Florida's Connected and Automated Vehicles (CAV) Business Plan

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Executive Summary

The Connected and Automated Vehicles (CAV) Program at the Florida Department of Transportation (FDOT) is gaining significant momentum. FDOT's Central and District Offices, planning and implementation stakeholders, industry entities, and university partners are aggressively supporting the deployment of the CAV Program to achieve near-term and sustainable safety, mobility, and economic development (SME) benefits. FDOT has started planning, designing, and deploying several CAV pilot projects. FDOT has also started to engage with private-sector companies that are developing, testing, and implementing CAV technologies and applications. FDOT's Transportation Systems Management and Operations (TSM&O) Program and the Statewide Arterial Management Program (STAMP) are key to the Department's CAV Program.

This CAV Business Plan identifies and captures the results of FDOT's coordination through internal and external meetings and workshops. These meetings and workshops assist in acknowledging the unknowns and help in developing an institutionalized framework and timeframes to aggressively move the CAV Program from research and pilot projects into statewide deployment using expedited planning and outcome-centric SME goals. This CAV Business Plan also outlines preparation efforts for Florida's infrastructure while drawing upon lessons learned from prior FDOT projects. This document is not intended to be a strategic plan, but builds on similar FDOT programs and plans, including but not limited to the: *Florida Transportation Plan (FTP), TSM&O Strategic Plan, STAMP Action Plan, Transportation Technology Strategic Plan, Strategic Highway Safety Plan (SHSP), Strategic Intermodal System (SIS) Policy Plan, Florida's Aging Road Users Strategic Safety Plan (Safe Mobility for Life Coalition)*, and *Traffic Incident Management (TIM) Plan.*

Drawing on the vision and goals from the strategic plans listed above, this CAV Business Plan identifies specific CAV short-term to long-term action items. This CAV Business Plan will remain active with periodic updates as opportunities and needs arise. This Plan identifies the following categories of CAV activities as key elements for fulfilling the SME goals in Florida.

- Identify **policies and governance** with a goal to develop and communicate an institutionalized framework for planning, designing, and deploying CAV in Florida to maximize the SME benefits.
- Leverage **program funding** and identify other funding opportunities for implementation, operations, and maintenance.
- Identify **education and outreach** program objectives with a goal to create awareness of CAV Program deployments and develop the current and future CAV workforce in Florida.
- Develop **industry outreach** to implement SME outcome-based CAV technologies **through active partnerships** with the industry, universities, and stakeholders.
- Identify and develop **technical standards and specifications** to create a framework for CAV infrastructure preparedness including general facilities design, software updates, and hardware upgrades.
- Establish a platform for **CAV implementation readiness** in terms of technology implementation, infrastructure improvements, and needs identification.
- Move towards full-scale **CAV deployment and implementation** using the most relevant CAV applications that have the potential to achieve the SME benefits.

Legend Key: CAV Business Plan Action Items, Symbols, and Acronyms

Status Symbols		Relative Cost Symbols		Role Acronyms	
Symbol	**Meaning**	**Symbol**	**Meaning**	**Symbol**	**Meaning**
O	Planned Task	$	Low Cost, e.g., < $ 250 K	E	Enabler
◉	Underway Task	$$	Medium Cost, e.g., $ 250 K - $ 1 M	NM	Needle Mover
✓	Completed Task	$$$	High Cost, e.g., > $ 1 M		
➡	Recurring Task	**Responsibility Acronyms**			
Term Acronyms		TEO	Traffic Engineering and Operations	R	Research
		D	Design	PP	Policy Planning
S	Short-term (< 1 year)	PM	Program Management	P	Systems Planning
M	Mid-term (1-2 years)	C	Construction	SIS	Strategic Intermodal System
L	Long-term (3+ years)	M	Maintenance	FT	Forecasting and Trends
Florida University Acronyms (UNIV)		S	Safety	TDA	Transportation Data Analytics
FAU	Florida Atlantic University	D1-7, FTE	Districts 1, 2, 3, 4, 5, 6, 7, and/or Florida Turnpike Enterprise	EM	Environmental Management
FIU	Florida International University			TT	Transportation Technology
FPU	Florida Polytechnic University	MPO/ TPO	Metropolitan and Transportation Planning Organizations	PIO	Public Information Office
FSU – FAMU	Florida State – Florida A&M University	LP	Legislative Programs	**Goal Impact Acronyms/Symbols**	
UCF	University of Central Florida	LT	Leadership Team	S	Safety
UF	University of Florida	FP	Freight Logistics and Passenger Operations	M	Mobility
UNF	University of North Florida	WP	Work Program and Budget	ED	Economic Development
USF/ CUTR	University of South Florida/ Center for Urban Transportation Research			📖	Policy, Guidance, Standard, Specification, Report, etc.

