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Design of Light Metal Trusses

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Annotation: This article discusses the calculation and operation of light trusses from rolling corners. Their advantages and disadvantages are shown, as well as their application in modern construction. Based on the analysis of those built in recent years, the mistakes that are made in the development of structures for covering trusses from single corners are considered.

Key words: truss, corner, corrosion, eccentricity, forces, nodal moment, support node, coefficient of longitudinal stability, coating rigidity.

Introduction

For a long time, in the construction of buildings and structures, light metal structures of various types from various parts of the world were widely used. The main type of structures of this type are roof trusses of coverings from single corners.

These structures are lattice rod systems. In such structures, the racks and braces are made of single corners, one of the shelves of the corners is installed in the truss plane, and the second shelf is oriented perpendicular to the truss plane.

Such farms are widely used to cover buildings and structures. But recently, the design of trusses from single rolling corners has been discontinued due to the economic crisis.

However, since the 2010s, in connection with the restoration of some industrial sectors, there has been a need for the construction of industrial and agricultural facilities. Issues of unification and optimization of metal trusses from rolling angles for covering buildings and structures.

Studies of the stress-strain state of various types of trusses, including trusses from single rolling angles, are still being carried out.

In many regions of the Republic of Uzbekistan, they returned to the use of trusses from single corners in agricultural construction. Trusses from single rolling angles have the following advantages over trusses with elements from two rolling angles:

- the complexity of manufacturing is lower by 25%;
- fewer gussets and lattice elements;
- up to 10% less material consumption
- high resistance to corrosive wear (trusses from single corners do not have hard-to-reach places.)

Fig. 1. - Farms from single rolling corners as part of the coating

Along with the advantages of such farms, they also have disadvantages;

- the axes of the centers of gravity of elements from single corners are located in different planes;

- as a result, in the nodes of such trusses there is an additional loading torque.

The effectiveness of the use of trusses from single angles is currently being investigated on the basis of the "Guidelines for the design of welded trusses from single angles".

Comparison of TECs of several types of metal trusses is given in Table.

Technical and economic indicators of metal trusses

Table 1.

Section of truss rods	Truss weight (kg)	labor costs	Cost indicators
Pair rolling corners	2210	1	1
Single rolling angles	2015	0.73	0.81
Bent-welded profiles (Molodechno farm)	1865	0.69	1.14

The design of trusses from single rolling angles must be carried out in accordance with the "Guidelines for the design of welded trusses from single angles". When designing, the features of the operation of such farms should be taken into account:

- checking the stability of the compressed elements is performed in two planes. The calculation for the stability of compressed braces from the truss plane is carried out as for compressedly curved elements;

- in all nodes of such trusses, the free edges of the corners of the lattice are connected by welding strips to the inner edges of the corners of the upper and lower chords;

- compressed braces, the force in which is more than 25% of the force in the support brace, are additionally connected by planks and welded to the corners of the chords;

The calculation of farm elements from single corners is carried out according to the formula

$$\frac{N}{A_н R_y \gamma_c} \le 1 \qquad (1)$$

where N – design force at the central supply of the truss rod; R_y – design steel resistance to yield strength; A_n – sectional area of rolling angle net; γ_c = 0,75 – coefficient of working conditions of a single truss corne.

Centrally compressed truss elements for stability under central compression is performed by the formula

$$\frac{N}{A\varphi R_y \gamma_c} \leq 1 \qquad (2)$$

where N – design force at the central compression of the truss rod; A – sectional area of the corner gross; φ – coefficient of stability under central compression, taken into account the greater flexibility of the element.

