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## *Executive Summary*

Pinellas County wishes to offer this application and proposed project to demonstrate congestion reduction along a major thoroughfare within the Tampa-St Petersburg Urban Area. The County has the ability to leverage several high technology, state of the art, construction and research projects that have been completed as a springboard to creating a truly integrated ITS multimodal corridor in a relatively short time frame. This multi-phase project also provides the means to implement, test, evaluate and measure the impacts of congestion pricing on a congested arterial roadway typical to most major metropolitan areas.

US Highway 19 runs the entire length of the County and is considered the spine for both transit and vehicular travel. This project brings together the major Congestion Reduction Demonstration Initiative (CRDI) components including Enhanced Transit Services, Intelligent Transportation Systems (ITS) technology and innovative arterial congestion pricing measures.

The Enhanced or Premium Transit Services would include variable transit fare pricing policies, queue jump lanes for buses through intersections, transit signal priority, reduced bus headways, upgraded/branded, hybrid buses, Wi-Fi Internet Access for bus riders and real time transit information kiosks. With the implementation of these transit improvements it is estimated that the ridership of Route 19 could increase about 20-40% during peak periods and consequentially divert approximately 1,800 peak period (both morning and evening), or 500 peak hour, drivers from the roadway. It is estimated that diversion of these trips to transit will reduce the cost of delay on US 19 by nearly \$1,700,000 per year and will reduce the cost of fuel wasted due to delay by nearly \$900,000 per year.

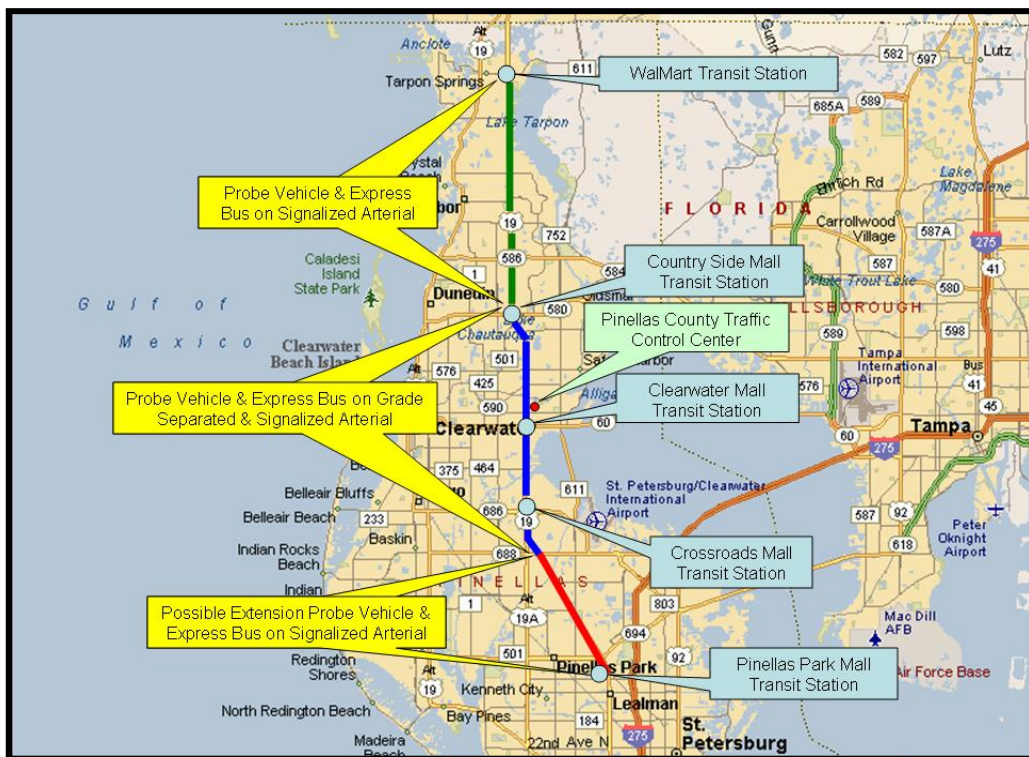
In conjunction with the transit aspects of the application the project also includes additional implementation of ITS congestion reduction strategies and technologies. These strategies include using a "Jump-the-Queue" lane (conversion of an existing continuous right turn lane) to demonstrate congestion pricing on an arterial. It is estimated that diversion of 500 trips (Level of Service B) to the Jump-the-Queue Congestion Pricing lane each peak hour will result in an additional cost of delay savings of about \$1,700,000 and an additional cost of fuel savings of about \$900,000 per year. In addition to the travel savings, toll revenue from the Congestion Pricing Demonstration could be as much as \$1,400,000 per year depending on pricing policies implemented for the demonstration.

