FDOT Research Quarterly Summary, April 2022

Prepared by the UFTI-T2 Center, University of Florida, Gainesville

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Completed FDOT Research, September 2021—April 2022

Newly Funded FDOT Research, September 2021—April 2022

Completed FDOT Research, September 2021—April 2022

— Project List —

Detailed descriptions below.

Maintenance

- **Redundancy of Twin Steel Box Girder Bridges**

Materials

- **Correlation of Slag Cement Composition with Durability of Portland Cement-Slag Concrete**
- **Accelerated Corrosion Testing of Grouts for PT Steel Strand**
- **Magnetic Flux Leakage (MFL) Method for Damage Detection in Internal Post-tensioning Tendons**
- **Florida ATMA Pilot Demonstration and Evaluation**
- **Testing Methods for the Next Generation of Concrete**
- **Design and Performance of Open-Graded Friction Course (OGFC) Mixtures Containing Epoxy Asphalt**

- **Raised Pavement Markers (RPMs) Assessment Using Highway Speed Mobile Retro Reflectivity Technology**

Planning

- **A Synthesis on Data Mining Methods and Applications for Automated Fare Collection (AFC) Data**
- **Florida Index for Transportation: A System of Systems Approach to Understanding the Changing Nature of Transportation**

Traffic Engineering and Operations

- **Effect of Real-time Traffic Data on Truck Diversion Routing on I-75**
- **Toward a Florida Automated, Connected, Electric and Shared (ACES) Transportation System Roadmap: Phase I**
- **Identifying and Prioritizing Target Regions to Conduct Outreach Activities to Improve Safety and Mobility of Aging Population**
- **Feasibility Analysis of Real-time Intersection Data Collection and Processing Using Drones**
- **Developing the Procedures for Welding, Testing, and Fabricating Weathering Stainless-Steel to Merge the Scope of the Current AASHTO/AWS D1.5 Bridge Welding Code with the AWS DF1.6 Stainless Steel Welding Code**

Turnpike

- **Strategies to Identify and Mitigate Secondary Crashes Using Real-Time Traffic Data on Florida's Turnpike System**

— Detailed Descriptions —

Maintenance

- **Redundancy of Twin Steel Box Girder Bridges**

  Florida International University researchers established a design target performance and safety level for twin steel box girder bridges, outlining a methodology and approach for assessing the redundancy of these bridges and assessing the redundancy of one curved girder bridge using the recommended approach.

  Project number: BDV29-977-40
  Principal investigator: Armin Mehrabi and Atorod Azizinamini, Florida International University
  Project manager: Richard Kerr and Thomas Beitelman, Maintenance
  [Read the Project Summary] ***[Read the Final Report]***

Materials

- **Correlation of Slag Cement Composition with Durability of Portland Cement-Slag Concrete**

  University of South Florida researchers identified methods to ensure sulfate optimization in slag-Portland cement cementitious systems. They also established the effects of sulfate-optimized slag-blended cementitious systems on durability and assess adiabatic temperature rise in slag-blended concrete mixtures.

Project number: BDV25-977-63
Principal investigator: A. Zayed, University of South Florida
Project manager: Jose Armenteros, Materials
[Read the Project Summary] ***[Read the Final Report]***

- **Accelerated Corrosion Testing of Grouts for PT Steel Strand**

  Florida International University researchers identified and developed test methodologies to assess corrosion susceptibility of steel strand in post-tensioning grout for material selection and specification.

  Project number: BDV29-977-44
  Principal investigator: Kingsley Lau, Florida International University
  Project manager: Matthew Duncan, Materials
  [Read the Project Summary] ***[Read the Final Report]***

- **Magnetic Flux Leakage (MFL) Method for Damage Detection in Internal Post-tensioning Tendons**

  Florida International University researchers developed magnetic nondesturctive testing equipment for field inspection of internal tendons.

  Project number: BDV29-977-45
  Principal investigator: Atorod Azizinamini, Florida International University
  Project manager: Ivan Lasa and Matthew Duncan, Materials
  [Read the Project Summary] ***[Read the Final Report]***

- **Florida ATMA Pilot Demonstration and Evaluation**

  University of Florida researchers evaluated the performance of an autonomous truck-mounted attenuator (ATMA) system based on ongoing or completed projects by other agencies that adopted ATMA and actual testing of the equipment during a demonstration pilot in Gainesville, FL. The project produced a critical analysis report to better understand the feasibility or applicability of the autonomous system to enhance operational or safety benefit on work zones in Florida.

