MIAMI-DADE'S SMART LOOP

South Florida Region's growth will continue to aggravate the already existing problems of safety, traffic congestion, pollution, limited resources, hurricane evacuation, and sea level rise and flood conditions arising from climate change. At the same time, the region is facing a significant growing population (including aging, differently abled and youth populations), increasing employment trend, increasing freight traffic attracted by the seaport and airport, and rapid changes in technology. These trends are exacerbating the growing digital divide and accessibility gaps for disadvantaged groups, while intensifying the need for safe mobility innovations capable of transforming our future. Industry, cities, and authorities around the nation need new and innovative solutions to meet various threats associated with their transportation systems. Many of the threats and issues facing South Florida are also faced by other regions around the nation. Thus, proven technologies on the corridors, campuses, and ports of South Florida will provide important inputs to automated vehicle deployments in metropolitan areas around the nation.

Miami-Dade's Department of Transportation and Public Works (DTPW), in partnership with Miami-Dade Metropolitan Planning Organization (MPO), Florida Department of Transportation (FDOT), Miami-Dade Expressway Authority (MDX), and Florida International University (FIU), proposes to establish a proving ground for the **safe** and **secure testing**, **deploy** and **operation** of connected and automated vehicle (CAV) technologies in Miami-Dade County, while providing new management tools for its leaders to increase predictability and economic prosperity, enhance the quality of life, improve road user safety and experience, and move toward a sustainable future.

What sets Miami-Dade's project apart from others is how we are leveraging existing assets to spur and advance innovation and to develop a safe, secure, sustainable, scalable business model for multi-modal multi-facility CAV technology testing, deployment, and operation. The Automated Vehicle Proving Ground being proposed by DTPW and its partners, hereafter referred to as Miami-Dade's **SMART Loop**, will use planned projects and ongoing efforts of infrastructure improvements to support Vehicle-to-Vehicle (V2V), Vehicle-to-Infrastructure (V2I), autonomous vehicle, and connected automated vehicle technologies solutions that can be joined together with a portfolio of partnerships to provide a safe and secure environment for the testing, demonstration and deployment of CAV technology applications for campuses, arterial roads, general purpose and manage lane freeway facilities, airports and seaports, and transit facilities and services.

Pooling existing technology and a development of improved technology, the SMART Loop Project will provide a safe testing and deployment environment for CAV technology applications for multiple users including the disadvantage population, transit, and freight. As part of the Community of Practices, the SMART Loop Project will develop a central data repository to provide a fabric of shareable compatible data; share safety and security approaches, best practices, research efforts and education to enhance knowledge and public awareness of CAV technology; and create opportunities for technology innovation; while contributing to the solution of the long-range and immediately challenges faced by the nation, Miami-Dade County and the entire South Florida Region.

MIAMI-DADE'S CHALLENGES

Miami-Dade is the most populous county in Florida and the 7th most populous county in the nation, with a total urbanized population of approximately 2.7 million and is projected to exceed 3.3 million residents by 2040. The County is ranked one of U.S.'s top 15 urban areas with the worst traffic congestion and Miami is the 7th most traffic congested metropolitan area in the nation. What should be a 20-minute freeway trip in Miami actually requires 50-60 minutes of planned driving time.

In 2015, Miami-Dade County had the highest number of traffic-related fatalities across all population segments in the State, accounting for the 12 percent of the total traffic fatalities in Florida – among all states, Florida had the largest increase with 445 additional traffic fatalities (17.8 percent increase). These traffic congestion and safety challenges have led to local and regional efforts to investigate, understand the cause of traffic-related crashes and establish transportation safety strategies and initiatives to improve safety performance across all transportation modes including testing of AV and CV technology applications.

At the same time, Miami-Dade must also address other challenges that, if not unique, are especially emphasized by its particular combination of geographic, cultural, demographic, and environmental characteristics as well as its transportation context within Florida and the US. More specifically, Miami-Dade County is limited by its geographic surroundings, including an ocean and the Everglades; these constraints prevent further outward expansion and require vertical growth that will inevitably increase urban density. The near and mid-term effects of climate change have profound implications for future growth and development. Porous land and limited elevation represent just two challenges to the necessary mitigation that Miami-Dade County will have to undertake to ensure its long-term sustainability.

MIAMI-DADE'S AUTOMATED VEHICLE PROVING GROUND PILOT | SMART LOOP

PROGRAM MANAGEMENT TEAM

The proposed AV proving ground pilot will be managed through a partnership between DTPW and MPO, FDOT, MDX and FIU. DTPW and FDOT are the two agencies that plan, design, operate and maintain all roadways, sidewalks, bicycle facilities and traffic control devices within Miami-Dade County; while MPO brings all partner together for the implementation of transportation related projects and programs federal funds and develop local consensus. The region has one of the most advanced transportation system management and operations (TSM&O) program in the nation. DTPW is the agency responsible for managing all aspects of mobility improvements and services such as transit, traffic engineering/signals, and for-hire transportation. FDOT has one of the most advanced active traffic and demand management that involves a managed lane network and ramp metering on freeway facilities. MDX, the agency operating and maintaining the major east-west tolled corridors in Miami-Dade County, has been a leader in innovative mobility solutions for the state of Florida, bringing advanced technology to SF through the cashless toll expressway and the pay-by-plate. FIU, designated by FHWA as Minority Institute of Higher Education (MIHE), is a major research institution in CAV technology and ITS development, serving South Florida community through professional development and technology transfer in collaboration with FDOT, MDX, DTPW and USDOT. FIU is currently ranked first in awarding B.S. in Engineering degrees to Hispanics in the continental US and number five for African Americans nationwide, with minority consisting 80 percent of current students in engineering.

VISION

The proposed testing site is the Miami-Dade's SMART Loop, a **highway corridor** formed by a heavily traveled east-west freeway, parallel and crossing arterial roads, FIU campuses, and Miami airport and seaport. The SMART Loop concept was created by the Miami-Dade County CAV Task Force group led by the MPO and focused on the development and deployment of CAV pilot projects within the County. The task force includes, in addition to public agencies in the region, representatives from private sector CAV vendors who together with other vendors are ready for immediate testing of their technologies and products on the SMART Loop.

The SMART Loop initiative will build on planned projects and ongoing efforts of infrastructure improvements to existing roadway facilities to support AV technology and V2I communication, as detailed next. The east-west corridors forming the SMART Loop are part of County's economic backbone, linking the Warehouse/Industrial District, Miami International Airport (MIA), Miami Intermodal Center (MIC), PortMiami, FIU campus, Downtown Miami, Business Central District (BCD), Financial District, Health District, and regional transit systems (e.g., Tri-Rail and Metrorail) and intercepting north/south commuters along SR-826 and the Homestead Extension Florida's Turnpike (HEFT). **Figure 1** illustrates the alignment of the SMART Loop and future extensions.

PROVING GROUND PILOT DESCRIPTION

The SMART Loop is formed by SR-836 to the north, SW 8th Street to the south, LeJeune Road to the east and W 137 Avenue to the west and include FIU campuses, the MIC, MIA, and PortMiami (See **Figure 1)**. The SMART Loop will include a mini-loop (sub-loop) with the FIU campus that includes a closed track, a low speed signalized street loop around the main campus, six major parking garages, many parking lots, and shuttles and student movers.

Dolphin Expressway/SR-836 (SMART 836) Corridor is an all-electronic (cashless) tolled freeway facility fully instrumented with ITS technologies including closed circuit TV (CCTV) cameras, traffic sensors, dynamic message signs (DMS) operated by MDX. SR-836 is one of the most heavily traveled corridors in Miami-Dade County. Up to 200,000 vehicles per day use SR-836, and forecasts from 2014 suggest that traffic volumes will increase by more than 20 percent by 2030.

