

Cost–Performance Evaluation of Seismic Retrofit Solutions for URM and Confined Masonry Buildings

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Abstract. Economic factors have a final say on the retrofitting of existing buildings when there is an economic constraint, usually in the form of funding constraints for large scale strengthening programs. In such cases, the retrofit strategy to adopt must be chosen to achieve the criterion of economic efficiency. In this research, retrofit cost and change in structural performance are related by examining two residential masonry buildings in Kruja, Albania. These buildings represent two typical structural types; unreinforced masonry (URM) and weakly confined (CM). Both structures were heavily damaged in the earthquake and fell into the condition category DS-4 (Damaged State) prior to designing for retrofit. Retrofit performance-based measures were based on a performance approach; the retrofit measures were quantified based on detailed construction cost estimates prepared from actual project documentation. The cost effectiveness of retrofit measures was estimated based on the retrofit cost and the capacity and damage reduction performance improvement. Comparative indicators such as cost per increase in base shear capacity and cost relative to replacement value were used to assess the effectiveness of the strengthening strategies. Results indicate that although both buildings benefit from retrofit interventions, the economic efficiency differs between the two structural systems. For weakly confined masonry structures, higher levels of retrofit expenditure may result in relatively smaller effectiveness improvements. The results provide a useful reference to decision makers involved in seismic risk mitigation and emphasize the need to combine the assessment of structure behaviour with economic factors in establishing retrofit goals.

Keywords: Seismic retrofit cost; Cost–benefit analysis; Masonry buildings; URM; Confined masonry; Seismic performance.

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