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Analysis of Twisted Tall Structure Considering Lateral Load using ETABS A Review

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ABSTRACT

This examination presents the underlying way of behaving of RCC wound building exposed to dynamic burdens. The similar concentrate between RCC wound building is made. In a wound tall structure different pace of contort for RCC bent building was investigated. The different pace of bend as 10, 12.5 and 15 degrees at the focal point of the RCC wound building was thought of. The demonstrating and investigation is finished utilizing ETABS. Dead loads, live burden, seismic burden and wind loads are allocated for demonstrated designs and results acquired are plotted for boundaries, for example, removal, story float, time-frame and base shear. This paper presents literature review related to analysis of tall structures.

Keywords : RCC twisted building, Steel twisted building, base shear, time period, displacement & storey drift.

I. INTRODUCTION

Tall structures arose in the late nineteenth 100 years in Chicago and New York. Following quite a while of diverse plan in the mid twentieth 100 years, the International Style won during the mid-twentieth hundred years and delivered various kaleidoscopic Miesian style towers everywhere. The present engineering, including tall structures, can be seen distinctly through acknowledgment of the strength of pluralism. This contemporary engineering configuration pattern has created different complex-molded tall structures, for example, curved, shifted, tightened and freestyle towers, similar to the cases with the contorted Cayan Tower in Dubai, shifted Gate of Europe Towers in Madrid and tightened freestyle Phare Tower in Paris. This paper concentrates on execution based underlying framework plan choices for different complex-molded tall structures.

Tall structures convey exceptionally enormous gravity and sidelong loads. Subsequently, underlying effects of turning, shifting, tightening and free-framing tall structures are critical, and more cautious examinations are expected for the plan and development of complex-formed tall structures. However normal nowadays, complex-formed tall structures are a still extremely ongoing design peculiarity, and just a restricted measure of related research has been led. This study presents similar assessment of multi story skyscraper structure with curve at various points and contrasts the outcomes and the exposed casing of ordinary design.

II. LITERATURE REVIEW

Sridhar and Rose (2021) [23] the research paper presented comparison of the flexural behavior of post-tensioned concrete beams with bonded system. Four rectangular post-tensioned beams were tested and analyzed. The beams were tested under single point monotonic loading condition and two point monotonic loading condition. The load-deflection behavior, stress-strain behavior and crack patterns are presented from the test results. Post-tension system effectively controlled deflection and crack due to the presence of tendons in addition to the reinforcing steel. The results stated that the prestressed concrete beam with high PT force (64kN and 42kN) achieved the maximum load when compared to other beam under two point loading and single point-loading condition respectively. There was an increase in load by 11.11% when the PT stress is maintained at 150kg/cm2 compared to 120kg/cm2 under two point loading condition.

Reddy et. al. (2020) [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 (2020) [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

Anand et. al. (2018) [26] the research paper presented the comparison of seismic evaluation of typical RC framed structure of plan dimensions 24m x 24m having panel size of 8m x 8m with the three variations in its frame modelling. The first model consists of a conventional RC frame with all beams and columns as RCC. RCC peripheral beams consider as a second model and interior beams with PT (Post Tensioned) tendons and beams having PT tendons in third model. The models studied are varied in height from Ground + eleven stories to Ground + fifteen stories with square shaped cross section of columns. The column height is considered as 3m for each floor. If fifteen models is carried out a Static Nonlinear Pushover analysis generated in SAP2000 software. The post tensioned members are analyzed using ADAPT software. The results concluded that the seismic performance of RC framed structures having conventional RC beams on the periphery of the building and PT beams in the interior grids of the structure was the best for G+11 to G+15 storey structures. The stress value in the plastic hinges in case of frames with peripheral RC beams and internal

PT beams was observed to be not exceeded the collapse stage for all defined hinges in G+11 to G+14 storey building frames and after G+14 the collapse level was increased.

Ravi k et. al. (2018) [19] the research paper presented the ultimate load carrying capacity and maximum deflection of post tensioned beam, post tensioned retrofitted beam and post tensioned strengthened beam with AFRP, under two points loading. For this, beams of 1300 mm length, 150 mm width & 300 mm depth were casted and tested for M40 grade concrete and 0.4 water/ cement ratio. The experimental results stated that the deflection of Post Tensioned Strengthened beam and retrofitted beam with AFRP was reduced by 4.65% and 3.44% respectively when compared to Post Tensioned Beams. While using the analytical method, the deflection of Post Tensioned Strengthened beam with AFRP was reduced by 4.15% when compared to Post Tensioned beam. The ultimate load carrying capacity of Post Tensioned Strengthened beam was increased by 17.62% when compared to the Post Tensioned Beam.