1. Introduction and Background

The Connected and Automated Vehicles (CAV) Program at the Florida Department of Transportation (FDOT) is gaining significant momentum. FDOT's Central and District Offices, planning and implementation stakeholders, industry entities, and university partners are aggressively pursuing the deployment of the CAV Program to achieve sustainable safety, mobility, and economic development (SME) benefits. FDOT has started planning, designing, and deploying several CAV pilot projects, and is engaging with private companies that are developing, testing, and implementing CAV technologies. FDOT's Transportation Systems Management and Operations (TSM&O) Program and the Statewide Arterial Management Program (STAMP) are key to the Department's CAV Program.

FDOT and its partners are committed to continuing the deployment of the CAV projects to support the SME needs in the state. FDOT's CAV Program partners include the United States Department of Transportation (USDOT), local agencies (city and county), Metropolitan Planning Organizations (MPOs), Transportation Planning Organizations (TPOs), toll authorities, local transit agencies, private-sector technology and application developers, auto manufacturers (original equipment manufacturers (OEMs) and Tier 1 and Tier 2 suppliers), Florida and national modal, professional, and standards development organizations, and universities. This CAV Business Plan links the CAV Program with the various project activities and the CAV efforts to create a comprehensive statewide approach which includes planning, research, implementation, maintenance, and operations. This CAV Business Plan follows other FDOT programs and plans, including the *Florida Transportation Plan (FTP), TSM&O Strategic Plan, STAMP Action Plan, Transportation Technology Strategic Plan, Strategic Highway Safety Plan (SHSP), Strategic Intermodal System (SIS) Policy Plan, Florida's Aging Road Users Strategic Safety Plan (Safe Mobility for Life Coalition),* and *Traffic Incident Management (TIM) Plan.*

At the national level, FDOT is actively involved in committees and initiatives, including the multi-state Connected Vehicle (CV) Pooled Fund Study, the American Association of State Highway and Transportation Officials' (AASHTO) Committee on Transportation System Operations (CTSO), the AASHTO Committee on Traffic Engineering (CTE), the AASHTO Vehicle-to-Infrastructure (V2I) Deployment Coalition, the I-95 Corridor Coalition, the Institute of Transportation Engineers (ITE), and the Intelligent Transportation Society of America (ITSA). For example, FDOT responded to the AASHTO Signal Phase and Timing (SPaT) challenge with a project in Tallahassee. Such activities have allowed FDOT to sustain and expand its national leadership while developing a strong CAV Program.

The CAV Business Plan was initiated within FDOT's Statewide Traffic Engineering and Operations Office (STEOO). As the CAV Program is expanding, the coordination and collaboration efforts with FDOT Central and District Offices are also increasing. To better understand the perspectives of various offices on CAV opportunities and challenges, and their planned roles, the STEOO interacts and collaborates with internal partners and external stakeholders. This Plan supports safety, mobility, and infrastructure advancements achievable by deploying CAV technologies.

1.1. Vision, Goals, and Objectives

The CAV Program goals and objectives support the *FDOT TSM&O 2017 Strategic Plan*. The CAV technologies have the potential to significantly reduce highway crashes that result in traffic fatalities. This is consistent with FDOT's vision and that of *Vision Zero*. The CAV technologies also have the potential to improve travel time, increase vehicle and person mobility, enhance multimodal operations, and positively affect the economy in Florida.

1.1.1. CAV Vision

This CAV Business Plan drives, towards *Vision Zero* with a fatality-free roadway network and a congestion-free transportation system in Florida using CAV technologies.

1.1.2. Safety Objectives

The objective of the CAV Program is to improve safety for all transportation modes and road users, including pedestrians and bicyclists. This safety objective aligns with the FDOT's SHSP, FTP, SIS Policy Plan, and other state and national programs funded by the Federal Highway Administration (FHWA), the Federal Motor Carrier Safety Administration (FMCSA), and the National Highway Traffic Safety Administration (NHTSA). NHTSA observed that 94% of highway crashes are caused by human error[1]. Recognizing the potential to mitigate human error, while noting that this expectation needs to be tested and validated, implementation of CAV technology is anticipated to improve safety in the long-term.

