SEISMIC ANALYSIS OF JUNCTION HOUSE IN VARIOUS SEISMIC ZONES

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Abstract – *The study on performance of braced junction house is widely studied in many branches of structural engineering. Over the years, mainly for their greater capacity of carrying external load. From the study we observed that braced steel frames are economical for the earthquake loadings. The current study consists of four different models. First model is behaviors of junction house with inverted v-shaped bracing or chevron bracing system in zone II. Second model is behavior junction house with inverted v-shaped bracing or chevron bracing system in zone III. Third model is behavior junction house with inverted v-shaped bracing or chevron bracing system in zone VI. Fourth model is behavior junction house with inverted v-shaped bracing or chevron bracing system in zone V with the consideration of IS 800 2007, and IS 1893 2002. The performance of junction house under the earthquake load condition consideration of various zones in India is evaluated and compared by response spectrum method.*

***Key Words*: Junction house, Earthquake loading, Bracings, Response spectrum method.**

1. INTRODUCTION

Junction house is a steel framed structure which is used in belt conveyorssystem i.e., in small and large scale industries, coal handling plants, iron ore transportation etc. It is used as a junction point to transfer the material from one conveyor belt to another conveyor belt in the system, therefore it is also known as Transfer Tower. The requirement of junction house may arise due to change the direction of the material, conveyor or when the conveyor belt continuity is to be broken. In the junction house the material flow from the main conveyor belt to another conveyor belt which would transfer the material to another location. Junction accommodates the mechanical components like pulley, drive/pulley, driving motors, belt conveyors and its components. The Total height of the junction house is depending on the height of conveyor placed to the carry the coal or ore.

General Features of Junction House

- Steel structure building with Beams , Columns &Bracings, platform Consists of
  - [1] Platform for monorail maintenance.
  - [2] Prism gate operation platforms etc.
- Steel sheets are used for Side sheeting & Roofing
- R.C.C Floors or cheered Plate
- Proper floor slope for drainage
- The floor openings such as Erection Hatches, Stair Case entries etc. should be covered with Removable covers or Hand rails
- Junction House may be equipped with Lifting devices like EOT cranes , Electrical Hoists (as per requirement)
- Pulley frames, Base frames, chutes are be provided.

Provisions of junction house

- ✓ Effective ventilation
- ✓ Adequate lighting
- ✓ Cleaning facilities
- ✓ Firefighting arrangements
- ✓ Adequate space for maintenance
- ✓ Power socket outlets.

Some previous study are made by

Alan R. Kem F(1998): They studied the Cross-Brace behavior at the intersection of home. It describes a series of 13 experiments with joist systems, "diluent ratios in the range of 102 to160. The measured performance is compared with the results of an analysis on the basis of formulas flexibility and the American and European junction housing design manuals. Drying-based project formulation lows to provide accurate predictions of the strength of cross brace.

S.kitipornchai(1994):They studied the screws Slip Effect on Final constructions Structures behavior. This article investigates the effect theoretically bolts sliding in the deflection response and maximum resistance network structures. For purposes of this study are presented idealized models two sliding bolts. The study shows that skidding winch screw increases the uncertainty in the estimation of the structural deformation. The authors believe that the conclusion of this article is unlikely to be different, even if a different and more realistic bolt-skid model is used.

Fatma Y. Kocer(2002):He presented a paper on Design Great Junction home Subject to loading the earthquake. This article was made a historical analysis of the structure Run. The restrictions imposed in a draft code. Two methods have been submitted and calculated for such a discrete variable in optimization problems. In first method, referred to as two-stage process uses of a combination is continuous and discrete optimization algorithms, and the second method is called adaptive discrete command uses only in a optimization of algorithm is continuous. From these results are concluded that the GA is to use of very simple method for the discrete problems.

Mark W. Fantozzl (2006) : Member ASCE has studied seismic design Junction house design. In this paper, a non-linear analysis of a 2000 feet Junction housing with and without a mass irregularities. The analysis relates to the basic movement in phase and making a comparison between phase. The results of nonlinear analysis are compared with the results obtained with the method of the equal lateral force results.

2. OBJECTIVES OF THE STUDY

The objectives of this project is to review the design of the junction house and to determine the economic aspects and do the parametric study of the member of junction house by using steel.

- To study the Seismic behaviour of junction house by using E tabs.
- Comparative study of seismic behaviour of junction house for various seismic zones in India by using E tabs.
- To Study the behaviour of various parameter like BM, base reaction, displacement, storey shear, storey stiffness in various zones in India.

