Cover Page

Project Name	**Pinellas County Integrated Multi-Modal Mobility Management**
Eligible Entity Applying to Receive Federal Funding	Pinellas County Department of Public Works
Total Project Cost (from all sources)	
ATCMTD Request	
Are matching funds restricted to a specific project component? If so, which one?	
State(s) in which the project is located	Florida
Is the project currently programmed in the: ▪ **Transportation Improvement Program (TIP)** ▪ **Statewide Transportation Improvement Program (STIP)** ▪ **MPO Long Range Transportation Plan** ▪ **State Long Range Transportation Plan**	TIP = Yes STIP = Yes MPO LRTP = Yes State LRTP = Yes
Technologies Proposed to Be Deployed (briefly list)	1. Data Fusion Environment 2. Connected Vehicle Technologies a. Roadside Units b. SPaT c. Ped Safety 3. Demand Management and Incentivization 4. EcoTrafiX a. Information Exchange Network b. Performance Measures c. Decision Support Subsystem 5. Transit Signal Priority 6. Pedestrian Detection/ Safety 7. Mobility Management Applications a. MOD Sandbox b. SmartTracs Website c. Data Feed for developers

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1. PROJECT NARRATIVE

1.1. Introduction

The Pinellas County Department of Public Works submits this grant application to the U.S. Department of Transportation (USDOT) Federal Highway Administration (FHWA) under the Advanced Transportation and Congestion Management Technologies Deployment (ATCMTD) program. The application is being submitted by Pinellas County on behalf of the Region.

Pinellas County experiences severe traffic pattern fluctuations from Tampa towards Clearwater Beach and St. Petersburg, especially during Spring Break months, and during regular commuter traffic. Visitors to Clearwater Beach have reached record numbers and continue to grow each year, resulting in an increase in traffic congestion and crashes. The Memorial Causeway Bridge (SR 60) is the only roadway connection between Downtown Clearwater and Clearwater Beach, which creates a bottleneck during peak travel periods. During spring break and some holiday weekends (e.g., Memorial Day and Labor Day), traffic often builds to the point of gridlock on the Causeway causing significant travel delays. Buses also find themselves impacted by this congestion. Despite the increase in trails, there is a shortage of safe biking and walking facilities. As a result, the need to manage demand and provide additional transportation options has become paramount.

The Pinellas Regional Integrated Mobility Management (RIMM) Project will deploy technologies to assist the region with multi-modal and multi-agency strategies to improve mobility within the region.

- The project's foundation is a data fusion environment which will integrate both public and private regional data sources into a single data warehouse for use in managing the mobility of the County.
- Utilizing an Integrated Corridor Management (ICM) program, the County agencies will balance loads on the arterials to key destinations within the County using a Decision Support System which will use demand management analytics. This will also provide the potential for incentivization of drivers to take alternate routes, modes, and trip start times.
- The County will deploy connected vehicle technologies along the key corridors to improve safety for vehicles, pedestrians and intersections and to improve the efficiency of mobility services. This will include LIDAR based pedestrian detectors at key pedestrian crossings along the Clearwater Beach area.
- Pinellas Suncoast Transit Authority is a key partner in this project which is providing mobility on demand and fixed route transit for the County, they are also in process of finalizing plans for a Bus Rapid Transit route from Tampa International Airport and Clearwater Beach, this investment will allow the County to improve mobility in the region, and the ATCMTD project

will deploy technology to assist the operation through CV applications for Signal Phase and Timing (SPaT) and Transit Signal Priority (TSP).

To realize these objectives, the grant effort focuses on the following goals and initiatives:

1. *Enhance Data Collection, Fusion, Distribution and Archiving*
    a. Development of a Data Fusion Environment to collect and fuse Traffic Signal (Cities and County), Transit information (Pinellas Suncoast Transit Authority), Freeway (FDOT), and Arterial (City and County) information
2. *Improve Safety of Pedestrian and Intersections within the Region*
    a. Deploy Pedestrian/ Intersection Connected Vehicle Technologies along key arterials with history of pedestrian crashes
    b. Deploy Pedestrian detection system at heavy pedestrian areas
    c. Deploy Signal Phase and Timing (SPaT) at key intersections along corridors
3. *Reduce Congestion through Demand Management Techniques*
    a. Develop ICM Strategies for balancing demand across network
    b. Arterial congestion messaging through DMS
    c. Provide data for incentivization app developers
4. *Improve Mobility within the Region*
    a. Deploy Signal Phase and Timing (SPaT) at key intersections along corridors
    b. Deploy Transit Signal Priority technologies
5. *Accelerated deployment if V2X technologies*
    a. Deploy Roadside Units (RSUs) along key corridors in the county
    b. Deploy SPaT, TSP, and Pedestrian Safety applications
6. *Reduction in the number and severity of traffic crashes and an increase in driver, passenger, and pedestrian safety*
    a. Provide timely, accurate and actionable real-time and dynamic traffic information to CVs via existing mobile apps.
7. *Improve Incident Response to congestion and events*
    a. Deploy an Information Exchange Network (IEN)
    b. Integrated Corridor Management

Most of the proposed initiatives should be broadly transferable to other areas of the state and country.

1.2. Geographic Area

Figure 1: Pinellas County, FL

Pinellas County is located on the Gulf Coast of Florida. The county seat is the City of Clearwater and its largest city is St. Petersburg. Pinellas County is included in the Tampa-St. Petersburg-Clearwater Metropolitan Statistical Area (urban area) along with Hillsborough and Pasco Counties. The total population of the urban area is 2,758122 (2015), 18th largest in the United States. The population of Pinellas County is 944,971 (2015), with an additional 78,340 seasonal population (2015) and 6.2 million tourist visitors (2015). The population density of Pinellas County is the highest of all counties in Florida at 3,347 persons per square mile.

1.2.1. Clearwater Beach

Clearwater Beach includes a resort area and a residential area on the Gulf of Mexico in Pinellas County on the west central coast of Florida. Located just west over the Intracoastal Waterway by way of the Clearwater Memorial Causeway from the City of Clearwater, Florida, of which it is part.

Clearwater Beach is characterized by white sand beaches stretching for 2.5 miles (4 km) along the Gulf and sits on a barrier island. It has a full marina on the Intracoastal Waterway side and is linked on the south by a short bridge to another barrier island called Sand Key, where Sand Key Park is located. Clearwater Beach was named No. 1 in the U.S. on TripAdvisor's list of Top Beaches for 2016 and No. 4 in 2017

Figure 2: Clearwater Beach

1.2.2. Highway Systems

The existing highway network in the Pinellas County region includes several controlled access highways. Primary access from Tampa into Pinellas County is through 3 major bridge crossings. These routes are the primary routes for Hurricane Evacuation in the area, and thus are critical to the region. The existing highway network within Pinellas County is shown in **Error! Reference source not found.**, below includes I-275, I-175, I-375, US-92, and US-19. Interstate highways are operated by the FDOT as part of their regional SunGuide Freeway Management System. I-275 is the primary route from Tampa into downtown St. Petersburg. SR 60/Gulf-to-Bay Boulevard is the northernmost east-west corridor and travels across Clearwater from Clearwater Beach in the west, connecting the city to Hillsborough County and the area around Tampa International Airport via the Courtney Campbell Causeway.

Figure 3: Regional Transportation

1.2.3. Arterial Signal Systems

Currently, each arterial management agency operates and maintains their own signal systems, as shown in the table below. As Pinellas County implements the new ATMS system, arterial signals are moved to the central system to be operated on a regional basis. However, existing systems do overlap jurisdictionally and as part of this project will be more synchronized as part of the ICM response plans and Decision Support System.

The current system configuration managed by Pinellas County includes operation of 425 traffic signals of which over 190 intersections can run one of three Adaptive Signal Control algorithms;132 CCTV cameras; 54 arterial Dynamic Message Signs (DMS); 180+ miles of fiber optic communications cable; and 100+ Bluetooth travel time sensors.

Table 1-1: Traffic Signals in the County

Agency	# of Signalized Intersections	Controller Types	Central Software
Pinellas County	425	Econolite	MIST
City of Clearwater	100	Econolite	Centracs

Pinellas County currently uses three Adaptive Signal Control systems within the county corridors including OPAC, InSync and Centracs.

1.2.4. Transit

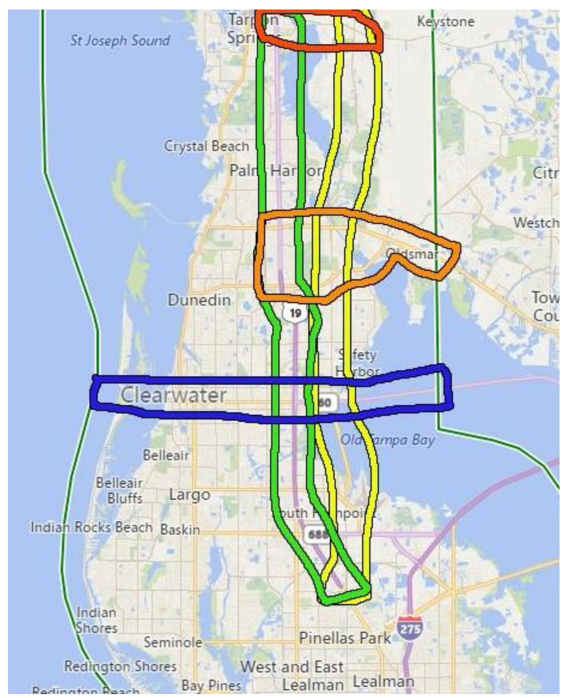
The PSTA operates 210 buses servicing 4,929 bus stops on 40 routes across the county, with major stops at all commercial centers. Along the Gulf Beaches, PTSA operates the Suncoast Beach Trolley. PTSA also offers two express routes to downtown Tampa connecting with Tampa's Hillsborough Area Regional Transit (HART) Lines and the Pasco County Public Transportation (PCPT) Lines. The system's two main bus terminals are in downtown Clearwater and downtown St. Petersburg. PSTA provided more than 14.9 million passenger trips in FY 2015.

