

## **Buildings Founded on Thermal Insulation Layer Subjected to Earthquake Load**

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**Abstract :** The modern energy-efficient houses are often founded on a thermal insulation (TI) layer placed under the building's RC foundation slab. The purpose of the paper is to identify the potential problems of the buildings founded on TI layer from the seismic point of view. The two main goals of the study were to assess the seismic behavior of such buildings, and to search for the critical structural parameters affecting the response of the superstructure as well as of the extruded polystyrene (XPS) layer. As a test building a multi-storeyed RC frame structure with and without the XPS layer under the foundation slab has been investigated utilizing nonlinear dynamic (time-history) and static (pushover) analyses. The structural response has been investigated with reference to the following performance parameters: i) Building's lateral roof displacements, ii) Edge compressive and shear strains of the XPS, iii) Horizontal accelerations of the superstructure, iv) Plastic hinge patterns of the superstructure, v) Part of the foundation in compression, and vi) Deformations of the underlying soil and vertical displacements of the foundation slab (i.e. identifying the potential uplift). The results have shown that in the case of higher and stiff structures lying on firm soil the use of XPS under the foundation slab might induce amplified structural peak responses compared to the building models without XPS under the foundation slab. The analysis has revealed that the superstructure as well as the XPS response is substantially affected by the stiffness of the foundation slab.

**Keywords :** extruded polystyrene (XPS), foundation on thermal insulation, energy-efficient buildings, nonlinear seismic analysis, seismic response, soil-structure interaction

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