Seminar no. 2

A Generalized Newmark Method with displacement hardening for the prediction of seismic performance of diaphragm walls

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Seismic Performance–Based Design (PBD) of retaining structures relies upon a displacement–based approach, where the seismic demand is quantified by the permanent displacement induced by the design earthquake, and the system capacity is defined as the maximum allowable residual displacement for the limit state under consideration. The design process typically involves an iterative procedure, where seismic demand and capacity are systematically compared until all performance objectives are achieved (Kramer, 2014). It follows that a simple method for computing seismic displacements is essential for an effective implementation of the PBD methodology in standard design.

This seminar focuses on recently proposed Generalized Newmark Method (GNM) which incorporates a displacement hardening mechanism for the prediction of permanent displacements accumulated by diaphragm walls during earthquakes. A key feature of the proposed approach is the adoption of an evolution law for the critical acceleration, which links its current value to the accumulated wall permanent displacements. This displacement hardening mechanism is based on a simplified relation between the average plastic shear deformations experienced by the passive zone of soil below dredge level and the mobilized soil friction angle. This relation is determined indirectly by the evolution of the passive earth pressure coefficient with wall displacement/rotation, as obtained in quasi–static model wall experiments. The proposed approach has been validated by comparing its predictions with the experimental data obtained in centrifuge model tests of cantilevered and propped walls. In spite of the simplifying assumptions on which it is based, the GNM has demonstrated capable of capturing the essential features of the retaining structures kinematics and provides realistic predictions of permanent wall displacements.