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Analysis of A Long Span Structure Considering Prestressed Beams Using ETABS

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ABSTRACT

A significant number of the unpredictable practices of strengthened concrete cement under shear and flexure are yet to be recognized to utilize this material profitably and financially. The advancement in the understanding and quantitative appraisal of the conduct of part exposed to flexure and shear has been less fantastic. The key idea of shear and inclining pressure quality isn't yet obviously comprehended. Along these lines, further fundamental examination ought to be experienced to decide the component, which brings about shear disappointment of strengthened solid individuals. The investigation presents the investigation of the conduct of strengthened cement deepbeam under seismic (vibration) stacking and the impact of shear fortification. The impact of variety of web fortification dispersing (both vertical and level) on the shear quality of profound R.C. bar is examined. The overall pattern in split example, the heap diversion attributes and the method of disappointment of profound R.C. shaft under two-focuses stacking are additionally explored. Through the examination, it is seen that under two-focuses stacking framework, inclining splits are normally the primary breaks to be seen free range of the profound bar. In this examination we will contrast profound pillar and PT shaft in G+10 structure utilizing investigation instrument ETABS.

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I. INTRODUCTION

In India RCC Structures are normally utilized for Residential just as business Buildings. Post-tensioned Pre-focused on radiates are once in a while utilized for similar Buildings, or we can say for limited capacity to focus. As the floor framework assumes a significant part in the general expense of a structure, a post-tensioned floor framework is imagined which lessens the ideal opportunity for the development lastly the expense of the structure. In certain nations,

including the U.S., Australia, South Africa, Thailand and India, an extraordinary number of enormous structures have been effectively developed utilizing post-tensioned floors. The explanation behind this lies in its conclusive specialized and practical advantages.Two Decade back there was a major issue of Skilled Workers for Pre-Stressing work. Yet, presently there are endless offices for execution of a similar work. In RCC Beams, profundity of shaft increments with increment in Span, in light of avoidance restriction. Profundity of shaft can be decreased in Pre-focused on segment, for longer range pre-focused on radiates are less expensive. This work is continuing on the grounds that I need to realize the rate cost distinction between the two procedures concerning length. Profound bar can be characterized as a shaft having a proportion of range to profundity of around 5 or less, or having a shear length not exactly about double the profundity and which are stacked at the top or pressure face just (ACI-1989).

They are experienced in multi-story structures to give segment balances, in establishment dividers, dividers of rectangular tanks and containers, floor stomachs and shear dividers. In view of their properties profound bar are probably going to have quality constrained by shear.

The examination is exposed to assessment of execution of RCC profound bar and PT shaft section with multistory structure framework with seismic stacking execution utilizing investigation apparatus ETABS.

Floor chunks under level burden, limited ability to focus conveying weighty loads, and move braces are instances of profound pillars. Profound pillar is a shaft having huge profundity/thickness proportion and shear range profundity proportion under 2.5for concentrated burden and under 5.0 for appropriated load. Since the calculation of profound shafts, their conduct is diverse with slim bar or transitional beam.Deep radiates assume an extremely noteworthy part in plan of mega and just as little structures. A few times for structural purposes structures are planned without utilizing any section for an enormous range. In such case if common bars are given they can cause disappointment, for example, flexural failure.To dodge this issue of development of some exceptionally long range corridors and so on the idea of profound bars is extremely viable and strong. Yet, there are additionally some minor issues with the development of profound shafts.

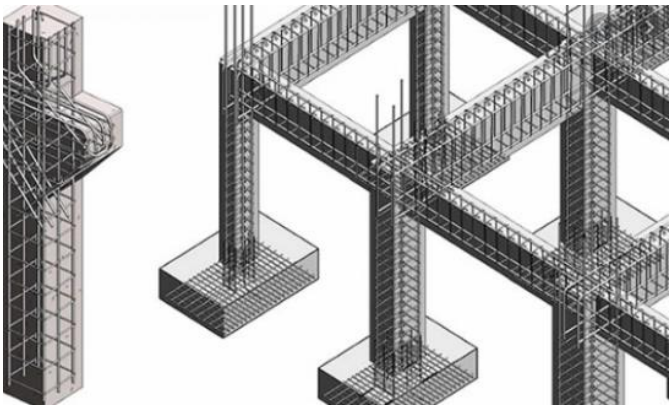


Figure 1. RCC Beam

II. LITERATURE REVIEW

Sridhar and Rose (2019)[23] the examination paper introduced correlation of the flexural conduct of post-tensioned solid bars with fortified framework. Four rectangular post-tensioned pillars were tried and dissected. The shafts were tried under single point monotonic stacking condition and two point monotonic stacking condition. The heap redirection conduct, stress-strain conduct and split examples are introduced from the test outcomes. Post-strain framework viably controlled avoidance and break because of the presence of ligaments notwithstanding the strengthening steel. The outcomes expressed that the prestressed solid bar with high PT power (64kN and 42kN) accomplished the greatest burden when contrasted with other pillar under two point stacking and single point-stacking condition individually.

There was an expansion in load by 11.11% when the PT stress is kept up at 150kg/cm2 contrasted with 120kg/cm2 under two point stacking condition.

Reddy et. al. (2019)[21] the research paper presented comparative analysis of deep beams considering specimen of length 1200 mm X 200 mm X 600 mm, 1100 mm X 200 mm X 600 mm and 1000 mm X 200 mm X 600 mm. The flexural, shear, crack pattern of reinforced concrete deep beams with different l/D ratios. The width of bearing plate, depth, the percentage of tension reinforcement, and the percentage of vertical and horizontal shear reinforcement are constant under three-point loading using loading frame are tested. The experimental results showcased the Load Vs Deflection and crack width of the beam. The results concluded that The Load obtained for the deep beam of length 1000mm is 837kN and was more when compared to other deep beams and the load obtained by the deep beams experimentally was more compared to the load calculated by using code. The deflection obtained for the 1000mm length beams was also satisfactory when compared to other beams. The crack obtained in this deep beam was less when compared to other beam and the width of crack was about 6.78mm and the first crack obtained at 640.3kN load.

