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Analysis of A Shaped Column Tall Structure Under Lateral Loading Using ETABS

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ABSTRACT

Presently a-days, the designers frequently restrict the widths of the segments so that all the more free space is accessible and for the great stylish look of the structure without sections distending out of the dividers and corners. Propels in underlying individuals and strategies to oppose sidelong powers are by and large utilized now days to imagine more steady and safe design.

In present work with the ultimate objective to differentiate sustained strong construction utilizing customary segments against structure planned with exceptional formed sections considering seismic burdens on G+12 multi-story building having plan estimation 63.20mx29.50m m is shown and taken apart in Etab variation facilitated assembling frame programming. Proportionate static examination and dynamic response range assessment are performed on the design.

Keywords : Structural Stability, Analysis, Advance Techniques, Software's, Columns, Lateral Forces.

I. INTRODUCTION

As of now a-days, the creators consistently prohibit the widths of the portions so more free space is available and for the incredible slick look of the construction without areas projecting out of the dividers and corners.

Strong designs with non-rectangular phenomenally framed unstable sections found as a choice as opposed to the above said issue and it is found that non-rectangular particularly formed humble fragments performs well essentially with all examination results inside agreeable limits. This kind of design satisfies spatial necessities of corners similarly as crossing point of corners with the objective that no undeniable edges or prominent section would appear in the designs. This develops the genuine usable floor an area and more furniture can be placed into the designs. Subsequently, frame structure with extraordinarily shaped section is suitable blooms, especially for estate and multi-story structures. This paper explains the lead of designs with rectangular

portions and designs with exceptionally shaped fragments and assessments of various limits like story float, story migration, story immovability, etc in view of equal weights

Fundamental arrangement is a science and specialty of understanding the lead of helper people presented to weights and arranging them with economy close by prosperity, handiness and as a solid design. The ongoing proposal work will oversee such an examination of essential people made of RCC as it is by and large used because of its adaptability. Area is in a general sense a helper part assigned for conveying compressive weights. It passes center burdens from shafts and moves it on to adjust. The segments are perceived according to different perspectives and various sorts are watched. Taking into account the slimness extent areas are called as short or long fragments. The short fragment crashes and burns by pounding and long portion bombs by fastening. Considering the stacking plan there are crucially stacked section, center fragment with uniaxial bowing, center portion with biaxial winding. Sections continue differently under static and dynamic stacking conditions. The powerful weight believed is must for where the seismic development is high. Consequently when seismic weights are seen as the joined strategy of malleability and quality should be applied. The breeze loads, snow loads, creep, shrinkage and temperature impacts are seen as where they are fundamental. The snow load thought contrasts on country to country, and district to region. It should be thought of as per significant arrangement codes of huge codes. The possibility of wind stacks primarily depends upon height of design and the bearing and speed of the breeze in the district .The fragments should be planned to convey the breeze loads in such circumstances. A part of the complex numerical circumstances and building irregularities requires test and orderly approaches for different material properties and sectional properties. Such limits can't be authentically gotten by the construction code books and rules. The underlying essential leads the modeler to think about different shapes and cross region of the support points, sections, plates, etc. This incited particular cross portions of sections subject to the spot and limit, for instance, L-shape, Tshape, C-shape, +shape, etc. Without a doubt, even the different conditions of portions are furthermore eventually, for instance, shaft, trapezoid, zenith and cross area. All of these sections should be construction and cast with prosperity, economy and up-to-date appearance. Typically the particular cross fragments of sections, for instance, L-shape, Tshape, C-shape, cross shape have rolled out an improvement in essential planning by which they offers the basic response for regions in uncommon cases.

In the RCC structures, portions are helper parts which are dominatingly presented to significant compressive powers, minutes, and moves full scale trouble from the super design to sub-structure. Various conditions of the fragments are used. A few ordinary shapes are square, rectangular, round areas and a few unprecedented conditions of fragments are L-shaped, T-framed and notwithstanding (+) formed portions as showed up in figure 1.1 which are not routinely used at this point gives more indoor space than typically used conditions of sections. Extraordinary formed fragments evade obvious corners in a room which increases usable floor zone.