Recently, the MDX Board of Directors approved a resolution designating the portion of SR-836 between LeJuene Road (SW 42nd Avenue) and W 137th Avenue (approximately 10.3 miles) as "SMART 836" to initiate infrastructure connectivity through the partnership with local, state and federal agencies to integrate design, technology and equipment necessary for the implementation of CAV technologies. Copy of MDX Board Resolution is provided as an attachment.

SMART 836 is a critical corridor for transit operations because its connectivity with MIC and transit terminals and park-and-ride facilities. Starting in late 2017, DTPW will operate three new Express Bus Routes on SMART 836 shoulders as part of the DTPW's Active Traffic Management Program and three new transit stations, enhancing intermodal connectivity within the east-west corridor.

SW 8th Street/SR-41 Corridor is a State arterial road that runs parallel to SMART 836, serving approximately 50,500 vehicles per day. Adaptive Signal Control Technology (new model 2070LX controllers, Advanced Traffic Management System (ATMS) with adaptive control capabilities and ITS infrastructure) will be deployed on SW 8th Street corridor, from SW 67th Avenue to SW 142nd Avenue (7.5-mile segment with 29 signalized intersections) to enable the traffic signal infrastructure to be integrated with CV technology. This corridor serves major and highly productive DTPW's bus routes.

LeJeune Road/SR-953/W 42 Avenue Corridor is a crossing State arterial road that connects SMART 836 and SW 8th Street with MIA and MIC. This arterial road is used by 65,000 vehicles per day. The deployment of Adaptive Signal Control Technology on LeJeune Road, from SW 8th Street to NW 14th Street, is programmed for 2017.

W 137th Avenue is a crossing County's arterial road connecting SMART 836 and SW 8th Street. As part of the County's traffic signal system upgrade project, new model 2070LX controllers will be deployed on W 137th Avenue in 2018.

REGIONAL MOBILITY IMPACT

With access to major ports for both goods and people, and as a bustling international gateway, SMART Loop will provide for the efficient movement of people and goods by road, rail, water, and air through the implementation of CAV technologies. The proposed project will integrate different facility operations and transportation modes, and provide access to County's most populated areas, major regional transportation and trade hubs, regional activity/job centers. The location of the SMART Loop and connection with major regional corridors such as the HEFT, SR-826, US-1, I-95 and SR-924 provides a unique opportunity for future extensions, having a broader impact on regional mobility and economy.

The SMART Loop will serve to improve intermodal connectivity by enhancing access to major regional transportation and trade hubs with the following characteristics: *Miami Intermodal Center (MIC)* is a major multimodal transportation hub providing seamless access to all modes of public transportation including Metrobus, Metrorail, Tri-Rail, Amtrak, Greyhound, ridesharing services, and a rental car center. Tri-Rail is a commuter rail connecting to the counties of Broward and Palm Beach. Metrorail will also connect to AllAboard, Florida's new rail passenger service connecting Miami with Orlando. *Miami International Airport (MIA),* the 10th busiest airport in US, is the second airport with most international passengers. In addition, MIA is among the top 25 US international trade freight gateways by the value of shipments in 2014. *PortMiami,* the busiest cruise ports in the world, is one of the top 25 ports by containerized cargo in US.

The location of the SMART Loop provides access to an opportunity to streamline and transform the supply chain for major industrial and commercial end-users. Perishable goods, refrigerated items and high end electronics would lead the way in benefiting from the reduced travel times and direct connections that CAV technology would make available. Time currently spent in transferring from a ship to a truck then to a train or airplane would be reduced eliminating dwell times and making the overall process cheaper and more efficient. Many areas of western Miami that have developed as transportation centers for warehousing, freight consolidation and freight forwarding could be repurposed to other land uses and much of the chronic traffic congestion and traffic-elated crashed in these areas could be reduced. The SMART Loop initiative will serve as a role model for other cities in the US to learn from and copy, facilitating the safe testing and deployment of CAV technology across the country

MANDATORY CRITERIA

DESIGNATED SAFETY OFFICER

Since the facilities forming the SMART Loop are owned, managed and operated by different agencies, the AV Program will have a Safety Officer Committee composed of three Safety Officers (a safety officer per agency) and the Principal Designated Safety Officer. The group will regularly report to the Principal Designated Safety Officer and will coordinate and oversee the project activities through its own staff as well as consultants, industry collaborators, faculty from different university departments, and subject matter experts.

The Principal Designated Safety Officer will be responsible for SMART Loop's safety management plan and will participate in the Community of Practice's regular quarterly meeting of Safety Officers.

PRINCIPAL DESIGNATED SAFETY OFFICER

Dr. Hadi Mohammed, PE, FIU

SAFETY OFFICER COMMITTEE MEMBERS

- **Carlos Cruz-Casas, P.E.,** DTPW, Assistant Director
- **Javier Rodríguez, P.E.,** FDOT, TSM&O Program Engineer
- **Ivan Del Campo,** MDX, Chief Information Officer/ Manager of ITS

PRINCIPAL DESIGNATED SAFETY OFFICER

Dr. Hadi has over 30 years of industrial and academic experience in ITS planning, design, implementation, evaluation, and testing including CV and AV projects. He has been involved in ITS since the emergence of the field in the early 1990s. The safety officer committee members have been managing most ITS highway and transit projects in Miami-Dade County. They will be supported by CV and AV deployment and testing specialists from their ITS consultants and faculties of various engineering departments at FIU. The current ITS consultants of the SMART Loop partner agencies include HNTB, Southwest Research Institute (SWRI), Atkins, AECOM, Gannett Fleming, and EAC Consulting. The Designated Safety Office and Committees will utilize the required resources to assist in developing, reviewing, and implementing the safety management plan at the highest level expected by the USDOT. The SMART Loop will comply with all applicable Federal, State, and local laws. The committee will use the USDOT CV and AV Guidance, industry standards and best practices in developing and implementing the safety plan to ensure that the systems are safe under real-world conditions. The plan will address the testing

(AV driven by an employee of the partner agencies) and deployment (AV driven by members of the general public) of the technologies on a test track at FIU campus, the mini-loop at FIU campus, and the SMART Loop roadways. The plan will ensure that the AV system with different levels of automation can operate safely in the intended environment.

The Safety Management Plan will address areas such as data recording and sharing, privacy, system safety, cybersecurity, Human-Machine Interface (HMI), crashworthiness, and consumer education and training. In addition, the plan will discuss how to identify, document, and verify the Operational Design Domain (ODD) for each AV system, the Object and