Harsha and Raju (2019)[7] the paper presented preliminary support for proposing a new shear strengthening technique during the design of the member. The results concluded that Diagonal Tensile Stresses increases rapidly if proper care was not taken for the stresses criteria while designing the beam. Major Failure was diagonal cracking in Deep Beams, with the increase in span to depth ratio, the inclination of cracks increases. The portions of un-cracked concrete depth resist the shear stress and the transfer of shear at cracked portion was negligible. Concentrating of shear reinforcement within middle region of shear span can improve the ultimate shear strength of deep beam. Shear strength decreases with the increase in the depth of the beam

Objectives of the Study

1. To evaluate performance of PT beam under seismic effect with different profile of tendons.
2. To check performance of RCC deep beam and PT beam slab with multistory building system with seismic loading performance.
3. To compare cost of deep RCC beam with PT beam.

III. METHODOLOGY

Step-1 First step is collection of data related to RCC Deep Beams and PT Beams considering to software implementation.

Step-2. Modelling of Structure using ETABS

An RCC Structure is chiefly a get together of Beams, Columns, Slabs, and establishment between associated with one another as a solitary unit. For the most part, the move of a load in these structures is from chunk to bar, from shaft to the segment lastly section to the establishment which thus exchanges the whole load to the soil. In this investigation, we have received three cases by expecting distinctive frameworks for load opposing structure demonstrated utilizing Csi-ETABS'16. The arrangement and 3-D perspective of the unpredictable building are appeared in the figure beneath.

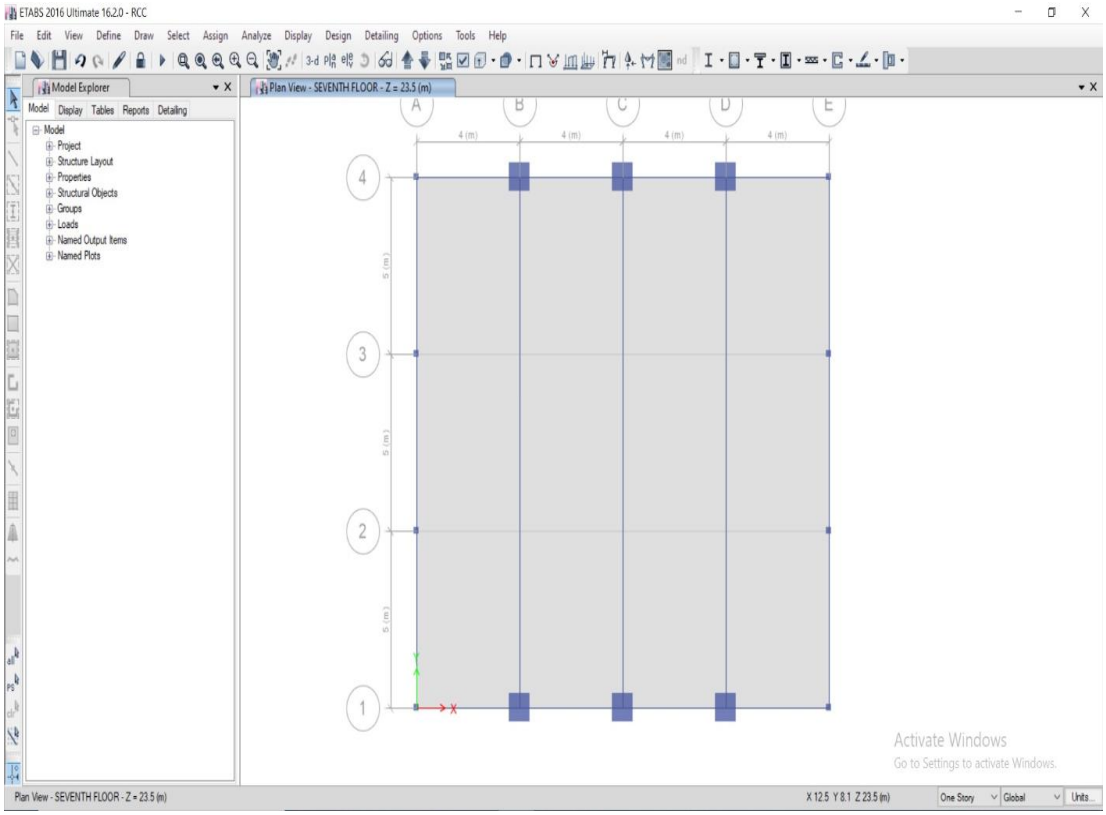


Figure 2 Plan

The dimensions of the structure were designed in all the two cases.

