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# Influence of Reinforced Concrete Shear Wall on Multistorey Buildings

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## Abstract

This work presents the behavior and change in length of shear wall in buildings varied by increasing equal heights from 3.5m to 28m i.e, ground storey (G) to G+7 keeping thickness of shear wall as constant of 250mm and observing the dimension of shear wall in length only. The study was carried by considering both wind and seismic forces for all the zones and soil types as per IS: 1893(part I):2002 and wind loads as per IS: 875(part III):1987. A total of 96 buildings were analyzed for this work using RESIST software. Buildings with symmetrical dimensions (20mx20m), varying wall length and keeping wall thickness as constant (250mm) the effect of shear wall length, wind drift, wind shear, wind moment, seismic drift, seismic shear, and seismic moment, base moment, base shear are studied and results are presented in graphs with height.

**Keywords**: shear wall, wind drift, wind moment, wind shear, seismic shear, seismic moment, seismic drift, wall length, base moment, and base shear.

## Introduction

: Shear wall are a part of multi storey buildings which resist lateral forces (wind and seismic) in the resisting system of structures. These walls helps in avoiding total collapse of buildings built in regions likely to experience high winds and repeated earthquakes. In the past, shear walls are constructed in reinforced concrete buildings to resist wind forces. From the recent observations, shear walls performance is excellent under seismic forces and are now used extensively for all earthquake resistant designs. Shear walls which are meant to resist earthquake and wind forces shall be designed for ductility. The thickness of shear wall at any part of the structure preferably is not less than 150mm as per IS: 13920:1993. Hence the shear wall length was fixed to 250mm, as in India the wall thickness will be usually 230mm.

## Research Work

The present work was done to observe the dimensions of shear wall with increase in storey height and by keeping thickness of shear wall as constant (250mm). The buildings considered are of 20mx20m in area with storey height of 3.5m. Both wind and seismic forces are considered for analysis of shear wall resisting buildings. The buildings were analyzed for all the seismic zones and soil types as per Indian standards using RESIST software. With change in storey to storey of equal heights the effect of base shear, base moment, wind drift, wind shear, wind moment, seismic drift, seismic shear, seismic moment, wall height are analyzed.

## Software Information

RESIST is software developed by NPEEE (National Program on Earthquake Engineering Education) which was distributed by NICEE (National Information Center of Earthquake Engineering). The software was supplied to our college (R.V.R & J.C College of Engineering) under NPEEE an initiative of the ministry of human resource development, Govt of India. RESIST is developed for research and education purpose only.

## Design Information

**Dimensions and loads:**

No of storey: G, G+1, G+2, G+3, G+4, G+5, G+6, G+7.
Length in X-direction: 20meters.
Length in Y-direction: 20meters.
Storey height: 3.5meters.
Roof height: 1.5meters.
Floor weight: Heavy (assuming 150mm slab with 50mm mortar and 25mm floor surfacing) dead load:6.5KPa.

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Interior walls: medium (all walls are with brick)
Exterior walls: Heavy (assumes 25% glazing and 75% 230mm plastered brick).

Roof weight: Heavy (assumes a 200mm deep hollow core reinforced concrete. slab plus topping and light weight screed to allow for drainage 4.8Kpa.).

**Seismic data input:** All the considered buildings are analyzed for all the seismic zones specified as per IS: 1893 (part I): 2002 are:

| Zone | Intensity | Zone value |
|---|---|---|
| II | Low | 0.10 |
| III | Moderate | 0.16 |
| IV | Severe | 0.24 |
| V | Very severe | 0.36 |

Importance factor considered is 1.0 used for all the buildings as per IS: 1893 (part I): 2002.

**Soil type:** All the buildings considered are analyzed for the three types of soils, rocky (hard), medium, soft soils as per IS: 1893 (part I): 2002.

**Wind and terrain information:**
Wind region: 5 (pink).
Basic wind speed: 50m/s.
Terrain category: Built up towns.
Site shape: Flat.

**Shear wall details:**
Wall thickness: 250mm (Kept constant through out this work).
Wall length: varied with increase in height with equal increase from storey to storey of 3.5meters.
No of walls: 2 walls in X-direction and 2 walls in Y-direction.
Type of wall: Reinforced concrete shear wall.
Load combinations: Wind loads: 1.2G & 1.0Qu & 1.5Wu
Earthquake loads: 1.5G & 1.5Eu.