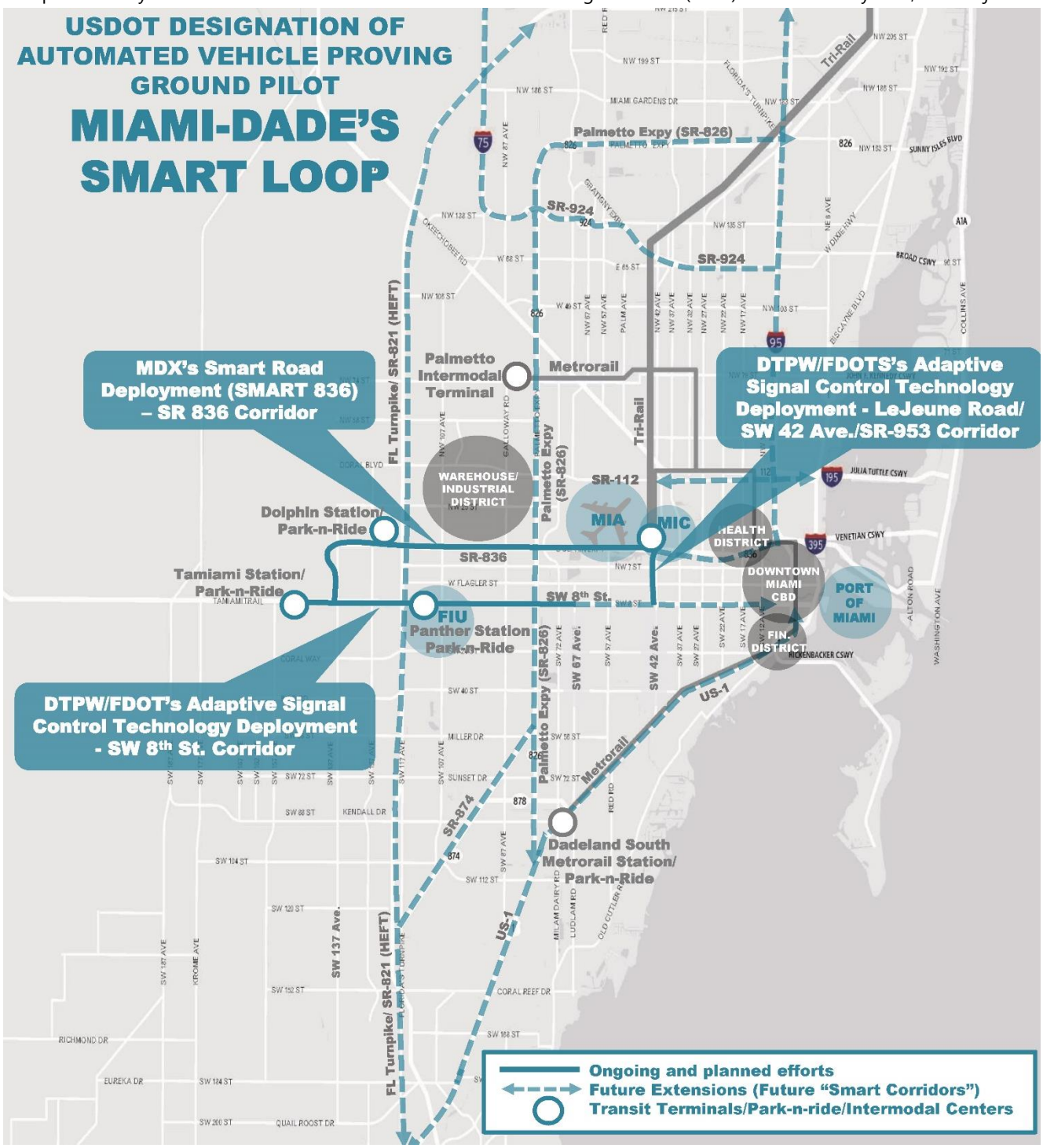

Figure 1: Proposed Automated Vehicle Proving Ground Pilot Map –Map of Miami-Dade with SMART Loop alignment, connections and potential future extensions

Event Detection and Response (OEDR), and fall back minimum risk condition. More details about this are given later in this application. The SMART Loop partners are committed to sharing the approaches to safety and safety data generated through testing and operation with the community as coordinated with the USDOT.

COMMITMENT TO SHARING FACILITY'S APPROACHES TO SAFETY AND SAFETY DATA GENERATED THROUGH TESTING AND OPERATION

The project team will track safety performance measures on a continuous basis for the duration of pilot projects conducted as part of the SMART Loop and will prepare quarterly status reports summarizing and documenting the progress of our efforts, approaches, lessons and results. These progress reports will be made available to the Community of Practice, USDOT, research community, technology companies, as well as stakeholders and residents within Miami-Dade County.

The project team will document processes for testing, validation, and collection of events, incidents, and crash data, including data for event reconstruction purposes according with National Highway Traffic Safety Administration (NHTSA) guidance. In addition, the processes will ensure collecting, storing, analyzing and sharing data regarding positive outcomes that include events in which the automated vehicles correctly detect a safety event and successfully avoid an incident. A plan will be developed for sharing the data with the USDOT and other entities, while meeting the security and privacy requirements and existing and future data recording and sharing standards.

Staff from DTPW, partner agencies, technology companies and system operators will be available to work with USDOT on any additional data requests. We recognize the importance of independent evaluation, and we believe in full transparency in tracking our progress. Project research team will work directly with USDOT and provide any requested safety data pertaining to the testing and operation of the SMART Loop project, and assist with additional data collection or data inference requests. This includes providing USDOT, Community of Practice or independent evaluator access to the site and site staff in coordination with DTPW and partner agencies staff.

The project team will be available and assist with any surveys, interviews, evaluation-related experiments requested in this context, meetings, collaboration, conferences, presentations and publications.

PROPOSED CONTRIBUTIONS

PROGRAM MANAGEMENT

PARTNERSHIP DRIVEN APPROACH

DTPW, the agency leading this effort, has assembled a team that comprises a unique combination of partner agencies and institutions with the resources, experience, expertise and leadership required to implement and manage the proposed AV program successfully, and to share the learnings and results. Other team members include companies and system operators and will expand during subsequent phases of the program.

The SMART Loop project will be managed via a partnership between DTPW and MPO, FDOT, MDX and FIU. The partner agencies are responsible for planning, designing, operating, and maintaining the County's street network and transit systems. As mentioned above, the ITS consultant of the partner agencies have been involved in CV and AV testing and implementation. The current ITS consultants include HNTB, SWRI, Atkins, AECOM, Gannett Fleming, and EAC Consulting. Faculty from the FIU College of Engineering and Computing will provide additional expertise such as sensors, cybersecurity, V2V and V2I communications, and other AV software and hardware. The team's experience with the associated guidance, processes, tools, plans, and pilot deployment of CV and AV, combined with the regional agencies long experience in applying active traffic and demand management, transit management and operations, ITS and tolling technology, in conducting CAV technology research, in managing public outreach programs, and in managing and accessing freight transportation impacts, will be leveraged to support the program success.

LEADERSHIP IN AUTOMATED VEHICLE

BROADLY APPLICABLE RESEARCH AND DEPLOYMENT OPPORTUNITIES

What sets Miami-Dade's proposal apart from others is the spectrum of research and deployment possibilities resulting from the combination of the project *partnership* managing the program; the integration of *different facility types and operations* which provides opportunities to test and compare a wider range of AV and CV applications; the integration of *existing and planned investments* from different facilities and system operators to further advance AV and CV technology testing and deployment; the project *scalability* resulting from the centric *location* within the South Florida Region and along a primary and heavy travelled corridor, linking the SMART Loop with major regional commuter, transit and freight corridors, international airport, intermodal centers, warehouse and distribution centers, populated areas, seaport and research campus (the campus provides ideal conditions for controlled

testing environment prior technology deployment), facilitating future extensions.

Integration of Different Facility Types and Operations

The use and integration of different facilities forming the SMART Loop (tolled expressway and arterial roads) and the minor loop in the FIU campus will allow to test, deploy, evaluate and compare the functionality and safety performance of a wider range of AV and CV technology applications and combinations for multiple users and scenarios. For example, the use of AV applications for cars, transit and freight could be evaluated first in a closed loop at FIU, if needed, then on the minor loop at FIU, then on expressways, intersections and ramps. Similarly, the arterial roads will provide opportunities to evaluate V2I applications for a broader range of customers, including pedestrians and bicycles, and transportation operations.

Integration of Existing and Planned Investments

The SMART Loop project will build on the individual efforts, assets, expertise and capabilities of its partner agencies, general consultants, faculty/researchers and technology companies. We will leverage existing infrastructure, current business practices and planned investments to further test and advance AV technology and secure the CV ecosystem that will support a transportation network of shared, connected and automated vehicles; while maximizing the benefits that these emerging technologies can offer. The SMART Loop will support additional multi-disciplinary research at FIU by FIU researchers possibly in collaboration with researchers from other Florida universities. FIU researchers have already built strategic relationships with the public agencies in the region and with their ITS consultants and vendors working on multiple CV/AV and other ITS projects. This will also lead to a multidisciplinary education and training program at FIU to provide the industry with much needed workforce in CV and AV technologies. It is expected that the education program will be taught by faculty from different departments of the College of Engineering and Computing.