Hussain et. al. (2018) [8] the research paper presented the effect of exist of opening in web of deep beam loaded directly and indirectly and the behavior of reinforced concrete deep beams without with and without web reinforcement, the opening size and shear span ratio (a/d) was constant. Nonlinear analysis using the finite element method with ANSYS software release 12.0 program was used to predict the ultimate load capacity and crack propagation for reinforced concrete deep beams with openings. The results stated that the reinforcement details of different model have clear effects of beam capacity and beam behavior. The strengths of beam can be effectively enhanced for deep beams reinforced with both horizontal and vertical stirrups. Experimentally and theoretically analysis approved that the existing of vertical stirrup reinforcement increase the ultimate load of beam capacity. The deep beams analysis results with and without openings using ANSYS was shows a good agreement compared with experimental results with small difference observed for all tested and analyzed beams.

Ankith et. al. (2018) [2] the research paper presented an experimental study on the flexural behavior of post tensioned beam. This paper presented the study about the deflection, initial load carrying capacity and flexural behavior of the beam. Three beams were casted for the study with M60 concrete where the two samples was a conventional concrete and second sample included replacement of 20% of cement with GGBS and third sample was replacement of 5% cement with silica. All the three beams were post tensioned with required prestressed and the beam dimension was 400mm width, 300mm depth and 2000mm length. The flexural strength or Modulus of Rapture and deflection were measured with the use of flexural strength testing machine. The results stated addition of 20% GGBS with replacement of cement and 5% replacement of cement increases the Compressive Strength by 3% and 5% respectively when compared with Conventional Concrete Beam. The increase in the compressive strength of the mixes with addition of admixture. The results concluded that use of Silica Fume with 5% replacement of cement in Post tensioned on M60 grade of concrete is the most efficient mix as compared with other mixes. The Flexural Strength test performed on 5% Silica Fume addition in replacement of cement in post tensioned beam presented the load carrying capacity of 1800 KN. The deflection of post tensioned beam with GGBS has 1 mm at load application of 1800 KN and Initial cracking load at 900KN with 0.1mm deflection and flexural strength is 100 N/mm2.

Mohammed et. al. (2017) [1] the research paper focused on the optimization of post tensioned concrete slab in order to minimize the strain energy of the slab which can ultimately lead to reduction in the area of the post-tensioned tendons and consequently decreases the construction cost. This research focused on the optimization of the PT concrete slab. The objective of the optimization procedures developed herein is to minimize the SE of the slab which leads to a reduction in the area of the PT tendons and consequently decreases the construction cost. As the result, the SE was reduced approximately 38%. A significant reduction in the area of PT tendons was also reached which was approximately 22%. The mid-span deflection and maximum tension stress were decreased during the optimization iterations within the allowable limits due to the increase the eccentricity. It was also noticed that the optimum area has increased when the magnitude of applied load is increased. The ultimate load for the controlled BPT slab after optimization was found to be 111 kN against 122 kN for the not optimized BPT slab. Thus a reduction of the controlled load which is 9% compared to the area of PT tendons optimization (almost 22%).The research paper concluded that the optimization of area of PT tendons of the post tensioned slab is very important because, it enable us to find the optimal area of PT tendon with low cost and suitable service conditions. The optimum values of SE and the area of tendons are affected by the number and location of the applied point loads. It is obvious that the critical type of loading is when the load is applied near the mid-span of the bonded PT slab.

Dixit and Khurd (2017) [4] the research paper developed three dimensional finite element modeling (3D-FEM) of Post Tensioned Concrete Beam that can be used to investigate the nonlinear response. The accuracy of the results obtained from nonlinear static analysis using ANSYS was validated. The results were generated for the fully prestressing case (31.1 KN) and the partial prestressing force (15.1KN) for post-tensioned concrete beams.

The result revealed the response obtained by Ansys for nonlinear analysis were close to literature study for given loading condition and deflection. The initial behaviour for first loading presented close agreement in deflection than the remaining load cases it was due to difference in convergence criteria for nonlinear analysis and due to mesh density.

