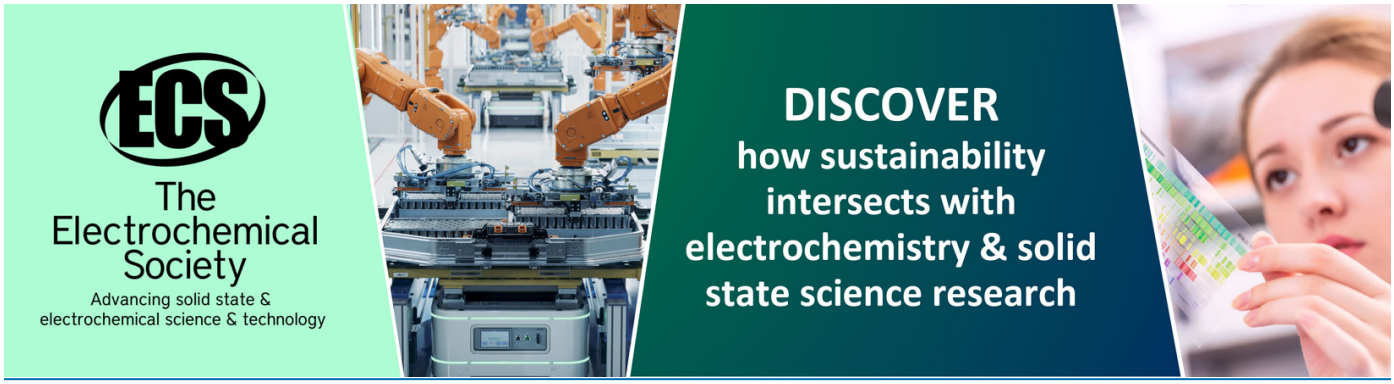
Load Carrying Wooad and Metal Structures of Trusses of Covering of Long Spanned Rail Depot



Load Carrying Wooad and Metal Structures of Trusses of Covering of Long Spanned Rail Depot

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Abstract. The most significant constructive part of any large-span building is a system of coverage (roof). It defines the lasting quality of the building ensuring spatial rigidness, the exterior of the building, the size and condition of interior: the width of the span, the aperture of the required columns, determining magnitude and quality of sustained surcharge; and occurs to be the most labor-consuming and the most expensive segment of the construction activities, which consumes from 30 to 40% of the estimated cost.

1. Introduction

In general the constructions that are used for large-span structures of reinforced concrete girder behave well in compression and behave badly in tension, demand heightening of the staking, additional bracing, put extra strain on load carrying structures, increase materials-output ratio which significantly affects the cost of the construction.

2. Materials and methods

Steel trusses with replacement of angular constructions with the hollow ones allow to lower the weight of the construction and the consumption of steel for 10 to 35%, while formless connections of bands to lace considerably decreases the labor intensivity, but also constrictions of this type are of high price, the height of English trusses is significantly greater than of the simple ones required. The heel joint allows only the pinned conjunction of truss with the columns, holding down the lateral rigidity of the building, and the middle gutter are highly elongated by rule, their cuts has to be chosen by parabolic moment line, which causes cost overrun of the material, require special equipment for rigging up and deliver. Steel trusses undergo exposure of the severe atmosphere of colorific, etching and other chemically active elements of repair unit of engine shed.

In reconstruction, the usage of steel structures is hardened by the lowering of bearing capability of underlying construction, and a high cost of delivery. Usage of combinatory steel and wooden constructions, which fully use proprieties of both materials, will be more reasonable. Such constructions possess less steel intensity, which considerably shortens the period of delivery and erection, not requiring involvement of special equipment. To increase fire explosion safety the needed processing takes place in plant conditions.

Combinatory steel and wooden constructions of trusses are suggested, which are characterized with what allows significantly lower the weight and height of the construction by implication of top chord of a truss from veneer wood space structure reinforced with steel prestrained hinge pin with coefficient of reinforcement 0,01-0,04, and implication of lower flange of steel grips tie, which increase solidity of the truss and decrease steel intensity by handling tremor under wind pressure with tension tie of

mechanic actuator which increases the capacity 1,6-3,2 times, leaving the construction light, but less nonrigid.

