SEISMIC ANALYSIS OF G+5 BUILDING WITH AAC BLOCKS AND CONVENTIONAL BRICKS FOR DIFFERENT ZONES BY USING STAAD PRO

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Abstract: *In order to compete in the ever growing competent market it is very important for a structural engineer to save time. As a sequel to this an attempt is made to analyze and design a multistoried building by using a software package STADD PRO. As STAAD Pro is the current leading design software in the market, many structural designing companies use this software for their project design purposes. So, this article mainly deals with the analysis of the results obtained from the design of a building structure when it is designed using STAAD Pro Software. The software method of analysis is used for a G+5 Residential building with AAC blocks and conventional bricks, located in Zone-III, Zone IV and zone V. In this study two types of infill material used first is brick infill, second is AAC block infill. So there for two types of infill material in which 18 models will be prepared in Staad pro. In this study G+5 storey building is considered for analysis which is located in Zone III, zone IV and Zone V earth quake region.Static analysis is done using Staad pro software, soil conditions is to be medium, Soft and Hardand importance factor is to be taken as 1.2. various parameter studied like lateral displacement of building, axial load in column, Maximum Bending moment and Maximum shear force for a particular beam for all two types of material and for all cases and weight calculations as per code IS 1893:2002.*

IndexTerms **– Conventioal Bricks, AAC blocks, Staad Pro**

INTRODUCTION

Bricks remain one of the most important building materials in the country. Brick making is a traditional industry in India, generally confined to rural areas. It has directly or indirectly caused a series of environmental and health problems. At a local level, in the vicinity of a brick kiln, environmental pollution from brick-making operations is injurious to human health, animals and plant life. The environmental pollution from brickmaking operations contributes to the phenomena of global warming and climate change. Extreme weather may cause degradation of the brick surface due to frost damage. Various types of blocks can be used as an alternative to the red bricks, to reduce environmental pollution and global warming. Aerated Concrete blocks (AC) may be one of the solutions for brick replacement. AC is one of the eco – friendly product. AC is porous, non-toxic, reusable, renewable and recyclable. Aerated Concrete, also known as aircrete, is a lightweight, load-bearing, high insulating, durable building product, which is produced in a wide range of sizes and strengths. AC is produced out of a mix of quartz sand or pulverized fly ash, lime, cement, gypsum/anhydrite, water and aluminium and is hardened by steam-curing in autoclaves. Being aerated, it contains 50 - 60 % of air, leading to lightweight and low thermal conductivity. AC is a lightweight, precast building material that simultaneously provide fire resistance, construction, economy and speed.

LITERATURE REVIEW

Sr. NO.	Title of paper	ISSN NO.	Journal	M
1	Seismic Analysis and Design of G+9 RCC Residential Building in STAAD.PRO for Zone II Region	2347-6710	International Journal of Innovative Research in Science, Engineering and Technology	Vol. 7, Issue 5, May 2018
2	Study and Comparison of Structure Having Different Infill Material (Bricks, AAC Blocks and Hollow Concrete Blocks) using ETABS.	2394 – 3386	International Journal of Engineering Technology Science and Research	Volume 4, Issue 12 December 2017
3	Seismic Performance of Autoclaved Aerated Concrete (AAC) Masonry: From Experimental Testing of the In-Plane Capacity of Walls to Building Response Simulation	1363-2469	Journal of Earthquake Engineering	DOI: 10.1080/13632461003642413
4	Comparative Analysis of G+10 RCC Building with AAC Blocks and Conventional Blocks	2395-0072	International Research Journal of Engineering and Technology	Volume: 06 Issue: 04 | Apr 2019
5	comparison and analysis of multi-storey building in various seismic zones	2249-6149	International Journal of Emerging Trends in Engineering and Development	Issue 7, Vol. 3 (May 2017)
6	seismic design and analysis of (g+6) residential building in zone 3&4 using staad pro and it's cost estimation	2582-5208	International Research Journal of Modernization in Engineering Technology and Science	Volume:02/Issue:05/May-2020

OBJECTIVES OF STUDY

- The objective of this project is to study the effect of AAC block and Convectional Brick on the seismic behavior of the building.
- To study various effects of AAC and Conventional bricks in the structures various parameters such as lateral displacement, Max. Bending Moment, Maxi. Shear force etc. are studied.

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- To Compare the Staad pro results for the following parameters such as Displacement, Maximum Shear force, Maximum bending moment etc.

