

Seismic vulnerability of heritage churches in Québec: the néo-roman typology

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ABSTRACT

Several seismic events have demonstrated the vulnerability of masonry churches. The long seismic history in the Italian territory has provided materials to observe and to study the structural performance of churches. Since the 1976 Friuli earthquake many studies have contributed to the definition of specific damage and vulnerability assessment methods for churches, based on the identification of macro-elements and kinematic mechanisms [1, 2]. In this context, the paper presents the application of the Italian vulnerability assessment methodology [3] to a case study representative of the néo-roman church typology in Montreal, Québec. The study is part of a collaborative project between Politecnico di Milano and École de Technologie Supérieure of Montreal. The relevance of such a study derives from the moderate seismicity of Montreal associated to a high density of churches. Starting from a previous inventory of 108 churches in Montreal Island, the néo-roman church typology was selected to be investigated. Specificities of this typology are the position of the bell tower in the middle of the façade and the interaction between the timber structure and masonry walls. This combination between the façade and bell tower macro-elements requires to reconsider the mechanisms associated to these elements. In light of territorial specificities (materials and macro-element combination) [4], the original methodology is adapted to consider the local construction techniques used in Québec churches [5]. A detailed survey of the roof and bell tower timber structures of a néo-roman church was done, and a 3-D numerical model was developed for a better understanding of this type of structure. Modal analysis of the complete 3D-model was then carried out considering the interconnection between the timber and masonry structures. The structural behaviour of the néo-roman church typology was assessed recurring to the consolidated Italian methodology including the specificities of construction techniques in the Canadian territory.

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