The combination of the Premium Transit Service, Jump-the-Queue Lanes and Congestion Pricing Strategies proposed within the Pinellas County Congestion Pricing Demonstration are nearly \$3,400,000 in annual delay savings and \$1,750,000 savings in fuel.

Through previous projects US Highway 19 already has a fully built Advanced Traffic Management System (ATMS) including the nation's largest installation of the FHWA sponsored Adaptive Control Software (ACS). In addition, full CCTV camera and DMS coverage is available for incident detection and traveler information. An extensive fiber optic backbone network has been build to provide the communication infrastructure for the ITS. The new project will utilize this existing investment while adding wireless communications to track probe vehicles along the arterial, display arterial travel times and integrate transit service into the ACS software. The transit components would also be integrated with the ITS technology to provide toll transponders, variable lane use control signing, automated video enforcement and wireless two-way data communications to the transit vehicles.

All the proposed transit and traffic operational improvements require a means to communicate between the vehicles, the roadside, the intersections, the toll collection/enforcement equipment and the various control centers. Pinellas County plans to use new innovative broadband wireless technologies including 4.9 GHz dedicated by the Federal Communications Commission (FCC) for Public Safety use, to provide additional communications infrastructure. In addition the project also includes plans to integrate 5.9GHz technology dedicated to ITS use for vehicle to roadside communications. The advantages of deploying the 5.9GHz along US Highway 19 allows the opportunity to test and evaluate the capabilities of probe vehicle travel time data and other vehicle to roadway data transfer while building a platform that can be used towards future enhancements of ITS and Vehicle Infrastructure Integration (VII) initiatives.

This project has both broad base political and jurisdictional support. Pinellas County's Metropolitan Planning Organization (MPO) has a standing ITS subcommittee that has been utilized to develop project needs. The ITS subcommittee provides representation from all subject areas of ITS including transportation, transit and emergency services. The MPO has integrated transit and ITS policies for relieving traffic congestion as part of their Long Range Transportation Plan (LRTP). The Pinellas County's Board of County Commissioners has shown on-going support for the implementation of a Countywide ATMS/ITS system as shown by their approval of a dedicated one-cent fuel tax. The entire Tampa-St Petersburg Urban area has the continued support of Congressman Young for innovative efforts toward the overall congestion management issues and high technology research.



**Figure 1: Pinellas County Location Map**

The following pages will provide more detail relative to the proposal including a phased implementation approach that provides flexibility in both technologies and strategies. We believe that this project meets the goals of the CRDI and would be a superior location to demonstrate integrated arterial level ITS multimodal congestion management. This location would also provide a platform as an additional long term testing of VII, ITS, ATMS and transit related technology development.

## ***Pinellas County Congestion Reduction Demonstration Initiative Project***

### ***(i) Introduction***

The Pinellas County Congestion Reduction Demonstration involves integration of complimentary services to address congestion on US 19 in Pinellas County. The demonstration will be divided into two phases, as follows:

- Phase 1a: Demonstration of Premium Transit Service on US 19 including Jump-the-Queue Lanes from Tarpon Road to Evans Road and on regular lanes from Evans Road to Ulmerton Road or 70<sup>th</sup> Avenue North. This phase will also test pricing impacts on transit ridership and use transit signal priority to maintain and possibly reduce headways without adding buses.
- Phase 1b: Demonstration of congestion pricing of Premium Transit Services. Additional transit vehicles will be added, transit prices will be lowered during congested periods to attract more riders and transit vehicles will use the Jump-the-Queue Lanes improve travel time reliability.
- Phase 2b: Demonstration of personal vehicle congestion pricing using the Jump-the-Queue Lanes on US 19 from Tarpon Road to Evans Road. The Premium Transit Services pricing demonstration will remain in operation during the personal vehicle congestion pricing demonstration.