SCOPE OF THE STUDY

1. The present study focused on the seismic response of reinforced concrete structure of G+5 storey.
2. Two models of five stories frames will be modeled as per IS1893:2002 in STADD PRO.

METHODOLOGY

1. Study various literatures related to codal comparison of structure.
2. Selection of structure and modeling in STADD-PRO.

3. Modeling of two structures in STADD PRO according to IS1893:2002
4. Design of structure as per required IS code.
5. Comparison of results for both the models will done to check the effect on seismic response of structure.

MATERIALS

PARTICULARS	CONVENTIONAL RED BRICKS	AAC BLOCKS
Strength	30-40 Kg/cm2	35-40 Kg/cm2
Shape & Size	Non Uniform & Irregular	Uniform & Regular
Water Absorption	40 – 45 %	15 – 20 %
Breakage / Wastage	8 – 10 %	Nil – 0.5 %
Mortar Consumption	High	Less
Density	1500 – 1700 Kg/M3	550 – 650 Kg/M3
Nos. of Bricks for per Cubic Meter	592 Nos [9x4x3inch]	67 Nos.[25x9.6x4inch]
Mortar Joint Thickness	15 – 18 mm	8 – 10 mm
Plaster Thickness	15 – 20 mm	10 – 12 mm

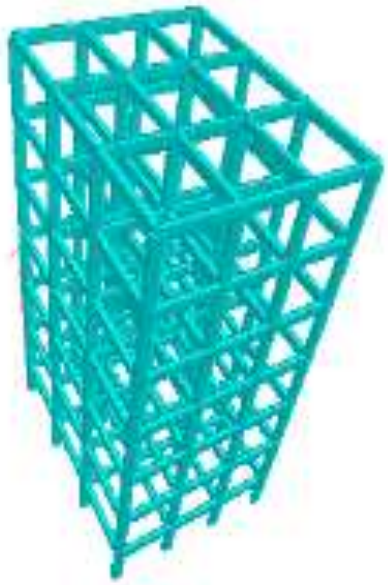
Detail of building considered in this work are as follows Type of structure - Residential building

Shape of building – Rectangular building
Number of stories 5
Height of typical floor: 3.0m
Column size: 230mm X450mm
Beam size: 230 mm X 450mm
Slab thickness: 150 mm

Masonry wall thickness: 230 mm Live load : 2 Kn/m^2

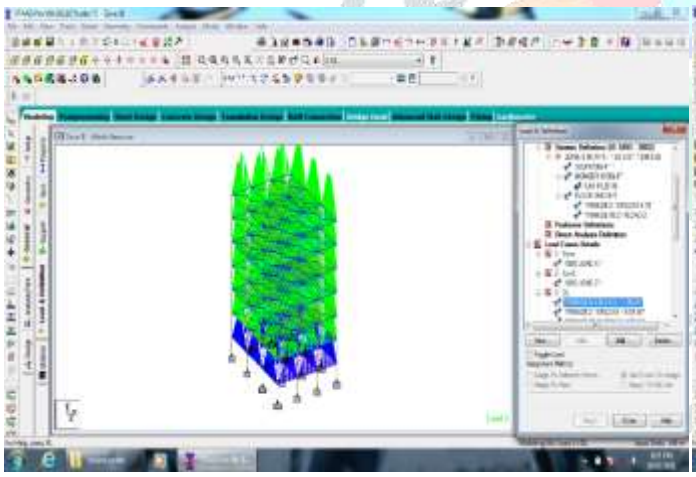
Floor finish : 1 Kn/m^2

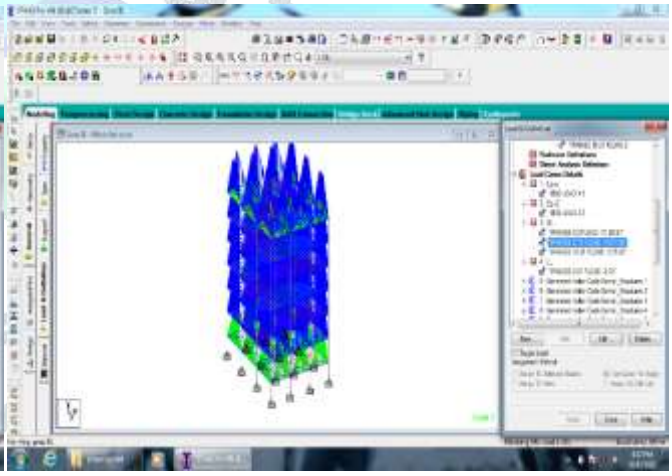
All the columns are assumed to be fixed at their base. Characteristic compressive strength of concrete, fck: 25N/mm2 Grade of steel : 500 N/mm2
Density of concrete : 25N/mm2
Modules elasticity of concrete : 2500N/ mm2
Density of brick masonry : 19.2 KN/m3
Modulus elasticity of brick masonry: 14000N/mm2

