COMPARISON OF SEISMIC ANALYSIS OF BUILDING RESTING ON PLAIN GROUND WITH AND WITHOUT SHEAR WALL

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Abstract

The work presented here is a study of seismic response of buildings resting on plane ground. This thesis investigates the seismic performance of building situated on plain surfaces, focusing on the effectiveness of incorporating shear walls to mitigate structural vulnerabilies. A review of studies on the seismic behavior of buildings resting on plane ground has been presented through a comparative analysis, exploring the impact of shear wall on the structure. The study explores how shear wall influence the dynamic response and stability of buildings and resilience of structures in the absence and present of shear wall on plane surfaces during seismic events. The research aims to provide deeper knowledge of the role of shear wall in enhancing structural performance, by evaluating factors such as lateral displacement, base shear, storey drift, storey displacement, the research aims to provide valuable insights that can inform design practices for building in region characterized by plain ground. The shear wall are installed around the building's perimeter. Using STADD.ProV8i, the frame models are examined following IS 1893: 2000 using the Response spectrum method for G+5 RCC building in zone V. And when compared studies agree that the buildings resting on plain ground without shear wall has higher displacement and lower base shear compared to buildings resting on plain ground with shear wall.

Keywords: *Comparative analysis; RCC building, Shear wall; seismic zone V; G+5 building.*

1. INTRODUCTION

In the realm of structural engineering seismic resilience is a paramount concern, particularly for building resting on plain ground. The ever presented threat of seismic activity necessitates a comprehensive understanding of structural dynamics to ensure the safety and stability of such constructions. This thesis delved into the comparative analysis of building on plain ground, specially investigating the influence of shear wall on their seismic performance. The study seeks to contribute valuable insights into the dynamic behavior of building on plain ground by contrasting those with and without shear walls. Buildings behavior in earthquakes depends on various uncertainty factors. These uncertainties originate from different sources, earthquake nature, components behavior, and the analytical methods. Therefore, the response of the building is dependent on ground motions and an assembly of individual responses of structural and non-structural components in a fully probabilistic framework. Experience in past earthquakes has demonstrated that many common buildings and typical methods of construction lack basic resistance to earthquake forces. In most cases this resistance can be achieved by following simple, inexpensive principles of good building construction practice. Adherence to these simple rules will not prevent all damage in moderate or large earthquakes, but life threatening collapses should be prevented, and damage limited to repairable proportions. Structural analysis is mainly concerned with finding out the behavior of a structure when subjected to force. This force can be in the form of weight of things such as people, furniture, wind, snow, etc. or some other kind of excitation such as an earthquake, shaking of the ground due to a blast nearby, etc. A static load is one which varies very slowly & dynamic load is one which changes with time fairly quickly in comparison to the structure's natural frequency. If it changes slowly, the structure's response may be determined with static analysis, but if it varies quickly, the response must be determined with a dynamic analysis. Dynamic analysis for simple structures can be carried out manually, but for complex structures response spectrum analysis can be used to calculate the mode shapes and frequencies. By conducting a comparative analysis, we aim to identify the impact of shear walls on parameters such as lateral displacement, base shear, storey drift and displacement.

The objective of The Work

1) To study the behavior of building with and without shear wall under earthquake excitations.
2) To analyze different parameters in high-rise RCC structure
3) To investigate the efficient shear wall in high-rise RCC structures by following the point of view

a) Base shear
b) Peak storey shear
c) Storey displacement
d) Storey drift

2. METHODOLOGY

Structural Details

The structure will be G+5 storey structure is symmetrical. 7 bays will be constructed along the X direction. Storeyheight will be 3 meters. The Bay width will be 3 m along both X and Z directions. The total height of the structureis 18 m. size of the columns is ‘0.35x 0.5’ and the size of the beams is ‘0.35x0.35’. Shear wall are provided of thickness 0.12 m. The structure is situated in medium soil conditions.

This report presents and discusses the analysis's methodology. To determine the optimal structural performanceof RCC buildings under lateral loads, comparison research has finally been presented.

Description	**Values**
Number of stories	G+5
number of bays in the X-direction	7
number of bays in Y -the direction	6
height of each story	3m
Bay width in the X direction	3m
Bay width in the Y direction	3m

size of beam	0.35x0.35 m
size of column	0.35x0.5m
the thickness of the RCC slab	0.150m
the thickness of shear wall	0.120m
(floor load + floor finishing)	4.75 KN/m^2
wall load	12.5 KN/m
live load	4 KN/m
grade of concrete	M20
grade of steel	Fe415
seismic zone	V
Type of soil	Medium soil
importance factor	1.0