LEADERSHIP AND MANAGEMENT CAPABILITIES

The unique qualifications, management capacity and leadership capabilities of each of the team organizations are summarized below. The collaboration of different agencies will allow for broader use of applications, establish a transfer of knowledge and practices.

DTPW, the recently merged department, is the Florida's largest transit system and the 15th largest in the nation, with a service area of 360-sq.mi (Miami-Dade and parts of Broward and Monroe Counties) and over 350,000 passengers per day. It is composed of 34 individual municipalities with an urbanized population of approximately 2.7 million. A trend persists in some areas throughout the county to incorporate, which leaves a large portion of the county populated by disadvantaged individuals in unincorporated areas that are dependent upon county services. DTPW is one of the largest departments in Miami-Dade County government and responsible for planning and managing all aspects of mobility, safety and reliability improvements of transportation system services in the County including transit, traffic operations and control, highway design, for-hire transportation (i.e., taxis, and rideshare) and transportation safety and security. This integrated view of the transportation system components as part of the overall region provides an important basis to DTPW activities and this proposal to the USDOT.

As the Community Transportation Coordinator (CTC) for Miami-Dade County, DTPW is responsible of creating programs, applying for the grants and coordinating transportation services for the disadvantaged, and is actively seeking for innovative solutions to expand the safety, accessibility and reliability created by emerging mobility services to members of our community with different accessibility needs. In addition, DTPW participates on numerous panels, committees, boards, fairs, and programs serving the community, including the disadvantaged groups, and provides transportation assistance for approximately 126 agencies in Miami-Dade County.

DTPW operates an integrated multimodal transit system comprise of four modes: Metrobus (98 routes, 820 buses and over 28.8 million miles of revenue per year), Metrorail (25-mile heavy rail system), Metromover (4.4-mile automated people-mover), and 24- hours of paratransit service. All bus feet is equipped with Computer Aided Dispatch/Automatic Vehicle Location (CAD/AVL) and Automatic Passenger Counters (APC) to monitor ridership activity at the system, route, and stop levels and provide real-time Estimated Time of Arrival (ETA). In addition, DTPW has successfully deployed a Transit Signal Priority (TSP) for buses.

As one of the two agencies responsible for planning, designing, operating, and maintaining all street network within Miami-Dade County, DTPW manages the County's traffic signal system. The entire roadway network is controlled via approximately 3,000 traffic signal controllers that are constantly monitored and coordinated by DTPW's ATMS operated from the DTPW's state-of-art Traffic Management Center. As part of the programmed technology upgrades, DTPW partnered with FDOT to deploy and evaluate Adaptive Signal Control Technology (ASCT) along the 12 most congested corridors in Miami-Dade County as a pilot project–technology deployment started in fall 2016. The pilot program will contribute to expand and supplement existing technologies and services, and implement operating strategies for optimum functionality and coordination of the County's traffic signal system.

FDOT-District 6. FDOT is the agency that owns, manages and maintains all state roads, interstate system and SunGuide

Communication System (an incident management system deployed through all freeways and major state highways to observe and communicate with the public through DMS. FDOT has organized a strong Transportation System Management and Operations (TSM&O) and ATMS programs for Miami-Dade County that are among the most advanced programs in US.

Florida was the second state to adopt legislation allowing for research, development, and testing of AV technology on public roadways. As a result, FDOT created the Florida Automated Vehicle (FAV) Initiative[1] and formed Stakeholders Working Groups to address opportunities and challenges associated with implementing AV technology. Through the FAV Initiative, FDOT is deploying pilot projects to establish Florida as a leader in the AV technology movement. As an example, FDOT partnered with DTPW and FIU to install and test Mobileye Shield + technology on ten Metrobuses as a pilot project. The AV technology will be installed on a high demand Metrobus route serving a high crash corridor to test Forward Collision Warning (FCW), Pedestrian and Cyclist Collision Warning and Zone Detection, Headway Monitoring Warning (HMW), and Lane Departure Warning (Mobileye LDW) applications.

MDX, led by a strong active traffic management policy approved by the board (MDX ATM Policy is attached), has a proven reputation for being a progressive organization in the deployment of technology. The successful conversion to Open Road Tolling (ORT) is a great example. MDX has deployed a comprehensive suite of ATMS capabilities, including traffic sensors, CCTV cameras, DMS for traveler information, and ATMS software. The complete suite of traffic management systems is linked to the FDOT-District 6 Transportation Management Center, where MDX works in collaboration with FDOT to manage traffic flow and incidents. The backbone of this system is a redundant fiber optic communications network that covers the entire MDX system. MDX has also partnered with DTPW to provide transit operations on the shoulders of select expressways in Miami as part of their ATM program. This partnership has been formalized through an intergovernmental agreement reached in 2010.

Furthermore, to facilitate the testing and to advance the deployment of CV technologies, the MDX Board of Directors approved a resolution designating portion of SR-836 (the most traveled east-west corridor in Miami-Dade County) as SMART 836. In support of the SMART 836 resolution, MDX has identified the implementation of the CV technology initiatives for 2017.

MPO is the lead agency for the transportation planning process in Miami-Dade County. The MPO's role is to ensure conformance with federal regulations requiring that highways, mass transit and other transportation facilities and services are properly developed and deployed in relation to the overall plan of urban development and to approve plans for regional and state transportation network accessibility. In addition, federal guidelines require that the use of Federal Aid for transportation be consistent with MPO endorsed plans and programs. Federal, state and local transportation planning funds are utilized on an ongoing basis to insure the effectiveness of the MPO process. FDOT adopts the MPO's Long Range Transportation Plan (LRTP) as the plan for implementing transportation system improvements in Miami-Dade County. In 2016, the MPO approved the Strategic Miami Area Rapid Transit (SMART) Plan to advance six rapid transit corridors and Bus Express Rapid Transit (BERT) services within Miami-Dade.

The MPO is instrumental in the incorporation of CAV technology into the County's transportation planning. For example, the MPO formed the CAV Task Force[2] and Working Group to enhance collaboration and facilitate CAV project development and deployment within Miami-Dade County. This local collaborative provides a workspace for transportation agencies, academics, entrepreneurs and industry experts to facilitate the dialogue, flow of information, exchange of ideas, and development of solutions related to the safe implementation of CAV initiatives. The development of the SMART Loop concept and this proposal to the USDOT's AV Proving Ground Pilot Program are great examples of the CAV Task Force's Working Group efforts.

In support to the ongoing efforts to advance the safe implementation of CAV initiatives in Miami-Dade, the MPO Governing Board has adopted a resolution supporting the DTPW's application, for Miami-Dade County, to be designated as one of USDOT AV Proving Ground Pilots. Copy of the resolution is provided as attachment.

FIU, the largest research institution in South Florida Region. FIU research team has been involved in ITS research projects including CV and AV research at the national, state, and regional level and have had a close relationship with the other SMART Loop agencies. The Departments of Civil and Environmental Engineering, Electrical Engineering, Mechanical Engineering, and Information Technology and Computer Sciences will be involved in this effort. The FIU team has developed a web-based data analytic tool (ITSDCAP) that captures and aggregates data from multiple sources and can be used

[1] FDOT Florida Automated Vehicle (FAV) initiative (http://www.automatedfl.com/our-efforts/overview/)

[2] MPO Connected-Autonomous Vehicle (CAV) Program, CAV Task Force (http://miamidadempo.org/connected-autonomous-vehicle-program.asp)

for multiple research applications. ITSDCAP will be used to support the evaluation of the AV and CV technologies. Developed and managed by FIU, ITSDCAP is an off-line and real-time web-based tool that is among the most advanced ITS data analytics tools in the nation. This tool is currently used by FDOT-District 4 and is being adopted by DTPW's Traffic Management Center.