1.1.3. Operations/Mobility Objectives

Traffic congestion (Figure 1) in Florida is increasing due to several factors, including population and tourism growth. According to the USDOT, CAV signal-control applications reduced travel time by 27%, while the cooperative adaptive cruise control and speed harmonization reduced travel time by 42%. While continuing to implement conventional operational improvements, the objective of the CAV Program is to leverage CAV technologies to significantly improve traffic operations, and increase vehicle, person, and multimodal throughput.

Source: FHWA

Figure 1. Peak Period Congestion 2045
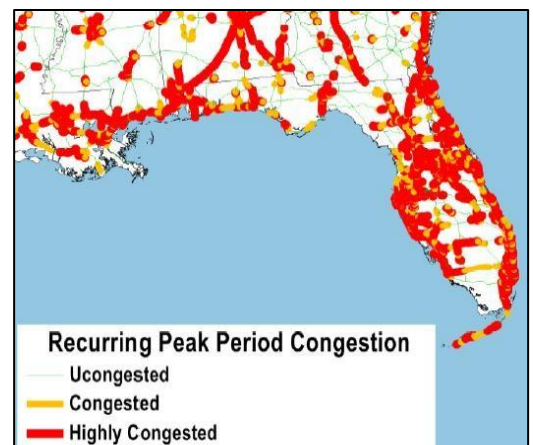
1.1.4. Economic Development Objectives

The objective of the CAV Program is to interact with the private sector to promote economic development in Florida. As of September 2018, FDOT has already entered into statewide data user agreements with Waze, Traffic Technology Services (TTS), Connected Signals (CS), Live Traffic Data (LTD), and is exploring other industry partners, such as freight, transit, etc. Collaboration with transportation industry partners is essential for accomplishing this objective.

1.2. Focus Areas

The following are the seven priority focus areas of this Business Plan:
1. Policies and Governance
2. Program Funding
3. Education and Outreach
4. Industry Outreach and Partnerships
5. Technical Standards and Specifications Development
6. Implementation Readiness
7. Deployment and Implementation

1.3. CAV Implementation Roadmap Overview

Of the three phases (Figure 2) to implement this Plan, the *Initialization Phase* has been in progress since FY 2017 with various research and pilot projects, along with involvement in national committees and

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[1] https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/812506

organizations that focus on CAV standards and implementation efforts. Table 1 shows the relationship between the roadmap and the specific priority focus areas.

Figure 2. CAV Implementation Roadmap Overview

| 2017-2018 Initialization | → | 2019-2020 Early Implementation | → | 2020+ Full-Scale Implementation and Operations |

Table 1. CAV Focus Areas Roadmap

CAV Focus Area	Initialization	Early Implementation	Full-Scale Implementation and Operations
Policies and Governance	◉	➡	➡
Program Funding	◉	➡	➡
Education and Outreach	◉	O	➡
Industry Outreach and Partnerships	◉	O	➡
Technical Standards and Specification Development	◉	O	➡
Implementation Readiness	◉	O	➡
Deployment and Implementation	◉	O	O

NOTE: Please refer to the Legend Key, preceding Page 1.

The **2017-2018 Initialization Phase** focus elements include a wide range of activities, including:

- Participate in national organizations such as AASHTO and ITE.
- Develop and build relationships with CAV technology manufacturers and application developers.
- Provide opportunities for both internal and external developers to develop and test technologies and applications.
- Build industry partnerships and update the relevant FDOT policies and approaches.
- Participate in CAV initiatives and use available tools such as those from USDOT.
- Develop, implement, and evaluate CAV pilot projects.
- Develop a data management plan, an operations and maintenance (O&M) framework, education and outreach activities, and understand the existing conditions.
- Coordinate internally on CAV activities, while aligning with other plans and FDOT's vision.

The **2019-2020 Early Implementation Phase** focuses on small- to medium-scale implementation and pilot projects, using O&M funds, phasing in CAV, upgrading SunGuide® software, utilizing the Data Integration and Video Aggregation System (DIVAS), updating architecture documents, developing performance measures, and collaborating with private and public industry partners.