The strengthened strong design system with extraordinarily formed areas is a structure commonly got in private designs in view of no uncovered shafts and sections in the room. The common sense and solace of fortified concrete (RC) frame with exceptional formed segments in helper structure and its positive help make it for the most part used being developed industry.

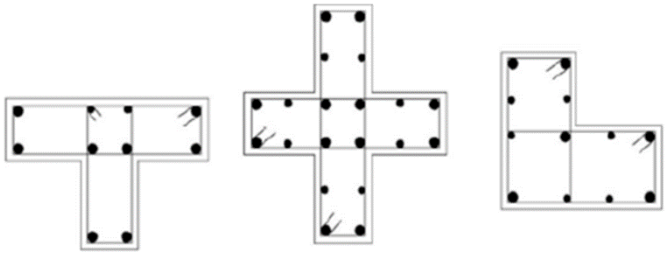

Fig 1. Specially shaped (T, +, Plus) columns with Longitudinal and lateral reinforcement.

II. LITERATURE REVIEW

Literature Review

Yuzhuo WANG et al (2019) The investigation paper presented testing of three T-outlined steel-invigorated solid areas dissected under high temperature and vertical weights, to imitate fire influence. The results assumed that failure characteristics, course of temperature field, vertical deformation credits and imperviousness to fire were moreover investigated under various focus pressure degrees and different unpredictability. The test also showed that the breaks reached out with the augmentation of focus point pressure degree and unexpectedness. The damages of the web were severer than the rib. The breaks were for the surprising side on the eccentric side and overall slanted parts in the model. The upward increase turned out to be logically evident as the eccentricism diminished. The invulnerability to fire decreased as the significant weight degree expanded. Separated and, the invulnerability to fire of immense center point pressure models (the critical weight degree was 0.6) was diminished by 57% than less center strain models (the middle weight degree was 0.2). The solidness to fire decreased by around 30min as eccentricity stretched out by 20mm.

Mary Paul V and Nisha Vargheese (2019) The assessment paper eviscerated Crisscrossed framed portions related by the limiting bar, Single vertical steel plate with stiffeners, Double vertical steel plate, Effect of level, Effect of width and urgent compressive lead. The traits of the restricted part assessment were utilized on quite far conditions and material properties utilizing ANSYS 16.2.

The outcomes determined that Mono pieces related with twofold vertical steel plate had more weight passing on limit anyway Mono portions related by a limiting bar had a less weight conveying limit. Mono areas related by single vertical steel plate with stiffeners have more weight passing on limit than confining bars. Trouble giving cutoff oppositely propositional to the level of the parts. Trouble passing on limit relies upon the width of the steel plate. The extent of constraint concrete extended trouble conveying limit.

Objectives of the study:

The primary goals of this study are to assess the exhibition of working with unique molded section.

Followings are the particular goals of this review.

(1) To concentrate on the way of behaving of the structure under sidelong loads like seismic and wind loads.

(2) Determination of avoidances, story floats, story solidness and story upsetting snapshot of the structures under wind and seismic circumstances.

(3) To analyze the presentation of the exceptional molded section working with working of rectangular segments.

(4) To decide the impact of molded section over solidness of the construction.

(5) To analyze cost investigation of the relative multitude of cases according to S.O.R.

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IV. METHODOLOGY

For this research work following steps should be followed:
Step-1 Firstly literature survey should be done to determine the past research and Need of study.
Step-2 To prepare Sample of light weight concrete to determine its properties to be Assign in ETABS.