PSTA has partnered with Uber and United Cab to solve the first-mile, last-mile problem. PSTA covers up to $5, if passengers are going to or from a bus stop in designated zones. This program started in February 2016 and was the first of its kind in the country. Under the new system, riders will open their Uber app and toggle over to the PSTA option. They can then page a nearby driver, and the credit will be automatically applied. The program, which will increase accessibility and ridership, illustrates PSTA's willingness to innovate to reach new riders.

Figure 4: PSTA Bus System Map

1.2.5. Pedestrians

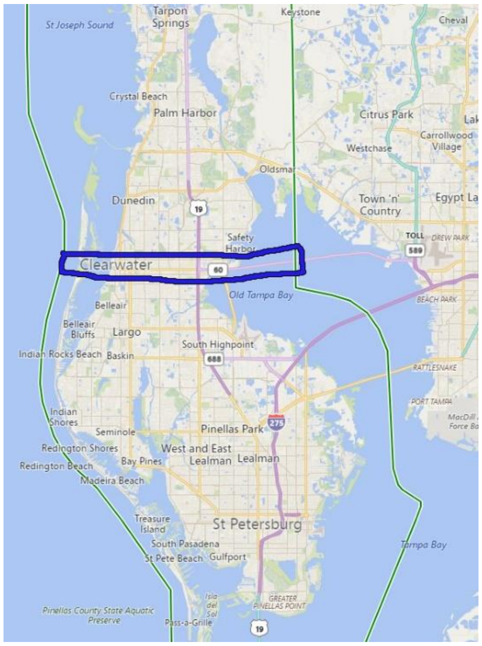
Concentrated pedestrian traffic occurs along the corridors of this project and at the coastal beaches, particularly Gulf Boulevard, which have high levels of tourism and daily pedestrian traffic. Crossing in these environments creates a dangerous situation for both pedestrians and drivers. Pinellas County ranks very high in accidents and fatalities associated with vulnerable roadway users. An average of 35 fatal crashes per year involved pedestrians. Pedestrian deaths accounted for 35% of all traffic fatalities. This is more than twice the national average.



1.2.6. Key Management Corridors

In order to have the most benefit to the region, the stakeholders have chosen three key corridors, with two supporting corridors for the region. SR60 is the primary east-west corridor in the County, and balancing demand on the two north-south corridors, Route 19 and County Road 611into the county from the north is a key to improving the efficiency and reducing congestion in the County

Figure 5: Project Corridors



1.2.6.1. State Route 60

SR 60 within Pinellas County is one of the County's most important transportation corridors, serving several destinations, communities, and mobility needs. The corridor is also a gateway from Hillsborough County, providing access to many residential and commercial uses and serves as the primary connection to activity centers such as Downtown Clearwater and Clearwater Beach.

The SR 60 corridor, like much of the Tampa Bay area, has been designed solely for moving automobiles, even in residential areas. Minimal consideration has been given to alternative modes such as biking, walking, and transit, leading to fewer transportation options and increased safety risks for residents and visitors alike.

Tourism is a major contributor to Pinellas County's economy. Travelers from across the globe come to the area to enjoy one of the County's best assets, its beaches. As a result, access to these amenities is critically important. This is especially true of Clearwater Beach, repeatedly rated one of the best beaches in the country, most recently in 2016.

Figure 7: SR60 Corridor

1.2.6.2. Route 19

A 34-mile highway extending from Tarpon Springs to St. Petersburg, US 19 is the most heavily traveled arterial road in Pinellas County. It is part of the Florida Strategic Intermodal System (SIS), a statewide network of high-priority transportation facilities, and is served by Route 19, which has the highest ridership of all routes in the Pinellas Suncoast Transit Authority (PSTA) system.

Since the 1980s, substantial public investment has converted US 19 from an at-grade arterial road to an uninterrupted partially controlled access facility, including overpasses and interchanges, from 49th Street in Pinellas Park to SR 580 in Clearwater.

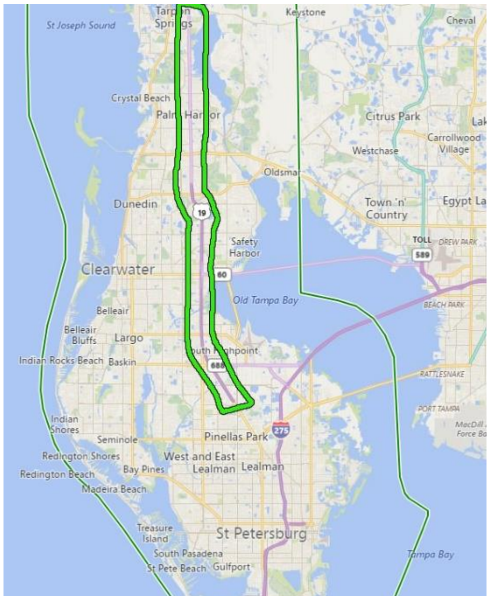


Figure 8: Route 19 Corridor

There has also been substantial investment made toward improving the safety of the corridor, including crosswalk installations, sidewalk construction to close existing gaps along the roadway, median modifications, intersection improvements and wayfinding signs. Safety remains a serious concern, however, as the highest crash rates in the County continue to be reported at US 19 intersections. In addition to safety, other major issues afflicting the corridor include lack of accessibility afforded to vulnerable users (e.g., pedestrians, bicyclists and transit users), and the economic impact of the partially controlled access improvements on adjacent businesses.

Figure 9: Bayside Bridge

1.2.6.3. County Road 611

County Road 611 is a 22-mile corridor for this project and consists of three primary roads: McMullen Booth Road, the Bayside Bridge, and 49th Street North. McMullen-Booth Road is a principal arterial road, which means that any crash creates severe impacts to traffic flow in the area. McMullen-Booth Road then becomes the Bayside Bridge at State Route 60, and once across the Bay becomes 49th Street North which goes into downtown St. Petersburg.

Both CR611 and State Route 19 are the primary routes from the northern part of the county, and destinations north and east of the county into St. Petersburg.

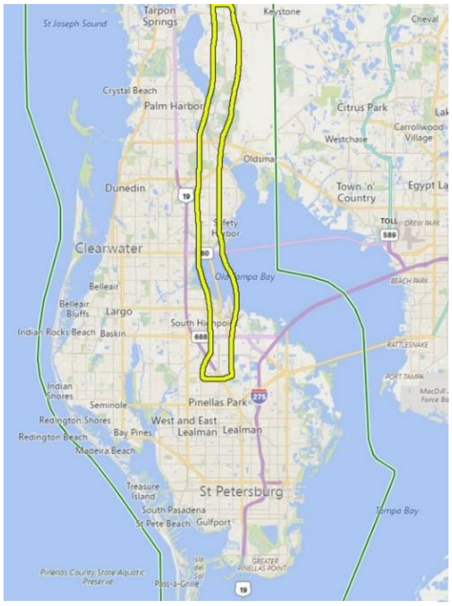


Figure 10: County Road 611 Corridor

1.2.6.4. Supporting Routes

At the northern part of the county, two east-west routes will support the balancing of loads on State Route 19 and CR 611. Keystone Road is the northern most part of the parallel corridors, and will be used by drivers entering the County from the north. County Road 580 and Curlew Road will be used by drivers entering the county from the North Tampa area.

1.3. Issues and Challenges

1.3.1. Crashes

In 2015, a total of 28,501 motor vehicle crashes were reported in Pinellas County. Of these, 99 resulted in one or more fatalities, while 3,465 caused serious injuries. For most crashes (20,798), there were no injuries or fatalities reported. There were 101 traffic crash fatalities in Pinellas County in 2015-16 less fatalities than the 117 in 2014.

Reducing the number of traffic crashes remains a challenge given increases in population, VMT, the number of licensed drivers, and the declining price in the cost of a gallon of gasoline. As these numbers steadily increase, Pinellas County continues to face challenges in reducing the number and severity of traffic crashes.

Historically, traffic crash frequency has been the preferred approach to analyze and measure the safety of an intersection and/or road segment in Pinellas County. While crash frequency is one of the simplest forms of crash data analysis, it does have limitations when comparing roadways that carry high volumes of traffic to roadways that have much less capacity, and thus smaller numbers of crashes. For the 2016 Traffic Crash Trends and Conditions Report a different methodology was used. Crash rates were calculated for all intersection and roadway segments within the Forward Pinellas Transportation Planning Inventory (TPI) network database. Crash rates were calculated by adding the number of crashes of the individual intersections or roadway segments and dividing the sum of the entering traffic volumes, converted to million vehicles entering (for intersections) or million vehicle miles traveled (for roadway segments). This metric is considered a more reliable measure of the relative safety of an intersection or segment because it incorporates exposure data into the calculation which allows for a more effective comparison of varying locations throughout the transportation system.

