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Design and Analysis of Reinforced Concrete Flat Slab Using Various Codes

Ayush[1], Miss Nitu[2]

[1]M.Tech, Structural Engineering & Construction, Department of Civil Engineering, Matu Ram Institute of Engineering and Management, Rohtak, Haryana, India
[2]Assistant Professor, Department of Civil Engineering, Matu Ram Institute of Engineering and Management, Rohtak, Haryana, India

ABSTRACT

The slab is typically supported by a beam, and the beam, in turn, is supported by a column in the standard design and construction method. The term "beam column construction" refers to this kind of building structure. However, in the case of the flat slab design, we are erected without the use of beams, which means that the available net clear ceiling height of the structure is not diminished. When compared to a conventional slab, which is a slab that rests on beams and columns in a frame building, the formwork for a flat slab construction is much simpler. Additionally, the reinforcing scheme is also much simpler, and the storey height is reduced. Check for the second order effect in flat slab buildings (the second order effect is also known as the P-Delta effect). limitations have been placed on the P-Delta ratio in today's international design standards. These limitations appear to have been established to maintain a minimum reloading stiffness during cyclic response and with adequate regard for the expected ductility demands put on structures. It has been proposed that the present code limitations should be reviewed for tall buildings due to the limited displacements that genuine earthquake ground movements impose on such buildings. While it is possible that the current code limits are suitable for structures of normal height, it has also been stated that the current code limits should be reasonable for structures of normal height. Within the scope of this work The second order effect, also known as the P-Delta effect, describes the extra action in the structure that occurs as a result of the structural deformation that is brought about by the loads that are applied. P-Delta is a non-linear phenomenon that happens in every construction that has elements that are subjected to axial stress. It is caused by the bending of the elements. The Pdelta effect is amplified in architectural configurations that feature thin columns or tall buildings. When designing high-rise structures with vertical irregularity, it is of the utmost importance to determine whether or not the impacts of the second order P-Delta are substantial. This project comprises of six building models with a total of 10, 20, and 30 storeys in height for conventional slab modal and 10, 20, and 30 storeys in height for flat slab modal. These models were analyzed both with and without P-Delta. In this model, seismic zone V is assumed to be present, and a comparison was made between the impacts of storey drift, storey displacement, and overturning moment on each individual model, both with and without the effects of PDelta.

Keywords: Reinforced Concrete, Flat Slab Using Various Codes, Flat Slab Design

INTRODUCTION

The flat chunks arrangement of development is one in which the shafts used in the conventional methods for developments are removed. This is in contrast to the usual procedures for developments. The section just rests on top of the segment, and the weight of the chunk is transferred directly to the segments until finally being transferred to the establishment. In order to alleviate overbearing responsibilities, the thickness of the piece near to the help with the section is increased; they are known as drops, and segments are often given developed heads known as segment heads or capitals. Drops and segments are both referred to as capitals. The lack of pillars results in a flat roof, which results in an improved structural look and, additionally, reduced defenselessness in the event of a fire compared to the typical circumstance in which bars are applied. Plain roofs are easier to create and need less costly structural work. They also disperse light more effectively than complex roofs. Different countries have developed varied tactics for the development of level sections and have provided their guidelines in their own particular codes. These strategies are based on the local circumstances and the availability of resources. The objective of this work is to investigate and try to demonstrate the methods that are used for level section setup employing IS 456:2000, ACI-318, and NZS:3101 configuration codes and the near-conversation that can be found within them. The aforementioned codes were used to build an inside board of a level chunk of an existing structure in order to finish the project. The board's dimensions were meters by 5.6 meters, and it had an extremely forced load of kilonewtons per square meter.