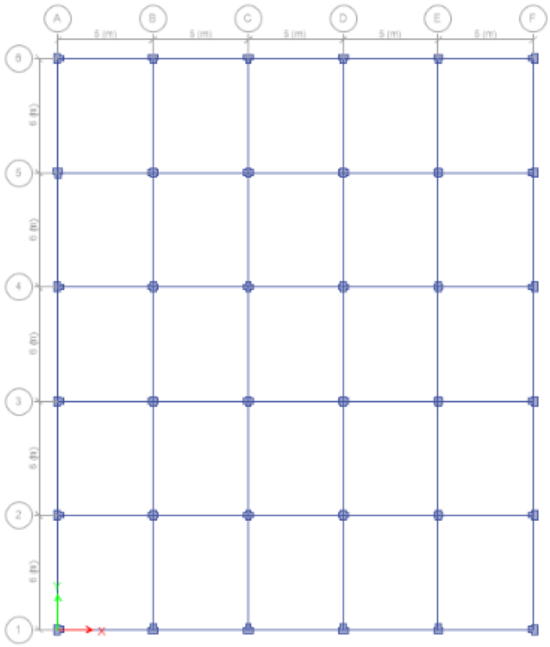

Fig 2 plan of structure

Step-3 To prepare modelling of a symmetrical building frame (G+12) using ETABS"17.

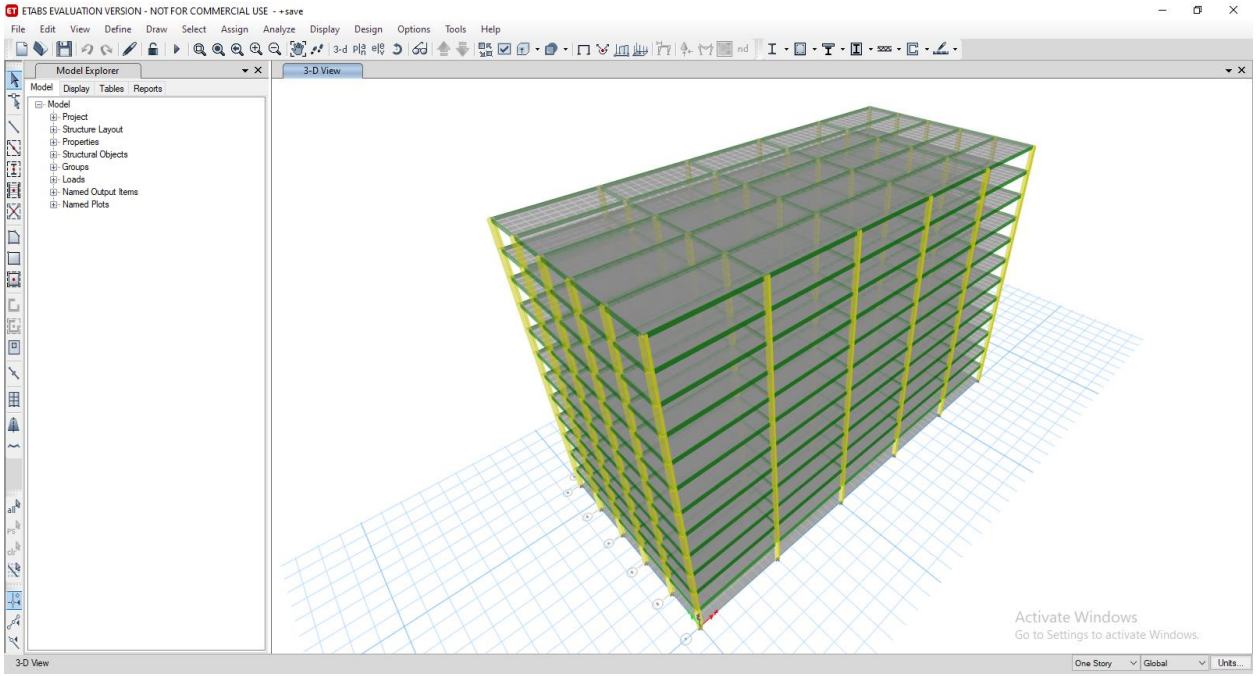

Fig 2 Model of the structure

Step-4 To assign properties and support conditions.

