DESIGN AND ESTIMATION OF STEEL SHED

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ABSTRACT

This project is based on the topic design and estimation of steel shed. Different workshop like welding, bar bending, scaffolding and brick masonry will take place under one roof. The major aspect before erection of any building is testing the soil. After performing certain tests discussed further we found that the soil is stiff. So, we took certain measures and design aspects according to that. Next, we started designing the structure as our structure is completely a steel structure we designed it according to IS 800:2007, IS 875(Part 3):1987. We designed for the fink truss members, columns and footing. For the design of footing we used IS 456:2000. Then we started with the estimation of the project. We calculated the cost of each and every member section which we are using in the design and also calculated the cost of bricks, paver blocks which we are going to provide on the ground. We also included various labour cost in the estimation. Then we calculated the entire cost of the project and we found out to be around Rs.1300000.

Key Words: *Estimation, Steel shed, Design and estimation, scaffolding.*

1. Introduction

Project is based on the design of a multipurpose laboratory designed under one roof. Different workshop like welding, bar bending, scaffolding and brick masonry will take place. For designing the shed the preliminary task is to perform the soil test on the site. According to the soil test we designed isolated, strap or raft footing.

Then provide the cost estimation of the complete project and for getting cost estimation various parameters of the structure should be known like length, width, height, plinth level, footing depth etc.

Then comes the design part of the structure. The roof is supported by the fink truss which is further supported by steel column. The load of the column is bearded by footing which is bolted with it by a base plate and anchorage is provided so that load can be distributed to ground and resist the uplifting (tensile) force due to moment.

Sections used in fink truss are angle section and column is I-section as load transferred to the section is a light load. Trusses in the form of bracing are used in horizontal planes of industrial building to resist lateral loads and also to provide lateral stability.

Spacing of roof trusses can be kept $1/5^{th}$ to $1/6^{th}$ for 15 to 30 m span of roof trusses. No industrial building should have less than two braced bay. Various combinations of loads on roof trusses are considered and the critical condition is considered for the design. It may be noted that earthquake loads are not significant for roof trusses because of the small self- weight. The load combination may be due to dead load, live load, wind load, snow load. But according to region we are opting for dead load, wind load, live load.

The truss members are generally assumed to be pin connected and therefore the transfer only axial force from one member to another. For analysis of roof truss we can use algebraic method of joints, graphic method of joints, the matrix method etc. We have analysed the roof truss by algebraic method.

Purlins are provided over roof trusses to support the roofing between the adjacent trusses these are placed in a tilted position over the principle rafter of the trusses. Channels and angle sections are commonly used as purlins. We have used grade of steel for trusses and column of Fe410 i.e. HYSD (High yielding strength deformed bars) and grade of bolts 4.6.

2. Methodology

2.1. Core Cutter

This test is done to determine the in-situ dry density of soil by core cutter method as per IS: 2720 (Part XXIX) – 1975.The apparatus needed for this test is

i) Cylindrical core cutter

ii) Steel dolley

iii) Steel rammer

iv) Balance, with an accuracy of 1g

v) Straightedge

vi) Square metal tray – 300mm x 300mm x 40mm

vii) Trowel Procedure Determine the In-Situ Dry Density of Soil by Core Cutter Method.

Description	Determination
Internal diameter of core cutter	100
Internal height of core cutter	130
Volume of core cutter	1000
Weight of core cutter	850
Weight of core cutter + soil	2700
Weight of soil	1850
Bulk density of soil	18.5
Moisture content	11.11%
Dry density of soil	16.4

2.2 Design procedure

1. Depending upon the span lighting roofing material etc. available the type of truss is decided as the span is 18m we opted fink truss.

