Memo

To: David Stevens, Project Manager, Utah DOT, Research Division, email: davidstevens@utah.gov
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Re: Task 5 Memo reporting completion of fixed-head lateral pile load testing.

We have completed lateral load tests on four square fixed-head piles located at distances of 2, 3, 4, and 5 pile diameters (D) from the center of the pile to the back face of the MSE wall. The test piles consisted of 12-inch square steel tube piles that extended through the 20 feet MSE backfill and 20 feet into the underlying silty sands. The pile head was restrained from rotation using 2 feet thick pile caps that extended approximately 2.5 feet beyond the test piles. We placed smooth steel rollers between the pile cap and the underlying ground to reduce interface friction and provide a normal force on the pile that restricted rotation during loading. Although this did not prevent all rotation, the rotation was significantly reduced and would likely be similar to that for a real bridge abutment.

We performed these tests at the simulated bridge abutment constructed at the point of the mountain. To create a virgin loading condition, without reconstructing the entire wall, the backfill soil was excavated to the top of the third layer of reinforcements or 6.25 ft. Because the lateral resistance of the piles near the MSE wall is primarily dominated by the soil stiffness and reinforcements in the shallow layers, this approach produced an MSE wall and backfill that was similar to the virgin condition. The original welded wire grid and ribbed strip reinforcements were destroyed in the excavation process but were replaced with new reinforcements with new strain gauges. Therefore, the tensile force distribution in the reinforcements could be measured during the lateral pile load testing. In addition to lateral load-deflection, bending moment was measured with depth in each pile. Furthermore, ground deflection, failure planes, and wall movement were measured during lateral pile loading.

Despite the change in the pile head boundary condition, the tests did show a reduction in lateral resistance as the pile were placed closer to the MSE wall as shown by the pile head load-deflection curves in Fig. 1. Previous studies on free-head piles indicated that lateral pile resistance was largely unaffected by the presence of the MSE wall when piles were placed more than about 4D behind the wall, but reduced resistance occurred for piles closer to the wall. Similarly, for these fixed-head tests relatively little reduction in resistance is observed for the pile at 4D in comparison to the pile at 5D. However, the piles located at 3D and 2D behind the wall experienced progressively greater reductions in resistance, as expected.

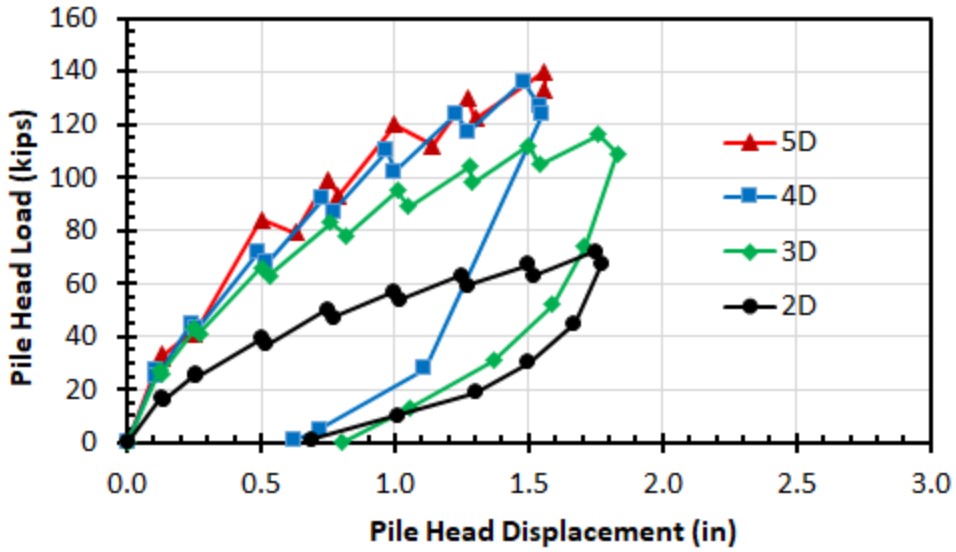

Fig. 1 Measured lateral pile head load versus deflection curves for fixed head test piles located at 2, 3, 4, and 5 pile widths (D) behind the wall. (Preliminary results based on measurements during field testing.)