## Results and Discussions

From the results with a gradual increase in height of buildings in all zones and soil types, the wall length also changed linearly. Result analysis is done in terms of percentages in RESIST software i.e. if the result is <=100% then ok, if >100% condition is failure. All the results of Base shear (Fig:1,2,3,4), wall length (Fig: 5), Base moment(Fig:6,7,8,9), wind drift(Fig: 10), wind shear(Fig:11), Wind moment(Fig:12), Seismic drift(Fig:13,14,15,16), Seismic moment(Fig:17,18,19,20), Seismic shear(Fig:21,22,23,24) are shown in graphs in terms of percentages.

With increase in height the base shear of medium and soft soils have no change and varied linearly, but for rocky soils there is a slight decrease in base shear after 20mts of building height.

The minimum thickness to prevent wall buckling is 204mm for G+7 building was observed. The study helps in understanding the effect of wind and seismic forces on length of shear wall and also the resulting base shear and remaining parameters covered in this paper.

Increase in length of shear wall increased the stability of the structure in the considered constructed plane of shear wall of the multistory building.

## Conclusions

This research helps in understanding shear wall consideration for wind and seismic forces and also in considering different parameters which are analyzed and can be used in research and education purposes also.

**Fig: 1 Base shear vs Height for zone V.**

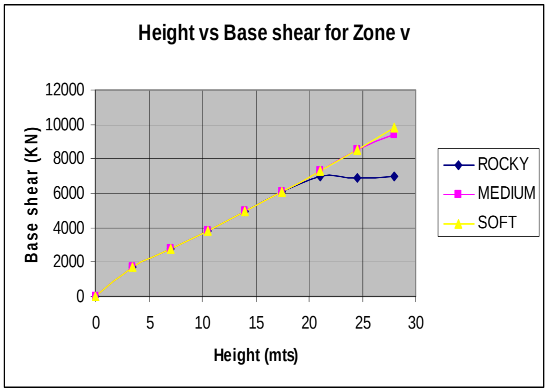


**Fig: 2 Base shear vs Height for zone IV.**

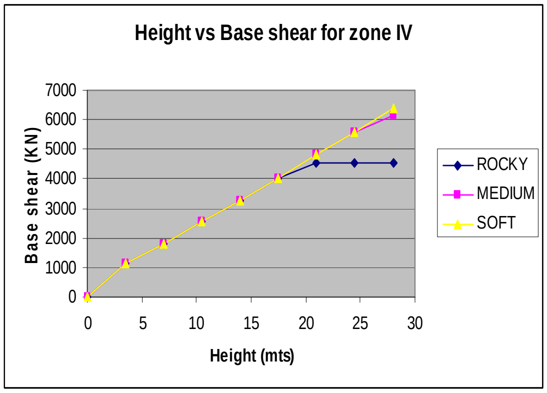


**Fig: 3 Base shear vs Height for zone III.**

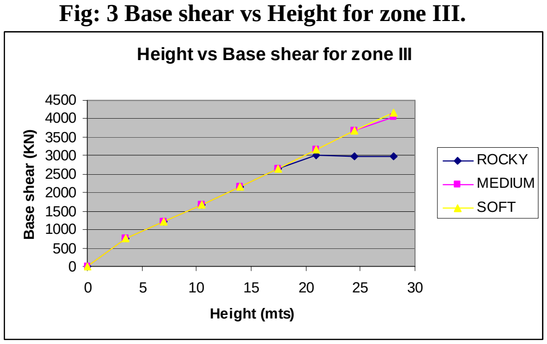


**Fig: 4 Base shear vs Height for zone II.**

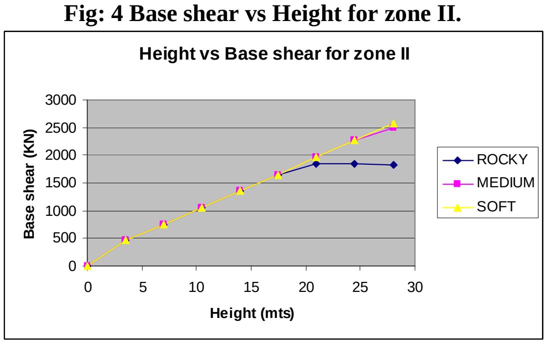


**Fig: 5 wall length (vs.) Height for all zones.**

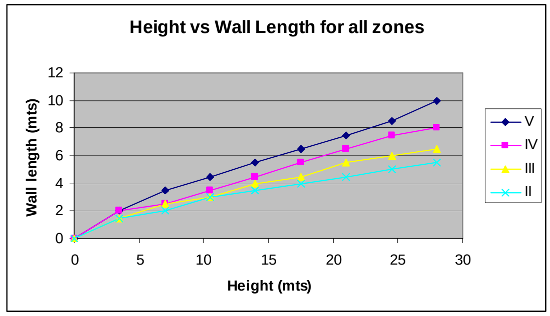


**Fig: 6 Base moment vs Height for zone V**

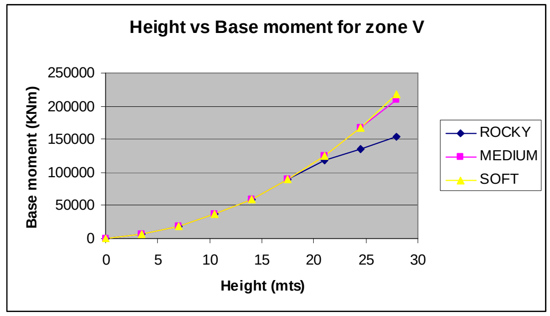


**Fig: 7 Base moment vs Height for zone IV.**

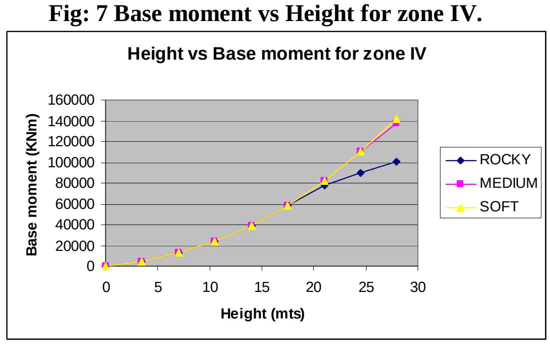


**Fig: 8 Base moment vs Height for zone III.**

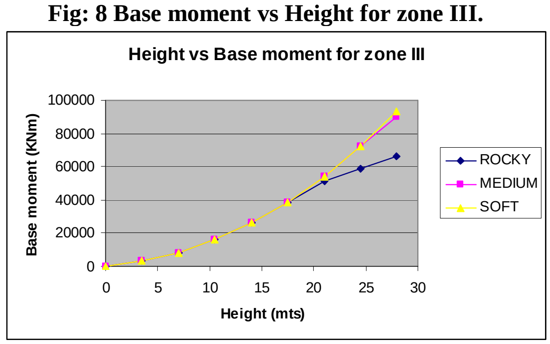

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Fig: 9 Base moment vs Height for zone II.

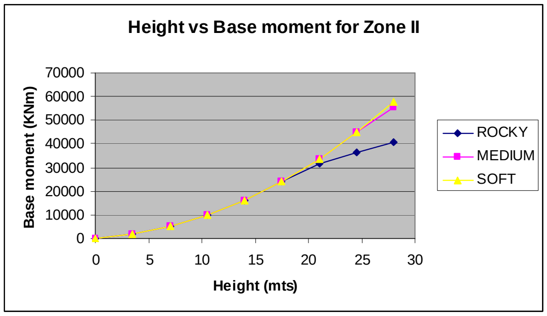


Fig: 10 Wind drift vs Height for all zones.

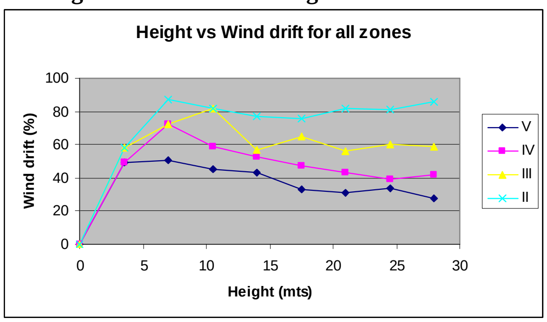


Fig: 11 Wind shear vs Height for all zones.

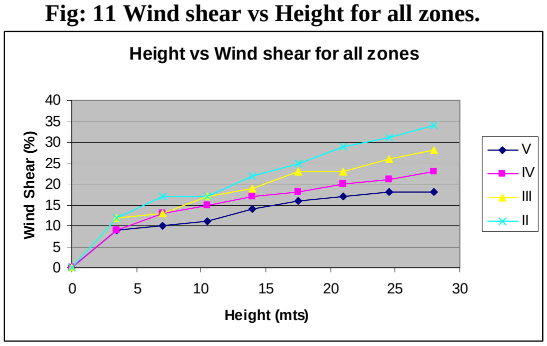


Fig: 12 Wind moment vs Height for all zones.

