This request is open to Florida universities with an executed Master University Agreement on file with the Florida Department of Transportation.

The Research Center request written proposals to provide research services to quantify the bearing capacity of permanent steel sheet pile walls. Evaluate both the friction and bearing components. Develop practical recommendations for designers to estimate the bearing capacity of steel sheet pile wells, and develop practical methods to determine and verify the bearing capacity in the field.

Details of the Services are described in Exhibit “A”, Scope of Services, attached hereto.

The basis form of Agreement shall be a task work order issued under the Master University Agreement by the Research Center.

The maximum amount of funding available is $360,000.00 and the anticipated timeframe for the project is 36 months.

Proposal Format Instructions:

I. The proposal is limited to 50 pages. The cover page should contain the contact information for an Administrative contact and the Principal Investigator.

II. Provide an Executive Summary which demonstrates knowledge of current practices, recent work, technology, developments and publications that could be used in this project. The Executive Summary should demonstrate and understanding of the theoretical concepts that could be used in this project.

III. Provide a Technical Plan with proposed theoretical and practical approaches to the development of the different tasks of the project. The proposal should include the numerical Modelling approach, small scale Lab load Testing Approach and the approach to establish a field testing protocol.

IV. Provide a Management Plan which explains the approach, capabilities and means to be used to administer and manage the work. The Management Plan should explain the functions and responsibilities of each key person and their experience. The Management Plan should identify equipment and computer capabilities (laboratory, computing equipment, software, and other resources) available for this project.

V. The Price information shall be submitted on the form provided and detailed information provided to support the lump sum amounts identified for each deliverable. Indirect cost is limited to 10%.

Proposal Evaluation:

A Selection Committee will be established to review and evaluate each proposal submitted. The Committee will evaluate each technical proposal and assign points based on the criteria identified
below. The Research Center will review the price information and assign points based on price evaluation formula.

<table>
<thead>
<tr>
<th>Category</th>
<th>Points</th>
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<tr>
<td>Executive Summary</td>
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<td>Technical Plan</td>
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<tr>
<td>Management Plan</td>
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<tr>
<td>Price</td>
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The criteria for price evaluation shall be based upon the following formula:

\[(\text{Low Price/Proposer’s Price}) \times \text{Price points} = \text{Proposer’s Awarded Points}\]

**PLEASE EMAIL PROPOSALS TO:**

Patti Brannon at [patti.brannon@dot.state.fl.us](mailto:patti.brannon@dot.state.fl.us)

Include in the subject line the following information: RFRP-17/18-002 Determining Bearing Resistance of Cantilever Sheet Piles

**PROPOSAL ARE DUE BY NOON ON NOVEMBER 16, 2017.** Proposals received after this date and time will not be accepted.

The Research Center will notify all proposers of the final decision on December 7, 2017.

**Special Notes:**

Proposal will be rejected if more than one proposal is received from a University.

The Research Center intends to award the contract to the responsible and responsive proposer whose proposal is determined to be the most advantageous to the Department.

Any questions related to this request should be directed to Patti Brannon at [patti.brannon@dot.state.fl.us](mailto:patti.brannon@dot.state.fl.us) or (850) 414-4616.
Exhibit A – Scope of Service
Determining Bearing Resistance of Cantilever Sheet Piles

Background Statement

Sheet pile walls are structures that FDOT has used for permanent and temporary lateral support only. The Department has not allowed these elements to be used as vertical load bearing elements because of the inability to confirm bearing resistance during construction.

Current FDOT practice requires discrete deep foundations (piles or drilled shafts) for bearing purposes which may or may not be combined with permanent sheet piles for lateral retaining purposes. Some designers have previously considered using sheet piles to support both vertical bridge loads and lateral earth loads; however, the concept has not survived final design due to the inability to confirm the capacity of these elements in the field and accept them as bearing piles. For end bents of small bridges, there is a potential for realizing savings if we can verify the axial resistance of the sheet piling and eliminate the need for separate deep foundations. This would relieve the complications that arise in construction when driving piles and sheet piles in close proximity.

Project Objective(s)

The objectives of this project are to:

- Quantify the bearing capacity of permanent steel sheet pile walls. Evaluate both the friction and bearing components.
- Develop practical recommendations for designers to estimate the bearing capacity of steel sheet pile walls.
- Develop practical methods to determine and verify the bearing capacity in the field.

Supporting Tasks and Deliverables

Project Kickoff Teleconference

The principal investigator will schedule a kickoff meeting that shall be held within the first 30 days of task work order execution. The kickoff meeting will consist of a webinar at least 30 minutes in length. The purpose of the meeting is to review the tasks, deliverables, deployment plan, timeline, and expected/anticipated project outcomes and their potential for implementation and benefits. The principal investigator shall prepare a presentation following the template provided at http://www.fdot.gov/research/Program_Information/Research.Performance/kickoff.meeting.pdf

The project manager, principal investigator, and research performance coordinator shall attend. Other parties may be invited, if appropriate.