3. METHODOLOGY

Methodology that has been followed in this project is described below

- Junction house is selected for the analysis and all the parameters required for fixing up the junction house geometry was worked out.
- Loads on the junction house structure are calculated as per IS 875 part 1,part 2, part 3.
- The model as a 3 dimensional space frames by using E TABS
- Considering mild steel of 250 MPA yield strength the members of the junction house are initially assigned a nominal angle size and analyzed by successive iterations.
- The weight of the junction house for both angles and tubular sections are tabulated and the conclusions are made.
- To evaluate the behaviour of the structure during the effect of seismic force and wind force and make better design to resist these forces.

4. RESULTS AND DISCUSSIONS

Case 1:- Behavior of junction house in zone 2

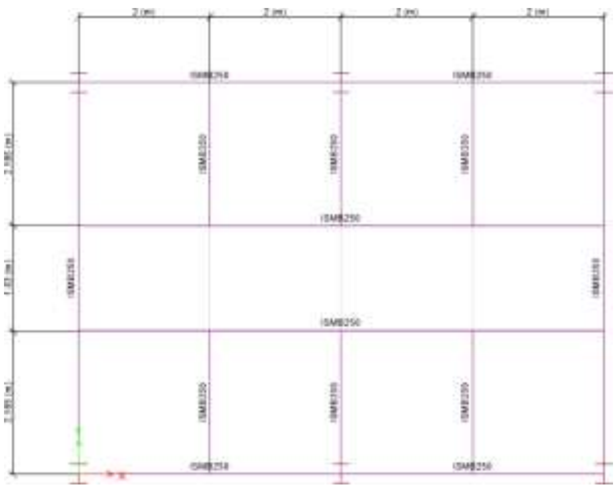

Figure 1: **Base floor plan of junction house**

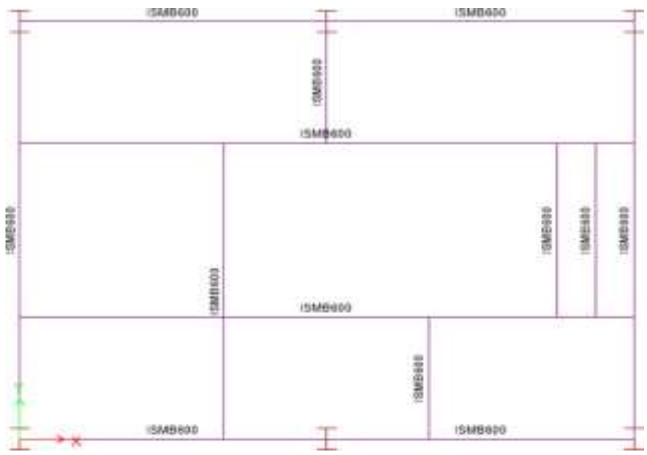

Figure2: **Conveyor floor plan of junction house**

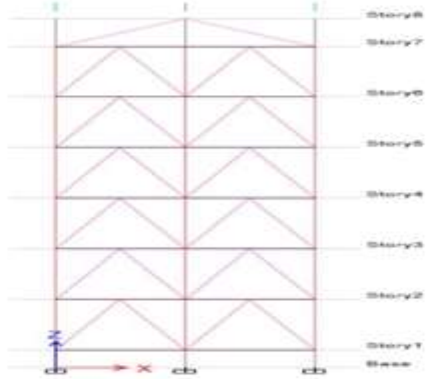

Figure 3: Elevation showing columns, braces and beams of junction house

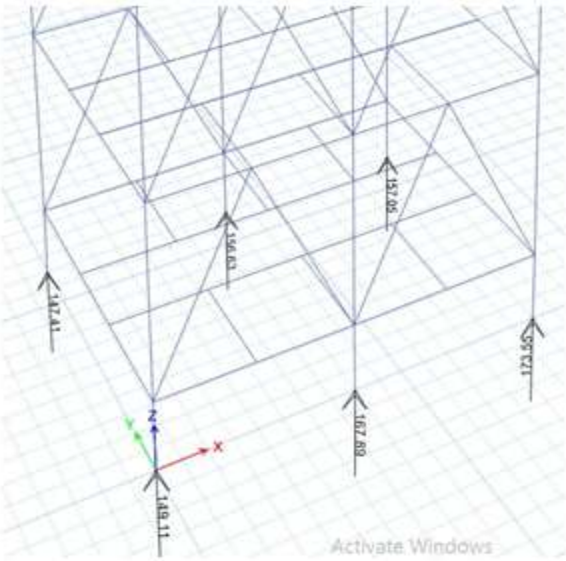

Figure 4: Base reaction

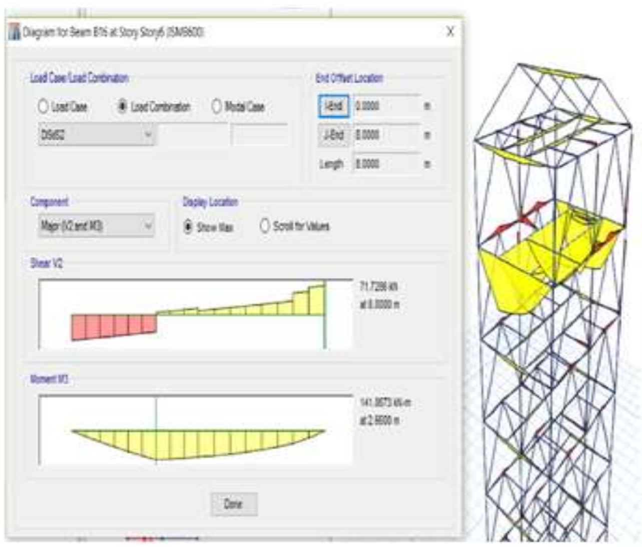

Figure 5: BMD and SFD

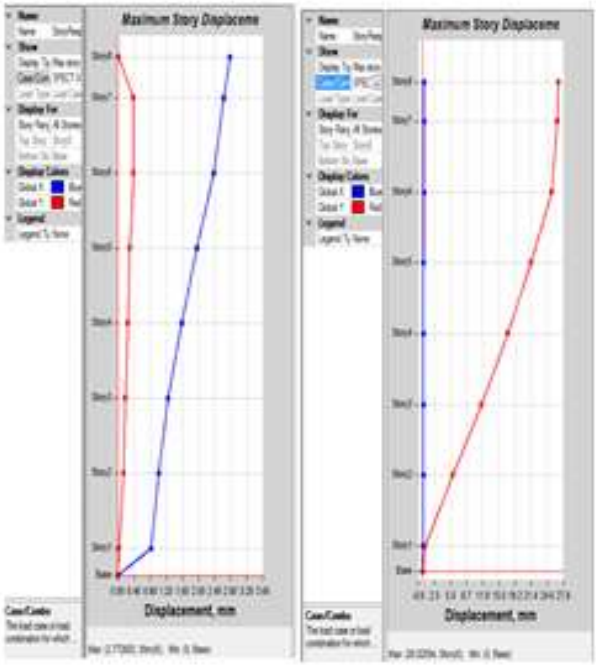

Figure 6: Displacement

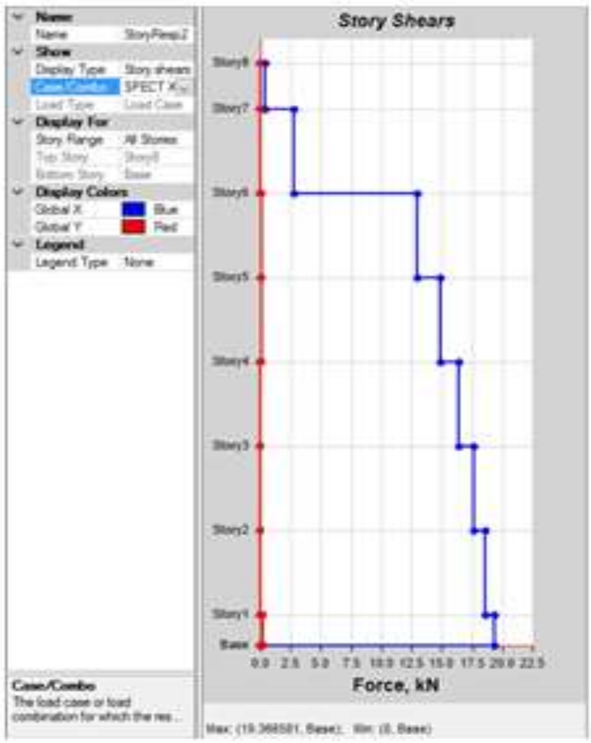

Figure 7: Storey Shear in X-direction

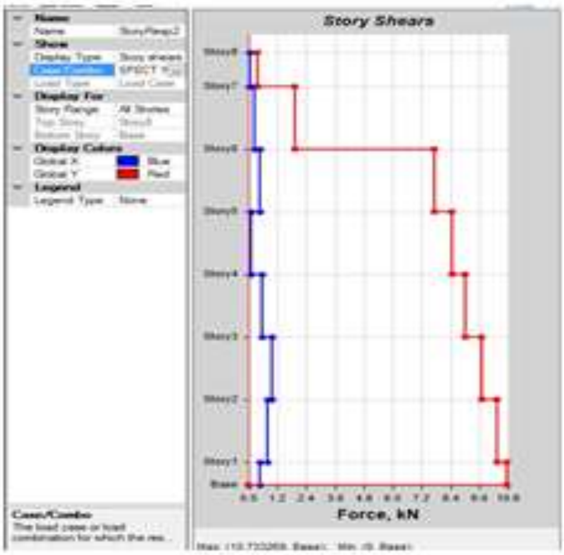

Figure 8: Storey Shear in Y-directions