During 2015, the intersection with the greatest crash rate was Gulf-to-Bay Boulevard (S. R. 60) & Belcher Road, followed by U.S. Highway 19 & Tampa Road. Collison diagrams for the Gulf-to-Bay Boulevard (S. R. 60) & Belcher Road and the U.S. Highway 19 & Tampa Road intersections were evaluated to determine the dominant crash type. For both 30% and 58% respectively, for all collisions that occurred at these intersections. It is important to note that even though U.S.

Highway 19 is grade-separated through the Drew Street area, this intersection is still experiencing a high rate of traffic crashes because of the high number of at-grade conflict points below the overpass.

Table 1-2: Top 10 Intersections for Crashes

Rank	Main Route	Minor Route	Jurisdiction	No. of Crashes	Total Intersection AADT	Intersection Crash Rate
1	S.R. 60	Belcher Road	Clearwater	141	73,904	**5.23**
2	U.S. Highway 19	Tampa Road	Unincorporated	170	107,523	**4.33**
3	54th Ave. S.	31st Street South	St. Petersburg	46	36,492	**3.45**
4	Alternate 19	Curlew Road	Dunedin	42	34,241	**3.36**
5	66th St. N. (S.R. 693)	38th Avenue North	St. Petersburg	72	62,396	**3.16**
6	U.S. Highway 19	Drew Street	Clearwater	131	116,958	**3.07**
7	U.S. Highway 19	Curlew Road	Unincorporated	128	115,750	**3.03**
8	U.S. Highway 19	Alderman Road	Unincorporated	89	86,758	**2.81**
8	Gandy Boulevard	4th Street North	St. Petersburg	77	75,125	**2.81**
9	Alternate 19	Rosery Road	Largo	45	44,215	**2.79**
10	Fort Harrison Avenue	Chestnut Street	Clearwater	33	32,776	**2.76**

1.3.2. Pedestrian Safety

Walking is an important mode of travel in Pinellas County. Everyone is a pedestrian, and people make pedestrian trips daily, whether that means walking from the transit stop to work, walking from the parking lot to the store, or walking with children to school. Walking is also a great form of exercise. Our region places a high value on walkability and Forward Pinellas is working with local, state, and Federal government partners to ensure that walking is a safe, comfortable, and viable transportation option in Pinellas County.

Back in 2016, the seven most dangerous metro communities for pedestrians were all in the Sunshine State, according to the annual Dangerous by Design report released by Smart Growth America. That included the Tampa-St. Petersburg-Clearwater area, which was ranked seventh in the nation with 821 pedestrians killed over a 10-year period through 2014.

The numbers didn’t change much from 2016 to 2017. Pinellas County saw a small drop, according to data from the Florida Department of Highway Safety and Motor Vehicles. State numbers said 44 people were killed while walking in Pinellas in 2016, with that number dipping to 34 in 2017. Bicyclist deaths rose from 2 to 4 in the same time period.

1.3.3. Congestion

Roadways are congested if the peak rush hour traffic volume is 90% or more of the road’s adopted level of service standard. More than 77% of all lane miles monitored by Forward Pinellas are uncongested, with the remaining 23% being congested during morning/evening rush hour. Congested conditions on all monitored lane miles have increased by about 5% since the 2012 State of the System Report. Of the 526 congested lane miles monitored, 32% are SIS and 68% are nonSIS roads, about the same as 2012.

Part of the congestion management process includes analyzing the most severely congested road segments that also have the longest duration of congestion. These roadways are ranked based upon their volume-to-capacity ratios and multiplied by the duration of congestion hours to determine ranked results. Ranked results show the most severely congested road segments for the longest period for both Strategic Intermodal System (SIS) and non-SIS roads. Rankings for the top twenty most severely congested SIS road segments are shown in the tables below.

Top 20 Most Severely Congested Non-SIS Facilities/Segments

Rank	Facility	From/To
1	East Lake Rd	Woodlands Blvd to Lansbrook Pkwy
2	Forest Lakes Blvd	Pine Ave to Hillsborough C/L
3	Courtney Campbell Cswy	Hillsborough C/L to Bayshore Blvd
4	West Bay Dr	Missouri Ave to Clearwater-Largo Rd
5	SR 688/Ulmerton Rd	Roosevelt Blvd to 40th St
6	SR 688/Ulmerton Rd	Belcher Rd to Starkey Rd
7	East Lake Rd	Lansbrook Pkwy to Keystone Rd
8	SR 688/Ulmerton Rd	Starkey Rd to 101st St
9	Alt US Hwy 19/ Bay Pines Blvd	West end of bridge to Park St
10	East Lake Rd	North Split to Woodlands Blvd
11	Forest Lakes Blvd	SR 580 to Tampa Rd
12	Alt US Hwy 19/ Palm Harbor Blvd	Tampa Rd to Alderman Rd
13	Alt US Hwy 19/ Bayshore Blvd	Skinner Blvd to Curlew Rd
14	McMullen Booth Rd	Gulf-to-Bay Blvd to Sunset Point Rd
15	SR 686/East Bay Dr	Keene Rd to US Hwy 19
16	Park Blvd	49th St to US Hwy 19
17	SR 688/Ulmerton Rd	Roosevelt Blvd to 49th St N
18	Ft Harrison Ave	Belleair Rd to Chestnut St
19	McMullen Booth Rd	Sunset Pt Rd/Main St to SR 580
20	Gateway Express/ Roosevelt Blvd	Ulmerton Rd to 49th St N

Top 20 Most Severely Congested SIS Facilities/Segments

Rank	Facility	From/To
1	US Hwy 19	SR 580/Main St to Curlew Rd
2	I-275	22nd Ave N to 38th Ave N
3	Gandy Blvd	Brighton Blvd to San Martin Blvd
4	US Hwy 19	Tampa Rd to Alderman Rd
5	I-275	54th Ave N to Gandy Blvd
6	US Hwy 19	Curlew Rd to Tampa Rd
7	Gandy Blvd	4th St N to Brighton Blvd
8	US Hwy 19	Klosterman Rd to Tarpon Ave
9	US Hwy 19	Alderman Rd to Klosterman Rd
10	I-275	Gandy Blvd to SR 686/Roosevelt Blvd
11	US Hwy 19	Gandy Blvd to Mainlands Blvd
12	I-275	38th Ave N to 54th Ave N
13	I-275	I-375 to 22nd Ave N
14	US Hwy 19	Beckett Way to Pasco County Line
15	I-275	4th St N to Pinellas Shoreline
16	I-275	28th St S to I-175
17	I-275	38th Ave N to 54th Ave N
18	I-275	22nd Ave S to 28th St S
19	Gandy Blvd	US Hwy 19 to Grand Ave/Gandy Access
20	US Hwy 19	Tarpon Ave to Beckett Way

Source (both tables): Forward Pinellas TPI Database - monitored roads, 2016

1.3.4. Performance of the Transportation System

The Fixing America's Surface Transportation (FAST) Act became law in 2015, and requires performance-based, multimodal planning processes to address the safety challenges on the U.S. transportation system. The FAST Act authorizes FHWA to establish safety performance measures. Forward Pinellas began reporting on these safety performance measures in its Traffic Crash Trends and Conditions Report, (October 2016), and this section of the Countywide Trends and Conditions Report, (October 2017), continues to report on these same safety performance measures, which are summarized in the tables below.

The hard work and dedication of safety partners in implementing the Strategic Highway Safety Plan continues to pay off in that Pinellas County's fatal crashes due to driver impairment dropped 12%, fatal intersection crashes dropped 12% and fatal crashes due to aggressive driving dropped

10%. Only fatal crashes involving at-risk drivers increased (by 6%) while fatal crashes due to distracted driving remains steady with an average of five fatalities per year.

Table 1-3: Safety Performance Measures

FHWA Safety Performance Measures	2011	2012	2013	2014	2015	2016	5 Year Rolling Avg. (2011-2015)	5 Year Rolling Avg. (2012 - 2016)	5 Year Rolling Avg. % Change
Number of Motor Vehicle Crash-Related Serious Injuries	999	925	879	911	982	1,010	939	941	0.2%
Number of Motor Vehicle Crash-Related Fatalities	114	101	80	117	101	107	103	101.2	-2.0%
Number of Serious Injuries of Bicycle/Pedestrian Users	162	199	162	169	153	190	169	174.6	3.0%
Number of Bicycle/Pedestrian Fatalities	40	41	34	47	36	43	39.6	40.2	0.5%
Number of Serious Injuries per Vehicle Miles Traveled (VMT)	47	43.4	41	41.6	43.6	*	43.3	42.4	-2.0%
Number of Fatalities per Vehicle Miles Traveled (VMT)	5.4	4.7	3.7	5.3	4.5	*	4.7	4.6	-2.0%

* 2016 Vehicle Miles Traveled (VMT) data for Pinellas County was not available at the time this report was published

1.3.5. Tourism – Impact

Tourism is one of Pinellas County's most important industries, and arguably its most visible. Pinellas County has experienced significant growth in visitors in recent years. Visit St. Pete/Clearwater, the Convention and Visitors Bureau for Pinellas County, reported approximately 5.4 million visitors in 2012, increasing to approximately 6.3 million (17% growth) in 2016.