A design organization in Russia completed a project for a workshop building and a project for a new farm from single corners. After the examination, the following shortcomings were identified:

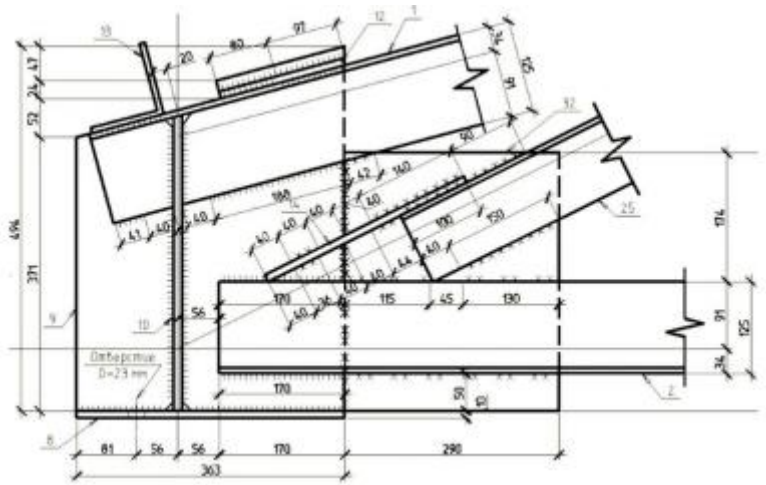

Fig. 2. - The design of the truss support unit developed in the project

1. The design of the truss support assembly (Fig. 2) was developed without taking into account the design guidelines in accordance with the "Guidelines for the design of welded trusses from single angles" developed at the TsNIISK named after V. A. Kucherenko. Recommended, taking into account the comments, the design of the truss support unit from single rolling corners is shown in Fig.-3.

2. The static calculation of the truss was performed without taking into account the additional nodal moment

3. The lower belt of the truss consists of an equal-shelf angle 100x100x8 according to GOST 8509-93. According to the project, the lower chord of the truss has only one spacer, which does not meet the requirements for the ultimate flexibility of the stretched chord from the plane of the truss.

4. The system of horizontal and vertical ties along trusses from single rolling angles does not provide spatial rigidity of the shop floor.

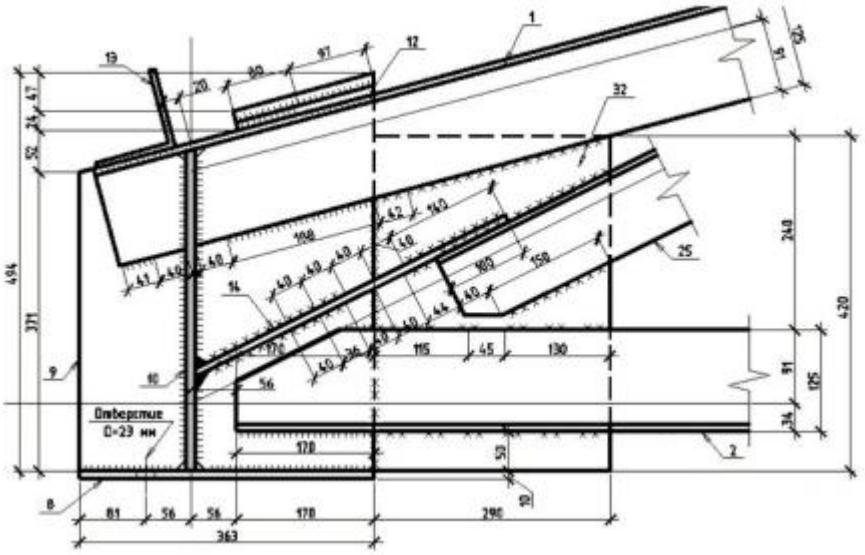

Fig. 3. - The design of the truss support assembly, made in accordance with the design recommendations in the "Design Guide for Welded Truss from Single Angles

When using light metal trusses from single rolling angles, the following requirements must be met at the design stage:

1. When designing the truss support unit, it is necessary to assign a distance from the butt of the corner of the upper chord to the truss axis, which is aligned with the alignment axis of the row, depending on the size of the corner flange;

2. When performing a static calculation of trusses from single rolling angles, it is necessary to take into account the additional loading torques in the truss nodes;

3. Spatial rigidity of the pavement with such trusses in tie blocks will be ensured by installing additional vertical ties.

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