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ANALYSIS OF STRUCTURES ON VARYING SLOPING TERRAINS UNDER DIFFERENT SEISMIC CONDITIONS AND SOIL COMPOSITIONS

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ABSTRACT

This research investigates the structural response of buildings on sloping terrains under different seismic conditions and soil compositions. Using STAAD.Pro V8i, a comparative analysis is performed on a G+10 building with varying slope angles (0°, 7°, and 14°) across seismic zones II, III, IV, and V with soft, medium, and hard soil. The study evaluates parameters such as base shear, bending moment, shear force, and displacement. Results indicate that structures on steep slopes experience higher lateral forces, necessitating enhanced design considerations for stability and seismic resilience.

Keywords: Seismic Analysis, STAAD.Pro, Sloping Terrain, Structural Response, Seismic Zones

1. INTRODUCTION

The scarcity of level ground in hilly regions necessitates construction on sloping terrains, posing unique structural challenges. Seismic forces exert significant impacts on such buildings, often leading to structural failures. This study aims to analyze the behavior of G+10 structures under different seismic conditions and soil types, utilizing STAAD.Pro for numerical modeling.

2. METHODOLOGY

The study involves modeling a G+10 structure with variations in slope angles (0°, 7°, and 14°) and different soil compositions (soft, medium, hard). Seismic loads are applied based on IS 1893:2002, and structural parameters such as base shear, bending moment, shear force, and displacement are analyzed.

3. RESULTS AND DISCUSSION

3.1 Base Shear Analysis (Table 1: Base Shear values for different terrains and soils)

Slope (°)	Soil Type	Zone II (kN)	Zone III (kN)	Zone IV (kN)	Zone V (kN)
0	Soft	100.03	158.77	237.10	354.58
7	Soft	92.99	147.37	221.79	329.48
14	Soft	85.50	135.20	202.30	302.50

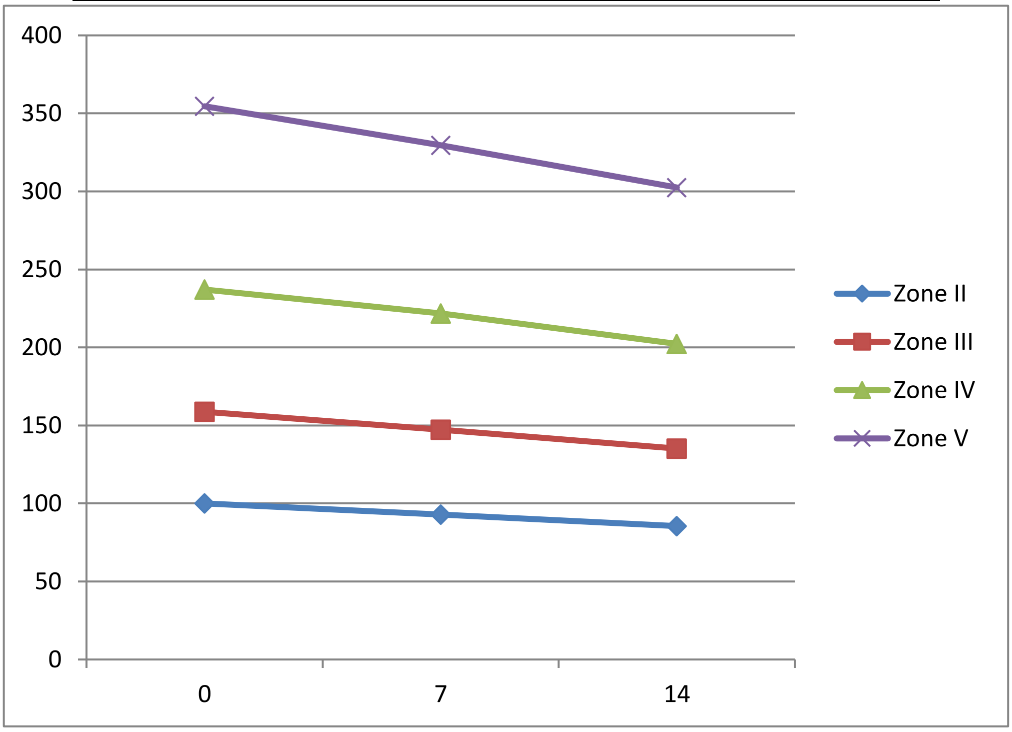

Figure 1: Base Shear vs. Slope for Different Seismic Zones

3.2 Bending Moment Analysis

Table 2: Maximum Bending Moment values

Slope (°)	Soil Type	Zone II (kN-m)	Zone III (kN-m)	Zone IV (kN-m)	Zone V (kN-m)
0	Medium	175.08	267.18	392.3	584.5
7	Medium	227.50	341.16	533.92	804.79
14	Medium	280.30	415.80	650.45	970.60

