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

Final Report

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PREPARED FOR

Florida Department of Transportation

July 2021

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Florida Department of Transportation
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July 2021

Disclaimer

The opinions, findings, and conclusions expressed in this publication are those of the authors and not necessarily those of the State of Florida Department of Transportation.

Metric Conversion

SYMBOL	WHEN YOU KNOW	MULTIPLY BY	TO FIND	SYMBOL
LENGTH				
in	inches	25.4	millimeters	mm
ft	feet	0.305	meters	M
yd	yards	0.914	meters	M
mi	miles	1.61	kilometers	km
VOLUME				
fl oz	fluid ounces	29.57	milliliters	mL
gal	gallons	3.785	liters	L
ft^3	cubic feet	0.028	cubic meters	m^3
yd^3	cubic yards	0.765	cubic meters	m^3
NOTE: volumes greater than 1000 L shall be shown in m^3				
MASS				
oz	ounces	28.35	grams	G
lb	pounds	0.454	kilograms	kg
T	short tons (2000 lb)	0.907	megagrams (or "metric ton")	Mg (or "t")
TEMPERATURE (exact degrees)				
ºF	Fahrenheit	5 (F-32)/9 or (F-32)/1.8	Celsius	ºC

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16. Abstract

Automated, Connected, Electric, and Shared (ACES) technologies are rapidly evolving and will continue to impact development of vehicles, infrastructure, communities, commerce, and the economy. With rapidly evolving technology, it is difficult yet critical to maintain coordination and increase collaboration among research, development, testing, deployment, demonstration, evaluation, and educational initiatives in the ACES arena. Therefore, the concept of a Florida ACES Transportation System Roadmap was suggested. To successfully envision and build an ACES transportation roadmap for Florida, several objectives were earmarked. Primary objectives are to create an inventory of past, present, and future ACES projects and initiatives in Florida, to develop an active ACES stakeholder database for the state and to create a graphical interface that will serve as a hub for collaboration and coordination among the various existing and potential ACES stakeholders. Through this Phase I project, CUTR has successfully accomplished these important objectives. Targeted outreach was also conducted toward potential ACES stakeholders and how they could leverage the progress made during Phase I of the project to foster new collaborations, secure new lines of funding for ACES-related research and development, and engage in knowledge and technology transfer activities centered around regional economic development. Results from Phase I of the ACES Roadmap Initiative show the power of the tools and products developed and ACES outreach activities conducted to foster new collaborations and facilitate the rapid development, deployment, implementation, and evaluation of appropriate and optimized ACES technologies according to desired performance measures.

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Executive Summary

Automated, Connected, Electric, and Shared (ACES) technologies are evolving rapidly and will continue to impact development of vehicles, infrastructure, communities, commerce, and the economy. With rapidly evolving technology, it is difficult yet critical to maintain coordination and increase collaboration among research, development, testing, deployment, demonstration, evaluation, and educational initiatives in the ACES arena. Therefore, the concept of a Florida ACES Transportation System Roadmap was suggested. To successfully envision and build an ACES transportation roadmap for Florida, several objectives were earmarked. The primary objectives were to

- create an inventory of past, present, and future ACES projects and initiatives in Florida,
- develop an active ACES stakeholder database for the state, and to create a graphical interface that will serve as a hub for collaboration and coordination among the various existing and potential ACES stakeholders.

To achieve these objectives set forth by the Center for Urban Transportation Research (CUTR) and project leadership, a Florida ACES Leadership Group was convened as part of the Phase I project. This group played an important role to guide CUTR in performing various project tasks, provide feedback on the design of the Florida ACES database and Activity Viewer, assist in conducting ACES outreach activities and special university initiatives, and provide insights on future efforts that could be conducted based on the current phase of the project. Once the Leadership Group was set, efforts were undertaken by CUTR to visualize an initial structure for the ACES Transportation Roadmap. This primarily involved envisioning an initial design of the ACES database and Activity Viewer. CUTR sought inspiration from existing active transportation portals to develop its own version of the Florida ACES database and Activity Viewer.

A major goal for the ACES database and Activity Viewer was to serve as a forum to engage in knowledge and technology transfer using the graphical interface as a medium to share data, findings, and best practices between and among transportation agencies, other public agencies, the private sector, and university communities. After reviewing several available platforms and components, CUTR developed the front and back ends of the ACES database and Activity Viewer and developed a platform that can be easily accessed, is not costly to operate and maintain, and provides a secure mechanism to hold and host ACES project-related data collected as part of this project. The ACES database and Activity Viewer also can track statewide initiatives (such as bikeshare activity and electric vehicle charging infrastructure) and several federal initiatives (such as the National Operations Center of Excellence [NOCoE] signal phase and timing deployment [SPaT] challenge and the USDOT Connected Vehicle Deployment). The ACES database and Activity Viewer will be made available to all ACES stakeholders with varying levels of accessibility to facilitate information dissemination and knowledge and technology transfer.

To maximize collaboration and develop greater cooperation among research, testing, deployment, demonstration, and educational ACES initiatives in Florida, the project also focused on the development of ACES outreach tools and materials as well as planning and conducting outreach activities to promote coordination and collaboration to advance the implementation of ACES technologies in Florida. To facilitate this, CUTR developed outreach tools and materials for supporting engagement efforts and used the project stakeholder network and other professional listservs to distribute products such as an introductory Florida ACES slide deck, the ACES website, and the initial version of the ACES database and Activity Viewer.

Due to the impact of the COVID-19 pandemic and travel restrictions on ACES outreach activities, CUTR planned for and transitioned from in-person to online (virtual) outreach events. The research team organized virtual outreach activities in cooperation with FDOT and other organizations to encourage and expand engagement with the Florida ACES Transportation Roadmap and the Activity Viewer, facilitate data sharing, and connect with relevant stakeholders. Virtual outreach activities included email communications with the ACES Leadership Group, selected stakeholders, and transportation professionals, a poster presentation at the 2021 Transportation Research Board (TRB) Annual Meeting, a Florida Local Technical Assistance Program (LTAP) Center webinar on ACES, and a presentation to the CUTR Advisory Board.

CUTR recognized the importance of continuing outreach activities for greater information dissemination and more collaborative engagement with ACES stakeholders. Phase I of the project focused on the university initiative, a Florida ACES stakeholder kickoff meeting, and a wrap-up Web meeting. CUTR coordinated with FDOT and the Florida ACES Leadership Group to propose strategies to involve university communities on ACES, specifically the next generation of planners and engineers, and on embracing ACES technologies and leveraging the resources created through the project for their personal and professional endeavors. A stakeholder kickoff meeting was conducted, which mainly provided information on how current and potential ACES stakeholders could be involved in, benefit from, and collaborate through the major product of this project, namely the Florida ACES database and Activity Viewer. A Phase I wrap-up Web meeting was also conducted to summarize project accomplishments, reach solid conclusions, obtain valuable feedback on project products and ACES outreach activities made in Phase I, and recommend future directions. Members of the Leadership Group were the main attendees at this Web meeting, in addition to the CUTR team. The meeting supported FDOT and CUTR in charting the course for a future phase of the Florida ACES Roadmap Initiative.

Based on these project tasks and discussions with the FDOT ACES Leadership Group and interested ACES stakeholders in Florida, CUTR realizes the need for the project to continue beyond Phase I so the products and momentum can continue in future phases and place Florida

in an advanced stage for facilitating, deploying, and implementing ACES technologies. With these in mind, CUTR recommends the following:

- Continue to engage actively with Florida ACES stakeholders (existing and new) to track developments on ACES projects and initiatives (existing and new) across the state.
- Continue to enhance the products from Phase I, namely the ACES database and Activity Viewer, and promote their use among transportation professionals in the state.
- Conduct more outreach events to inform interested stakeholders about the potential of the database and Activity Viewer to foster new collaborations, explore new lines of research, and actively contribute to enhancing the of the scope of ACES research in Florida.
- Engage with other professional organizations to leverage Florida's expertise and experience in onboarding ACES technologies and continue to serve as a reference point in rapid development, deployment, implementation, and evaluation of ACES technologies.
- Continue to actively involve the future generation of engineers and planners from schools, colleges, and universities via outreach programs and other educational initiatives to achieve knowledge and technology transfer.

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1. Background and Motivation

The dramatic and disruptive transformation of the transportation system as a result of development and adoption of Automated, Connected, Electric and Shared (ACES) transportation systems is currently underway. Advanced technology is and will continue to impact development of vehicles, infrastructure, communities, commerce, and the economy. At the national level, the U.S. Department of Transportation (DOT) continues to coordinate and develop policies, programs, and pilots focused on connected automated transportation. Figure 1-1 shows the current (May 2021) locations of 139 known planned and operational connected vehicle deployments, including several in Florida. U.S. DOT also recently published *Ensuring American Leadership in Automated. Vehicle Technologies: Automated Vehicles 4.0* (AV 4.0)[1], which provides policy guidance and guidelines for working with U.S. DOT on automated surface transportation systems.

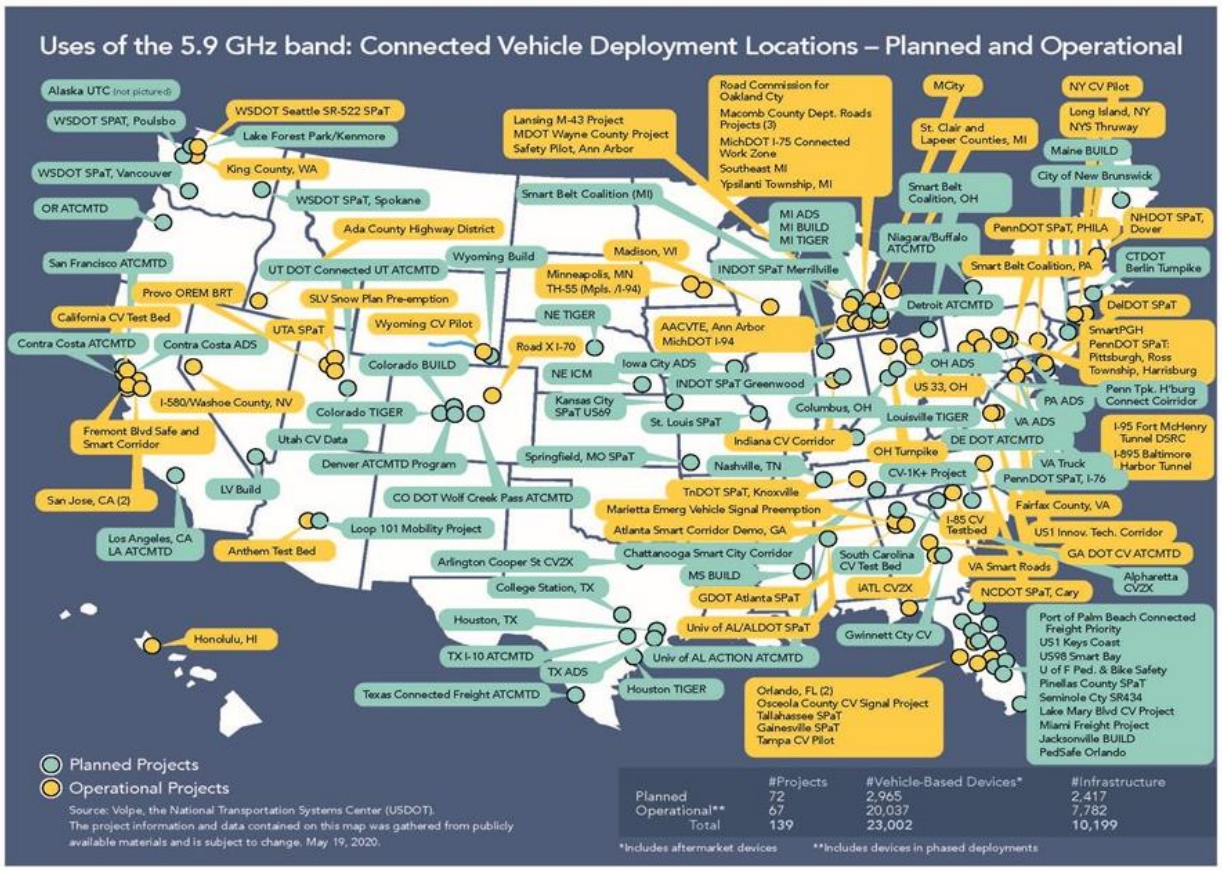

Figure 1-1 U.S. Connected Vehicle Deployments as of May 2021

(Source: https://www.transportation.gov/research-and-technology/map-current-deployments-safety-band)

[1] https://www.transportation.gov/sites/dot.gov/files/2020-02/EnsuringAmericanLeadershipAVTech4.pdf

The Florida Department of Transportation (FDOT) is leading the way with the Florida Connected Vehicle Initiative[2]. As shown in Figure 1-2, FDOT has catalogued 8 current planning projects, 10 design/implementation initiatives, and 15 operational projects as of May 2021. FDOT's mission includes improving safety, reducing congestion, and leveraging advanced technologies, and Florida leads a number of Transportation Systems Management and Operations (TSM&O) initiatives that incorporate ACES elements. This list may expand based on how the scope of incorporation of ACES elements are modified, and there may be other projects in various stages of development or that are underway in Florida that are not shown in Figure 1-2.

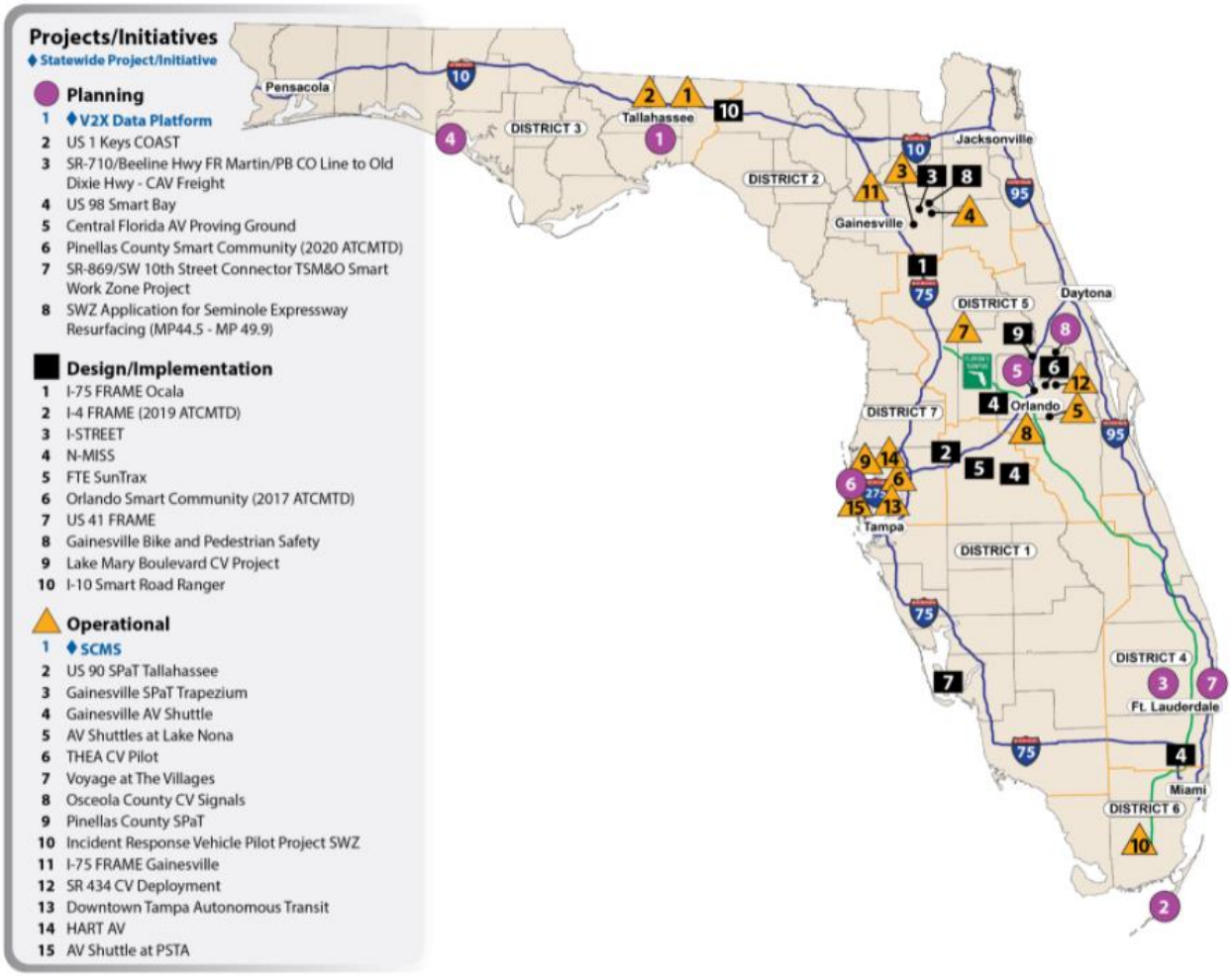

Figure 1-2 Florida Connected Vehicle Initiative

(Source: https://www.fdot.gov/traffic/its/projects-deploy/cv/connected-vehicles)

In 2013, FDOT, the Tampa Hillsborough Expressway Authority (THEA), and many other public, private, and university partners organized the first Florida Automated Vehicle (FAV) Summit in Tampa. Its goal was to showcase Florida's progress in preparing for advancing ACES technologies and transportation system technology and supporting planning and policy efforts.