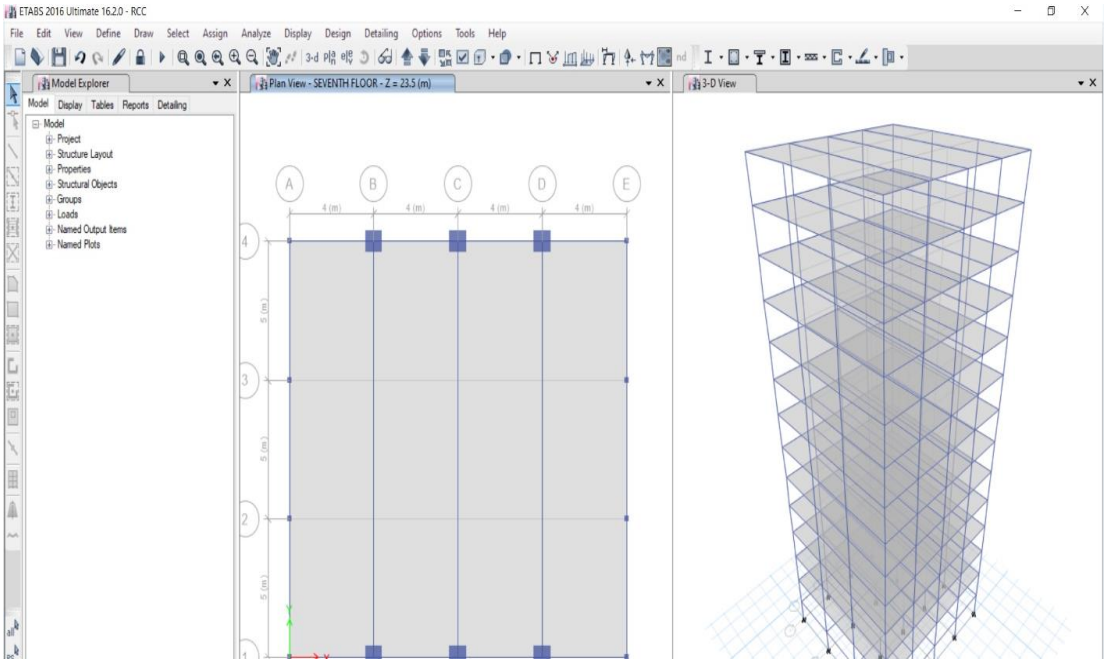


Figure 3 Modelling of Structure with RCC DEEP Beams

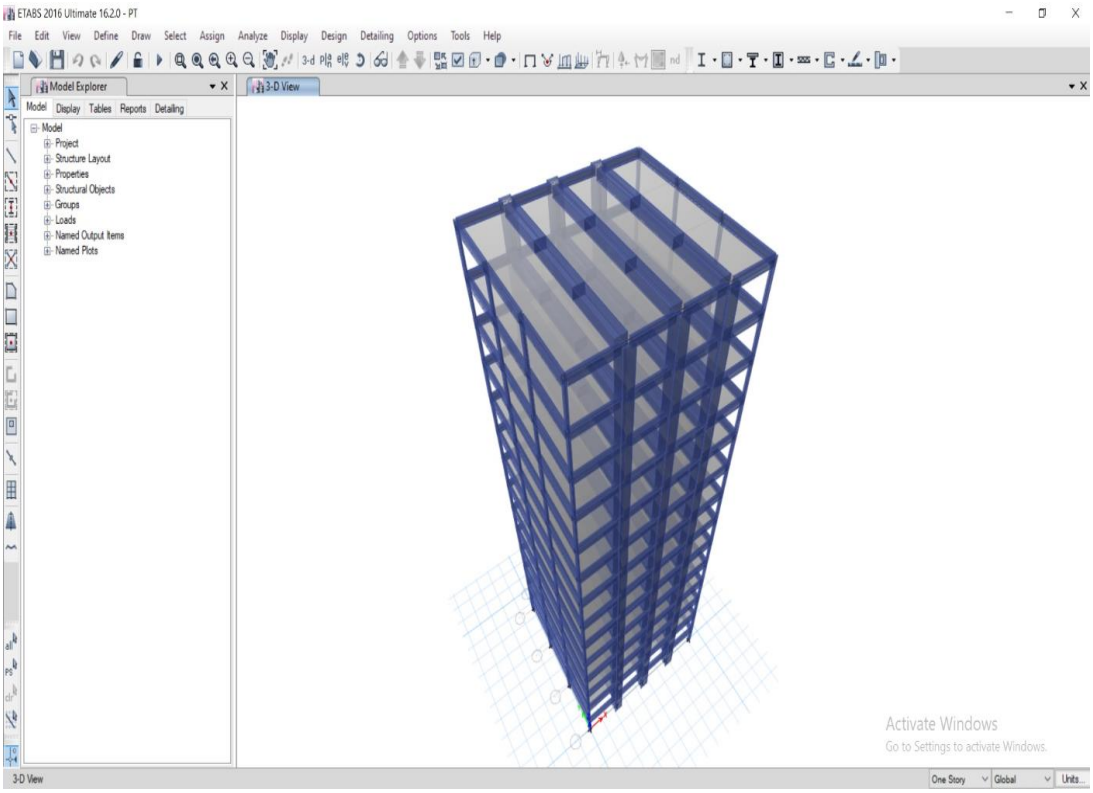


Figure 4 Modelling of structure using Post Tensioned Beams

Step-3 Generating material properties

Etabs give us a development alternative to give material properties in a particular way to dole out in structure. In etabs we are allowed to dole out any sort of material as it gives a practical altering device to make the material.

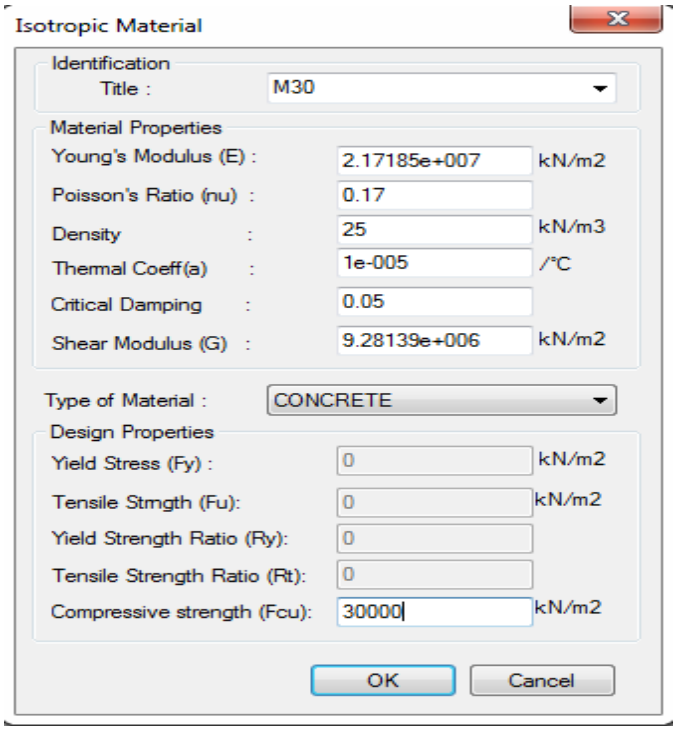


Figure 5 Creating M30 concrete in ETABS.

Materials make up the basic parts, which everything gathering systems require to work with. Amassing first class things effectively require organized data on complex joint efforts among a huge number of factors including thing plan necessities, materials and their properties and gathering structures that convert these materials into required structures. Today there is a wide extent of materials and methods available and the task of picking the best material while restricting the costs of amassing is a noteworthy test. Meeting such a test requires a concentrated appreciation of the properties of materials and structures and the related amassing development.

