FDOT Research Quarterly Summary, August 2021

Completed FDOT Research, May—July 2021

Newly Funded FDOT Research, May—July 2021

Completed FDOT Research, May—July 2021

FDOT Materials Office

- **Quantifying the Duration of the Corrosion Propagation Stage in Stainless Steel Reinforcement**

  University of South Florida researchers developed a rational quantitative estimate of the duration of the corrosion propagation stage of concrete reinforced with stainless steel (SS) in current and anticipated Florida Department of Transportation practice, establishing alternative corrosion monitoring methods if needed. These findings were then applied as inputs to damage function models to determine how any resulting added durability credit can be used to optimize materials and design options.

  Project number: BDV25-977-56
  Principal investigators: Christopher Alexander and Gray Mullins, University of South Florida
  Project manager: Ron Simmons, FDOT Materials Office

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

- **Durability Evaluation of Ternary Mix Designs for Extremely Aggressive Exposures, Phase II**

  Concrete mixtures can be very durable even in very aggressive environments. Concrete permeability is one of the main factors that governs reinforced concrete durability when exposed to chloride or sulfate ions. University of Florida researchers determined the correlation between the concrete mixture proportions for ternary blends and surface resistivity. Correlations between the concrete mixture proportions and alternate concrete transport property indexes, including the

formation factor, were determined. Finally, they determined the relationship between surface resistivity results of concrete ternary blends and concrete durability performance for areas of degradation concern in the Florida environment, including reinforcing steel corrosion caused by chloride ingress and sulfate attack durability.

Project number: BDV31-977-100
Principal investigator: Kyle Riding, University of Florida
Project manager: Harvey DeFord, FDOT Materials Office

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

FDOT Planning Office

- **Assessing the Health Impacts of Transportation Projects – a Synthesis**

  Florida International University researchers, recognizing the need to help the Florida Department of Transportation identify and evaluate projects that achieve a balance between economic development and public health, provided a comprehensive synthesis of existing knowledge and experience in health impact assessment (HIA) methods as well as tool applications. This work lays the foundation for future development of HIA methods or tools that may help the FDOT incorporate health considerations into the planning process.

  Project number: BDV29-977-56
  Principal investigator: Xia Jin, Florida International University
  Project manager: Neil Lyn, FDOT Planning Office

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

FDOT Roadway Design Office

- **Non-Contact Scour Monitoring for Highway Bridges**

  Florida Atlantic University researchers used laser ranging sensors with a wavelength in the green spectrum (approx. 500 nm) for underwater scour monitoring. This included developing methodologies to use the green laser system on static or mobile platforms like trucks, boats, unmanned surface vehicles (USVs), and unmanned aerial systems (UAVs) to map the condition of bridge substructure submerged in the water. Methods were developed to convert the derived depth information from these non-contact bathymetric sensors to meaningful scour conditions, which was accomplished in this project through simulated lab-based and actual prototype field experiments.

  Project number: BDV27-977-16
  Principal investigator: Sudhagar Nagarajan, Florida Atlantic University
  Project manager: Carlton Spirio, FDOT Roadway Design Office

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

- **Innovative and Integrative Best Management Practices (BMPs) for Surface and Groundwater Protection**

  University of Central Florida focused on the design, development, and implementation of stormwater BMPs based on use of activated media for both stormwater and groundwater protection.

  Project number: BDV24-977-25
  Principal investigator: Kelly Kibler, University of Central Florida
  Project manager: Catherine Earp, FDOT Roadway Design Office

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

FDOT Traffic Engineering and Operations Office

- **Crash Risk for Low-Income and Minority Populations: An Examination of At-risk Population Segments and Underlying Risk Factors**

  Florida Atlantic University researchers conducted an epidemiological investigation of crash risk in lower-income areas within Broward and Palm Beach counties. The researchers identified specific at-risk subpopulations and their associated risk factors. The researchers made recommendations for integrating these findings into Florida Department of Transportation Policies and Practices.

  Project number: BDV27-977-17
  Principal investigators: Eric Dumbaugh and Diana Mitsova, Florida Atlantic University
  Project manager: Mark Plass, FDOT Traffic Engineering and Operations Office

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

- **Design and Construction of an Integrated Solar Lighting Pedestrian Crosswalk(s) and Sidewalks with Enhanced Visibility**

  University of Florida researchers sought to improve lighting for pedestrian facilities. In one approach, they integrated solar panels into an already established pedestrian crosswalk, coupling this technology with battery storage, light-emitting diode (LED) lighting for alerting oncoming traffic, and powering overhead lighting. The second approach involved constructing a small portion of sidewalk with commercially available photoluminescent stones to measure their performance in terms of durability and emittance duration during nighttime.

  Project number: BDV31-977-78
  Principal investigator: Jonathan Scheffe, University of Florida
  Project managers: Ronald Chin and Trey Tillander, FDOT Traffic Engineering and Operations Office

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

- **Application of Dynamic Crash Prediction Methodologies to FDOT Safety and Transportation System Management and Operational (TSM&O) Programs**

  University of South Florida researchers documented the current state of practice for dynamic crash prediction methods and software as well as the types of reports and information produced by these methods of software that can be used by safety engineers and traffic management center (TMC) staff. The researchers developed new standard operating guidelines or action plans for the

TMC and local agencies that would be implemented when using dynamic crash prediction methods or software. They estimated safety and mobility benefits from implementing the standard operating guidelines or action plans. They documented the resources and local partnerships needed to implement the standard operating guidelines (SOGs) or action plans, such as with local law enforcement and emergency responders. They produced a pilot study of dynamic crash predictions SOGs and action plans in FDOT District 4 and made recommendations for implementation in Florida.

