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A NEW STRUCTURAL SOLUTION FOR EARTHQUAKE RESISTANT CROSS-BAR SPATIAL STRUCTURES.

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Abstract:

In seismic zones, the article provides instances of buildings and structures created employing various forms of cross-bar spatial arrangements. A comparison of steel profiled decking roofing choices is presented.

Keywords: Nodes, spatial structures, profiled decking, roofs, thermal insulation.

INTRODUCTION.

Increased reliability is one of the benefits of cross-bar spatial structures (CBSS), which is defined by the system's multi-connectedness. The ability to redistribute forces after failure or transition to the plastic stage of deformation of particular overloaded elements is the survivability reserve of multi-connected systems.
At the same time, you'll save 20-30% on your own weight and material use.

The CBSS provides for a reduction in building height by a factor of 1.5-2.0, resulting in a reduction in overall volume of the building, which helps to lower the present value of construction expenses.

In earthquake zones, rod-shaped spatial roof structures are becoming more popular. Experimental investigations of natural structures were conducted prior to their usage, allowing for the definition of dynamic characteristics and attenuation parameters in certain types of CBSSs intended for use in mass construction in seismic areas.

METHODS AND MATERIALS.

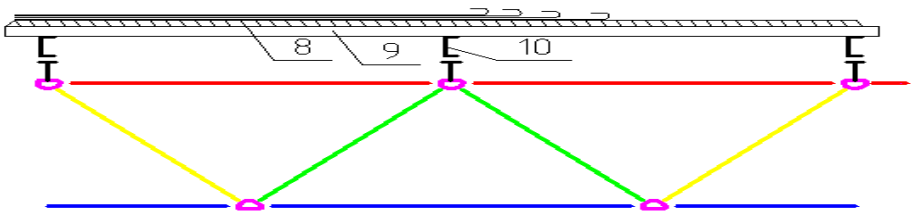
Below are some examples built using different types of CBSSs in seismic areas.

A 900m^2 "Store-warehouse" and 1800 m^2 "Trade Market" in Khiva"Fruit and vegetable processing plant" with an area of 40,000 m^2, "Mineral fertilizer warehouse" with an area of 3600 m^2 in Bukhara,"Central Market" with an area of 2,700 m^2 in Tashkent, "Siyab and Marble Market with an area of 1800 m^2 in Samarkand, Central Market with an area of 1800 m^2 in Cheleke and others (Fig.1).

Fig.1.Siyab market in Samarkand.

In these examples, the building coverings have been designed as lightweight, profiled flooring. A 50 mm thick rigid synthetic-binder mineral wool thermal insulation board was adopted as insulation.

a



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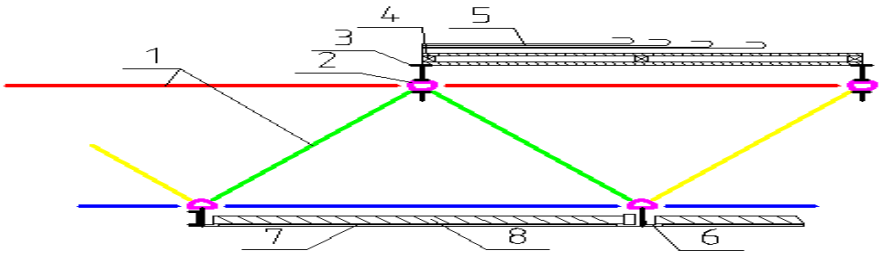

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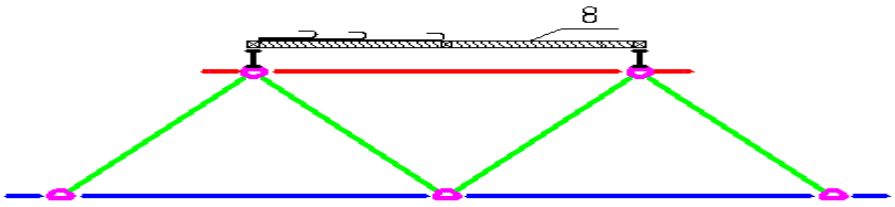

Fig.2.Roofing options on the CBSS.

Where: a-lightweight coating on profiled steel decking; b–with a warm suspended ceiling; c– with a warm roof without a suspended ceiling. 1-core element; 2-nodal element; 3- support table; 4- three-layer panel with timber frame; 5-four layer roofing felt; 6-suspended ceiling purlin; 7-suspended ceiling panel; 8-insulation;9-corrugated decking; 10-channel beam.