[2] https://www.fdot.gov/traffic/its/projects-deploy/cv/connected-vehicles.shtm

The Summit continued each year—in Orlando (2014), Jacksonville (2015), Tampa (2016, 2017, 2018), and Miami (2019). In addition to the leadership provided by FDOT and THEA, other agencies are also playing prime roles in the advancement of ACES technologies, including but not limited to the Florida's Turnpike Enterprise (FTE), Central Florida Expressway Authority (CFX), Miami-Dade Expressway Authority (MDX), Jacksonville Transportation Authority (JTA), City of Gainesville, City of Tampa, Gainesville Regional Transit, Hillsborough Area Regional Transit, and others. Cities, counties, transit agencies, and metropolitan planning organizations (MPOs) are interested in data, tools, and guidance about how to incorporate planning for ACES technologies into their work, and private sector players are also active in Florida, with new demonstrations, pilots, deployments, and developments being launched regularly. In addition to the public and private sectors, faculty and students from Florida universities, colleges, and high schools have been important constituents of the FAV Summit and are working on various ACES-related projects in Florida and beyond. Academic research and education, starting with high school and earlier, are important to ensuring that Florida is prepared for the technological wave of change in our transportation system.

1.1 Project Objectives

ACES technologies are evolving quickly, and it is difficult—yet critical—to maintain coordination and increase collaboration among research, development, testing, deployment, demonstration, evaluation, and educational initiatives in the ACES arena. Therefore, the concept of a Florida ACES Transportation System Roadmap was developed and project objectives were identified and earmarked. For the current phase of the project, objectives included the following:

- Develop an initial inventory of past, current, and planned ACES initiatives in Florida.
- Provide a knowledge and technology transfer forum and graphical interface to share data, findings, and best practices between and among transportation agencies, the private sector, and colleges and universities.
- Leverage expertise and funding across multiple jurisdictions and sectors.
- Encourage and expand communication, cooperation, and collaboration.
- Facilitate the rapid development, implementation, and evaluation of appropriate and optimized ACES technologies according to desired performance measures.

To accomplish these project objectives, a research team at the Center for Urban Transportation Research (CUTR) at the University of South Florida (USF), in consultation with FDOT, set out to conduct identified project tasks; key findings of these tasks are highlighted herein.

1.2 Report Organization

The rest of this report is organized as follows. Chapter 2 discusses the formation of the Florida ACES Leadership Group and insights learned while establishing the structure of the initial version of the ACES Roadmap. Chapter 3 discusses the efforts and achievements in designing, piloting, and finalizing the ACES Roadmap database and Activity Viewer, the primary product of

this project. Chapter 3 provides details on the database and Activity Viewer features and characteristics and the vision behind their creation. Chapter 4 presents a description of the marketing and outreach materials developed and used for the project and describes the ACES outreach plan and accomplishments of virtual outreach activities (in response to the COVID-19 pandemic) conducted with participation from existing and potential Florida ACES stakeholders, researchers, and university students. Chapter 5 describes planning and conducting the ACES stakeholder kickoff meeting, a special university initiative with support from the Florida ACES Leadership Group, and the Phase I wrap-up meeting to obtain input, feedback, and recommendations for a future Florida ACES Roadmap. Chapter 6 provides summary findings from the project, identifies future needs, and proposes efforts by the research team for future phases of the Florida ACES Program.

2. ACES Roadmap Leadership Group and Initial Structure of ACES Roadmap

This chapter describes the formation of the Florida ACES Roadmap Leadership Group that provided leadership and feedback on the development and structure of the overall ACES Roadmap and the products that emanated from this effort. It also introduces the initial structure of the ACES portal developed by CUTR.

2.1 Formation of Florida ACES Leadership Group

To provide leadership and guidance on the development and structure of the overall Florida ACES Roadmap, CUTR recommended the formulation of a Florida ACES Roadmap Leadership Group to provide guidance and feedback on the various products, processes, and tools developed as part of the ACES Roadmap Initiative and to chart a course for the Florida ACES Roadmap Phase I and beyond. Based a comprehensive review of expertise, knowledge, and experience in the ACES arena and consultation with the FDOT Project Manager, 12 individuals were identified and selected as members of the ACES Roadmap Leadership Group for Phase I. All are either faculty members at Florida universities or professionals affiliated with the FDOT Central Office. Members of the group were invited to participate in ACES-related meetings facilitated by CUTR to discuss updates and provide input/feedback over the duration of the project. The group played an important role in guiding CUTR to perform various project tasks, provide feedback on the design of the Florida ACES database and Activity Viewer, assist in conducting ACES outreach activities and a special university initiative, and provide insights on future efforts that could be conducted.

2.2 Initial Structure of ACES Roadmap

In addition to formation of a Leadership Group, CUTR, with guidance from the FDOT Project Manager, created an initial structure for the ACES portal. To accomplish this, researchers reviewed available interactive transportation portals from across the world to sketch out what the main components of the ACES database and Activity Viewer would look like. Major features of the proposed web-based ACES portal included the following:

- **Spatial distribution of Florida ACES efforts:** The Web-based portal would feature a multi-layered interface with a spatial distribution of all past, present, and planned Florida ACES initiatives. The interface would include projects at the point, corridor, and larger geographic area levels of spatial distribution.
- **Interactive portal with up-to-date project information**: The Web-based portal would be interactive with multi-level authentication embedded to enable access to different project stakeholders. In the most updated version, project information would be included with succinct summaries, a clear description of project objectives, and the main outcomes expected (or achieved).

- **Seamless data-sharing**: The multi-layered authentication enabled on the ACES Roadmap database and Activity Viewer would allow for seamless data-sharing among project stakeholders and FDOT.

After consulting with the FDOT Project Manager and selected experts from the Leadership Group on database management, CUTR identified the sample fields shown in Table 2-1 to be included in the ACES Roadmap database and Activity Viewer to describe projects to be added as part of this initiative.

Table 2-1 Sample Project Data Fields – ACES Roadmap Database and Activity Viewer

Project Title	Project Type
Project Sponsor	Start Date
Project Lead	End Date
Project Cooperating Organizations	Products
Sponsors/Funding	Data Sets
Geographic Location	Images
Abstract	Performance Measures
Keywords	Last Update
ACES Category	

Based on an extensive review of available interactive transportation portals, CUTR developed mockups of the proposed Activity Viewer for the purpose of illustration, as shown in Figure 2-1 and Figure 2-2 .

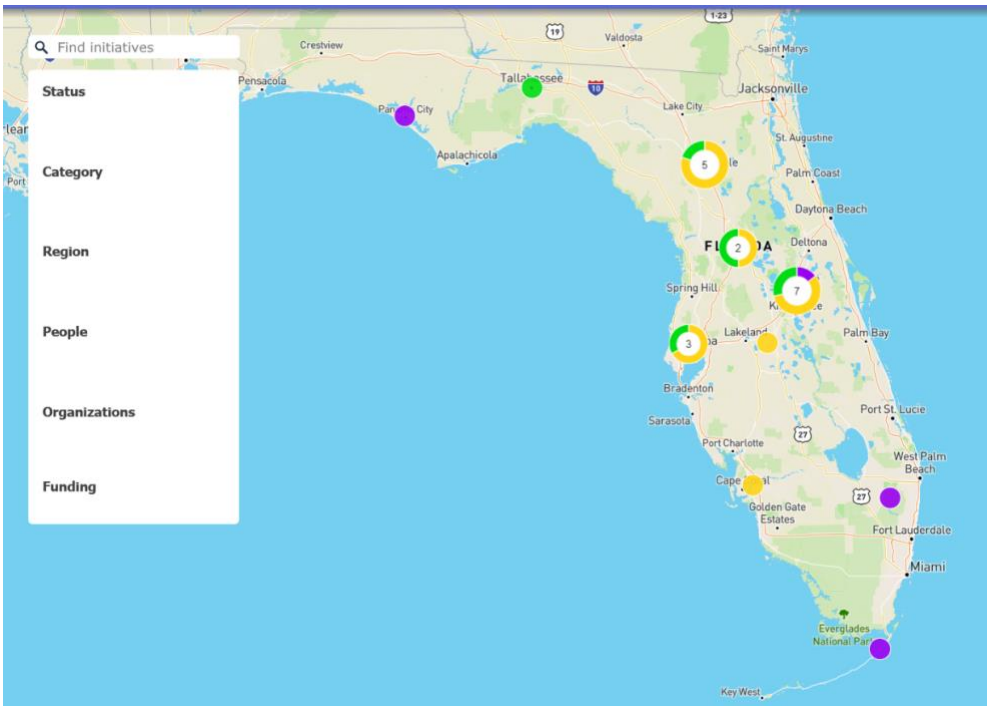

Figure 2-1 Illustrative Mockup, Florida ACES Database and Activity Viewer

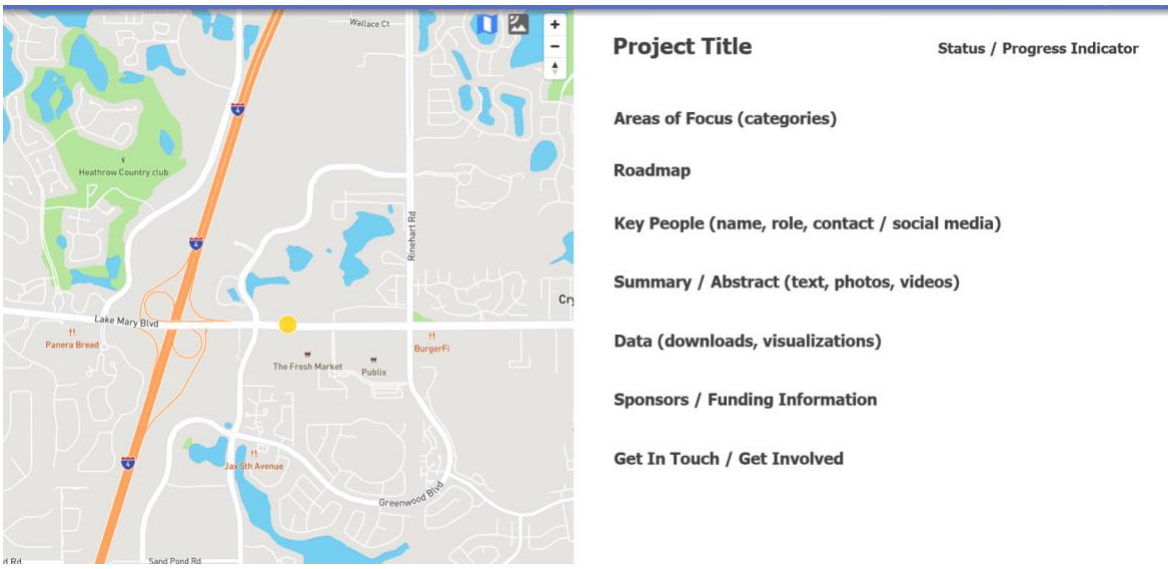

Figure 2-2 Illustrative Mockup, Project Page, Florida ACES Database and Activity Viewer

With review and approval from the FDOT Project Manager, CUTR proceeded to develop the proposed Florida ACES database and Activity Viewer components and markups. The main details on this development and key findings/lessons learned are discussed in Chapter 3.

3. Design and Development of ACES Database and Activity Viewer

With the rapid advancement of ACES technology across the world, it is critical to maintain coordination and develop collaboration among ACES research, development, testing, deployment, demonstration, and educational activities. With this in mind, CUTR embarked on the design and development of an ACES database and Activity Viewer for documenting ACES efforts in Florida. The Activity Viewer serves as a forum to engage in knowledge and technology transfer and as a graphical interface to share data, findings, and best practices between and among transportation agencies, other public agencies, the private sector, and university communities.

To showcase ACES-related project data from ACES transportation stakeholders in Florida, CUTR designed a fundamental ACES Roadmap database and Activity Viewer for implementation through the project. The database design is comprehensive to incorporate information from ongoing ACES projects and flexible to allow changes due to future requirements. Data from current ACES projects were compiled and input into the database, which presented the stored ACES project data on an interactive, location-based display system. The Activity Viewer also supports submission of new project data through various levels of vetting/approval processes.

At the outset, CUTR set out to develop the database and Activity Viewer on a platform that could be easily accessed, inexpensive to operate and maintain, and provide a secure mechanism to hold/host ACES project-related data collected as part of this project.

Details of the design architecture for the ACES database and Activity Viewer, major Florida ACES initiatives included, and access to the Activity Viewer are presented in the following sections.

3.1 Design Architecture for ACES Activity Viewer – Front End

To make the Activity Viewer more easily and readily available to the public, the design and development of the viewer focused on creating a Web-based solution that operated on both traditional and mobile platforms. Additionally, various supporting technologies were selected and configured to increase data security, decrease maintenance costs, and allow for rapid deployment of features and improvements.

The Activity Viewer website is hosted on Netlify,[3] a development platform for fast and secure delivery of Web content. Bridging the gap between development and deployment, Netlify automated the process of compiling the source code, building the website, and making the

[3] https://www.netlify.com/.

content available for public access. The current version of the Activity Viewer resides at https://florida-aces.org/ (see Figure 3-1).