The increase in out-of-county and out-of-state cars, as well as rental cars, places additional demands on the area's roadway network. Peak impact is seen during the annual occurrence of Easter and spring break for schools and colleges. Traffic congestion on routes between the mainland and barrier islands, a popular draw for tourists, is particularly visible during these periods. These visitors also pay sales and gas taxes, which provide additional revenue to fund transportation projects. Tourism had a $9.7 billion economic impact in 2016 (up 34% from 2012, unadjusted for inflation), according to Visit St. Pete/Clearwater's Annual Visitor Profile Report for those years.

The peak impact tends to be related to the annual occurrence of Easter and spring break for schools and colleges, and during Summer vacation months.

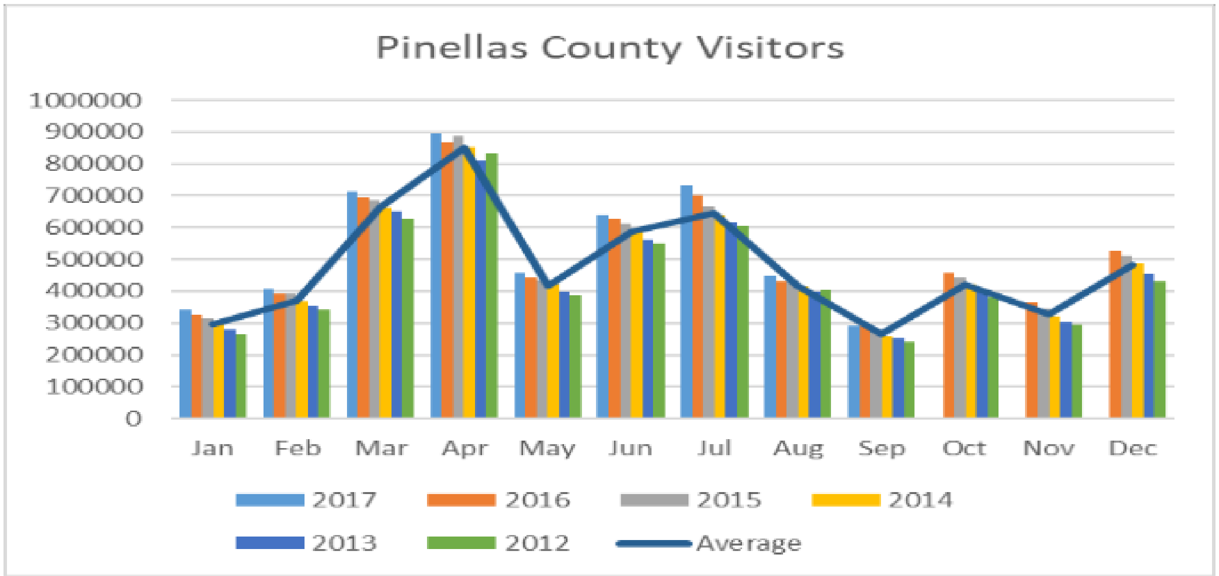


Figure 11: Hotel Occupancy in Pinellas County, Monthly Totals

1.4. Transportation Systems and Services

The following summarizes the transportation systems and services that are proposed for the project, as shown in Figure 13. It also details the purpose of the system/service and the specific technology/system to be deployed to support that system/service. Traffic data is collected and processed, and made available to the operators on various platforms. In that regard, our proposed system will:

- Consolidate the various data sources into one single, centralized data warehouse and make it available to the operators through a multi-layered dynamic map and integration with their operational systems.
- Implement a real-time performance measures platform to dynamically monitor and operate the regional transportation network based on performance measures.
- Implement an Expert Rule Engine and deterministic model to balance demand along the key corridors. Deploy DMS
- Deploy Connected Vehicle technologies for Signal Phase and Timing (SPaT), Transit Signal Priority, and Pedestrian Safety
- Deploy pedestrian detectors along beach areas with high pedestrian traffic and issues
- Deploy a deterministic model system using machine learning technology, to provide recommendation for balancing demand across corridors
- Deploy dynamic signs along key corridors to display congestion levels on alternate routes
- Share the fused data with Regional partners through one Data Mart, and through an Information Exchange Network
- Provide data to 3rd party developers for creation of a incentivization application for demand management

The implementation of these coordinated strategies requires the development of a new and potentially complex set of inter-jurisdictional agreements and operating procedures.

1.4.1. Data Fusion Environment

The data fusion engine (DFE) is the center piece of the entire system. As the data becomes available, they are fused, stored, shared with various internal and external applications and stored and archived for the development of real-time and archived performance measures analysis. The performance measures application will be used to archive data and provide agencies with the ability to create performance measures as well as configured operational dashboards per the agency's needs.

The Data Interfaces (DI) will extract data from the data sources, validate it, transform it into a suitable format for retrieval and analysis, and store the data into one of the data warehousing components. The data warehousing components consist of traditional data warehousing technologies such as SQL Server relational database management system with geographically based data.

The DFE represents a paradigm shift from silos of information and applications to a shared data environment that synergizes data streams and data sources not previously integrated to support data analytics of value.

The DFE will extract, transform, and load traditional structured and transactional data, unstructured data, and geographical and time-based data in a way to support efficient search, retrieval, and analysis. The DFE subsystem will provide DIs to the data sets, data streams, and derived data sets and data streams based on a processed output of other data sets and data streams. The DFE subsystem will be designed to label and store multiple versions of a data source to accommodate simulated data to facilitate simulation and testing for the integration, test, maintenance, and training activities of Pinellas RIMM while also maintaining live, production operations.

The DFE will serve as the warehouse for all available traffic data sources including any locally-deployed systems such as pavement sensors, Bluetooth, tag readers, etc., as well as third-party probe data sources. Using historical data, Kapsch will develop the predictive analytics services, which provide near-term predictions of speeds and volumes. The service leverages historical data sources to understand traffic patterns, and then applies machine learning-based time series forecasting with real-time data to automatically generate accurate predictions (Mean Absolute Error in the range of 1% to 6%) for the next 30 minutes. The predicted data, along with energy cost estimates, is then used as an input into the dynamic flow distribution route choice model.

1.4.1.1. Data Interfaces

The data interfaces that will be deployed for Pinellas RIMM which are used to collect data, fuse the data, and store the data in the data warehouse for use by the other systems include:

- **Traffic Signal Data –** Traffic Signal Status, Location, and Timing Plan data from the Centracs and MIST systems
- **GTFS Data -** Transit Schedule and Route Data will be collected from the PSTA GTFS data feed

- **Transit AVL Data –** The real-time location of transit vehicles will be collected from the Clever Device data feed.
- **ATMS Data –** ITS device (DMS, CCTV), speed, volume, occupancy, and event data will be received from the FDOT SunGuide C2C interface and the Pinellas County MIST system
- **V2X Data** – Connected Vehicle information will be received from the Road Side Units (RSU) deployed within the region
- **3rd Party Data** – Traffic information will be integrated from three different providers: HERE, Uber, and Waze.

Data interfaces will be developed and deployed based on the availability of the source systems, and the experience of the systems integration team.

1.4.2. Integrated Corridor Management

ICM is an essential system for the operating agencies within the region to implement coordinated strategies to meet transportation performance measures and in response to recurring congestion and planned and unplanned traffic events causing congestion and/or delay. The ICM system will become the collective knowledge resource to select appropriate response plans either through an automated or human process and determine potential corridor benefits of proposed response plans. The ICMS is comprised of three main systems: 1) an Information Exchange Network, 2) Decision Support System, and 3) Performance Measures. The EcoTrafiX product will be used as the foundation of the ICMS.

Based on the lessons learned from ICM deployment projects in Dallas, Orlando, and San Diego, we have partnered with Kapsch to provide expertise in ICM. The ICM system's Information Exchange Network will be the Kapsch EcoTrafiX product, which was used in the Dallas ICM for exchange of transportation data, event data, and coordination of response plans.