Task 1: Literature Review and Information Collection

Collect and review existing literature and documents dealing with steel sheet piles used as axial load bearing elements. Review design methods, numerical methods and field load testing procedures that have been attempted or performed by others. Identify what current theoretical methods could be used
and evaluated to compare with the results of the small scale lab testing and numerical modelling (Tasks 2 and 3).

Collect information about how the vertical capacity is being tested and verified in the field. Collect any field data, such as static load or dynamic load testing, that is available. Collect information not only from Florida sources but from other states and countries as well. Select methods that will be used for further evaluation during this research.

**Task 1 Deliverable:** Upon completion of Task 1, the Principal Investigator will submit to the Research Center at research.center@dot.state.fl.us a written report that presents the work performed and summarizes the findings in Task 1. The report should present and summarize two main issues: Analysis and Design Practices (current or suggested by others) and Load Testing Methods.

**Task 2: Numerical Modeling**

Develop a numerical model to simulate the bearing capacity mechanism of steel sheet piles. The intent of the numerical model is to use it as a tool that could be used to predict behavior of the sheet pile under vertical loading (load-settlement behavior) and to predict bearing capacity. Use widely accepted numerical methods and computer programs. Identify in detail the soil parameters, loading, size, geometrical and other factors that may affect the bearing capacity of sheet pile walls. If possible, calibrate the model with known closed-form estimates and/or simplified calculations. Perform sufficient number of runs to evaluate whether the results are practical and agree with the range of results obtained from Task 1. Identify in your proposal the number of scenarios you intend to run to properly evaluate the factors that may affect the bearing capacity.

**Task 2 Deliverable:** Upon completion of Task 2, the Principal Investigator will submit to the Research Center at research.center@dot.state.fl.us a written report that presents the work and findings performed during this task. Include a theoretical and practical justification of the numerical model(s) developed during this task, a description of the approach, and how the material properties and other factors are considered in the proposed numerical modelling. Include the results of the parametric study of the influence of the varying factors affecting the bearing capacity of sheet pile walls.

**Task 3: Small Scale Lab Load Tests**

Design and develop small-scale lab load tests to represent the problem at hand to help calibrate and validate the numerical modelling and to compare with the theoretical models. Test several conditions to account for varying factors and to establish reliable conclusions. Compare predictions of current theoretical models with the numerical model and the lab load tests. Evaluate the accuracy of the different evaluated methods. Based on the lab load test results, make adjustments to the numerical modelling and to the theoretical models.

Select or develop an analysis and design methodology that could be easily adopted by designers to estimate capacity and to estimate settlements under service loadings. Perform sufficient numerical model runs and lab testing as required to achieve a reliable methodology. Identify in your proposal the number of scenarios you intend to run and test to properly evaluate the factors that may affect the bearing capacity.
Incorporating the findings from Tasks 2 and 3, recommend a design methodology that can be practically used by designers. Establish practical conclusions and recommendations for design. Develop equations, correlations, charts or other design aids that could be used in the design.

**Task 3 Deliverable:** Upon completion of Task 3, the Principal Investigator will submit to the Research Center at research.center@dot.state.fl.us a written report that presents the work performed during this task and contains the following:

- The lab procedures used to simulate the sheet piling, soil system and loading.
- The report shall also include a summary of the predicted capacities of the evaluated methods and comparisons with the results from the lab load testing and numerical modeling.
- Conclusions about the comparisons of predictions and test results and the evaluated design methods.
- Suggested methodology to estimate load-settlement behavior and bearing capacity. Include equations, correlations, charts or other design aids that were developed during this task.

**Task 4: Field Testing Protocol**

Develop and propose field load test procedures. Evaluate and determine how dynamic testing and static load test can be used for this purpose. Consider what others have done regarding this issue (see Task 1 above). The methods proposed for testing should be practical, so that it can be reasonably evaluated in a subsequent phase of implementation. In addition, the methods proposed should be able to be implemented on FDOT projects without adding significant cost to the project.

Recommend a comprehensive methodology that can be practically used by consultants and designers. Establish practical conclusions and recommendations for geotechnical engineers and construction personnel. Develop a field protocol that could be used to verify the design estimates provided in the recommended design methodology from Task 3.

Also, as part of this task, perform an analysis of potential benefits of implementing steel sheet piles as vertical axial bearing elements. Establish both qualitative and quantitative potential benefits.