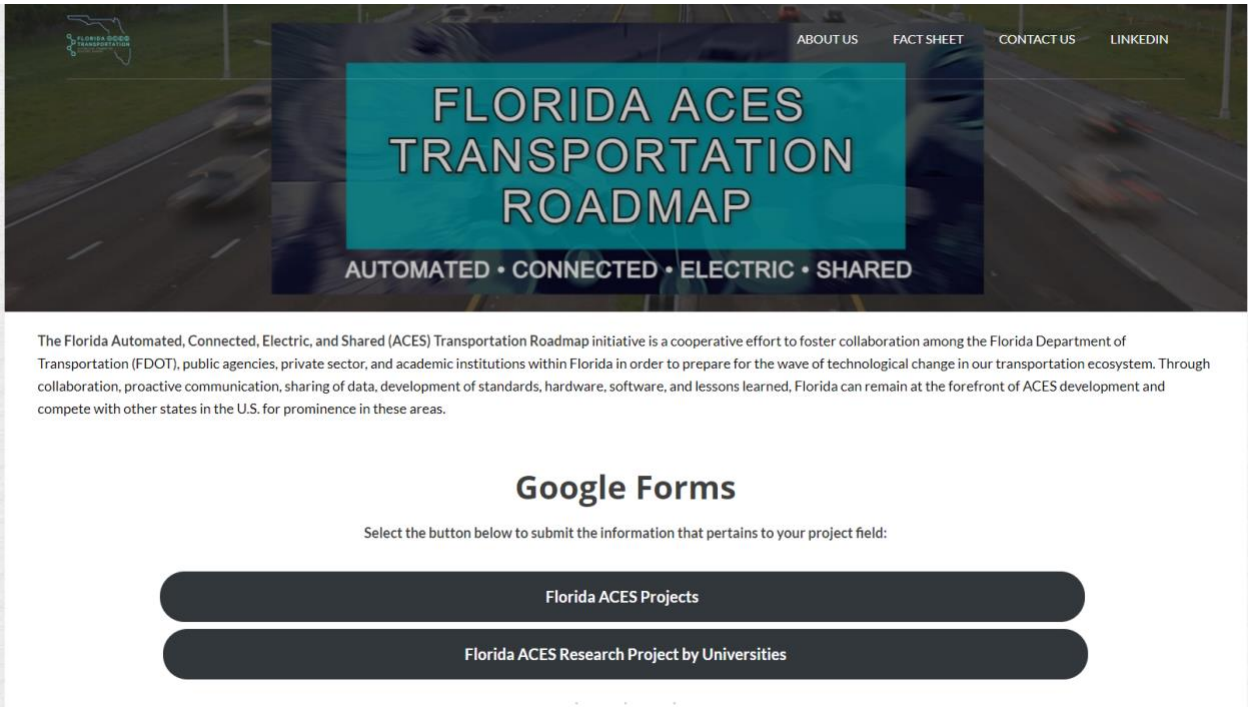

Figure 3-1 Florida ACES Transportation Roadmap Initiative Website

The Activity Viewer's user interface (UI) was implemented using React,[4] a JavaScript-based Web development framework. Instead of individual pages, the website was built with components that can be reused and reconfigured in different parts of the UI, an approach that streamlines development and increases the website's responsiveness. For the UI's interactive map display, a critical component was that it must be able to render thousands of data points and complex shapes while responding to myriad user interactions. To accomplish this, multiple mapping solutions were considered, focusing on performance, scalability, and ease of integration. Mapbox[5] was chosen as the UI's underlying mapping technology rather than better-known products from Google and Esri because of the high level of control it affords the developer.

To standardize the information that can be displayed by the Activity Viewer, 17 data fields were developed to describe each ACES project. These data were stored in a project database managed by the development team. In the current version, summaries of 33 Florida-based ACES projects outlined by the FDOT Connected Vehicle Initiative[6] were used as illustrative examples to develop the Activity Viewer. As more projects are added to the database or

[4] https://reactjs.org/.

[5] https://mapbox.com/.

[6] https://www.fdot.gov/traffic/its/projects-deploy/cv/connected-vehicles.

existing data changes, the information shown by the Activity Viewer will be updated accordingly.

In addition to the ACES projects database, the Activity Viewer used data from other sources. Alternative fuel station data were collected from the National Renewable Energy Laboratory (NREL)[7], and Citybikes[8] supplied the bikeshare information developed as part of additional initiatives under the Activity Viewer. Nationwide signal phase and timing deployment (SPaT Challenge) data were extracted from the National Operations Center of Excellence (NOCoE)[9]. Because these data are from external sources, effort was required to ensure that they are available for use and are correctly formatted for display.

3.2 Design Architecture for ACES Activity Viewer – Back End

The ACES Activity Viewer relied on several back-end services. In addition to a database for ACES project data, a file server was required to store project-related data files, and an authentication service was needed to secure the administrative portion of the Activity Viewer, where project data could be modified. A reliable method of communication between the Activity Viewer and these back-end services was established.

Traditionally, privately-owned servers can handle these tasks, if configured correctly. However, this approach required constant monitoring against security risks, data loss, and hardware integrity. To overcome these challenges, CUTR chose to adopt a cloud-computing approach, keeping in mind the need to minimize server-side maintenance. After comparing multiple well-known providers, including offerings from Google and Microsoft, Amazon Web Services (AWS) was selected based on its broader range of services, more extensive support, and lower costs. ACES resources stored on AWS are also protected by industry-leading security measures.

The ACES project database is supported by the DynamoDB[10] service on AWS. DynamoDB is fast and flexible and accommodates future changes to the project data fields. S3[11] provides nearly unlimited file storage capacity for the Activity Viewer. Cognito[12] handles authenticating user accounts, so only approved users can make changes to the project database via the Activity Viewer. Through the API Gateway[13] service, the Activity Viewer can make requests to view or change project data, and the Lambda[14] service executes custom logic to fulfill these requests.

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[7] https://developer.nrel.gov/.

[8] https://citybik.es/.

[9] https://transportationops.org/.

[10] https://aws.amazon.com/dynamodb/.

[11] https://aws.amazon.com/s3/.

[12] https://aws.amazon.com/cognito/.

[13] https://aws.amazon.com/api-gateway/.

[14] https://aws.amazon.com/lambda/

Figure 3-2 shows an overview of the interactions among front-end and back-end services for the Florida ACES Activity Viewer.

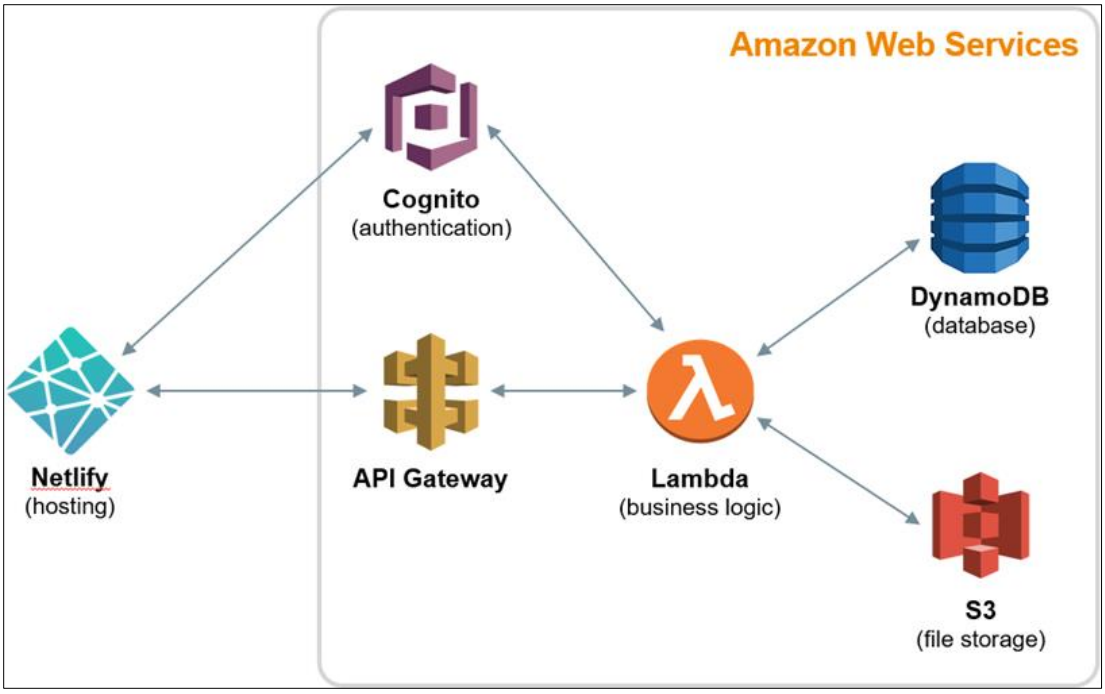

Figure 3-2 ACES Activity Viewer Services

3.3 ACES Database and Activity Viewer

This section details the various components of the Florida ACES database and Activity Viewer developed by CUTR. The current iteration of the ACES Activity Viewer consists of a landing page, as shown earlier in Figure 3-1.

Map View

The "ACES Initiatives" navigation menu provides access to selected Florida and federal initiatives added into the Activity Viewer by CUTR; a brief description of these initiatives is described later in this section. The Florida-specific view features an interactive, location-based display of Florida-based ACES projects (currently showing 33 projects at different stages of development), prominent bikeshare networks across the state, and electric vehicle charging stations. The map can be zoomed, panned, rotated, and tilted according to the user's desire. A satellite view is also supported. Several ACES projects are in various stages of development across the state (planning, design, deployment, evaluation); the interactive Activity Viewer allows the user to quickly discern each project's location and type. Green markers on the map indicate projects in deployment, yellow indicate projects in the design stage, and magenta indicates projects in the planning stage (Figure 3-3).

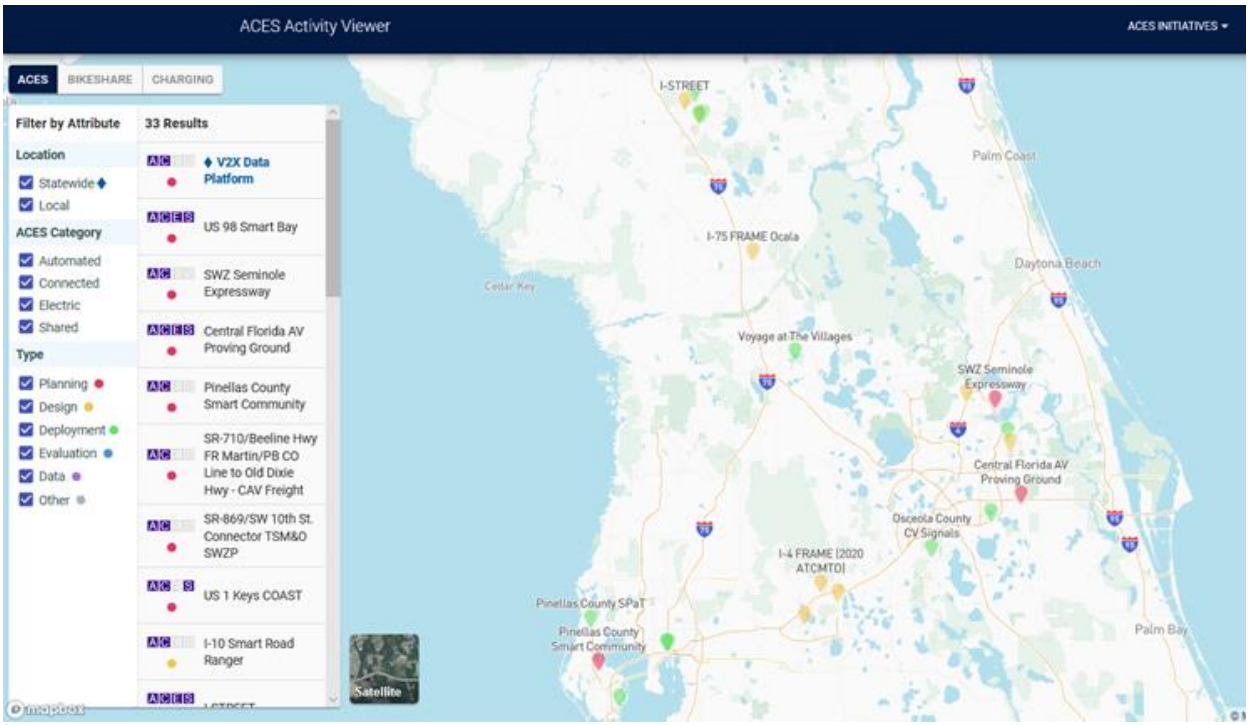

Figure 3-3 Overview of Florida ACES Projects

On the left side of the map, a filtering control provides a quick way to narrow down the projects shown on the interactive display. For example, nine deployment projects are classified under the “Electric” or “Shared” verticals (as shown in Figure 3-4).

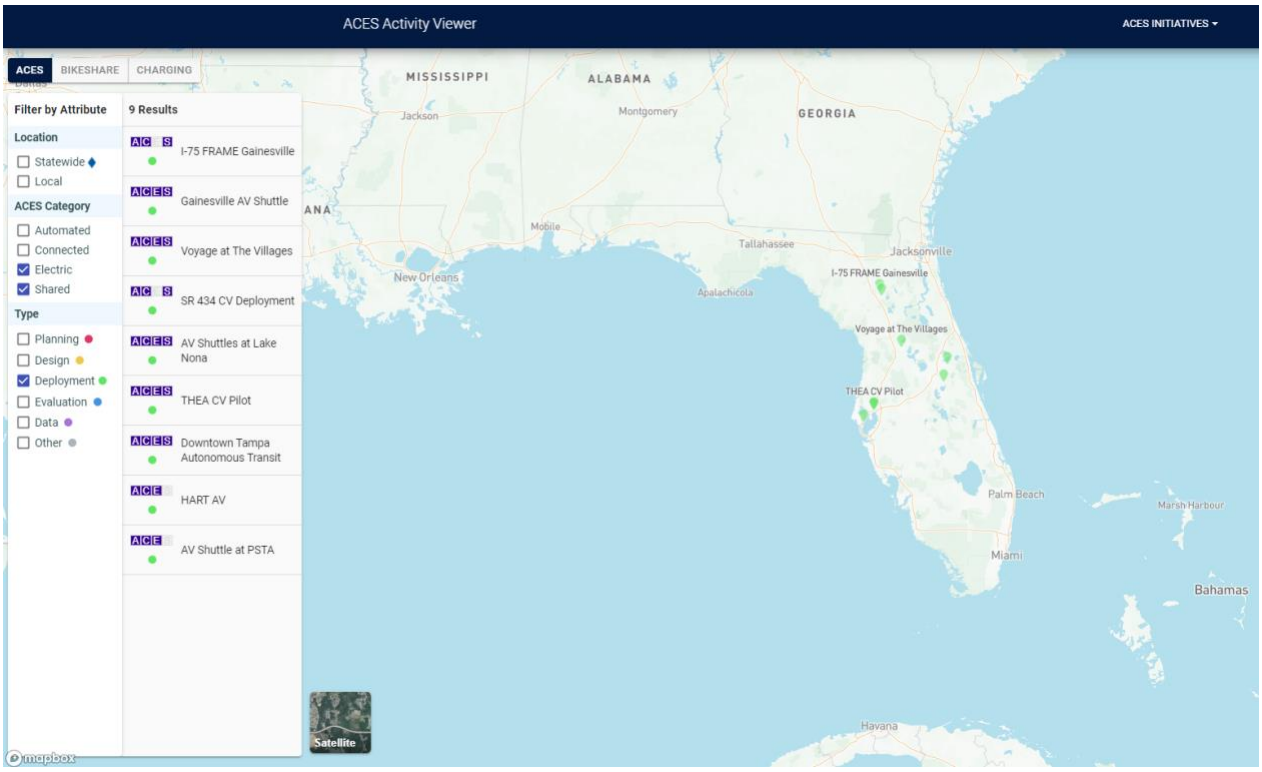

Figure 3-4 ACES Activity Viewer – Project Selection Filters

Project View

Hovering the cursor over a particular project reveals its geographic confines (Figure 3-5). Some projects are located along linear corridors, some fall within a specifically-shaped geographic area, and some may be located at discrete points—the Activity Viewer supports all of these types of geographical descriptions. Selecting a project in the overview brings up the details display, where additional project information is shown alongside the location-based view. Where feasible, project details included project scope, development status, managing organizations, and data files (and other data fields described in Table 2-1), depending on how much project data are available. It is also worth noting that only available data fields are displayed under each project, thereby creating a clean interface, devoid of any missing information.

In addition to showcasing Florida's ACES projects, CUTR curated several major initiatives that were made available as part of the Florida ACES database and Activity Viewer.

