

A REVIEW PAPER ON SINGLE COLUMN CIRCULAR, SQUARE, RECTANGULAR SHAPE SEISMIC BUILDING

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Abstract- Due to increasing urbanization and rapid infrastructural development, scarcity of land is a problem. Multi-story structures have been constructed to eliminate this problem. But for the requirement of large service spaces and good aesthetic appearances, the mono column structural system achieved popularity. They require less area for providing foundation and gives more space for parking.

The design and analysis of RCC structure supported on a single column is done in this project. This project presents effects of three different plan configurations i.e., Square, Circular, rectangular, with same plan area. Mono column structure with different plan geometry react adversely in contrast to earthquake and wind loads.

Modeling, analysis and design of Multi storey mono column structure is done by using staad pro software. Seismic analysis has been done and maximum values of Storey displacement, Storey drift, Storey shear, overturning moment, Storey stiffness and Time period results are manifest in form of figures. The purpose of this analysis is to determine the most effective and vulnerable shape of structure in areas

Keywords: Staad pro, Single column, seismic analysis.

INTRODUCTION:

Mono column building is the structure supported on a single column which provides large serviceable area as compare to RCC and steel frame structure. Mono column building supported on a single column has more aesthetic view compared to other frame structures. The requires less area for providing foundation and gives more space for parking. They are also unique. Mono column structures are constructed with RCC or Steel. Mono column structures are complicated one, compare with the other framed structures, mono column supports entire structure, all other members will act as cantilevers. These structures provide more proper spaces for offices and parking. Mono column provides maximum serviceability. They are also good at the place where flood occurs. Mono column buildings decrease the excavation area of the land and saving money. This project describes planning, structural analysis, design and drawings with various components of the whole building.

Primary aim of all structural design is to ensure that the structure will perform satisfactorily during its design life. Specifically, the designer must check that the structure is capable of carrying the loads safely and that it will not deform excessively due to the applied loads. This requires the designer to make realistic estimates of the strengths of the materials composing the structure and the loading to which it may be subject during its design life.

Earlier, modelling and structural analysis of buildings were carried out using hand calculation method based on simplified assumptions and understanding the whole behavior of the structure. But it seems to be time consuming and complicated for high rise buildings. At present, computer hardware's and software's for modelling and analysis of structure is widely available. We need to know how the knowledge secured in the class room is applied in these practical sides of work. When we got this project, we come into practical field to collect construction techniques and to meet the various difficulties in the construction. Also it is necessary to have sufficient knowledge regarding various software's currently used in planning analysis and design of and are not included during the design process of the primary structure. Since the 1990s specialist software.

LITERATURE REVIEW:

MRS. SHILPA VALSAKUMAR, THEJUS SREEHARI (2022):

From literature review, it is found that Mono column buildings has unique structure. They have good aesthetic view. Mono column structure can withstand all loads including earthquake loads and wind loads. Mono column building save ground space as requires less area for proving foundations and providing more space for parking.

A rectangular mono column (1.8 m x1.8 m) building analyzed. The maximum displacement is 54.58 mm in Y direction and 36 mm in X direction. The maximum shear force in X direction is 1260.5 kn and 1308.9 kn in Y direction. A circular mono column (d = 2.03m) building also analyzed. The maximum displacement is 57.6 mm in Y direction and 37.3 mm in X direction. The maximum shear force in X direction is 1223 kn and 1223 kn in Y direction. The study shows that the rectangular mono column structure has less deformation than circular mono column structure.

SIJIN JOHNSON, INDU SUSAN RAJ (2022):

Mono column structures are tree like structure that the whole building is supported on single column. Since the whole structure is supported on single column all other members will act as cantilever. Eccentric loading can twist the building in any direction and causes failure. Mono column structure showed high deflection in members, high story displacement and high story drift. The maximum shear force and maximum bending moment in the members are more in seismic analysis than in the non-seismic analysis. Mono column structure are costlier than the conventional type of structure. These mono column structures are vulnerable to seismic loading. The plan configuration also plays an important role in the seismic performance of the building and it is proved that asymmetric plan shaped structure is prone to severe damage due to excessive torsional responses and stress concentration. Plan asymmetry also changes the lateral deformation in the structure. The studies showed that diagrid structural system improves the seismic performance of the structure and it provides good aesthetic appearance. It made the structure stiffer and lighter than the conventional type of structure. It reduces the number of structural elements and reduces the possibility of failure due to the lateral loading such as seismic load and wind load. The diagrid structure provides the efficiency due to its triangular configuration. Diagrid structural system decreases the story displacement, story drift and the base shear than the conventional structures.