Project number: BE548
Principal investigator: Zhenyu Wang, University of South Florida
Project manager: Melissa Ackert, FDOT Traffic Engineering and Operations Office

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

Newly Funded FDOT Research, May—July 2021

FDOT Aviation Office

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

  New proprietary and nonproprietary 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 and 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

FDOT Geotechnical Office

- **Geo-Statistical Deep Foundation Software**

  University of Florida researchers will implement updates to the existing software package and deliver demonstration sessions for in-house personnel and consultants. Areas emphasized will be implementation of Measuring While Drilling (MWD) results that will lead to improvements in site characterizations for deep foundation design, implementation of cone penetration tests (CPT) ito

bring about increased flexibility for assessing axial resistance, and investigating a methodology by which the valid zonal radius emanating away from a candidate test shaft location can be identified through usage 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 Geotechnical Office

[TRB Research in Progress entry]

FDOT Materials Office

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

  University of Central Florida researchers will validate and update the sinkhole index and chart using both large-scale sinkhole simulation tests and the updated dataset containing other geological formations and geotechnical conditions. They will develop a set of criteria and guidance for the sinkhole index and vulnerability assessment and evaluate raveling evolution and the effect of grout-take using the updated 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]

- **Open-Graded Friction Courses Suitable for Suburban Environments**

  Auburn University researchers will determine alternative friction courses that are more durable in suburban environments and are drainable while providing adequate friction and texture properties. As rural parts of Florida become more urbanized, roadway sections paved with open-graded friction courses (OGFCs) are exposed to more challenging traffic movements, particularly at signalized intersections and other locations where acceleration, deceleration or turning movements are common. These traffic patterns potentially quicken failure. This research will deliver alternatives to the currently used OGFC mixtures. These alternative mixtures will prolong pavement life while still addressing safety aspects.

  Project number: BEB15
  Principal investigator: Fan Gu, Auburn University
  Project manager: Wayne Rilko, FDOT Materials Office

  [TRB Research in Progress entry]

- **Development of a Test to Quantify Organic Content in Silica Sand**

  University of Florida researchers will select a chemistry test appropriate for use as stated in Section 902 2.2, including modifying an existing test, to create a draft Florida Test Method. This test should cost no more than about $100 at a commercial laboratory and should not require more than five days to complete. The researcher shall provide a basis for recommended Quality Control test frequencies for the chemistry test to be performed at silica mines.

  Project number: BEB28

Principal investigator: Kyle Riding, University of Florida
Project manager: John Shoucair, FDOT Materials Office

[TRB Research in Progress entry]

FDOT Planning Office

- **Assessing the Impacts of Autonomous Connected Electric and Shared (ACES) Mobility on Travel Demand**

  Florida International University researchers will incorporate the derived behavior insights and market assessment from a previous project (BDV29-977-47) into the demand analysis and planning process to determine the impacts of ACES on mobility and travel demand.

  Project number: BDV29-977-68
  Principal investigator: Xia Jin, Florida International University
  Project manager: Terry Corkery, FDOT Planning Office

  [TRB Research in Progress entry]

FDOT Public Transportation Office

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

  Many studies have assessed the impact of AVs or AV-based microtransit, but few have examined preliminary implementation challenges as well as the real-life benefits or drawbacks of these travel modes. University of Florida researchers will address some fundamental questions. Regarding 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. Impacts on mobility improvement and community livability will be examined, 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]

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

  University of South Florida researchers will evaluate the effectiveness of buss-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' reaction, BOS motorist violations, etc. They will 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 BOSS installed in both the northbound and southbound directions at the 38th Avenue N and 54th Avenue N on-ramps. They will evaluate whether I-275 BOS project leads to traffic and safety impacts to I-275 project segment and parallel local streets due to spill-over of traffic from on-ramps of I-275 segment. Finally, they will. provide recommendations 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: Yu Zhang, University of South Florida
Project manager: Craig Fox, FDOT Public Transportation Office

FDOT Research Center

- **Financial Achievability Model (FAM): Operationalization Case Studies and Analysis**

  Florida State University researchers will evaluate options for incorporating economic analysis into the current research process.

  Project number: BDV30-977-36
  Principal investigator: Patricia Born, Florida State University
  Project manager: Jason Tuck, FDOT Research Center

  [TRB Research in Progress entry]

FDOT Traffic Engineering and Operations Office

- **A Before-and-After Study to Evaluate the Operational Benefits of the Dynamic Flashing Yellow Arrow Decision Support System (DFYA-DSS)**

  University of Central Florida researchers will identify candidate intersections for dynamic flashing yellow arrow treatment. They will conduct a pilot before-and-after study on one intersection and, after addressing shortcomings to the stucy process, perform a before-and-after study on a full sample of intersections. Recommendations for best practices will be developed.
  Project number: BDV24-977-39
  Principal investigator: Hatem Abou-Senna, University of Central Florida
  Project manager: Jim Stroz, 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 design a driving simulator experiment to test driver behavior in response to different safety messages, including subjects across all age groups to validate results. They will identify several human factors to be studied and evaluate the effectiveness of innovative safety messages and develop a statistical model that will accurately analyze the impacts of the safety messages on driver behavior. Based on their findings, they will determine criteria to be incorporated into Florida Department of Transportation's safety message approval process.

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 Midblock Pedestrian Signals**

  University of Central Florida researchers will conduct an extensive evaluation of midblock pedestrian signals to understand their effectiveness, based on analysis at 27 study sites. The researchers will evaluate the effectiveness of midblock pedestrian signals for the immediate and longer-term periods after installation. They will also use emerging technologies to collect extensive data regarding traffic operational effects, safety benefits, pedestrian crossing behaviors, and driver 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]