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Aseismic Stiffening of Architectural Buildings as Preventive Restoration Using Unconventional Materials

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Abstract : In the proposed design concept, laminated glass and laminated plexiglass, as ”unconventional materials”, are considered as a filling in a steel frame on which they overlap by the intermediate rubber layer, thereby forming a composite assembly. In this way vertical elements of stiffening are formed, capable for reception of seismic force and integrated into the structural system of the building. The applicability of such a system was verified by experiments in laboratory conditions where the experimental models based on laminated glass and laminated plexiglass had been exposed to the cyclic loads that simulate the seismic force. In this way the load capacity of composite assemblies was tested for the effects of dynamic load that was parallel to assembly plane. Thus, the stress intensity to which composite systems might be exposed was determined as well as the range of the structure stiffening referring to the expressed deformation along with the advantages of a particular type of filling compared to the other one. Using specialized software whose operation is based on the finite element method, a computer model of the structure was created and processed in the case study; the same computer model was used for analyzing the problem in the first phase of the design process. The stiffening system based on composite assemblies tested in laboratories is implemented in the computer model. The results of the modal analysis and seismic calculation from the computer model with stiffeners applied showed an efficacy of such a solution, thus rounding the design procedures for aseismic stiffening by using unconventional materials.

Keywords : laminated glass, laminated plexiglass, aseismic stiffening, experiment, laboratory testing, computer model, finite element method
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