  Project number: BDV31-977-133
  Principal investigator: Nithin Agarwal, University of Florida
  Project manager: Tim Ruelke, Materials
  [Read the Project Summary] ***[Read the Final Report]***

- **Testing Methods for the Next Generation of Concrete**

  University of Florida researchers determined if existing test methods can quantify concrete's performance with respect to cracking, durability, and heat generation at the mix design phase. A literature review was conducted to identify these methods, with preference given to methods based on these criteria: (1) testing is conducted on conventional portland cement concrete containing coarse aggregate – not mixture components, derivatives, or specialty mixes (e.g., paste, mortar, grout, UHPC, RCC); (2) time for test completion does not exceed 30 days; (3) testing does not utilize any hazardous materials; (4) tests are relatively simple, within the scope of a high-school education; and (5) cost of testing equipment not to exceed $30,000. Tests were assessed for their ability to determine potential for excessive shrinkage, potential to experience excessive temperature rise, and chloride and sulfate durability. The research team categorized test methods

meeting the criteria: Category I – Test meets current needs of FDOT without any modifications; Category II – Test can be modified to successfully meet FDOT needs; and Category III – Test shows some potential to meet FDOT needs, but does not meet one of the five criteria Methods in these categories were used to make recommendations to the Standards Specification for Road and Bridge Construction to be used in the concrete mixture approval process specified in section 346.

Project number: BDV31-977-136
Principal investigator: Christopher Ferraro, University of Florida
Project manager: Tim Ruelke, Materials
[Read the Project Summary] ***[Read the Final Report]***

- **Design and Performance of Open-Graded Friction Course (OGFC) Mixtures Containing Epoxy Asphalt**

  Researchers at the Auburn Research and Technology Foundation determined if epoxy-modified binders can improve the durability (life span) of open-graded friction course (OGFC) mixtures in Florida.

  Project number: BE702
  Principal investigator: Randy West, Auburn Research and Technology Foundation
  Project manager: Ahmad Chami, Materials
  [Read the Project Summary] ***[Read the Final Report]***

- **Raised Pavement Markers (RPMs) Assessment Using Highway Speed Mobile Retro Reflectivity Technology**

  University of Florida researchers measured the retroreflectivity of network-level raised pavement markers (RPMs) using highway-speed mobile retroreflectivity unit (MRU) technology. They assessed the feasibility of network-level RPM retroreflectivity, development of equipment/software, determination of the measurement precision, and implementation of survey protocol for the Pavement Marking Management System.

  Project number: BE715
  Principal investigator: James Fletcher, University of Florida
  Project manager: Charles Holzschuher, FDOT Materials Office
  [Read the Project Summary] ***[Read the Final Report]***

Planning

- **A Synthesis on Data Mining Methods and Applications for Automated Fare Collection (AFC) Data**

  Florida International University researchers provided a comprehensive review of existing knowledge and experience in utilizing automated fare collection (AFC) data, from both practice and research perspectives. From a practice perspective, they determined whether and how transit or planning agencies have utilized AFC data to support planning and operation activities. From a research perspective, innovative data collection and analysis methods and applications were summarized.

  Project number: BDV29-977-55
  Principal investigator: Xia Jin, Florida International University

Project manager: Neil Lyn, FDOT Planning Office
[Read the Project Summary] ***[Read the Final Report]***

- **Florida Index for Transportation: A System of Systems Approach to Understanding the Changing Nature of Transportation**

  Florida State University researchers identified and tracked external factors associated with all modes of transportation (i.e., auto, truck, transit, bicycle and pedestrian, aviation, rail, and seaport). They developed an understanding of the evolutionary and emergent nature of the Florida transportation system. This will facilitate informed policy and decision making in transportation planning.

  Project number: BDV30-977-28
  Principal investigator: Juyeong Choi, Florida State University
  Project manager: Jessica VanDenBogaert, FDOT Planning Office
  [Read the Project Summary] ***[Read the Final Report]***

Traffic Engineering and Operations

- **Effect of Real-time Traffic Data on Truck Diversion Routing on I-75**

  This research used origin-destination approaches in conjunction with advanced traveler information systems (ATIS) to determine and inform truckers of the benefits of alternative routes and collect data to determine rate of divergence off I-75 before and after the information is provided. The objective was to understand the correlation between travel time and divergence and to inform Integrated Corridor Management efforts soon to begin in the area.

  Project number: BDV24-977-28
  Principal investigator: Amr Oloufa, University of Central Florida
  Project manager: Jeremy Dilmore, FDOT Traffic Engineering and Operations Office
  [Read the Project Summary] ***[Read the Final Report]***

- **Toward a Florida Automated, Connected, Electric and Shared (ACES) Transportation System Roadmap: Phase I**

  University of South Florida researchers developed an initial inventory of past, current, and planned automated, connected, electric and shared (ACES) vehicles initiatives within Florida. They provided an educational and technology transfer forum and graphical interface to share data, findings, and best practices among transportation agencies, the private sector, and colleges and universities. The objectives of the forum were to leverage expertise and funding across multiple jurisdictions and sectors, to encourage and expand communication, cooperation, and collaboration, and to ultimately facilitate the rapid development, implementation, and evaluation of appropriate and optimized ACES technologies according to desired performance measures.

