FDOT Research Quarterly Summary, May 2021

Completed FDOT Research, February–April 2021

Newly Funded FDOT Research, February–April 2021

Completed FDOT Research, February–April 2021

FDOT Geotechnical Office

- **Comparison of Standard Penetration Test (SPT) N-value with Alternative Field Test Methods in Determining Moduli for Settlement Predictions**

  University of Central Florida researchers identified the most appropriate correlations with standard penetration test N-value (SPT-N) in order to obtain the most accurate modulus values compared to current practice of engineers using general correlations. In addition, the researchers identified supplemental field test methods that can yield modulus values which are even more accurate than those from SPT-N correlations in calculating the settlements. The effort was based on performance results using actual field settlement measurements under controlled conditions.

  Project number: BDV24-977-29
  Principal investigator: Luis Chopra, University of Central Florida
  Project manager: Larry Jones, FDOT Geotechnical Office

  [Read the Project Summary] ***[Read the Final Report]***

FDOT Materials Office

- **Evaluation of Self Consolidating Concrete and Class IV Concrete Flow in Drilled Shafts**

  University of South Florida researchers identified how self-consolidating concretes can be applied to drilled shaft applications with the ultimate goal of identifying a suitable mix design and/or mix criteria for typical Florida conditions.

  Project number: BDV25-977-25
  Principal investigator: Gray Mullins and Abla Zayed, University of South Florida
  Project manager: Harvey DeFord, FDOT Materials Office

  [Read the Project Summary] ***[Read the Final Report]***

FDOT Planning Office

- **Life Cycle Costs and Benefits Analysis of Freight Transportation Projects**

  University of Florida researchers developed a methodology and update the Florida Freight Transportation Economic Impact Kit (FreighTEC; based on FreightSIM) to forecast project travel time gains, project costs and benefits, and direct and indirect induced impacts over both the lifecycle and any given year of a freight transportation project. Several add-on functions were developed for FreighTEC. These new functions enable FreighTEC to estimate the total costs and benefits of the entire lifecycle of a freight transportation project as well as evaluate detailed costs and benefits for any specific year.

  Project number: BDV31-977-119
  Principal investigator: Zhong-Ren Peng, University of Florida
  Project manager: S. Tabatabaee, FDOT Planning Office

  [Read the Project Summary] ***[Read the Final Report]***

FDOT Public Transportation Office

- **Assessment of 5310 Program Utilization and Development of Strategies to Optimize Mobility Services for Seniors and Persons with Disabilities**

  University of South Florida researchers identified and analyzed demographic data for target populations; reviewed 5310 program parameters, and district-wide geographies. They examined historical 5310 grantee projects and results and assessed mobility services and major origin-destination trip attractors. The researchers compiled 5310 program strategies for assessing needs, identified opportunities to develop services and promote partnerships with eligible applicants. They established techniques and templates to periodically analyze needs, opportunities, and assessment of 5310 grant program administration.

  Project number: BDV25-977-55
  Principal investigator: Martin Catala, University of South Florida, Tampa
  Project manager: Paul Simmons, FDOT Public Transportation Office

  [Read the Project Summary] ***[Read the Final Report]***

- **University of Florida Testbed Initiative - Transit Components (Smart Bus Bike Rack System)**

  University of Florida researchers followed up on the development of the bus bike rack sensing system that can detect bicycle usage per rack position and performed usage analysis and behavior study of bike users.

  Project number: BDV31-977-113
  Principal investigator: Kyu Yoon, University of Florida
  Project manager: Gabrielle Matthews and David Sherman, FDOT Public Transportation Office

  [Read the Project Summary] ***[Read the Final Report]***

FDOT Research Center

- **Data Management and Analytics for UF Smart Testbed**

  University of Florida researchers surveyed data sources and requirements for use in data management and analytics of both real-time and stored data acquired from the UF smart testbed; They built hardware and software infrastructure for data analytics and designed data warehouse architecture for local servers and clouds. They developed applications using historical data from City of Gainesville and applications based on SPAT data

  Project number: BDV31-977-77
  Principal investigator: Sanjay Ranka, University of Florida Transportation Institute
  Project manager: Darryll Dockstader, FDOT Research Center Office

  [Read the Project Summary] ***[Read the Final Report]***

FDOT Structures Office

- **Hybrid Prestressed Concrete Bridge Girders using Ultra-High Performance Concrete**

  University of Florida researchers evaluated the effectiveness of using ultra-high performance concrete (UHPC) to contribute to the structural performance of prestressed bridge girders. The focus was on the effectiveness of UHPC in the reduction or elimination of visible end region cracking after release.

  Project number: BDV31-977-101
  Principal investigator: H. R. Hamilton and Gary R. Consolazio, University of Florida
  Project manager: William Potter, FDOT Structures Office

  [Read the Project Summary] ***[Read the Final Report]***

FDOT Traffic Engineering and Operations Office

- **A Roadway Context Classification Approach for Developing Safety Performance Functions and Determining Traffic Operational Effects for Florida Intersections**

  University of Central Florida researchers developed safety performance functions (SPFs) for different types of Florida intersections based on the Florida Department of Transportation (FDOT) context classification system.