The **2020+ Full-Scale Implementation and Operations Phase** focuses on completing infrastructure upgrades, implementing large CAV projects, conducting performance and outcome assessments, performing O&M activities, advancing outreach with stakeholders, and analyzing the impacts of agency and industry partnerships.

2. CAV Focus Areas and Action Items

2.1. Policies and Governance

This CAV Business Plan identifies the ***policies and governance*** elements with a goal to develop and communicate an institutionalized framework for planning, designing, and deploying the CAV Program in Florida. Table 2 shows the specific action items.

Table 2. Policies and Governance Action Items

Functional Areas and Action Items	Activity	Status	Term	Main Role	Outcome	Responsibility*	Cost
Perform Coordination for Technology, Data Governance, and Policies.	1	◉	S	E	📖	TEO, TT, PP, LP	$
Implement and Maintain the CAV Business Plan.	2	◉	S	NM	📖	TEO	$
Oversee CAV Program Delivery and Messaging.	3	◉	M	E	S, M, ED	LT, TEO	$$
Collaborate with the Office of Transportation Technology to develop an enterprise operation change management framework, if required.	4	➡	M	E	📖	TEO, TT, FP, EM	$

 NOTE: Please refer to the Legend Key, preceding Page 1.
*Several Offices (TEO, PM, D, C, D1-7, FTE, MPO/TPO, LT, R, PP, P, SIS, FT, TDA, EM, WP, FP, PIO and TT) may have a role.

The key initial steps for the ***policies and governance*** action items include:
- Identify opportunities to prioritize and coordinate CAV Program activities within Florida.
- Develop statewide CAV Program messaging.
- Incorporate other state agencies into the CAV project implementation process.
- Incorporate local agencies into the CAV project implementation process, leveraging the existing Local Agency Program (LAP) certifications to the extent possible.
- Evaluate federal and state policies related to CAV.
- Develop CAV Program workforce-related items such as training, skill development, resource needs, etc.
- Develop economic impacts through the CAV Program to follow FTP goals.
- Summarize current state and national legislation supporting CAV.
- Leverage and discuss SIS Policy Plan to support CAV Program.
- Identify roles and responsibilities for states, governing/regulatory agencies, local agencies, etc.
- Discuss and understand the CAV regulation elements.

2.2. Program Funding

Developing a ***program funding*** strategy can assist FDOT to prioritize work and make the best use of available funds. A sound funding strategy can assist with identifying grants or funding opportunities in advance to avoid last-minute proposals and make the best use of available resources. Table 3 shows the specific action items.

Table 3. Program Funding Action Items

Functional Areas and Action Items	Activity	Status	Term	Main Role	Outcome	Responsibility*	Cost
Establish Sustainable CAV Implementation, O&M Funding using State/SIS/District/Local Funds.	5	◉	S	NM	S, M, ED	LT, TEO, WP, FP, PP	$$$

Functional Areas and Action Items	Activity	Status	Term	Main Role	Outcome	Responsibility*	Cost
Track the role of CAV in the TSM&O Cost Feasible Plan.	6	◉	S	E	📖	TEO, D1-7, FTE	$
Study CAV Implementation and O&M Best Practices, and Staffing Needs.	7	O	M	E	📖	TEO	$

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The key initial steps for the ***program funding*** action items include:
- Identify funds to foster CAV deployments including O&M funding.
- Determine types and priority of projects that FDOT wants to support with startup funding.
- Actively coordinate with and involve Policy and System Planning, District Planning, and TPOs and MPOs early in the project planning process.
- Determine funding sources that FDOT intends to use.
- Develop funding applications for grant opportunities such as Advanced Transportation and Congestion Management Technology Deployment (ATCMTD), Accelerated Innovation Deployment (AID) Demonstration, and Better Utilizing Investments to Leverage Development (BUILD).
- Address staffing needs for implementation, maintenance, and development.
- Discuss SIS routes and potential of including CV technology earlier in the planning process.

The CAV equipment will require periodic and responsive maintenance such as inspections, preventive maintenance, repairs, and monitoring. Required on-call staff will handle critical emergency repairs as well as scheduled upgrades and replacements. Just as with ITS devices, CAV equipment will eventually start to age, and bring a considerable increase to its annual maintenance costs. Therefore, there is a need for dedicated O&M and replacement funds for the CAV deployment projects.