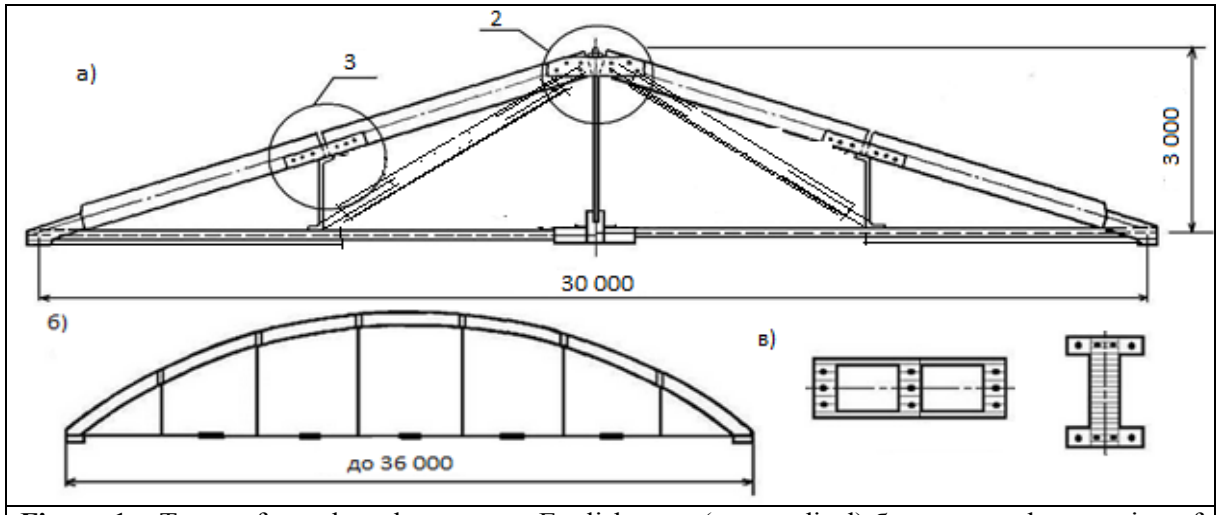

Figure 1 – Types of wood steel trusses: а- English truss (trapezodical);б - segmental; в- section of the truss.

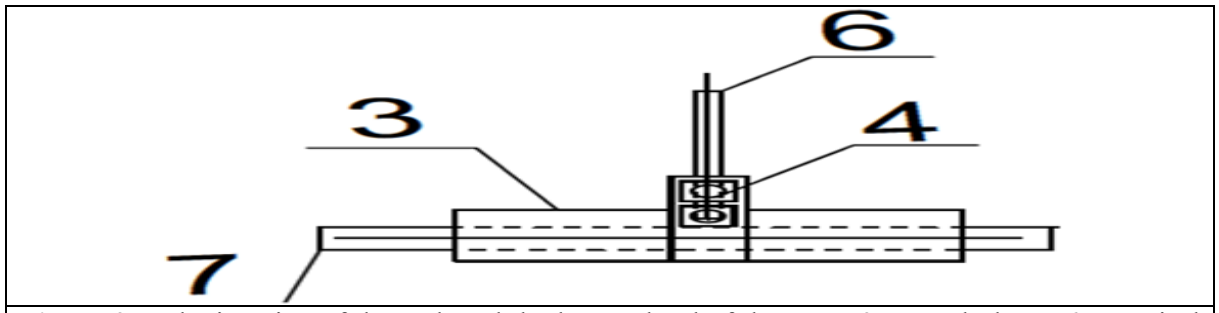

Figure 2 – The junction of the rack and the lower chord of the truss: 3 - metal plates; 6 – vertical post; 4 bolts; 7 – bottom chord, with the tightening of the actuator.