  Project number: BDV24-977-32
  Principal investigator: Haitham Al-Deek, University of Central Florida
  Project manager: Alan El-Urfali, FDOT Traffic Engineering and Operations Office

  [Read the Project Summary] ***[Read the Final Report]***

Newly Funded FDOT Research, February–April 2021

FDOT Materials Office

- **Practical Mix Design Guidelines for Reflective Cracking Resistant Mixtures**

  University of Florida researchers will develop simple, but effective guidelines and procedures for designing asphalt mixtures that will adequately mitigate reflective cracking.

  Project number: BDV31-977-138
  Principal investigator: Jian Zou, University of Florida
  Project manager: Howard Moseley, FDOT Materials Office

  [TRB Research in Progress entry]

- **Improved Resilience of Rigid Pavement Systems**

  Researchers from Applied Research Associates, Inc., will identify cost-effective and implementable solutions to improve the resilience of new and existing rigid pavement systems subjected to the combined effects of flooding and sea level rise.

  Project number: BEB14
  Principal investigator: Hyung Lee, Applied Research Associates, Inc.
  Project manager: Nour Nazef, FDOT Materials Office

FDOT Planning Office

- **Incorporation of Climatic and Hydrologic Nonstationarity into FDOT Planning and Design Guidelines & Processes**

  Florida International University researchers will focus on potential modifications to current manuals of practice being used by Florida Department of Transportation (FDOT) for transportation project design. When possible, guidance will also be provided on relevant

planning practices that may be in use by FDOT. With respect to TI designs, the research will identify which standards may warrant modifications to account for implications of future climate change, especially sea level rise and changes to extreme rainfall. The final report of this research project will recommend appropriate nonstationarity methods and data sets for future use by FDOT engineers and consultants for future planning and design of TI.

Project number: BDV29-977-67
Principal investigator: Jayantha Obeysekera, Florida International University
Project manager: Jennifer Carver, FDOT Planning Office

[TRB Research in Progress entry]

- **Florida Sea Level Scenario Sketch Planning Tool Extension for Custom Analysis**

  University of Florida researchers propose to develop an extension to the Sketch Planning Tool to facilitate custom analysis of the potential impacts of multiple flood events on transportation facilities at finer geographic scales. This new extension would produce "on-demand" analyses of custom, user-chosen areas and flood data (as they become available) for Florida Department of Transportation (FDOT) and its regional partners. The extension will be built on a new geospatial framework, comprising hardware and software infrastructure to support the analyses and user interfaces. This project specifically seeks to incorporate additional flood data, but this new geospatial framework will be designed to support inclusion of almost any climate data (in geospatial format) as they are developed and updated. This project will facilitate more robust and standardized vulnerability assessments of transportation infrastructure at a smaller geographic scale.

  Project number: BDV31-977-141
  Principal investigator: Crystal Goodison, University of Florida
  Project manager: Jennifer Carver, FDOT Planning Office

  [TRB Research in Progress entry]

FDOT Public Transportation Office

- **Assessment of the Mobility Energy Productivity (MEP) Metric for Public Transit Applications in Florida**

  Florida International University research will assess the Mobility Energy Productivity (MEP) metric tool to examine the potential transit applications in Florida. Insights will be provided regarding elements used by the model, maturity of software development, system capabilities, data needs, ease of use, and potential applications. One goal of the research is to help identify the possibility of implementation of the MEP metric model, as a tool for planning, assessing, and improving public transit in Florida.

  Project number: BDV29-977-66
  Principal investigator: Fabian Cevallos, Florida International University
  Project manager: Gabrielle Matthews, FDOT Public Transportation Office

  [TRB Research in Progress entry]

FDOT Safety Office

- **Evaluating the Operations and Safety Benefits of AI-driven Driver Information-focused Countermeasures for CAV Technologies**

  University of Florida researchers will quantify the benefits of this safety technology using a combination of conventional crash-analyses techniques and surrogate safety measures as CAV crashes are still rare events and there may not be adequate data in the short-term. The innovation in this project comes from a combination of developing an industry-first safety-based recommendation system for crash hotspots while using traffic simulation software that interfaces with the Surrogate Safety Assessment Model (SSAM) for the Trapezium corridor to assess the operational and safety benefits of connected and autonomous vehicle (CAV) deployments. Following the simulation analyses, the project will focus on on-field measurements of queues, delays, and near-misses for the Trapezium corridor.