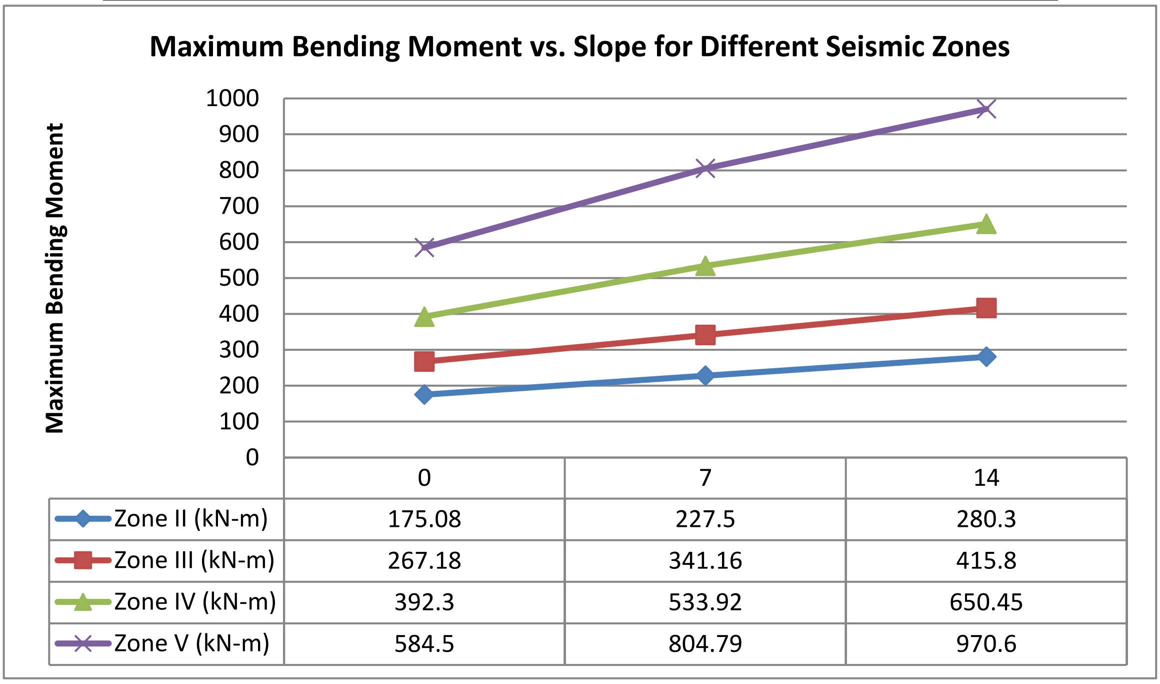

Figure 2 : Maximum Bending Moment vs. Slope for Different Seismic Zones

3.3 Displacement Analysis

Table 3: Maximum Displacement in X and Z Directions

Slope (°)	Soil Type	Displacement in X (mm)	Displacement in Z (mm)
0	Hard	60.75	62.75
7	Hard	56.65	60.55
14	Hard	52.45	57.35

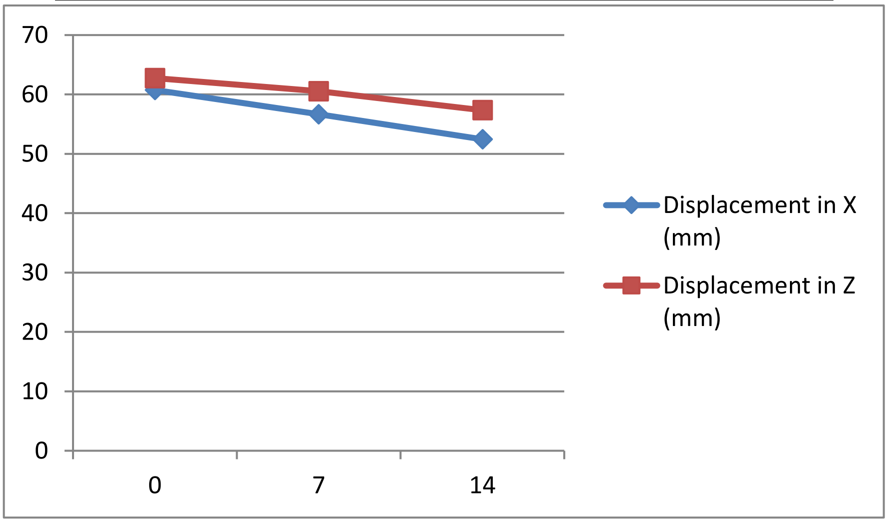

Figure 3: Displacement vs. Slope for Different Seismic Zones)

4. CONCLUSION AND FUTURE SCOPE

The study highlights that buildings on steep slopes and soft soil experience higher base shear, bending moments, and displacements. Structural reinforcement and improved foundation design are recommended for seismic resilience. Future research can explore dynamic time-history analysis for more comprehensive results.

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