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INVESTIGATION OF DYNAMIC PERFORMANCE OF REINFORCED CONCRETE POLYMER WALLS (RBS)

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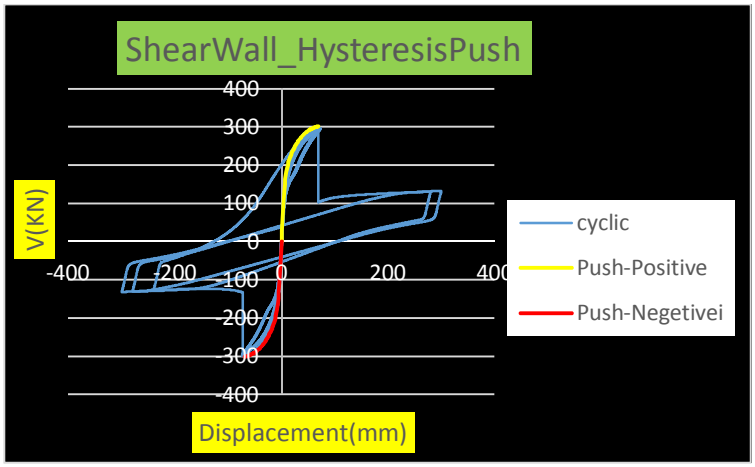
The RBS construction system is a reinforced concrete shear wall made with durable PVC molds. The system consists of highly resistant polymer components; these components have the permanent shape of variety of mold for all types of concrete walls, and these durable polymeric casts are loaded against the gravity and lateral loadings. The material is composed from polystyrene and some specific additives. After concreting, these forms remain in place and act as permanent polymer finishing wall. In this system, concrete walls are mainly used and other structural members such as columns and beams are also used with specific details as suggested by the manufacturer.

The purpose of this paper is to demonstrate the RBS construction system and its performance level, and description of the behavior of reinforced concrete shear walls with resilient polymer mold, and its behavior comparison with conventional reinforced concrete shear wall under various loading conditions.

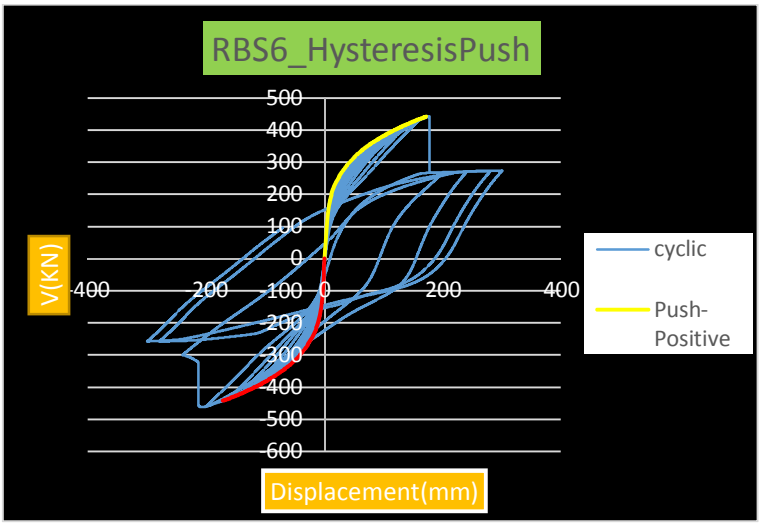
In this paper, the performance of the RBS walls are examined under cyclic loading. The results show that the seismic performance of the RBS shear wall are exceptional compared to ordinary reinforced concrete shear walls. Chahrour et al. (2005 and 2006) have conducted research on the single structural element of RBS shear wall and have achieved reasonable results. Also Shayanfar et al. (2018) have examined a 5-story building in this regard.

In the latter, they designed this building once with a common ordinary reinforced concrete wall and once with a RBS encased structural wall. In this research, at first a conventional reinforced concrete shear wall of the building was designed linearly by ETABS software, afterwards the building was analyzed nonlinearly by OpenSees source coding software. The same procedure was followed for the reinforced concrete building with a durable polymer mold and the final results were obtained. The main behavioral differences between these two structures appeared in their nonlinear analysis responses. The presence of a polymer in the structural wall of RBS with the elastic modulus 2900 MPa and ultimate strength 40 MPa caused remarkable response differences between these two structures. It should be noted that RBS wall in this investigation is RBS6, which is the most appropriate type of RBS for design of shear wall with thickness 150 mm and a width of 4000 mm. These structures were subjected to earthquake and their responses obtained by means of static nonlinear analysis (pushover). The results reveal improved seismic performance of RBS compared to ordinary wall.

In the current article, the two aforementioned 5-story buildings were subjected to cyclic loads according to ASCE protocol as illustrated in the following page. The accumulated damping energies of each structure during subsequent cycles were calculated separately, by MATLAB software, and the results show that the overall dissipated energy of RBS shear wall was 2.5 times higher than the corresponding value for ordinary concrete shear wall. Subsequently, the pushover curves for each wall were depicted and aligned on their hysteresis curves as can be seen in Figure 1 scrutiny. The results show higher strength, stiffness and energy dissipation for RBS walls compared to ordinary wall. The envelope curve of the cyclic responses for the two walls are closely follow the pushover results.



(a)



(b)

Figure 1. Comparison of load-displacement curves for: (a) ordinary concrete shear wall, and (b) RBS shear wall under cyclic and pushover analyses. (Shayanfar et al, 2018).

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