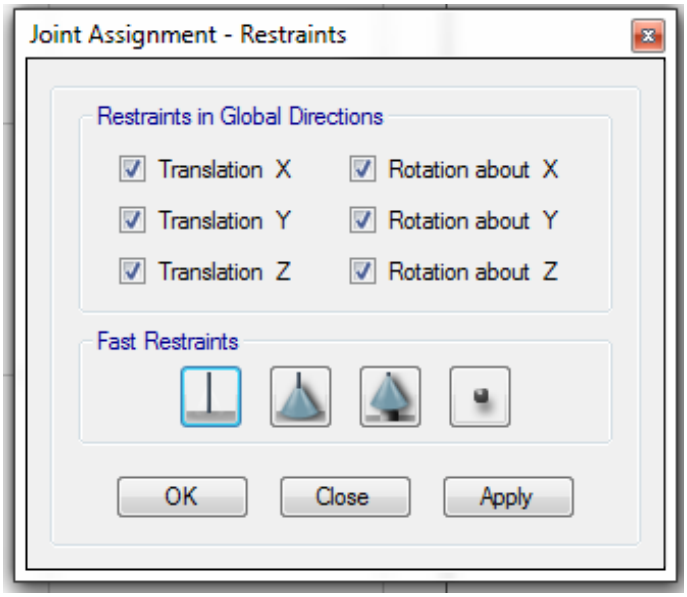

Fig 3. Assigning support conditions

Step 5 Defining and Assigning section Properties

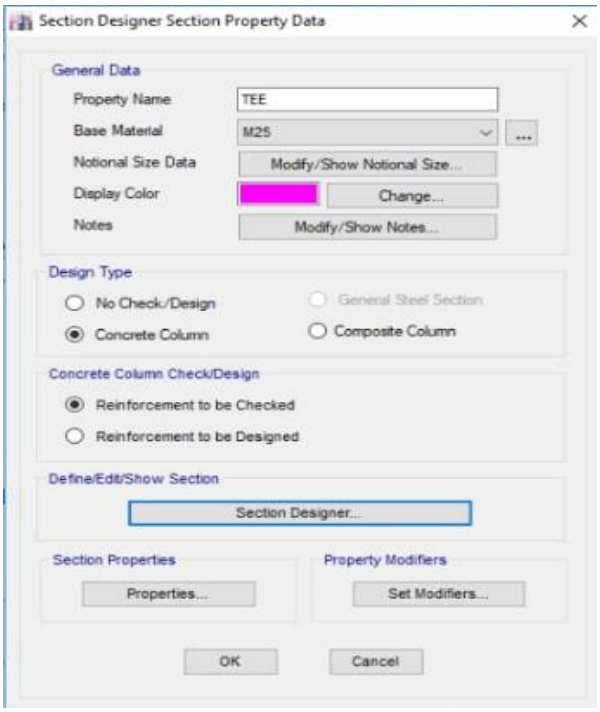

Fig 4 (a) Defining Section Properties

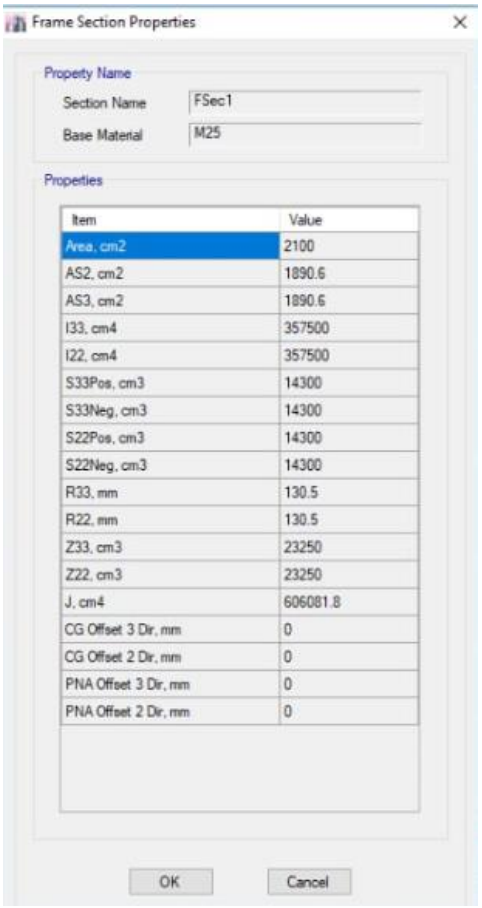

Fig 4 (b) Defining Frame Section Properties

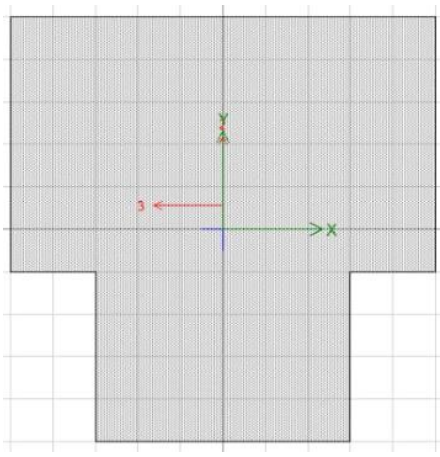

Fig 4 (c) Section Design T Shaped

