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FACULTY OF ENGINEERING

MONITORING OF BUILDINGS STRUCTURES IN MADINAH

BY

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STATEMENT

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ABSTRACT

The present thesis deals with the monitoring of buildings structures in Madinah of Saudi Arabia through field ambient vibration tests. The work done includes an extensive survey on the empirical relationship for estimating the fundamental period of RC building, determination of the dynamic characteristic of existing building through field tests measurement, different techniques to simulate infill walls in seismic analysis. Detailed review is given for earthquake Seismology in Saudi Arabia, including tectonics of the Arabian Plate, earthquake map, sites seismic monitoring stations and Earthquake Risk.

Field ambient vibration tests have been carried out for 32 RC buildings in the Madinah of Saudi Arabia in order to determine their dynamic characteristic, i e. frequencies and mode shapes. For each tested building, general information about its geometry and the measured modal parameters corresponding to the first three modes of vibration has been illustrated in plots and tables. From these modal parameters data, expressions for the fundamental period of typical RC buildings in Madinah region have been proposed.

The basic important algorithms for nonlinear pushover analysis methods have been described. These methods include the Coefficient Method of Displacement, the Coefficient Method of Displacement Modification, Capacity-Spectrum Method of Equivalent Linearization, and Improved Capacity-Spectrum Method of Equivalent Linearization. Different techniques to simulate infill walls have been studied through comparative example for single storey RC frame. From the results of pushover and dynamic characteristics analysis, modified equation for modeling of infill of RC building as equivalent link member has been proposed.

Further, two existing RC buildings in Madinah have been seismically evaluated with and without infill wall and their dynamic characteristic are compared with measured values in the field. After, updated the mathematical models for these two building with the experimental results, 3D pushover analysis has been carried out using a commercial software incorporating inelastic material behavior for concrete, infill and steel. The hinge status at target displacement, capacity diagram, demand diagram, ductility reduction factor, and structural over-strength for these buildings are determined and compared with seismic code requirements. The effect of changing the brick clad wall compressive strength values on the overall performance of a structural system, strength and deformation demands in design has been investigated. Summary, conclusions and important recommendations for future extension of the research work done within the thesis are presented.

Keywords: pushover analysis, infill walls, RC buildings, madinah , dynamic characteristic

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