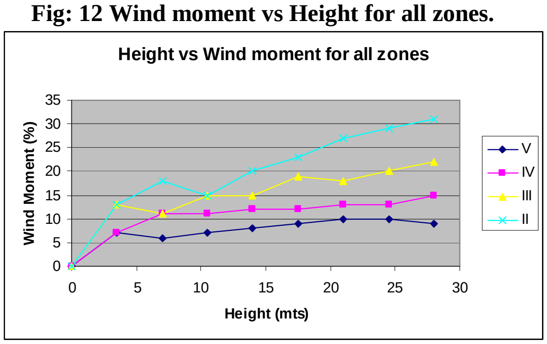


Fig: 13 Seismic drift vs Height for zone V.

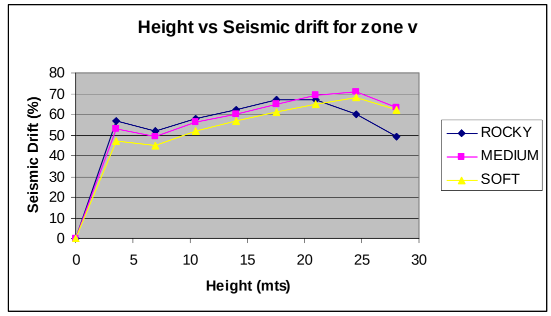


Fig: 14 Seismic drift vs Height for zone IV.

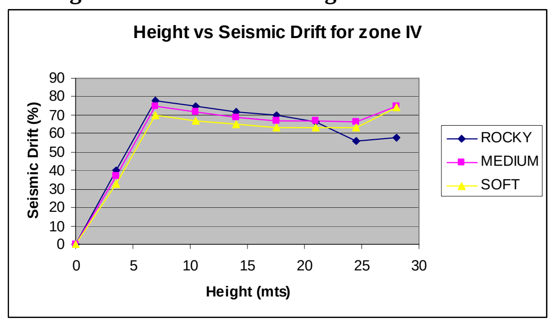


Fig: 15 Seismic drift vs Height for zone III.

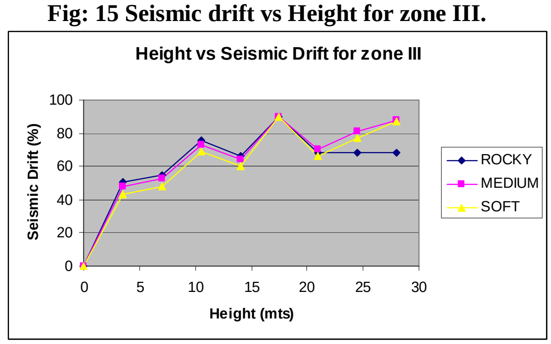


Fig: 16 Seismic drift vs Height for zone II.

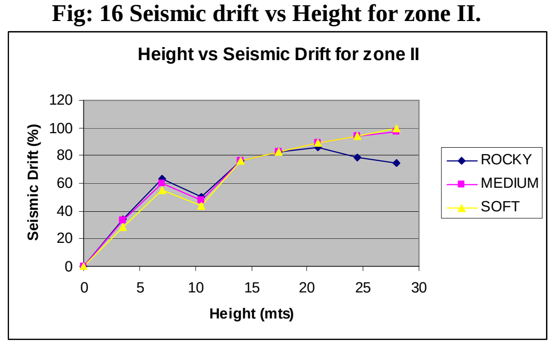

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**Fig: 17 Seismic moment vs Height for zone V.**