AMBATI VENU BABU, DR. DUMPA VENKATESWARLU (2016):

This paper studied about the single column is supporting whole structure; all other members will act as cantilevers. To reduce the cantilever span for the structural beams converting two-third of the length as simply supported by providing the two ring beams and inclined beams. The structure is analyzed and designed using Staad pro (structural analysis package), which is based on stiffness matrix method. The above structure has been analyzed for various possible loading conditions and the critical has been selected for design purpose.

From this paper it was concluded that the project Office Building with Mono Column (single supported building) is analyzed and designed with special attention and it is completed. Maximum space utilization is considered while planning and designing and we assure it will serve its maximum serviceability

MADIREDDY SATYANARAYANA (2016) :

He studied to analyze and design of multi-storey building resting on the single column by using different code provisions. A lay out plan of the proposed building is drawn by using AUTO CADD 2010. The structure consist of ground floor plus five floors, each floor having the one house. Staircase must be provides separately. The planning is done as per Indian standard code provisions. The building frames are analyzed using the various text books. Using this so many standard books analysis of bending moment, shear force, deflection, end moments and foundation reactions are calculated. Detailed structural drawings for critical and typical R.C.C. members are also drawn. Co-ordinates for all structural members are tabulated for ready reference.

From his research it was concluded that the limit state method of design is adopted. He had done the design aspects of the structure manually and software. In our project He also used the code provision of the SP 16 and SP 34 (the design aids for concrete and detailing). Finally learn detailing of various structural members by using SP 34 design aids.

ANUPAM RAJMANI (2015):

Studied a tall building, whose shape is unsuitable, often requires a great deal of steel or a special damping mechanism to reduce its dynamic displacement within the limits of the criterion level for the design wind speed. Understandably, an appropriate choice of building shape and architectural modifications are also extremely important and effective design approaches to reduce wind and earthquake induced motion by altering the flow pattern around the building, hence for this research work four different shaped buildings are generally studied namely circular, rectangular, square and triangular. To achieve these purposes, firstly, a literature survey, which includes the definition, design parameters, and lateral load considerations of tall buildings, is presented. Then the results are interpreted for different shaped buildings and of different stories thereby concluding as to which shaped high rise building is most stable for different conditions. Researchers conclude that,

E K MOHANRAJ (2002):

Analyzed a single column is supporting structure, in which all other members are acting as cantilevers. To reduce the cantilever span for the structural beams converting two-third of the length as simply supported by providing the two ring beams and inclined beams. The structure is analyses and designed using strap (structural analysis package), which is based on stiffness matrix method. Conclude that if maximum space utilization is considered while planning and designing then it will surely serve its maximum serviceability.

BADIKALA SRAVANTHI (2016):

Design and analysis of RCC structure supported on a single column is done in this project (figure 1). Cost Comparison is done between RCC single column and RCC multi column structure. This paper presents structural modelling, stress, bending moment, shear force and displacement design considerations for a structure and it is analyzed using STAAD Pro. Various steps involved in designing of RCC structure supported on a single column using STAAD pro and comparison of RCC single column and RCC multi column Structure. Single column structure has been designed successfully to withstand all loads including earthquake and wind load.. Single column structure provides better architectural view and free ground space even though it costs bit more than multi column structure.

ARIF SARWO WIBOWO AND SHIRO SASANO (2016):

The structural system that employs a wooden single column to support a roof structure is assigned only to four mosques on Java Island. Though at a glance displaying similarities in their scheme, they are classified into two distinctive types under a combination of building components. The Saka Tunggal Mosque of Banyumas is distinguished from the other three, regarding not only a primitive style that contrasts with the others employing four consoles that must have likely yielded a certain structural advantage, but also to an unrefined ceiling style without a decorated, stepwise ceiling, known as tumpangsari. Consequently, the system employed in the other three mosques may well be said to be more elaborate and refined if notice is taken of their architectural evolution, despite the humble appearance of the mosque in Kebumen. In this sense, the style of Banyumas's might allude to a certain primordial stage in the evolution of Java's mosques by applying the single column system, regardless of what is inscribed on the column concerning its construction date. As far as the historical data on Kebumen's mosque is reliable to some extent, the system of the single column in Banyumas's mosque, as a forerunner of its style, seems to have come into existence at the latest at the beginning of the 19th century.

GOMASA RAMESH (2021):

Based on a study of a traditional multi-story building and a single column structural structure, the following conclusions can be drawn. A multi-story building with a single column construction has been successfully engineered to withstand all loads, including earthquake loads. Under static loading conditions, RCC columns have adequate results. STAAD-Pro advanced software, which provides us with a platform for analyzing and designing structures that is fast, reliable, simple to use, and accurate. Ultimate strength and serviceability must be met by the structural design. The planning, study, and construction of framed structures are skills that a civil engineer must-have. As a result, it was suggested that the project work consists of selecting a problem that entailed the study and design of a commercial framed structure.

MR. JAYANT S. RAMTEKE , MR. M. R. NIKHAR , MR. G. D. DHAWALE , MR. S. G. MAKARANDE (2019):

A conventional multi-storey building & a Single column structure has been designed successfully to withstand all loads including earthquake load. Single column structure is 20 % more costly when compared with multi- column structure. We may also check the deflection of various members under the given loading combinations. The Result of deflection obtained from the software for a conventional multi-storey building & a single column building structure. RCC column give satisfactory result under static loading condition. Study the performance of lateral displacement at II zones when seismic load applied to the structure. Storey drift in high rise structures are subjected to excessive deflection. Deflection obtained by STAAD-Pro is checked by IS Code limitation for serviceability. Base shear gives the base shears for entire structures. STAAD-Pro advanced software which provides us a fast, efficient, easy to use and accurate platform for analyzing and designing structures.

G.PRADEEP,DR.H.SUDARSANARAO,DR.VAISHALI.G.GHORPADE(2018):

Single column structure has been designed successfully to withstand all loads including earthquake and wind load. Single column structure is 27.260 % more costly when compared with multi column structure. Using of this software analysis of bending moment, shear force, deflections, end moments and foundation reactions are calculated. Shear force and bending moment values in single column for a single column building are much higher than the Shear force and bending moment values for a column in multi column building. Deflections for single column in single column building are less when compared to a column in multi column building. Support reactions in single column for a single column building are much higher than the Support reactions for a column in multi column building. Details of each and every member can be obtained using Staad Pro. Single column structure provides better architectural view and free ground space even though it costs bit more than multi column references. structure. Maximum space utilization is considered while planning and designing and it assure that it will serve its maximum serviceability.

RAJ JOSHI, GAGAN PATIDAR, MAYANK YADAV, PIYUSH NATANI, PRADUMAN DHAKAD (2020):

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 storied building design to get the design of showing different properties having great impact in terms of environmental, 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 building design, enabling its utilization for different purposes of the building structural, storied with keeping the factor of structural properties high as well.

AMOGH, CHIRANJEEVI JOSHI, SHARANABASAPPA, VIKAS PATIL OKALY, RAVIKIRAN S WALI (2021):

Mono-column structure with 5-storeys was planned, analyzed and designed to resist earthquake in zone III areas. The design is based entirely on the relevant Indian Standard Codes. Staad Pro is used for analysis of the structure and manually checked by calculations. Storey drift is within the limits specified in IS codes. More parking area and floor area are available. Mono-column structures with shear wall provide more safety against seismic and lateral forces. It is noted that reinforcement percentage in sections is more in case of software design when compared to manual calculations.

DR. S. G. MAKARANDE , MR. JAYANT S. RAMTEKE , MR. M. R. NIKHAR , MR. SINGLE G. D. DHAWALE(2019):

A conventional multi-storey building & a Single column structure has been designed successfully to withstand all loads including earthquake load. Single column structure is 20 % more costly when compared with multi- column structure. We may also check the deflection of various members under the given loading combinations. The Result of deflection obtained from the software for a

conventional multi-storey building & a single column building structure. RCC column give satisfactory result under static loading condition. Study the performance of lateral displacement at II zones when seismic load applied to the structure. Storey drift in high rise structures are subjected to excessive deflection. Deflection obtained by Staad-Pro is checked by IS Code limitation for serviceability. Base shear gives the base shears for entire structures. Staad-Pro advanced software which provides us a fast, efficient, easy to use and accurate platform for analyzing and designing structures.

OBJECTIVE OF THE STUDY:

Objectives identified for the present study have listed as follows.

1. To analyses and design a mono column building
2. To compare the different shaped mono columns like rectangular and circular etc.
3. To compare the serviceable floor space with structure supported on many column
4. To study the behavior of earthquake on Rcc single column building.

FUTURE SCOPE:

1. To develop, planning and analysis model of the High rise structure in staad Pro V8i.
2. To study the seismic load applied on the structure as per IS 1893-2002.
3. To compare the results of seismic load applied on the structure by staad Pro V8i.
4. To verify displacement for a mono column building with steel and RCC.

CONCLUSION:

Single column structures are tree like structure that the whole building is supported on single column. Since the whole structure is supported on single column all other members will act as cantilever. To reduce the cantilever span for the structural beams converting two-third of the length as simply supported by providing the two ring beams and inclined beams. A multi-story building with a single column construction has been successfully engineered to withstand all loads, including earthquake loads. Under static loading conditions, RCC columns have adequate results. Staad-Pro advanced software, which provides us with a platform for analyzing and designing structures that is fast, reliable, simple to use, and accurate. Architectural modifications are also extremely important and effective design approaches to reduce wind and earthquake induced motion by altering the flow pattern around the building.

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