  Project number: BDV25-977-64
  Principal investigator: Robert Bertini, University of South Florida
  Project manager: Raj Ponnaluri and Thomas Byron, FDOT Traffic Engineering and Operations Office
  [Read the Project Summary] ***[Read the Final Report]***

- **Identifying and Prioritizing Target Regions to Conduct Outreach Activities to Improve Safety and Mobility of Aging Population**

  Florida International University researchers developed a geographic information systems (GIS) approach, incorporating existing Florida Department of Transportation (FDOT) resources, to strategically identify and prioritize specific regions that benefit the most from outreach activities. The research goal was achieved through extensive data visualization and spatial analyses in ArcGIS. The macroscopic analysis involved aggregating crashes involving aging road users over some geographic areas (e.g., census block groups or Traffic Analysis Zones) and spatially analyzing these crashes with an intent to identify socioeconomic, demographic, land use, and infrastructure-related factors that may contribute to these crashes. The relation between crashes and the built environment was determined, and this information was used to identify and prioritize the regions for conducting outreach activities and the type of education material that need to be distributed at these target regions. This approach can shape long-term planning and policy implications in improving the safety and mobility of aging population.

  Project number: BDV29-977-57
  Principal investigator: Priyanka Alluri, Florida International University
  Project manager: Gail Holley, FDOT Traffic Engineering and Operations Office
  [Read the Project Summary] ***[Read the Final Report]***

- **Feasibility Analysis of Real-time Intersection Data Collection and Processing Using Drones**

  Florida State University researchers tested the feasibility and efficiency of drone-based real-time data collection and processing at intersections, which can be used by FDOT planners and engineers at various levels of traffic operations and safety analysis. Consistent with this goal, the researchers extracted the vast amount of knowledge with respect to the drone implementations, video image processing software and other related data collection equipment. They analyzed the results of this search to identify the operational barriers, best implementations, practices, and strategies and conducted a pilot drone study at selected intersections. They provided recommendations to FDOT for evaluating the feasibility of drones as safer, cheaper, and faster data collection alternatives. They also provided guidelines for successful implementation of this pilot program.

  Project number: BDV30-977-29
  Principal investigator: Eren Ozguven, Florida State University
  Project manager: Alan El, FDOT Traffic Engineering and Operations Office
  [Read the Project Summary] ***[Read the Final Report]***

- **Developing the Procedures for Welding, Testing, and Fabricating Weathering Stainless-Steel to Merge the Scope of the Current AASHTO/AWS D1.5 Bridge Welding Code with the AWS DF1.6 Stainless Steel Welding Code**

  Researchers at Wood Environment & Infrastructure Solutions, Inc. (Alpharetta, GA) developed procedures for the safe welding, testing, repairing, and fabrication of weathering stainless steel that remains consistent with the AASHTO/AWS D1.5 Bridge Welding Code. A Florida Sampling and Test Method (Florida Method) was developed and will be considered for inclusion in a future version of the Florida Department of Transportation (FDOT) Steel Fabrication Specifications. The Florida Method will identify types of bridge steel components suitable for the available weathering stainless steel and allow FDOT to specify weathering stainless steel in bridge applications.

Project number: BE958
Principal investigator: Philip Dzikowski, Wood Environment & Infrastructure Solutions, Inc.
Project manager: Tim McCullough, FDOT Traffic Engineering and Operations Office
[Read the Project Summary] ***[Read the Final Report]***

Turnpike

- **Strategies to Identify and Mitigate Secondary Crashes Using Real-Time Traffic Data on Florida's Turnpike System**

  Florida International University researchers investigated ways to accurately identify secondary crashes on the Florida Turnpike System using real-time traffic and incident data. They identified factors that influence the occurrence of secondary crashes on the Florida Turnpike system. They also developed a communication plan to inform drivers on the Florida Turnpike System and the first responders in real-time of potential secondary crashes. Researchers explored the potential of emerging communication technologies and Connected Vehicle technologies in identifying and mitigating secondary crashes.

  Project number: BDV29-977-48
  Principal investigator: Priyanka Alluri, Florida International University
  Project manager: Eric Gordin, Florida Turnpike Enterprise
  [Read the Project Summary] ***[Read the Final Report]***

Newly Funded FDOT Research, September 2021—April 2022

— Project List —
Detailed descriptions below.

Aviation

- **Counting Airport Operations Using Aircraft Transponder Signals and/or Aircraft Automatic Dependent Surveillance-Broadcast (ADS-B) Data**

Civil Integrated Management

- **Development of Motorcycle VMT Estimation Method Using a Hybrid Approach**

Forecasting and Trends

- **Robustness Assessment of Florida Index for Transportation (FIT) as a Decision-making Tool in Transportation Planning-Phase 2**

Geotech

- **Relaxation of Driven Piles in Florida Soils**
- **Estimating the As-Placed Grout Volume of Auger Cast Piles**
- **Geo-Statistical Deep Foundation Software**

Materials

- **Factors that Influence the Variability of Concrete Surface Resistivity of Field Cast Samples**
- **Durability of Concrete Using Low Slag Cement Contents**
- **Validation and Update of the Sinkhole Index**
- **A Review of Protocols Used for Evaluating Defective Asphalt Materials and Pavements**
- **Steel Bridge Coating and Recoating Warranty Requirements**
- **Determining the Effect on Asphalt Mixture Performance by Increasing New Asphalt Binder Content Due to Inactive RAP Binder in the Mixture**
- **Synthesis of Galvanized Steel Reinforcement Corrosion Performance**

