Study of Large Span Slab In Horizontal Set Back Building: A Review

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Abstract- *The design and construction of long-span roof structures requires a blend of skills from the structural engineer not Normally required in more normal building types. Forces come into play, including material shrinkage, support settlement, temperature effects and sequence of erection that can normally be ignored in many building types but can have a dramatic effect on long-span structures. While a firm knowledge of structural behavior is essential, there are other challenges that face the structural engineer, there are equally as important. This article will explore the particular genre of buildings that are described as "long-span". It will outline some design considerations unique to this building type. It will focus attention on the necessary steps that must be taken in the design and construction of these buildings to make them live up to their high investment and lofty owner expectation.*

Keywords- large span slab, ETAB Svr.2016, Horizontal Set back Building, Flat slab, Waffle slab and ribbed slab

I. INTRODUCTION

Recent earthquakes, with most of the concrete structures severely damaged or collapsed, have demonstrated the need to assess the seismicity of existing buildings. About 60% of our country's land surface is susceptible to earthquake damage. We can't avoid future earthquakes, but the ease and safety of building construction methods can certainly reduce the amount of damage and loss. To strengthen and withstand current earthquake-prone structures, certain rules must be followed. Below, the different structural elements are introduced to discover the optimized structure. The structural member like flat plate, waffle plate, ribbed plate, etc. The other parameters such as the use of different structural shapes also resist the seismic response of the structure. Different types of ceilings are the best option for builders when it is necessary to cover large areas in a building with a small number of columns. Something new emerges from the flat slab with waffle ribs and becomes a major challenge for civil engineers. Plates are the structural elements that support additional dead and live loads in various structures. They are used in buildings, paths and bridges. They can usually be classified into one-way and two-way systems. One-way slabs with beams in one direction are often used for small spans up to six meters. For larger spans, bidirectional floors with beams and without beams are used. Double-sided plate systems are mainly used to withstand high loads or are used at large spans to minimize plate thickness and to reduce internal forces in the plate and limit plate deflection. It is common to have two-way tiles in parking floors because the spans are long and can reach thirty feet or more. Ledgers deeper than the height of the slab are very common, especially in parking garages and industrial buildings, because the presence of these ledgers does not affect the shape or use of the structure. Drop beams can be used in buildings with false ceilings and decorations. In residential buildings, it is not common to have false ceilings, therefore the presence of joists in these buildings is not recommended architecturally, hence the use of hidden joists. Two-way ribbed slabs are slabs with concrete blocks, while waffle slabs are slabs with removable molds. Double-sided corrugated sheets are often used in residential buildings and offices. The waffle iron can be used in corridors, commercial buildings and parking lots.

II. LITERATURE REVIEW

The following research papers are studied under the study of analysis of a Structure containing the different slabs such as Flat Slab, Waffle Slab, and Ribbed & Secondary Beam. The summarized reports of different researchers are as follows:

Imran S. M., Kumar R. R. & et. al. (2020) In this study, the appropriate design of the reinforced concrete slab (RCC), also known as waffle slab according to the RCC India codes, has been demonstrated. The objective work is the combined cost of reinforcement, concrete and formwork summarizing the cost of slab ribbed. The structure is analyzed using a specific design method. Purpose work is developed after reading the ribbed slab in detail. The improvement process is carried out

at different stages of concrete. Comparison results for different grades of concrete are calculated and listed. Reinforced concrete slab repairs (RCC) have been demonstrated and the results of better design and standard design are compared. The problem of improvement is the problem of the endless program (NLPP). The mathematical model is analyzed using mathematical software. From the analysis, it was found that savings of up to 25 percent can be achieved by repairing a reinforced ribbed slab.