When level pieces are used for the fundamental framework, problems with punching shear might arise as a result of high transverse shear concerns at the slab– segment relationships. As a consequence of the fact that the chunk segment associations in the structure contain strengthening points of interest that are appropriate for gravity load design, it is possible that they will not be able to continue disfigurement throughout the earthquake. The existence of openings in the vicinity of a segment reduces the area of solid that can resist transverse shear, which in turn makes the connection between the slab and the segment much weaker. In any event, the innovation has found use on a significant size for the first time in the last decade, and it is one of the rapidly developing innovations that are being used in the Indian construction business today. The rapid growth of innovation in India may be attributed in part to material advancements in the solid quality that is readily available for development; improvements in the nature of development; and the adoption of simplified structure and numerical methods. The construction method known as flat parts arrangement is one in which bars are used in the conventional building techniques.

The piece should be laid properly on the segment, and load from the section should be transferred directly to the segments, after which it should be transferred to the establishment. The thickness of the chunk close to the help with the section is increased so that it may support huge weights. These are termed drops, and segments are often provided with developed heads that are called segment heads or capitals. The absence of bars results in a simple roof, which results in an improved overall architectural appeal and furthermore results in reduced vulnerability. Taking into account the local climate and the availability of materials, several countries have developed unique approaches to the planning of level sections and written the regulations governing these approaches into their own specific codes.

MINIMUM THICKNESS OF TWO-WAY SLABS.

In order to keep the two-way slabs from buckling too much, the ACI Code requires a minimum thickness for the slabs. The amount that a slab will bend is determined by a number of different factors, one of which is the flexural stiffness of the slab. This property, in turn, is a function of the slab's thickness. When the thickness of the slab is raised, the flexural stiffness of the slab also increases; as a result, there is a decrease in the amount that the slab deflects. Because it is difficult to calculate deflections in two-way slabs and because excessive deflections should be avoided, the ACI Code places restrictions on the thickness of these slabs by adopting the following three empirical constraints, all of which are based on research that was conducted via experimentation. In the event that these constraints are not satisfied, it will be essential to calculate deflections.

OBJECT

1. The Study Reinforced Concrete Flat Slab Using Various Codes.
2. The study Two-way slab directly rests on column known as flat plates.

RESEARCH METHODOLOGY
STRUCTURAL DESIGNING

Structural engineers have the appropriate technical knowledge for the detailing of structures and the analysis of such structures. As a result, they have a greater amount of expertise designing buildings. Calculating the loads and stresses acting on the building, obtaining analysis results for the applied loading, and designing sections of structures to support the loads are all part of the structural designing processes that are carried out by structural engineers. This ensures that the structure designed will be able to safely withstand the loads that have been predicted. Additionally, structural engineers are engaged in the process of determining which materials are the most appropriate for use in the project. Because of this, having a thorough understanding of the many materials that are utilized in the building industry at the present time, including their economic considerations, their strength elements, and their durability aspects, will be required.

A structural engineer may evaluate the various construction materials' quality criteria to determine whether or not they are suitable for use in the design of the beams, columns, or foundations. This allows the engineer to make an informed decision. One other talent that a structural designer has to have is the ability to analyze structures. At the moment, programs like and SAP are responsible for performing this function. As time goes on, brand new software to analyze the behavior of buildings under various situations of loads, such as wind, earthquake, and so on, is being produced. The majority of structural engineers are required to learn this software and operate with it while having an understanding of both the technical intricacies and the programming details. In certain companies, the analysis is carried out by a programmer who may not have a degree in civil engineering but is helped by a structural engineer. This might happen if the programmer was not properly trained.

The structural engineer has to be able to comprehend and analyze the findings from the program in order to determine whether or not the numbers that are presented as output are accurate. This is true regardless of the style of analysis that is used. Some businesses will not place all of their faith in the findings produced by the computer; instead, they will do an additional computation by hand for additional peace of mind. Even though structural engineers are the ones who introduce and develop the design ideas and detail, he can only see it happen on the site if the structure is erected as planned. This is because structural engineers are the ones who are responsible for bringing the ideas and developing the detail. In order to do this, one's perception and thoughts need to be communicated with the other people participating in the initiatives. It is necessary for the structural engineer to coordinate with and seek advice from other members of the team, such as the site engineers, other design engineers, geotechnical engineers, landscape architects, architects, and project managers, among others. Knowledge aids in disseminating accurate information within the group, which in turn reduces the likelihood of misunderstanding and mistakes occurring.