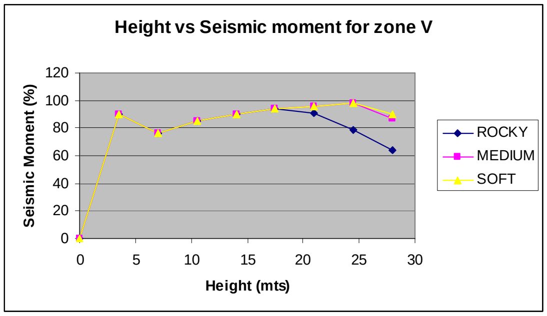



**Fig: 18 Seismic moment vs Height for zone IV.**

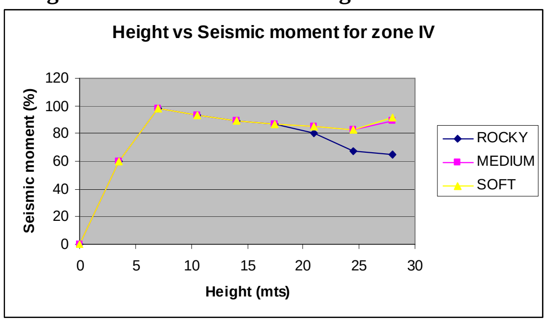



**Fig: 19 Seismic moment vs Height for zone III.**

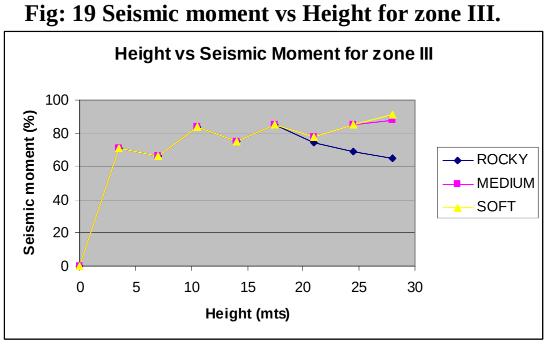



**Fig: 20 Seismic moment vs Height for zone II.**

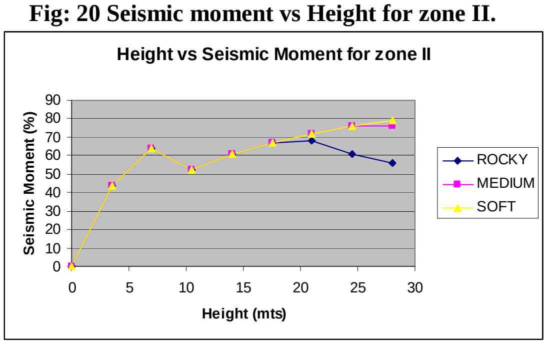



**Fig: 21 Seismic shear vs Height for zone V.**

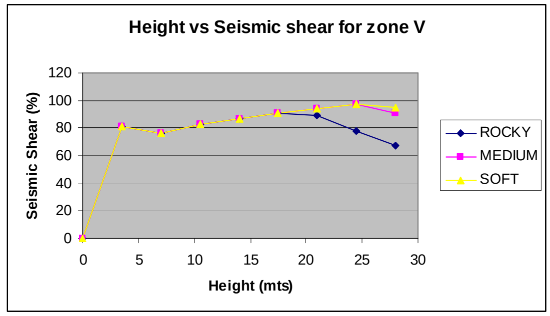



**Fig: 22 Seismic shear vs Height for zone IV.**

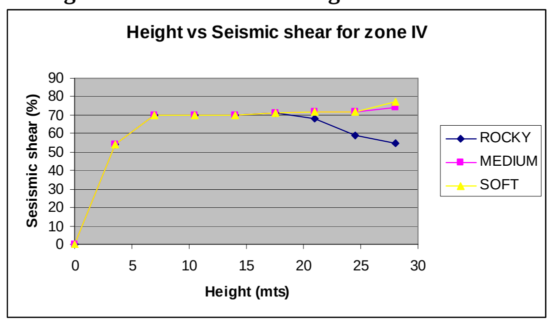



**Fig: 23 Seismic shear vs Height for zone III.**

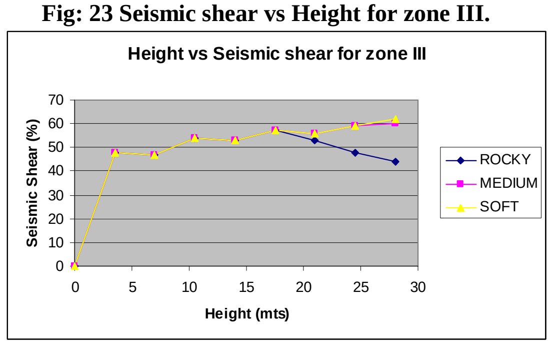
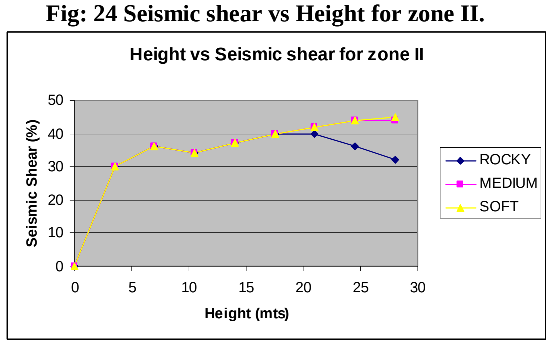



**Fig: 24 Seismic shear vs Height for zone II.**

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