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Planning, Analyzing and Designing of Railway Station Structure

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ABSTRACT

Stations are the places wherever trains stop to gather and deposit passengers. It should, therefore, be designed, pleasing to the attention (photo left), convenient and convenient for the traveler additionally as convenient in layout and operation. Stations should be suitably manage and maintained and must be operated safely. The Project railway station, enclosing traffic integration with town and alternative modes of transport, and therefore the rider facilities shall adapt to the look needs taken off during this Manual that square measure the minimum prescribed. This paper study regarding the importance of Railway Transportation and describe the advantages of using railways compared to other Transportation systems. Railway station plan prepared with the Total area 588 Sq.m using AutoCAD. Manual calculations and software analysis also carried for a proposed plan.

Keywords: Software, Analysis, Railway station and AutoCAD

1. INTRODUCTION

Indian Railways (IR) most one in each of the most important Railway networks of the world with over 64,000 route Kilometers (Km) and 7,000 stations. The Indian Railways (IR) overseen through operations Ministry of Railways (MOR), authorities of Asian country and sixteen Zonal Railways headed through trendy Managers. The IR carries larger than 17.5 million passengers day after day and variety of the key Railway stations manage a hundred-2 hundred million passengers every year. Most of the Railway stations are engineered over a hundred years past, New Classification of nodal objects on lines for Railway station

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1.1 Objective of the Station Project

- The objective of the Station assignment to be evolved thru this guide is to upgrade the present Station and its environment or construct a brand new Station into a world-magnificence passenger terminal in a manner which guarantees:
- Advanced offerings to passengers for the design passenger extent certain inside the CA
- Advanced educate operations (along with allied services e.g., parcel, posts and so forth.) and upkeep facilities affording more flexibility and more suitable operational efficiency for IR
- Smoother and more secure street traffic drift to and from the station, advanced avenue connectivity with the town and adequate parking inside the station premises;
- Cutting-Edge and stepped forward places of work, residential quarters and different centers for railway body of workers on the railway land surrounding the station;

1.2 Functional Design

The station will be designed to acquire full weather protection to every passenger/patron who enters the station building. All platforms should be parallel, of the same duration and in square alignment. Platforms and departure concourse have to each have a common place roof with unobstructed big span structural structures that gives in which

viable column-loose area and unobstructed imaginative and prescient throughout the duration and breadth of structures and concourse. Station interiors will be designed with partition partitions which are amenable for bendy area utilization for retails, workplaces, and other passenger services. All passenger regions will be provided with wall and ceiling finishes which do not create echo and further allow an surroundings that allows all public bulletins to be audible to humans anywhere during the most rush period.

1.3 Environmentally Responsible Design and Use of Materials and Resources

A primary objective of the station design will be environmental acceptability, sustainability, and energy efficiency. Station designers will create an environmentally responsible Railway Station that exceeds current standards and practices within the transit industry, creates a healthier, more ecologically responsible Station environment, Station surroundings, and complies with all relevant environmental laws.

Materials used in the station complex have to be eco-friendly. The building should be energy efficient. Rain Water Harvesting, use of Solar Panels for electricity and Waste Management are options to reduce the energy requirement for the Station building. Green/landscaped area must be increased and coordinated with the pedestrian and vehicular traffic.

These environmental goals will be achieved through the application of the Five Pillars:

- Electricity Performance
- Material And Useful Resource Conservation
- Indoor Environmental High-Quality (Ieq)
- Exceptional Operation And Upkeep
- Water Conservation and Site Management.

2. STRUCTURAL DESIGN

2.1 Design Data

Overall length of truss = 28 m
Overall width = 5.5 m
Width of c/c of roof truss = 5 m
Height of column = 11 m
Roofing material =Asbestos cement sheet
k_1 = 1.0
k_2 = 0.89
(For terrain category 3,building height = 11 m)
\ k_3 = 1.0 (for plain land)
v_b = 39 m/s
Design wind speed, V_z = $k_1 x k_2 x k_3 x v_b$
= 1x0.89x1.0x39
= 34.17m/s
Design wind pressure, P_d = $0.6 x v_z^2$
= 0.6 x 34.17^2
= 700 N/m^2
= 0.700 kN/ m^2