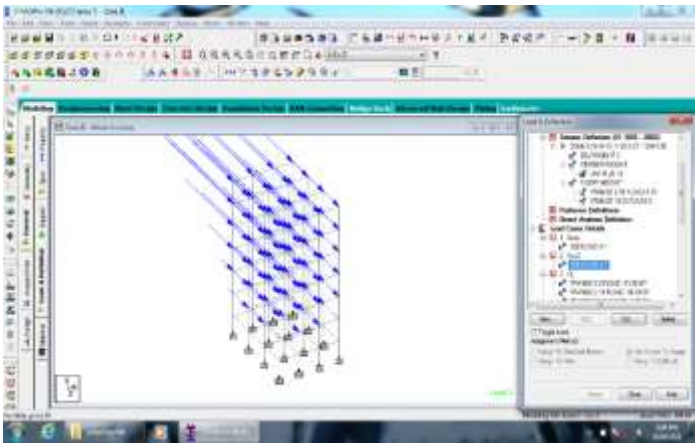


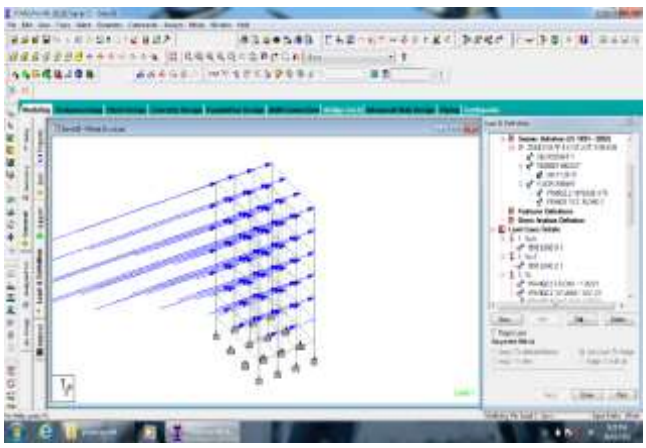
3D Modeling of Building

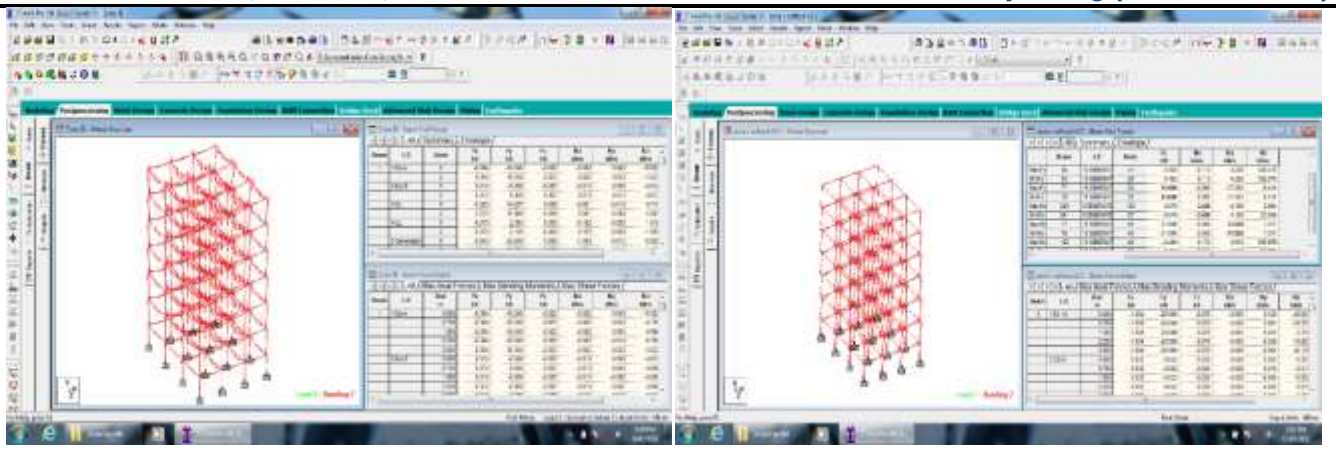