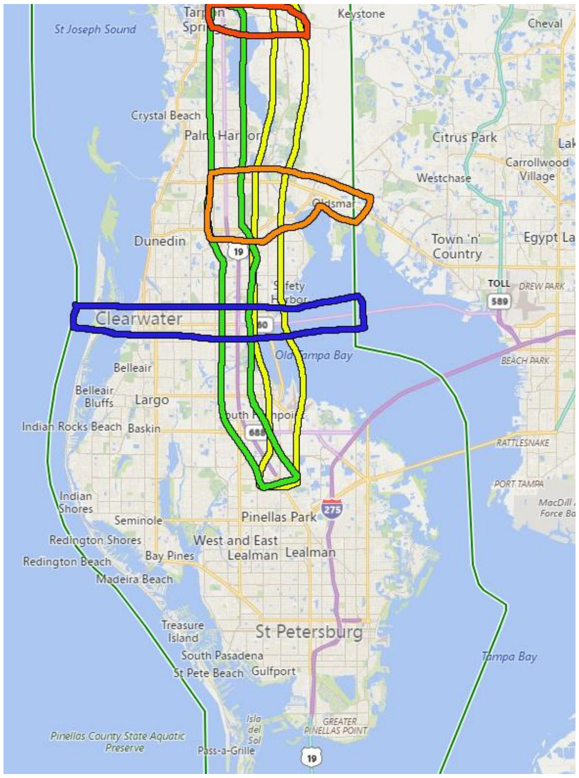


Figure 12: Project Corridors

Table 1-4: Solutions to meet the Goals of the Project

Goal	Solution Description	Proposed Technologies
Enhance Data Collection, Fusion, Distribution and Archiving	▪ Enhance the ability to collect, fuse and distribute data for all manner of performance measures, performance management, real-time operations and real-time information including	▪ Data Fusion Environment ▪ Performance Measures
Improve Safety of Pedestrian and Intersections within the Region	▪ Deploy LIDAR based pedestrian detection system and interface to traffic signal controllers in high pedestrian areas ▪ Deploy a Ped Safety application for CV to interface the pedestrian detection and transmit to public transit vehicles	▪ LIDAR Pedestrian detection ▪ CV Ped Safety application
Accelerated deployment of V2X and other advanced technologies	▪ Provide timely, accurate and actionable real-time and dynamic traffic information to CVs via existing mobile apps. ▪ Deploy Roadside Units (RSU) along intersections within the key corridors, Deploy On-board Units within public transit, and fleet vehicles	▪ Deployment of RSUs managed corridors ▪ Pedestrian and Intersection safety applications ▪ Deployment of OBUs
Reduce Congestion through Demand Management Techniques	▪ Deploy Dynamic Message Signs (DMS) at key decision points within the management corridors ▪ Develop and deploy a deterministic model to model and predict the congestion on corridors ▪ Develop and deploy an incentivization engine	▪ Incentivization Engine ▪ Dynamic Message Signs ▪ Deterministic Model
Reduction in the number and severity of traffic crashes and increase in driver, passenger, and pedestrian safety	▪ Provide timely, accurate and actionable real-time and dynamic traffic information to CVs via existing mobile apps. ▪ Implement Signal Phase & Timing (SPaT) messaging at signalized intersections	▪ Deployment of RSUs within corridors ▪ Pedestrian and Intersection safety applications
Improve Mobility within the Region	▪ Provide a data warehouse with all regional transportation data which will be used to enhance existing mobile apps ▪ Provide a Data Mart for 3rd Party app developers ▪ Provide Transit Signal Priority to ensure on-time schedules	▪ Mobile App ▪ Data Warehouse ▪ Data Mart ▪ Transit Signal Priority
Improve Incident Response to congestion and events	▪ Through deployment of the information exchange network, provide agencies with real-time network status and coordination of events	▪ EcoTrafiX IEN ▪ DSS

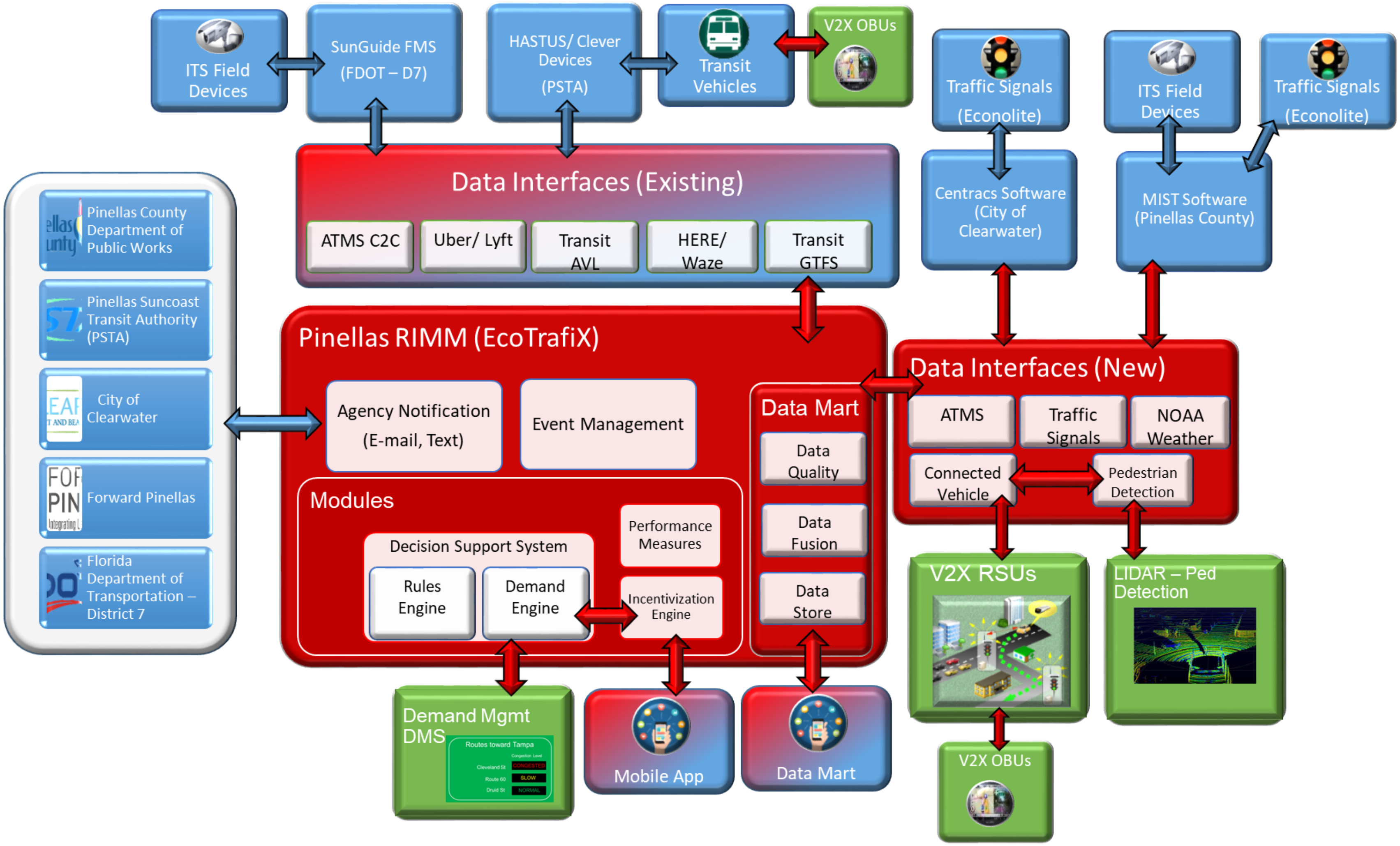


Figure 13: Pinellas RIMM Logical Architecture

1.4.3. Decision Support System and Incentivization Engine

The DSS will optimally distribute trips across the available network capacity based on speeds, travel times and current signal timings. It will use predictive analytical models to anticipate congestion before it happens, and then provide drivers with personalized routing and departure information to distribute them optimally across the roadway network.

The Incentivization Engine will provide an appropriate level of incentivization to offer drivers to persuade them to follow the recommended routes. The system uses artificial intelligence and machine learning algorithms to compile, organize and recognize daily activity patterns and purposes in the users' trips. This engine will be an extension of the existing behavioral framework created by Metropia and uses a behavioral model based on motivation theory, inducing behavioral change over time.

The incentivization process is further tuned by micro-surveys. These are individual questions presented to the users during normal interactions with the mobile applications. These questions have two purposes: to gather information for the behavioral model and to gradually introduce the user to new ideas about the benefits and advantages of dynamic flow distribution. Research has shown that progressively educating people on the benefits of behavioral change is more effective than suggesting a change suddenly.

1.4.4. Pedestrian/ Intersection Connected Vehicle Technologies

Connected Vehicle information services empower users with timely and relevant regional transportation information for data driven route decisions. The information dispersion strategy for Connected Vehicle in this case is to provide Pedestrian Safety messaging, Intersection Collision warnings and SPAT messaging to Traffic Signals. Connected Vehicle dispersion are communications abstract and the distribution systems should accommodate multiple communication methods such as 5.9 GHz Dedicated Short Range Communication (DSRC), cellular, and traditional fixed roadside communications. Increasing the breadth and depth of information channels ensures regional information for commercial carriers is available and accessible at the time needed. Core services being provided as a part of Pinellas RIMM promote mobility and safety compliance throughout the County. For the Pinellas RIMM Project, up to 120 Roadside units and up to 50 Vehicle based units specifically for transit vehicles will be deployed along the two corridors in Pinellas County. Additionally, Signal Phase & Timing (SPaT) integration with the Econolite controllers will be deployed along corridors in the region,

1.4.5. Demand Management

By using the DSS to distribute trips across the available network capacity based on speeds, travel times and current signal timings, Pinellas County will inform travelers through a variety of methods to try and impact their routes. By inducing some drivers to take alternative paths that might be personally sub-optimal but better for overall system performance, this platform will allocate vehicles more optimally to available network capacity over time and space. This will improve roadway network utilization when implemented across a metropolitan area and reduce fuel consumption.

Pinellas County will deploy some dynamic messages signs (DMS) to inform drivers at key decision locations to influence their routes. These DMS will provide congestion levels, not travel times, for the parallel routes along the managed corridors. With this information provided to the drivers, we believe some drivers will choose a less congested route instead of sitting in a congested route to their destination. **Error! Reference source not found.**Figure 14 shows a conceptual design of the signs that will be finalized once the project begins. These may require approval from FHWA for a variance to the MUTCD.