Public Transportation

- **A Comprehensive Evaluation of I-275 Bus-on-Shoulder (BOS) Pilot Project**
- **Examining Data Needs and Implementation Process of AV-based Microtransit Service: A Case Study in Lake Nona**

Roadway Design

- **Design of Stormwater BMPs for Surface and Groundwater Protection Based on Site-Scale Soil Properties: Phase I**
- **Evaluation on Effectiveness of Audible and Vibratory Treatment (AVT) Installations on Arterials and Collectors Based on FDOT Content-based Design Criteria**

Research Center

- **FY 21/22 Florida Local Technical Assistance Program**

Structures

- **Bond Performance Between Precast UHPC Substrates and Field Cast UHPC Connections**

Traffic Engineering and Operations

- **Evaluation of Pilot Deployment of Portable Visual Barriers to Reduce Impact During Freeway Crashes**
- **Using Computer Vision and Deep Learning Techniques to Extract Roadway Geometry from Aerial Images**
- **Development of a Roadway Corridor Safety Approach to Identify High-risk Corridors and Prevent Fatalities on Florida Roadways**
- **Local Technical Assistance Program Support on Computer-based FDOT Intersection Control Evaluation (ICE) Training**
- **Evaluation of Midblock Pedestrian Signals (MPS)**
- **Toward a Florida Automated, Connected, Electric, and Shared (ACES) Transportation System Roadmap: Phase II**
- **Human Factors Study on the Use and Effectiveness of Innovative Safety Messages on Dynamic Message Signs**
- **Evaluation of CARMA for I-STREET Testbed Implementation**

— Detailed Descriptions —

Aviation

- **Counting Airport Operations Using Aircraft Transponder Signals and/or Aircraft Automatic Dependent Surveillance-Broadcast (ADS-B) Data**

  New proprietary and/or non-proprietary systems have been developed in an effort to more reliably and accurately count aircraft operations at airports without a staffed air traffic control tower. These systems include methods which utilize equipment that identifies aircraft transponder and/or ADS-B equipment signals. Embry-Riddle Aeronautical University researchers will effectively update the 2018 FDOT Operations Counting at Non-Towered Airports Assessment report by exploring the feasibility, accuracy, and reliability of new technologies. These may include receiving equipment combined with specialized computer programming that would record aircraft operations. For example, a specific aircraft's location/altitude profile (as recorded using its transponder/ADS-B signals) in relation to a known airport's location, could be used to indicate a type of operation at that airport (e.g., landing, takeoff, etc.). Although several systems have been summarized in past research, new technologies continue to emerge, and this project will identify and evaluate systems for counting aircraft operations using currently available technologies.

  Project number: BDV22-977-02
  Principal investigator: Kenji Yoshigoe, Embry-Riddle Aeronautical University
  Project manager: Abdul Hatim, FDOT Aviation Office

  [TRB Research in Progress entry]

Civil Integrated Management

- **Development of Motorcycle VMT Estimation Method Using a Hybrid Approach**

  University of South Florida researchers will develop an implementable framework to collect and estimate annual motorcycle vehicle miles of travel (VMT) data in Florida. This project will investigate and evaluate existing vehicle detector technologies focused on motorcycles and study various approaches to estimate annual motorcycle VMT.

  Project number: BED25-977-01
  Principal investigator: Chanyoung Lee, University of South Florida
  Project manager: Joey Gordon, FDOT Civil Integrated Management Office

  [TRB Research in Progress entry]

Forecasting and Trends

- **Robustness Assessment of Florida Index for Transportation (FIT) as a Decision-making Tool in Transportation Planning-Phase 2**

  In this Phase 2 project, Florida State University researchers will (i) shed light on underlying relationships between influential external factors and their relevant transportation modes, (ii) enhance the robustness of the FIT framework, and (iii) maximize its implementability as a planning tool.

  Project number: BED30-977-01

Principal investigator: Juyeong Choi, Florida State University
Project manager: Jessica VanDenBogaert, FDOT Forecasting and Trends Office

Geotech

- **Relaxation of Driven Piles in Florida Soils**

  University of South Florida researchers will document as many cases as possible from within the state of Florida where pile relaxation has been experienced, with the ultimate goal of determining appropriate field and lab testing and/or protocols suitable for construction and design.

  Project number: BED25-977-05
  Principal investigator: Rodrigo Herrera, University of South Florida
  Project manager: Juan Castellanos, FDOT Geotech Office

  [TRB Research in Progress entry]

- **Estimating the As-Placed Grout Volume of Auger Cast Piles**

  University of South Florida researchers will obtain field data from ACIP pile projects to better correlate the measured grout volume to the as-built pile dimensions. A second objective is to develop a more reliable method for estimating grout volume by identifying the variables that affect pile volume other than the simplistic approaches used to date. These variables are likely to include, but are not limited to, soil type, construction methods, and types of equipment.