2D plan of Building





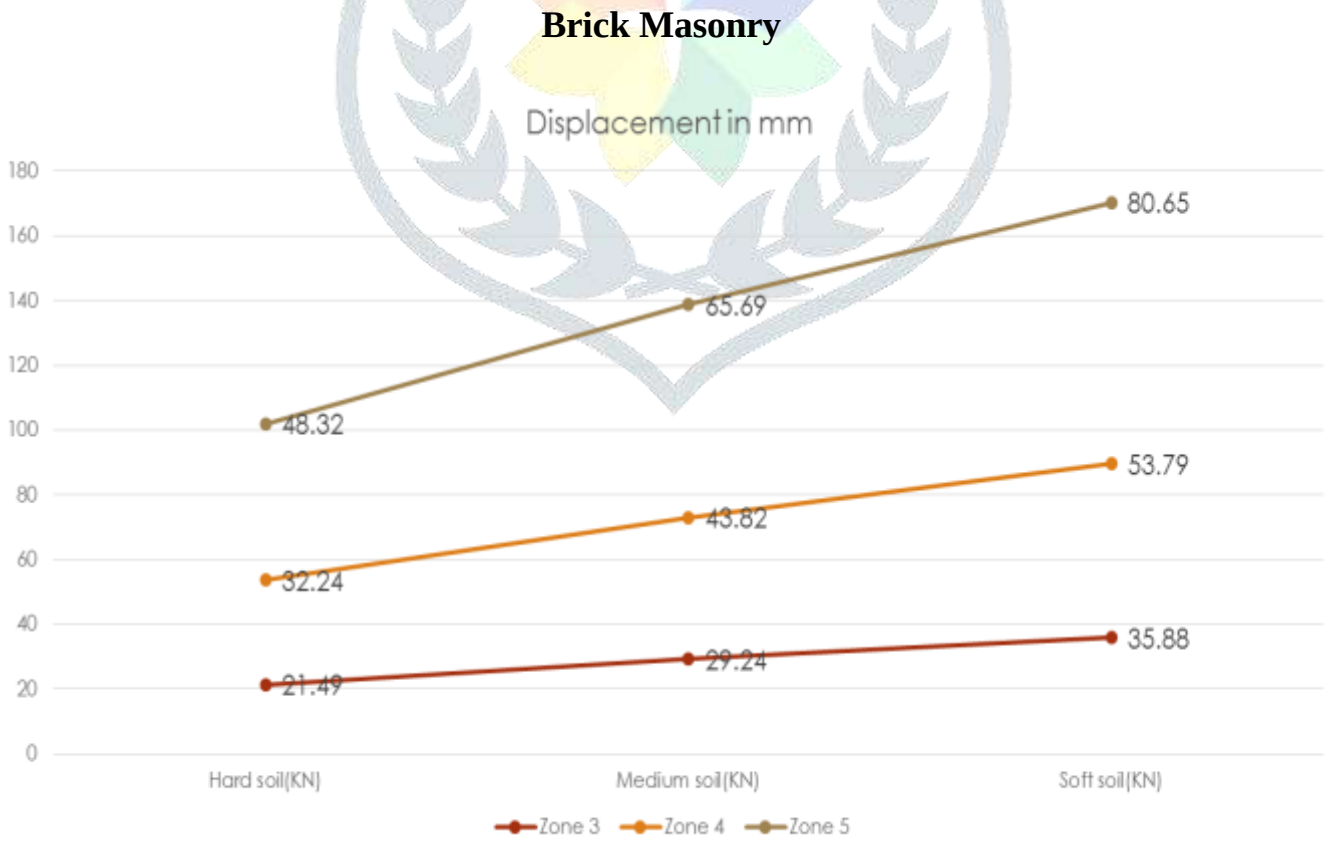


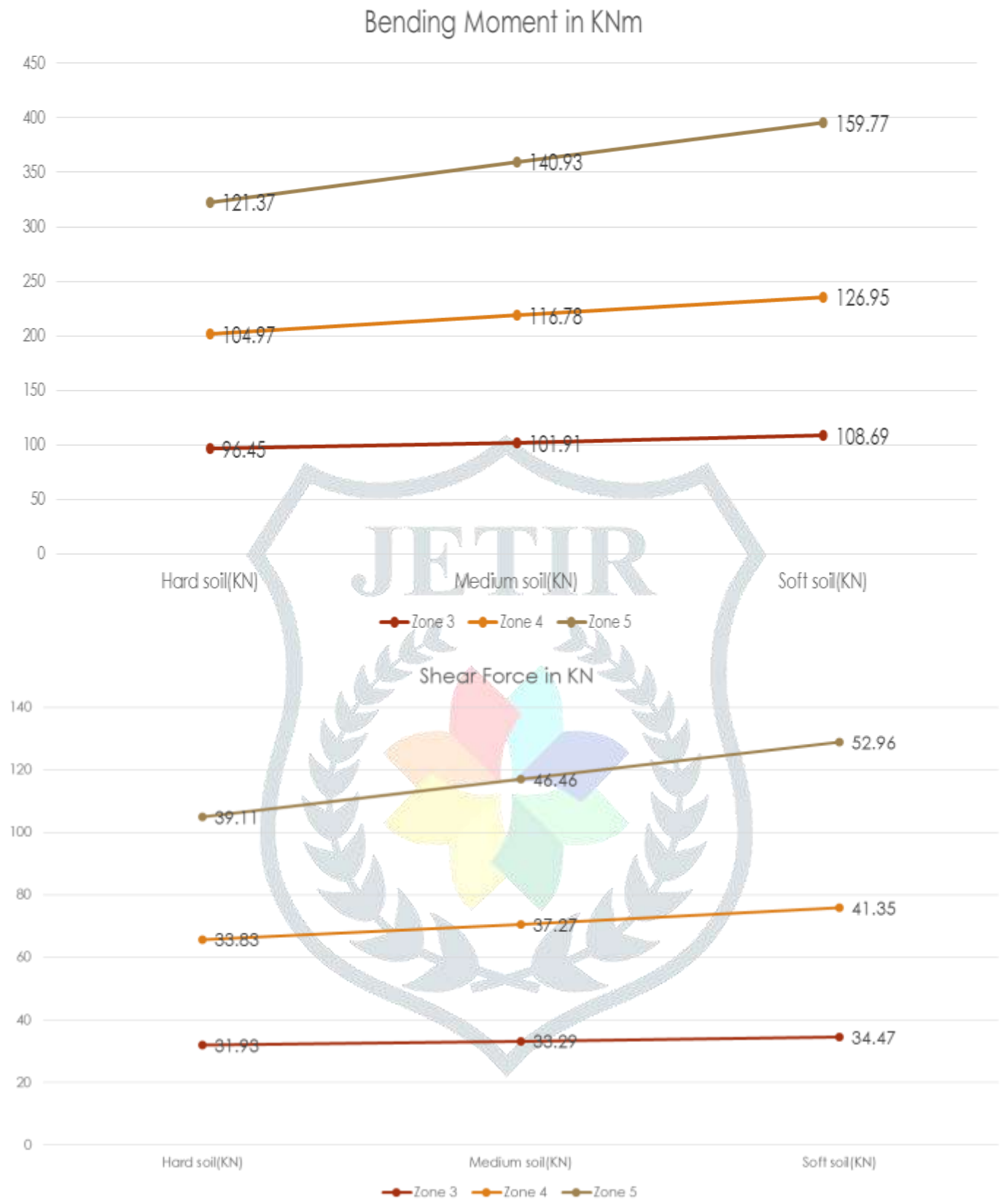