This application provides the following information to support selection of the Pinellas County Congestion Reduction Demonstration for Federal funding.

- Description of key participating parties along with roles and responsibilities;
- Description of congestion in the Tampa Bay region and Pinellas County along with the comprehensive congestion mitigation efforts currently in progress in the County. This section will also show how the various components of the County's congestion mitigation programs will work synergistically with the demonstration proposed in this application;
- Description, strategies and impacts of the proposed Jump-the-Queue Lanes personal vehicle pricing demonstration;
- Description, strategies and impacts of the proposed Premium Transit Service and transit pricing demonstration;
- Description of technologies that are incorporated into the Jump-the-Queue Lanes and Premium Transit Service demonstration;
- A summary of projects that will be accelerated because of the Pinellas County Demonstration;
- An estimation of travelers affected daily by both Pinellas County Demonstration;
- A summary of the technologies that have been implemented in the Tampa Bay region and in Pinellas County that create the framework to enable the Pinellas County Congestion Reduction Demonstration to be pursued at this time;
- A summarized project schedule and milestones;
- A cost estimate along with Federal and Local funding support needed to undertake the demonstration; and,
- Contact information

***(ii) Participating Parties***

There are both public sector and private sector parties to this proposed project. The public sector agencies are Pinellas County, Pinellas Suncoast Transit Authority (PSTA), and Florida Department of Transportation (FDOT). The following table summarizes the roles and responsibilities of each agency and, in the case of Pinellas County, of departments.

**Table 1: Pinellas County Demonstration - Partners**

<b>Organization</b>	<b>Role(s)</b>	<b>Responsibility</b>
Pinellas Co. Public Works Dept. – Traffic Operations Div.	Grant recipient Project Manager Roadway & ITS Project Manager	<ul style="list-style-type: none"> <li>• Project management</li> <li>• Funding &amp; contract management</li> <li>• Manage subcontracts for design and construction of roadway improvements</li> <li>• Manage subcontracts for design, implementation &amp; integration of ITS improvements</li> </ul>
Pinellas Suncoast Transit Authority (PSTA)	Transit Project Manager	<ul style="list-style-type: none"> <li>• Manage transit elements of project</li> <li>• Manage subcontracts for design &amp; implementation of transit enhancement</li> <li>• Operate &amp; maintain transit elements</li> </ul>
Florida Dept. of Transportation (FDOT)	Regulatory & Approval Authority	<ul style="list-style-type: none"> <li>• Review &amp; approve environmental documents</li> <li>• Review &amp; approve roadway design documents</li> <li>• Review &amp; approve revised signing &amp; markings</li> <li>• Review &amp; approve travel time messages on dynamic message signs</li> <li>• Ensure consistency with Tampa Bay Regional ITS Architecture</li> </ul>
Pinellas County MPO ITS Committee	Project Steering Committee	<ul style="list-style-type: none"> <li>• Monitor progress</li> <li>• Resolve policy issues</li> <li>• Champion project with respective agencies</li> </ul>
Pinellas County Sheriff's Dept., Emergency Management Dept. & Information Technology	Technical Advisory	<ul style="list-style-type: none"> <li>• Provide input on requirements, design, &amp; evaluation integration of communication networks including 2.4 GHz WiFi, 4.9 GHz, 5.8 GHz and 5.9 GHz wireless networks.</li> </ul>
WalMart	Transit Station	<ul style="list-style-type: none"> <li>• Fund transit station in Tarpon Springs</li> <li>• Construct transit station in Tarpon Springs</li> </ul>
Boulder Developers & Weingarten, Associates	Transit Center	<ul style="list-style-type: none"> <li>• Fund transit center at Town Center in the vicinity of the Crossroads Mall near US 19 and East Bay Drive</li> <li>• Construct transit center at Town Center in the vicinity of the Crossroads Mall near US 19 and East Bay Drive</li> </ul>

***(iii) Comprehensive Congestion Reduction Strategy***

According to the Texas Transportation Institute's (TTI) most recent report (2005 data) on national congestion, the Tampa-St. Petersburg area is the fifth most congested of the 25 urban areas between one million and three million in population. TTI rates Tampa-St. Petersburg as follows:

- Average Delay per Traveler: **Much higher than average**

- Travel Time Index: **Higher than average**
- Total Delay: **Much higher than average**
- Growth in Delay per Traveler: **Slower than average**
- Growth in Total Delay: **Much higher than average**

TTI further quantifies the congestion problem in the Tampa-St. Petersburg area as follows:

- Travel Delay: **56,203,000 hours/year**
- Excess Fuel Used: **35,281,000 gallons/year**
- Congestion Costs: **\$1,005,000,000/year**

In 2005, the Pinellas County Metropolitan Planning Organization (MPO) computed costs of congestion in Pinellas County, a portion of the Tampa St. Petersburg region, as follows:

- Individual Delay: **46 hours/year**
- Individual Congestion Cost: **\$775/year for lost time and excess fuel.**
- County Delay: **22,085,000 hours/year**
- County Fuel Wasted: **12,512,000 gallons/year**
- County Congestion Costs: **\$371,950,000/year**

Updating the Pinellas County statistics using TTI cost factors and current fuel prices of \$3.00 per gallon, the annual congestion cost in Pinellas County is **\$428,993,000** per year. This compares to a 2008 overall County budget of \$2,000,000,000 and a transportation capital improvement program of \$67,700,000.



**Figure 2: Typical Arterial Congestion in Pinellas County**

There are many causes of congestion in Pinellas County:

- Large and growing population, 938,505 people growing at 6% per year;
- Employment expected to grow by 30% by 2025;
- Two of three major employment centers in the County are largely accessed by arterials rather than freeways;
- Coastal attractions and weather account for 4,800,000 winter and spring visitors per year;
- Small geographical area, high population density: 3,330 persons per square mile;
- Nearly all freight delivery is by means of trucking;
- US 19, the only north-south route serving the entire county, is primarily a signalized arterial; and,
- Limited ability to add roadways or lanes to existing routes: 1.01% added capacity per year on average.

Pinellas County residents have historically agreed that transportation is the single most important challenge facing the County and the region. This acknowledgement has been expressed in several tangible ways:

#### At the Polls

On March 13, 2007, Pinellas County residents voted to extend the “Penny for Pinellas” one-cent sales tax for an additional ten years from 2010 to 2020. This measure was first voter approved in 1989 and then again approximately ten years later. This tax is largely dedicated to continued funding for projects such as bridges, roads, parks, drainage and an expanded jail facility.

#### Public Opinion Surveys

The latest survey (2005) conducted in Pinellas County revealed the following conclusions relative to funding priorities:

- 73% of the respondents stated Road Transportation/Traffic Flow was very important or important, second only to Public Safety Services at 74%;
- Single most important issue for Pinellas County was Road Traffic/Transportation;
- 72% thought flow of traffic on major county roads was poor or fair;
- 36% did not know if they were satisfied or not with the bus system operated by the Pinellas Suncoast Transit Authority;
- High priority ratings for allocation of funds to improve transportation included:
  - Improving the Timing of Traffic Signals – 63%
  - Building Vehicle Overpasses at Major Intersections – 58%
  - Widening Existing Roads – 49%
  - Single option most personally beneficial would be the improvement of timing of the traffic signals – 38%;
- 52% felt that the public transportation system was very important or important;
- 47% would strongly support a new Toll Expressway; and,
- 91% commuted to work by private vehicle, 2% commuted via bus. Those commuting 16-30 minutes each way on the 2005 Survey were 32% of the total response.

#### Modal Choice

Mass transit ridership has increased substantially on the Pinellas Suncoast Transit Authority (PSTA) and Hillsborough Area Regional Transit (HART) buses. Transit ridership is up nearly 10% according to PSTA’s 2005-6 counts. This was partly due to reducing headways on Route 19 in the US 19 corridor.

The Pinellas County Board of Commissioners, the Metropolitan Planning Organization (MPO), and the PSTA Board of Directors have strong records of awareness of and action to address congestion. Recently, these actions have included:

#### The Pinellas County Board of Commissioners

- Passed a 20-year one cent gas tax for improved transportation system operations; and,
- The Board of Commissioners approves all funding programs and projects so all of the congestion programs and projects have had formal review and approval by the full Board.