  Project number: BED25-977-04
  Principal investigator: Gray Mullins, University of South Florida
  Project manager: Juan Castellanos, FDOT Geotech Office

  [TRB Research in Progress entry]

- **Geo-Statistical Deep Foundation Software**

  University of Florida researchers will implement updates to the existing deep foundation software package and deliver demonstration sessions for in-house personnel and consultants, including thrusts in the following areas: (i) implementation of measuring while drilling (MWD) results are proposed that will lead to improvements in site characterizations for deep foundation design; (ii) implementation of cone penetration testing (CPT) is proposed to bring about increased flexibility for assessing axial resistance; and (iii) it is proposed to investigate a methodology by which the valid zonal radius emanating away from a candidate test shaft location can be identified through use of features unique to the as-deployed software.

  Project number: BDV31-977-143
  Principal investigator: Michael Davidson, University of Florida
  Project manager: Rodrigo Herrera, FDOT Geotech Office

  [TRB Research in Progress entry]

Materials

- **Factors that Influence the Variability of Concrete Surface Resistivity of Field Cast Samples**

University of Florida researchers will identify the influences on surface resistivity (per AASHTO T 358) and provide solutions to minimize variability. In addition, alternate nondestructive test methods to determine chloride ion permeability, including bulk resistivity (per AASHTO TP 119) will be explored.

Project number: BED05
Principal investigator: Kyle Riding, University of Florida
Project manager: Rodrigo Antunes, FDOT Materials Office

[TRB Research in Progress entry]

- **Durability of Concrete Using Low Slag Cement Contents**

  University of Florida researchers will identify what quantities of slag cement less than 50% will provide both long-term durability and required compressive strength. They will also identify whether the reduced slag cement percentages can be used for all environmental conditions or with certain restrictions based on sulfate and chloride resistance results. Lastly, They will identify a short-term qualification procedure and test methods to expedite approvals of these concrete mix designs.

  Project number: BEC98
  Principal investigators: Kyle Riding and Christopher Ferraro, University of Florida
  Project manager: Thomas Frank, FDOT Materials Office

- **Validation and Update of the Sinkhole Index**

  University of Central Florida researchers will (i) validate and update the sinkhole index and chart via both large-scale sinkhole simulation test and the updated dataset containing other geological formations and geotechnical conditions; (ii) develop a set of criteria and guidance for the sinkhole index and vulnerability assessment; and (iii) evaluate raveling evolution and the effect of grout-take via the sinkhole index.

  Project number: BDV24-977-41
  Principal investigator: Boo Nam, University of Central Florida
  Project manager: David Horhota, FDOT Materials Office

  [TRB Research in Progress entry]

- **A Review of Protocols Used for Evaluating Defective Asphalt Materials and Pavements**

  Auburn University researchers will evaluate the current practices and procedures used by the Florida Department of Transportation to evaluate defective asphalt material. Defective material is defined in Section 334 and 337 of the FDOT Standard Specifications for Road and Bridge Construction. For dense-graded mixtures (including dense-graded friction courses), material is considered defective if the air voids, density, asphalt binder content, or percent passing the #200 sieve fall outside of the master production ranges defined in Section 334. For open-graded friction course mixtures, material is considered defective if the asphalt binder content, percent passing the ⅜-inch sieve, percent passing the #4 sieve, or percent passing the #8 sieve fall outside of the master production ranges defined in Section 337.

  Project number: BEC97
  Principal investigator: Randy West, Auburn University
  Project manager: Howie Moseley, FDOT Materials Office

[TRB Research in Progress entry]

- **Steel Bridge Coating and Recoating Warranty Requirements**

  KTA-Tator, Inc. (Boynton Beach, FL) will develop draft contract language for steel bridge coating and recoating warranty contracts that will improve the quality and durability of steel bridge coatings. They will determine contract performance measures that will fairly and accurately evaluate the longevity of coating systems. They will recommend a warranty period that will protect the owner's investment and optimize the cost of bonding. The goal is to reduce the number of times bridges need to be recoated during their service lives due to the coating systems not achieving their anticipated service life. The use of warranties will impose financial responsibilities on contractors, thus encouraging higher quality work. The result will be significant savings, as each recoating involves costly items, including mobilization, traffic control, containment, disposal, surface preparation, coating application, and user costs.

  Project number: BED02
  Principal investigator: Peter Ault, KTA -Tator, Inc.
  Project manager: Felix Padilla, FDOT Materials Office

  [TRB Research in Progress entry]

- **Determining the Effect on Asphalt Mixture Performance by Increasing New Asphalt Binder Content Due to Inactive RAP Binder in the Mixture**

  FDOT's pavement condition survey identifies the number one pavement distress as cracking or raveling, as compared to rutting and ride rating. Cracking or raveling can be caused by several means, one of which is low asphalt binder content. FDOT would like to research means of increasing the asphalt binder content in structural mixtures containing recycled asphalt pavement (RAP), with the intent of improving cracking resistance without compromising rutting performance. Decreasing the contribution of the activated RAP binder to the total binder content by a certain percentage would afford the replacement of that amount of RAP binder with new asphalt binder. Additional asphalt binder could be beneficial with respect to reducing cracking or raveling, but too much asphalt binder can cause an asphalt mixture to be more susceptible to rutting. The goal of this research is to determine if reducing the available RAP binder contribution and replacing it with new asphalt binder will affect mixture performance (positively or negatively) and determine how to implement these changes during mix design and production. This project does not propose experimental determination of the percentage of RAP binder availability (i.e., how much of the RAP binder becomes active in the asphalt mix); the PI should determine this through literature review, as such work has been studied previously. Instead, this project will focus on how to incorporate the findings from the literature review on the availability of RAP binder into mix design and production and evaluate impacts on cracking and rutting performance.