Private Sector Providers, as currently participants of the CAV Task Force, will be involved in the development of the SMART Loop. As the SMART Loop project is developed further, additional project partners and stakeholders will be identified and added to the development team, including relevant government agencies, institutional investors, infrastructure developers, technology companies, service providers, and traveling public and safety advocates.

CONTRIBUTIONS TO COMMUNITY OF PRACTICE

COMMITMENT TO OPEN SOURCE DATA, PUBLIC/ PRIVATE ENTREPRENEURSHIP AND INNOVATION

BUSINESS MODEL

An important principle applied to the SMART Loop is to build a sustainable business model that can be applied to other parts of the country. The proposed effort will focus on testing and deploying new proven and safety system technologies that leverage existing and planned investments, while encouraging public-private partnership, research innovation, and entrepreneurship. We will leverage existing regional assets, current projects and plans, and private sector resources to optimize the investment required, but also to meet the unique safety, mobility and environmental needs of metropolitan Miami-Dade County. We will invite vendors, manufacturers, and start-up companies to meeting and workshops in Miami-Dade County and engage them in potential involvement in the testing and deployment of technology in the County. Several private sector technology vendors have already been engaged in the regional CV/AV discussion as part of the Miami-Dade County CAV Task Force.

STAKEHOLDER AND PARTNER ENGAGEMENT

To maximize stakeholder interest and involvement, DTPW partnered with MPO, FDOT, MDX and FIU as many of these stakeholders have been active participants in the development of the SMART Loop concept. Additional stakeholders will be identified early in the project and actively engaged in the concept development phase. Such stakeholders will include: MIC operations, MIA, PortMiami, rental car agencies, parking suppliers, commercial vehicle operators, municipalities (e.g., Cities of Doral and Miami), enforcement community, neighborhood groups, etc. In addition to these stakeholders, team member organizations will be identified as part of the stakeholder register. The register will be maintained by the Project Management Lead (PML) and will be updated as the concept is refined to include potential new stakeholders with an interest in the project.

Formalization of partnerships will be executed through intergovernmental Memorandums of Understanding (MOUs) where appropriate.

This effort will employ a series of workshops to elicit stakeholder needs, to map those needs to requirements, and to define solutions that meet the needs of the stakeholder community. We have learned during many projects that face-to-face stakeholder interaction strengthens relationships among stakeholders. Workshops will be scheduled to correspond to decision points in the concept development phase where stakeholder feedback will be most important.

ABILITY TO GENERATE BROADLY APPLICABLE RESULTS

The key to success on advanced technology programs, such as this, is having a detailed Program Deployment Plan and Approach and skilled program leadership. The project team will collaborate and join efforts with other project members and technology companies to fund, manage and implement a Program Deployment Plan consisting of *(1)* Program Management Plan to ensure the program stays on tracks and follows a systematic approach; *(2)* Risk Management Plan to register and address potential risks; *(3)* Security Management Operating Plan to approach physical security at the vehicle, roadside infrastructure, and back-office level; *(4)* Safety Management Plan to ensure safety considerations are met; *(5)* Performance Measurement and Evaluation Plan to evaluate and track project performance; Training and Stakeholder Education Plan; and *(6)* Outreach Plan.

USDOT System Engineering Process Approach

Any testing or pilot conducted as part of the SMART Loop project will be carried out based on the USDOT system engineering process. As part of this process; the needs that the technology is supposed to address, the various issues associated with the implementation, and the expected impacts of the implementation will be identified. This will ensure that all testing, deployment, and evaluation efforts are designed and implemented to produce results that are directly applicable to national and regional needs. When testing and deploying technologies, the team will perform the following phases:

Research/Synthesis Phase consists of the collection and analysis of information related to existing conditions, needs, and technologies that can be addressed by the product. The project team will also review past and ongoing studies on systems similar to the ones evaluated as part of the SMART Loop.

Project Development Phase consists of developing the Concept of Operation (ConOp) and requirements, evaluation plan, system design and installation, driver education/training, and testing. The ConOp and system requirements will be

developed based on the situation analysis from the previous phase. The ConOp will include the identification of goals, objectives, performance measures, associated policies, stakeholders and users, use cases, support environment, and operational scenarios. The evaluation plan will be developed following USDOT Guidelines, recent evaluation requirements of the three pilot CV sites, and all other related guidelines and reports. It will involve the development of the experimental design and statistical analysis that addresses various threats to the validity of the evaluation including the impacts of exogenous factors; formulation of hypotheses regarding expected outcomes; and development of testing plan to assess the formulated hypotheses. The final selection of technologies and products and system design will be based on the ConOp and system requirements. The technology and equipment will be installed in coordination with technology vendors. The project team in conjunction with the vendors will train the project and facility staff on how to use the different technology system. Facility staff or participants will include agency personnel, system operators and maintainers, drivers of vehicles involved in the pilot, and others determined to be impacted by the project. Based on training needs at each level, a training and education plan will be developed.

Full-Scale Demonstration Phase consists of operating and evaluating the system, conducting staff survey and focus groups, and performing public outreach and technology transfer activities. The technology will be continuously monitored for malfunctions and failures. The project team and the vendors will conduct weekly data review conference calls on the status, performance and issues with the system.

COMMITMENT TO DATA & INFORMATION SHARING

The SMART Loop partners are committed to share the developed safety management plans and access to testing data, and evaluation results in according with USDOT guidance and methods. Recognizing the importance of national, statewide, and regional public-private partnerships in successfully navigating the sea of changes that are already well underway. The SMART Loop partnership is fully committed to employing and promoting open source data protocols wherever possible and encouraging private entrepreneurship and innovation.

In order to assure the project data, outcomes, products and applications from the SMART Loop can be replicable in other across the nation, this project will document the data, processes employed, benefits, costs and constrains as well as the lessons learned. A data sharing plan will be documented as part of a performance measurement plan. The generated data (performance and evaluation data) and new applications developed will be shared with the Community of Practice, USDOT and posted at the specified frequency of reporting as needed by the USDOT on resources such as the Research Data Exchange (RDE) (https://www.its-rde.net/), which is the USDOT transportation data sharing system (if so directed by the USDOT), and will be shared for possible inclusion in the USDOT Knowledge Resources databases (http://www.itskrs.its.dot.gov/). The project team will meet all policy and governance requirements of the RDE. The research team will deliver multiple (frequent) one-hour webinars for progress updates.

COMMITMENT TO WORK WITH USDOT'S RESEARCH PROGRAMS

As mentioned above, a data sharing plan will be documented and the performance and evaluation data will be shared with the USDOT and posted at the specified frequency of reporting as needed by the USDOT on resources such as the RDE. In addition, the project research team is committed to participate in national and international conferences, meetings, workshops, collaborative, webinars among other research activities and transfer of knowledge related activities. The SMART Loop team has been very active in TRB, AASTHO, ITS America, and ITE meetings and committees. Workshops, trainings and courses will be incorporated into the project's Participant Training and Stakeholder Education Plan, as well as part of the FIU's engineering program. As described earlier, the SMART Loop activities are expected to result in developing multi-disciplinary undergraduate and particularly graduate level courses at FIU and continuous education training courses.

COMMITMENT TO SAFETY

A key component in the concept of operations for the SMART Loop deployment plan is how to deal with *safety* and *security* issues, including the safety of the proving ground personnel, facility users (e.g., staff from DTPW, MDX, FDOT and FIU researchers) among others. These topics will be addressed in the safety and security management plans for the project. The partner agencies will be bringing to it their extensive experience with safety considerations on roadway and transit projects, but also in the connected vehicle environment.

CAPABILITY TO CONTROL SAFETY RISKS AND SAFETY CONSIDERATIONS

SAFETY MANAGEMENT PLAN

The Safety Management Plan will include a set of safety scenarios for the applications and technologies of the pilot deployments. These safety scenarios include an evaluation of potential impacts and the mitigating benefits of fail-safe or other appropriate actions for the applications offered in this pilot program. A set of safety needs will be derived from this scenario-based analysis. The Safety Management Plan will identify levels of safety risk associated with the pilot deployments, by adopting or adapting standard automotive safety practices for production, such as ISO 26262 and Automotive

Safety Integrity Level (ASIL) hazard analysis and risk assessment, and also by adhering to equipment installation safety standards as prescribed by OSHA, DTPW, FDOT, and MDX.

The Risk Management Plan will address: risk identification; risk avoidance though proactive monitoring and management; strategies to assess and eliminate risk; assignment of responsibility for addressing; and monitoring risks and mitigation actions on a continuous basis.

The Security Management Operational Concept will include clear direction for data, network and physical security at the vehicle, roadside infrastructure and back-office levels.

The development and application of the Safety Management Plan will be in according with the USDOT and state policy and guidance and based on extensive examination of the technologies, standards, policies, guidance, tools, pilot projects, and results of research from around the nation and the world. The SMART Loop will require that manufacturers and other entities provide reports regarding how relevant guidance, standards, and policies have been followed. The NHTSA federal automated vehicle policy and associated guidance and tools will be used as one of the important bases. The USDOT V2V and V2I Guidance will also be followed. The Safety and Security Plan will have to be updated to accommodate the expected updates to USDOT policies, additional regulatory tools and new expertise and research and testing results from the proven grounds and pilots around the nation. In according with the Guidance, a manufacturer will be asked to provide certification to all applicable standards or, if applicable, an interpretation or exemption from the NHTSA policy.

The developed plans will ensure that the manufacturer should address the data recording and sharing capabilities; functional safety and cybersecurity best practices; HMI design best practices; crashworthiness/occupant protection; and consumer education and training. The manufacturer will be asked to clearly define the ODD and the corresponding Society of Automotive Engineers (SAE) level of the system. The ODD will define for each tested function the conditions that it is intended to operate in including roadway types, geographic area, speed range, lighting conditions, weather conditions, and other conditions that impact operations. Based on the defined ODD, the required OEDR capabilities of the AV will be examined to ensure safely operation in the identified conditions. The OEDR requirements will have to address normal driving scenarios, expected hazards such as other vehicles and pedestrians, and unexpected events such work zones.

The project team will work with device manufacturers to incorporate the safety requirements into the installation and operation of the devices. The project team will work with Roadside Equipment (RSE) device suppliers to understand installation requirements and incorporate them into the installation designs. Our specifications will address contractor safety, safety procedures for engineering staff conducting field analyses, and procedures to protect the traveling public, proving ground personnel and work crews in the work zones (e.g., hanging devices, installing cabinets, etc.). We will comply with DTPW, FDOT and MDX standards for work zone safety and we will enforce safety standards for subcontractors.

The project team will perform an ASIL style of analysis or develop appropriate measures using system engineering and project management principles. From the risk assessment and prioritization of risk register items, a list will be presented to stakeholders so that they may prepare responses to anticipated failures. These stakeholder responses will be accumulated into the Safety Management Plan, which will include: *(1)* Findings of ASIL decomposition and its management plans and procedures; *(2)* Fail-safe and fault tolerant approaches to pilot deployments and *(3)* Stakeholder responses to risk register scenarios. The final report will be incorporated into the Project Management Plan.

SECURITY MANAGEMENT PLAN

A key component in the concept of operations for the SMART Loop deployment plan is a comprehensive approach for privacy and security issues. The project team understands the critical nature of maintaining privacy for any individuals participating in the system. This is an important principle for a toll and transit agencies like MDX, FDOT and DTPW is taken very seriously by the project leadership team and will be addressed in the developed plans and concepts of operation.

Even if no personally identifiable information (PII) is collected, users must be able to trust that no tracking or identifying individuals will be conducted through data manipulation or analysis. The current security credential management system design (SCMS) includes protections against traceability, and the implementation of various internal physical, technical, and organizational controls will provide for additional protections. Each of the partner organizations will play an important role in the collection, analysis, archiving and dissemination of data on this project. This is common practice for DTPW, FDOT, MDX and FIU. Consequently, strict security policies and practices are already in place.

The methodology for deploying and testing pilots on the SMART Loop will include analyzing threats, assumptions, policies, and objectives, and developing security functional requirements to mitigate threats and ensure confidentiality, availability, integrity, authenticity, and non-repudiation of transmitted data. This represents standard practices for DTPW and partner agencies. A similar exercise was recently completed at FIU for their network and server security systems and policies. Existing analyses and update use cases,

measures, and requirements will be leveraged with an overall system implementation and application deployment viewpoint, to develop and execute an effective security management operational strategy.

By leveraging DTPW and partner organizations' expertise and resources (including industry experts), our team will determine which requirements can be fulfilled based on the prototype SCMS and align these requirements to each SCMS functional component.

The Security Management Operational Concept will include clear direction on how to approach physical security at the vehicle, roadside infrastructure, and back-office level. Several current hardware security standards exist for ensuring against tampering of physical devices. In addition, maintaining strong internal organizational controls, whether at the technical, legal, administrative, or personnel levels have already been developed and will be included in this concept in order to provide a robust a security environment as possible. Tools to monitor, measure, and track security elements at all levels will also be specified in the Security Management Operational Plan.

RESEARCH, APPLICATION AND DATA SHARING

BROADLY APPLICABLE RESEARCH SOLUTIONS

Our vision for this grant is to create a replicable and scalable solution with results and developed applications applicable to other regions. To deliver this vision, this project will address challenges that are common across the nation and will comply with all existing guidelines, architectures, and standards. A project focus is to advance, apply and expand the use of new technologies and business models to connect transportation systems and technology vendors for varied transportation applications. The proposed effort will focus on technologies that can be easily leveraged with either existing or planned investments by transportation agencies from around the nation to improve system performance

New findings and data resulting from this project will be documented, archived, and explained for possible use by other agencies. The project implementation will use to the maximum degree possible the national guidance, tools, and standards increasing its broad applicability

As previously mentioned, to make sure outcomes, products and applications from the Miami-Dade model can be replicable and used by other agencies and organizations across the nation, this project will document the lessons learned as well as the benefits, costs, risks, and constraints. The findings from the project, including the CV and AV comparison on safety performance and cost effectiveness will be shared for possible inclusion in the USDOT knowledge resources databases (http://www.itskrs.its.dot.gov/). Also, generated data and any new applications developed using the project funds will be shared through RDE.

PROJECT LOCATION, CONNECTIVITY & SCALABILITY

Miami-Dade offers extensive unique attractions of worldwide fame and importance in tourism, leisure, freight and transportation market. The location of the SMART Loop is ideal because of the connectivity with MIA, MIC, Downtown Miami, FIU campuses, Port of Miami and regional corridors, meeting the conditions to provide a quantum leap in future connectivity and modal reach for the entire transportation system moving goods and people within Miami-Dade County and South Florida Region. At the same time, the location and connectivity with regional transportation systems makes the SMART Loop a scalable project, providing opportunities for future extensions and expansion. Many of the safety, mobility, environment, and parking issues to be addressed by the SMART Loop testing and deployment are faced by other locations in the nation.