  Project number: BDV31-977-140
  Principal investigator: Sivaramakrishnan Srinivasan, University of Florida
  Project manager: Raj Ponnaluri, FDOT Safety Office

  [TRB Research in Progress entry]

FDOT Structures Office

- **Confinement Effect of Narrow Baseplates or Reaction Area on Anchor Breakout, Part 2**

  Florida International University researchers will (1) review and identify the effect of confinement of narrow baseplates or reaction area on screw anchors breakout resistance, (2) determine the effect of anchor groups and configurations on the anchor breakout resistance, (3) determine the failure mechanism and appropriate confinement modification factor of screw anchors used in various applications, (4) determine the screw anchors' performance under cyclic loads, (5) develop new Florida Department of Transportation (FDOT) Structures Design Guidelines criteria for screw anchors with confinement effects, and (6) develop modified FDOT Structures Design Guidelines criteria for adhesive anchors with confinement effects if necessary.

  Project number: BDV28-977-09
  Principal investigator: Nakin Suksawang, Florida International University
  Project manager: Steven Nolan, FDOT Structures Office

  [TRB Research in Progress entry]

- **Florida Slab Beam Bridge with Ultra-High Performance Concrete Joint Connections - Full-Scale Testing and Analysis of Results**

  Florida International University researchers will develop modified design details of Florida Department of Transportation's (FDOT's) Florida Slab Beam (FSB) Design Standard to utilize a ultrahigh performance concrete (UHPC) longitudinal joint between beams with an asphalt overlay. The modified details will be developed and tested using small and full-scale test specimens.

  Project number: BDV29-977-65
  Principal investigator: David Garber, Florida International University

Project manager: Christina Freeman, FDOT Structures Office

[TRB Research in Progress entry]

- **Design and Detailing of Anchorages for Externally Bonded CFRP**

  Florida Institute of Technology researchers will (1) perform a synthesis of existing research on the topic of carbon fiber-reinforced polymers (CFRP) anchorage design and detailing with interest in externally bonded shear strengthening and other externally bonded end anchorage applications. (2) They will provide modifications to the current design and detailing guidance within Volume 4 of the Structures Detailing Manual (SDM) along with construction specification guidance for installation and quality control. The CFRP anchorage alternatives will be evaluated based on developed criteria, and, at a minimum, include structural effectiveness, cost, invasiveness to the concrete section, and level of complexity during installation. The synthesis and guidance will include prestressed and reinforced concrete sections.

  Project number: BEA90
  Principal investigator: Nakin Suksawang, Florida Institute of Technology
  Project manager: William Potter, FDOT Structures Office

  [TRB Research in Progress entry]

FDOT Traffic Engineering and Operations Office

- **Phase I: Before Study Evaluation of Interstate 4 (I-4) Florida's Regional Advanced Mobility Elements (FRAME) Project (Before Analysis)**

  University of Central Florida researchers will develop the evaluation plan for the I-4 Florida's Regional Advanced Mobility Elements (FRAME) project as well as to conduct and document the evaluation study findings. To conduct the task, the research team will perform the following activities: (1) determine evaluation criteria tailored to the I-4 FRAME project objectives, considering the identifiable costs and in coordination with the other partners; (2) describe data collection procedures tailored to these criteria that are needed to report on achievement of project objectives; and (3) identify safety challenges on the project corridors and document how the I-4 FRAME project will address the challenges.

  Project number: BDV24-977-38
  Principal investigator: Mohamed Abdel-Aty, University of Central Florida
  Project manager: Raj Ponnaluri, FDOT Traffic Engineering and Operations Office

  [TRB Research in Progress entry]

- **Interstate 4 (I-4) Florida's Regional Advanced Mobility Elements**

  University of Florida researchers will conduct a two-part project. In Part A, they will provide stakeholder coordination support for evaluating the "before" conditions for the I-4 FRAME project. The research team will identify all relevant applications for I-4 FRAME along with the data to be collected for each application. These will consider a comprehensive performance measurement framework for the use cases identified. Part A of the research will also provide a comprehensive evaluation of the "before" conditions for the study area. The objective of Part B in the research project is to provide data management, sharing and stakeholder coordination

support for implementation of the I-4 FRAME project. Part B results will help to assess impacts of the deployed technologies in the I-4 FRAME project and help in assessing expansion of safety and mobility applications to similar corridors statewide.

Project number: BDV31-977-139
Principal investigator: Lily Elefteriadou, University of Florida
Project manager: Raj Ponnaluri, FDOT Traffic Engineering and Operations Office

[TRB Research in Progress entry]

- **Road Ranger Program for Arterials**

  University of Florida researchers will develop initial recommendations about a road ranger service for arterials in the Orlando area. Specifically, the study will determine whether service from staged locations or patrolling in beats (in a loop around the major arterials) would be appropriate. The study will also determine whether staged locations, if preferable, should be static or dynamic (i.e., staging locations vary over the time of the day and days of the week). The analysis will be based on data available (traffic crashes from police report, data from traffic incident management program, other data on traffic patterns such as from queues/congestion at intersections from Automated Traffic Signal Performance Measures, ATSPM), contextual knowledge, and opportunities and constraints imposed by network and lane use conditions.

  Project number: BDV31-977-142
  Principal investigator: Siva Srinivasan, University of Florida
  Project manager: Jeremy Dilmore, FDOT Traffic Engineering and Operations Office