2.2 Purlins

2.2.1 Dead load

Dead load of the roof covering asbestos cement sheets = 170 N/m^2
Dead load of purlin = 300 N/m
= 300x5
=1500 N

2.2.2 Selection of Section

Assume ISMB 500
Weight per meter W = 869 N

Sectional area A = 11074 mm^2
Depth of section D = 500 mm
Width of flange b_f = 180 mm
Thickness of flange t_f = 17.2 mm
Thickness of web t_w = 10.2 mm
Moment of inertia I_z = 45218.3 x 10^4 mm^4
I_y = 1369.8 x 10^4 mm^4
Radius of gyration r_z = 202.1 mm
r_y = 35.2 mm
Moduli of section Z_{ex} = 1808.7x $10^3\ mm^3$
Z_{ex} = 152.2 x $10^3\ mm^3$
Radius at root r_1 = 17 mm
Radius at toe r_2 = 8.5 mm

2.2.3 Effect of axial force

Maximum axial force in the member
P = 265 kN
p_y = axial load causing yielding
p_y = f_{yd} x A
= $\frac{415}{1.1}$ x 11074
= 4178kN
$\frac{P}{P_y}$ = $\frac{265}{4178}$

0.063 < 0.15

Therefore, the effect of axial force can be neglected.

Hence ok.

2.3 Design Of Column Base

Assume ISMB 500
Weight per meter W = 869 N
Sectional area A = 11074 mm^2
Depth of section D = 500 mm
Width of flange b_f = 180 mm
Thickness of flange t_f = 17.2 mm
Thickness of web t_w = 10.2 mm
Moment of inertia I_z = 45218.3 x 10^4 mm^4
I_y = 1369.8 x 10^4 mm^4
Radius of gyration r_z = 202.1 mm
r_y = 35.2 mm
Moduli of section Z_{ex} = 1808.7 x $10^3\ mm^3$
Z_{ey} = 152.2 x $10^3\ mm^3$
Radius at root r_1 = 17 mm
Radius at toe r_2 = 8.5 mm
Axial load of column = 265 kN
Grade of concrete = M25
Bearing strength of concrete = 0.45 f_{ck}
= 0.45 x 25
= 11.25 N/mm^2
Factored load P_u = 1.5 x 265
= 397.5kN

Area of base plate required $= \frac{P_u}{0.45 f_{ck}} = \frac{397.5 \times 10^3}{11.25}$

$= 35333.3 \text{ mm}^2$

Provide 600 x 300 mm size plate

Area provided = 660 x 270 mm

$= 178200 \text{ mm}^2$

Pressure (w) = load/area

$= (397.5 \times 10^3 / 178200)$

$= 2.23 \text{ N/mm}^2$

Projections are:

a $= \frac{660 - 600}{2}$

$= 30$ mm

b $= \frac{270 - 210}{2}$

$= 30$ mm

$= \{ \frac{2.5w (a^2 - 0.3b^2) \gamma_{mo}}{f_y} \} 0.5$

$= \{ \frac{2.5 \times 2.23 (30^2 - 0.3 \times 30^2) 1.1}{415} \} 0.5$

t_s = 4.65 mm

3. ABOUT SOFTWARE

STAAD or (STAAD.pro) is a structural evaluation and design software program software firstly developed with the aid of studies Engineers worldwide in 1997. In overdue 2005, research Engineers global became bought by using Bentley structures. Figure 1 shows the 3D view of the structure.

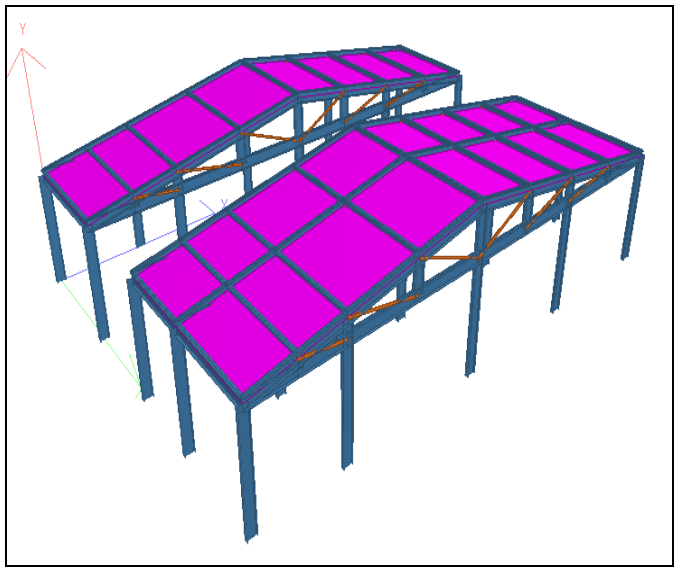

Figure 1 3D View of the Structure

Figure 2 shows the Load Assigned Diagram.