  Project number: BEC79
  Principal investigator: Fang Yin, Auburn University
  Project manager: Greg Sholar, FDOT Materials Office

  [TRB Research in Progress entry]

- **Synthesis of Galvanized Steel Reinforcement Corrosion Performance**

University of South Florida researchers will determine whether hot-dipped galvanized steel rebar should be used in FDOT marine-service reinforced concrete structures to increase service life, based on a synthesis of existing knowledge on corrosion performance and with focus on aggressive splash zone conditions.

Project number: BDV25-977-81
Principal investigator: Christopher Alexander, University of South Florida
Project manager: Ron Simmons, FDOT Materials Office

[TRB Research in Progress entry]

Public Transportation

- **A Comprehensive Evaluation of I-275 Bus-on-Shoulder (BOS) Pilot Project**

  University of South Florida researchers will evaluate the effectiveness of bus-on-shoulder (BOS) operation, including driver experience, ease of accessing the shoulders, adequacy of shoulder width, frequency of encountering obstacles on shoulders and how quickly they were cleared, passenger car drivers' reactions, BOS motorist violations, etc. The researchers will also evaluate transit route system performance changes, including BOS transit operations ridership, schedule reliability, safety (motorist, transit, law enforcement, passenger), frequency of use of BOS, and other indicators of transit level of service (LOS). They will evaluate the effectiveness of BOS installed in both the northbound and southbound directions at the 38th Avenue N and 54th Avenue N on-ramps. They will also evaluate whether the I-275 BOS project leads to traffic and safety impacts on the I-275 project segment and parallel local streets due to spillover of traffic from on-ramps of the I-275 segment. Recommendations will be made that may improve the implementation and operation of BOS, such as training, marketing, structure modification, traffic operations and control, etc.

  Project number: BEB63
  Principal investigator: Zhang Yu, University of South Florida
  Project manager: Craig Fox, FDOT Public Transportation Office

  [TRB Research in Progress entry]

- **Examining Data Needs and Implementation Process of AV-based Microtransit Service: A Case Study in Lake Nona**

  The success of this federally funded Better Utilizing Investments to Leverage Development grant project (hereafter BUILD grant) will have important impacts on future microtransit development based on autonomous vehicles (AVs) in the state of Florida. Therefore, it is important to document the full planning and decision-making process and collect baseline information in the Orange County area prior to implementation. This proposed research project includes collecting and analyzing baseline information for future BUILD grant evaluation and monitoring, documenting, and evaluating lessons learned in the implementation process of AV-based microtransit services. Though many studies have been conducted to assess the impact of AVs or AV-based microtransit, few research efforts have examined preliminary implementation challenges as well as the real-life benefits or drawbacks of an AV-based microtransit system. This proposed research project will address several fundamental questions, such as:

- What is the full scope of work necessary to successfully implement an AV-based microtransit system? Analysis will include organizational, infrastructure, safety, technology, and financing challenges and concerns.
- What are the impacts on mobility improvement and community livability based on a set of performance measures including, but not limited to, transit ridership impacts (e.g., mode shift, ridership changes, and service satisfaction), residents perceptions of safety and neighborhood livability, and impacts on transit agencies' operation (e.g., operation management, maintenance, and budget implications)?

Project number: BDV31-977-144
Principal investigator: Zhong-Ren Peng, University of Florida
Project manager: Paul Schoelzel, FDOT Public Transportation Office

[TRB Research in Progress entry]

Roadway Design

- **Design of Stormwater BMPs for Surface and Groundwater Protection Based on Site-Scale Soil Properties: Phase I**

  University of Central Florida researchers will identify the soil parameters most strongly related to nitrogen and phosphorus removal or sequestration to improve stormwater BMP designs for enhanced nutrient remediation. In Phase I, microcosm and soil column studies will be implemented to compare nutrient transformations in different soil types with the aim of developing experimental methods that can be appropriately scaled to address this objective over larger geographic regions. Preliminary testing will compare soils from within the Hawthorn Formation (e.g., Alachua and Marion Counties) to soils from areas without a confining layer (e.g., Orange County), and BAM. These proof-of-concept experiments will compare rates and mechanisms of nitrogen and phosphorus transformations through diverse soil types and BAM to isolate the media properties associated with high rates of denitrification or sorption. The new empirical scientific information created will be applied to improve the design of stormwater BMPs and ensure that nutrient remediation strategies are correctly targeted to project site conditions.

