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The use of MSE walls backfilled with Lightweight Cellular Concrete in soft ground seismic areas

Numerical analyses were performed on a Mechanically Stabilized Earth (MSE) wall that used Lightweight Cellular Concrete (LCC) instead of soil as infill. The wall geometry and input ground motions were based on a wall recently built for the Silicon Valley Rapid Transit (SVRT) system near San Francisco, California. For our analyses, the LCC-MSE wall was significantly weakened in our numerical models by using shortened geogrid lengths, and lower material strengths than the constructed wall. In spite of the weakened nature of the wall analyzed herein, seismic failure of the LCC materials and supporting ground was not predicted. Analysis results show that well designed LCCMSE walls tend to move dynamically in a quasi-rigid fashion, i.e., that they move mainly laterally and do not exhibit major rocking or seismic settlements. Additionally, because of their broad base of MSE walls, these walls distribute compressive and shear stresses to the underlying ground in a relatively even manner. Our numerical analyses also show that internal reinforcement of LCC-MSE walls is important to restrain side panels during earthquakes, but that the inertial loads from the panels are quickly transferred to the LCC. Hence, that long or continuous reinforcements are not needed for seismic stability. In summary, our analyses show that LCC is an excellent material for MSE walls and that the lightening of vertical loads that LCC provides has distinct seismic advantages in soft ground seismic areas, e.g., the elimination of ground improvement.

Dr. Daniel Pradel is a Professor of Practice at The Ohio State University in Geotechnical Engineering. Previously he was Vice-President of Shannon & Wilson in Glendale, California, and an Adjunct Associate Professor in the Department of Civil & Environmental Engineering at UCLA. He holds a Certificate of Postdoctoral Studies from UCLA, a Ph.D. from the University of Tokyo in Soil Mechanics and Foundation Engineering, and a Diploma from the Swiss Institute of Technology in Lausanne.

Dr. Pradel is currently registered as GE in California and PE in the CA, HI, UT, and NV. His areas of expertise include Slope Stability and Geo-mechanical Numerical Modeling. He has performed numerous reconnaissance visits after major natural hazard events such as Earthquakes, Landslides and Hurricanes. He is a Fellow of the American Society of Civil Engineers, and a Diplomate of the Academy of Geo-Professionals. He is a member of several ASCE-GI committees, including Embankments, Dams and Slopes, Retaining Walls, Awards, and the AGP Examination committees. In the Deep Foundation Institute he is a member of the Slope Stabilization and Foundation Testing committees. He is a member of the ASCE Committee on Accreditation Operations, and has been serving as an evaluator of ABET since 2008. Between 2007 and 2012 he served on the board of the ASCE Geotechnical & Geoenvironmental Journal (JGGE) where he became Associate Editor.