2.3.   Education and Outreach

The ***education and outreach*** program is aimed at organizational change management, while creating a unified message, and increasing awareness about CAV opportunities. ***Education and outreach*** are meant to provide the current and future transportation workforce with increased CAV Program knowledge and skills including, but not limited to, technology, deployment, integration, and software development. FDOT will explore the need for developing the educational outreach program to inform transportation planners, managers, engineers, local agencies, and users (travelling public, motor carriers, other road users) about the CAV Program. Outreach will assist in providing a better understanding of how CAV infrastructure will be deployed and operated, while also addressing the infrastructure requirements, standards, implications, and challenges with CAV deployments. Table 4 shows the ***Education and Outreach*** action items.

Table 4. Education and Outreach Action Items

Functional Areas and Action Items	Activity	Status	Term	Main Role	Outcome	Responsibility*	Cost
Develop CAV information.	8	◉	M	E	📖	TEO, P, TDA	$
Implement CAV awareness outreach.	9	O	M	E	📖	TEO, P, TDA, D1-7, FTE	$
Support Florida Automated Vehicles (FAV) Summit and other CAV events.	10	➡	L	E	ED	TDA, TEO, LP, FP	$

Functional Areas and Action Items	Activity	Status	Term	Main Role	Outcome	Responsibility*	Cost
Exploring teaming with organizations to collaborate on CAV education.	11	O	L	E	📖	TEO, TT, FP, D1-7, FTE	$

NOTE: Please refer to the Legend Key, preceding Page 1.
*Several Offices (TEO, PM, D, C, D1-7, FTE, MPO/TPO, LT, R, PP, P, SIS, FT, TDA, EM, WP, FP, PIO and TT) may have a role.

Educational outreach programs may:
- Highlight CAV benefits and trends.
- Identify elements and functions pertaining to the CAV Program.
- Develop CAV case studies and lessons learned.
- Provide an understanding and explanation of CAV architecture and infrastructure needs.
- Communicate CAV opportunities, challenges, benefits, and perceptions.
- Partner with Florida universities including FAU, FIU, FPU, FSU-FAMU, UCF, UF, UNF, USF/CUTR.
- Research the impacts of ride-hailing, shared mobility etc. on vehicle-miles traveled and CAV.

2.4.   Industry Outreach and Partnerships

The goal of *industry outreach and partnerships* is to foster economic development and to leverage private sector efforts to improve safety and mobility, and to implement outcome-based CAV solutions through strategic partnerships with the industry, universities, and others. Collaborating with industry leaders, researchers, and the private sector can assist FDOT to better prepare for leveraging opportunities and addressing challenges of CAVs. Table 5 shows the *Industry Outreach and Partnerships* action items.

Table 5. Industry Outreach and Partnerships Action Items

Functional Areas and Action Items	Activity	Status	Term	Main Role	Outcome	Responsibility*	Cost
Engage, Establish Favorable Environment for, and Create Public-Private Partnerships.	12	➡	S, M	NM	S, M, ED	TEO, TDA, LT, LP	$$
Provide Opportunities for Industry Partners to Test Hardware and Software.	13	◉	S	NM	S, M, ED	TEO, TT	$$$

NOTE: Please refer to the Legend Key, preceding Page 1.
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While obtaining industry input and feedback on CAV policy formulation and the development and implementation of this Plan, the Department will discuss its internal role versus what will be expected of the industry. Partnerships with different segments of the CAV industry can keep FDOT informed and better aligned with their short- and long-term decisions. Benefits to the industry and other partnerships in Florida include:
- Opportunities to fast-track CAV deployments
- Improved understanding of standards development process including O&M practices
- Increased ability to access innovation and test advanced technologies
- Better-aligned research and development investments with CAV industry needs
- Well-defined roles and responsibilities of public versus private entities
- Managed CAV agreements and deliverables
- Properly formulated policy on CAV with private industry engagement

2.5.   Technical Standards and Specifications Development

Standards play a vital role by providing interoperability between new and existing infrastructure, functions, and processes. These standards form the basis of how products and processes interact with

each other. The goal of CAV technical standards and specifications development is to create a framework for consistent infrastructure preparedness, including general facility design, software updates, and hardware upgrades. The CAV standards are currently under development through a cooperative partnership between the industry and USDOT. Advancing and adopting these standards will assist in expediting the deployment of CAV applications in Florida. Table 6 shows the specific action items.

