

civil structures. The steel and concrete composite cable space frame can have various shapes and contours. Curvature of the structure is achieved by changing length of the bottom chord.

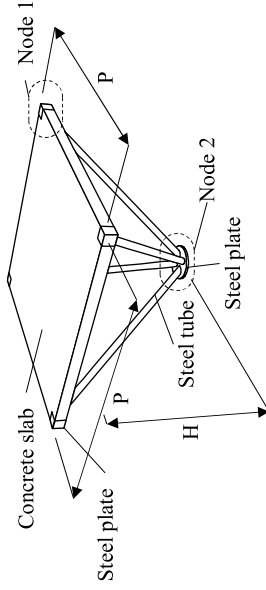


Fig. 1. The steel-concrete space units of the steel and concrete composite cable space frame

The steel-concrete space units are used for assembly various structures including flat double-layer grids, single-span shells and other [3, 4]. Distances that are covered with these structures reaches 100 m. In general, the curvature of the steel and concrete composite cable space frame depends on constrains.

There are a need to find effective structural systems including shells in today's conditions of the development of scientific and technological advances and the growth of social needs. The main requirements imposed on shells or its parts except reliability and the required bearing capacity are an architectural view, aesthetics, ergonomics and high indicators of efficiency.

Use of reliable and modern materials to search and designing of the new structural concept is an important issue. Steels, modern concretes with various fillers and composites belong to the materials that meet the stated requirements.

The effectiveness of the developed structures depends on the usage of these materials and their conditions of behavior it means that materials need to be under pressure of the forces, which they resistance well this means steel needs to use in stretched or compressed elements and concrete needs to use in compressed.

2.9. THE MODERN STEEL AND CONCRETE COMPOSITE CABLE SPACE FRAMES

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Development of infrastructure of cities needs modernization, changes or rebuild existing structures and constructing modern and original buildings. Structures that completely satisfy the demanding requirements of buildings are combination of steel space trusses, steel cables or bars and slabs that used for not only cover or protect from aggressive external factors, rain, snow and other atmospheric influences but also used as bearing element.

These composite structures were designed with the participation of the author at the Department of structures from a metal, wood and plastics of the Poltava National Technical Yuri Kondratyuk University (Poltava city, Ukraine) and were patented. They are called The Steel and Concrete Composite Cable Space Frames.

The purpose of the study is to present the new kind of spatial composite structure made from modern and strength materials for civil construction in particular to cover halls, hangars for aircraft and other vehicles, garages for a large machinery, large-span buildings and structures of airports etc.

Novelty of the steel and concrete composite cable space frame lies in effective application properties of materials [1].

The steel and concrete composite cable space frame are assembled on construction site from steel-concrete space units (Fig. 1) and the bottom chords. The structural members are routinely joined at node 1 and node 2 by designed by author bolted connections [2], but sometimes in specific cases can be joined by welded connections.

Besides, node 1 and node 2 can have different designs depend on the forces that appeared in the structural members [2]. Choice of a connection type (node 1 and node 2) are routinely depend on buildings function, their span and shape, but preference is given to bolted connections, because they are easier in assembling and they are able to carry the high loads that typically appear in structural members of

produce steel building structures, and other plants that have the equipment for processing steel and concrete casting of products. Technologies of processing, assembly, welding, loading and unloading of steel structural member of the composite steel and concrete grid-cable constructions are similar to the technology of production of conventional steel structures and concrete structures. Manufacturing technology of the steel and concrete composite cable space frame is divided into two separate processes: fabrication of a steel lattice (frame) and the making of slab.

Construction of the steel and concrete composite cable space frame is performed by the methods described in [11]. During design of steel and concrete composite cable space frame there is a task to get rid of the disadvantages of steel and concrete elements. The question concerning the choice of strength grade of concrete, steel tubes grade, acceptance of reinforcement ratio is of great importance [11].

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Considering this, the steel and concrete composite cable space frame is promising direction of building structures.

In [5] are proposed and developed kinds the steel and concrete composite cable space shells with the release of their main advantages and design features. In result of studied, the new efficient structures of shells that appointment for covering large-span buildings and areas were proposed.

Developed steel and concrete composite cable space shells appointment for industrial and civil construction. Applications developed designs for the construction of large-span covering objects provides a significant economic benefit through the efficient use of materials [6].

There is a problem of an excessive laboriousness and materials consumption, which appears in consequence of does not rational using of materials in construction. These factors have direct impact on the overall cost and duration implementation of the project. That is why there is a need in new constructions with structural concepts, which largely make it possible to save materials and reduce complexity of construction. These structures are the steel and concrete composite cable space frame. Steel-concrete composite structure was used for creating the new construction because this material is reliable, has studied well and is used very widely in various fields of construction [7, 8]. The essence of the steel and concrete composite cable space frame lies in rational and efficient use of materials and the behavior of structural elements.

Results of previous studies show that the steel and concrete composite cable space frame combine the advantages of space frame, reinforced concrete and cable structures [9]. The effectiveness of structural concept and optimal geometric dimensions have been found [10]. The steel and concrete composite cable space frame are reliable and have nice aesthetic appearance due to original spatial shapes and outlines. Therefore, it is necessary to prove the effectiveness of the steel and concrete composite cable space frame to increase interest and implementation them in the real sector of the construction.

Production of steel-concrete space units can be performed in the plants that