#### The Pinellas County Metropolitan Planning Organization (MPO)

Listed below are selected transit and intelligent transportation system related objectives from the Pinellas County Metropolitan Planning Organization’s 2025 Long Range Plan adopted in December 2004:

- Objective 1.3: Relieve traffic congestion on US Highway 19 while minimizing the impacts of development projects within the corridor to the fullest extent possible.
- Objective 1.4: Mass transit use shall be encouraged and promoted in order to increase ridership while reducing the number of single-occupant vehicles on the county’s roadways and as a primary means of travel for the transportation disadvantaged population.
- Objective 1.5: Develop a long range inter-county and regionally accessible transit system in Pinellas County that features advanced technology express service to intermodal transportation facilities, major employment centers, recreational points of interest, tourist destinations and significant commercial activity.
- Objective 1.6: Protect roadway capacity, optimize operating efficiency, enhance safety of transportation facilities and reduce congestion through the application of Intelligent Transportation System (ITS), system management and demand management strategies.

Congestion reduction strategies in Pinellas County have focused on five “Ts”: transit, technology and operations, telecommuting, tolling/pricing, and trails

Activities within each of the strategies include:

Transit:

PSTA is working to improve the efficiency and effectiveness of the transit system. PSTA is working on a variety of strategies to increase ridership. Specifically, PSTA has been working closely with neighboring transit agencies to support inter-county transit service, including:

- Regional connection points;
- Transfer centers that are maintained by PSTA in Tarpon Springs, Oldsmar and Clearwater;
- Provision of passenger benches and shelters, route and schedule information, shared bus stop locations, and planning requirements.
- Passengers can also utilize a new monthly bus pass for seamless travel between Pinellas and Hillsborough Counties. The new “Passport” provides unlimited travel on PSTA and HARTline routes and inter-county connections via Downtown Tampa Express Routes 100X and 300X.

Table 2, below, shows the overall health of the PSTA system. It shows routes with over 500,000 annual passengers as well as passenger growth.

**Table 2: PSTA Riders - Major Routes**

Route No.	Proposed BRT Corridor?	Connect to US 19 CRDI Corridor?	Riders Per Rev. Hr FY 2005/06	Rev. Miles FY 2005/06	Total Ridership FY 2005/06	Total Ridership FY 2004/05	% Change
18	Yes	Yes	28.33	529,645.80	1,122,822	1,025,939	9.44%
<b>19 (US 19)</b>	<b>Yes</b>	<b>Yes</b>	<b>21.29</b>	<b>943,809.30</b>	<b>1,323,655</b>	<b>1,103,271</b>	<b>19.98%</b>
52	Yes	Yes	23.85	619,582.20	992,384	909,013	9.17%
59	Yes	Yes	18.71	454,274.20	585,059	546,332	7.09%
60	Yes	Yes	36.32	167,992.20	510,637	479,010	6.60%
<b>Total All Regular Routes</b>			<b>19.34</b>	<b>8,054,433.30</b>	<b>10,736,713</b>	<b>9,852,737</b>	<b>8.97%</b>

PSTA has been applying technology to enhance transit service. These technologies include:

- Automatic vehicle location to track bus performance relative to schedule;
- On board stop enunciators;
- Automatic fare card readers; and,
- Automatic passenger counting technologies.

PSTA has been working closely with private property developers along transit corridors to attain private support for transit stations and park and ride lots. Two recent examples include:

- Wal-Mart is donating land and construction for a transit station near Tarpon Road in Tarpon Springs. This is the transfer point between the Pasco County transit system and PSTA.
- Boulder Developers is donating land and construction costs for a new transit station near US 19 and 70th Avenue North at a location called Central Plaza. This location will provide a point of transfer from the US 19 Route 19 to east-west routes in the central part of Pinellas County and will provide a connection to Hillsborough Area Regional Transit with express service to Tampa

The impacts of the PSTA recent activities have been very promising and the County transit system has grown significantly recent years. Several examples include:

- Total ridership increased from 8.1 million in FY 1994/95 to 11.0 million (projected) in FY 2005/06;
- Bus headways have been improved on major routes to 20 minutes during peak periods;
- Total bus fleet has increased to 200; and,
- The PSTA budget has increased from \$26 million to \$48 million.