Table 6. Technical Standards and Specifications Development Action Items

Functional Areas and Action Items	Activity	Status	Term	Main Role	Outcome	Responsibility*	Cost
Develop Systems Engineering Process for CAV.	14	◯	M	E	📖	TEO	$$
Implement Security Credential Management System (SCMS), and Cybersecurity and Physical Security of CAV Equipment.	15	◉	M	NM	📖, S	TEO, TT	$$$
Mainstream CAV into FDOT Standards and Specifications, Guides, and Manuals.	16	◉	M	E	📖, S	TEO, PM, D	$$

NOTE: Please refer to the Legend Key, preceding Page 1.
*Several Offices (TEO, PM, D, C, D1-7, FTE, MPO/TPO, LT, R, PP, P, SIS, FT, TDA, EM, WP, FP, PIO and TT) may have a role.

Several professional associations are currently developing, maintaining, and updating CAV-related standards. The USDOT also offers an array of useful online tools and requirements for collecting and distributing CAV data in real-time based on these standards. The following are the key implementation steps:

- Following the FDOT Transportation Technology Plan Enterprise Architecture
- Follow national/international standard associations/agencies, such as:
  - Society of Automotive Engineers (SAE) – J2735, J2945, etc.
  - Institute of Electrical and Electronics Engineers (IEEE) – P802.11p-2010, 802.3, 1609.0
  - 3rd Generation Partnership Project (3GPP)
  - National Transportation Commissions for ITS Protocol (NTCIP) – 1202, 1206, etc.
  - National/International Agencies such as Dan law, OmniAir Consortium, 7layers, etc.
  - International Organization for Standardization (ISO)
- Follow USDOT initiatives, such as:
  - Roadside Unit (RSU) Specifications
  - USDOT Proof of Concepts – SCMS, etc.
  - Information Data Exchange (IDE) Proof of Concept
  - USDOT (SPaT) MAP Data Development Tool
  - USDOT Pilot Projects – CAV Pilots, Smart City, Test Beds
  - Crash Avoidance Metrics Partnership (CAMP) Initiatives
  - Strategic Transit Automation Research Plan
  - Central Florida Connected Vehicles (CV) Proving Ground
  - Federal Transit Administration (FTA) Transit Automation Initiative Guidance
- Leverage lessons learned from various CAV pilot projects in Florida
- Participate in professional associations, such as Association of Unmanned Vehicle Systems International (AUVSI), IEEE, NTCIP, 3GPP, etc.
- Coordinate with FDOT Design Office for specifications and design standard updates
- Address security elements pertaining to SCMS usage and applications, physical security, and network and data security; refer to 14-2 F.A.C. cybersecurity standards, as applicable

2.6.   Implementation Readiness

The goal of **CAV implementation readiness** is to create a statewide CAV-ready environment for deployment of infrastructure and meeting any identified needs. For example, FDOT is implementing projects such as the SPaT Challenge and I-75 FRAME, while partnering with the University of Florida's (UF) I-STREET and Florida Turnpike Enterprise's SunTrax. As FDOT accelerates CAV deployment around the state, each project will have unique requirements that entail specific approaches to implementation and deployment; however, there is a large set of commonalities among the deployments. Table 7 provides the **Implementation Readiness** action items.

Table 7. Implementation Readiness Action Items

Functional Areas and Action Items	Activity	Status	Term	Main Role	Outcome	Responsibility*	Cost
Use and Apply USDOT Implementation Tools.	17	◉	M	E	S, M, ED	TEO, D1-7, FTE	$$$
Develop CAV-related Items for Traffic Engineering Research Laboratory (TERL) Processes.	18	◉	M	NM	📖	TEO	$$$
Develop CAV Infrastructure Deployment Plan.	19	◉	L	E	📖, ED	TEO	$$
Address RTMC Needs for Data Usage/Storage.	20	O	M	E	📖	TEO, D1-D7, FTE, TT	$$
Analyze CAV Safety Elements/SHSP Focus Areas.	21	◉	M	E	📖, S	TEO	$$
Prepare for Communication Options.	22	◉	M	NM	📖	TEO, TT	$$
Develop Decision Support Systems.	23	◉	M	NM	S, M	TEO, D1-7, FTE, ED, EM	$$$

NOTE: Please refer to the Legend Key, preceding Page 1.
*Several Offices (TEO, PM, D, C, D1-7, FTE, MPO/TPO, LT, R, PP, P, SIS, FT, TDA, EM, WP, FP, PIO and TT) may have a role.

