SEISMIC ANALYSIS OF FOOT OVER BRIDGE

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Abstract: A footbridge (also called a pedestrian bridge, pedestrian overpass, or pedestrian overcrossing) is a bridge designed for pedestrians and in some cases cyclists, animal traffic, and horse riders, instead of vehicular traffic. In many developed countries, footbridges are both functional and can be beautiful works of art and sculpture. For poor rural communities in the developing world, a footbridge may be a community’s only access to medical clinics, schools and markets, which would otherwise be unreachable when rivers are too high to cross.

In this project work seismic analysis of foot over bridge for different soil conditions are carried out. This paper highlights the effect of different soil conditions in different earthquake zones with Response Spectrum analysis using Staad-Pro.

Keywords: Seismic Analysis, Different Zones, Different Soil Conditions, STAAD Pro

INTRODUCTION -
Soil is one of the most abundant materials available throughout the world. This fact along with the demand for local construction material led to this investigation on the suitability of soil for use as a building material.

Foot over bridge are important passenger amenity and passenger safely items in station yards provided to facilitate easy movement of passenger and goods from one platform to other or from platform to outside of railway station or for crossing station yards. Footbridges are mostly constructed to allow pedestrians to cross water or railways. They are situated across the roads for pedestrians to cross safely without slowing down the traffic. As per the Indian code IS 1893:2002 Part1, about 60% Indian land comes under seismic zone III, IV, V. The main objective of structural analysis is to determine internal forces, stresses and deformations of structures under various load effects. There has been much progress in foot over bridge design in recent years with increasing use of advanced analytical design methods, use of new materials and new bridge concepts.

Objectives:
- Analysis of foot over bridge using STAAD Pro software.
- To understand the effects of earthquake on foot over bridge in different earthquake zones (II, III, IV, V).
- To examine the effects of different soil conditions in different earthquake zones for foot over bridge.
- To give most structurally efficient and economic foot over bridge superstructure according to earthquake zone and suitable soil condition.
**Modelling:**

**GEOMETRY OF FOOT OVER BRIDGE -**

<table>
<thead>
<tr>
<th>SN</th>
<th>Details</th>
<th>Dimensions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>EFFECTIVE SPAN OF FOOT OVER BRIDGE</td>
<td>20m &amp; 30m</td>
</tr>
<tr>
<td>2</td>
<td>HEIGHT OF BRIDGE DECK FROM GROUND LEVEL</td>
<td>6m</td>
</tr>
<tr>
<td>3</td>
<td>PANEL LENGTH</td>
<td>5m</td>
</tr>
<tr>
<td>4</td>
<td>NO. OF PANELS</td>
<td>4(20m) &amp; 6(30m)</td>
</tr>
<tr>
<td>5</td>
<td>WIDTH OF BRIDGE DECK</td>
<td>3m</td>
</tr>
</tbody>
</table>

**LOADING CALCULATIONS -**

1) Dead Load Calculation of concrete deck slab
   - Thickness of concrete deck slab- 200MM
   - Density of concrete- 25 KN/m3
   - Dead load of deck slab = 25 * 0.2 * 1 = 5 kN/m²

2) Live load - 4 kN/m²

Physical Properties of Structural Steel:
- i) Unit mass of steel, p = 7850 kg/m³
- ii) Modulus of elasticity, E = 2.0 x 10¹² N/mm² (MPa)
- iii) Poisson ratio, p = 0.3
- iv) Modulus of rigidity, G = 0.769 x 10¹² N/mm² (MPa)

**STRUCTURAL ANALYSIS -**

Node Reactions for 20m Span Foot Over Bridge Model with First Soil condition i.e. Hard Soil for Different EQ Zones

**Table: It Shows Node Reactions for EQ. Zone II**

**Table: It Shows Node Reactions for EQ. Zone III**

**Table: It Shows Node Reactions for EQ. Zone IV**

**Table: It Shows Node Reactions for EQ. Zone V**
Similarly, Node Reactions for 30m Span Foot Over Bridge Model with different soil condition for Different EQ Zones were obtained.

**Base shear comparison:**

![Base shear comparison of 20m span FOB](image)

![Base shear comparison of 30m span FOB](image)

**CONCLUSION:**

i) Column's sectional property changes with the change in soil condition of 30m span and no change in 20m span model of foot over bridge for different earthquake zones.

ii) Sectional members which passes in Earthquake Zone II & III, fails in Earthquake Zone IV & V.

iii) Support reaction increases with change in Earthquake Zone and soil condition.

iv) Maximum axial force and bending moment in column members of 20m & 30m span foot over bridge increases with change in
v) Base shear in 20m and 30m span foot over bridge increases with the change in soil condition and earthquake zones.

REFERENCES:


