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Analysis of A Tall Structure considering precast hollow flat & pre tensioning slab considering lateral load using ETABS A Review

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ABSTRACT

As the number of residential, commercial, and institutional buildings increases, concrete building structures receive a significant portion of the construction budget and national capital. Precast Empty Center Sections (HCS) have, be that as it may, demonstrated to be more alluring than RCC chunks lately because of the interest for efficient and speedy development, and they have been recommended as a useful substitute for RCC pieces.

In this paper introducing audit of writing connected with examination of construction utilizing examination device.

Keywords : Precast Hollow Core Slab, Storey Drift , Story Shear, Lateral Displacement

I. INTRODUCTION

It is the underlying architect's liability to ensure that the fabricated climate can areas of strength for endure occasions like breeze, seismic tremors and traffic. All Manufacturers need to know how their assembled climate responds to these unique activities. An immediate aftereffect of tremors is that many individuals pass on from the breakdown of designs and rubble, and over the long haul, a large number of individuals lose their homes because of the breakdown of structures and the vulnerability and reproduction process and the designing division plan the immediate result of these program by better the seismic reaction of building designs and working ceaselessly to work on the seismic plan.

A construction moves horizontally and in an upward direction during a tremor because of surface ground movement driven on by seismic waves. In most cases, the ground is moving faster (ag) and has a significantly greater lateral motion than vertical motion. This horizontal movement makes the structure experience inertial powers, which are determined as the amount of the construction's mass (m) and speed increase (a). As indicated by Newton's Subsequent Regulation (Power = Mass x Accleartion). The fundamental factors that determine a structure's response to an earthquake are its mass, size, and configuration.

Flat Slab A square slab known as a "drop panel" has a one- or two-sided support system and is referred to as a "flat slab" because the slab's sheer force is concentrated on the supporting columns. Drop

boards are vital in this present circumstance since they increment the general strength and limit of the ground surface framework underneath the upward loads while likewise working on the development's expense adequacy. Commonly, the level of drop boards is twofold that of the section.

For most of development projects as well as lopsided segment plans like bended or sloped floors, level pieces are viewed as reasonable. Applying level pieces has different advantages, remembering adaptability for plan course of action, level soffit, and profundity arrangements. Even though it can be expensive to build flat slabs, it gives architects and engineers a lot of freedom with their designs. The utilization of level pieces enjoys various benefits, not just regarding future plan and design viability yet in addition for the whole development process, especially for smoothing out establishment cycles and eliminating development time. Make the most of the thickness of flat slabs rather than drop panels by avoiding their use as much as possible. To keep up with the benefits of level soffits for the floor surface and to ensure that drop boards are given a role as a component of the section, this is important.

Fig 1 Flat Slab

II. LITERATURE REVIEW

Kamal Amin Chebo et.al (2022) The way of behaving of a solitary range empty center chunk under successive effect loads at the middle, edge, and near the help under a 600 kg quickly dropping steel ball from a level of 14 meters was analyzed in a review report. Explored were the section's underlying reactions to affect force, damping, speed increase response, and harm assessment. A solitary range empty center chunk is tried in an enormous scope exploratory program. The example has 6000 mm × 1200 mm × 200 mm aspects with a 100 mm cast in a spot besting section.

Results expressed that substantial strong segment acts in a greatly improved manner than the empty area regarding underlying harm and breaks age. Filling material, for example, froth can be utilized to retain a piece of the energy prompted in the body of the empty center unit to relieve the fragile break of the slender ribs, in this manner upgrading the primary exhibition of the section framework. The effect load site in the empty center chunk was helpless, as confirmed by the damping proportion that was displayed.

Vanteddu Satwika and Mohit Jaiswal (2022) used the post tensioning method to strengthen a flat slab in the research report. Contrasting RCC level pieces with post-tensioned fat sections with different ligament profiles, both scattered and joined ligaments were utilized. The boundaries were assessed: thickness, supporting responses, punching shear, and diversion when contrasted with ordinary level chunks. The models were built as per ACI 318-14, and these piece models were created utilizing ETABS programming.