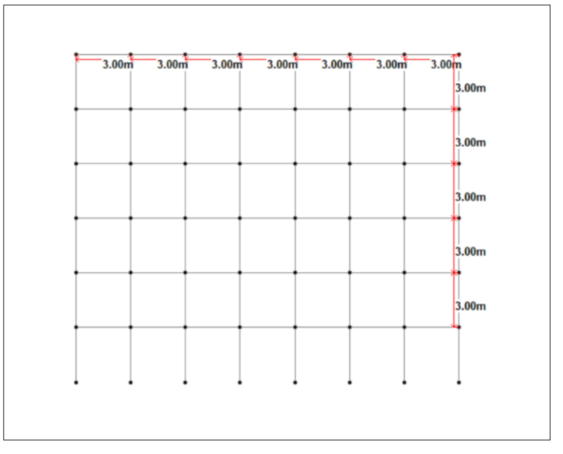

Fig. 2.1. Plan of the Building

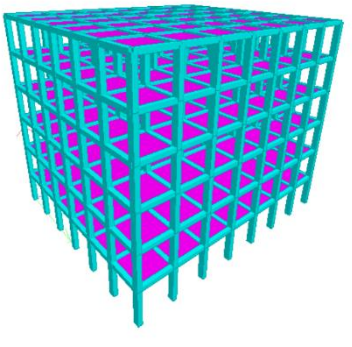

Fig:2.2 3D view of building

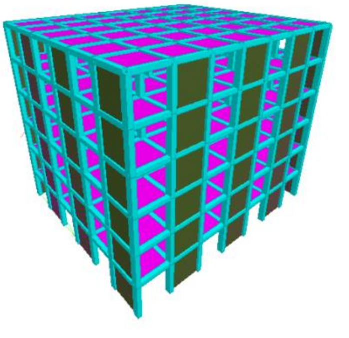

Fig:2.3 3D View of building with shear wall

3. RESULT

Table 3.1 storey displacement and storey drift comparison with and without shear wall

Storey No.	Storey Displacement without shear wall		Storey Displacement with shear wall		Storey Drift without shear wall		Storey Drift with shear wall	
	X-Direction	Y-Direction	X-Direction	Y-Direction	X-Direction	Y-Direction	X-Direction	Y-Direction
Base	0	0	0	0	0	0	0	0
Ground Floor	0.3914	0.2496	0.0141	0.0174	0.3914	0.2496	0.0141	0.0174
1st Floor	0.9052	0.6207	0.4607	0.1688	0.5139	0.3711	0.0119	0.0916
2nd Floor	1.4052	0.9906	0.6798	0.0705	0.4999	0.37	0.2594	0.0984
3rd Floor	1.8527	1.3232	1.0735	0.6688	0.4475	0.3326	0.3021	0.0633
4th Floor	2.2047	1.5858	1.1419	1.0189	0.352	0.2625	0.2223	0.113
5th Floor	2.4139	1.8476	1.3344	1.0148	0.2092	0.1618	0.0799	0.155