Joshi R., Patidar G., & et. al. (2020) In this research are analyzing the feasibility of G+3 building with a single column, alternatively applying the flat and waffle slab in place of the conventional one at a time to check the difference in the characteristics of a building like bending moment, end moments, deflection, shear force, etc. The interpretative study between both the slabs along with the G+3 single column building with varying floor span, slab span, slab thickness, column thickness, adding dome like structure on bottom has been carried out under the influence of loading via a software specially used for the analysis of the multi-storied building named as ETABS. The course of Single Column Multi-Storied Building is nothing different from the journey of any structural design when it comes to the point it was first developed and till now when it is near the edge of being completely adopted in the daily chores. Single Column Multi-Storied Building demonstrates how contrasting structural members could also be assimilated into the traditional multi-storied building design to get the design of showing different properties having great impact in terms of environmental, structural, construction management aspect. Flat Slab and Waffle Slab in one form (with or without outer column) have had noticeable effect in the properties of the multi-storied building design, enabling its utilization for different purposes of the building.

Gagankrishna R.R & Nethravathi S.M (2015) The method of analysis adopted in the current study is statistical analysis or statistical analysis. Push analysis is usually a type of migration control and is conducted in accordance with ATC-40 and FEMA document guidelines. Analytical parameters affecting structural performance and comparative studies are considered on a flat plate and flat slab for RC frames. Push-over analysis was found as an easy way to assess the inconsistent behavior of structures. The result is that the shear is found to be very high in the case of all construction systems with a vertical edge and a shear wall compared to a flat slab without a shear wall. This is due to the increase in the strength of the side of the structures. And note that the displacement is reduced by increasing the stiffness of the side by taking the shearing wall and sidewall beam of flat plate and flat slab.

Shaga A., Polisetty S. (2016) In the present work, the RCC flat-slab structure and common slab structures are considered by a comparative study of a 6-storey building located in the earthquake zone-II and earthquake loading, provisions of IS: 1893 (Part 1) -2002 are considered. Three-dimensional modeling and structural analysis was performed with the help of software E-tabs 2015. Linear Static Analysis and Response of the analysis spectrum is used for the analysis of plaques and the standard slab structure. The strength and all the displacement areas, floor shears and turnaround times developed in each building are analyzed. The results of the analysis are discussed. In addition, these results were used to understand the performance of both slabs and common slab structures under the influence of side loads and earthquakes. The results are compared and found that a flat slate structure performs better in an earthquake situation than a normal slab structure.

Bansal A., Patidar A. (2016) The purpose of the present work is to compare the behavior analysis, we can know the weak zones in the multi-storey buildings that have a flat slab with the grid structure and then a slab and study the effect of foundation shearing, floor drift and whether the part specifically retrofit or upper displacement purpose, three cases of high-rise buildings under seismic forces are considered. Different Slab RC Seismic Performance may not accurately represent dynamic phenomena the operating points of flat plates are larger than those of grill plate models. Series systems for longitudinal construction, the shifts studied for flat slabs are much larger than for grate slabs, there are different types of RC slabs taken as an analytical model, as well as floor cutting in both types of slabs and they have different o ' performed similar analyzes. The current work provides a good source of information on the parameters of the push analysis of multi-storey buildings. The final outputs are seems to be such that different impact the different results in the structures.

S. N. Utane, H. B. Dahake (2016) The current purpose of this project is to compare different parameters such as shear base, story transfer that works on a flat slab system and waffle slabs. With the same expansion behavior, provided between the existing building and the industrial building that is prevalent in the earthquake area, it is being considered. Analysis of huge industrial buildings constructed using a flat slab with a waffle-shaped slab and a rectangular shape plan is carried by etabs. Relocation of a factory building constructed using a flat system slab. Above Waffle system for square and rectangular plate plates. The rectangular design of a factory building constructed using a flat slab and a waffle slab is larger than a square plan building. With the rise of the migration of the building also continues to rise. To cut a story about an

industrial building built using a slabs system that is larger than a waffle slabs system of square and rectangular design.