Step-4 Creating beam and column section of the structure

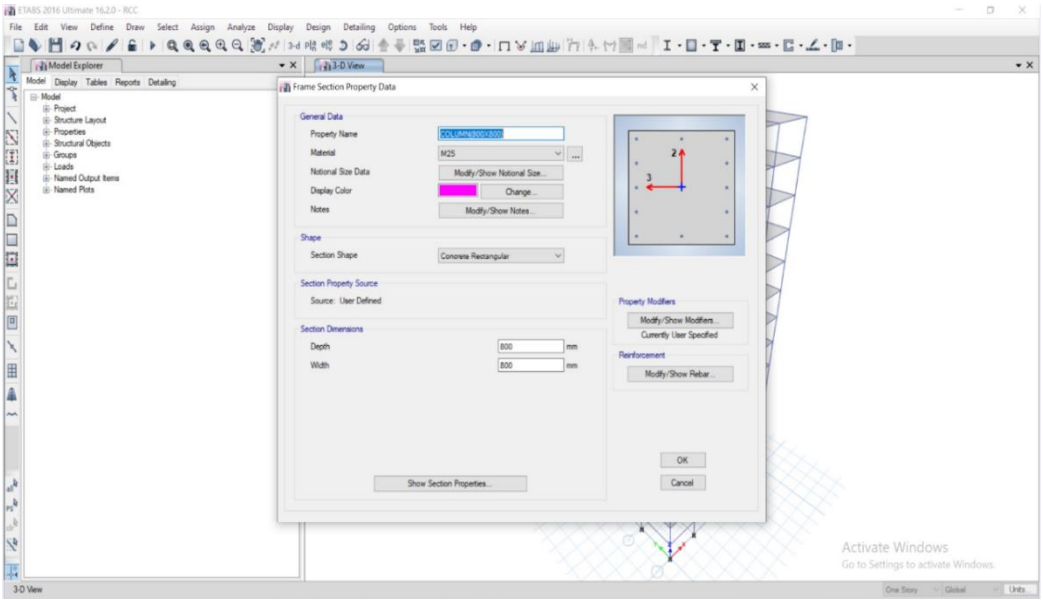


Figure 6 Creating sectional properties

Step-5 Assigning support condition

In ETABS we are allowed to dole out any sort of help either settled, stick or roller for which we have to tap on dole out instrument on the menu bar > then we will choose joint > after that we have select the kind of help we have to dole out.