  Project number: BDV24-977-43
  Principal investigator: Kelly Kibler, University of Central Florida
  Project manager: Jennifer Green, FDOT Roadway Design Office

  [TRB Research in Progress entry]

- **Evaluation on Effectiveness of Audible and Vibratory Treatment (AVT) Installations on Arterials and Collectors Based on FDOT Content-based Design Criteria**

  University of South Florida researchers will evaluate the effectiveness of audible and vibratory treatment (AVT) installations defined in FDOT Roadway Design Bulletin 18-03 and current FDOT Design Manual on Florida arterials and collectors based on Florida Department of Transportation (FDOT) context-based design criteria in roadway departure crash prevention and injury severity mitigation, taking into consideration reducing noise pollution and accommodating bicyclists.

  Project number: BED25-977-03
  Principal investigator: Pei-Sung Lin, University of South Florida

Project manager: Gevin McDaniel, FDOT Roadway Design Office

[TRB Research in Progress entry]

Research Center

- **FY 21/22 Florida Local Technical Assistance Program**

  The overall goal and associated objectives of the Florida LTAP Center are to deliver a highway training curriculum and technical assistance that will provide local agencies with tools to build their capacity and means to innovatively address their roadway network challenges and be reflective of FHWA's current core areas of safety, infrastructure management, workforce development and organizational excellence.

  Project number: BDV25-977-79
  Principal investigator: Pei-Sung Lin, University of South Florida
  Project manager: Jennifer Clark, FDOT Research Center

Structures

- **Bond Performance Between Precast UHPC Substrates and Field Cast UHPC Connections**

  Florida International University researchers will investigate the bond between hardened and freshly cast ultrahigh performance concrete (UHPC) and develop cohesion and friction coefficients which can be used with current AASHTO LRFD Bridge Design Specifications design capacity equations, unless the current equations prove to not fit well, in which case, design capacity equations will be developed. Construction specifications will be written that FDOT can use to ensure that durable joints can be achieved. Variables investigated will include UHPC mix design (both proprietary and non-proprietary), concrete strength and age (of both the precast and field-cast UHPC), surface treatment, and pre-wetting procedures. Surface treatment methods investigated will include multiple depths of form-liners, multiple grades of paste retarders, and combinations of both techniques. Surface treatment methods which result in exposed steel fibers will be investigated. Methods for preventing exposed steel fibers from corroding between pre-casting and field-casting will also be investigated.

  Project number: BEC96
  Principal investigator: David Garber, Florida International University
  Project manager: Christina Freeman, FDOT Structures Office

Traffic Engineering and Operations

- **Evaluation of Pilot Deployment of Portable Visual Barriers to Reduce Impact During Freeway Crashes**

  University of South Florida researchers will (i) perform a comprehensive literature review regarding (a) the impact of rubbernecking on traffic mobility and safety and (b) potential countermeasures to prevent rubbernecking, and (c) identify types of portable visual barriers (PVBs) available and examine their potential use; (ii) plan, coordinate, and conduct a pilot deployment of an approved

PVB via Florida Department of Transportation (FDOT) Road Rangers operations to reduce rubbernecking due to freeway crashes; (iii) perform in-depth data analyses to evaluate the effectiveness and benefits of the deployment of PVBs to reduce freeway traffic congestion and potential secondary crashes; (iv) (a)develop implementation guidelines on when, who, where, and how to deploy PVBs, (b) document analysis results and research findings, and (c) provide recommendations for future deployments in Florida.

Project number: BED25-977-02
Principal investigator: Pei-Sung Lin, University of South Florida
Project manager: Megan Arasteh, FDOT Traffic Engineering and Operations Office

[TRB Research in Progress entry]

- **Using Computer Vision and Deep Learning Techniques to Extract Roadway Geometry from Aerial Images**

  Florida State University researchers will develop computer vision tools to extract different roadway geometry data such as school zone markings, lane configurations (i.e., turning lanes lengths, and lane, shoulder and median widths), presence of signals (i.e., identification of signal poles), and sidewalks (i.e., presence or absence of sidewalks) from high resolution aerial images, which can be used by FDOT planners and engineers at various levels of traffic operations and safety analysis. Consistent with this goal, the researchers will (i) examine how traffic data collection can leverage emerging computer vision techniques, in particular, image processing, deep learning, machine learning, and artificial intelligence to develop statewide roadway inventory lists, (ii) design an automated signalized intersection geometric data extraction algorithm based on high resolution images in order to identify roadway geometry data such as school zone markings, lane configurations (i.e., turning lanes and their lengths), and sidewalks (i.e., presence or absence of sidewalks) from high resolution aerial images, and (c) generate a GIS-based inventory list of these roadway geometry features for the entire state of Florida, including on and off roadways. This is an innovative solution that employs computer vision technology to potentially replace traditional manual inventory, which is labor intensive and prone to errors.