2. Various loads acting over roof truss is estimated.

3. The roof truss is analysed by any suitable method i.e. algebraic method.

4. The member design forces are computed using various load combinations.

5. Double angle is provided for principle tie and rafter (as designed forces are more).

6. A minimum of 50x50x6 mm angle section is provided.

3. Results

3.1. Estimation

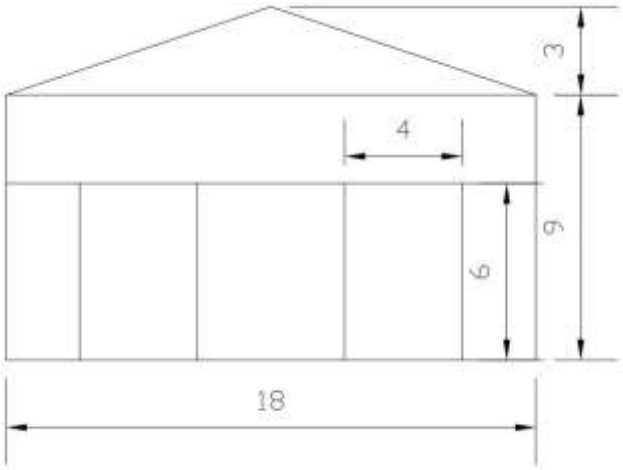

Figure 1: Elevation of Shed

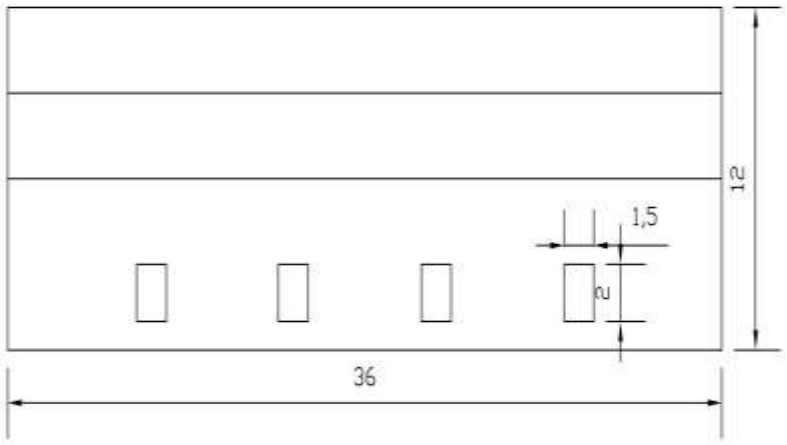

Figure 2: Side view of Shed

Window Specifications: 2x1.5 m

Door Specifications: 6x4 m

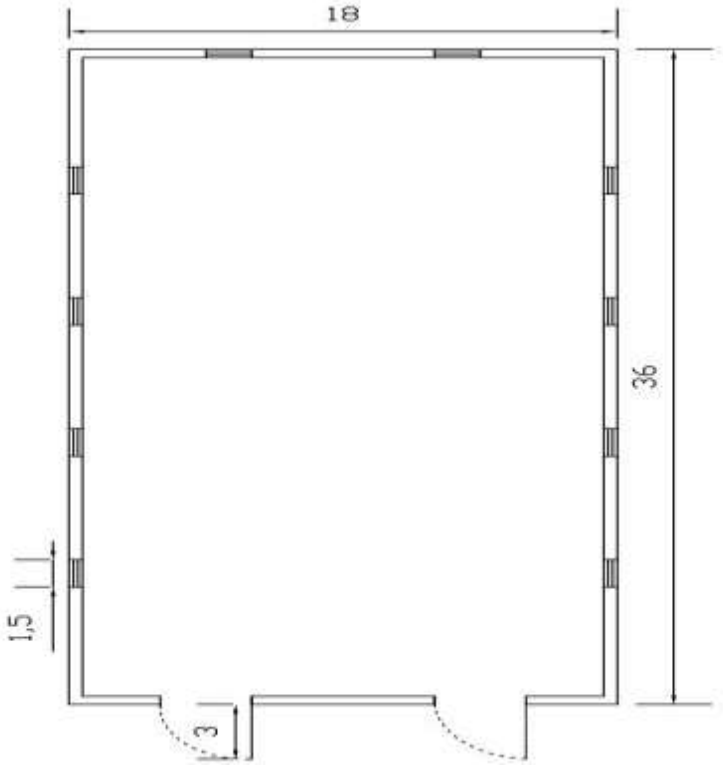

Figure 3: Plan of Shed

3.2. Calculation of center line

Table 1: Calculation of center line

Work	Length(m)	Breadth(m)	Height(m)	Quantity(m^3)	Description
Excavation of earth	107.1	0.6	0.34	21.85	
Cement concrete in foundation	107.1	0.6	0.15	9.64	
Brick Work					
1st Footing	107.1	0.46	0.15	7.4	
Upto ground level	107.1	0.225	0.04	0.96	
Brick Work					
Above ground level	107.1	0.225	5	120.5	(Excluding doors
Window	1.5	0.225	2	5.4	2x8x1.5x2x0.22
Doors	4	0.225	6	10.8	2x4x6x0.225
Total Brick Work above ground level				104.3	Deducting doors and windows

3.3. Cost Estimation of the project

Table 2: Cost Estimation of the project

Particulars	Cost
Steel Sheet @ 151 N/m^2	Rs.4144
Modular bricks (20x10x10)cm	Rs.382635