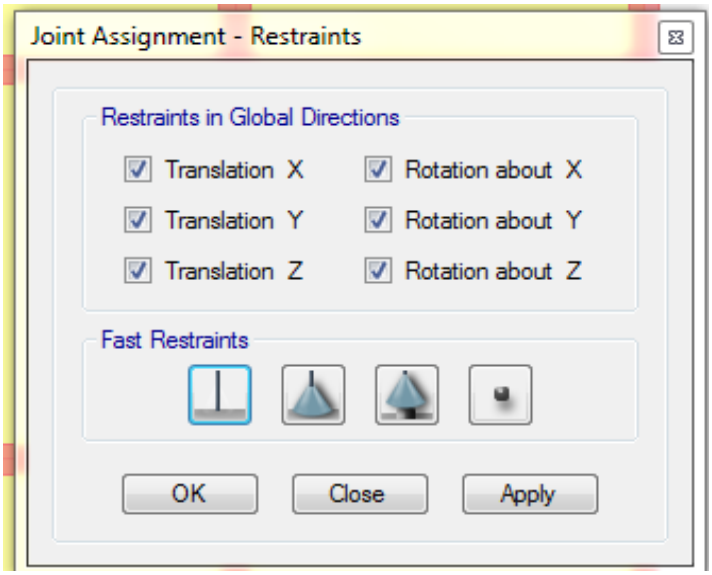


Figure 7 Support Conditions

Step-6 Defining response spectrum as per I.S. 1893:I:2002

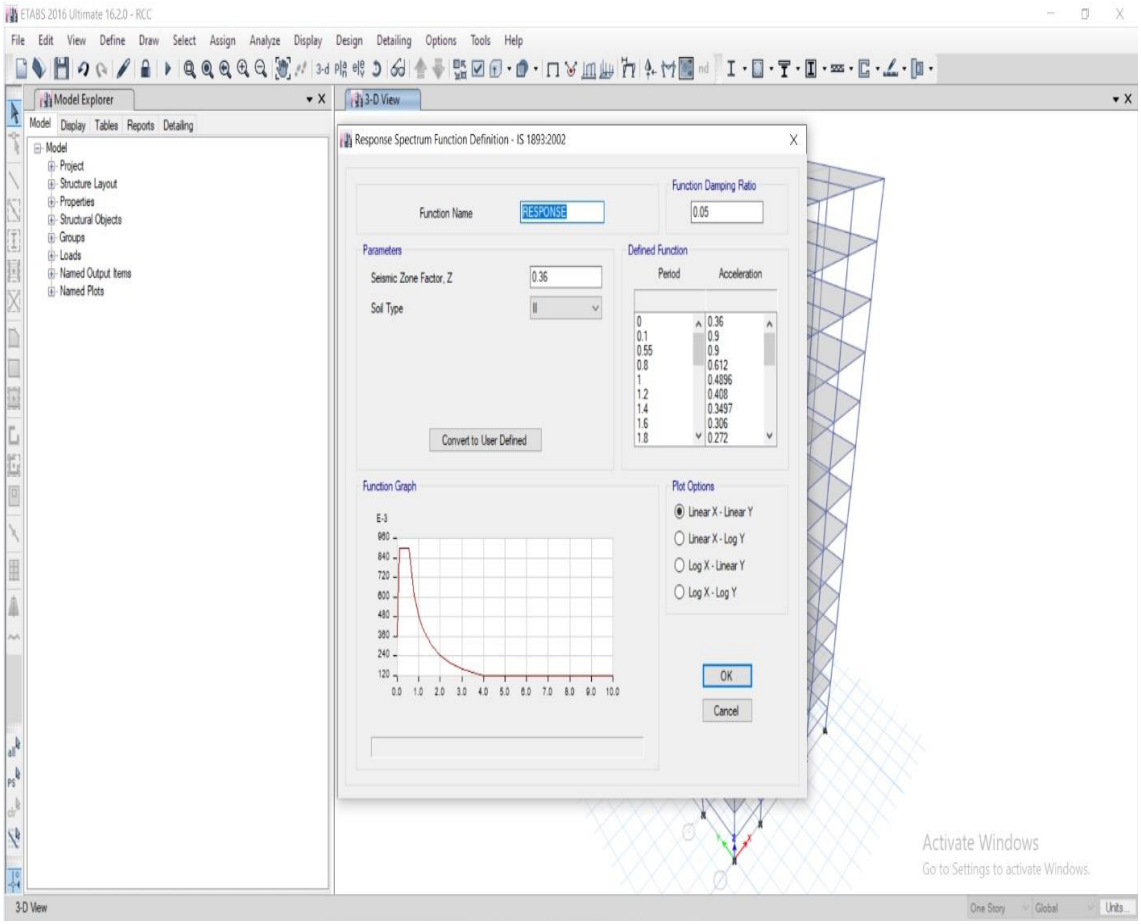


Figure 8 Seismic load

Step-7 Assigning Loading Conditions

For the investigation of the structure, all the Load conditions to the structure are connected. The estimations of configuration loads are computed according to IS 875 Part I and II and IS-1893 section I. Dead loads will be computed based on unit weights of materials given in IS 875 (Part I) which will be set up considering the materials indicated for development. The circulation of the dead load. The forced load is characterized as the heap that is connected to the structure that isn't lasting and can be variable and will be accepted as per IS 87S (Part II). The dispersion of the live load.

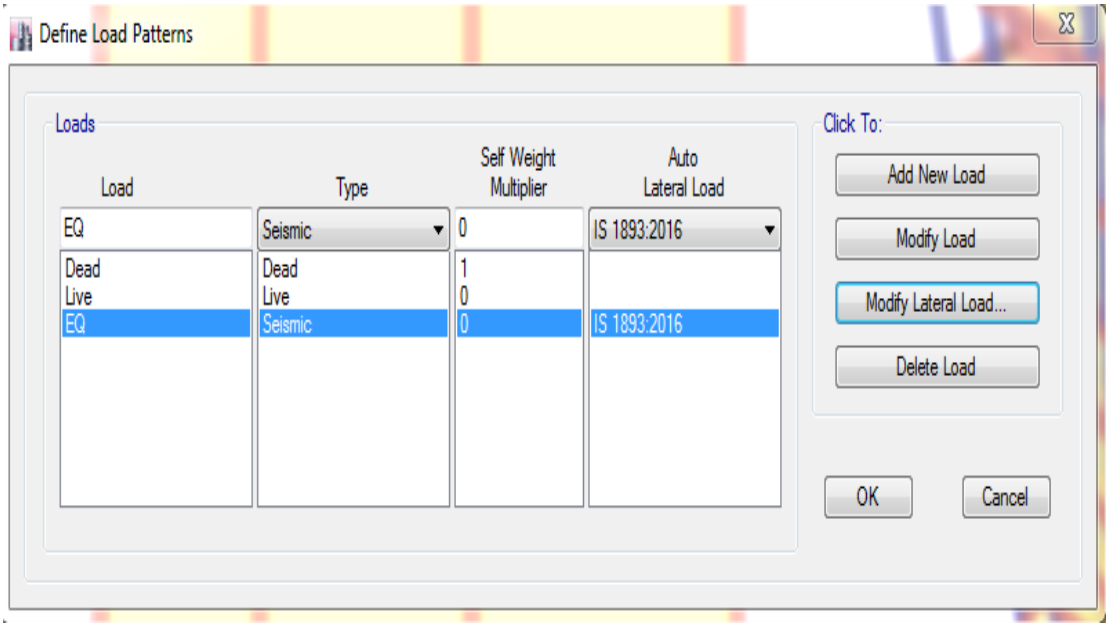
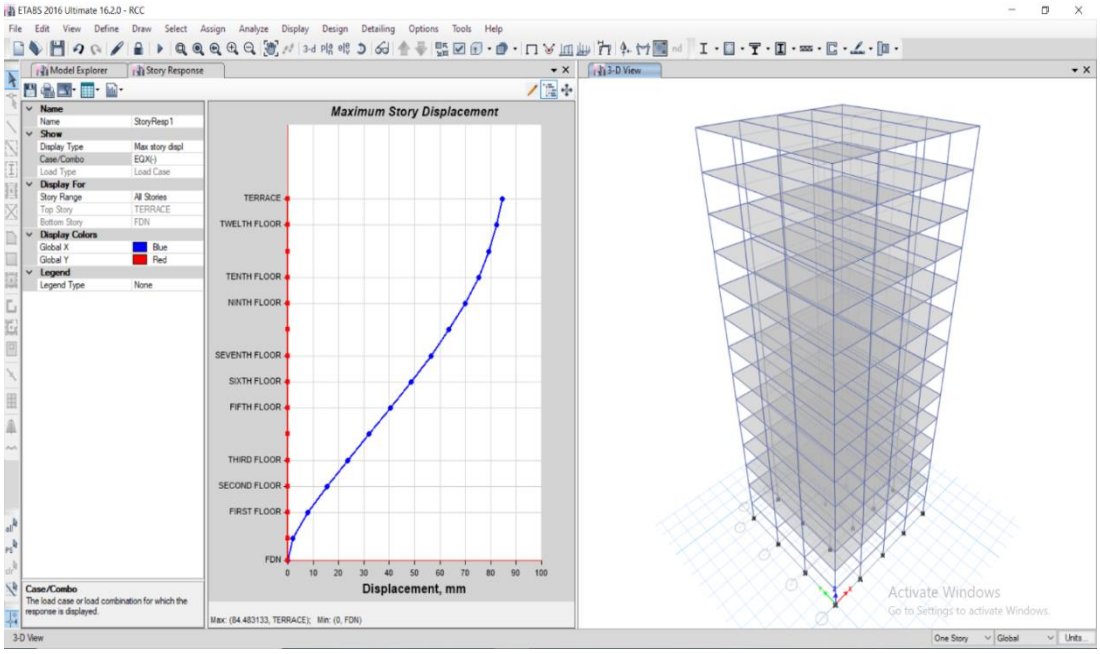