RESEARCH RESOURCES AND CAPABILITIES

Florida International University is the largest research institution in South Florida. The researchers of various department and colleges of the university will collaborate on conducting multi-disciplinary research that advance the state-of-the-art in CV and AV technology and implementation. The FIU researchers will work closely with the USDOT, public agencies in Florida, their consultants, and other universities in Florida and elsewhere on research projects that meet the needs identified in the SMART Loop effort. A research advisory subcommittee will be formed of public, private, and academic participants to identify problem statements, identify potential funding sources, monitor research progress, and ensure the successful implementation of research results.

STATEWIDE EDUCATION PROGRAM

The SMART Loop activities will allow different FIU departments will collaborate on developing materials for graduate and undergraduate courses, continuous education courses, and possibly community college courses (in collaboration with Miami-Dade Community College). The developed course materials will be made available to other universities for potential use.

COMMITMENT TO OPEN DATA, AND SHARING PERFORMANCE METRICS AND RESULTS OF OBJECTIVE TESTS

Data collection and performance assessment are critical aspects of the proposed project. As stated earlier, performance metrics that are measurable and quantifiable will be identified in the evaluation plan to ensure the success of the project. A

data collection plan will be developed to ensure that the identified performance measures can be assessed. In addition, the project team will work with the independent national evaluator, if assigned by the USDOT, to identify and collect the required data for the evaluation.

The SMART Loop will have a documented process for testing, validation, and collection of event, incident, and crash data, in addition to positive outcomes (e.g., incident prevention due to technology). The occurrence of malfunctions, degradations, or failures will be recorded to allow the identification of the cause of such issues. Data recording will be at enough level of detail to allow event reconstruction. Processes will be developed for recording and sharing testing and evaluation results and raw data if applicable, with privacy and security consideration.

An outreach plan will be developed in coordination with the USDOT to ensure that the project findings are communicated to agencies in the State of Florida and around the nation using webinars, conference presentations, journal applications and other methods as needed.

DATA COLLECTION PRACTICES AND APPROACH

The project will collect data from both CV and AV technology implementations including information about vehicle position, speed, acceleration/deceleration, braking, steering (turning action), alarms from the warning system, and other information needed. This data will be fused with data obtained from multiple other sources including: transit data (e.g., schedule, AVL, safety, and operations data), traffic management system data warehouse, crash databases, weather data, incident data, and system planning data.

A web-based data analytic tool referred to as ITS data capture and performance measurements (ITSDCAP) produced by FIU will be used to collect, fuse, archive, analyze, and visualize the data and estimate the measures.

The team will also install video recording equipment, if needed, on a subset of the equipped buses, intersection, and bus stops to allow a better assessment of the nature of the alerts. Camera images will be recorded at the time of each warning using digital video recording (DVR) and will be fused with the data to determine the nature of the alarm events and the rate of the false alarms.

COMMITMENT TO DATA AND INFORMATION SHARING

As part of the performance plan, a data sharing plan with test generated data (performance and evaluation data) and new developed applications will be documented and shared, at the specified frequency of reporting as needed by the USDOT, with the Community of Practice, USDOT and research community through webinars, workshops, conferences, USDOT transportation data sharing system and knowledge resources databases, among others. An outreach plan will be developed in coordination with the USDOT to ensure that the project findings are widely accessible.

DEMONSTRATED INVESTMENTS

DEMONSTRATED INVESTMENTS IN AND COMMITMENT TO AUTOMATED VEHICLE TESTING.

CAPITAL IMPROVEMENTS TO THE PROVING GROUNDS TO ADVANCE AUTOMATED VEHICLES

Ongoing AV and CV Technology Initiatives

Since the 1990s, FDOT, MDX, and DTPW have implemented advanced traffic management systems that are the most advanced in the nation including incident management, ramp metering, dynamic pricing managed lanes, traveler information systems, diversion strategies, advanced signal retiming strategies, adaptive signal control, and transit signal priority.

Adaptive Signal Control Technology Deployment

As part of the programmed technology upgrade to County's traffic signal system, DTPW, in partnership with FDOT, has begun upgrading the entire traffic signal system from the model170 controller to the new model2070LX controller to enable the traffic signal infrastructure to be integrated with connected vehicles. As part of the initial deployment phase, DTPW selected 12 arterial corridors as pilot projects where advanced traffic management strategies will be deployed and evaluated. The new model2070LX controllers and ATMS with adaptive control capabilities will be installed on these corridors (300 traffic signals) that will allow the deployment of CV technologies including Multi-Modal Intelligent Traffic Safety System (MMITS), Signal Phase and Timing (SPaT) messages, and queue warning technologies. FDOT has begun a study to evaluate how Freight Signal Priority (FSP) using CV technologies can support freight mobility in the area surrounding MIA. The SMART Loop includes the SW 8th Street and LeJuene Road which are two of the pilot corridors, providing a significant opportunity to implement and evaluate the safety performance of intersection-based CV applications.

ATMS, ICM and CV Technology Deployment on Freeways

MDX has deployed a comprehensive suite of Advanced Traffic Management Systems (ATMS) capabilities (with traffic sensors, closed CCTV cameras, DMS and ATMS software). MDX's traffic management systems are linked to the FDOT District 6 Transportation Management Center, allowing both agencies to work together in the management of traffic flow and incidents. The backbone of this system is a redundant fiber optic communications network that covers the entire MDX system and provides redundant, and, in some cases, primary links to

other partners such as FDOT, FTE, and the Port of Miami Tunnel. MDX has allocated funding to start, in 2017, the installation of V2I equipment on SMART 836.

A multimodal travel and integrated corridor management (ICM) initiative is being implemented in the region that will involve integrating the transportation operations on SMART 836 with DTPW traffic signals on parallel and crossing arterial roads, including SW 8th Street and LeJuene Road. Components of the ICM include the establishment of traffic signal timing response plans to be activated by SunGuide software when events occur on SMART 836, advance messaging and alerts, including queue warnings to, video sharing among agencies, and additional detection capabilities along the corridor to monitor traffic conditions on SMART 836 and approved alternate routes. The region has also developed a performance dashboard that can be used to monitor the performance on its corridors and can be produced by the web-based ITSDCAP, mentioned earlier.

Advanced Transit Management System and AV Technology

DTPW has implemented one of the most advanced transit management systems in the region including AVL, APC, security system, DMS, etc. DTPW, in partnership with FDOT and FDOT, is currently installing Mobileye crash avoidance devices on 10 Metrobuses in a pilot program to test the safety performance and effectiveness of these AV technologies.

In addition DTPW and FIU have been discussing plans for a potential pilot project to operate autonomous vehicle shuttle that operate at low speed in Downtown Miami and FIU (main) campus.

AUTHORIZATION FOR THE PROVING GROUNDS TO ADDRESS REGULATORY CHALLENGES ASSOCIATED WITH HIGHER LEVELS OF AUTOMATION

FLORIDA LEGISLATION

Florida was the second state to adopt legislation allowing for research, development, and testing of AV technology on public roadways. Therefore, in addition to national guidance and standards, the Smart Loop will fully comply with the State AV Legislation issued in 2012. This legislation permits operation of AV on public roads by individuals with a valid driver license. This legislation eliminates the requirement that the vehicle operation is being done for testing purposes and removes a number of provisions related to vehicle operation for testing purposes. It also requires autonomous vehicles to meet applicable federal safety standards and regulations, which is a main principle of the SMART Loop initiative.

LOCAL AUTHORIZATION AND SUPPORT

In addition to the State Legislation, the MDX Board of Directors approved on December 6th 2016 a resolution designating portion of SR-836 as a providing ground for AV and CV technologies. Examples of local support for the testing and deployment of AV and CV technology includes the resolution approved by the MPO Governing Board on December 8th, 2016, supporting this application, for Miami-Dade County to be designated as one of USDOT AV Proving Ground Pilots.

TESTING OR DEPLOYMENT UNDERWAY TO DETERMINE AUTOMATED VEHICLE TECHNOLOGY FEASIBILITY

The following projects are on-going, programmed, or planned.