Wani and Bhadke (2017) [28] the research paper presented a parametric study of deep rectangular beams for point load and results of deflection, flexural stress and shear stress of cantilever prismatic deep beams obtained using FEM program for isoparametric elements, and ANSYS 2D analysis were compared. The results stated that Deflection values given by EBT was much less than the values given by FEM program and ANSYS in case of rectangular deep beam.From the results given by FEM program, ANSYS was found that the flexural stress distribution in deep beam was not linear as in case of slender beams, but EBT gives the flexural stress distribution as linear for deep beam.EBT gives the maximum shear stress at the centre line of the beam, but in deep beams the maximum shear stress is below the centre line of the beam.It was observed that the neutral axis moves downward.It was observed that though there was a variation in the results of deflection obtained from FEM Program and ANSYS.

Kun Ye et. al. (2016) [31] the research paper presented the behavior of indirect loading, deep flanged reinforced concrete (RC) beams. The load was applied via shear on the side arms of the beam with bearing plates. Eighteen reinforced concrete deep T-beams designed to fail in shear. The beams without web reinforcement were tested under indirectly loading conditions. The beams were divided into three groups according to the ratio of shear span to effective depth. The specimens had different flange depth and flange width in order to investigate the effects of flange dimensions. The behavior of beams was observed; cracking load, ultimate loads, concrete strain, deflections and crack widths. Experimental results indicate that the indirectly loaded deep beams can carry additional loads after diagonal cracking. Furthermore, the experimental results were compared with prediction data used the equation for ordinary beams that recommended by ACI Building Code

(318-08). It was concluded that the ACI Code equation underestimated the concrete shear strength of the single span indirectly loaded Flanged deep beams.

Szreniawa et. al. (2016) [20] the research paper presents results of implement prestressed transfer slab in the building. Slab made over an underground tunnel supports 5 storeys. Presented project is a first venture of this type in project workshop of authors. Results of measurements of deflection during construction of the building indicate slight deviations from predicted values. Values were calculated, however in simple models using a substitute load method, it is difficult to expect precise compliance. The values of deflection in final monitored stage of implementation, however, shows that imposed conditions are met with a certain reserve. It can be noted, that maximum span/depth ratio for posttensioned beams carrying 5 storeys is 17.6. This is higher in comparison with reported similar realizations. It was achieved by four step prestressing and high level of bottom compressive stresses.

de Souza et. al. (2016) [3] The research paper's main objective was to present the analysis and design process of deep beams through a manual approach of SPM. The practical examples stated that SPM is a method of easy application, as it is a very attractive alternative for analyzing reinforced concrete deep beams and it results in a model as simple as STM. The main difference between these two methods is that, while STM results in a more concentrated reinforcement in the considered ties, SPM can result in a more distributed one, by calculating a web reinforcement for the considered panels. The conducted non-linear analyses showed that SPanCAD, as a simple software that depends on the definition of only five parameters, presented close results to ATENA 2D, especially for the ultimate loads. Safety and in-service conditions for both deep beams could be verified through the non-linear analyses and the results showed that SPM provided a good solution for designing these structures. However, further investigations need to be done, in order to analyze the behavior of structures designed by SPM by an experimental program, so an adequate comparison between SPanCAD's solutions and experimental data can be made.

Reddy et. al. (2014) [29] to study the flexural behavior, deflection and load carrying capacity of strengthened beams subjected to static loading. To achieve this 6 number of post-tensioned beams of size 100mm x 150mm x 1000mm were tested analytically and experimentally under two points loading condition. Conclusions were drawn based on the plot of load deflection and moment-curvature graph. Here analytical and experimental measurements are compared based on numerous tests available on the literature and published by different authors. The finite element simulated response agrees remarkably with the corresponding experiment results. The results concluded that both analytical and experimental work shows that, strengthening of post-tensioned beams by FRP wrapping technique method enhances load carrying capacity significantly. The analytical model failed to predict the failure modes observed in the final static test, i.e., debonding of the FRP sheets in FGFRP. The Post-Tensioned beams strengthened for full length of bottom was found to be more effective and the load carrying capacity was increased about 40.53 % as compared to control specimens. And increased about 22.19% as compared to beams strengthened only at flexure zone. The strengthened beams FGFRP failed due to debonding of GFRP, that means bond failure occurred as loading approaches the ultimate load. But there was no debonding in TGFRP. Conclusion stated that the continuous wrapping is best wrapping technique and to restore the ultimate flexural capacity of strengthened beams it could be necessary to prevent fiber debonding. The deflection of the beams both in analytical and experimental method found to be similar with less difference.