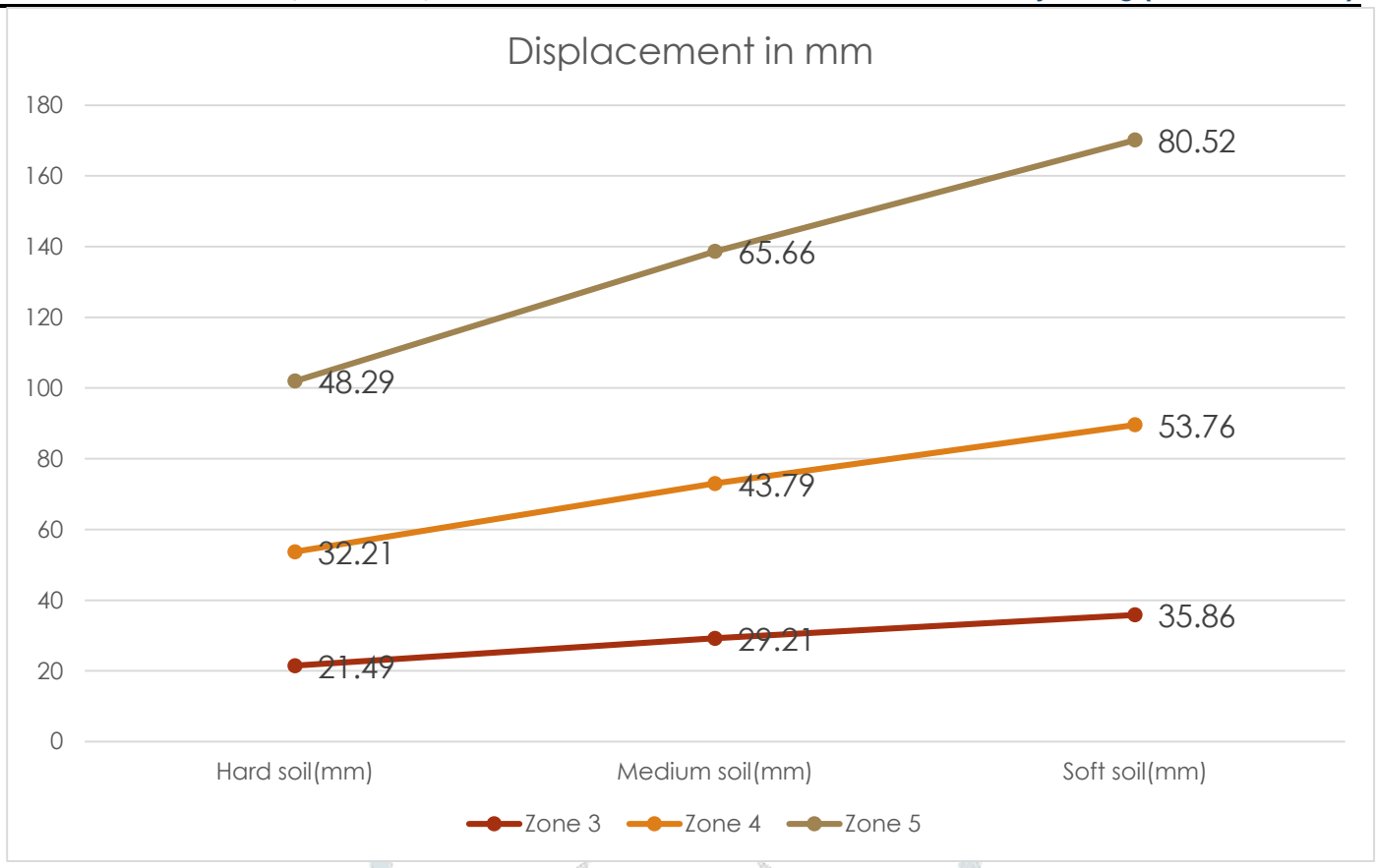
Result and Discussions

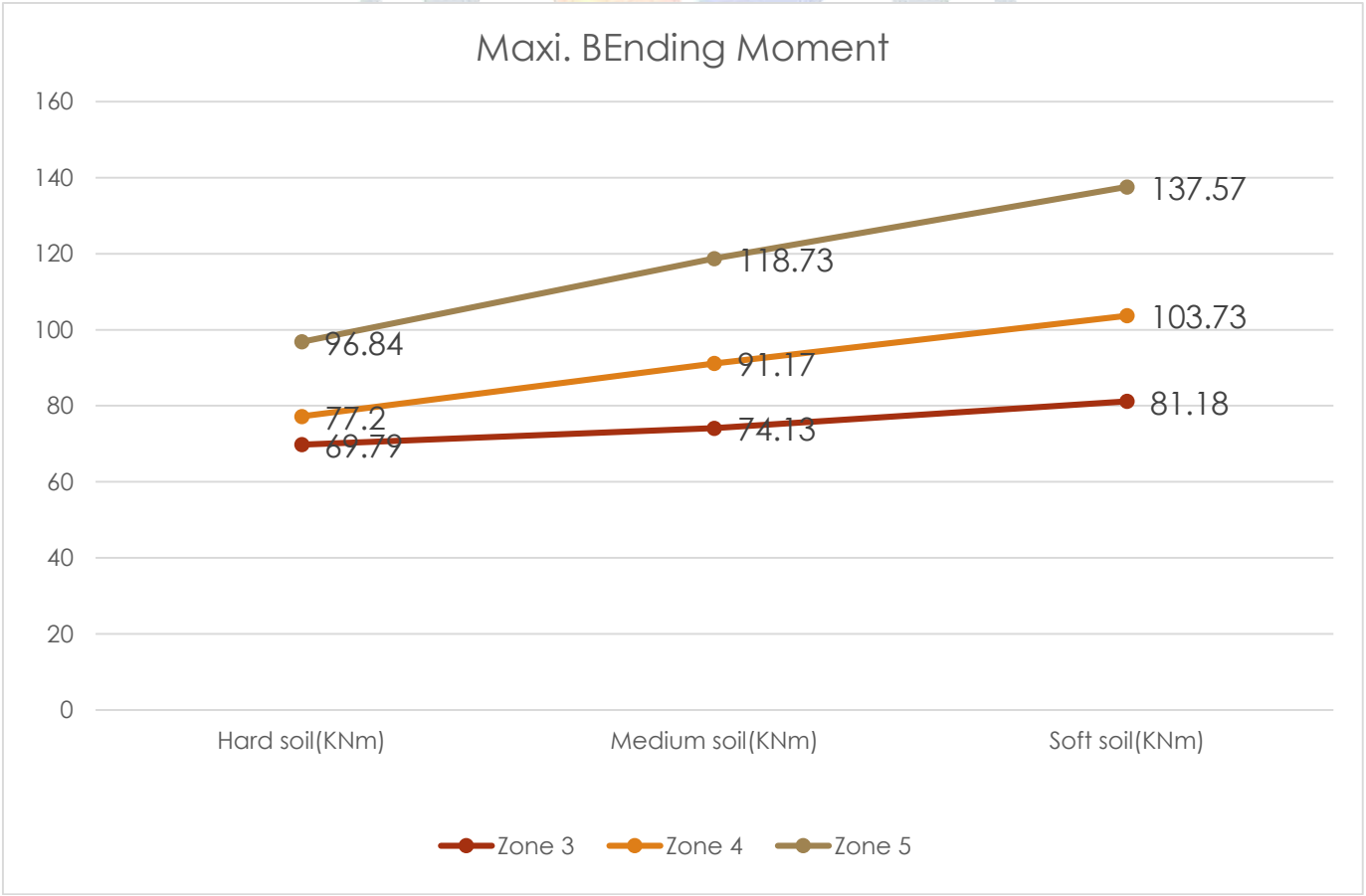
The results of G+5 building model are presented in this chapter. The analysis carried out is equivalent static analysis. The result of Lateral displacement, Maximum Bending moment, Maximum shear Force were presented for different seismic zones and different types of soil of India.

