

# 2017 UDOT RESEARCH PROBLEM STATEMENT

\*\*\* *Problem statement deadline is March 5, 2017. Submit statements to Vincent Liu at [vlou@utah.gov](mailto:vlou@utah.gov). \*\*\**

**Title:** Lateral Pile Resistance for Fixed-Head Piles Near MSE Walls

**No. (office use):** 17.04.04

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**Select ONE Subject Area**  Materials/Pavements  Maintenance  Traffic Mgmt/Safety  Structures/Geotechnical  
 Preconstruction  Planning  Data Analytics  Public Transportation

## 1. Describe the problem to be addressed:

Recent Pooled-Fund research has led to the development of equations to account for reduced lateral pile resistance and increased reinforcement forces for laterally loaded piles near MSE walls. This research was largely carried out on single 12 inch diameter piles under free-head conditions. Additional testing would be desirable to confirm and expand the applicability of the approach for fixed-head piles which are more realistic representations of typical bridge abutments. Fixed-head piles are stiffer and develop higher forces and bending moments as a function of pile deflection. This effort could be carried out rather efficiently using the test facility developed for previous testing and leveraging the effort with in-kind contributions from industry partners. .

## 2. Explain why this research is important:

Previous research has indicated that lateral pile resistance decreases significantly when piles are located closer than about four pile diameters behind an MSE wall face. In addition, lateral force on the reinforcements increases as piles are loaded laterally. Increasingly, bridge abutment piles are placed near MSE wall faces and engineers must account for the effect of the wall. No tests are presently available to confirm how a more realistic pile head fixity would influence the results obtained from previous tests. These tests would help eliminate remaining questions regarding the applicability of the research for inclusion in AASHTO codes.

## 3. List the research objective(s):

1. Measure reduction in lateral pile resistance for fixed-head piles placed at different distances behind an MSE wall
2. Measure tensile force-distribution developed in MSE reinforcements owing to lateral pile load of fixed-head piles
3. Develop reduction factors (p-multipliers) to account for pile-MSE wall interaction and compare with results from previous free-head tests
4. Develop equations to predict increased force in the reinforcements

## 4. List the major tasks:

1. Excavate top 6.5 ft of soil at Point of the Mountain test site and recompact soil around instrumented reinforcements
2. Construct pile caps atop each test pile and conduct lateral load tests on piles at 2, 3, 4, and 5 diameters behind the MSE wall
3. Reduce data and prepare relevant plots showing the test results
4. Develop p-multipliers to account for the presence of the wall and consider need for separate correlation.
5. Develop equations to predict the force induced in the reinforcement and compare with previous general equations
6. Prepare final report along with papers for journals and conferences to disseminate results.
7. Conduct implementation seminars as needed.

## 5. List the expected results:

- ~~1. P-multipliers to account for lateral resistance with distance from the MSE wall for fixed-head piles~~
2. Equations to predict tensile force that develops in the reinforcements for fixed-head piles

**6. Describe how the research results will be implemented:**

P-multipliers can be directly applied in LPILE analyses that are currently performed on piles. Tensile forces can be used in computing pull-out resistance of reinforcements in MSE wall design procedures.

**7. Requested from UDOT: \$40,000**  
**(or UTA for Public Transportation)**

**Other/Matching Funds: \$**

**Total Cost: \$40,000**

**8. Outline the proposed schedule, including start and major event dates:**