Working Time And Location Of A Structural Engineer

When considering the amount of time spent working and the locations in which structural engineers do their jobs, it is important to note that the majority of highly engaged structural engineers spend their time working both in offices and on building sites. They are able to function if they divide their time equally between the two settings. The types of work settings each need its own unique set of workplaces. The working patterns and environments of rural and urban places are quite different from one another. It is possible that structural engineers may need to work long hours on occasion, in a manner that is comparable to that of site engineers. This will mostly rely on the scale of the project as well as the scale of the organization. If the structure of the organization is clearly defined and vast, then it will have adequate members for the design team, the planning team, and the execution team. These teams will be comprised of a collection of professionals, skilled as well as semi-skilled employees, and laborers. This will relieve the structural engineer of some of their responsibilities.

Description Of Model Type

The framework of the model is made of RCC, while the foundation of the model is made of concrete. The Grid Slab and Flat Slab that make up each floor of the structure are the primary components of this project. The front half of the building has a flat slab installed in order to create a beamless region for the sake of aesthetics. The interior side of the building, on the other hand, has a grid slab installed in order to more easily resist loads and to enhance the stiffness of the structure. Because of this consideration of both flat slab and grid slab, we are able to employ fewer columns that are positioned near together. The many factors that were taken into consideration during the study and design process are listed below:

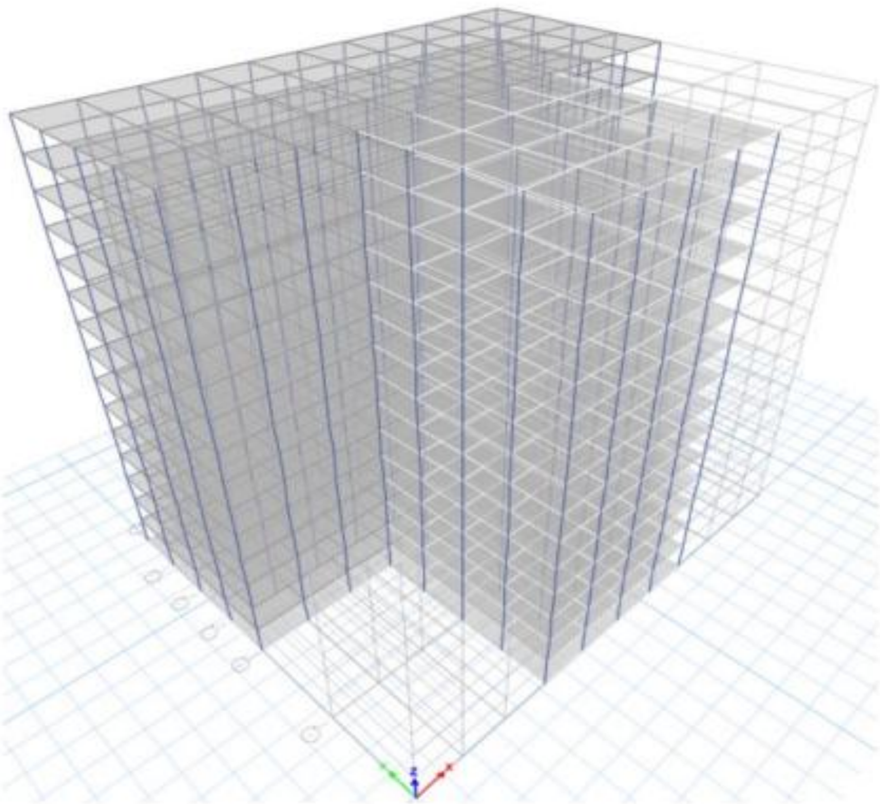


Figure 1 Isometric View of Structure.