The outcomes demonstrate that post-tensioned level chunks have better punching shear limits even at more profound profundities, prompting segments that

are all the more financially sound. Lower redirection is one more advantage of the consideration of ligaments.

Distributed tendons are more successful at reaching shallower depths than banded tendons. The post-tensioned flat slab required fewer construction materials because there was less dead weight and fewer support responses. Subsequently, development costs are lower. Because of the lower support reaction for PT pieces, less segments and less support are expected for the parts that bear load from the chunks, for example, sections and establishments, which brings down the expense of development generally. A flat slab's punching shear strength can be increased even at shallower depths by employing the post-tensioning method. This resolves one of the primary issues with the flat slab design. By including post-tensioning ligaments, descending diversions can be altogether diminished, bringing about great functionality. The most proficient strategy, while considering the whole adequacy of the level piece, is the arrangement of scattered ligaments along with drop.

Dheekshith K and Prasad Naik (2021) research paper looked at the reaction of RCC section building and empty center piece under the seismic burden conditions for a G+9 story structure demonstrated utilizing insightful application ETABS considering shear walls on the sides. As empty center sections can't be straightforwardly demonstrated by ETABS, Optional Pillars were taken on with similar aspects as Empty Center Chunks. The empty center piece were displayed utilizing ANSYS(Investigation of Frameworks programming). Three models were assessed for each RCC working in Zones 3, 4, and 5 and for every normal roof structure.

Results expressed that story uprooting expanded for empty center chunk contrasted with RCC structure. Storey's hollow core slab building acceleration is lower in the X direction than that of the RCC building, but it is higher in the Y direction. When contrasted with RCC building, empty center section development takes less time and has less story float. Because the building is lighter, hollow core slab construction has a lower base shear than RCC construction.

Omar Ahmad (2021) In an exploration work, an expense correlation of post-tensioned and supported substantial level sections was introduced. As per the article, less concrete is required for post-pressure sections than for level chunks in light of the fact that the post-strain pieces are more slender and there are less segments given. A hydraulic jack extends the special steel tendons that were used in post-tensioned slabs after the concrete is cast, eliminating the need for reinforcement steel bars. Albeit just post-pressure chunks use ligaments, there is less steel utilized in post-strain sections than in level pieces. The expense of the worker for hire's work shifts relying upon whether a level section or a post-tensioned chunk is being constructed. The study compared the costs of concrete, steel, and contractor work.

The results of the comparison study between flat slabs made of reinforced concrete and post-tension slabs indicate that post-tension slabs are less expensive.

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In the study paper, Umamaheswara Rao Tallapalem et al. (2019) developed the three types of Beam-column connections—rigid, semi-rigid, and hinged—for use in G+20 high-rise buildings. To recognize the way of behaving of the associations in these elevated structures, time chronicles of high seismic waves, moderate seismic waves, and low seismic waves were dissected. The consequences of top removals, story floats, and between story floats were thought about for the different associations and different seismic waves. The staad.pro software was used to create the model, which included three different types of precast joint connections—a rigid connection, a semi-rigid connection, and a hinged connection.

Results expressed that lower tremors most extreme entomb story float for pivoted associations are multiple times higher than the semirigid associations. It could lead to nine times more assumptions than the one currently in place. Unbending associations were 1.81 times lesser than the Semi-Inflexible association. It might prompt lower suppositions 1.81 times than existing one. At long last in Serious Tremor impacted regions and Low Quake impacted regions Pivoted associations are accepted to Roughly multiple times higher thought than Semi Unbending associations. For directed quake impacted regions unbending associations and Semi Inflexible associations act almost something similar.

Jay Vekariya et.al (2018) research paper introduced examination and plan of the post-tensioned level section with drop board and post tensioned voided chunk utilizing the Adjust Manufacturer 2015.

As per the outcomes, a voided section has a lower self-weight than a strong chunk, so by adding a voided piece of 35% to a strong chunk, redirection can be decreased by up to 19 percent. 2. By presenting voided level piece framework punching shear decrease to 23 percent, the level chunk framework had the option to essentially lessen a significant issue with punching shear. Contrasting a voided piece with a strong level section, less ligaments were utilized to oversee redirection and burden. By offering a 35 percent voided piece, the section's self-weight was brought by up down to 13 percent.