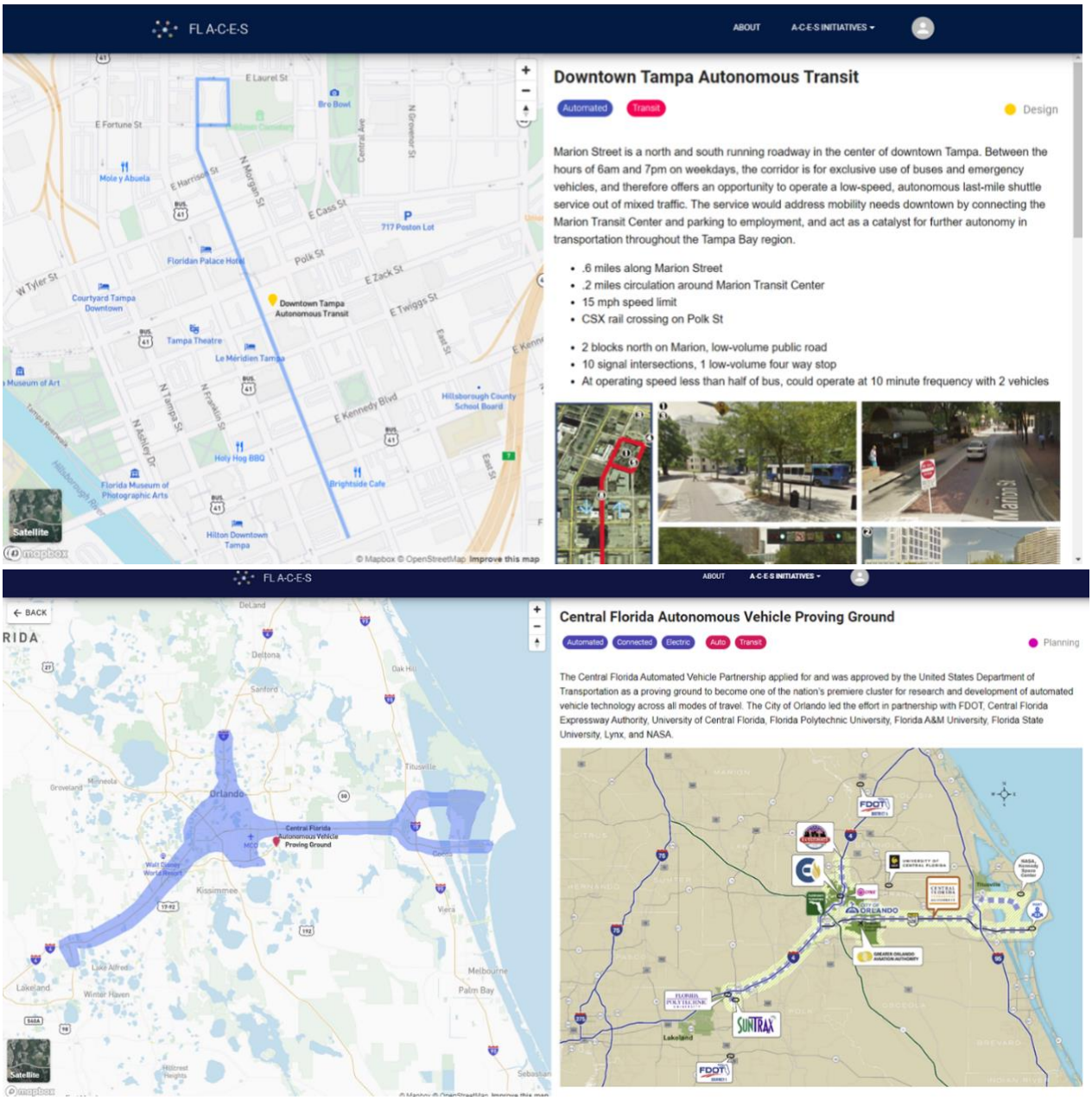

Figure 3-5 ACES Activity Viewer – Project View Highlighting Geographic Coverage

3.4 Major Florida ACES Initiatives included in Database and Viewer

Florida Bikeshare Systems Activity

The "Bikeshare" tab displays bikeshare system activity using near real-time station information from five micromobility networks spread across Florida (Figure 3-6). The data for this section

has been gathered from Bike World Map[15]. Currently, there are five bikesharing networks in Florida—Miami, Fort Lauderdale, Tampa, St. Petersburg, and Aventura—with more than 2,000 bikes available via station-based systems. Data from these systems are displayed simultaneously, giving the user a clear overview of bikeshare stations across the state.

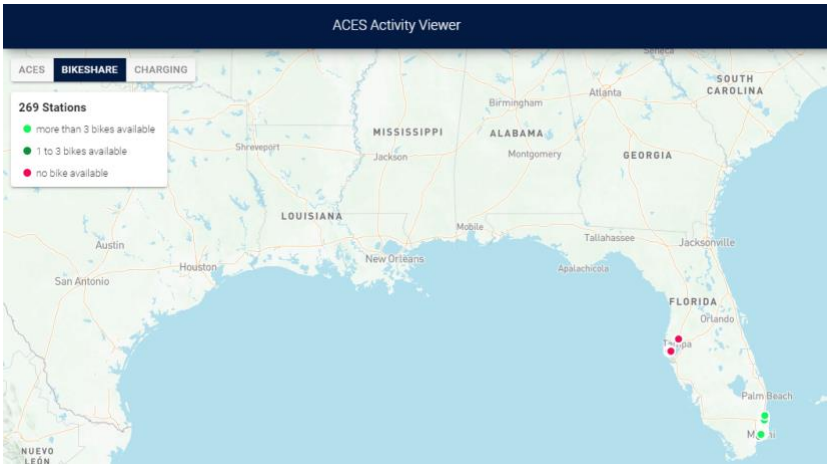

Figure 3-6 ACES Activity Viewer – Florida Bikeshare System Coverage

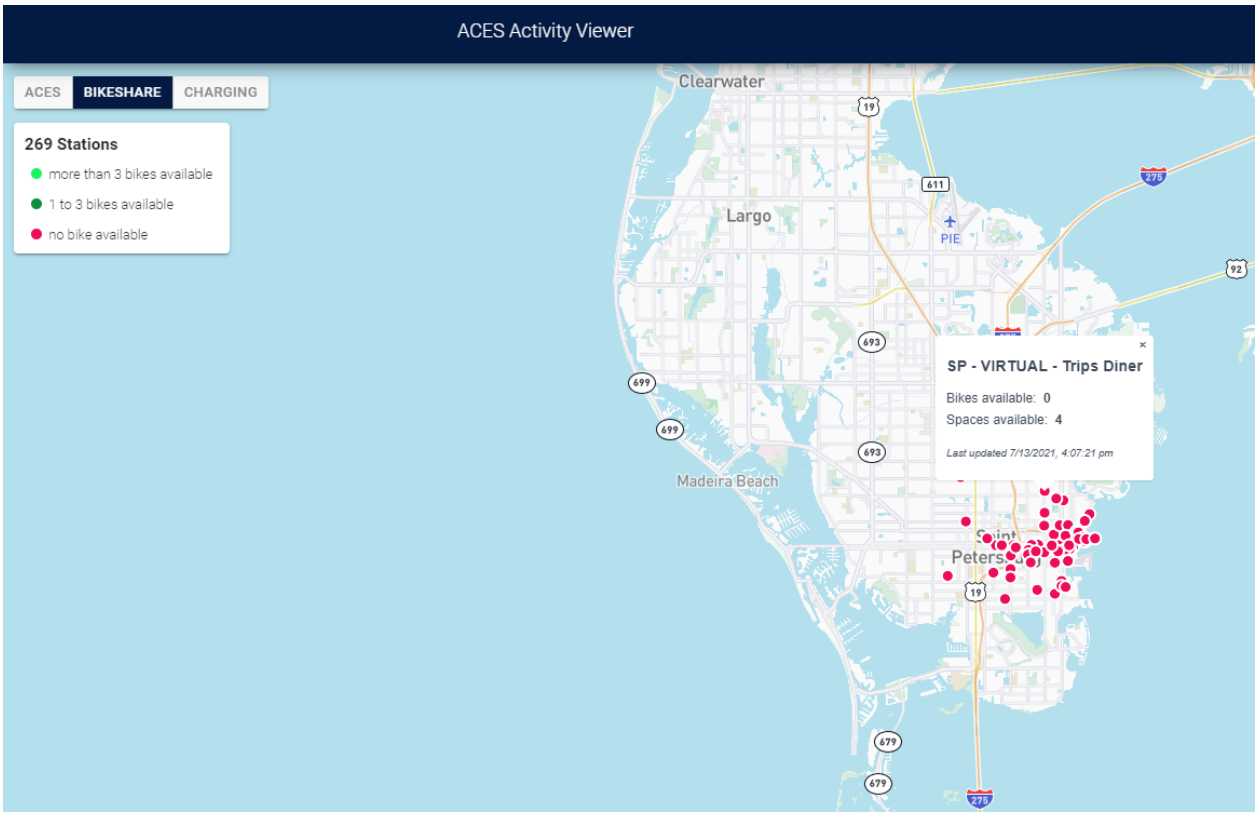

Figure 3-7 ACES Activity Viewer – St. Petersburg Bikeshare System Availability

[15] https://bikesharemap.com/#/3/-30/30/

Selecting a bikeshare network further expands the map and shows the various station locations in detail. Along the network, hovering the cursor over any location provides details about each bikeshare station, including information on the number of bikes available in near real-time. Stations labeled in red have no bikes available, those in dark green have 1–3 bikes available, and those in bright green have more than 3 bikes available. An illustrative example of the St. Petersburg bikeshare system operated by Coast Bikes is shown in Figure 3-7.

Florida Electric Vehicle Charging Infrastructure

The "Charging" tab shows the locations of all electric vehicle charging stations in Florida (Figure 3-8). The data for this section has been gathered from the Alternative Fuels Data Center[16].Upon clicking on any station marker, users can view the station's address and contact information. CUTR will add information on the type of charging infrastructure available at each station location in the later phases of this project.

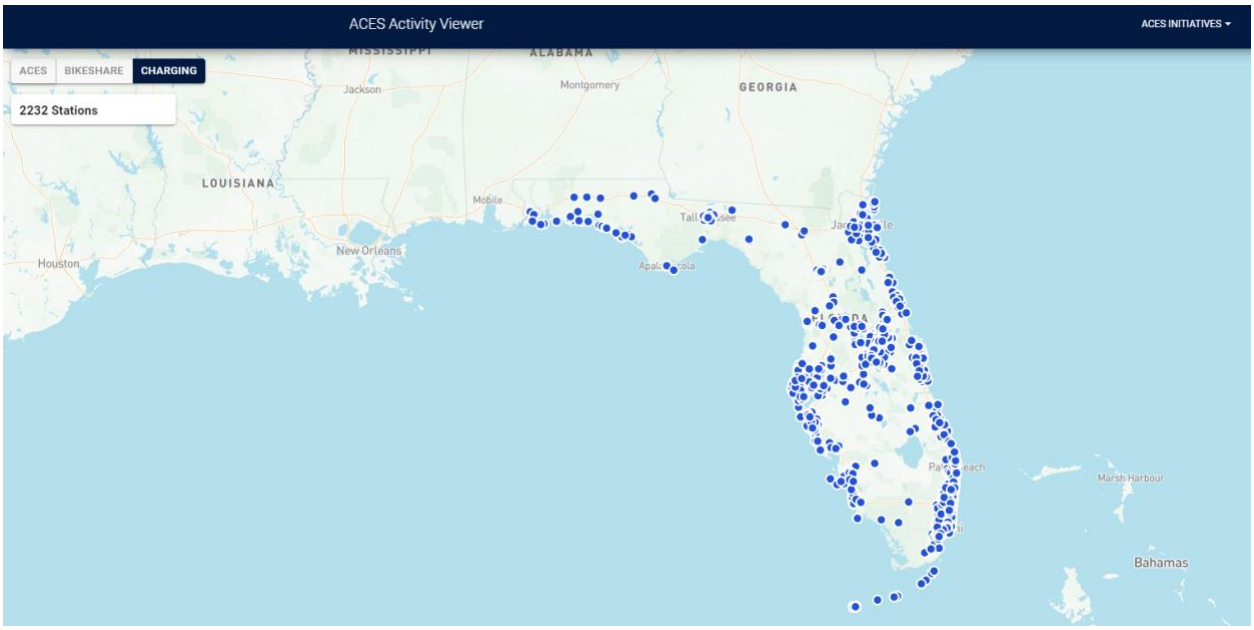

Figure 3-8 ACES Activity Viewer – Electric Vehicle Charging Infrastructure

Zooming into a charging station location further expands the map and shows the various charging points in detail. Along the network, hovering the cursor over any location provides details about each charging station, including address and contact information. An illustrative example of the Clearwater area shows that there are 17 charging stations in the vicinity (Figure 3-9).

[16] https://afdc.energy.gov/stations/

Other ACES Initiatives

Under the “ACES Initiatives” navigation menu, “NOCoE” (under “Federal”) opens an interactive map of live and upcoming signal phase and timing deployments from the SPaT Challenge (Figure 3-10). The red pins indicate deployments currently underway, and the green pins highlight those currently in operation.

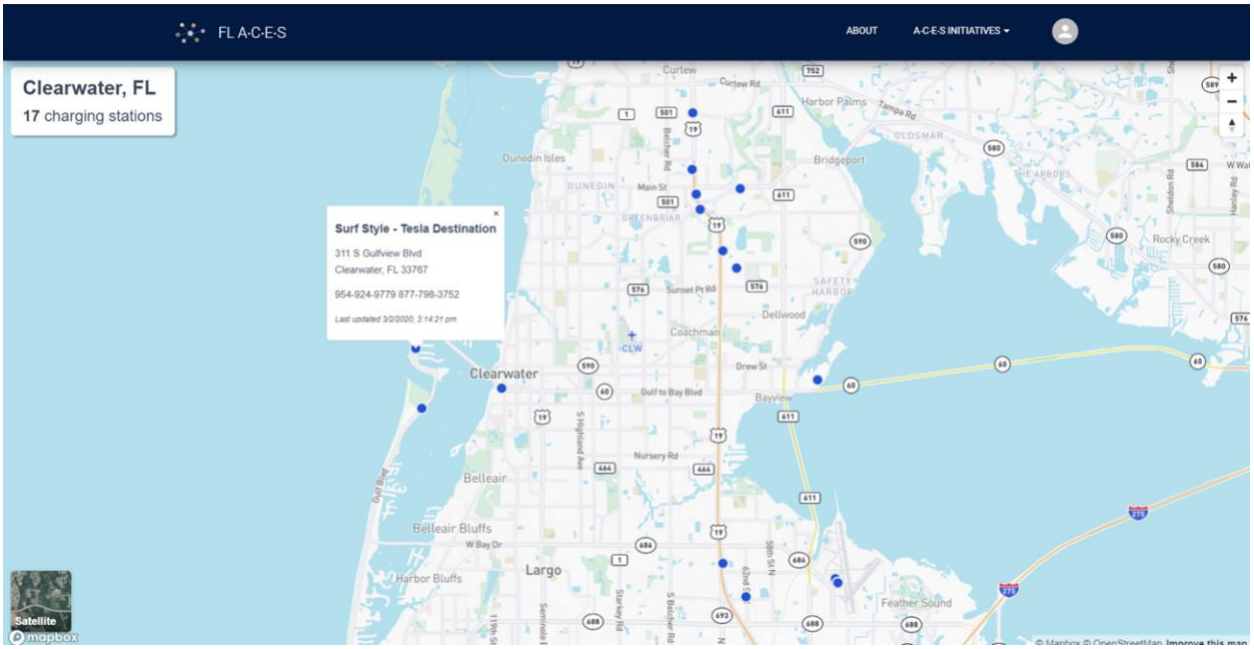

Figure 3-9 ACES Activity Viewer – Clearwater EV Charging Infrastructure

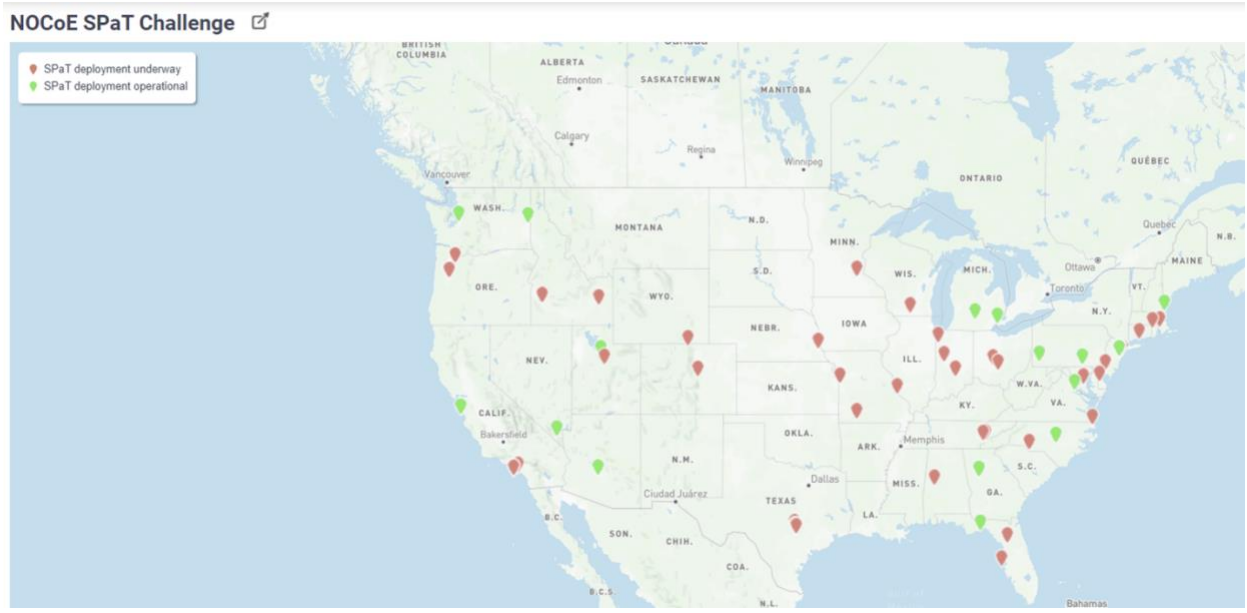

Figure 3-10 ACES Activity Viewer – NOCoE SPaT Challenge

The “USDOT” option brings up an interactive map that displays operational (yellow) and planned (blue) connected vehicle deployment locations across the U.S (Figure 3-11). It also contains information on state-by-state crash fatalities and the economic costs (red) that potentially could be mitigated through deployment of Safety Band-related technology.