Bent profiles were used as purlins, mounted at 3 m intervals on the nodes of the upper purlin grid. The main roll roof carpet consisted of three layers of glass felt (Fig.2) [1].

The drawings show that the roof structure consists of the following:

The top chord joints of the CBSS are covered with channel beams, with profiled decking, thermal insulation and a four-layer roofing felt.The purlins are fixed in knots to special tables.

RESULTS AND DISCUSSIONS.

In the proposed structural solution, where in unheated buildings, the profiled decking is installed directly on top of the top chords of the CBSS roof structure.[2].Steel profiled decks are fixed to the top chord rods with self-tapping screws and to each other with combined rivets every 500 mm along the length of the decking (Fig.3).

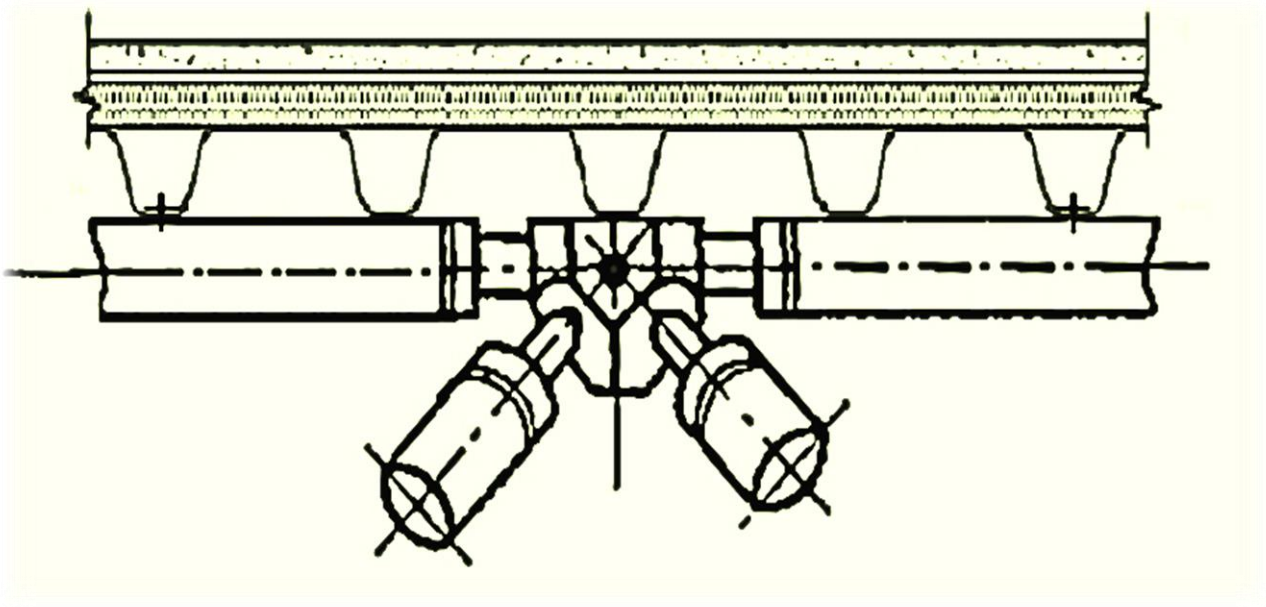

Fig.3.No purlin solution of the CBSS roof structures.

As can be seen in figure 3, the overall dimensions of the node element do not prevent the profiled decking from being attached directly to the top rods of the CBSS.It is recommended that the smallest corrugation of the profiled sheets should be at least 60 mm high [3].
Samarkand Metallurgical Plant is currently developing the production of steel profiled decking for the roof structures according to the range of profiled decking.

CONCLUSION.

By eliminating the support table and purlins, the steel profiled deck is incorporated directly into the roof structure, thereby increasing the stability of the compressed upper chords of the structure [4].

The LIRA calculations with and without purlin and with steel profiled decking result in a 6.6% reduction in the weight of the decking.

In addition, the amount of installation work and construction time is reduced, and metal is saved due to the absence of tables and purlins.

By attaching the steel profiled decking to the structural upper web in this way, its stability is increased from the plane, thereby reducing the forces in the upper web rods.

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