The following are the key implementation steps:
- Leverage the Open Source Application Development Portal.
- Make resources and investments available based on alternative evaluations.
- Prepare readiness plans for freeways and expressways, signalized intersections, non-signalized intersections, and integrated corridors.
- Perform analysis of infrastructure, and capabilities of network, data centers, local agencies, etc.
- Prepare for continuous and real-time collection of data, data archival, data retrieval and analysis of data from the pilot projects
- Develop CAV Infrastructure Deployment Plan - establish a method to identify, track, communicate, and meet miscellaneous CAV infrastructure needs through the **CAV technical standards and specifications development** process.
- Address risk management by:
    - increasing the knowledge and understanding of risk amongst all stakeholders,
    - improving internal risk culture and aligning the CAV Program goals with risks,
    - identifying economic impacts and assessing risks of the CAV Program, and
    - identifying risks such as those related to interoperability, obtaining the Federal Communications Commission (FCC) approvals in a timely manner, and data storage.
- Analyze Regional Transportation Management Center (RTMC) requirements for:
    - data retrieval, storage, archival, sharing, etc.,
    - integration with ROADS,
    - establishing data governance, and

o   utilizing data in SunGuide, sharing data through DIVAS.
- Analyze CAV safety elements to address statewide safety issues and SHSP priority focus areas.

2.7.   Deployment and Implementation

The FDOT's **CAV deployment and implementation** effort focuses on *phasing in* the CAV applications. The goal is to move from planning to full-scale CAV deployment and implementation using various applications to achieve the SME goals in Florida. Based on the type of deployment planned, the FDOT Central Office (CO) will assist the District Offices and local agencies in identifying the infrastructure required for the deployment. FDOT has traditionally identified deployment projects that are funded through various sources including those with federal match or through state and research programs; these projects (I-75 FRAME, US 90 SPaT, Gainesville SPaT Trapezium, etc.) are being planned or deployed. This approach should continue at a fast pace since the industry is rapidly evolving and technologies are changing. **CAV** Deployment and Implementation generally work together with applicable recurring tasks in prior Sections 2.1 through 2.6. Table 8 shows the **Deployment and Implementation** action items.

Table 8. Deployment and Implementation Action Items

Functional Areas and Action Items	Activity	Status	Term	Main Role	Outcome	Responsibility*	Cost
Implement Statewide CAV Deployment Plan.	24	○	M	NM	S, M, ED	TEO, FP	$$$
Incorporate CAV into RTMC Operations.	25	◉	M	NM	S, M	TEO, D1-7, FTE	$$$
Develop Standard Operating Procedures.	25.01	○	M	NM	📖	TEO, D1-7, FTE	$$
Develop and Implement Updates to SunGuide®.	25.02	◉	M	NM	📖	TEO, D1-7, FTE	$$$
Develop Benefit-Cost (B/C) Ratios (In-Field or Proxy) for CAV Applications.	26	○	S	E	📖	D1-7, FTE	$$$

NOTE: Please refer to the Legend Key, preceding Page 1.
*Several Offices (TEO, PM, D, C, D1-7, FTE, MPO/TPO, LT, R, PP, P, SIS, FT, TDA, EM, WP, FP, PIO and TT) may have a role.

The following are the key steps to deployment and implementation:
- Perform a District survey, and advise, on regional long-range transportation plan and project needs in coordination and consultation with the District and Central Planning Offices.
- Focus on the MPOs and TPOs, in consultation with FDOT Central and District Offices.
- Leverage existing regional partnerships with cities, counties, and universities.
- Advance projects based on Districts' needs following the guidance from the TSM&O Leadership Team.
- Potential near-term CAV Deployment Plan project categories include:
  o   Provide network connectivity and types of connections from field locations to the RTMCs and Traffic Management Centers.
  o   Upgrade traffic signal controllers and evaluate upgrade options so that signal controllers can interface with an RSU for extraction of SPaT basic safety messages.
  o   Develop MAP data for pilot locations.
  o   Conduct pilot projects with applications in Smart Work Zones (SWZ), Autonomous Truck Mounted Attenuators (ATMA), Truck Platooning, pedestrian safety applications, multimodal applications including transit and freight, and aging driver mobility applications.
  o   Implement CAV projects in all FDOT Districts to achieve the SME goals. This shall be accomplished with input from the Districts and the TSM&O Leadership Team.