**Task 4 Deliverable:** Upon completion of Task 4, the Principal Investigator will submit to the Research Center at research.center@dot.state.fl.us a written report that contains the following:

- Conclusions and recommended methodology for the analysis and design of steel sheet piling as foundations. Include practical equations, correlations and charts of the recommended procedures.
- Proposed procedures, drawings and sketches to illustrate the required devices and equipment needed for both static load testing and dynamic load testing.
- Analysis of potential benefits of using steel sheet piles as bearing elements.
- Recommendations to consider in any following implementation phase of the findings and recommendations from this research.

**Task 5: Draft Final Report and Closeout Teleconference**
Task 5 Deliverable A: Ninety (90) days prior to the end date of the task work order, submit a draft final report to research.center@dot.state.fl.us. The draft final report will contain findings of the proposed study, including (a) recommended design methodology of sheet piling as foundations, including equations, design aids and charts/graphs, (b) field testing protocol be used to verify the design estimates, (c) potential benefits of using steel sheet piles as bearing elements, and (d) recommendations for implementation of findings and recommendations. The draft final and final reports must follow the Guidelines for University Presentation and Publication of Research available at http://www.fdot.gov/research/docs/T2/University.Guidelines.2016.pdf.

The report must be well-written and edited for technical accuracy, grammar, clarity, organization, and format.

Task 5 Deliverable B: Thirty (30) days prior to the end date of the task work order, the principal investigator will schedule a closeout teleconference. The principal investigator shall prepare a Powerpoint presentation following the template provided at http://www.fdot.gov/research/Program_Information/Research.Performance/closeout.meeting.reqs.pdf.

At a minimum, the principal investigator, project manager, and research performance coordinator shall attend. The purpose of the meeting is to review project performance, the deployment plan, and next steps.

Task 6 Final Report

Task 6 Deliverable: Upon Department approval of the draft final report, the university will submit the Final Report in PDF and Word formats electronically to the Research Center at research.center@dot.state.fl.us.

The final report is due by the end date of the task work order.
**Deliverables Schedule**

Note: this document will be used by the Research Center to monitor principal investigator performance and activity on the project. The PI should give careful consideration to the time needed to complete a task(s) and deliverable(s) against current workload. Failure to submit deliverables in a timely manner may result in cancelation of the task work order.

Remember to include kickoff teleconference, submittal of draft final report, closeout teleconference and final report. The Research Center must at a minimum receive a deliverable every 6 months on a project. Failure to submit deliverables in a timely manner may result in cancelation of the task work order.

For planning purposes January 2018 should be used as the anticipated start date for this project.

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<tr>
<th>Deliverable # / Description of Deliverable as provided in the scope (included associated task #)</th>
<th>Anticipated Date of Deliverable Submittal (month/year)</th>
<th>TO BE COMPLETED BY RESEARCH CENTER (performance monitoring)</th>
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Proposer must attach a detailed budget to support the lump sum amount identified per task. If applicable, the following information must be included.

**Use of Subcontractor(s)**

If a subcontractor is to work on the project, describe the work the subcontractor will perform. A scope of work and budget must be provided for the subcontractor.

**Use of Graduate Student(s) and other Research Assistants**

Describe the work any student(s) will perform.

**Equipment**

Florida Administrative Code states “for statewide financial reporting purposes, all tangible personal property with a value or cost of $1,000 or more and having a projected useful life of one year or more must be capitalized. Any hardback book with a value or cost of $25 or more and having a useful life of one year or more that is circulated to students or the general public, and any hardback book with a value or cost of $250 or more that is not circulated must be capitalized. A review of the items on the Exception Property should be performed to ensure items to not fall within this category.

*Universities must adhere to the Department’s $1,000 threshold for equipment or items of lesser value appearing on the Exception Property listing. The university must provide a copy of the purchase invoice/property description/serial number and date of receipt for the equipment with the applicable task invoice.*
A description of the equipment to be purchased must be included with a copy of the quotes obtained. Justification of specific requirements for the project and why the equipment should be purchased instead of leasing (leasing of equipment is preferred) is required for all equipment.

**Expenses**

Describe any expense items to be purchased, if applicable.

**Travel**

*Standard Research Center policy is that travel to conferences is not an allowable expenditure.*

Describe travel that will take place, including justification of the need for travel, if applicable. Include the traveler’s name/position, location(s), purpose and duration.

*If travel is budgeted, the following text must appear, as worded:*

All travel shall be in accordance with Section 112.061, Florida Statutes. Bills for travel expenses specifically authorized in the agreement shall be submitted using the Department’s Travel Form No. 300-000-06, unless the university provides proof of the Department of Financial Services approval to use an alternate travel form. The Department shall not compensate the University for lodging/hotel in excess of $150.00 per day (excluding taxes and fees).

The maximum amount of travel is limited to $(insert amount). The maximum amount of indirect cost on travel is limited to $(insert amount).