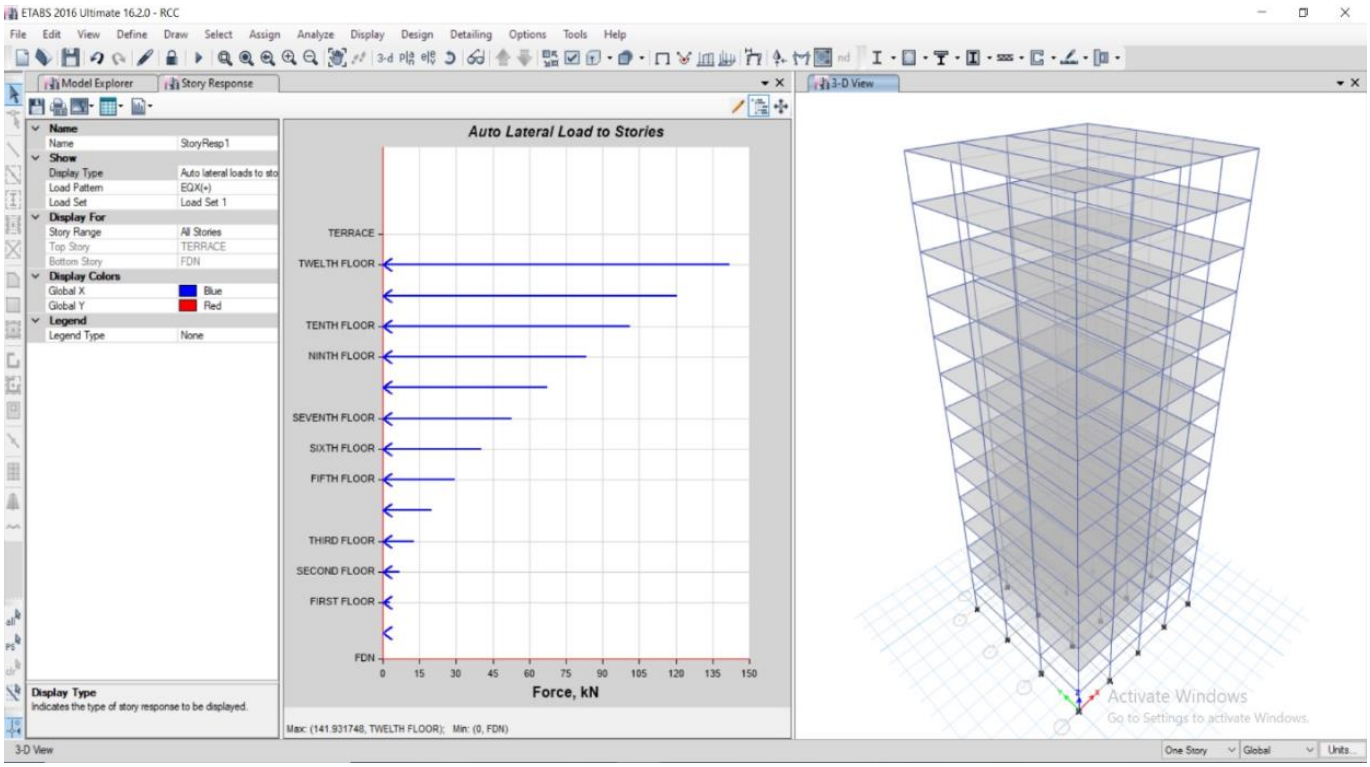
Figure 9 Assigning Load Condition

Step-8 To perform finite element analysis

The Finite Element Analysis (FEA) is the reproduction of some random physical marvel utilizing the numerical procedure called Finite Element Method (FEM). Architects use it to lessen the number of physical models and tries and enhance parts in their structure stage to grow better items, quicker.



a. **Displacement in mm**



b. **Forces in KN**

Figure 10. Analysis results

Step-9 Designing of RCC and PT beam.

Plan of RCC structure is done on ETABS programming utilizing IS-456:2000. Amid the plan of RCC framework segments such as Beams, Columns, Slabs different outline parameters are chosen as given underneath:-

Grade of concrete = M-30

Grade of main steel = Fe415

Grade of secondary steel = Fe415

Clear Cover = 40 mm

Max. Size of main reinforcement = 40 mm

Min. Size of main reinforcement = 25 mm

Max. Size of secondary reinforcement = 12 mm

Min. Size of secondary reinforcement = 8 mm

Table 1 : Geometrical details

Sr, no,	Number of Stories	Ground + 10 storey
	Height of stilt floor	3.3 m.
	Height of upper stories	3.3 m.
	Depth of foundation	-1.5 m
	Grade of concrete for RCC structure	M 30
1.	Plan area	16 x 15 m
2.	PT beam	450 x 300 mm
3.	Column	500 x 500 mm
4.	Slab	150 mm
5.	Seismic	Response Spectrum (V)

Analysis Results:

