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OPTIMIZING THE DESIGN OF THE ROOF OF A UNIVERSAL GYM

Xolqoziyeva Madina Eshpolat qizi*; Jamolova Mohigul Xudoyberdi qizi; Boqiyev Sulaymon Vahobovich*****

*Master Degree Student,
Samarkand State Architecture and Civil Engineering Institute,
Named after Mirzo Ulugbek., Samarkand, UZBEKISTAN
Email id: xolquziyeva_madina@umail.uz

**Master Degree Student,
Samarkand State Architecture and Civil Engineering Institute,
Named after Mirzo Ulugbek., Samarkand, UZBEKISTAN

***Associate Professor,
Samarkand State Architecture and Civil Engineering Institute,
Named after Mirzo Ulugbek., Samarkand, UZBEKISTAN

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ABSTRACT

The article proposes the design and comparison of traditional double-angle and low-metal-consumption profile trusses, which are widely used in roofing. It is noted that profiled trusses are double-angled, more efficient than trusses, their grids are attached directly to the strips without trusses, corrosion resistance due to their closed contours, and the priority of equal positioning inertia axes is high. As an example, 24 m. arched trusses were designed and compared.

KEYWORDS: *Roof-Covering, Truss, Interval, Base, Knot, Bar, Eccentricity, Bending Moment, Share Force, Axial Force, Angular, Profile.*

INTRODUCTION

Metal trusses of various structural forms are currently used in the design of building roofing. In this situation, the proposed farm should, first and foremost, have low metal consumption and labor costs. These metrics verify the design's cost-effectiveness. The precise choice of design scheme and cross-sectional forms is critical for optimizing and effectively designing steel usage in tomyopma farms. Farms of various types are now commonly employed in construction. Trapezoidal, parallel-striped, triangular, polygonal, and segmented trusses are examples. The type of cutting of the stems can be divided into: double-angled, single-angled, tubular, elongated, right-angled profile; according to the geometric structure of the grids: mortar, mortar and columnar, elongated mortar and columnar, cross-shaped, panel bracing; according to the type of cutting of the stems can be divided into: double-angled, single-angled, tubular, elongated, right-angled profile. **[1]**

The truss rods have a large shelf-curved cross-section and are double-angled, single-angled, tubular, curved, with a bent welded profile. Several varieties of roof trusses are originally compared in terms of design forms and cut types in the design of roof trusses. The best option is determined by comparing trapezoidal profile trusses to similar geometrically designed double-angle trusses in this scenario. **[2]**

The main part: Corrosion resistance, equal superiority over shafts, and the lack of painted surfaces distinguish bent welded profile trusses from other trusses. In comparison to other trusses, bending welded profiles make it easier to weld truss fences directly to the strips without trusses, as well as attach the progon and ties to the truss. Farms of this type are also slightly better than tubular farms. Right-angled profiles with the same cross-section as the pipe have a higher priority than pipe rods because their inertia radii are slightly bigger.The upper band of the trapezoidal trusses has a slope of $\frac{H}{L}=\frac{1}{8}:\frac{1}{10}$. For this type of farm, a slope like this is ideal. The adoption of a multi-cut type profile to conserve metal consumption in the design of low-consumption farms produces better outcomes than other farms (Figure 1.)

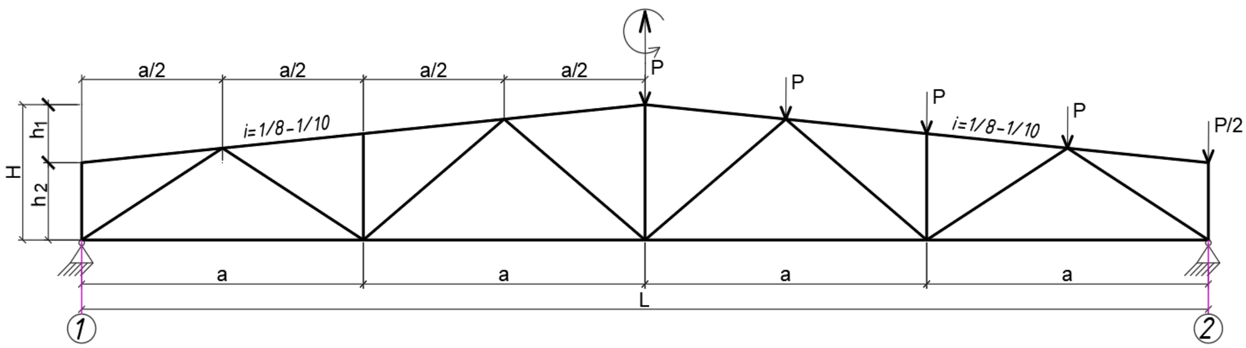

Figure 1. Calculation scheme of low metal consumption profile farm.