3. Project Selection Criteria and Performance Measures

3.1. Selection Criteria

All projects to be funded for deployment should follow the systems engineering (SE) process. A high-level operational concept should be developed to define user needs and perform stakeholder coordination. The following project selection criteria provide general guidance to develop CAV deployment projects. A score on a scale of 1-10 (10 being the most beneficial rank) may be assigned to the identified project for each criterion (see Table 9). These criteria may be used for various purposes, including project prioritization at the Districts and by the Central Office.

Table 9. Project Selection Criteria and Scoring Matrix

Categories	Criteria	Self-Score
Accelerate the CAV Program	Does this project accelerate the deployment and implementation of CAV technologies in Florida?	
Safety	Does this project directly reduce or have the potential to reduce fatal, serious injury and/or secondary crashes?	
Mobility	From a mobility perspective, does this project directly benefit all modes including pedestrians, bicyclists, disabled, economically disadvantaged, and aging road users?	
Efficiency and Reliability	Does this project directly benefit (or have potential to impact) efficiency and/or reliability for all travelers, freight, transit riders, aging road users, pedestrians, and bicyclists?	
Feasibility	Is this project implementable (technology-ready), scalable, and portable for statewide deployment?	
	Do proposed technologies comply with or have the potential to comply with relevant state and federal safety law?	
	Is the proposed project interoperable and/or does it have the potential to become interoperable with the existing or programmed CAV Projects?	
Funds	Does this project leverage federal, local, and/or private funds? Are there any private organization and/or local agency partners? If yes, what are their match types and roles? Is there an agreement or Memorandum of Understanding (MOU) in place?	
Benefit/Cost	Does this project offer benefits with a high B/C and a good return on investment?	
Data and Security	Does this project collect, disseminate, and use real-time traffic, transit, parking, and other transportation information to improve safety and mobility, and reduce congestion? Explain how the project will safeguard data privacy and deploy a cybersecurity platform.	
Operations and Maintenance	Does this project address staffing, funding, and procedures for operations, maintenance, and replacement of CAV infrastructure, technologies, and applications?	
Project Evaluation	Does this project have pre-defined performance measures? What and how are these outcomes measured?	
	Will there be a before and after analysis performed, and lessons learned documented? If yes, how will this be documented and shared?	
	Is there a systems validation and verification process in place? Explain how this will be performed.	
	Total Score	

3.2. Evaluation and Performance Measures

Project evaluation is an integral part of pilot implementation. Evaluation should be performed at two stages of the project life cycle:

- Pre-project evaluation for the selection of projects based on strategies listed in Section 3.1 to meet the overall statewide CAV Program's SME goals
- Post-project evaluation to assess the impact of the project meeting the overall project objectives and goals

These evaluations are identified to document and share lessons learned and to develop future guidance. All projects should have verification, validation, and testing, and should answer the following questions:

- Was the system built as envisioned and designed? Is the project doing what it is intended to do? For example, are the SPaT and MAP messages being broadcasted, are they accurate, etc.?
- Did the project achieve the benefits expected when the project was selected for implementation? For example, are intersection-related crashes and delays at SPaT-equipped intersections reduced?

The project-specific performance measures may be discussed and developed by the stakeholder team. The SME benefit-cost analysis should also be conducted during the pre-project evaluation phase with the benefit-cost and return on investments analyses evaluated and tracked after implementing the projects.

4. Summary

This CAV Business Plan identified the following categories of CAV Program activities as key elements for fulfilling the SME goals in Florida.

- Identify **policies and governance** with a goal to develop and communicate an institutionalized framework for planning, designing, and deploying CAV in Florida.
- Leverage **program funding** and identify additional funding opportunities for implementation, operations, and maintenance.
- Identify **education and outreach** program objectives with a goal to create awareness and usage of CAV Program deployments and develop workforce on CAV Program practice in Florida.
- Develop **industry outreach and partnerships** to implement SME outcome-based CAV technologies through active partnerships with the industry, universities, and stakeholders.
- Identify and develop **technical standards and specifications** to create the framework for consistent CAV infrastructure preparedness, including general facilities design, software updates, and hardware upgrades.
- Establish a platform for **CAV implementation readiness** in terms of technology implementation, infrastructure improvements, and gaps identification.
- Move to full-scale **CAV deployment and implementation** using the most relevant CAV applications that have the potential to achieve the SME benefits, and track the benefits realized from CAV deployments.