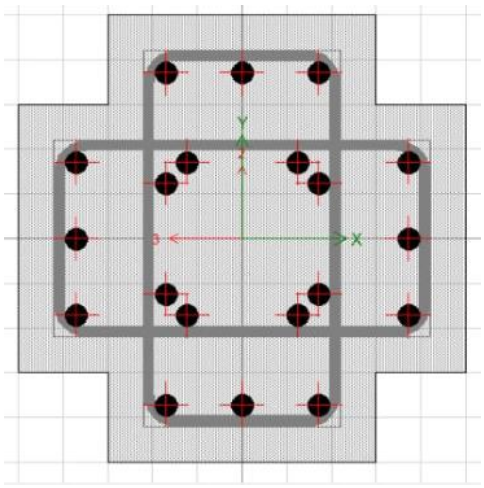

Fig 4 (d) Section design Plus Shaped

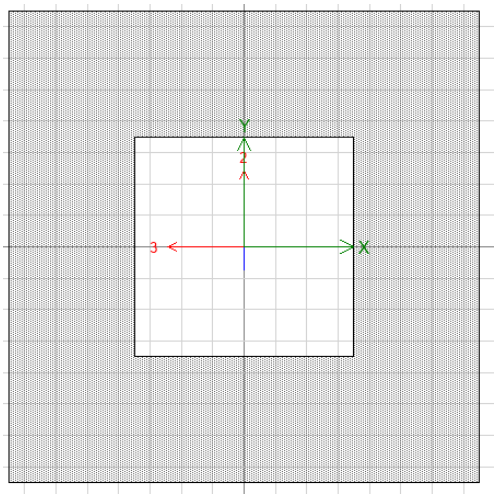

Fig 4 (e) Section design General Shaped

Step-6 To Assign lateral force (response spectrum) dynamic analysis as per I.S. 1893-Part-I: 2016.

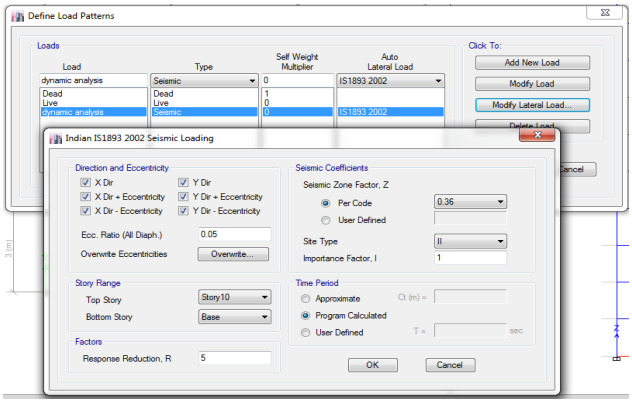

Fig 5 Defining loading conditions

Step-7 To analyze the structure for dynamic loading.

