

2019 UDOT RESEARCH PROBLEM STATEMENT

*** Problem statement deadline is Feb. 6, 2019. Submit statements to UTRAC@utah.gov. ***

Title: Improved detailing practices and specifications for grouted splice couplers

No. (Office Use): 19.04.01

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Select **ONE** Subject Area Materials/Pavements Maintenance Traffic Mgmt/Safety Structures/Geotech
 Planning Perf Mgmt/Data Analytics Public Transportation Other

1. Describe the problem to be addressed:

Recent experiments of column to footing joints of prefabricated concrete components connected with grouted couplers have shown encouraging results. However, only two tests were carried out and each had different details. The current UDOT Structures Design and Detailing Manual (SDDM, 2017) has recommendations for grouted couplers as part of Prefabricated Bridge Elements and Systems (PBES). There are some uncertainties/unknowns that could benefit from additional research particularly when it comes to providing additional data points to assure performance. Moreover, it is important to be able to develop new details for expanding current research to provide better ductility to grouted splice couplers to match Cast-In-Place (CIP) details.

2. Write the project objective (25 words or less):

Provide assurance that PBES can achieve ductility similar to CIP detailing, while providing guidance for updating the Standards and SDDM with associated design implications.

3. Explain why this research is important:

(In response, consider addressing specific UDOT goals, applicability in Utah or other states, etc.)

- Innovation by showing the benefits of Accelerated Bridge Construction with seismic details between prefabricated components. Build enough confidence and provide assurance that prefabricated components can achieve similar ductility to cast-in-place details.
- Evaluate several options for constructing PBES systems with superior seismic details and guidance for updating the SDDM.
- Report on new details that will be developed and the implication for future designs.

4. List the major tasks:

- Evaluate existing grouted splice coupler design details.
- Perform small-scale tests to determine debonding details of steel bars, and grouted splice sleeve performance for oversized sleeves with respect to steel bar diameter. The debonding method affects the initial stiffness of the specimen and this has implications for the dynamic response of the bridge. The SDDM recommends that the grouted splice sleeve should be one size larger than the steel reinforcement diameter, however this must be evaluated and confirmed with small-scale tension tests.
- Perform cyclic tests of two half-scale column-to-footing connections with improved details. The specific details will be obtained from the results of Task 2. The first half-scale specimen will be built with the new debonding details and a grouted splice sleeve coupler equal in size to the bar diameter. For improved constructability, the second specimen will be built with the new debonding details and a grouted splice sleeve coupler one size larger than the steel bar diameter. The performance of the two specimens will then be compared.
- Perform pushover analysis to simulate the experimental results. Suggest improved design and construction details and modify the specifications.

5. List the expected deliverables (reports, manual, specification, design method, training, etc.):

1. Evaluation report of existing grouted splice sleeve coupler details
2. Report on small-scale debonding detail tests and oversized grouted splice sleeve couplers with respect to steel bar diameter
3. Determination of best design practices for constructing superior seismic connections using grouted splice sleeve couplers to provide better ductility

**6. Describe how the research results will be implemented:
(In response, consider addressing UDOT leader support, process or standard improvement, etc.)**

1. Add findings to UDOT's SDDM and Specifications to be used in future projects
2. Develop detailed drawings for superior seismic connections in PBES in ABS of bridge structures
3. Provide rigorous and simplified analysis methods to UDOT personnel for conducting pushover analysis of PBES constructed with grouted splice sleeve couplers

**7. Requested from UDOT: \$50K
(or UTA for Public Transportation)**

Other/Matching Funds: \$40K

Total Cost: \$90K

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

The proposed schedule shown below assumes a starting data of July 1, 2019 and a period of performance of one year. If the actual starting date and/or period of performance are different, the schedule will be adjusted accordingly.

Task *a*: July-December 2019
Tasks *b*: August-December 2019
Tasks *c*: November 2019 – May 2020
Task *d*: January-June 2020