Analyses of liquefaction effects for an interbedded soil deposit: Çark Canal in the 1999 M7.5 Kocaeli Earthquake

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The performance of Çark Canal in the 1999 M=7.5 Kocaeli earthquake is evaluated using common liquefaction vulnerability index (LVI) methods, a nonlinear dynamic analysis (NDA) method, and a Newmark sliding block method to examine possible factors contributing to why different analysis approaches often overestimate liquefaction effects in interbedded deposits. The characterization of the interbedded fluvial stratum based on cone penetration test (CPT) data utilized an inverse filtering procedure to correct CPT data for thin layer and transition zone effects. Common LVIs computed using the measured and inverse filtered CPT data with a site-specific fines content calibration show that the combination of these two steps reduce the LVIs by 30-50% for this site and seismic loading. Two-dimensional NDAs are performed using stochastic realizations for the interbedded stratum and the PM4Sand and PM4Silt constitutive models for the sand-like and clay-like portions, respectively. Computed deformations are evaluated for their sensitivity to stochastic model parameters, the cyclic strength assigned to the sand-like soils, the undrained shear strengths assigned to the clay-like soils, the level of shaking, and other input parameters. Newmark sliding block analyses are performed with different allowances for how inter-bedding influences the composite strength of the interbedded stratum. The differences between results obtained with these analysis methods, along with those presented by Youd et al. (2009), provide insights on how the various factors can contribute to an over-estimation of ground deformations in interbedded deposits of sands, silts, and clays.

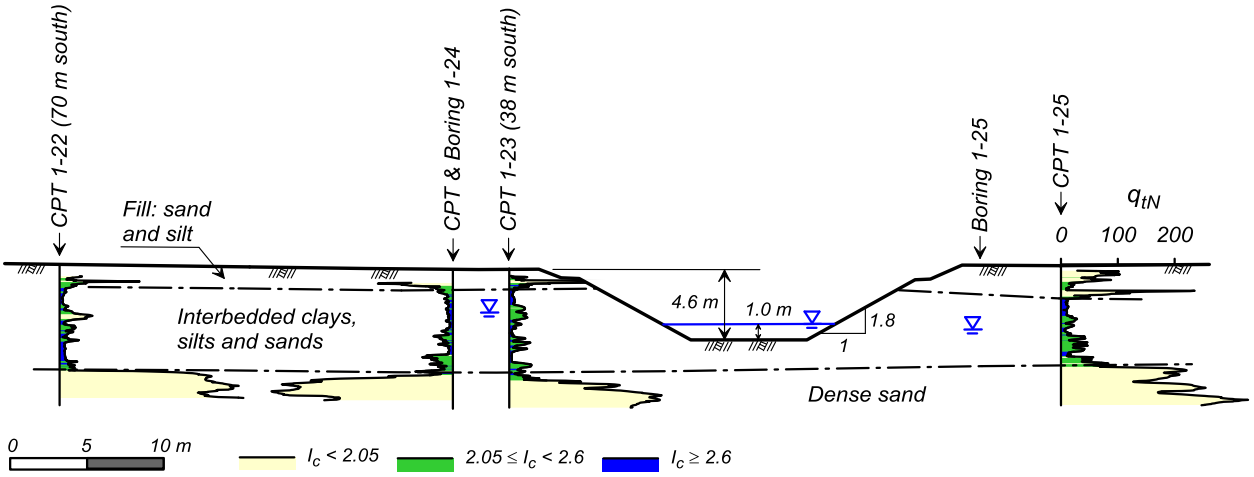

Figure. Cross section of canal showing CPT profiles (data from Youd et al. 2009)