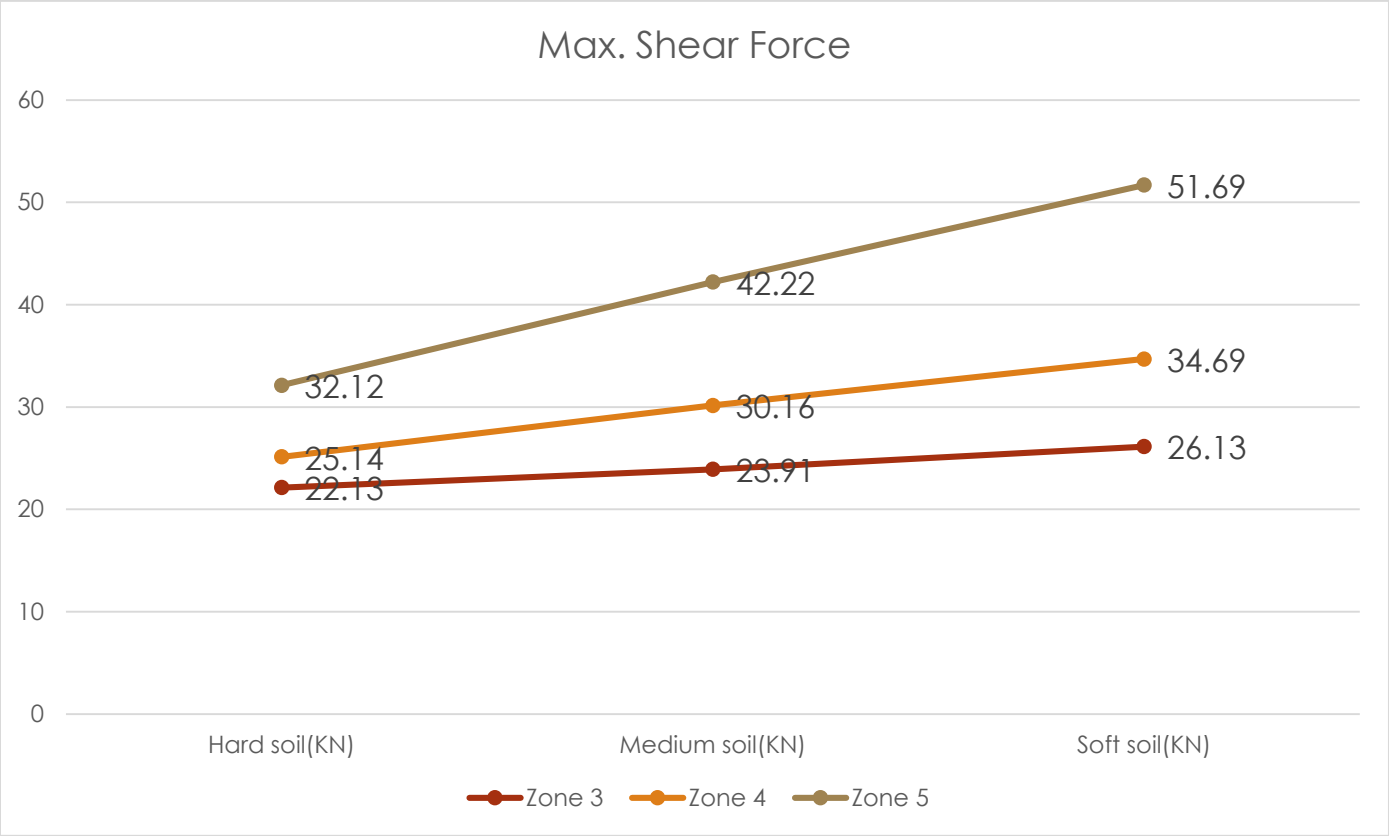



Bending Moment in KNm
450
400
350
300
250
200
150
100
50
0
159.77
140.93
121.37
126.95
116.78
104.97
108.69
101.91
96.45
Hard soil(KN)
Medium soil(KN)
Soft soil(KN)
Zone 3
Zone 4
Zone 5
Shear Force in KN
140
120
100
80
60
40
20
0
52.96
46.46
39.11
41.35
37.27
33.83
34.47
33.29
31.93
Hard soil(KN)
Medium soil(KN)
Soft soil(KN)
Zone 3
Zone 4
Zone 5

AAC Blocks


Displacement in mm
180
160
140
120
100
80
60
40
20
0
80.52
65.66
48.29
53.76
43.79
32.21
35.86
29.21
21.49
Hard soil(mm)
Medium soil(mm)
Soft soil(mm)
Zone 3
Zone 4
Zone 5


Maxi. BEnding Moment
160
140
120
100
80
60
40
20
0
137.57
118.73
96.84
103.73
91.17
77.2
81.18
74.13
69.79
Hard soil(KNm)
Medium soil(KNm)
Soft soil(KNm)
Zone 3
Zone 4
Zone 5



CONCLUSION

Brick Masonry

- Maximum bending moment is occur in Zone V (SoftSoil)= 159.77KNm.
- Maximum Shear force is in 52.96 KN.
- Maximum lateral displacement is =80.65 mm

AAC Block

- Maximum bending moment is occur in Zone V (SoftSoil) = 137.57 KNm.
- Maximum Shear force is in 51.65 KN.
- Maximum lateral displacement is =80.55 mm

- If we used AAC block in place of conventional brick we are saving almost around 10-15 % in cost.
- Autoclave Aerated Concrete has been shown to provide better insulation to sound transmitted by air than other solid building materials, e.g. dense concrete, clay bricks, etc., under comparable conditions.
- AAC is non-combustible, and due to its low thermal conductivity and slow rate of heat transfer, AAC has high fire resistance capabilities.
- Result has been proved that ACC block is good as compare to Brick Masonry building.

FUTURE SCOPE

- The multistory buildings resist all types of loading in design criteria so it can be constructed in any seismic zones.
- The use of ACC Block structure application may prove fruitful as it has potential due to the economy that can be achieved by these components in terms of time, labor and money.

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