



Experimental Investigation for Quantifying Damage Considering Soil-Structure Interaction Effect on a Small-Scale Model

Saranika Das¹, Amitesh Baghel¹, Divya Grover¹, Koushik Roy¹

¹Indian Institute of Technology, Patna, India 801106

Abstract

Vibration-based damage detection techniques have gained popularity in structural health monitoring due to their non-destructive nature. Most of the experimental studies on buildings are developed considering fixed-base models without considering the underneath soil effect. The scope of the present study is to develop a realistic scenario of soil-structure interaction (SSI) through a small-scale model. The main objective is to determine structural damage based on the modal parameters by considering flexible base of the structure. For the experimental study, a 6-storey mild steel moment-resisting frame with single-bay on both sides has been designed. The length of the soil mass has been considered such that it imitates free-field response. By similitude laws, a geometric scale factor of 1:60 has been applied to finalize the small-scale model. An equivalent shear beam (ESB) container of aluminum and rubber layers has been developed to replicate soil dynamic response with minimum possible error. Fixed-base and flexible-base experiments have been performed for both the damaged and undamaged cases using APS400 long-stroke shaker. Results showed that structural damage can be localized as well as quantified with efficacy. The novelty of the study lies in modelling the effect of the semi-infinite soil layer under realistic base excitation by operating on a scaled-down model. The study also signifies the influence of SSI in determining structural damage.

Keywords: Damage identification, Soil-structure interaction, Small-scale model