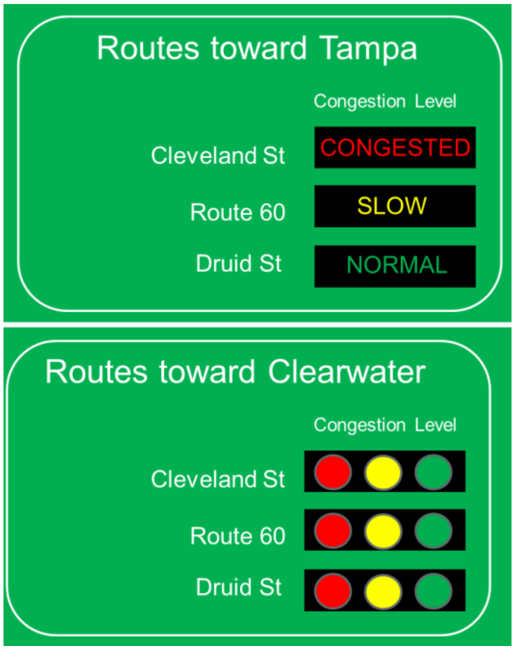


Figure 14: Demand Management Concept Signs

1.4.6. Network Demand Management and Incentivization

Unmanaged distribution of vehicles across our roadway networks results in greater traffic congestion, energy consumption, environmental impacts, and frustrated travelers. Studies have shown that influencing routing choices by a mere 3-5% can lead to dramatic improvements in overall system performance while reducing emissions.

Most vehicle routing applications and services focus on the individual driver by determining the optimal route through the network for that driver. These services do not account for network-wide performance, do not explicitly concern themselves with energy impacts, and are not designed to induce long-term behavioral changes. Dynamic flow distribution seeks the adoption of a more holistic approach to allocating drivers across the network by better accounting for available capacity and individual user routing preferences, combined with the introduction of gamification and incentivization approaches as a method for demand management.

Although the concept of flow distribution routing was proposed nearly 20 years ago, until recently has been difficult to actualize. While there are currently a few companies in Europe testing dynamic flow distribution, even state-of-the-art technology has key shortcomings including (1) lack of tools to accurately learn driver behavior and (2) lack of focus on influencing long-term behavioral changes.

Our proposed solution overcomes these deficiencies in several ways:

(1) The individualized user-behavioral model allows the system to target routing suggestions to those travelers most likely to follow the recommendation.

(2) Incorporation of incentives to support dynamic flow distribution provides a tool for inducing change in user behaviors.

(3) Using micro-surveys to collect information about the user as well as influencing the user’s thinking will improve the likelihood of behavior change over the long term.

1.4.7. Pedestrian Safety Applications

Since Pinellas County is the 7th worse location in the country for pedestrian fatalities, the RIMM project will deploy a LIDAR based pedestrian detection system which will allow alerts to be sent to drivers via V2X technologies and integrated with beacons, flashers and signals at pedestrian crossings, which will lead to the improved operation of the existing pedestrian crossings in the Clearwater Beach area.

This technology has been deployed in Las Vegas as part of their Smart City program, and provides a key tool in improving the safety of pedestrians. Like the pedestrian traffic in Las Vegas, Pinellas County has a large amount of pedestrian traffic along key locations within the County. Similarly, many of these pedestrians are tourists visiting the County and may be more distracted with their surroundings.

1.4.8. Performance Measures System

Performance Measures, obtained via analytics and dashboards can be used to provide important statistics that can help to detect and correct issues found within a transportation network. The Performance Measures system will provide analytics and graphical dashboards that will allow the regional stakeholders to view archived, statistical data related to the Region's transportation network.

Figure 15: Operational Dashboards

The dashboards will contain support for multiple profiles corresponding to the multiple views and roles in the system ranging from seeing high-level status, to corridor level performance, to very detailed status of intersection data.

Additionally, to assess improvements in emissions and energy consumption, the team will design and build a performance modeling tool for the routes under study. This is a small-scale simulation model that will be used to compare energy costs for baseline trips against trips made by users responding to flow distribution suggestions.

1.5. Deployment Plan

This section describes some of the high-level tasks and considerations that will be addressed during the deployment of the Pinellas RIMM project.

1.5.1. Deployment Sequencing

Once the planning and design phase of the project is completed, we expect the deployment of the components/ subsystems of the solution to be deployed in a logical and consistent manner.

Based on the Systems Integration experience of our team, we expect the Solutions described in Section 0 to be deployed in the order shown in Figure 12 below.

Figure 16: Deployment Sequencing

1.5.1.1. Phase 1

Phase 1 will include the systems that are already well known and available from the systems integration team. The hosting environment and networking will be deployed. The Data Fusion Environment/ Data Warehouse will provide the databases that will be used by all the other systems. As discuss previously, Phase 1 of the Data Interfaces have already been developed and will be configured for this project. The historical data for the deterministic model will be collected and the algorithms for the model will begin at this phase. The EcoTrafiX Information Exchange Network will be deployed.

1.5.1.2. Phase 2

Phase 2 will focus on the additional Data Interfaces and deployment of the Road Side Units for the V2X technologies. The Performance Measures system will be deployed and the reports and dashboard work can begin. The incentivization engine will be deployed.

1.5.1.3. Phase 3

Phase 3 is the final step in deployment of the decision support system with the integration and calibration of the components deployed in Phases 1 and 2. The new field infrastructure for the project will be deployed including the LIDAR Pedestrian detectors, and Demand Management Signs. The management systems for these will be deployed so that the final data interfaces can be developed and deployed in Phase 4.

1.5.1.4. Phase 4

The final deployment phase of the project will include the data interfaces for the systems deployed in Phase 3, and the completion and deployment of the Mobile App.

1.5.2. Operations and Maintenance

It is anticipated that each agency will be tasked to operate and maintain the systems that are deployed within their jurisdiction and/or systems. The team will examine areas where it may be necessary for specific vendors to operate and maintain their systems for at least a start-up/shake down period. DPW and the Regional partners will work to ensure that any needed O&M funds are programmed onto the TIP as this project advances. The following table provides additional detail.

Table 1-5: Long-Term Maintenance

System	Proposed Maintainer
Data Fusion Environment	Pinellas County Department of Public Works
Data Interfaces	Pinellas County Department of Public Works
Integrated Corridor Management System	Pinellas County Department of Public Works
V2X RSUs	Pinellas County Department of Public Works and FDOT
V2X OBUs	Pinellas Suncoast Transit Authority
Pedestrian LIDAR	Pinellas County Department of Public Works
Demand Management Signs	Pinellas County Department of Public Works

1.6. Challenges

There are no significant obstacles to deployment and certainly no insurmountable ones. The Regional Stakeholders support the Pinellas RIMM Project. The 2006 County Inter-Local Agreement for ATMS/ITS/Signals gives Pinellas County authority to deploy the Pinellas RIMM Project. The Pinellas County share of the funding is in place through the TIP, STIP, MPO Long Range Plan and Florida Long Range Plan. Connected and automated vehicle technology is supported in Florida by several statutes.

Pinellas County has passed one regulatory hurdle in CV application by securing the 5.9GHz FCC licensing from the state and federal governments. Anticipated institutional/other challenges include:

- Overall coordination of the large set of agency stakeholders;
- Development and implementation of an explicit O&M Plan acceptable to all members;
- Integration of the wide variety of legacy systems;
- Approval of Demand Management Signs through the MUTCD process;
- Technology system changes/advancement during the life of the project; and
- Maintaining a realistic schedule.

1.7. Quantifiable Performance Improvement

System performance is a result of the various projects that support the goals of the study. The following system performance improvements are expected because of the project elements identified in the proposal.

Table 1-6: System Performance Improvements

Performance Area	Description	Key Performance Measures (Targets)
Pinellas RIMM will provide the following System Performance benefits:		
Improve Corridor Performance	Optimizing networks at the corridor level will result in an improvement to multi-modal corridor performance, particularly in high travel demand and/or reduced capacity periods.	Increased Person throughput on ICM corridors (2%)
Reduce Congestion	Providing improved mobility information, especially route congestion information and incentivization.	Reduction in congestion along managed corridors (3%)

1.8. Quantifiable Safety, Mobility, and Environmental Benefits

Based on the expected system performance measurements, the following key outcome performance indicators are identified for our project. These measures will be further defined as part of the evaluation task along with the data collection and management approach. Other input, output related performance measures will also be defined. For example, the team will assess the improvements to situational awareness, the use of the DSS and the effectiveness of the CV applications that are proposed as part of the project. However, measures of effectiveness for input and outputs are not presented in the table below due to page limit restrictions.