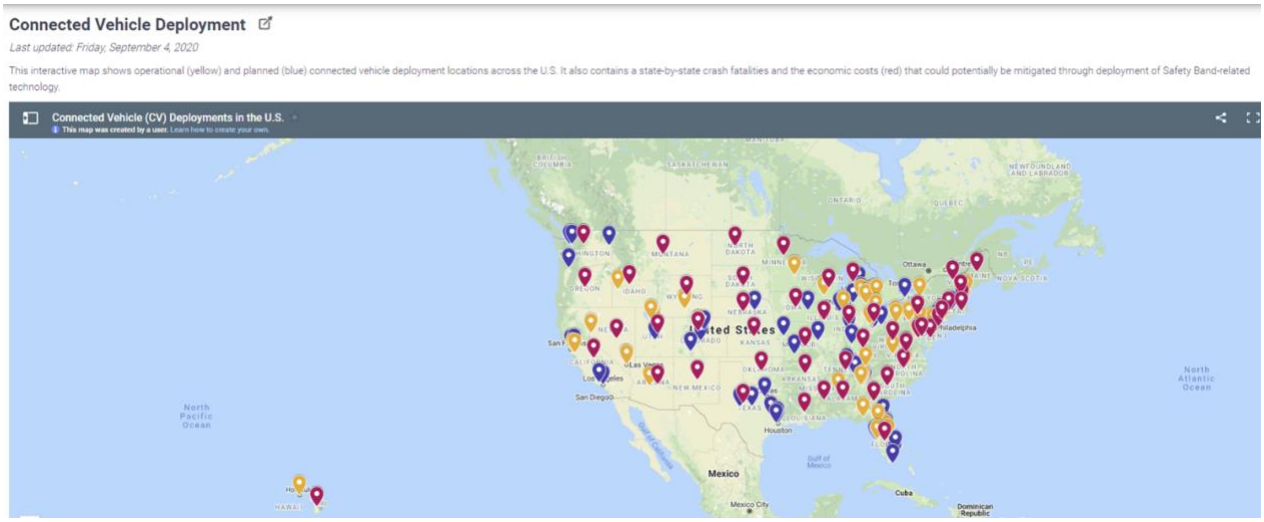

Figure 3-11 ACES Activity Viewer – USDOT Connected Vehicle Deployments

3.5 Access to Activity Viewer

The current version of the Activity Viewer is available at https://flaces.netlify.app. With the suite of Web services used to create the Activity Viewer, CUTR has developed a platform that can provide access at multiple levels, depending on the level of authentication of the user. In its most disaggregate form, the Activity Viewer is accessible to the general public, who can view the ACES projects across the state, check out Florida ACES initiatives, and interact with the Activity Viewer to develop a better understanding of Florida’s efforts in ACES.

The Activity Viewer contains an administrative section where a logged-in user can make changes to the ACES project database (Figure 3-12). When available for mass consumption (including public access), the Activity Viewer will be accessible to several types of users at varying accessibility levels. For example, an authenticated user (member of design and development teams from CUTR and/or FDOT) has the most disaggregated level of access and can create new ACES projects or make changes or updates to existing ACES projects. A newly-created project is, by default, not visible on the Activity Viewer, pending review and approval. Project approval can be granted only by an authenticated user who is part of the development team.

In the future, project stakeholders, through their created login credentials, will be able to input project data and provide updates on their projects, which can be verified and approved by the design and development team. The general public will be able to use the Activity Viewer/portal

to familiarize themselves with the latest updates on the four verticals (Automated, Connected, Electric, Shared) in Florida and other initiatives set up.

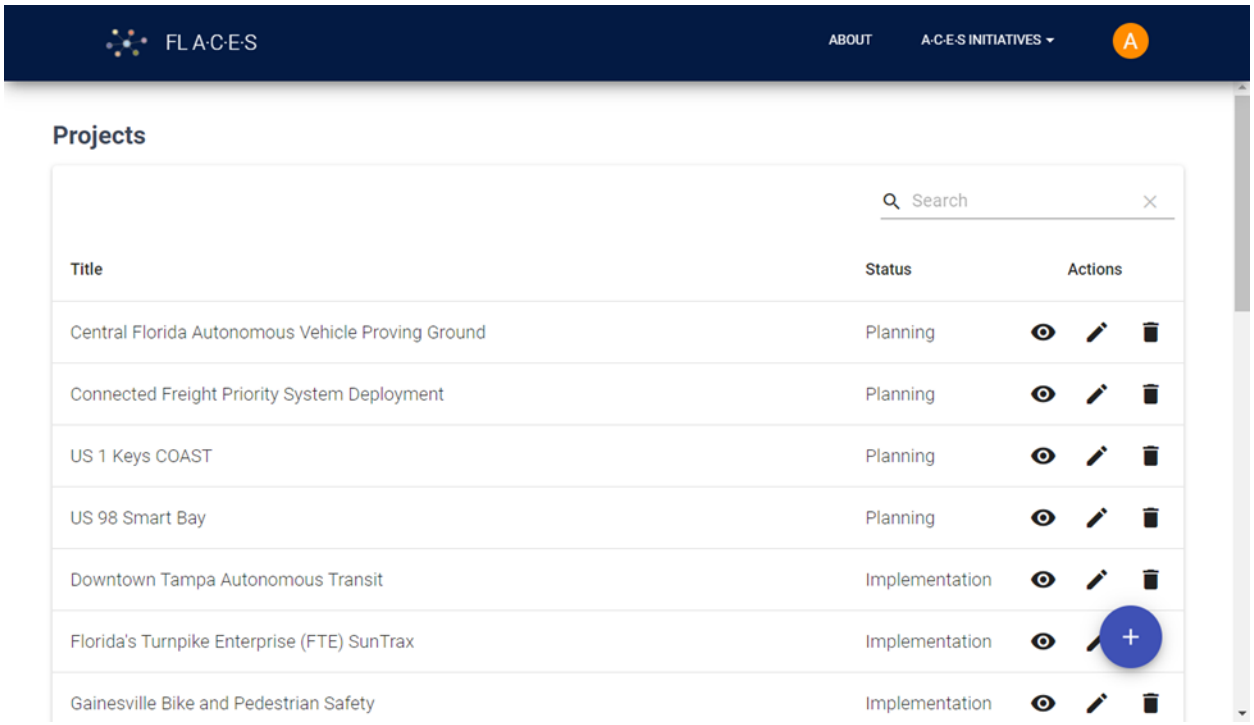

Figure 3-12 ACES Activity Viewer – Administrative View

3.6 Summary

In this chapter, the design and development of the initial version of the Florida ACES database and Activity Viewer are highlighted. The Activity Viewer serves as a forum to engage in knowledge and technology transfer for all ACES initiatives in Florida. The graphical interface has tremendous utility as a medium to share data, findings, lessons learned, and best practices between and among transportation agencies, other public agencies, the private sector, and university communities.

To promote awareness of the products of the Florida ACES Roadmap Initiative, the Florida ACES Program, the ACES database and Activity Viewer, and knowledge and technology transfer opportunities, CUTR embarked on conducting outreach for the ACES Program. Chapter 4 provides details of the outreach efforts, including development of ACES outreach tools and materials, hosting the Florida ACES Leadership Group meeting to kick off ACES outreach activities, and conducting a series of outreach communications, presentations, and webinars to interested project stakeholders.

4. ACES Roadmap Outreach

To achieve the full potential from collaboration and cooperation among ACES research, testing, deployment, demonstration, and education in Florida, the project focused on the development of ACES outreach tools and materials and planning and conducting outreach activities.

CUTR first developed outreach tools and materials for supporting engagement efforts and then used the CUTR and Leadership Group network and professional listservs to distribute products developed, such as an introductory Florida ACES slide deck, the ACES website, and the initial version of the ACES database and Activity Viewer.

Due to the impact of the COVID-19 pandemic and travel restrictions on ACES in-person outreach activities, CUTR planned for and transitioned from in-person to online (virtual) outreach events. The research team organized virtual outreach activities in cooperation with FDOT and other organizations to encourage engagement with the Florida ACES Transportation Roadmap and the Activity Viewer, facilitate data-sharing, and connect with relevant stakeholders. Virtual outreach activities included email communications with the ACES Leadership Group, selected stakeholders, and transportation professionals, a poster presentation at the 2021 TRB Annual Meeting, a Florida Local Technical Assistance Program (LTAP) Center webinar on ACES, and a presentation to the CUTR Advisory Board.

Overall, the Florida ACES outreach plan followed a four-pronged approach of collaboration, engagement, communication, and outreach, incorporating ingredients such as a program website, a LinkedIn Group page, and a branded Mailchimp newsletter to encourage active collaboration and dialogue among stakeholders. To support these efforts, CUTR developed an engagement kit that includes an ACES PowerPoint presentation template, a color palette, a recommended typeface, elements, photographs, and other assets to support digital and in-print marketing materials.

Major accomplishments and associated ACES activities included the Leadership Group kickoff meeting, development of outreach tools, and planning and conducting of ACES outreach existing and potential Florida ACES stakeholders to reach a variety of transportation professionals, university researchers, and students. Details are provided below.

4.1 Leadership Group Kickoff Meeting

On October 9, 2020, CUTR, in coordination with FDOT, hosted the Florida ACES Leadership Group Kickoff Meeting via Microsoft Teams to formally introduce the Leadership Group, which consists of ACES leaders and faculty from Florida universities and FDOT, and to obtain their input on the Florida ACES Roadmap Initiative. CUTR presented the Florida ACES Activity Viewer, initiated dialogue among group members, obtained feedback on ways to best facilitate outreach and engagement, and established a coordinated outreach effort to assist with populating the Activity Viewer.

During the meeting with the Leadership Group, it was decided that in addition to Florida ACES projects, the ACES database and Activity Viewer would house a collection of past and present Florida university-led ACES research projects. Data collection on these research projects is underway, and this feature will be added to the next stage of the ACES database and Activity Viewer in the next phase of the project.

To facilitate support from the Leadership Group, CUTR distributed a follow-up email that contained a Google form link to allow respondents to input relevant ACES project information from their ACES research project(s), specifically projects that occurred within the past five years. CUTR also distributed a link to a brief survey that requested feedback on ideas or plans of Leadership Group members for informing and engaging students and university faculty for the Florida ACES Roadmap Initiative.

4.2 Development of Outreach Tools and Materials

Engagement Kit

An engagement kit was developed to support outreach for the Florida ACES Roadmap Initiative, available at usf.box.com/s/yduetjaobnroirruiw7mr3twb4dzcfgn. The kit contains materials used to facilitate outreach, engagement, and collaboration in a consistent design scheme to enhance recognition and elevate the profile of the Florida ACES Roadmap Initiative and includes a program logo, an ACES PowerPoint presentation template, a color palette, a recommended typeface, photographs, elements, boilerplate, and tags and keywords for SEO optimization.

Logo options were developed by CUTR in consultation with a graphic designer. The Florida ACES logo (Figure 4-1) combines the four verticals (Automated, Connected, Electric, Shared) as a single unit, depicted by four circles connected by interlinking lines, with the Florida outline in the background. The logo demonstrates the interconnection among these four verticals and illustrates the program's goal of providing an interactive portal containing the latest information on relevant ACES projects in Florida, all accessible through the publicly-available Activity Viewer.

The engagement kit will be continually updated as additional graphics are developed. For example, as engagement activities are hosted, photos and other documentation from these outreach activities will be used in subsequent outreach materials to help build recognition and awareness of the Florida ACES Transportation Roadmap Initiative.

Figure 4-1 Florida ACES Transportation Roadmap logo

Email Communications

The CUTR team developed an email template in Mailchimp, which was selected based on an extensive review of available contact communication platforms. The final selection was made primarily for the robustness of features offered, including the ability to import data, maintain multiple projects, provide geolocation and website integrations, and obtain flexibility with email design. The aesthetics of the campaign template (Figure 4-2) were designed following the color palette in the engagement kit; the template includes links to the Activity Viewer and the Florida ACES Program website. A stakeholder contacts database was imported to Mailchimp upon finalization of the first draft of the database. CUTR intends to continually update this form as new stakeholders become engaged in the Florida ACES Program and sign-ups are conducted through the Google sign-up form (accessed at www.cutr.usf.edu/Florida ACES).

FLACES Activity Viewer

The FLACES Activity Viewer is a collaborative map-based portal that supports Florida's emerging technological capabilities, project awareness, and demonstrates innovation through data sharing and stakeholder engagement.

Learn more about past, current, and planned ACES initiatives in Florida.

To submit data on a current, planned, or future ACES project, access the Activity Viewer.

Get Involved

Visit the FLACES Webpage

Visit the FLACES webpage to learn more about the program and ways to stay engaged.

Join the FLACES LinkedIn Group

Stay connected and network with peers engaged in ACES work around the state.

Figure 4-2 Mailchimp Email Campaign Template

Presentation Templates

To expand the outreach and visibility of the Florida ACES program, CUTR developed a presentation template (Figure 4-3) to support engagement efforts at both virtual and in-person conferences, workshops, and events. The slide deck can be viewed at https://usf.box.com/s/ah8redgqx243lcf1dnbbar279mx17hli.

Figure 4-3 Florida ACES Presentation Template Cover

Program Website

The ACES program website (https://florida-aces.org/) was set up to house information about the program and the project and to provide a link to the Activity Viewer. Currently, the website contains menu items including “About Us,” “Fact Sheet” (with download option), “Contact Us,” and a direct link to the Florida ACES group LinkedIn page (Figure 4-4). As the program grows and feedback is received from stakeholders, the website will be augmented with other menu items and categories. The functionality and use of the website allow for quick access and browsing. The focal point of the website is the Activity Viewer (viewed at https://flaces.netlify.app/#/projects). The website can be viewed on a desktop computer, a cell phone, or a tablet. Future menu options include the ACES stakeholder list, program highlights, an ACES staff directory, and a calendar of events. The color scheme used for the website is consistent with the outreach materials to maintain program continuity with visuals.