Elsharkawy et. al. (2013) [9] the research paper presented an experimental and analytical study on the behavior of post-tensioned concrete beams with variable discontinuous fibers' content. Eleven half scale T-shaped post-tensioned simple beams were cast and tested in four points bending under the effect of a repeated load using a displacement control system up to failure. The test parameters were the fibers' type (steel and polypropylene) and content, as well as the prestressing ratio (partially or fully). Key test results showed considerable enhancement in the crack distribution, crack width and spacing, concrete tensile strength and flexural stiffness in all beams with steel fibrous concrete. The latter aspects were directly proportional to the steel fibers' contents. On the other hand, beams containing polypropylene fibers demonstrated a slight decrease in the flexural strength and a slight increase in flexural stiffness. In addition, the tensile steel strains decreased in all fibrous concrete beams, with lowest values in steel fibrous concrete specimens when compared to those of the polypropylene fibers. Furthermore, fibrous concrete beams also demonstrated enhanced ductility and energy absorption, which reached the highest values for steel fibrous concrete specimens. The results stated that their was a Significant increase in the tensile strength of the concrete ranges from 2.6% to 29.7% and 1.2% to 29.5% for fully and partially prestressed beams respectively, decrease in the cracks widths and decrease in the spaces between cracks. Increase in the flexural stiffness decrease the deflection and the tensile stress of the steel reinforcement. Increase in peak load ranges from 3.78% to 11.48% and 2.38% to 8.32%, enhancement in ductility ranges from 7.2% to 26.22% and 13.39% to 27.63% and energy absorption ranges from 8.86% to 45.18% and 14.33% to 33.37% for fully and partially prestressed beams respectively. The analytical model used for beams containing steel fibers, showed a very good agreement with the measured peak load with error ranges from 4% to 5%.

Kulkarni et. al. (2013) [22] the research paper presented analysis and design of beams subjected to two points loading with two different L/D ratios using Programme in FORTRAN 77 for analysis and I.S.456-2000 for design purpose , to plot the variation of flexural stress, strain and shear stress in deep beam. The results concluded that the strength of beams with 250 mm shear span was about 5 % less than that of 200 mm shear span. It was clear from these results that the strength of deep beam is inversely proportional to the steep and arch action not only reserve flexural capacity in most cases but also efficiently sustains required shear force. Arch is clearly observed in those beams and finally beams fail due to either sudden tensile crack formation parallel to the strut axes or compressive crush in normal direction to the strut axes shear span for the constant depth of the beam. All the beams had low deflection at failure as there was no flexural failure. The flexural steel requirement of by using IS456:2000 is more by a margin of 8.17 % than Finite Strip Method. Therefore it was concluded that tensile reinforcement requirements of I.S .method was near to the FSM. The design was found conservative. The flexural tensile force as per the FEM analysis was concentrated in lower 1/3 height for all the beams. Therefore in the deep beams loaded with two point loading, steel for the flexural tensile force may be provided mainly in this height. This was matching with the codal provisions.

T.H. Kim et. al. (2012) [27] the primary motive behind the research paper was to evaluate the behavior and strength of prestressed concrete deep beams using nonlinear analysis. By using a sophisticated nonlinear finite element analysis program, the accuracy and objectivity of the assessment process can be enhanced. A computer program, the RCAHEST (Reinforced Concrete Analysis in Higher Evaluation System Technology), was used for the analysis of reinforced concrete structures. Tensile, compressive and shear models of cracked concrete and models of reinforcing and prestressing steel were used to account for the material nonlinearity of prestressed concrete. A bonded or unbonded prestressing bar element is used based on the finite element method, which can represent the interaction between the prestressing bars and concrete of a prestressed concrete member. The results stated that the ultimate shear capacity of prestressed concrete deep beams increases with an increasing degree of prestress and increasing concrete strength. The proposed constitutive model and numerical analysis describe with acceptable accuracy the inelastic behavior of the prestressed concrete deep beams. This method may be used for the nonlinear analysis and design of prestressed concrete deep beams.

III. CONCLUSION

- The researchers have endeavored to discover the variety in stability which happens because of beams, following are the results of writing survey:
- Determine that casing with PT beam results in generation of less moment.
- That structure utilizing deep beam are more steady.
- Difference in outline with different types of deep beams.

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