Table 1-7: Key outcome-related performance measures

Performance Area	Description	Key Performance Measures (Targets)
Pinellas RIMM will provide the following Safety benefits:		
Safety	The Region will realize an improved overall safety outcome, through better incident management and utilizing connected vehicle technologies and pedestrian detection.	Reduction of Pedestrian-Related Crashes across the Region (3%) Reduction in Pedestrian fatalities in the Region (5%)
Pinellas RIMM will provide the following Mobility benefits		

Performance Area	Description	Key Performance Measures (Targets)
Improved Event Management	Operating agencies within the Region will improve management practices and coordinate decision-making, resulting in enhanced response and control.	Reduction of total response time to incidents reduced across the Region (5%)
Better Inform Travelers	Travelers will have actionable multi-modal (highway, arterial, transit, parking, etc.) information resulting in more personally efficient mode, time of trip start, and route decisions especially during high-demand and capacity constrained times	Improvement in planning time index and buffer time index for key facilities (Target 3%)
Improve Corridor Performance	Optimizing networks at the corridor level will result in an improvement to multi-modal corridor performance, particularly in high travel demand and/or reduced capacity periods.	Increased Person throughput on ICM corridors (2%)
Reduce Congestion	Providing improved mobility information, especially route congestion information and incentivization.	Reduction in congestion along managed corridors (3%)

1.8.1. Safety Benefits

The impact of this project on Safety will be evaluated to ensure that the systems deployed and the management strategies used will have a positive direct and measurable effect on the Region. This project will consider several safety performance measures to evaluate the safety benefits to the Region including overall crash rate, fatality and injury rates. Indirect measures including vehicle speeds, speed variability, the number of traffic violations, percentage reduction in rescue response time and public perceptions will also be considered.

1.8.2. Mobility Benefits

The actual impact of improved traveler information, coordinated incident response, and many of the strategies we are proposing on mobility includes several key performance measures. This includes travel time reliability for both freight and commuters in the Region; better managing capacity across modes by utilizing ICM strategies; informing travelers of the travel time of routes so that trips can be postponed or alternate routes can be taken thereby decreasing travel demand and improving travel time reliability. As part of the evaluation of the project, we will consider several of the key performance measures previously mentioned including freight travel time reliability and mileage of uncongested routes.

1.8.3. Environmental Benefits

Transportation is a major contributor of CO_2 and other greenhouse gas emissions from human activity, accounting for approximately 14 percent of total anthropogenic emissions globally and about 27 percent in the U.S. Fortunately, transportation technologies and strategies are emerging that can help to meet the climate challenge. These include automotive and fuel technologies, intelligent transportation systems (ITS), and mobility management strategies that can reduce the demand for private vehicles. While the climate change benefits of innovative engine and vehicle technologies are relatively well understood, there are fewer studies available on the energy and emission impacts of ITS and mobility management strategies. In the future, ITS and mobility management will likely play a greater role in reducing fuel consumption. Studies are often based on simulation modes, scenarios analysis, and limited deployment experience.

A 2013 study estimated that integrated corridor management projects in San Diego, Dallas and Minneapolis would lead to annual fuel savings of 323,000, 981,000, and 17,600 gallons, respectively, correlating to 6 million, 17.6 million, and 316,800 lbs. of annual CO_2 reductions for the three sites.

1.9. Vision, goals, and objectives

With the high tourism activities, adverse weather conditions and major sport activities as well as a Regional transportation network managed by multiple independent agencies, the Region has realized the need for better coordination and management of the transportation network.

In general, the Region and agencies handle their typical recurring traffic and congestion and manage their facilities as expected without much coordination of operations with others. Given the current situation the Region is not ready to deal with unexpected events in the most efficient manner, utilize the available alternative routes, coordinate operations and work as a team to manage the event as efficiently as possible.

1.9.1. Vision

The Pinellas RIMM Project is a collaborative effort between Pinellas County Department of Public Works, Florida Department of Transportation, the City of Clearwater, Pinellas Suncoast Transit Authority, and Forward Pinellas. The Vision for Pinellas RIMM is:

"The RIMM project will measure and improve the operational performance of the Pinellas County transportation network by reducing the number and severity of traffic crashes and increase driver, passenger, and pedestrian safety. The RIMM project will collect, disseminate, and use real time transportation-related information to improve mobility, reduce congestion, and provide for more efficient and accessible transportation."

1.9.2. Goals

The primary Regional transportation mobility goals are:

- **Enhance Data Collection, Fusion, Distribution and Archiving** - Development of a Data Fusion Environment to collect and fuse Traffic Signal (Cities and County), Transit information (Pinellas Suncoast Transit Authority), Freeway (FDOT), and Arterial (City and County) information. The building blocks of any multi-agency, multi-modal integrated system is its data collection, fusion, storage and archiving applications and every goal mentioned will rely on this function one way or another. With the USDOT's request for performance measures reports, the need to automate the entire process is essential.

- **Accelerated deployment of V2X and other advanced technologies** – Deployment of CV technologies for pedestrian and intersection safety; deployment of automated vehicle shuttles within parking areas around Pier District of Clearwater Beach and Beach Drive of St. Petersburg
- **Provide Technologies to Support Connected Communities -** Deployment of technologies for a multimodal transportation system provides Americans with safe, reliable, and affordable connections to employment, education, obtain and provide healthcare, and other essential services**.** Leverage PSTA first mile/ last mile service. Deploy Automated Vehicle Shuttles
- **Reduction in the number and severity of traffic crashes and an increase in driver, passenger, and pedestrian safety** – Deployment of V2X technologies for intersection and pedestrian safety. Deploying Automated Vehicle shuttles will reduce the potential for pedestrian accidents caused by bus driver blind spots.
- **Expand Regional Smart Mobility -** Deploy a parking management system around the Clearwater Beach area and/or around major trip generators, such as hospitals, stadiums, special events, downtown business areas and more. Integrate real-time and forecast weather information system and the alerting applications within the Region. Develop a dynamic Regional Decision Support System and performance measures application to ensure optimized operational level of service.

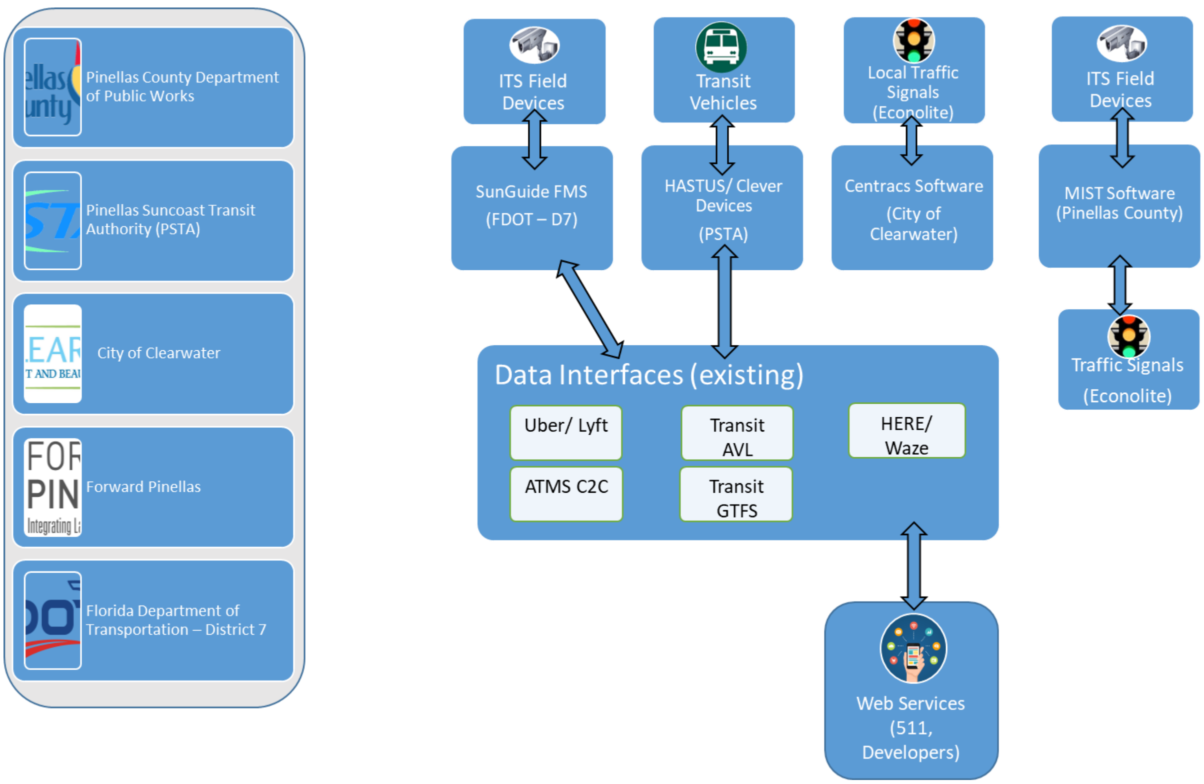


Figure 17: Existing Systems Deployed in the Pinellas County Region

1.10. Leverage Existing Investments

The Region has many investments by the local, state, and federal government to ensure travelers move efficiently and reliably within the Region. Pinellas County agencies have extensive investment in ITS ATMS/ATIS incident management and advanced traffic control, as partially shown in Figure 17.

Today, Pinellas County DPW has 54 dynamic message signs along roadways that alert drivers of upcoming incidents and allow them to make better route decisions. Traffic controllers in the Pinellas Primary Control Center monitor traffic in real time using 132 video cameras that are installed at selected intersections which allow them to activate dynamic message signs promptly. Of the 801 traffic signals in Pinellas County, 191 are managed by adaptive control systems that can automatically adjust and coordinate signal timing to improve traffic flow along critical corridors.