Figure 4-4 Florida ACES Website

Social Media

After a review of social media platforms, CUTR selected LinkedIn Groups to create an ACES page with the aim to solicit and maintain engagement from ACES stakeholders and other transportation professionals in the industry, and academia. The Groups setting is closed to the public, and future members are either invited or must request to access the Groups page. Through the social media platform, LinkedIn Group members can share research, articles, stories, best practices, lessons learned, and innovative ideas surrounding ACES technologies (Figure 4-5). Florida ACES LinkedIn Group accessed is at https://www.linkedin.com/groups/13915019/.

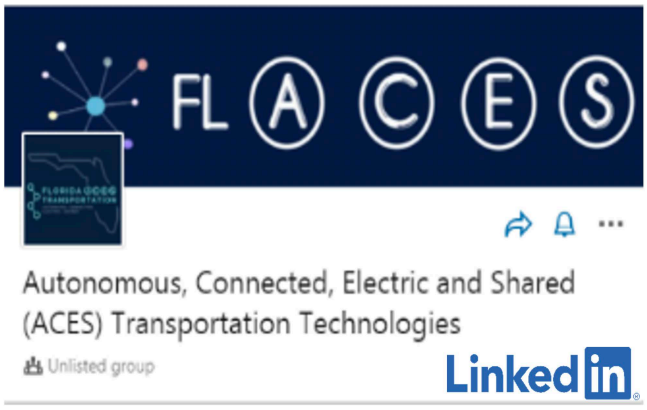

Figure 4-5 Florida ACES Program LinkedIn Group

4.3 Planning and Conducting ACES Outreach

Outreach Plan

The major objective of ACES outreach was to engage stakeholders and transportation professionals through the Florida ACES Roadmap Initiative to facilitate information exchange; connect key public, private, and academic organizations; establish partnerships; and foster collaborative technology and data-sharing practices. Government agencies and transportation professionals from academia and industry undertaking ACES activities in Florida are involved in such initiatives on a variety of levels, including deploying vehicle and technology pilots, conducting field deployments, performing research, and developing planning and policy guidelines.

The outreach plan details the process CUTR employed to engage these diverse stakeholders in a way that produced meaningful engagement and collaboration. Underscoring this outreach plan was the recognition that (1) inter-sectoral collaboration and data-sharing are critically important, and (2) collaboration among academic research institutions, public agencies, and industry are key to stimulating innovation, facilitating knowledge exchange, and supporting ACES-related project developments so that their benefits can be realized in the state. Central to this outreach plan was the development of a statewide stakeholder contact list, methods for initially engaging stakeholders, and plans for maintaining synergies to cultivate meaningful, robust collaboration among stakeholders.

As illustrated in Figure 4-6, CUTR, in coordination with FDOT and the Florida ACES Leadership Group, adopted a four-pronged outreach approach that includes collaboration, engagement, communication, and outreach activities to facilitate effective cross-collaboration among Florida's colleges and universities, transportation agencies, the private sector, and local, regional, and state government agencies.

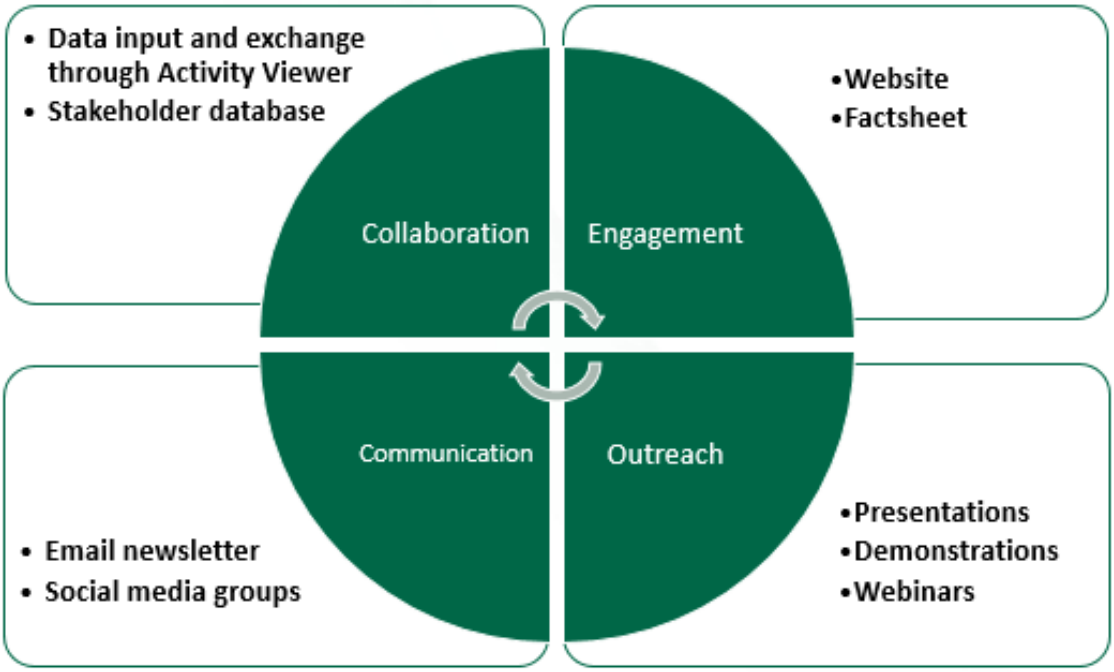

Figure 4-6 Florida ACES Four-Pronged Outreach Approach

Stakeholder Contacts List

A stakeholder contacts list was developed that included a diverse set of stakeholders representing various sectors including public agencies, transit, local government, industry, academia, infrastructure providers, utilities, and special interest groups. The list is a living document, with stakeholders continuously being added through engagement activities, mailing list sign-ups, social media collaborations, and other opportunities to reach a broad audience beyond the academic community. The initial stakeholder list (with 122 members) was developed by leveraging other stakeholder groups, including the Tampa Bay Clean Cities Coalition and university partners throughout Florida to obtain input for contacts.

The stakeholder contacts list was used to distribute a branded email newsletter via Mailchimp that highlighted the existing ACES portal. The newsletter also contained links to the Florida ACES website and the Activity Viewer and provided details on upcoming information webinars, conferences, convenings, workshop, and events related to the Florida ACES Transportation Roadmap program.

LAST NAME	FIRST NAME	ORGANIZATION NAME	ORGANIZATION TYPE
Woelfling	Andrew	Argo AI	Industry
Esparza	Servando	Bird	Industry
Yeggy	Gretchen	Bird	Industry
Schnader	Jared	CALSTART	Nonprofit
Li	Hui	Center for Advanced Power Systems; FAMU/FSU	University
McGinnis, Sr.	Roger	Center for Advanced Power Systems; FAMU/FSU	University
Pamidi	Sastry	Center for Advanced Power Systems; FAMU/FSU	University
Concas	Sisinnio	Center for Urban Transportation Research	University
Kettles	Doug	Central Florida Clean Cities/Drive Electric Florida	Nonprofit
Schatz	David	Chargepoint	Utility
Dunn	David	City of Orlando	Government agency
Bhide	Vik	City of Tampa	Government agency
Lefevre	Pierre	Coast Autonomous	Industry
	Joe	Coast Bike	Industry
Oates	William	College of Engineering; FAMU/FSU	University
Kraaslan	Enes	Connected Wise LLC	Industry
Celebrezze	Rachelle	Cruise	Industry
King	Peter	Duke Energy/Drive Electric Florida	Utility
Coyle	Eric	Embry-Riddle Aeronautical University	University

Figure 4-7 Example Florida ACES Stakeholders Contact List

The success of the Florida ACES program hinges on facilitating active engagement among stakeholders and transportation professionals and developing methods for maintaining synergies to cultivate meaningful, robust collaboration among stakeholders. Given the challenges of organizing and hosting in-person activities during the COVID-19 pandemic, CUTR had to move away from traditional in-person outreach activities such as trainings, meetings, and conferences and adapt to a virtual platform. These constraints presented challenges for outreach, as opportunities to demonstrate the Florida ACES Transportation program at major conferences and meetings such as the Florida Automated Vehicle Summit were limited given that this conference and others were either canceled, postponed, or hosted virtually in a limited capacity. CUTR had to assess which outreach activities were feasible in this environment and then transition from in-person to online outreach events.

Under these constraints, virtual outreach activities were successfully planned and conducted. The following sections describe various stages of program outreach and engagement activities that used the tools created to facilitate this outreach, including the Florida ACES website, social media presence, email communications, and outreach materials. As a consequence of this "new normal," CUTR resorted to two stages of outreach, as detailed in the sections below.

Stage 1 – Email Outreach

An initial email was distributed in December 2020 to the stakeholder contacts list to introduce the Florida ACES Roadmap Initiative, disseminate outreach materials, and detail specific actions stakeholders could take to participate, such as visiting the website, joining the LinkedIn Group, and submitting data and information from ACES activities into the Activity Viewer. Stakeholders were encouraged to share with their networks to heighten visibility of the Florida ACES

initiative to a broader audience. A follow-up email to invite ACES stakeholders to attend an ACES introduction webinar hosted by the Florida LTAP Center was sent in January 2021.

An initial introductory email was also distributed to members of the Leadership Group, who were asked to assist in reaching out to their networks to promote the Florida ACES Initiative. Direct follow-up actions, such as including program information in their organization's communications (listserv, e-newsletter, website, social media), were included in the introductory email distributed to these organizations. A follow-up email to invite the Florida ACES Leadership Group to attend an ACES introduction webinar hosted by Florida LTAP was also sent in January 2021. Through partnership with the Florida LTAP Center, more than 7,500 transportation professionals received an email announcement and email reminder from the Florida LTAP Center about the ACES introduction webinar.

CUTR plans to use Mailchimp for most future email communications. Analytics for these emails can be tracked using Mailchimp digital marketing analytics reports to identify trends and track performance of the email campaign, including number of subscribers, audience trends (unsubscribe requests), clicks and open rates, total audience breakdown and percent changes, and page landings. In this way, CUTR can track growth and engagement from these reports to gauge levels of interaction with the audience and collect key data to be used to evaluate the effectiveness of these campaigns and the reach to stakeholders.

Stage 2 – Virtual Outreach Events

Given the distinct challenges with in-person outreach and engagement activities due the on-going public health emergency, CUTR, in coordination with FDOT, developed a schedule of virtual outreach events to introduce stakeholders and transportation professionals to the Florida ACES Initiative. The events and activities are described below.

TRB 2021 Annual Meeting Poster Presentation

CUTR researchers presented a poster, "A Roadmap Towards a Florida Automated, Connected, Electric, and Shared (ACES) Transportation System (TRBAM-21-03271)," at the 2021 Transportation Research Board (TRB) Annual Meeting on January 25, 2021, during Session 1077, "Current Issues in Research Innovation Implementation Management," sponsored by the Standing Committee on Research Innovation Management (AJE35). This session provided an opportunity to expand engagement to a national audience, highlighting FDOT efforts and demonstrating Florida as a leader in the planning, development, deployment, and evaluation of ACES technologies. The core of the presentation focused on Florida's efforts with the ACES program, the characteristic features of the database and Activity Viewer, and the authors' vision for outreach, engagement, and future opportunities.

Florida LTAP Center Webinar

To provide an informative introduction of Florida ACES Transportation Roadmap Initiative and Florida ACES Program to ACES stakeholders and transportation professionals in Florida, CUTR coordinated with the Florida LTAP Center and FDOT to host a Florida LTAP training webinar, "Introduction to the Florida Automated, Connected, Electric, and Shared (ACES) Transportation Roadmap Initiative," on January 29, 2021.

The Florida LTAP Center delivers training, technical assistance, technology transfer, and other transportation needs to the local and tribal transportation workforce. Housed at CUTR, it is a premier resource in providing training and technical assistance to local agencies to help meet the needs of local transportation communities in the state. An email announcement was sent to the Florida LTAP Center email distribution list, reaching to more than 7,500 transportation professionals.

The webinar, hosted in collaboration with FDOT, introduced the Florida ACES Initiative to local transportation agencies, the FDOT Central Office and Districts, consulting companies, and academia and provided key ACES state updates, demonstrated the benefit of the Florida ACES Program to local agencies, and included an overview of how agencies can contribute to the ACES Program and become more involved. The core of the webinar presentation included a section on FDOT's vision for ACES in Florida and an introduction to the Florida ACES Program. It also summarized efforts undertaken on the Florida ACES Initiative and discussed the role of public agencies, the private sector, and universities; provided an overview of the ACES Activity Viewer; and detailed how transportation agencies and ACES stakeholders could become involved and benefit from the Florida ACES program. Table 4-1 shows the total number of attendees and a breakdown of Florida and non-Florida webinar attendees.

Table 4-1 Participant Distribution, Florida LTAP Webinar on ACES Introduction

2021	Number of Webinar Sessions	Number of Participants in Webinar Session	Number of Participants from Florida	% of Participants from Florida	Number of Participants Outside Florida	% of Participants Outside Florida
January	1	333	292	87%	41	13%

As shown in Figure 4-8, the webinar registered participants from 19 states in addition to Florida, with 87% from Florida and significant participation from the industry, local government, and FDOT.

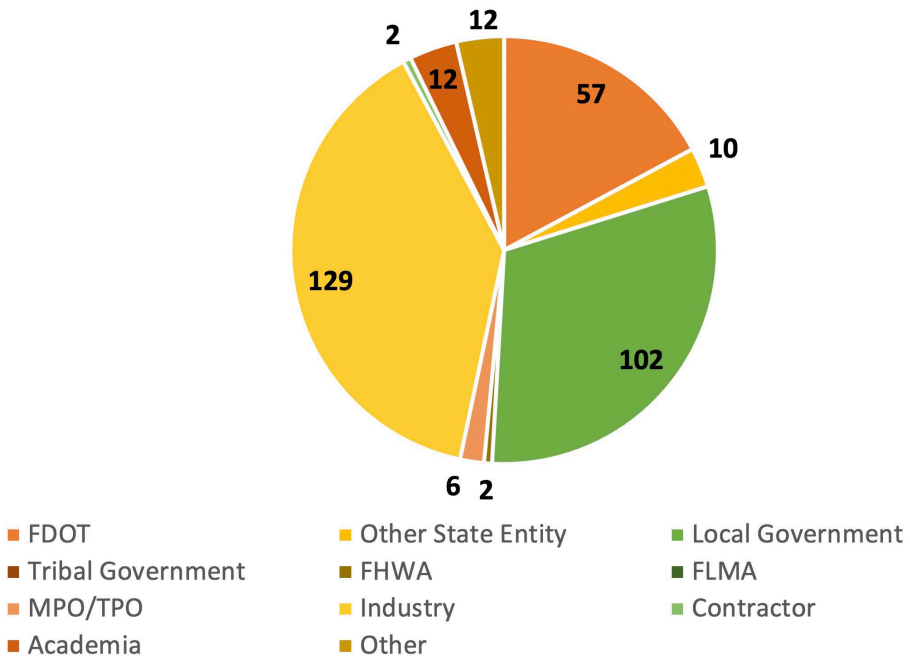

Figure 4-8 Affiliation of Participants in Florida LTAP Webinar on ACES Introduction

CUTR Advisory Board Meeting Presentation

On February 9, 2021, CUTR presented on the Florida ACES Initiative to the CUTR Advisory Board at a meeting hosted virtually on Microsoft Teams. Board members represent state and local government agencies, expressway authorities, and industry, and CUTR faculty and staff also were present for the meeting, which had a total of 40 attendees.

