

# SEISMIC VULNERABILITY ASSESSMENT AND RETROFITTING OF EXISTING REINFORCED CONCRETE BUILDINGS

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*PROJECT3: TYPICAL APPLICATIONS AND MONITORING OF REHABILITATED  
STRUCTURES*

## **TENTATIVE DISCUSSION HEADINGS**

### **Typical Applications**

Over the last 30 years or so, a growing number of buildings have been subjected to structural interventions at different levels in the Balkan area following earthquakes. There exist many common traits among the type of urban buildings built in those countries, and multistory reinforced concrete. It is recognized that early applications were probably useful in restoring gravity load carrying capacity because column jacketing or use of epoxies were prevalent. Later intervention procedures probably accounted for restoration of lateral capacity more realistically because combinations of structural walls, in-fills, and braces were utilized, leaving individual element restoration to the domain of architectural improvement. Many of these techniques have stemmed from laboratory experiments of varying quality and scale, and some measure of difficulty exists on how they could be extrapolated. So the question of how well a given retrofitted building would perform if it were subjected again to strong ground motions awaits confirmation through full-scale monitoring.

I believe we should build consensus to cover the following items:

- What is the typology of the average retrofitted building in the partner countries?
- What type of an intervention was conducted on these? Does experimental data form the background material for the method chosen? How reliable are these results? Can they be extended to full-scale structures with confidence?
- Do we have any background material for judging the long-term success of any of these?
- What are the rational measures for acceptable levels of intervention? What level of strengthening would be appropriate for which class of building? Can performance criteria be established for them?
- Is there a need to include a wider array of buildings? If so, which types would these be?

## Monitoring

The ultimate test of whether a given intervention could be judged to have been a success needs to be answered through a natural test-another earthquake. This is seldom possible. I think a survey of the technical literature for inclusion as an appendix would be useful. Enabling a well-designed test case requires a building for which detailed post - earthquake assessment and condition reports are available. As a sequel, the as-built retrofit design must be at hand as well. In most cases “instrumented” buildings are those that are equipped with only accelerometers at suitable locations (not always optimal however), whose output, if properly processed, yields displacements if it is subjected to a renewal of ground shaking. I am not aware of a full-scale, fully instrumented, retrofitted building that has been struck by renewed earthquake activity, though such may have been the case in Japan. Items that require discussion would include the following:

- What should be the level of instrumentation? Should provisions be made for strain measurements? Do we have the technology that would permit accurate measurements of structural response quantities?
- Do GPS or interferometer technologies have a potential in monitoring activities?
- Do we have the necessary background in calibrating observed response with performance criteria for retrofitted buildings?