme, is investigated by mathematical and analytical methods. For this, the finite element method (FEM) is currently recognized. In this case, it is important that the conditions of equilibrium and compatibility of deformation are satisfied.

Such modeling is more relevant for multivariate design and when studying the influence of different variable parameters on the work of a structure.

Similarity is called a deformable system that is similar geometrically and stresses, displacements, deformations and the investigated quantities at similar points at similar points in time can be expressed through certain ratios - the scale of the transition. That is, the regularity of the ratio of the geometric size between the model and nature, constants, loads, deformations and stresses. There are types of similarity, such as simple or strict, extended or incomplete. The simple condition is to observe the mechanical and geometric similarity with the content of the indicators. In extended similarity, not all investigated parameters are modeled, but only stresses at control points.

During modeling the building, the physical and geometric nonlinearity of the stiffness characteristics of the elements was taken into account, the destruction schemes were checked [2]. At each stage of load application, the result is forces, stresses, crack patterns and plastic hinges. The building was modeled using PC LIRA and PC SCAD. The calculation is carried out: the kinematic method of limiting equilibrium, the calculation of the FEM in the PC. A feature of this modeling is the behavior of the entire building.

Modeling a reinforced concrete structure such as a hipped roof. The method of statistical calculation of the FEM was used. The calculated force was calculated using the PC LIRA. The performance of the model was studied prior to destruction. At the stage of limiting equilibrium, the stress-strain state of the model gave a picture of cracks. Based on it, dependencies were obtained. The calculation was also carried out by the FE method using the PC ANSYS. The tests were carried out on a small-scale model and gave an estimate of the critical load of full-scale structures in the elastic loading stage with a loss of local stability (LS). It was also found that the discrepancy between the calculations and the model is no more than six percent. The dependence obtained on the basis of the similarity theory shows that in the case of recalculation, it is only necessary to observe the geometric similarity.

References

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