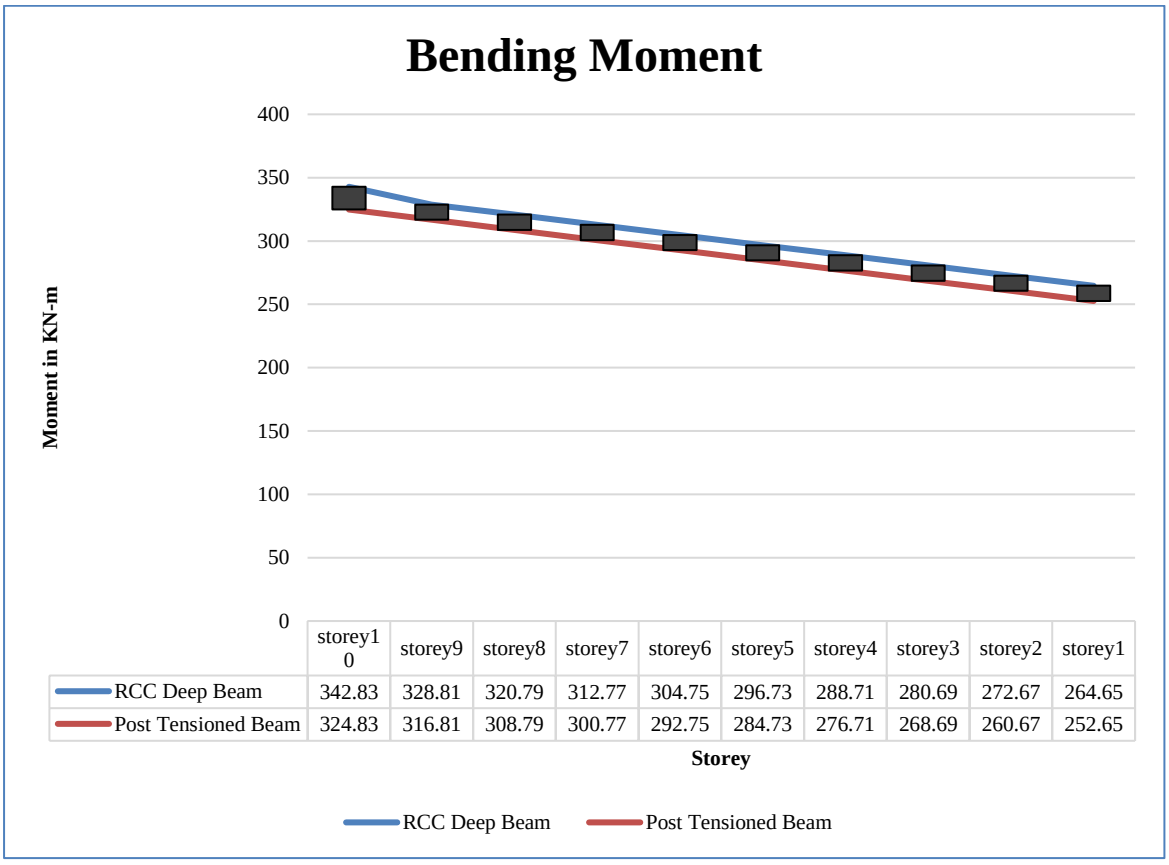
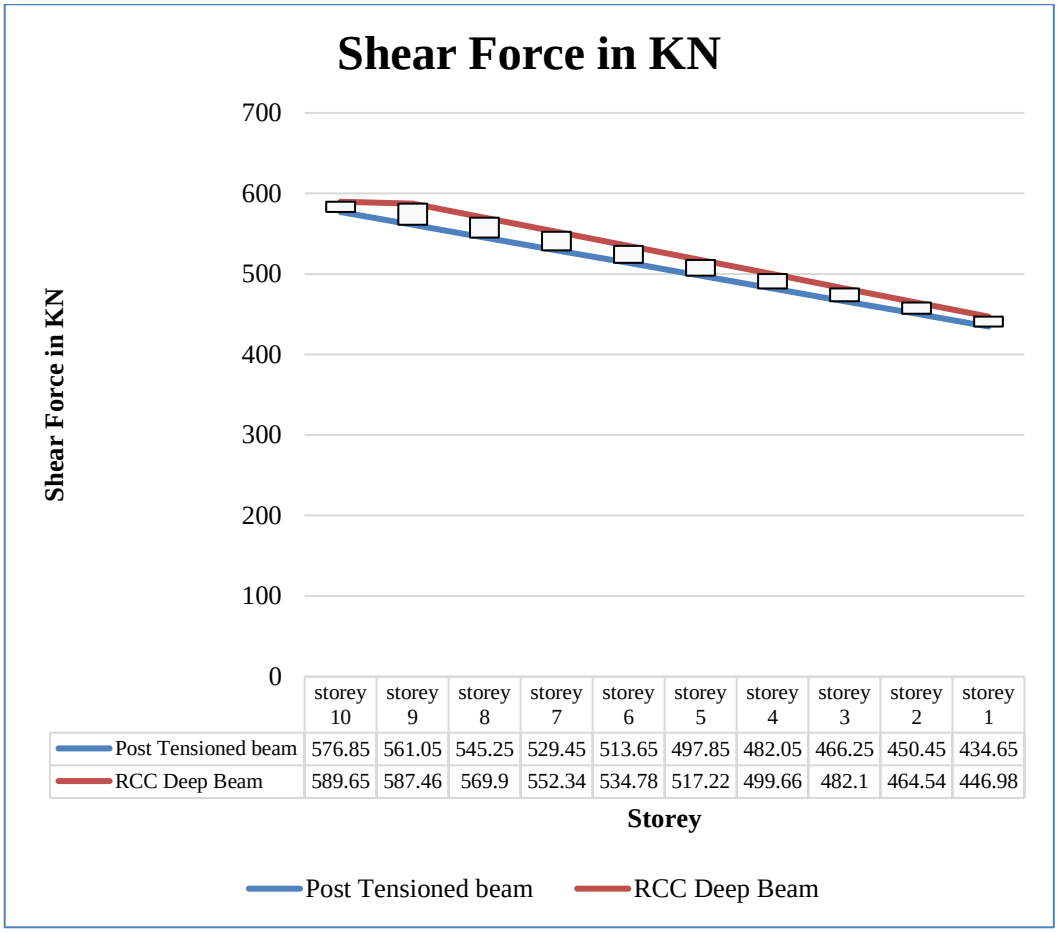


Fig 11 : Bending Moment



	storey 10	storey 9	storey 8	storey 7	storey 6	storey 5	storey 4	storey 3	storey 2	storey 1
Post Tensioned beam	576.85	561.05	545.25	529.45	513.65	497.85	482.05	466.25	450.45	434.65
RCC Deep Beam	589.65	587.46	569.9	552.34	534.78	517.22	499.66	482.1	464.54	446.98