  Project number: BED30-977-02
  Principal investigator: Eren Ozguven, Florida State University
  Project manager: Alan EI-Urfali, FDOT Traffic Engineering and Operations Office

  [TRB Research in Progress entry]

- **Development of a Roadway Corridor Safety Approach to Identify High-risk Corridors and Prevent Fatalities on Florida Roadways**

  University of Central Florida researchers will develop a roadway corridor safety approach that can be used to define, identify, and evaluate high-risk urban roadway corridors on the Florida State Highway System with respect to fatal crash frequency. First, a high-level risk-based analysis will be conducted to identify roadway corridors with high fatal crash risk for priority treatment. Corridor safety models will then be developed using roadway and intersection data to better understand reasons for differences in fatal crash risk between corridors. Using a risk-based approach allows for the incorporation of non-crash data, such as citations, to provide a more holistic understanding of a roadway corridor's fatal crash risk rather than only considering crashes. Determining risk factors can help Florida Department of Transportation (FDOT) identify countermeasures that might not have been considered otherwise. This approach will assist FDOT's effort of Toward Zero Deaths by

identifying high-risk corridors that are expected to experience many fatal crashes in the near future. It will also help FDOT determine appropriate countermeasures to prevent fatalities from occurring in these corridors. Analyzing entire roadway corridors that include intersections and roadway segments can provide insights not identifiable when studying intersections and roadway segments separately.

Project number: BED26-977-01
Principal investigator: Haitham Al-Deek, University of Central Florida
Project manager: Alan El-Urfali, FDOT Traffic Engineering and Operations Office

[TRB Research in Progress entry]

- **Local Technical Assistance Program Support on Computer-based FDOT Intersection Control Evaluation (ICE) Training**

  In response to The lorida Department of Transportation's (FDOT's) strong interest, University of South Florida researchers will provide technical support through the Florida Local Technical Assistance Program (LTAP) on the development of computer-based FDOT Intersection Control Evaluation (ICE) training to meet the training needs of the statewide transportation workforce. The CBT will be made available to FDOT employees through the FDOT Learning Curve platform, and to local agency and other traffic engineers statewide through an LTAP online platform. This project is complementary to, and shall be delivered through, the annual LTAP project.

  Project number: BDV25-977-78
  Principal investigator: Cong Chen, University of South Florida
  Project manager: Alan El-Urfali, FDOT Traffic Engineering and Operations Office

  [TRB Research in Progress entry]

- **Evaluation of Midblock Pedestrian Signals (MPS)**

  University of Central Florida researchers will conduct extensive evaluation analysis to understand the effectiveness of midblock pedestrian signals (MPS). Based on analyses at 27 study sites, there are two main objectives to be fulfilled. Basically, the research will achieve the following: (i) the project will comprehensively evaluate the effectiveness of MPS for the immediate and longer-term periods after installation; and (ii) the project will use emerging technologies to collect extensive data regarding traffic operational effects, safety benefits, pedestrians' crossing behaviors, and drivers' compliance in yielding to pedestrians with different pedestrian crossing enhancement countermeasures.

  Project number: BDV24-977-42
  Principal investigator: Mohamed Abdel-Aty, University of Central Florida
  Project manager: Alan El-Urfali, FDOT Traffic Engineering and Operations Office

  [TRB Research in Progress entry]

- **Toward a Florida Automated, Connected, Electric, and Shared (ACES) Transportation System Roadmap: Phase II**

  University of South Florida will (i) engage with private Industries to leverage Florida's ACES expertise and promote the Florida ACES program; (ii) develop procedures for management and maintenance of the Florida ACES Transportation System Roadmap via further engagement of stakeholders, increased number of Florida ACES projects in the database, and continued outreach

to transportation professionals as well as university faculty and students; and (iii) successfully plan, coordinate, and transfer the Florida ACES Database and Activity Viewer and associated management, operations, and maintenance from CUTR to FDOT.

Project number: BDV25-977-80
Principal investigator: Pei-Sung Lin, University of South Florida
Project manager: Raj Ponnaluri, FDOT Traffic Engineering and Operations Office

[TRB Research in Progress entry]

- **Human Factors Study on the Use and Effectiveness of Innovative Safety Messages on Dynamic Message Signs**

  University of Central Florida researchers will (i) design a driving simulator experiment to test driver's behavior in response to different safety messages and invite enough subjects across all age groups to validate results; (ii) identify several human factors to be studied and evaluate the effectiveness of innovative safety messages; (iii) develop a statistical model that will accurately analyze the impacts of the safety messages on driver behavior; and (iv) determine criteria to be incorporated into Florida Department of Transportation's (FDOT) safety message approval process (Topic Number 000-750-015).

  Project number: BDV24-977-40
  Principal investigator: Hatem Abou-Senna, University of Central Florida
  Project manager: Dana Knox, FDOT Traffic Engineering and Operations Office

  [TRB Research in Progress entry]

- **Evaluation of CARMA for I-STREET Testbed Implementation**

  University of Florida researchers will develop a guidance document for FDOT on the application of CARMA software suite to transit. This will potentially assist FDOT to leverage and extend the application of existing investments (e.g., I-STREET Living Lab and Mobileye ADAS system on Regional Transit System buses) and also assist with planning future connected and autonomous vehicle (CAV) deployments.

  Project number: BDV31-977-145
  Principal investigators: Pruthvi Manjunatha and Nithin Agarwal, University of Florida
  Project manager: Edith Wong, FDOT Traffic Engineering and Operations Office