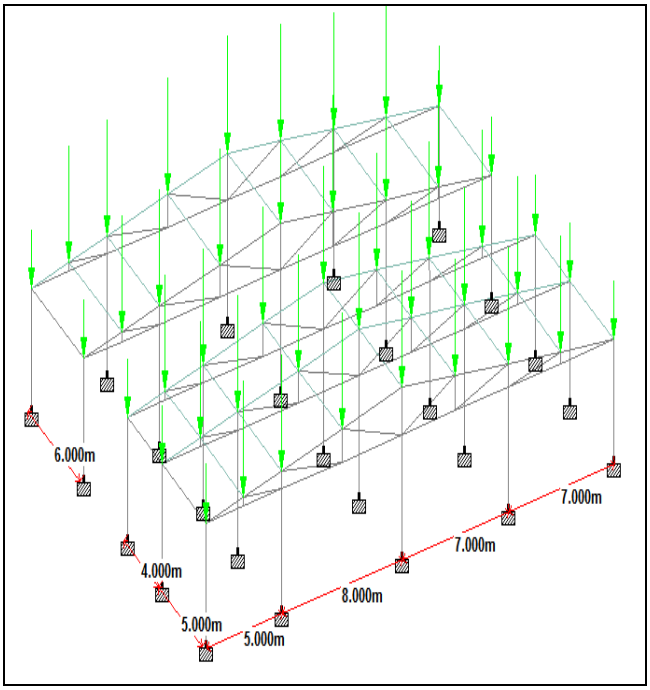

Figure 2 Load Assigned Diagram

Figure 3 shows the Axial Force diagram for inclined member

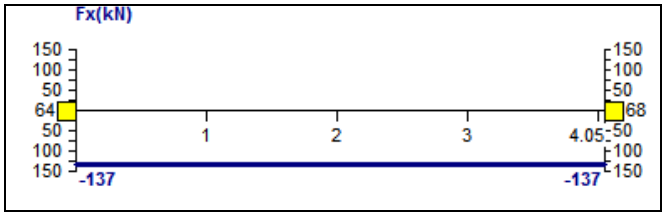

Figure 3 Axial Force Diagram for Inclined Member

Figure 4 shows the steel designs.

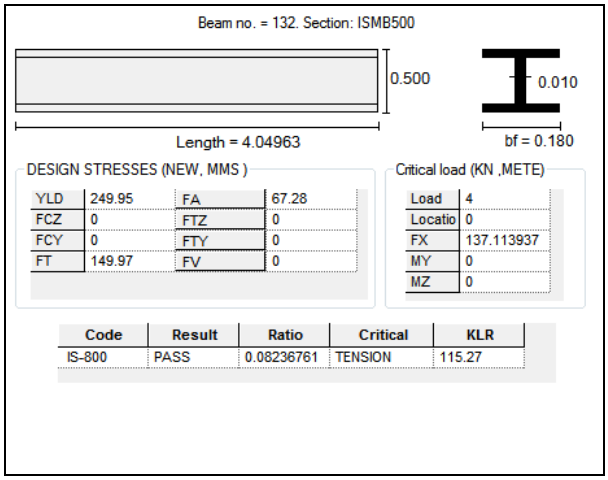

Figure 4 Steel Designs

4. CONCLUSION

Rail transport helps to transfer passengers and items on automobile strolling on rails or Tracks. The greatest advantage of rail transport is that most reliable method of transport as the smallest amount precious by climate conditions which include rains, fog and so on. It has constant routes and schedules; its carrier is added definite, homogeneous and normal in comparison to other mode of carry. Railway delivery is low-budget, quicker and nice proper to sporting heavy and cumbersome items over long distances. So we put together Railway station building plan using AutoCAD and steel structure evaluation using Staad-seasoned for stability test.

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