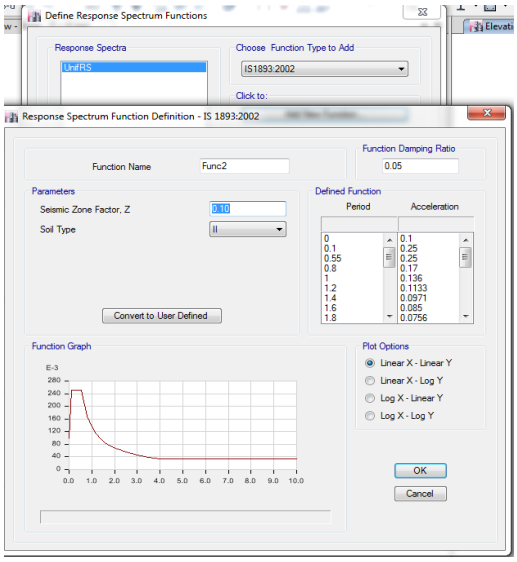

Fig 6 Dynamic analysis

Step-8 To compare the results of the structure.

Problem Formulation:

Table 1 Details and Dimension of the Building Models

Type of structure	Ordinary moment resisting RC frame
Grade of concrete	M 40 (fck= 40 N/mm2)
Grade of reinforcing steel	Fe 415
Plan area	63.20mx29.50m
Number of stories	G+12
Total Height of Building	43.2 m

Floor height	3.6 m
Rectangle Shaped Column	230x 600mm
Plus Shape column	350mmx750mm
T Shape Square column	350mmx600mm
Beam size	500x300mm
Wall thickness	230mm
Thickness of Slab	200 m
Density of concrete	25000 KN/ m^3
Live Load on Floor and roof	3 kN/mm2 and 1.5 kN/ mm2
Plan irregularity	T Shape and Plus Shape
Seismic Zone	II
Soil Condtion	Medium Soil
Floor Finish	1.0 kN/m2

Table 2. Material properties of structure

s. no	**Description**	**Values**
1	Material property	Values
2	Grade of concrete	M-25
3	Young's modulus of concrete, E_c	$2.17x10^4$ N/mm^2
4	Poisson ratio	0.17
5	Tensile Strength, Ultimate steel	505 MPa
6	Tensile Strength, Yield steel	215 MPa
7	Modulus of Elasticity steel	193 - 200 GPa

V. ANALYSIS RESULT

Max. Bending Moment:

Table 3 : Max. Moment in KN-m

Moment in kN-m			
Storeys	Rectangular Column	T Shape	Plus Shape
storey12	825.76	724.17	516.81
storey11	815.58	725.63	513.84
storey10	785.44	627.09	510.87
storey9	775.21	628.55	517.9
storey8	715.3	620.01	511.93
storey7	695.67	521.47	501.96
storey6	655.2	522.93	481.99
storey5	625.1	524.39	471.02
storey4	555.89	525.85	461.05
storey3	575.9	427.31	451.08
storey2	525.99	268	431.11
storey1	515.22	421.05	421.14

Max. Shear Force

Table 4 : Max. Shear Force in KN

Shear force in kN-m			
Storeys	Rectangular Shape	T Shape	Plus Shape
storey12	921.85	810.43	831.54
storey11	923.25	813.87	737.91
storey10	902.65	717.31	731.23
storey9	882.05	710.75	738.9
storey8	862.45	714.19	713.45
storey7	842.85	717.63	694.766
storey6	832.25	611.07	632.85
storey5	812.65	614.51	637.31
storey4	792.05	617.95	639.21
storey3	772.45	611.39	533.36
storey2	752.85	514.83	534.45
storey1	732.25	518.27	538.77