Sharma A. & Pushpa. C. J. (2015) In this paper, an attempt is made to investigate the impact of the G + 9, G + 14 and G + 19 seismic levels on a multi-storey building with waffle slab and flat slab using ETABS 2013 software. Spectral according to IS 1893. It is noted that waffle slabs are a good concept for a building with a height of less than 40m, but for buildings over 40m, it is ideal for moving with a flat slab. From the above findings, it may be noted that in buildings less than 40m tall it is advisable to use a waffle slab without a flat slab, and for buildings over 40m in height, it is advisable to use a flat slab. .

H. S. Mohana , M. R. Kavan (2015) In the project work the G + 5 commercial of a multi-storey building with a flat slab and a standard slab is analyzed for parameters such as shear foundation, floor drift, axial force, and migration. The function and behavior of these two buildings in each earthquake zone in India were reviewed. In the current work the flat floor plan is 5% larger than a typical slum building, the axial strength of a flat lab building is almost 6% larger than a standard building, the floor shift of the floor structure is usually about 4mm. on each floor. The existing work provides sensible information about the suitability of a flat slab in various seismic environments without compromising the performance of common slab structures. The slab floor slab is 6% larger compared to the standard slab structure, and the floor slab is much lower at the bottom and at least at higher level. The design axial forces on the flat slab are large compared to the conventional structure, the power difference is almost 5.5%. The relocation of the floor is much higher on the roof level than the foundation, and the relocation of the floor-slab building is larger than the conventional structure, there will be a median shift of 4mm in each seismic area in both buildings.

Moldovana I., Mathe A. (2015) In this paper the issues of calculating square waffle slabs, supported by rapid and parabolic bi-tensioned reinforcement, are illustrated. The waffle slab system, its features, pre-design of the molding materials, technical aspects of the precast panel design, details of materials used, reinforcement scheme and pre stress strength calculations are described. Work has demonstrated the design, calculation and placement of pre stress reinforcement (TBP9 tendons) to be attached to waffle-type slab ribs. Specifies the sequence in which the tendons are under pressure, the geometric features of their design and indicate the calculation of the previous pressure in terms of the maximum force applied to the TBP9 tendons and the onset of previous pressure during. It will be mentioned that the angular change in the tendon profile results in a stiffening force in the joint that 'equips' the dead loads of the structure.

Midhun M. S. (2017) This paper learns how the waffle slabs react with the slab openness and behavior when the space between the poles is changed. The result of the opening of the different sizes is studied. The opening is placed in the center of the slab. Proper re-use methods so that the areas around the hole do not fall off immediately due to pressure. From the comparison table it can be interpreted that the size of the 1400mm hole reduces the strength of the waffle slab by only 38.62%. If high loads are active, the hole size can be estimated at 1000mm. this high load-bearing capacity is achieved mainly due to the presence of I-beams which add great strength to the construction of waffle slabs. The span variation of the I beams does not have a significant impact on the strength of the waffle slab compared to the impact of the holes. By increasing the length of time, a higher economy can be achieved without much reduction in the load-bearing capacity of the waffle slab.

Idrizi Z. & Idrizi I. (2017) This article conducts a comparative study between a system of "hard" and "waffle" plates. A typical 14-story RC building was selected as a model for this study. The first part of this study focuses on finding the most powerful solution for a slab and waffle system, which will then be considered as part of all the stories in the 14-slab structure. The second section describes the effects of the two-slab system in addition to the 14 building models. The aim of this study was to highlight the economic, structural safety, and performance advantages of intermediate-coded structures, including the waffle plate system, over structures characterized by solid-type slabs.

Uzodimma U.O. (2016) In this paper, a hall of 12m x 20m dimensions was designed with no interior columns using Eurocode2. The floor system of the hall was supported by an interaction of primary and secondary beams. The full steps for load analysis, load transfer from secondary beam to primary beam, structural analysis, and full design of the structure was carried out manually. After the analysis and design, a section of 900mm x 400mm, and reinforcement ratio of 1.786% was found to satisfy both of the primary beams. Finally, it was concluded that primary and secondary beams can be used as alternatives in large span construction, provided that adequate analysis, design, and detail of members are carried out.