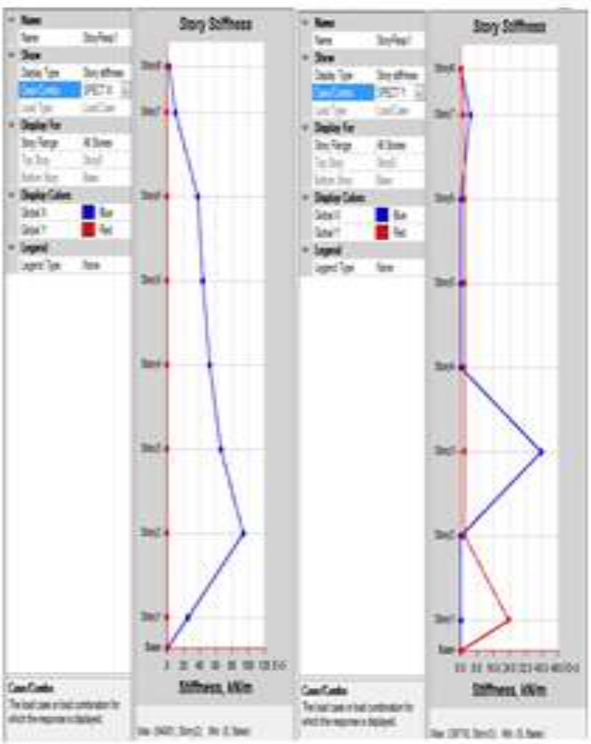

Figure 9: Storey Stiffness

Fig 4:-After analysis check the base reaction at the supports select maximum value for the design of the footing. From the figure we absorbed maximum reaction is 173.55kN, hence we designed all the footings for maximum base reaction.

Fig 5:-Represents the maximum Bending moment and Shear force of the junction house after analysis , maximum bending moment and shear force occurs at the conveyors storey level.

Fig 6:- The Displacement shall not exceed 0.004 times The storey height (H/250) from IS 1893-2002 clause 7.11.1 page number 27

The present case total height of the structure is 28.82m.

Maximum allowable displacement =(28.82*1000)/(250) = 115.28mm

The maximum displacement in the structure is 2.8mm & 27mm < 115.28mm Hence it's safe in zone 2

Fig 7&8:- Represents the story shear along spect X and Spect Y direction , maximum shear will be occurs at along X direction.

Fig 9:- Represents the storey stiffness along X and Y direction maximum stiffness along X direction.

5. CONCLUSIONS

Based on the study, the performances of junction house under the seismic load condition are described below.

I. Bending moment and shear force of a junction house in all the zones in India are equal (MBM = 141.067 kNm & MSF=71.729kN)but the critical section is simultaneously varied in conveyor slab.