Storey Displacement in mm

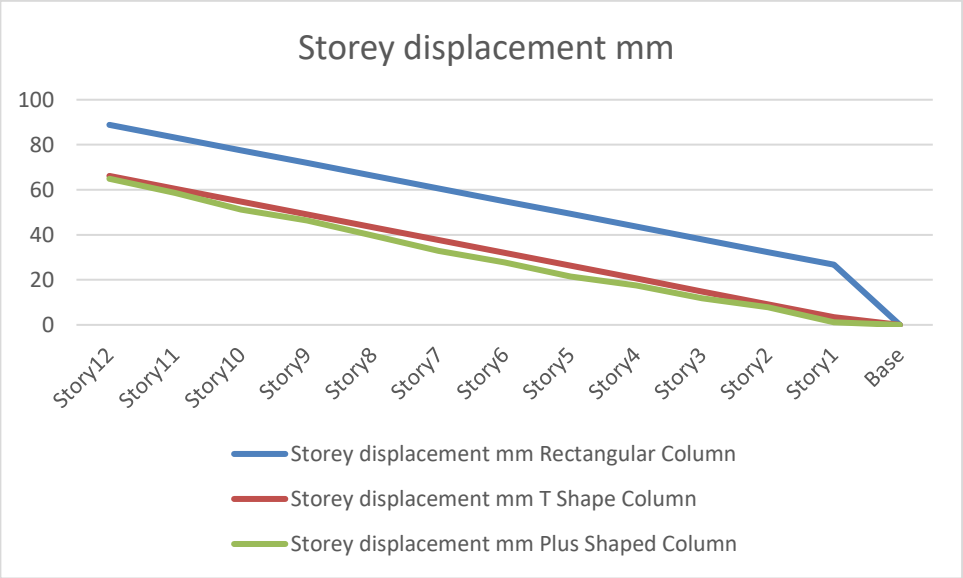

Fig 7 : Storey Displacement

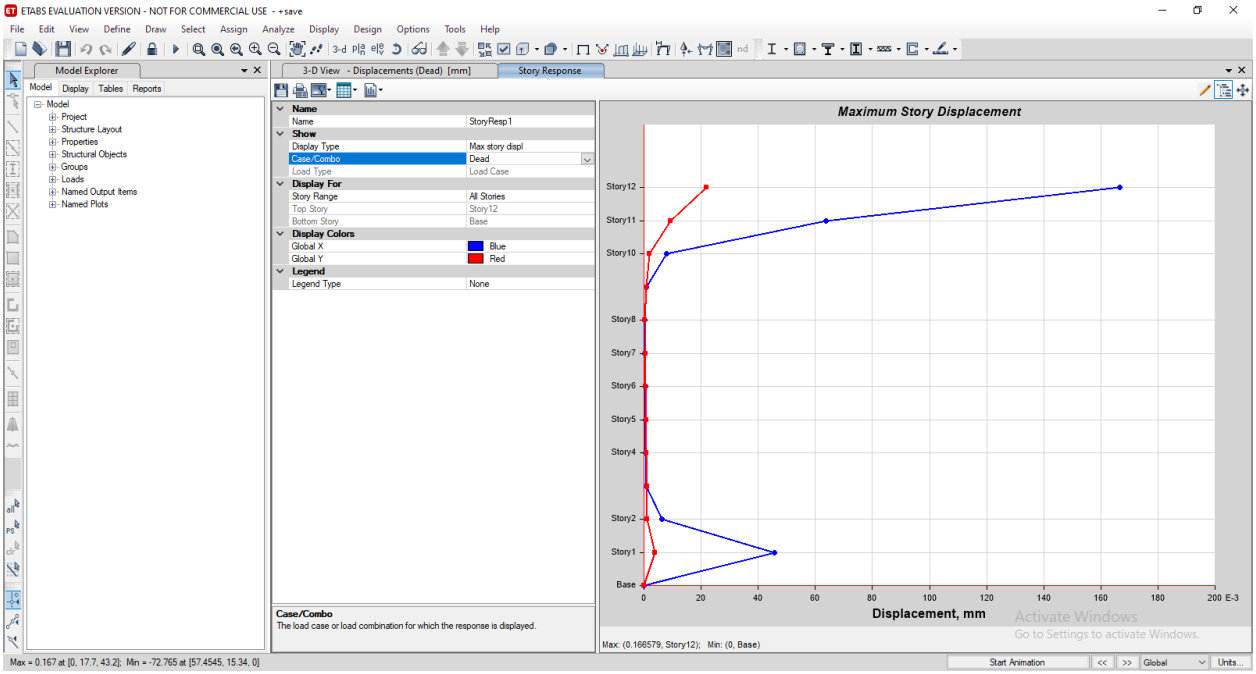

Fig 8 : Storey Drift

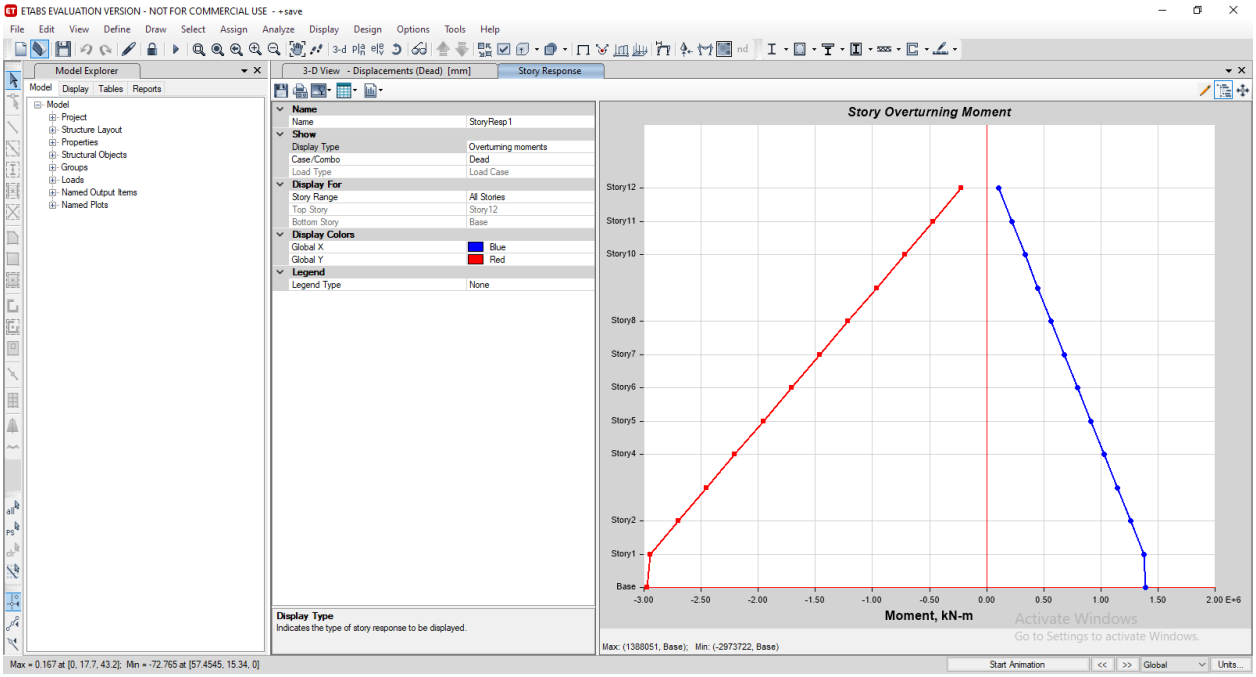

Fig 9 : Overturning moment

VI. CONCLUSION

In the section above, it is plainly seen that twisting second in structure utilizing Rectangular segment was 826.76 kN-m while structure utilizing T shapes and Plus Shaped section showed less bowing second as 734.17 and 566.81 kN-m, subsequently Plus formed case requires less support.

In above section it is seen that unbalance powers are most extreme in rectangular case 941.85 kN while in Plus formed case these are decreased to 840.43 kN which shows strength of the construction.

It is seen that sidelong soundness is similarly expanded in structure with in addition to formed section case contrasting with structure utilizing customary rectangular segment. If there should arise an occurrence of light weight structure uprooting is limited to 66.16 mm rather than 88.84 mm in exposed outline.

In the above section it is seen that there is exact moment variety in hub force as it is considered for same stacking condition in both the cases.

VII. FUTURE SCOPE

i) In the proposed work high rise building is considered which can be increased to some more floors in future with variation in floor to floor height.

ii) In this study seismic analysis is considered whereas in future study wind load can be consider.

iii) In this study analysis is done using etabs whereas in future SAP2000 can be prefer for P-delta analysis.

iv) In this study cost analysis is performed as per S.O.R. whereas in future one can adopt market rate for estimation.

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