Paver Blocks	Rs.231430
Cement (Mortar + Concrete) (PPC)	Rs.9030
Rafter ISA 100x65x8	Rs.121879
Main principle tie ISA 100x75x8	Rs.122669
Strut – ISA 80x50x8	Rs.40981
Sling – ISA 80x50x8	Rs.32485
Column - ISHB 225	Rs.215806
Purlins – ISLC 75	Rs.76105
Total	**Rs.1237164**

3.4. Other Charge Estimate

Beldar = Rs.329/day

Mason = Rs.417/day

Coolie = Rs.329/day

Bhisti = Rs.363/day

Water Charges 1% = Rs.12372

Assuming the span of the project to be 30 days. Total cost of the project = Rs.1292676/-

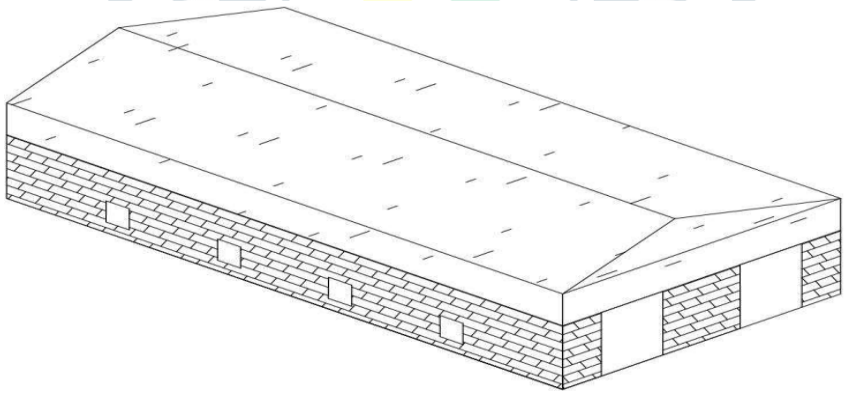

Figure 4: Isometric View of the Shed

4. Conclusion

From this project we learnt the various aspects and specifications used in the design of a truss member. We also learnt about the various soil testing techniques and at last we learnt about the estimation of the shed.

Design aspects:

Computations of various loads such as:

a) Live load
b) Dead load
c) Wind load

Selection of section to be provided in truss members, bracings, purlins and columns. Computation of angle of roof and spacing of roof.

Then we calculated the strength of connections. Then we selected the footing from various types as: Isolated, strap, raft, trapezoidal etc.

We designed a concrete pedestal as load applied on the footing from the column is less.

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