Jnanesh Reddy R K and Pradeep A R (2017) In an exploration report, the monetary viability of supported cement and post-tensioned level chunk frameworks were analyzed. The two frameworks were inspected utilizing the plan philosophy based examination devices Riveted and ETABS, separately. The structure was planned utilizing the ETABS, and the model utilized has a storm cellar, ground level, and four stories with estimations of 38.13 m by 28.85 m with the greatest ranges of 9.44 m by 6.16 m. (level piece). The segment is 750*750 mm in size. For sections, pillars, and pieces, M30 grade concrete and Fe415 grade rebar are thought about. According to IS 875 part 2, the slab is loaded for self-weight and has a live load of 5 kN/m2.

As per the outcomes, 330 m3 of cement was expected for the development of a R.C.C. level piece with edge radiates and 247 m3 for a PT section with drop boards. The expense of the steel required for the development of the R.C.C. Level Section was Rs. 3915751, and the expense of the steel and ligaments required for the development of the PT Chunk is Rs. 3445148. Also, the results showed that Post

Tensioned level sections are more affordable than RCC chunk frameworks.

In the research paper by Kamal Padhiar et al. (2017), two distinct floor post-tensioning floor systems were taken into consideration: flat slab and flat slab with drop panels. Four ranges were considered for the same edge framework to assess primary boundaries like substantial grade M35 to M50. The flat plate slab and the flat slab with drop panel have two distinct span-to-depth ratios. Dead burden because of self load of the design, live burden and post-tensioned burden was considered for the investigation. Grade of cement straightforwardly affecting the diversion &Non PT steel(conventional steel) of level plate. With changing grade of cement, impact of punching shear proportion, considered second at mid range and PT amount was researched and the plan was directed utilizing the PC examination program Adjust PT.

Required amount of PT steel if there should arise an occurrence of level plate chunk is 5-10% a bigger number of than level piece with drop board for various range. However, changing the grade of the concrete for each span does not increase it. In the two kinds of math for a similar range with expanding grade of concrete, the amount of non PT steel is decreased by 5-10%. However, for a similar grade of cement having a similar range, the amount of non PT steel in the event of level plate section is 40-half a larger number of than the level piece with drop board. According to the conclusion, a flat plate slab with a span of 8.0 meters was suitable and cost-effective. Assuming need of length more than 8.0 meter or more up to 13 meter level piece with drop board gives economy.

Mohammed Imran et.al (2017) The objective of the examination paper was to look at and assess the seismic way of behaving of RCC level sections and post-tensioned chunks utilizing the straight time history investigation procedure that is a center part of the Etabs 2015 program in India's Zones 2 and 3. Different kinds of Structures with G+9, G+11, G+14, G+19 and G+24 stories were considered with contrasts in mathematical properties and material properties. The objective was to look at how these developments acted for different elements, including horizontal relocation, interstory float, hub power, and story shear.

Results showed that post tensioned level chunks performed preferred under seismic stacking over level pieces, despite the fact that post tensioned section development is turning out to be increasingly more typical since it shares large numbers of similar benefits. The weight decrease, speed, economy, and most vitally, more limited building time, are tremendously improved; it is exceptionally famous, particularly for business spaces. The thickness of the section and the size of the segments might be expanded to additional upgrade the consequences of the level piece under seismic and warm loads.

Prasad Bhamare et.al (2017) Exploration paper researched numerous precast ideas top to bottom, read a ton of writing, and found pertinent information. One structure was utilized for instance, and plans for both customary cast set up structures and precast structures were thought about. Based on cost and length, a plausibility check and cost investigation were directed.

The precast substantial innovation was viewed as more savvy than the conventional cast set up approach, in spite of the fact that there are still a few contemplations while using precast, like the volume of development and the site's separation from the assembling office. Precast is the best choice to choose for standard and dull work, no matter what the kind of development, and so on. The most urgent part of precast development to be assessed in an observational review is the way rapidly it very well may be fabricated. It needs prepared project workers and talented laborers, and the starting expense is

lower for greater activities. The most significant disadvantage of precast is its transportation from the manufacturing site to the installation site.

