Seismic Site Characterization of Mathura, UP

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Abstract

Mathura, a historically significant and densely populated city in western Uttar Pradesh, lies in Seismic Zone IV (BIS, 2016), indicating high earthquake risk. Despite its vulnerable alluvial soil and rapid urbanization, no detailed seismic site characterization has been conducted for this region. This study aims to characterize the seismic response of Mathura using the Horizontal-to-Vertical Spectral Ratio (HVSR) technique, a simple, non-invasive, and cost-effective method based on ambient noise recordings. Microtremor data will be collected using a three-component seismograph at multiple sites, and analyzed following SESAME (2004) guidelines to estimate dominant frequency and amplification factors. Empirical relations (Ghofrani & Atkinson, 2014) will be applied to derive Vs30 values and classify soil types using NEHRP standards. The resulting maps of fundamental frequency and Vs30 will help identify zones of high ground motion amplification and guide earthquake-resistant design and urban planning. The novelty of this research lies in conducting the first detailed HVSR-based seismic site characterization of Mathura, a high-risk yet understudied region. By integrating HVSR-derived parameters with empirical Vs30 estimations, this study will bridge a major knowledge gap and provide baseline data essential for future seismic microzonation, disaster preparedness, and resilient infrastructure development in Mathura.