

A Review On Parametric Study of a Multi-Storey Building's with Different Hollow Cross Section in Beam for Seismic Response Spectrum Analysis Using SAP 2000

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Abstract

Building design must be such as to ensure that the building has adequate strength, high ductility, and will remain as one unit, even while subjected to very large deformation. Earthquakes are natural hazards under which disasters are mainly caused by damage to or collapse of buildings and other man-made structures. Experience has shown that for new constructions, establishing earthquake resistant regulations and their implementation is the critical safe guard against earthquake-induced damage. With our development in modern society and continuous technological advancement, we have achieved sustained performance in structural infrastructure, from residential buildings to industrial buildings to thermal power stations, bridges and dams.

Three Multi-storey building models are selected which contain different number of storey as each and every model contains 25 columns and 40 beams in each floor. Use M-30 concrete and Fe-250 grade steel. In proposed work different shapes of beam with equal perimeter. We use Csi software SAP2000. Five hollow cross-sections (Chamfer, Circular, Hexagonal, Rectangular and Square) beams are considered with constant span length and unchanged perimeter. The example of hollow beam is modeled and analyzed in SAP 2000 and the responses are found to be fairly matching. For the purpose of the parametric study, the five hollow cross-sections are modeled in SAP2000. The span length, cross-section and material property remain unchanged. The best cross section and find minimum deflection and bending moment we choose a 10, 15, and 20-storey buildings of 20-meter-wide and height of each column is 3m.

Keywords: Longitudinal Bending Stress; Shear Lag; Transverse Bending Stress; SAP 2000.

Introduction

Previous earthquakes have shown that earthquakes can occurred significant financial losses in building. Related financial losses during rehabilitation, periods of rest and disruption of performance must be taken into account fully assess the impact of the earthquake on society. For that, there are several ways to implement it a recent earthquake assessment has been proposed. [1]

High-rise buildings are more attractive than low-rise to medium-sized buildings in large cities with expandable land resources. Although seasonal construction of low-rise buildings is used to a large extent, it is limited to high-rise buildings. One of the reasons is the lack of knowledge about the resistance of the lateral forces of tall buildings when they are built according to the conventional method. Future goods in high-rise buildings are particularly related to wind and earthquake loads. [1] On the one hand, the wind load is generally greater when the height of the building increases from a structural point of view. On the other hand, many cities have expanded their earthquake zones to reduce the risk of loss of life and property in earthquakes. [2] At the same time, conditions that are higher than primary have a smaller impact on

the earthquake response of tall buildings as opposed to buildings of low to medium height. It is therefore important to read the resistance from future forces when planning and designing high-rise buildings to achieve a common structure. [2] Seismic buildings are buildings designed and constructed in accordance with seismic structures and carefully constructed to avoid accidents in the event of a future earthquake. Although the structures were designed and built after digital decisions, there is evidence that ancient earthquakes failed. The properties of strength, stiffness and energy stability are the most important areas where improvements can be made to make structures more resilient. Various techniques developed with different alloys are now used to improve earthquake resistance. [3]

Review Process Adopted

The review process is divided into five stages in order to make the process simple and adaptable by every researcher. As it reflects from the literature that while beginning the finding of research objectives, it is necessary to start with a broader domain of any area / sub area of interest and narrow down to specific issue, the process described in the diagram includes the narrowing down. We have followed one of the typical processes to make a literature review and frame the objectives of research. The process diagram is shown in Fig. 1, which includes all five stages defined as under:

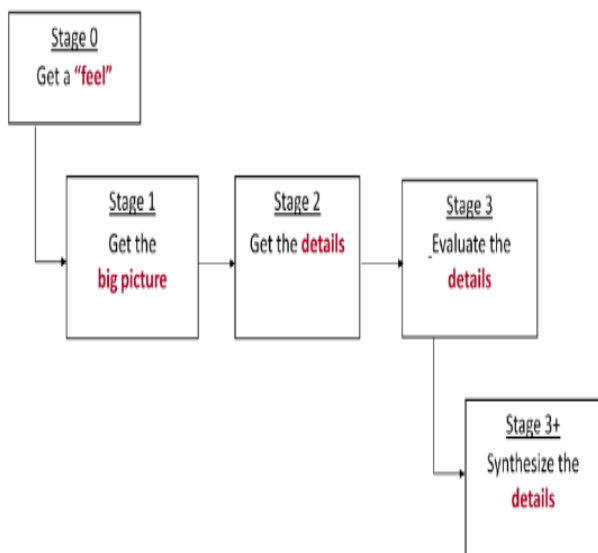


Fig 1: Literature Review Process

Stage 0: Get the Feel

Stage 1: Get Big Picture

Stage 2: Get the Details

Stage 3: Evaluate the Details

Stage 3 +: Synthesize the Details.

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Strengths

- Simple beam theory for analyzing box sections is a crude approximation. [1]
- Use of shear wall and bracing to strengthen structures capable of withstanding earthquakes. [2]

- Models with shear wall and bracing show maximum displacement, indicating increased stiffness. [2]
- The minimum mobility can be observed in a closed model, which of this type represents the seismic verification method in this test. [2]
- Studies have shown that the force transfer without shear and bracing walls is greater than in models with shear walls and bracing in different sections. [2]
- Maximum distortion has been shown to decrease dramatically after installation or attachment of shear walls to reinforced concrete frame. [2]
- The best location of shear wall in multi-storey building is parallel shear walls. And the best type of bracings that can be used is cross bracing. [3]
- FRP couplings can be used effectively to improve structural vibration properties, increase belts, control opening and expansion, and reduce stiffness and forced damage. [3]
- With different bending ranges, the reaction time and voltage decrease as the bending range increases. [4]

Limitations

- The critical load combination under which max displacement is achieved is $1.5(DL+EQZ)$. [2]
- The base structure has the highest value of story displacement as represented by the study. [2]
- The use of seismic restraints significantly decreases the movement of the structure of reducing the story shear of all the stories. [2]
- It is concluded that, optimization using cross bracings is the best procedure, in present work mode for maximum earthquake resistance. [2]
- It imparts flexural as well as shear strength to the structure there by improving resistance of structures to wind or seismic forces. [3]
- In order to perform the seismic analysis and design of a structure to be built at a particular location, the actual time history record is required. [4]
- For static and response spectrum analysis also deflection value increases with increase in span to depth ratio. [4]
- For response spectrum analysis also deflection, moment reaction and stress is less for trapezoidal shape. So for designing box girder trapezoidal shape is best. [4]
- Stiffness and strength of the Rectangular box girder bridge is more as compared to the Trapezoidal and Circular box girder bridge. [4]

Objectives of the Study

1. To analysis of bending moment, base shear for a long span beam with different hollow cross-section and equal perimeter.
2. Find best shape of beam for which minimum axial force and deflection is finding for dead load and seismic load and combination of it.

3. Draw a graph between different configurations for bending moment and base shear for all cross section of equal perimeter.
4. Suggest shape of best beam.

Methodology

S. No.	Authors	Year	Methods Used
1.	P.K. Gupta, K K Singh and A. Mishra	2010	SAP Finite Element Method
2.	Kiran Kumar Bhagwat, Dr. D. K. Kulkarni, Prateek Cholanpanavar	2017	Finite Element Software Csi Bridge 2017
3.	Saumya E, Biby Aleyas	2017	Finite Element Software ANSYS 16
4.	Shahzeb Khan, Vishal Yadav, and Sandeep Singla	2019	STAAD-PRO V8i
5.	Sigmund A. Freeman, et-al	2007	Time-History Method Response Spectrum Techniques
6.	Sanjivan Mahadik, S. R. Bhagat	2020	Addition Of Shear Wall Base Isolators Energy Dissipaters

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