II. Displacement in zone 2 is 2.8mm and 27mm in X and Y direction respectively, in zone 3 is 4.8mm and 34mm in X and Y direction respectively, in zone 4 is 5.4mm and 50mm in X and Y direction respectively and in zone 5 is 9.8mm and 92mm in X and Y direction respectively and Displacements are slightly increases in zone 2 to zone 5.Displacement increases in zone 3 is 1.7 & 1.26 times(X and Y direction respectively)to zone 2, In zone 4 is 1.95 & 1.855 times (X and Y direction respectively) to zone 2 and zone 5 is 3.5 & 3.41times (X and Y direction respectively)to zone 2.

III. Storey shear in zone 2 & zone 3 are same (20mm & 10.8mm in both X & Y direction), in zone 4 & 5 are same (44mm & 21mm in both X & Y direction).

IV. Storey stiffness in zone 2 & zone 3 are same (95mm & 23mm in both X & Y direction), in zone 4 & 5 are same (94mm & 24mm in both X & Y direction). Stiffness in all the zones are almost equal.

V. Base reaction of junction house in all the zones are same and the critical load is 173.55kN.

VI. Maximum stress in zone 2 is developed at the column section, Maximum stress in zone 3 is developed at the column section , central beam in conveyor slab and also some of the bracings in the structure, Maximum stress in zone 4 developed at the column section, central beam in conveyor slab and also some of the bracings in the structure and Maximum stress in zone 5 is developed at the column section , central beam in conveyor slab, and also all the bottom bracings in the structure. (Failure section or critical section in the junction house will be changes in each zones).

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