With the approval of a one cent gas tax dedicated to ATMS/ITS improvements and the leveraging of federal and state grants, most major roadways in Pinellas County are scheduled to have some form of ITS application installed on them by the end of the decade. Once completed the gas tax will be used for long term management and operational of the system as well as any new projects for system improvements.

The transportation projects scheduled over the next five years (2015–2019) are listed in the MPO's Transportation Improvement Program (TIP). These projects previously were prioritized through the long-range planning process and are now funded by various implementing agencies including FDOT, Pinellas County, and cities within the county.

Error! Reference source not found. illustrates the State and County roads on which technology is being used to help address congestion and the flow of traffic. Divided into three phases, the Pinellas County Intelligent Transportation Systems network, along with the projects funded by the State, will be completed by 2019.

The Pinellas Suncoast Transit Authority (PSTA) is the public transit provider in Pinellas County, Florida, providing more than 14.4 million rides a year. 187 buses serve 5,368 bus stops on 40 routes in Pinellas County including two express routes that travel to Tampa. In recent years, PSTA has developed mobility services which will be leveraged for the Pinellas RIMM project. The Mobility on Demand Sandbox project provides Paratransit services to include Uber and LYFT as options for customers. The Direct Connect services provides options for travelers to use Uber, United Taxi, and Wheelchair Transport from transit stops in the region.

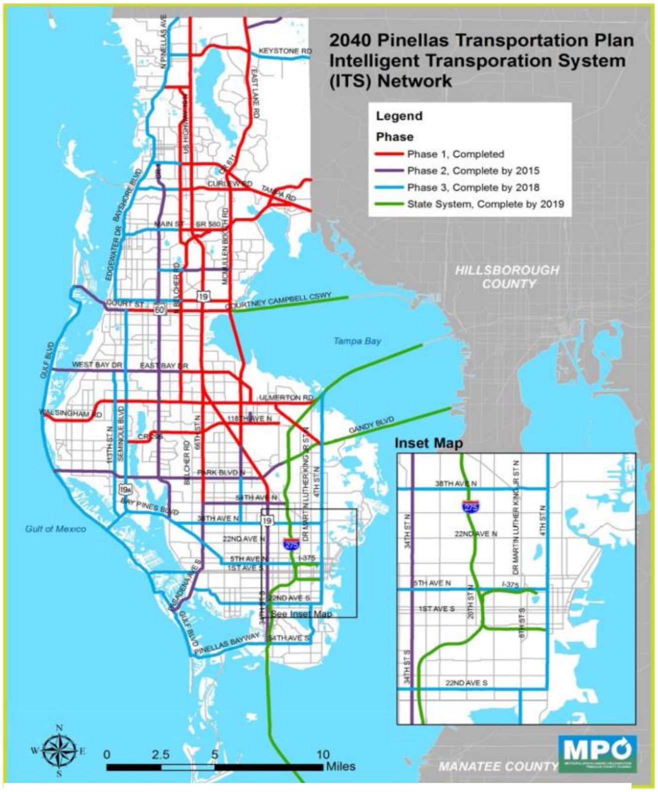


Figure 18: Planned ITS Network

Pinellas County Intelligent Transportation System (ITS) infrastructure, SmartTracs, is comprised of various technologies used to monitor traffic conditions and provide real-time information to travelers throughout the County. Pinellas County DPW manages a 24/7 centralized operations center and controls over traffic signals, CCTV, and DMS.

Closed Circuit Television (CCTV) cameras allow operators from the DPW operations center to monitor traffic conditions throughout the County. Dynamic Message Signs (DMS) are used to provide travelers with information on current traffic conditions within the County. Messages displayed on DMS include information on incidents, construction events, travel times, weather conditions and special events.

Travel times to the beach are also displayed on specific DMS signs as travelers enter Pinellas County across the Causeway.

FDOT D7 uses SunGuide software to manage the ITS infrastructure installed along the Interstate routes within the County. FDOT manages a 24/7 centralized operations center and controls over Safety Service Patrols, CCTV, and DMS.

FDOT also provides a statewide 511 system that will be leveraged to inform travelers of the conditions and special events in the region. The PSTA currently provides route and schedule information, trip planning, Where's My Bus information, and travelers can sign up to receive personalized alerts and notifications on PSTA services through the PSTA website.

Figure 19: Proposed High-Level Schedule

1.11. Schedule

We are proposing a 3-year schedule, with a 24-month planning/design/build phase followed by a 12-month Operations and Maintenance phase.

1.11.1. Phase 1: Planning Phase

For the planning phase of the project, a Concept of Operations document and Requirements document will be the primary deliverables. The Concept of Operations has already been started under our GEC contract with Kapsch, and should be completed this Fall. Following the FHWA Systems Engineering process, a Project Management Plan (PMP) and Systems Engineering Management Plan (SEMP) will also be provided.

1.11.2. Phase 2: Design Phase

Our experience has shown that a hybrid waterfall and agile process is appropriate for projects which have well know elements and less known elements. For this phase, the well-defined elements which our Systems Integrator has previous experience deploying will be identified and designed. This phase will also identify the elements which will be design & developed during the Agile Deployment phase. All elements designed during the Design phase 1 will be developed during the Phase 3 integration build.

1.11.3. Phase 3: Design-Build Phase (Agile Deployment)

Since some of the data used for the system will be new, an agile development process will be followed. We currently expect three iterations of the build to be designed, prior to a final Integration build which will be used for the Systems Acceptance Test (SAT). Our goal is to have an operational system within 18 months after the planning phase is complete.

1.11.4. Phase 4: Testing and System Acceptance

Testing is an activity embedded as an integral part of our software and system development methodology as well as final deployment and start of operations. Implementation includes unit coding, unit testing, unit integration, and integration testing. The final step in testing, once the Unit and Integration testing is complete is the System Acceptance Testing (SAT). The SAT plan and scripts will be developed by the consultant team, and reviewed and approved by the stakeholders. The SAT will be completed by a group identified by the stakeholders to test the system and "accept" it for operations.

1.11.5. Phase 5: Operations and Maintenance Phase

Following the ICM program's model, we are proposing a 6-month "soft launch" of the system to test and modify the operational processes prior to a 12-month full O&M phase.

1.12. Support of USDOT ITS Initiatives

The Pinellas RIMM project will support the ITS JPO's mission to Conduct an ongoing intelligent transportation system program to research, develop, and operationally test intelligent transportation systems and to provide technical assistance in the nationwide application of those systems as a component of the surface transportation systems of the United States.

1.12.1. Accelerating Deployment

Through testing of new technologies and operational strategies, the Pinellas RIMM project will assist USDOT with this research area. Pinellas County will assist USDOT through lessons learned from this deployment and providing USDOT with support of these activities.

1.12.2. Automation

Automated vehicles are those in which at least some aspect of a safety-critical control function (e.g., steering, throttle, or braking) occurs without direct driver input. Automation has the potential to significantly impact our driving safety, personal mobility, energy consumption, operating efficiency, environmental sustainability, and land use. Pinellas RIMM will deploy technologies that

1.12.3. Connected Vehicles

Connected Vehicle Program works with state and local transportation agencies, vehicle and device makers, and the public to test and evaluate technology that will enable cars, buses, trucks, trains, roads and other infrastructure, and our smartphones and other devices to "talk" to one another. For the Pinellas RIMM project, we will deploy several technologies to support the USDOT initiative to include deployment of Roadside Units (RSU) and On-board Units (OBU) to test deployment of safety applications, utilization of Ped Safety, SPaT, and TSP applications.

1.12.4. Emerging Capabilities

The Pinellas RIMM project will demonstrate the use of several new and innovative technologies that will support the USDOT effort in identifying new technologies and practices that we believe will improve the transportation services within the County.

1.12.5. Enterprise Data

The basic building blocks of the Pinellas RIMM Project is data, through the development of our Data Warehouse and Data Mart we will integrate large amounts of data that are already generated by many of the systems within the county, but are not currently fully utilized. Using the Decision Support System, the Performance Measures, the Mobility Mobile App, and the Data Mart Data Feed the agencies, travelers and developers will have access to this large data set being developed through the Data Fusion Environment.

1.12.6. Interoperability

The Pinellas RIMM Project will ensure effective connectivity among devices and systems. Most the systems deployed and data integrated for Pinellas RIMM will use ITS and industry standards to ensure interoperability. Beginning with the data interfaces, we will use Center-to-Center and TMDD standards where appropriate. Transit Route and Schedule data is provided using the GTFS standard. Our Data Mart Data Feed will be an XML based system that will allow developers to easily consume the data provided for development of their own applications and systems.

2. STAFFING DESCRIPTION

2.1. Organization and Key Personnel

Figure 20: Pinellas RIMM Organization Chart

The organization provides a high-level structure for the management and implementation of this project. Participating stakeholder agencies on the steering committee for this project include:

2.1.1. Key Personnel

- **Ken Jacobs, PE** – Project Manager, Pinellas County Department of Public Works
- **Heather Sobush, AICP** – Planning Manager, Pinellas Suncoast Transit Authority
- **Ronald Chin, PE** – District 7 Traffic Operations Engineer, Florida Department of Transportation
- **Paul Bertels** – Traffic Operations Manager, City of Clearwater
- **Chelsea Favero, AICP -** Principal Planner, Forward Pinellas

2.2. Primary Point of Contact

The primary point-of-contact for our proposal is:

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