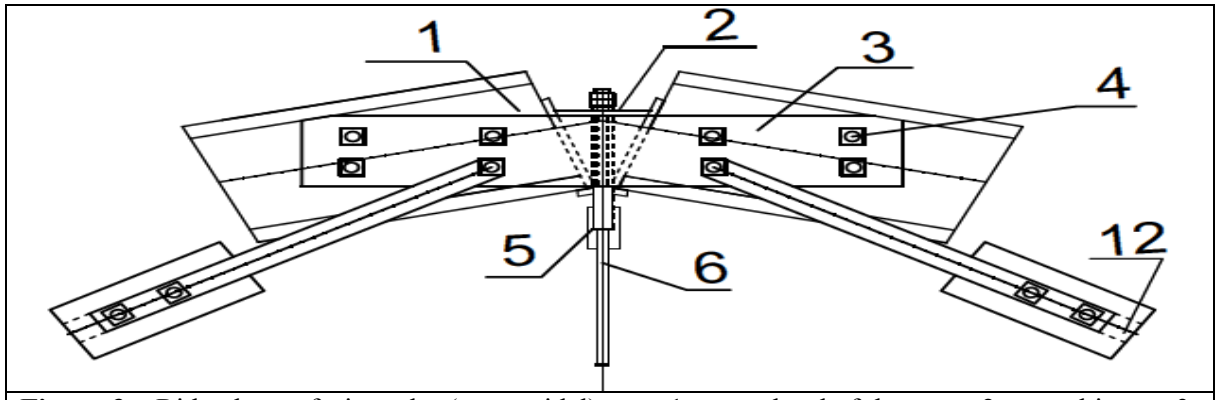

Figure 3 – Ridge knot of triangular (trapezoidal) truss:1 – top chord of the truss; 2 - metal insert; 3-metal covers; 4 - the bolts; 5 - a metal tip; 6 – vertical post 12- element for tightening the actuator.

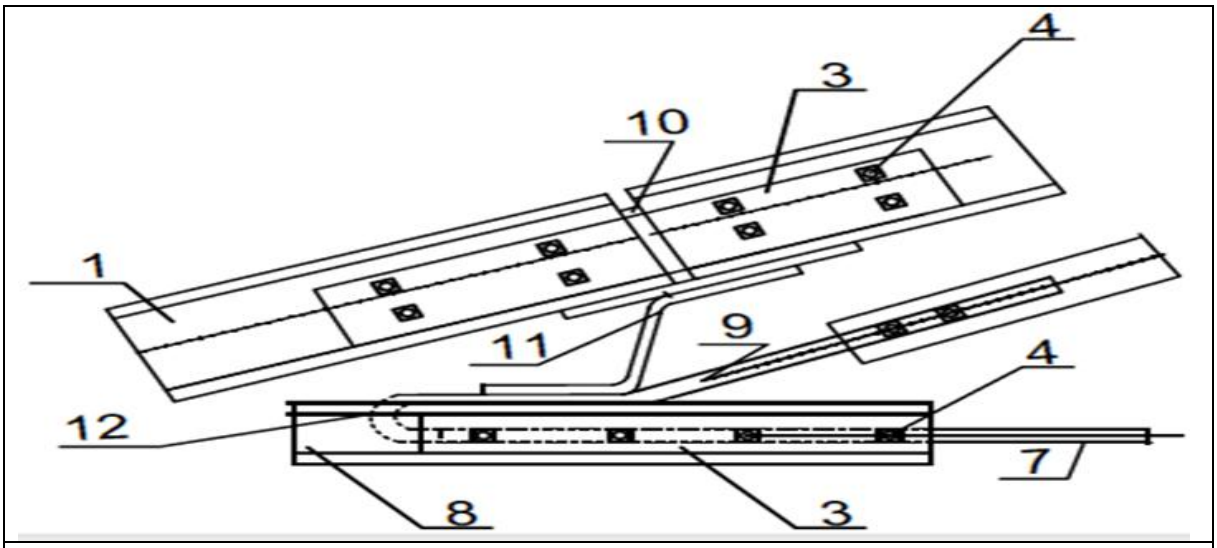

Figure 4 – Connecting the heel joint and the vertical post with an inclined brace: 1 – top chord of the truss; 3-metal covers; 4 - the bolts; 7 - the lower belt of the farm; 8 - supporting metal element from welded corners or I-beam; 9 - metal profile of the brace; 10-metal connecting insert; 11-profile; 12- element for tightening the actuator.

Metallic packing blocks with parallel edge were placed in hairline joint, providing the required imporosity of abutting joint centralization blocks of the truss.

Trusses with compression chord from veneer and laminated wood and steel stretch provide less stiffness of a structure in comparison to whole timber. However,the lace's peculiarity of such truss lies in a narrow loading, as lineation of top chord close to the pressure curve from the load uniformly distributed over the span from its own weight and is leveled by the loop-like tightening of the actuator. Because of the uncertainty of the compliance of the joint nodes, an estimated calculation was made. Let us construct the diagrams of uplift forces, for a plane frame with a concentrated mass and two degrees of freedom.