More R.S., V. S. Sawant & et. al. (2013) More R.S. The grid slab system is preferred for this purpose. To study the effect of disposal panels on flat slab behavior during lateral load, the flat plate system is also analyzed. Spatial and terrestrial conditions are two other important parameters that affect building behavior are also included. ETABS software is used

for this purpose. In this study a relationship is developed between the number of stories, the place and the state of the world.

A. E. Hassaballa, M. A. Ismaeil, & et. al. (2014) In this project the researcher is dealing with an existing four-story concrete residential building in the city of Khartoum-Sudan, which was hit by an earthquake. A plastic hinge is used to represent the failure mode on beams and columns when a member is producing. Push-over analysis was performed on the structure using SAP and a static standard according to UBC 97. The pruning of the base as opposed to the forward curve of the structure, called the push-over curve, is an important result of the push analysis. Push analysis is performed on x and y for positive and negative directions. The default hinge properties, which are found in some programs based on FEMA -356 guidelines and Applied Technology Advice, are used for all members. Another subject has been selected for this purpose. Tests have shown that a four-story residence building is unsafe in an earthquake.

Arman I. M. (2014) In this study, the ACI direct design method is used as a manual or manual calculation method and the solution will be compared with the results of the 3D structural model analysis performed by the Sap2000 computer program. The moments in the beams, the slab column strip and the middle slab strip will be defined. It will be shown that the distribution of minutes on double slabs and concealed steel is similar to the distribution of minutes on slabs without planks, since the hardness of the hidden steel is low. It is suggested that the use of 3D modeling and computer software is the best solution for the definition and distribution of times.

K. S. Priya, Durgabhavani T. & et. al. (2012) In this article, the researcher performs extrusion analysis on flat slabs using standard SAP2000 software. Most of the existing horizontal structures may not be able to withstand the load of an earthquake. Therefore, it is important to read their response to earthquake conditions and to assess modern seismic patterns. But compared to the connections between beams and pillars, flat slabs are becoming more popular and gaining in value because they are economically viable. Under pressure from recent developments, seismic codes have become explicitly required to identify sources of inelasticity in structural responses along with quantifying their ability to absorb energy. Many existing buildings were not designed for seismic impacts. Knockout analysis becomes important for strengthening and evaluating existing structures. By performing displacement analysis on flat slabs, a displacement curve and a demand curve can be obtained. Then, based on the results, a decision is made that the reconstruction or re-equipment depends on the seismic zone of the existing structures.

Shuraim A. B. (2002) The behavior and parallel analysis of dual-level systems supported by primary and secondary beams mesh is not fully understood. The overall purpose of this two-part study is to investigate the application of ACI coding methods for estimating design times for such quality programs. In this section, five beam-slab systems of different configuration are analyzed using coding and cross-cutting systems. One floor system had no second beams, while the other four had second beams and a structural beam to a slab deep ratio of 2.6 to 5. However, finding plate systems of the same weight is not easy and cannot only be tested on sector properties. The result area equal strength of the slab system based on sectional properties alone resulted in a 38% error in calculated deflection. In the beam quality system, the shoulder project is a model problem. There are two options considered: the rigidly braced physical offset option, or the equivalent beam where the beam was increased in size to pay for the displacement of the ribs. This section of the study discusses the pros and cons of both presentation modes.

III. CONCLUSIONS

On The basis of above study on “Seismic Response of Large span slab in Horizontal Setback Building” in which four cases of same storied and height structures has been taken under consideration as defined earlier, and concluded result in form of different Seismic behavior like response spectrum analysis and time history analysis. And it observed that Most preferable long spans lab on the basis of this study is Building with Waffle or ribbed Slab.

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