On assignment in Istanbul: Retrofitting for 0.4g

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Summary

The paper covers the seismic evaluation and upgrading of an existing 20 - storey hotel building for compliance with a peak ground acceleration of 0.4g in the city of Istanbul. The assignment was performed by SECO. It was finalised only recently and lasted for about 6 years. The implementation of the strengthening design into an operating hotel proved to be an exciting challenge. The standard storey area of the building is about 35.000 m². The building's structure comprises an (in plan view) S-shaped classical reinforced concrete frame of beams, columns and slabs, divided by 2 joints in 3 independent blocks, but disturbed by the presence of some major irregularities. Quite an experience ...

Keywords: Recent notable project, retrofitting, evaluation and retrofit, buildings, displacement-based design, elastoplastic ductility, capacitive designing

Abstract

An elastic analysis of an existing 20-storey reinforced concrete moment resisting frame divided in 3 blocks shows that beams supported on corbels of the adjacent block at the expansion joint loose their support when each independent block vibrate on its own under earthquake. Different reconnection hypothesis were considered, ranging from fixing totally each block to the adjacent one to more flexible options leaving some free relative move between blocks. An elastic modal superposition followed by a pushover analysis considering the final reconnection principle were made. The degrees of freedom of the joint reconnections were observed to be an important parameter. The solution found leaves a free relative rotational move between blocks and a flexible translational movement, so that forces at the connection do not become uselessly high. The springs used (long tie rods) work essentially elastically so that no permanent relative displacement exists between blocks after an earthquake.

1. Introduction

Building collision, commonly called 'pounding', occurs during an earthquake when, due to their different dynamic characteristics, adjacent buildings vibrate out of phase and the at-rest separation is insufficient to accommodate their relative motions. Pounding between adjacent structures such as buildings or bridges or between parts of the same structure during major earthquakes has often been reported. Both high and low-rise inadequately separated adjacent structures are susceptible to damages induced by poundings.

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