4.4 Summary

This chapter focused on the development of ACES outreach tools and materials, the Florida ACES Leadership Group meeting to kick off outreach activities, and virtual outreach activities (including communications, presentations, and a Florida LTAP webinar) to promote awareness of the Florida ACES Roadmap Initiative, the Florida ACES Program, the ACES database and Activity Viewer, and collaboration and technology transfer opportunities.

In next chapter, detailed efforts and highlights on the University Initiative, the ACES Roadmap kickoff, and the Phase I Wrap Up Web-meeting are presented.

5. University Initiative, ACES Roadmap Kickoff, and Phase I Wrap-Up Web Meeting

This chapter focuses on the efforts and accomplishments of the University Initiative, the Florida ACES stakeholder kickoff meeting, and the Phase I wrap-up Web meeting. One of the major objectives for this project was the planning, preparation, coordination, and facilitation of University Initiative activities. CUTR coordinated with FDOT and the Florida ACES Leadership Group to propose strategies to involve the university communities, specifically the next generation of planners and engineers, on embracing ACES technologies and to leverage the resources created through this project for their personal and professional endeavors.

Active recruitment and engagement of ACES stakeholders are essential to the success of the Florida ACES Program. After a successful ACES outreach webinar conducted on January 29, 2021, in coordination with Florida LTAP, CUTR conducted a stakeholder-focused Florida LTAP webinar on March 29, 2021, as an ACES stakeholder group kickoff meeting. The meeting provided detailed information to existing and potential stakeholders on how current and potential ACES stakeholders could be involved in, benefit from, and collaborate through the major products of this project, namely the Florida ACES database and Activity Viewer.

This chapter also highlights the Phase I wrap-up web meeting that summarized project accomplishments, reached solid conclusions, obtained valuable feedback on project products and ACES outreach activities made in Phase I, and recommended future directions. Members of the Leadership Group were the main attendees at this web meeting in addition to the CUTR project team. The meeting supported FDOT and CUTR to chart the course for a future phase of the Florida ACES Roadmap Initiative.

5.1 Florida ACES University Initiative

In coordination with FDOT and the Florida ACES Leadership Group, a meeting was facilitated by CUTR on October 9, 2020, to kick off the ACES University Initiative. The main purpose of the meeting was to explore potential opportunities for leveraging available resources and include university students as part of the Florida ACES Roadmap Initiative. Following the initial meeting held in October 2020, CUTR developed a data collection instrument to elicit information from the Leadership Group on their plans to inform and engage with their students and to solicit ideas on how best to involve the future generation of engineers and planners to embrace ACES technologies and leverage products from the Florida ACES Roadmap for their benefit. Four action items were identified by CUTR as appropriate strategies to involve and engage students and colleagues:

- Distribute and share Florida ACES materials with colleagues and students.
- Give a brief intro on the Florida ACES project to students.

- Ask students to provide feedback on the Florida ACES database and Activity Viewer.
- Ask colleagues to provide ACES-related project information on a Google form.

The Leadership Group provided assistance for involving and engaging students and colleagues on the Florida ACES Roadmap Outreach Initiatives. ACES education outreach materials were developed by CUTR and distributed to university communities via the Florida ACES Leadership Group for their use in December 2020. Several email communications were made by CUTR to check the progress on the ACES outreach on university campuses. A follow-up meeting was conducted on March 29, 2021, to track progress on the activities conducted by the Leadership Group as part of the University Initiative. In addition to the plans and initiatives discussed above, other ideas were proposed by the Leadership Group as potential tools for engaging and involving more university students with the Florida ACES Roadmap Initiative:

- Use of transportation student listservs (ITE, WTS student chapter rosters) to inform students of various ACES events being conducted; students would be encouraged to attend these events
- Provision of extra credit for students to report on key lessons they learned from participating in a Florida ACES activity
- Conduct of student term projects on transportation-related courses that include ACES components

5.2 Florida ACES Stakeholder Kickoff Meeting

To provide an informative introduction to Florida ACES Roadmap Initiative and the Florida ACES Program to stakeholders and transportation professionals, CUTR coordinated with the Florida LTAP Center and FDOT to host a Florida LTAP training webinar, "Introduction to the Florida Automated, Connected, Electric, and Shared (ACES) Transportation Roadmap Initiative," on January 29, 2021.

With the objective to kick off engagement with Florida ACES stakeholders and recruitment of new ACES stakeholders, CUTR also conducted a Florida ACES stakeholder meeting through a Florida LTAP training webinar titled "How to Contribute, Collaborate, and Benefit from the Florida ACES Database and Activity Viewer" on March 29, 2021. CUTR introduced the Florida ACES Roadmap Initiative to stakeholders, transportation professionals from local/regional transportation agencies, consultants, and academia and provided an overview on how to contribute their ACES projects, input their ACES projects via Google Forms, collaborate with other professionals and agencies using the Activity Viewer, and benefit from using the products developed from the Florida ACES Roadmap Initiative. The core of the presentation focused on the vision for ACES in Florida, an introduction to the Florida ACES Program, and a summary of the efforts undertaken on the Florida ACES Roadmap Initiative. Additionally, CUTR provided an overview on how to input ACES project details into the Google Forms and how transportation

agencies, ACES stakeholders, and other professionals could foster a culture of collaboration to become more involved in ACES efforts undertaken in the state and secure new projects, collaborations, and work as a medium for information and technology transfer. The presentation concluded with a discussion on how ACES stakeholders, including agencies, professionals, young members (students), and others, could benefit from the products designed as part of the project (website, database, Activity Viewer, other promotional materials) to move ahead and be a trailblazer in implementing and benefiting from these technologies at the individual and system levels.

The stakeholder kickoff meeting also introduced the attendees to the various products discussed during the meeting:

- Florida ACES Program Website
- Florida ACES Database and Activity Viewer
- Data Collection Form (Google Form) for Florida ACES Projects in Florida
- Data Collection Form (Google Form) for Florida ACES Research Projects Conducted by Universities
- Autonomous, Connected, Electric, and Shared (ACES) Transportation Technologies – LinkedIn Group
- Florida ACES Stakeholder Sign-Up Form

To facilitate seamless ACES data collection, CUTR created a custom Google ID for users who may not have one to access the Google Form. The custom Gmail ID and password were also shared with the attendees of the kickoff meeting—mail: flaces123@gmail.com, password: floridaaces.

Table **5-1** shows the total number of attendees and a breakdown of Florida and non-Florida attendees in the ACES stakeholder kickoff meeting.

Table 5-1 Attendee Information, Florida ACES Stakeholder Kickoff Meeting

Date	# of Webinar Sessions	# of Participants	# of Total Participants	# of Participants from Florida	% of Participants from Florida	# of Participants Outside Florida	% of Participants Outside Florida
3/29/21	1	181	181	162	89.5	19	10.5

As shown, there was a good mix of attendees from all types of organizations, with consultants constituting more than one-third (37%) of all meeting attendees and a significant representation from local government (30%) and FDOT (17%). Other respondents (academia, other state government entities, MPO/TPOs, contractors, others) constituted around 16% of meeting attendees. Overall, the stakeholder kickoff meeting registered participants from 17 states in addition to Florida, with close to 90% from Florida.

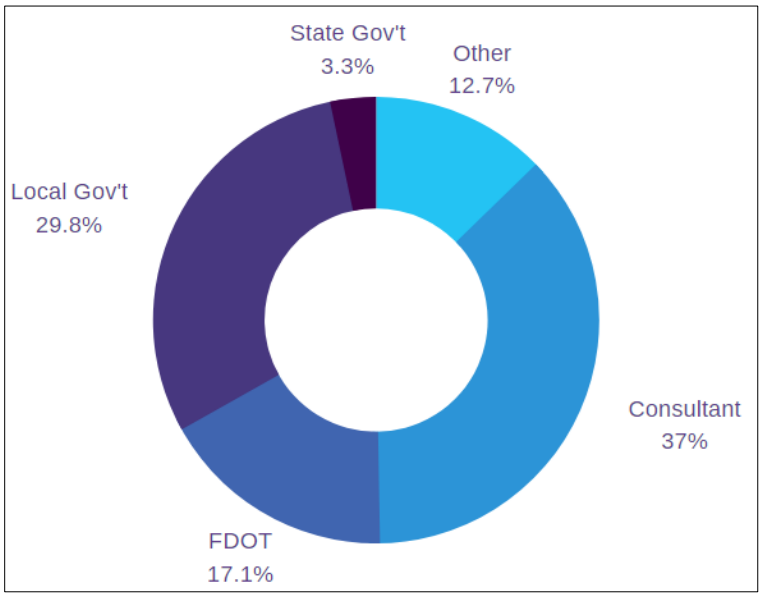

Figure 5-1 Florida ACES Stakeholder Kickoff Meeting Attendee Composition by Organization Type

Distributions of the stakeholder kickoff meeting attendees in Florida and in the U.S. are shown in Figure 5-2 and Figure 5-3, respectively. In the post-webinar survey, 43 attendees reported that they would like to become Florida ACES stakeholders to further contribute to, participate in, and receive information on Florida ACES initiatives and activities. CUTR added these respondents to the Florida ACES stakeholder list.

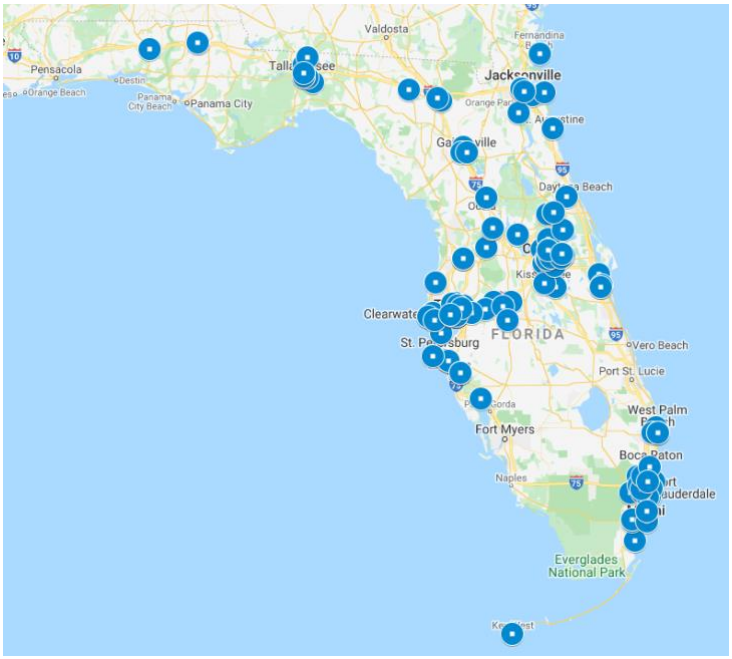

Figure 5-2 Spatial Distribution of Florida ACES Stakeholder Meeting Attendees in Florida

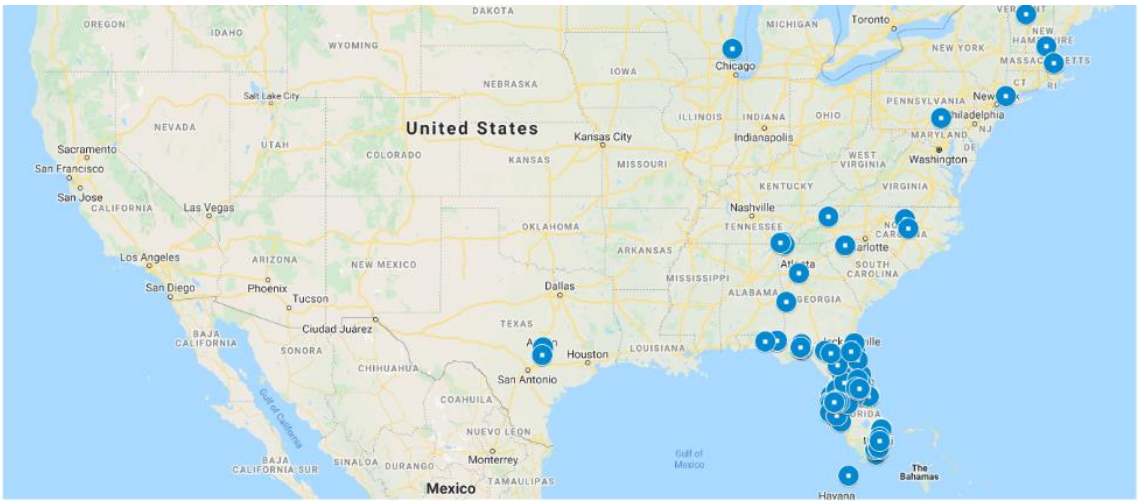

Figure 5-3 Spatial Distribution of Florida ACES Stakeholder Meeting Attendees in U.S.

5.3 Florida ACES Phase I Wrap-Up Web Meeting

The Florida ACES Phase I Wrap-Up Web meeting was conducted on March 29, 2021, with participation from FDOT leadership, CUTR, and the Florida ACES Leadership Group. The objective of this meeting was to report the accomplishments from Phase I, highlight key findings, solicit feedback from the Leadership Group on Phase I of the project, and chart the path for future phases of the Florida ACES Transportation Roadmap Initiative.

CUTR highlighted the accomplishments from Phase I of the Florida ACES roadmap initiative, including the Florida ACES Program website and the Florida ACES database and Activity Viewer. The current version of the Activity Viewer consists of 33 projects across the four verticals (Automated, Connected, Electric, Shared) listed under the Florida Connected and Automated Vehicle Initiative. The presentation also included information on the ACES stakeholder database (an ever-growing list of interested ACES professionals in Florida, currently at 122 professionals), and the two data collection instruments—Florida ACES projects and Florida ACES research projects conducted by universities.

The wrap-up meeting provided an opportunity to discuss the extent of outreach activities conducted by CUTR as well as university initiatives spearheaded by members of the Florida ACES Leadership Group. The meeting also provided the opportunity to solicit feedback from the Leadership Group on Phase I and a potential future phase of the Florida ACES Roadmap Initiative. The Leadership Group was appreciative of the effort put forth by CUTR for Phase I of the Florida ACES Roadmap Initiative. Itemized and detailed feedbacks on the project tasks conducted during Phase I of this project and future directions of Florida Roadmap initiatives are presented in Chapter 6.

5.4 Summary

This chapter provided descriptions, activities, and accomplishments of three major project subtasks, including the University Initiative, the Florida ACES stakeholder kickoff meeting, and the Phase I wrap-up web meeting. Through the University Initiative and the Florida ACES Program, the ACES database and Activity Viewer were introduced to many university students and ACES-related researchers. Through the ACES stakeholder meeting, participants were introduced to existing and potential ACES stakeholders and transportation professionals in both the public and private sectors in Florida who learned how to be involved in, contribute to, collaborate with, and benefit from the Florida ACES database and Activity Viewer. The Phase I project wrap-up Web meeting summarized project accomplishments and offered suggestions for future directions for the Florida ACES roadmap initiatives.

6. Development of the ACES Roadmap – Looking into the Future

6.1 Overview

ACES technologies have evolved rapidly and have become popular and essential and will continue to impact the development of vehicles, infrastructure, communities, commerce, and the economy. This project focuses on the development of the Florida ACES Roadmap Initiative, statewide outreach and promotion of the Florida ACES Program, university initiatives to engage university students and faculty members, and initial engagement of Florida ACES stakeholders on project data input. Given that ACES technologies are important to transportation safety, mobility, economy, and environment, it is essential to continue and expand the Florida ACES Roadmap Initiative so that the benefits of ACES technologies can be realized.

Based on input and feedback from the Florida ACES Roadmap Leadership Group, including FDOT ACES Roadmap Initiative leaders and key university leaders on ACES, current and potential Florida ACES stakeholders, and the CUTR ACES Phase I team, CUTR identified future efforts to successfully maintain, enhance, expand, and further promote the Florida ACES Roadmap and next steps to ensure the success of the Florida ACES Roadmap Initiative and the Florida ACES Program.

6.2 Input and Suggestions Obtained for Future ACES Roadmap Development

CUTR obtained valuable input and suggestions from the Florida ACES Roadmap Leadership Group during the Phase I wrap-up web meeting and communications through emails, phone calls, and other virtual meetings.