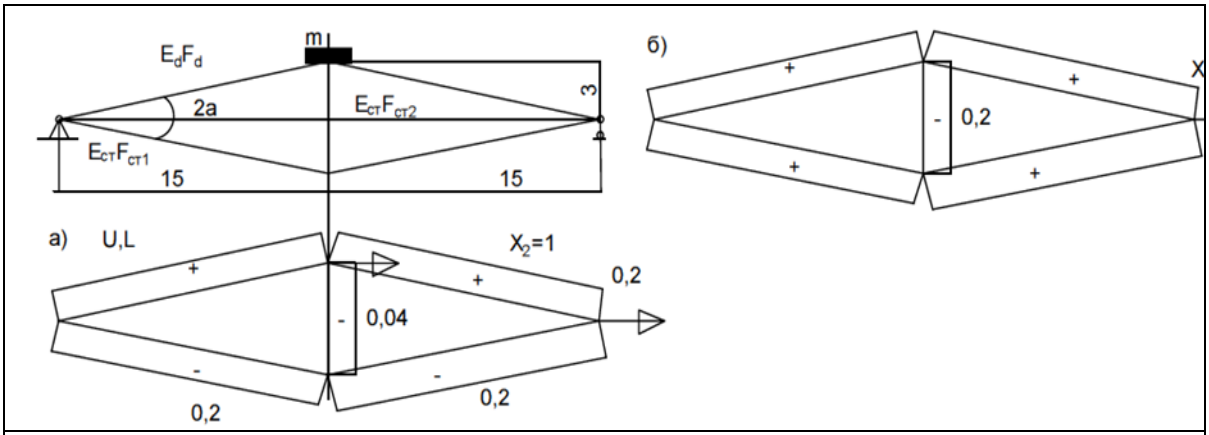

Figure 5 – Structural design: а, б- diagrams of unitary efforts.

The calculation was made taking into account the actual values of the elastic moduli of the applied wood and steel linings, and collar ties, with a correction factor of 0.85.

Let us construct the graph of the deflections along the segments of the truss.

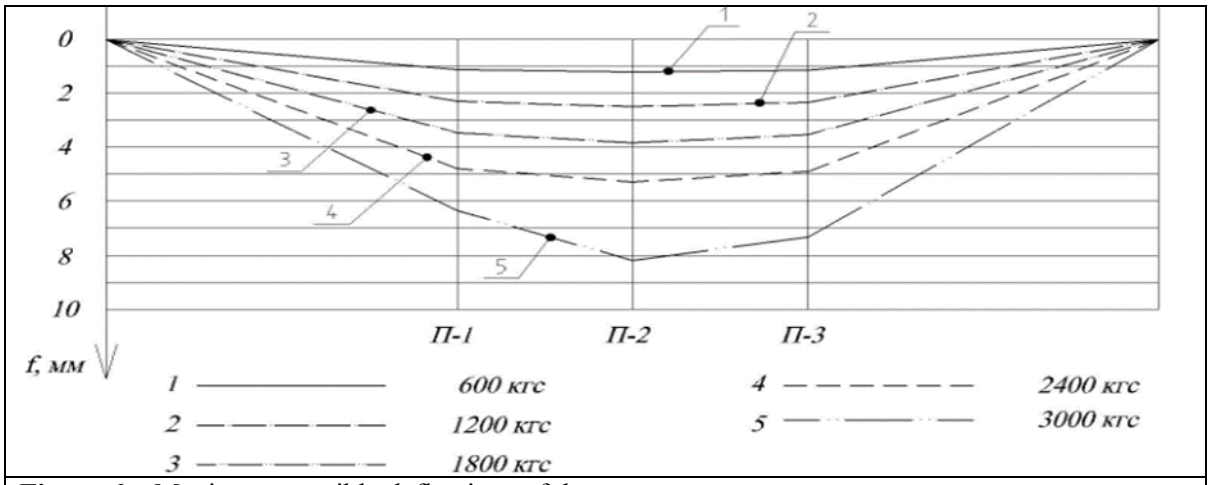

Figure 6 – Maximum possible deflections of the segment truss

3. Discussion

As it can be seen from the calculations, in the developed construction, the rigidity in the vertical plane is more than 45 times smaller than in the horizontal plane, so conditionally, we can assume that a truss of this kind will have one degree of freedom, rather than two, as we originally assumed. In this case, the frequencies of natural oscillations will depend only on the mass of its own weight, the mass of the coating, and additional snow and wind loads, with the inertia forces arising from wind loads being the main influence.

4. Conclusions

The advantage of the developed system will be the absence of a rigid tightening and the application of the loop-like mechanical system of the actuator, which starts and ends at the ridge of the truss, and thus assembles the truss into a single unit.

The advantages of wood-metal constructions:

- wide perspective of implementation, with the possibility of manufacturing most of the parts at the construction site, low material intensity;
- the possibility of using design solutions, which will significantly enhance the architectural expressiveness;
- relatively light weight, with good load-carrying capacity of the structure;
-possibility to use in large-span buildings, with spans of up to 30 meters and more, including through the use of a controlled tie system;
- stability of operational characteristics, seismic stability;
- compliance with the requirements of environmental safety and chemical resistance.

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