V. G. Mutalik Desai and Mohammad J. Shaikh (2016) In an examination paper, investigation and conduct of a post-tensioned level chunk were given. Both PT flat slabs and flat slabs were modelled and analyzed with SAFE. The PT section was analyzed utilizing 12.7 dia and 9.5 dia 7 handle high ductile steel strands for post-tensioning. A chunk board estimating 8 by 12 meters was demonstrated for a few situations and given the fitting credits. The section was isolated into focus and segment fragments. Drops were set along the section strip in both level chunk and PT level piece, and the outcomes were thought about with regards to redirection, punching, second, and stresses. PT flat slab shows that it might be a better option than flat slab when it comes to project cost, stability, and longevity.

A study article by Supriya T. J. and Praveen. J. V. (2014) examined the behavior of precast hollow core slabs in high-rise buildings. Utilizing the same static methodology and the Reaction range technique, five models of empty center piece structures with different part measures are inspected for seismic zone IV. These designs highlight a particular second opposing substantial edge with flexible shear walls as their primary framework. Using various member sizes, five distinct models of hollow core slab construction have been tested. As indicated by the guidance of IS: 1893(Part 1):2002, static investigation was performed utilizing the same static methodology, and dynamic examination was performed utilizing the reaction range technique.

As per the outcomes, for different seismic zones, empty center piece structures had lower base shear than strong chunk structures. In contrast with strong chunk structures, story float is higher in empty center piece structures. The construction of hollow core slabs requires less material than that of solid slabs. Thus, empty center piece development is desirable over strong section development.

Renee A Lindsay et.al (2004) A full-scale precast substantial super-collection was inherent the lab and tried two times as a component of the review report. In the first stage, the investigation of the existing structure revealed significant construction technique flaws that would lead to very poor seismic performance. The discoveries from the subsequent stage, which analyzes the effect of further developed development subtleties on seismic execution, are introduced in this paper. The new subtleties incorporate a direct (stuck type) association framework with compressible material for the supporting shafts and a low grating bearing strip, as well as a 750 mm wide wood infill between the edge radiates and the primary precast floor unit.

As per test results, the new association detail performs fundamentally better compared to the ongoing standard development subtleties, with somewhat little harm to the casing and ground surface framework at high sidelong float levels. That's what the discoveries show, with the expanded specifying, interstorey floats more than 3.0 percent might be kept up with without losing support for the floor units. Hysteretic execution is utilized to measure the super-generally speaking gathering's presentation, while float harm is utilized to order delicacy suggestions.

III. Conclusion

The seismic behavior of multi-storied building frame during an earthquake motion depends upon the distribution of strength, mass and stiffness in both horizontal and vertical planes. All models are analyzed by using design and analysis software ETABS or SAP and designed as per IS 456:2000 and IS 1893:2002. Push over analysis is a non linear static

analysis had been used to obtain the inelastic deformation capability of frame. Only non-linear dynamic analysis is more accurate than pushover analysis; where non-linear dynamic analysis is time taking to perform. In order to obtain dynamic response of the structure, Time history analysis is carried out. So we can conclude that pushover analysis is the appropriate method to use for performance based design to get the response of the structures. Boskey Bahoria gives the idea about the post tensioned flat slab building structure having four cases depending upon by varying the span length by 0.5 m interval and discuss the comparative study of four cases with respect to economy.U. Prawatwong makes a two models one with drop panel shows the connections between slab-column and another is without drop panel shows connection between interior columns with PT flat plate and bonded tendons having seismic performance on two three fifth scale pattern under constant gravity load to investigate the seismic performance. Using the RAPT and ETABS softwares, Jnanesh Reddy RK examines the cost effectiveness of the post-tensioned flat slab with respect to the RCC flat slab, concluding that the PT flat slab is preferable to the RCC flat slab since it lowered the dead load by reducing slab thickness.