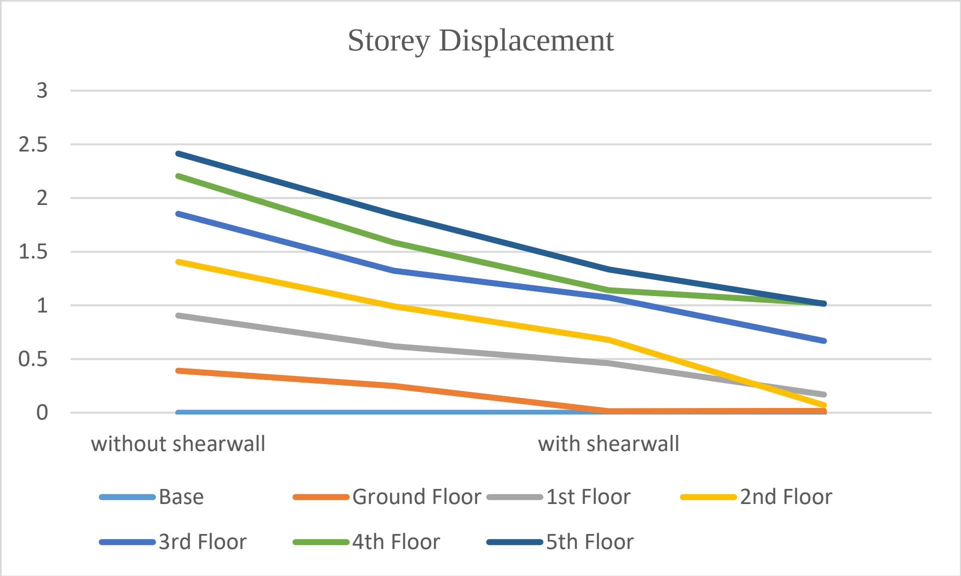

Figure: 3.1 Storey displacement comparison with and without shear wall

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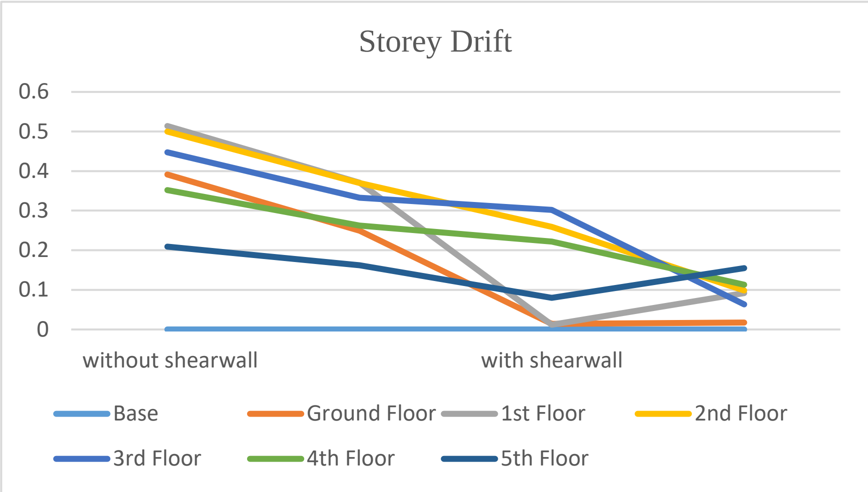

Figure: 3.2 Storey drift comparison with and without shear wall.

Table 3.2 Peak story shear comparison with and without shear wall

STORY	LEVEL IN METE	PEAK STORY SHEAR IN KN WITHOUT SHEARWALL		PEAK STORY SHEAR IN KN WITH SHEARWALL	
		x	Z	x	Z
6	18	9201.86	10775.31	9917.08	9969.24
5	15	18041.87	21167.13	20590.74	20535.89
4	12	25151.52	29618.22	29970.5	29932.65
3	9	30747.93	36204.58	36308.51	36484.93
2	6	34835.49	40783.33	40290.57	40417.75
1	3	36834.9	42815.15	42285.79	42263.47
BASE	0	36834.9	42815.15	42324.95	42305.71

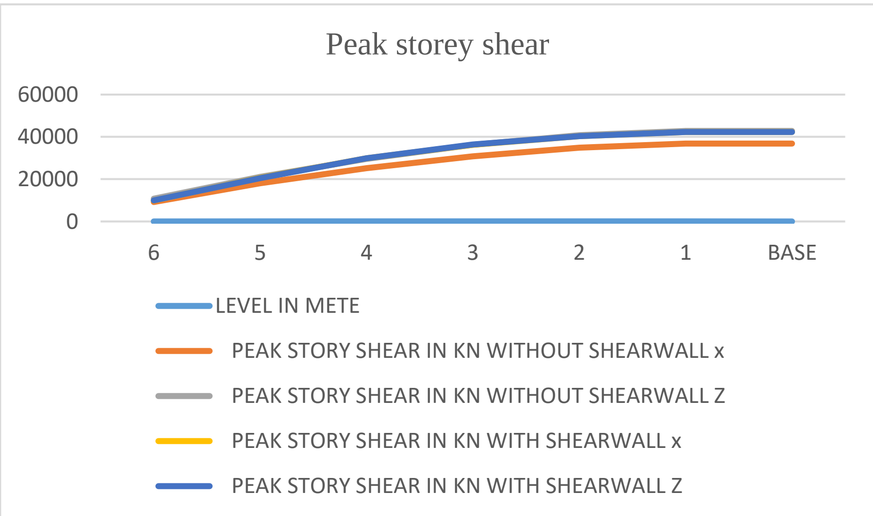

Figure: 3.3 Peak storey shear comparison with and without shear wall.

4. CONCLUSION

A general overview of structural system for sloping ground has been provided in this thesis. When shear wall is added to a structure, it increases the structure performances, seismic resistance, lateral deflection resistance, storey displacement and storey drift at various storey levels, calculated frequencies for load cases, peak storey shear have all been used to assess the building performance.

Based on the present study the following conclusion can be drawn:

1) The results reveal that the inclusion of shear wall significantly enhances the overall structural performance of building by reducing deformation and increasing resistance to lateral forces.
2) The presence of shear wall also imposes load distribution and overall stability. Thus reducing the risk of failure.
3) Using shear wall, the storey drift decreases as compared to the building without shear wall.
4) The storey displacement is reduced in building after providing shear wall.
5) Peak storey shear of building with shear wall is increase as compared to building without shear wall.

FUTURE SCOPE OF WORK

The further scope for the thesis have several potential area for exploration and research like conducting a more in depth comparison involving quantitative analysis of factors such as performance during seismic events or soil settlement, studying the dynamic response of building, investigating different design parameter to determine the most efficient and cost effective solution by geotechnical testing and analysing the soil structure to determine the influence of soil for all this further study an analytical study might be conducted.

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