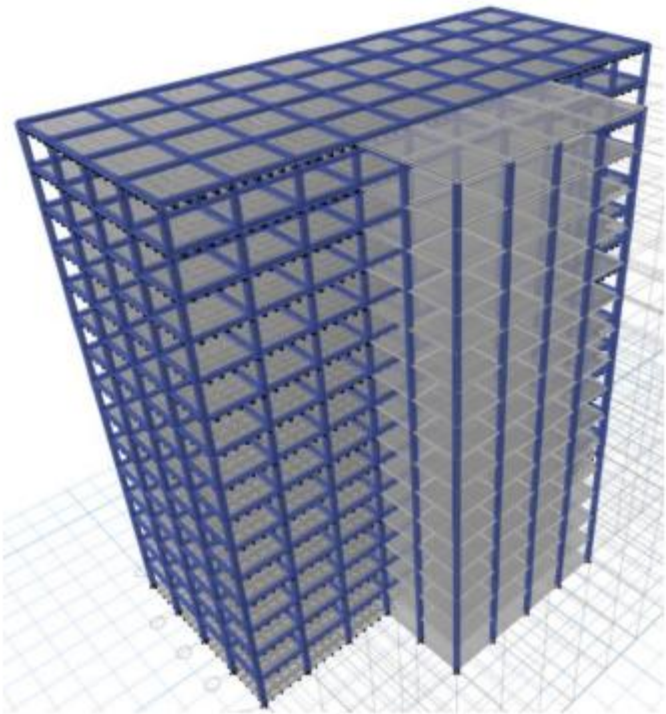


Figure 2 3D Rendered View of Building.

The composition of the construction includes both flat and grid slabs. The rendered view of the structure that is shown in the preceding figure clarifies it. Flat slabs are the name given to slabs that are used in construction without any beams. This indicates that the weight bearing on the slab is resisted by the slabs themselves rather than being transmitted to the beams. In the case of a flat slab, the weight is carried straight from the slab to the columns. The distribution of load does not follow either a one-way or a two-way phenomenon inside this structure of slabs. The construction made use of drop panels in order to protect itself against punching failure. The Plan recognized that finishing this study was of higher value, and it chose to do so. As a result, I decided on a Plan that is capable of satisfying all of the requirements during the whole analytical process. The following diagram depicts the plan that was used to model an existing structure:

DATA ANALYSIS
STRUCTURE DATA

This chapter will give information on the geometry of the model, including things like narrative levels, point coordinates, and element connectivity.

Story Data

Table. 1 Story Data

Name	Height Mm	Elevation mm	Master Story	Similar To	Splice Story
Story15	3000	45000	Yes	None	No
Story14	3000	42000	No	Story15	No
Story13	3000	39000	No	Story15	No
Story12	3000	36000	No	Story15	No
Story11	3000	33000	No	Story15	No
Story10	3000	30000	No	Story15	No
Story9	3000	27000	No	Story15	No
Story8	3000	24000	No	Story15	No
Story7	3000	21000	No	Story15	No
Story6	3000	18000	No	Story15	No

Story5	3000	15000	No	Story15	No
Story4	3000	12000	No	Story15	No
Story3	3000	9000	No	Story15	No
Story2	3000	6000	No	Story15	No
Story1	3000	3000	No	Story15	No
Base	0	0	No	None	No