DTPW AND FDOT AV AND CV TECHNOLOGY INITIATIVES

Adaptive Signal Control Technology Deployment

DTPW's Advanced Traffic Management System Project, Phase 3, consists of upgrading the County's signal controllers to V2I capable 2070LX controllers. The fully funded technology deployment on 12 pilot corridors commenced in fall 2016. The funding allocation is included in the FY2016-17 DTPW's Proposed Budget and Multi-Year Capital Plan adopted on October 1st, 2016 (http://www.miamidade.gov/budget/FY2016-17/proposed/library/transportation-and-public-works.pdf)

Mobileye Collision Avoidance Technology Deployment

The installation of Mobileye crash avoidance devices on DTPW's buses is programmed to start early in 2017. This project is fully funded by FDOT and I'll be carry out via partnership between DTPW and FDOT and FIU.

On-Demand Autonomous Shuttle Deployment

DTPW and FIU have been discussing plans for a potential pilot project to test and deploy an on-demand autonomous vehicle shuttle that operate at low speed in Downtown Miami and FIU campus.

CV-Based Technology Application for Freight Operations

Installation of CV-based technologies on NW 119th Avenue for freight applications.

MDX'S CV TECHNOLOGY INITIATIVES

MDX has identified the implementation of the following CV technology initiatives on SMART 836 for Fiscal Year 2017.

SMART 836 CV Technology Deployment

Installation of DSRC-based roadside equipment (RSE) and on-board equipment (OBE) units on SMART 836 to exchange safety and travel related information in a safe environment.

V2I Mobility Applications Deployment

Implementation of V2I-based mobility applications to enhance the FDOT's SunGuide Traffic Management Center

(TMS) software. Several years ago FDOT implemented a Connected Vehicle module as part of a demonstration project during the Annual ITS America Event. .MDX plans to review this module and update it as needed with new features and technological capabilities.

DSRC-Based Application for Pavement Surface Analysis

Development of a pavement surface analysis application using DSRC as the communication infrastructure. This initiative will consist of an application to evaluate the conditions of the roadway and reporting in real time using DSRC communication back to MDX's Fiber Optic backbone.

Bluetooth and Wi-Fi Readers Technology Deployment

Deployment of Bluetooth and Wi-Fi readers technology to improve data collection capabilities. With the deployment of Bluetooth and Wi-Fi readers it is expected to improve data collection capabilities, travel time, as well as, origin and destination information accuracy and reliability for distribution and dissemination to the public

READINESS

READINESS FOR TESTING BY JANUARY 1, 2018

As stated in the previous section of this application, SMART 836 will be soon fully covered with CV DSRC-based RSE. This deployment will be supported by an enhanced SunGuide Traffic Management Center software to collect and archive the data. The parallel arterials will be equipped with state-of-the-art controllers that will allow CV and V2I technology applications. FIU labs and campus signals will be provided by the same technologies to allow testing prior deployment. In addition, data analytic tools have been developed and used to analyze the data from multiple sources.

THE FACILITY SUPPORTS TESTING BY MULTIPLE USERS, OR THE DATA GENERATED BY THE PROVING GROUND IS SHARED OPENLY TO THE PUBLIC

The SMART Loop management team will develop a detailed plan on processes to allow multiple users to test their equipment on the SMART Loop, as long as they meet the documented requirements, specification, standards, and policies of the SMART Loop initiative, which as stated earlier also ensure compliance with the national and state ones. In addition, the unique combination of facility types and operations (including FIU campus area) provides opportunities for testing a wide range of AV and CV technology applications.

DESIGNATED POINT OF CONTACT

The designated point of contact for the SMART Loop:

Mr. Carlos Cruz-Casas, P.E.
DTPW |Assistant Director
Address| 701 NW 1st Court, Suite 1700 Miami FL 33136
Phone| (786)442-5248
Email| cruzc@miamidade.gov

PUBLIC ENGAGEMENT AND OUTREACH

An outreach and communication plan will be developed to work with the communities to communicate information and address any concerns. Community groups and advocates will be included in the stakeholder groups mentioned earlier. It should be mentioned that the ITS public agencies in South Florida have long experience in such activities and have hired consultants that have focused on these activities. This effort has been instrumental in successful implementation and operations of strategies such as ramp metering and managed lanes, which were expected to be faced with concerns from communities in the region but the outreach and public relation activities in the three main languages in the region proved to be very effective in relieving these concerns.

TRANSPORTATION OUTREACH PLANNER TOOL

The project team plans to employ the MPO's Transportation Outreach Planner tool developed by FIU's Geographic Information Systems and Remote Sensing Center (FIU-GISRSC) in 2003. This is a web-based tool primarily utilized by Public Involvement Managers/Officers and Planners in the transportation field (both public and private), to develop an effective public involvement (PI) program and accomplish the Title VI goal of properly identifying attitudes and issues facing a particular community. The tool utilizes 'Sociocultural Effect' principles (evaluating the effects of a transportation action on communities and their quality of life) to evaluate and incorporate community considerations into the planning and development of transportation plans, programs, and projects.

The tool, used by Miami-Dade, Broward and Palm Beach MPOs, is composed of three (3) segments: (1) Customized Demographic Reports, an interactive GIS mapping tool that contains demographic data that produces a comprehensive public involvement plan report for the end user. (2) Public Outreach Strategies containing a multitude of public involvement tools (PIT), which have been collected, researched, and presented in a standardized format listing definitions, descriptions, target demographic group(s), steps needed to implement the strategy, and case studies associated with each strategy, whenever possible. (3) Community Background Reports (CBR) provided at the municipality and neighborhood level.

ANTICIPATED CHALLENGES AND OPPORTUNITIES

The only anticipated challenge is maintaining the tool (technology application) for its primary intention; to serve as a function in assisting end users to develop effective public involvement plans for transportation projects. When individuals are first introduced to the tool, they are fascinated at how easy and useful it is. While this is a positive response, sometimes there are requests to add features that do not support the intended use. It is at these times that we must clarify the end use, and stand firm on that decision. Ultimately, this is a project funded by USDOT to serve its primary function, not to veer off course to serve other interests.

ADHERENCE TO LAWS, REGULATIONS, AND FEDERAL POLICY

HOW SMART LOOP WILL ADHERE TO ALL LOCAL AND STATE REGULATIONS

As mentioned earlier, the SMART Loop will adhere to all applicable local, state, and federal laws and regulations. The SMART Loop will require that manufacturers and other involve entities provide reports regarding how they meet relevant laws and regulations. As needed, these will be tested using simulation and/or operation on closed track before implementing on SMART Loop freeways and urban arterials.

As higher level of automation are tested, we will ensure that these vehicles meet local regulations such as speed limits, traffic control devices, one-way streets, access restrictions, permissive left-turn, U-turns, right turn-on-red., metering ramps, and other traffic circumstances and situations.

CAPABILITY TO ADHERE PRIMARY SUBJECT AREAS OUTLINED IN THE NHTSA POLICY FOR AUTOMATED VEHICLES (FEDERAL AUTOMATED VEHICLES POLICY: ACCELERATING THE NEXT REVOLUTION IN ROADWAY SAFETY) FOR ANY TESTING OR DEPLOYMENT OF L3-L5 SYSTEMS ON PUBLIC ROADS

As described earlier, all NHTSA policy and guidance will be adhere to. This include cross cutting issues applied to all automation levels such as data recording and sharing capabilities; cybersecurity; HMI design, crashworthiness/occupant protection, and consumer education and training, in addition to level-specific ODD and OEDR for normal conditions, expected events, and unexpected events discussed in the Safety Commitment section of this proposal. It should be mentioned that many of the areas listed above are also applicable to the lower levels of automation (Level 2 or below) and will be required when testing these levels also.