Variant1. The following elements must be included in the design of the profile farm. The farm is 24 meters tall, with a pitch of -6 meters. The material is low carbon C235 grade steel. (R_y=235 MPa). **[3]**

Normative and calculated spread loads respectively q^H=0,95 kH/m^2, q=1,18 kH/m^2.

Loads acting on the farm without roofing are transmitted through prongs laid in steps of d = 3.01m.

Solution. We determine the loads that have an impact on the farm. Table 1 shows the normative and design loads for roofing.

TABLE 1

№	Loads names	Normative load, $\kappa H/m^2$	Reliability coefficientsγ_m	Accounting load, $\kappa H/m^2$
1	SANDWICH panel Progon,	0,20	1,1	0,22
2	fasteners, farm	0,25	1,05	0,26
3	Snow	0,50	1,4	0,70
	Total	q_n= 0,95		q_o=1,18

Solution: Calculated and accumulated loads influencing the farm's top belt.

P=q·B·d=1.18·6·3.01=21.31 kH.

The geometric shape of the farm is created using the above recommendations.

High band slope; $i=1/10=0.1$; $h_1=i\cdot L/2=0,1\cdot 24/2=1.2$ m.

H=2,8m; $h_2=H-h_1=2.8-1.2=1.6$ m

From the profile, we choose all of the farm's sections.

The farm's computation scheme is depicted in Figure 2.

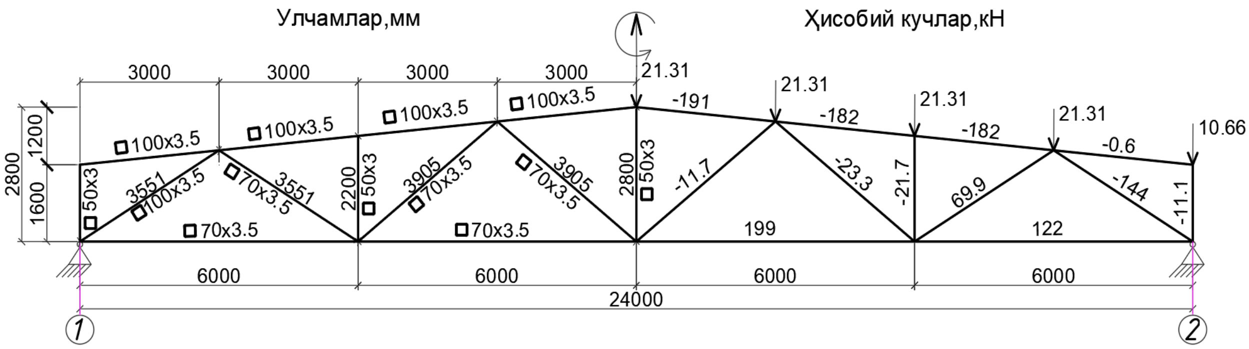

Figure 2. Farm calculation scheme.

We calculate the farm using the LIRA-CAPR program. The following figures illustrate the results of the computations, the bending moment, and longitudinal force diagrams.

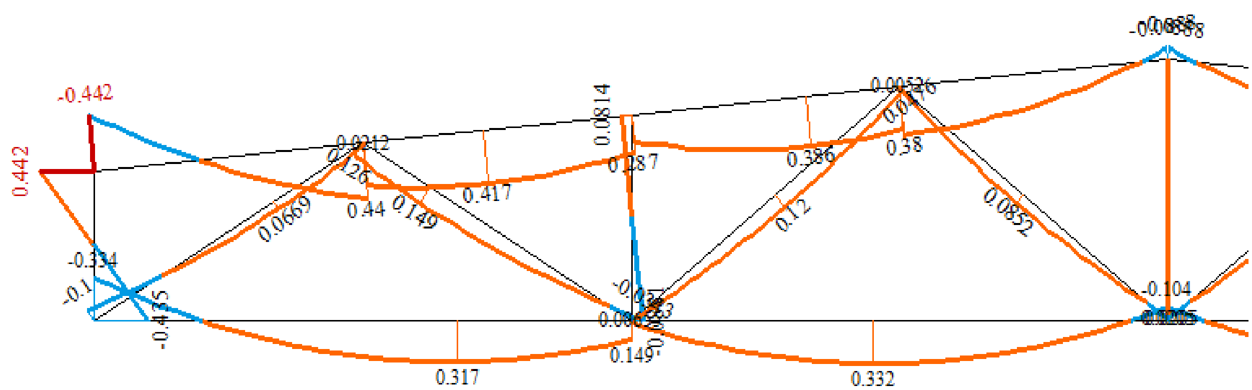

Figure 3. Bending moment diagram.