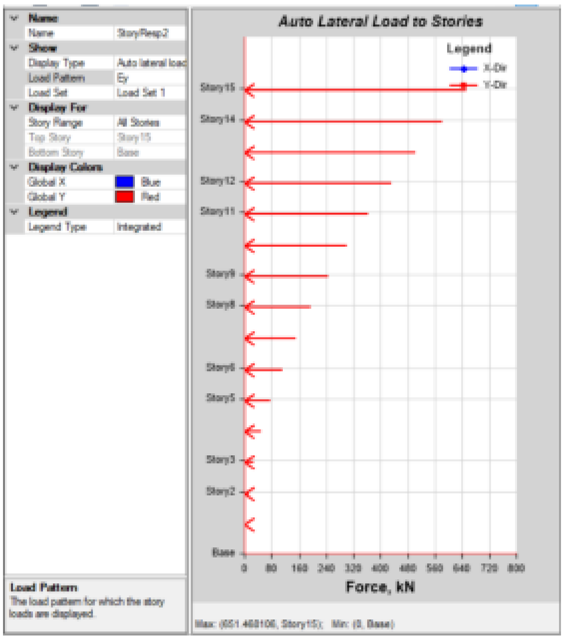
LOADS

The loading information that has been applied to the model is presented in this chapter.

Load Patterns

Table. 2 Load Patterns

Name	Type	Self-Weight Multiplier	Auto Load
Dead	Dead	1	
Live	Live	0	
Name	Type	Self-Weight Multiplier	
Masonry	Superimposed Dead	0	
Ex	Seismic	0	



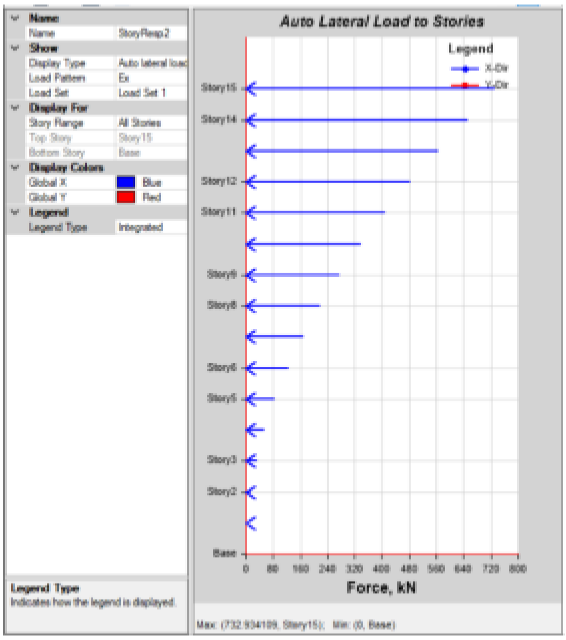


Figure. 1 (A): Earthquake Loading Along-X **Figure. 2 (B): Earthquake Loading Along-**

The two graphs shown up above indicate the lateral loads that were taken into account for this construction. The zone in which a structure is situated may significantly affect the severity of an earthquake. The structure in question is located in Lucknow, Uttar Pradesh, India, which serves as both the seismic zone and the site of the construction site. In regions that are prone to earthquakes, the most common reason for structure collapse is seismic loading. When doing an analysis of a structure, it is necessary to take into account seismic loading in order to produce earthquake-resistant buildings. If a building has five floors or more, dynamic analysis is the most important factor to take into mind.

CONCLUSION

Although the methods used to assess the varied outcomes of different slabs inside a single structure are distinct from one another, the primary objective remains the same: is, to evaluate how successful the slabs are from a structural standpoint. In order to determine the collective response of the slab and the beams to the external loads, both static and dynamic analyses are currently being carried out. Numerous researchers are examining the effectiveness of the economical section under a variety of load scenarios. The installation of grid slabs helps to reduce the likelihood of storey drift. After reading all of these publications, I've come to the conclusion that a grid slab is not required if we are thinking about things from an economic standpoint. If, on the other hand, we are creating a significant construction in which there is a need for expansive expanses, Grid slabs will play an essential part there. Some structural engineers advocate for the installation of floating columns in public areas such as parking lots, open spaces, and the like; nevertheless, doing so necessitates additional strengthening for beams and columns in the surrounding area that bypass the loading that is passed by that column. to have an understanding of the interrelationship that exists between grid slabs and flat slabs, as well as their dependence on neighboring beams, and to investigate the influence that this has on reinforcing and section details.

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