Fig 12 : Shear Force

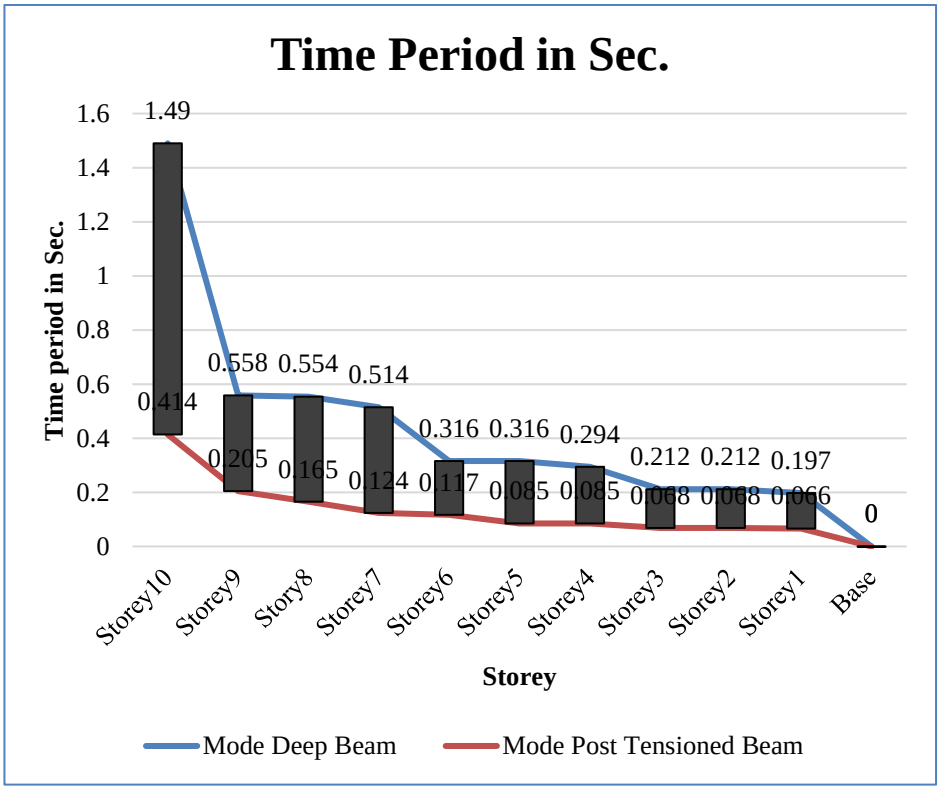


Fig 13 : Time period

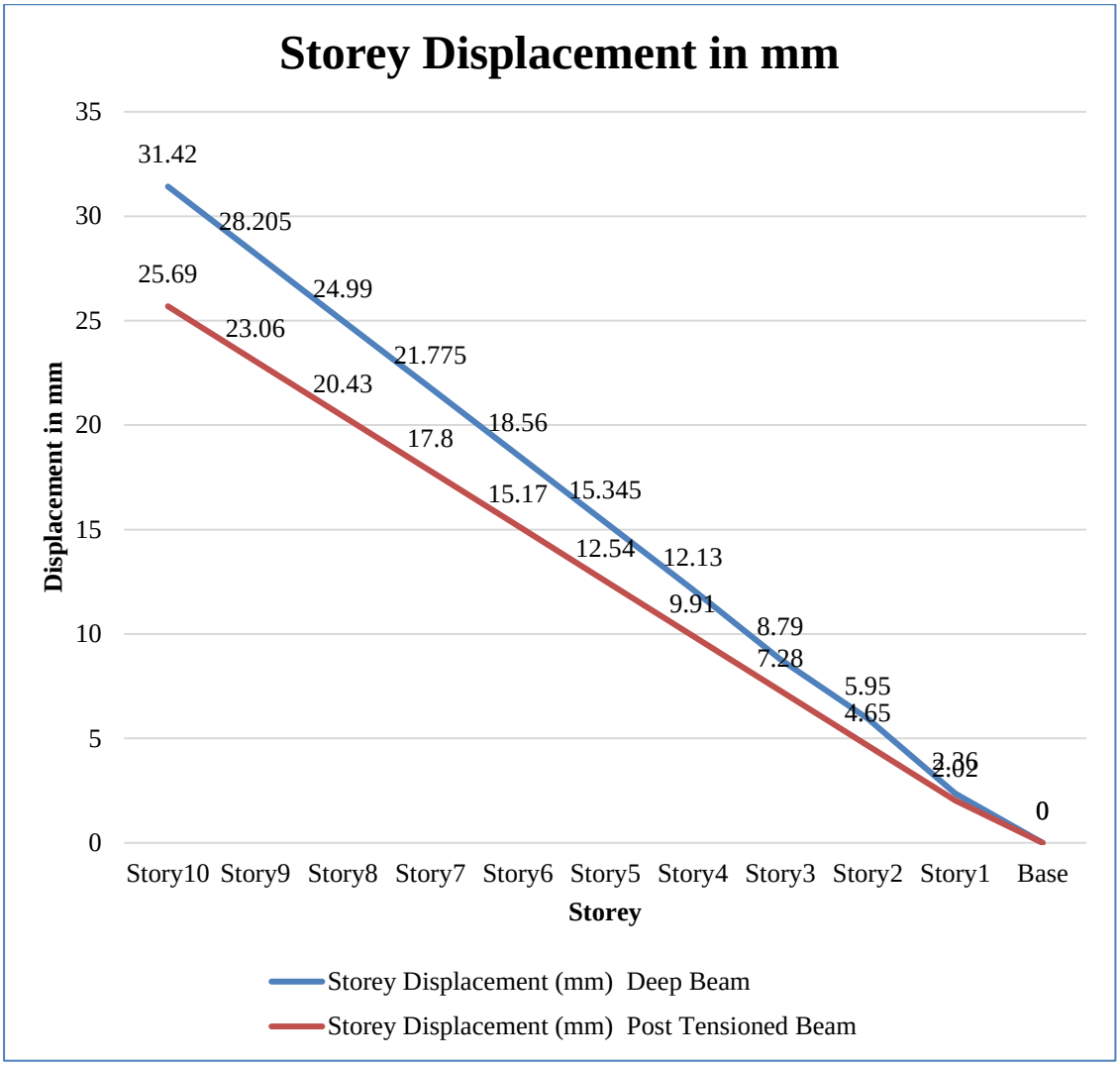


Fig 14 : Displacement

IV. CONCLUSION

In present investigation near examination is done on a G+ 10 story structure with various bars in particular RCC profound pillar and Post Tensioned Beam for same loadings which will be steady, acceptable in firmness, financially savvy, conservative and effectively accessible.

Shear power: As shear power is produced due to unbalancing at the joints interfacing various individuals, here in above section it is seen that structure utilizing Post tensioned pillar can limit the powers unbalancing by around 22% consequently making structure more steady.

Diversion: The redirection separation of a part under a heap is legitimately identified with the slant of the diverted state of the part under that heap, and can be determined by incorporating the capacity that numerically portrays the slant of the part under that heap. In results above it is seen that casing structure utilizing Post tensioned bar is opposing diversion contrasting with structure with profound pillars

Cost Analysis: As India is a developing nation thus development of new construction with cost effectiveness is important for its proper and budgeted development. Here results shows that using Post tensioned beam structure can minimize the cost by 21.41% of the total cost.

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