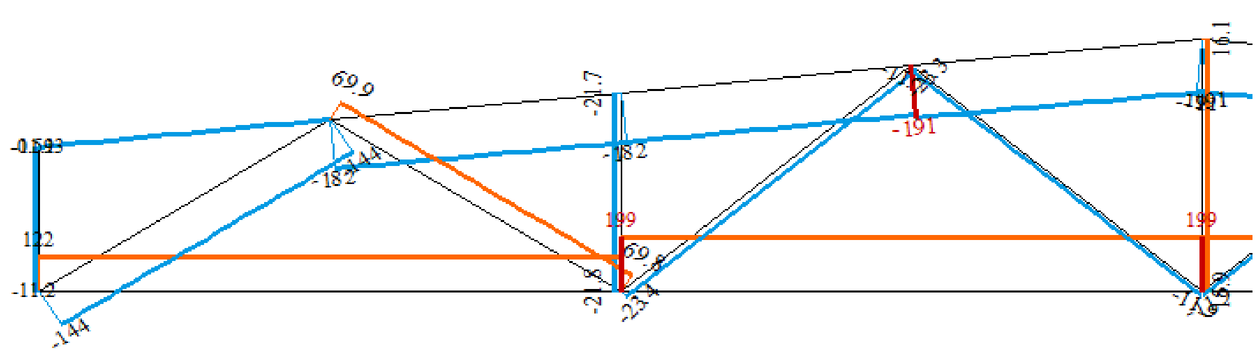

Figure 4. Longitudinal force diagram.

Variant 2.A double-angle truss with the exact same geometric shape was used as a comparative option, and the quantity of loads was taken as a profile truss.(figure 5.)

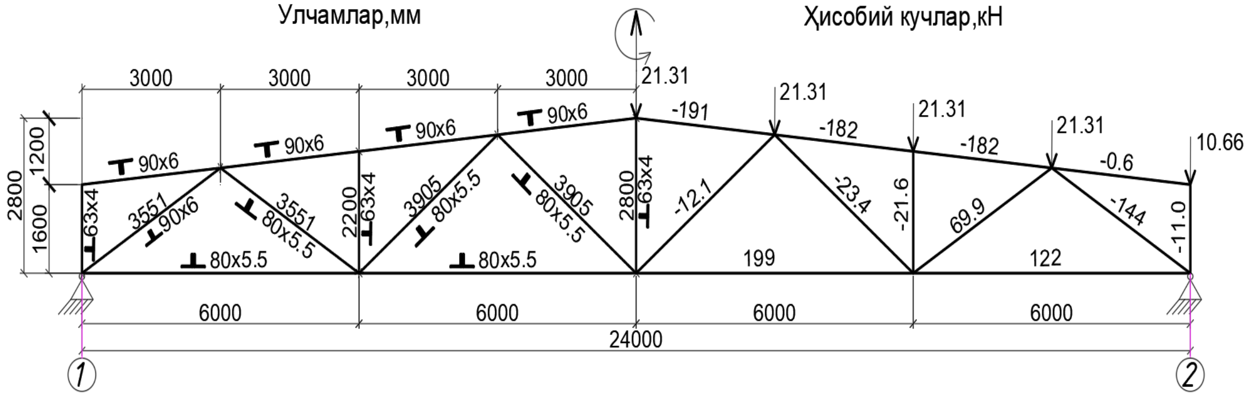

Figure 5. Double-angle farm calculation scheme.

Working drawings of the farms were created for both choices based on selected cross-sections of the farm pieces, and the quantity of steel consumed for each farm was calculated.Tensions on farm rods were determined using the LIRA-CAPR program. **[4]**

Table №2shows the results of the comparison.

TABLE №2:

Farm type	Number of rods	Number of nodes	Consumable Steel, kg.
Profile	17	14	785.5
Double angle	17	14	1280.3

CONCLUSION

Profiled trusses are bangular, economical in terms of steel consumption compared to trusses, corrugated trusses corrugated due to the closed contour, and truss is favored in a flat plane in the logical design of trusses used for roofing. Its design is also more convenient than that of double-angle farms. Metal usage is 39 % lower than on double-angle farms, which is a good thing. These farms are commonly used in the roofing of huge arching structures. It is cost-effective to cover the roofs of existing gyms with such farms. **[5]**

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