INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS

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Thesis Title: Seismic Behaviour of RC Frame and Wall-frame Systems Supported on Pile Foundations Considering Soil-Structure Interaction.

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SHORT ABSTRACT

The main aim of the study is to investigate the influence of soil-structure interaction (SSI) on the seismic behaviour of RC frame and RC wall-frame systems supported on pile foundations. To realise the objectives of the present study, a rigorous numerical study has been carried out using the finite element (FE) based software framework (OpenSEES). Necessary convergence and validation studies are conducted to establish the efficacy of the numerical model. For numerical studies incorporating SSI, it is essential to model an appropriate extent of the soil domain, while simultaneously ensuring accuracy and computational efficiency. In the present study, simple relationships have been proposed for deciding an optimum lateral extent of the soil domain for different structural widths and levels of soil nonlinearity. The incorporation of soil-pile foundation flexibility modifies the elastic and inelastic behaviour of the RC frame and RC wall-frame systems, which depends on several parameters of the structure and soil-pile foundation system. The elastic behaviour is assessed in terms of the modification of the fixed-base natural period (quantified in terms of modification factor, $MF = T_{SSI} / T_F$). With the aid of Artificial Neural Network (ANN), predictive relationships are proposed for the quick and easy estimation of MF, which are further utilized for estimating effective natural period, T_{SSI}. The influence of SSI on inelastic behaviour of the structures is assessed in terms of the ductility capacity and ductility demands. SSI modifies the yield and ultimate drifts, thereby leading to a modification in the ductility capacity of the RC frame and RC wall-frame systems. Depending on the frame type, configuration, and soil condition, the extent of variation in ductility capacity under SSI is different. SSI modifies the local and global ductility demands of the RC frame and RC wall-frame systems. Besides the properties of the superstructure and the soil-pile foundation system, the extent of modification is also dependent on the extent of nonlinearity experienced by the SSI system. The present study recommends conducting nonlinear SSI study and verifying the response of RC frame and RC wall-frame systems for which their corresponding fixed-base models exhibit inelasticity, represented by the inelastic response reduction factor $R_\mu \geq 2$.