Through collaboration with the Florida LTAP Center to conduct ACES outreach and stakeholder meetings via two ACES-related webinars, CUTR obtained valuable feedback and suggestions from current and potential ACES stakeholders on the Florida ACES Program and future needs. Both webinars were well attended, with 333 attendees in the ACES outreach webinar on January 29, 2021, and 181 attendees in the stakeholder kickoff meeting webinar on March 29, 2021. With outreach and recruitment from CUTR, the total number of Florida ACES stakeholders reached 122 as of May 2021.

Input and suggestions for future Florida ACES roadmap development were also obtained from CUTR staff via their regular bi-weekly project meetings. CUTR staff shared similar vision, input, and suggestions as the ACES Leadership Group and current and potential ACES stakeholders and recognized the importance to continue future project phases on the Florida ACES Roadmap Initiative based on the experience, success, and lessons learned from Phase I.

The rest of this chapter outlines the common themes that emerged from the above-mentioned three groups followed by a discussion of other input and suggestions from the individual groups.

Common Inputs and Suggestions

Common inputs and suggestions for future Florida ACES roadmap development from all three groups included the following:

- Obtain more information on past, present, and new Florida ACES projects to expand the ACES database and Activity Viewer.
- Continuously enhance the Activity Viewer based on input and feedback from users.
- Actively engage with Florida ACES stakeholders to regularly update their projects.
- Actively engage with Florida ACES stakeholders to input new ACES projects for inclusion in the Florida ACES project database.
- Promote the use of the Florida ACES database and Activity Viewer among transportation professionals in Florida.
- Recruit more stakeholders in the private and public sectors, including consultants from the transportation industry, State and local transportation agencies, and academia.
- Conduct outreach on research engagement, promote transportation solutions, provide project information access, and update Florida ACES projects and initiatives.
- Expand university initiatives to reach more education partners and stakeholders.
- Promote the use of the Florida ACES database and Activity Viewer among transportation professionals in the state, industry leaders, university professors, researchers, and students, toward growing the ACES workforce.
- Use the database and Activity Viewer to raise and share awareness, capabilities, and expertise of Florida transportation professionals to enhance the intellectual footprint across multiple sectors and jurisdictions.

Additional Inputs and Suggestions from ACES Leadership Group

Highlights of specific input and feedback from the ACES Leadership Group are presented in this section.

Feedback, Needs, Vision, and Efforts for Future ACES Project Phases

- Recognize efforts and contributions from all on the success of Phase I and building on the foundation and success of Phase I for future phases.
- Reach out to City authorities to determine their interest in adopting aspects of the bikeshare map for use by the general public via the ACES database and Activity Viewer.

- Capture success through collaboration and leveraging community efforts via TRB or the Institute of Transportation Engineers (ITE) to scale up to a larger effort.

University Initiative

- Expand university initiatives to reach more educational partners and stakeholders and build a more inclusive community with professors and researchers from disciplines such as Electrical Engineering, Computer Science, Psychology, and Behavioral Science, who would play a key role in the ACES arena.
- Use listservs of student chapters of ITE, WTS, and others to inform students about ACES events such as meetings and webinars.
- Encourage students to attend ACES-related events such as meetings and webinars and providing extra credit to report what they learned from these events.
- Encourage students to complete course term projects to include ACES components.

Additional Inputs and Suggestions from Current and Potential ACES Stakeholders

Additional input, feedback, and suggestions received from current and potential ACES stakeholders via webinar post-surveys included the following:

- Inform on FDOT's vision and plan on the Florida ACES Program.
- Provide more ACES webinars with beginner to advanced-level content.
- Consider the facilitation of one platform to allow municipalities to host their applications on or push information to their ACES platform or system.
- Encourage major private sector investments in Florida (mobility innovation company headquarters or significant presence) and workforce development (university/college degrees, curricula, training programs).

Additional Inputs and Suggestions from CUTR

Some specific inputs and suggestions from CUTR are provided below:

- Enhance the Florida ACES website and Activity Viewer based on input and feedback from the FDOT Project Manager and users.
- Work closely with the Florida ACES Leadership Group to encourage more students to engage and participate in ACES-related events and projects.
- Work closely with the FDOT Project Manager and the Florida ACES Leadership Group to raise the Florida ACES Program to the next level.
- Continue to work with Florida LTAP to conduct outreach and promote the Florida ACES Program and collaboration and technology transfer via Florida LTAP webinars.

6.3 Identified Future Efforts for ACES Roadmap Initiative

Based on the valuable feedback, input, and suggestions described earlier, the products and tools developed, and the success and lessons learned from Phase I as a foundation, this section discusses and identifies future efforts needed for the ACES Roadmap Initiative and briefly describes proposed approaches to achieve these future efforts.

Future efforts toward critical needs include the following:

- Actively engage with Florida ACES stakeholders and academic researchers to input new projects and regularly update lessons learned from their current projects, as support for entities planning new projects.
- Obtain more information on past, existing, and new projects to expand the Florida ACES Roadmap database.
- Enhance the Florida ACES Roadmap database and Activity Viewer based on input and feedback from users.
- Promote use of the Florida ACES Roadmap database and Activity Viewer among transportation professionals in the state.
- Expand initial university initiatives to reach more educational partners and stakeholders.
- Use the database and Activity Viewer to raise and share awareness, capabilities, and expertise of Florida transportation professionals to enhance the intellectual footprint across multiple sectors and jurisdictions.

Actively engage with Florida ACES stakeholders and academic researchers to input new projects and regularly update their existing projects – Florida ACES stakeholders and academic researchers are pioneers in ACES technology research and implementations across the state. Projects included in the preliminary version of the Florida ACES database and Activity Viewer are in various stages of development (planning, design, deployment, evaluation), and some projects are ongoing. Therefore, it is crucial to actively engage with project stakeholders and academic researchers to input new projects and regularly update information on their existing projects. CUTR developed a four-pronged outreach plan (discussed earlier) composed of a variety of outreach approaches to engage stakeholders, including an engagement kit, email communications, webinar presentations, demonstrations, an ACES program website, social media groups, etc., which will be critical to maintaining synergies to cultivate meaningful, robust collaboration among stakeholders. Following the outreach plan, continued effort will be necessary to engage and communicate with Florida ACES stakeholders and academic researchers for regular and timely updates on their ACES projects. For instance, it would be beneficial to conduct annual or semi-annual Florida ACES Roadmap stakeholder meetings/webinars to collaborate with stakeholders and keep them informed and engaged. CUTR aims to plan and conduct active outreach events in the future including webinars, meetings, and quarterly/monthly newsletter dissemination to further engage with existing

ACES stakeholders and academic researchers to input new projects and regularly update their existing projects.

Obtain more information on past, existing, and new projects to expand the Florida ACES Roadmap database – During this project, CUTR designed and developed a Florida ACES database and Activity Viewer that serves as a forum to engage in knowledge and technology transfer. The current version of the Activity Viewer houses 33 projects outlined by the FDOT Connected Vehicle Initiative[17] in various stages of development across the state (planning, design, deployment, evaluation). As noted earlier, rapidly-evolving ACES technologies quickly impact the development of vehicles, infrastructure, communities, commerce, and the economy. As such, the database of the existing ACES Roadmap is not complete, and it is of critical importance to expand it by obtaining more information on past and existing projects not included in the initial version. A greater emphasis will also be placed on standardizing project information based on predefined project data fields in the database. As the ACES technologies and their applications are advancing rapidly, it is of significant importance to continue to add new project information on a regular basis to expand the database, making the Florida ACES Roadmap a resource hub to share ACES data, findings, and best practices. In this regard, CUTR works closely with the Florida ACES Leadership Group and ACES leaders to identify champions to recruit more Florida ACES stakeholders to provide information on past, existing, and new projects to expand the Florida ACES Roadmap database.

Enhance the Florida ACES Roadmap database and Activity Viewer based on input and feedback from users – The design and development architecture for the Florida ACES database and Activity Viewer included both front- and back-end design, as discussed in an earlier section. Front-end design architecture includes the Activity Viewer website and UI on both traditional and mobile platforms and standardized information displayed on the website to describe each ACES project based on the data fields defined in the database. Back-end design architecture includes the ACES Roadmap database, a file server to store project-related data files, an authentication service to secure the administrative portion of the Activity Viewer, and a reliable method of communication between the Activity Viewer and back-end services. The Florida ACES Roadmap database and Activity Viewer developed in this phase of the project provide a user-friendly interface and sizeable database for demonstration, but further improvements are needed. Feedback collected from public and private sector users is an important input to improve the database and functions of the ACES Roadmap. Therefore, future effort is needed to enhance the Florida ACES Roadmap database and Activity Viewer based on feedback collected, which is also important to expand it as a resource hub to share ACES data, findings, and best practices among the public and private sectors and to expand communication, cooperation, and collaboration among these sectors. For instance, more data fields could be

[17] https://www.fdot.gov/traffic/its/projects-deploy/cv/connected-vehicles.

defined in the database to better describe the project if a specific type of information is of user significant interest; existing additional Activity Viewer functions may be enhanced or additional functions may be added after assessing the feedback collected from users. To meet these objectives, CUTR will administer Florida ACES stakeholder surveys to obtain input and feedback (from the user perspective) to improve the front end and the back end of the Activity Viewer by employing safer, smarter, more resilient hardware architecture. CUTR will also ensure that the database and Activity Viewer constantly undergo operations and maintenance checks to ensure that all software is up to date. Efforts will also be undertaken to enhance the Activity Viewer with more accessibility levels/features for different types of users.

In future phases of the project, CUTR will form an expert group on software and hardware development to elicit feedback obtained from the stakeholder survey on potential improvisations to the front-end and back-end of the Activity Viewer.

Promote use of the Florida ACES Roadmap database and Activity Viewer among transportation professionals in Florida – In earlier stages of this project, as part of the ACES outreach plan and stakeholder kickoff meeting, CUTR worked with the Florida LTAP Center and FDOT to host two webinars to introduce the Florida ACES Roadmap Initiative to local transportation agencies, the FDOT Central Office and Districts, consulting companies, and academia and to provide key ACES state updates, demonstrate the benefit of the Florida ACES Program to local agencies, and include an overview on how agencies can contribute to the program and become more involved. An email announcement was sent to the Florida LTAP Center email distribution list, reaching 7,000+ transportation professionals. More than 500 attended the webinar sessions, which registered participants from 19 states in addition to Florida, a significant portion of whom were from industry, local government, and FDOT.

In the future, more effort needs to be focused on promoting the use of the Florida ACES Roadmap database and Activity Viewer to transportation professionals in the public and private sectors in Florida using the approaches proposed in the ACES outreach plan, with the goal to increase the exposure and use of the products from the ACES Roadmap Initiative. CUTR envisions on making the ACES database and Activity Viewer a primary resource hub on ACES technologies and implementation information-sharing. CUTR envisions accomplishing this through partnering with agencies such as Florida Puerto Rico District of ITE (FPRITE), Florida Association of County Engineers and Road Superintendents (FACERS), and Florida LTAP Center to conduct targeted outreach to their members or contacts on the benefit of using the Florida ACES database and Activity Viewer.

Expand initial university initiatives to reach more educational partners and stakeholders – In an earlier stage of this project, a special university initiative was established to engage students and university faculty through outreach activities proposed throughout Phase I. Expanding these university initiatives is needed to reach more educational partners and stakeholders and build a more inclusive community with faculty and researchers from disciplines such as

Electrical Engineering, Computer Science, Psychology, and Behavioral Science, who would play a key role in the ACES arena. Leadership Group members discussed proposals to continue engagement with university students. Continued engagement at the university level will prove to be a success in introducing the ACES Roadmap to academia and getting the younger generation involved in the ACES fields.

In the future, it will be important to expand the initial University Initiative to reach more academicians, researchers, and students (including K–12) to encourage them to use the Florida ACES Roadmap database and Activity Viewer, learn more about ACES developments across the state, and coordinate with them to share the research achievements on ACES topics. The initiative could be fulfilled through facilitated virtual or in-person workshops or meetings with invited presentations from universities, outreach events during engineering expos, high school student involvement initiatives, poster displays of ongoing ACES projects (research and campus related), and other collaboration exercises.

Use the database and Activity Viewer to raise and share awareness, capabilities, and expertise of Florida transportation professionals to enhance the intellectual footprint across multiple sectors and jurisdictions – The overall goal of the Florida ACES Roadmap Initiative is to improve communication, collaboration, and coordination, leverage investments, and position Florida as a leader in the planning, development, deployment, and evaluation of emerging technologies to improve the safety and mobility of people and goods and to raise and share awareness, capabilities, and expertise of transportation professionals in Florida. Continued effort is needed through the noted approaches to improve the comprehensiveness and functionality of the Florida ACES Roadmap to make it a resource hub to share ACES technology updates and best practices and to continue to conduct statewide ACES outreach to promote the roadmap, leverage expertise and funding across multiple jurisdictions and sectors, and facilitate the development, implementation, and evaluation of promising ACES technologies. To accomplish this, CUTR will introduce, share, and promote the Florida ACES database and Activity Viewer via venues such as the TRB Annual Meeting and other TRB data symposia as well as through communities such as TRB, ASCE, and ITE to highlight Florida's progress, advancement, and expertise in ACES areas, and potentially increase the scale of the Florida ACES Transportation Roadmap initiative.

6.4 Conclusions and Recommendations

A primary objective of Phase I of the Florida ACES Roadmap Initiative was to develop an initial inventory of past, current, and planned ACES initiatives within Florida. A start in this regard was made by CUTR, which collected ACES project-related information from an initial list of 33 projects collated as part of the FDOT Connected Vehicle Initiative. As more projects are scaling up in Florida, CUTR will continue to track them, collect information that can be stored in the

products developed, and provide access to this information to all ACES stakeholders in a streamlined, organized manner.

Another key objective was to provide a knowledge and technology transfer forum and graphical interface to share data, findings, and best practices between and among transportation agencies, the private sector, colleges, and universities. The initial version of the Florida ACES database and Activity Viewer serves this purpose by creating a platform for collaboration and coordination among transportation agencies, other public entities, the private sector, university researchers, industry, and the general public. Interested ACES stakeholders will be able to leverage the power of the ACES database and Activity Viewer to find potentially new collaborations among peer agencies and other partners in the public and private sectors, including colleges and universities, based on their past research experiences in this arena.

Another goal of Phase I was to leverage expertise and funding across multiple jurisdictions and sectors. With the streamlined nature of the ACES database and Activity Viewer as a one-stop-shop for all things ACES, interested stakeholders will be able to leverage the expertise and experience of other practitioners and agencies, find new lines of funding to support their work, and create long-lasting multisector collaborations that might be the engine for economic development at a local/regional/statewide scale.

The products developed as part of Phase I will result in achieving some of the objectives set out by organizations to facilitate the rapid development, implementation, and evaluation of appropriate and optimized ACES technologies according to desired performance measures. It is imperative that the progress made in Phase I be continued to reap longer-term system-level benefits from the trailblazing efforts conducted by advancing ACES technologies. To this end, the following recommendations are proposed by CUTR:

- Continue to engage actively with Florida ACES stakeholders (existing/new) to add and track developments on ACES projects and initiatives (existing/new) across the state.
- Continue to enhance the products from Phase I, namely the ACES database and Activity Viewer, and promote their use among transportation professionals in the state.
- Conduct more outreach events to inform interested stakeholders about the potential of the database and Activity Viewer to foster new collaborations, explore new lines of research, and actively contribute to enhancing the intellectual footprint of Florida.
- Engage with other professional organizations to leverage Florida's expertise and experience in onboarding ACES technologies and continue to serve as a reference point in the rapid development, deployment, implementation, and evaluation of ACES technologies.
- Continue to actively involve future generations of engineers and planners from schools, colleges, and universities via outreach programs and other educational initiatives to achieve knowledge and technology transfer.