The drop panels and columns only provide a direct support for the slab in certain construction styles, according to the summary. Floor to floor height of the building decreases as a result of direct support from drop panels and building columns, making more space accessible for our usage. When we compare a flat pt slab to a regular slab, the results show that the cost and reinforcement are both 30% higher for the conventional slab. Due to the beam's ability to handle a greater load, the post-tensioning slab required more reinforcing. Formwork can be removed early when post tensioning with a reinforcement beam, however it cannot be removed earlier in a usual situation. More concrete is needed for one level in a PT slab with a reinforced concrete beam than in a PT slab alone.

IV. REFERENCES

[1]. Supriya T J and Praveen J V, [Use of Precast Hollow Core Slabs in High Rise Buildings], International Journal of Engineering Research & Technology (IJERT), ISSN: 2278-0181, Vol. 3 Issue 10, October- 2014.

[2]. Umamaheswara Rao Tallapalem, Shaik Nurulla and Srinivasa rao allu, [Time History Analysis on Precast Building Connections], International Journal of Recent Technology and Engineering (IJRTE) ISSN: 2277-3878, Volume-8 Issue-4, November 2019.

[3]. E. Michelini, P. Bernardi, R. Cerioni and B. Belletti, [Experimental and Numerical Assessment of Flexural and Shear Behavior of Precast Prestressed Deep Hollow-Core Slabs], International Journal of Concrete Structures and Materials, 2020.

[4]. Renee A Lindsay, John B Mander and Des K Bull, [EXPERIMENTS ON THE SEISMIC PERFORMANCE OF HOLLOW-CORE FLOOR SYSTEMS IN PRECAST CONCRETE BUILDINGS], 13th World Conference on Earthquake Engineering Vancouver, B.C., Canada August 1-6, 2004 Paper No. 585.

[5]. Dheekshith K and Prasad Naik, [LINEAR DYNAMIC ANALYSIS OF HOLLOW CORE SLAB AND RCC SLAB OF MULTI-STOREY BUILDING], International Research Journal of Engineering and Technology (IRJET), Volume: 08 Issue: 07 | July 2021.

[6]. Omar Ahmad, [Financial comparative study between post-tensioned and reinforced concrete flat slab], International Journal of Advanced Engineering, Sciences and Applications (IJAESA), ISSN: 2703-7266, 2021.

[7]. Prasad Bhamare, Sagar Bhosale, Akshay Ghanwat, Shubham Gore, Sheetal Jadhv and Sachin Patil, [COMPARE PARAMETERS OF RCC AND PRESTRESSED STRUCTURES], International Journal of Advance research in Science and Engineering, Vol.no.6, Issue no. 4, April 2017.

[8]. Kamal Amin Chebo, Yehya Temsah, Zaher Abou Saleh, Mohamad Darwich and Ziad Hamdan, [Experimental Investigation on the Structural Performance of Single Span Hollow Core Slab under Successive Impact Loading], Materials 2022, 15, 599.

[9]. Soubhagya Ranjan Rath, Susanta Kumar Sethy and Mukesh Kumar Dubey, [Comparative Study on Analysis and Designing of PostTensioned Flat Slab Vs Conventional Slab], International Journal of Research in Advent Technology, Vol.7, No.5, May 2019 E-ISSN: 2321-9637.

[10]. V. G. Mutalik Desai and Mohammad J. Shaikh, [Comparative Analysis of Flat Slab and Post-Tensioned Flat Slab Using SAFE], International Advanced Research Journal in Science, Engineering and Technology, Vol. 3, Issue 8, August 2016.

[11]. Jay Vekariya, Dr. Deepa Sinha and Bhavin Sheladiya, [Comparative Study of a Post Tensioned Flat Slab with Post Tensioned Voided Flat Slab], Journal of Emerging Technologies and Innovative Research (JETIR), November 2018, Volume 5, Issue 11.

[12]. Mohammed Imran, M. Visweswara Rao and Dr. Jammi Ashok, [A Comparative Study of Flat Slab Vs Post Tensioned Flat Slab], International Journal for Scientific Research & Development| Vol. 5, Issue 09, 2017.