UC Berkeley Geosystems Group
Wednesday Lecture Series

Wednesday, August 30, 2023
12:10 – 1:00 PM
Lecture Room: 406 Davis Hall

TBM TUNNEL REPAIR USING A SECANT “HORSESHOE” COMPRESSION SHORING SYSTEM

Lisheng Shao, Malcolm Drilling

In Detroit, Michigan, a Tunnel Boring Machine (TBM) was damaged during the construction of a 16-foot storage and drainage tunnel. The TBM's shield, cutting head, and interior components needed to be replaced, along with several completed tunnel segments. To repair the tunnel liner and critical components, the tunneling contractor needed a repair shaft with a depth of 99 feet and an unobstructed plan dimension of 50 feet. However, the use of internally braced excavation solutions was not feasible. To resolve the issue, a unique compression ring was analyzed, but it couldn't close at depth due to the existing tunnel liner. Thus, an innovative solution using a "horseshoe" compression shoring system was developed below the tunnel's crown. The 3D soil-structure interaction around the "horseshoe" was analyzed using PLAXIS to determine the concentrated stress and deformations generated by the opening in the compression ring. Despite tight installation tolerances, the project was successfully completed. This talk presents the site conditions, innovative geo-structure design, 3D FEM analysis, construction, and challenges associated with this repair shaft.

Dr. Lisheng Shao is a professional and geotechnical engineer registered in California, North Carolina, Hawaii, and Alberta. Shao will be based in Malcolm’s corporate office in San Francisco with the responsibilities of ground improvement design, analysis, quality control, and technology development throughout the country. He has extensive experience on liquefaction mitigation, soft soil improvement, excavation support, and dam rehabilitation, employing vibro stone columns, soil mixing, jet grouting, micropiles, and groutings.