Other activities implemented by PSTA to support continued growth of a quality transit system include:

- A state-of-the-art operations/administration facility was constructed to provide high-quality transit services well into the future;
- Ridership related to special events has increased substantially;
- The majority of system ridership is concentrated on a few routes. Routes that fall below 75 percent of the system averages for passenger productivity are monitored for two consecutive quarters. Routes are thus monitored for at least six months before any adjustments are made, such as headway improvements or the consolidation of fixed routes;
- PSTA continues to explore alternative service delivery options, including point-to-point shuttles, service routes, small bus technology, community-based transit routing and commuter vanpools;
- Interagency cooperation has resulted in transit links to multiple counties, and PSTA is very proactive in bringing together all transit partners in the region;

**Synergy:** Enhanced or Premium Transit Service (BRT) on US 19 is a major component of the Pinellas County Congestion Reduction Demonstration. Reducing bus headways from 20 minutes to 10 minutes, upgraded buses, Wi-Fi Internet access for bus riders, transit travel time signs and other enhancements to Route 19 are a major part of the Demonstration. Once the service has been established, further use of pricing strategies to attract additional riders will be employed to optimize total riders.

#### Telecommuting

**Telework Tampa Bay (TTB)**, a partnership between the Tampa Bay Regional Planning Council (TBRPC) and the Bay Area Commuter Services, Inc. (BACS) kicked off in February 2004. The

Telework Tampa Bay program is designed to develop telecommuting programs as pilot projects with area businesses, both public and private sector. Examples of TTB programs include:

- Promotes telework/telecommuting within Pinellas and Hillsborough counties;
- Educates businesses and employees on the benefits of telework;
- Recruits Tampa Bay employers to host pilot telework programs within their worksites;
- Assists selected employers in setting up and evaluating their companies telework programs; and,
- Telework Tampa Bay offers one-on-one expertise, design and implementation of the program, development of telework policies and agreements, marketing to upper and middle management, sample documents and case studies, program evaluation guidelines and strategies, and training sessions and focus groups;

**Synergy:** TTB and TBRPC will be resources for recruiting volunteers to test vehicle probe technologies in the US 19 corridor. These same volunteers will have opportunity to participate in the intersection queue jump lanes during the last year of the Pinellas County Congestion Reduction Demonstration. First priority for use of the queue jump lane, after transit, will be carpools and van pools. Second priority will be for single occupant vehicles. Carpools and vanpools registered with TTB and TBRPC will be first choice to for access to the queue jump lane but will still have to pay all or a portion of the toll according to the ultimately selected pricing policy.

Technology & Operations

Pinellas County has made significant advances in the use of technologies to manage traffic and reduce congestion. The first step in centralizing traffic control along ITS corridors was to reach agreement with cities in the county that traffic signals and ITS Devices on all major arterials would come under the control of the Pinellas County Public Works Department, Traffic Signal Division. All cities have agreed to this central countywide control with the exception of St. Petersburg who will continue to monitor their own signalized corridors.

Transportation providers in Pinellas County have made a significant investment in technology for several years. Table 3 lists technology applications that are in various stages of implementing in Pinellas County.

**Table 3: Pinellas County - Technology to Reduce Congestion**

Technology and Management Topic	Implementation Status and Comments
Innovative incident detection and management strategies	County Traffic Control Center (TCC) monitors traffic conditions and supports incident and emergency management. The TCC is staffed during peak traffic periods.
Parking management tied to transit service	Dynamic message sign (DMS) on major approach to beach parking areas in Clearwater. DMS will be used to advise beach users of beach parking availability and locations of alternate parking with shuttle service to the beach.
Managed lanes	Continuous right turn lane on US 19 will be managed for buses and right turning vehicles. Photo enforcement will be used to assist with enforcement.
Signal priority systems for buses	Existing AVL/GPS on PSTA buses will used to request signal priority for BRT routes using dedicated short range communication technology.
Real-time travel information	PSTA plans to use real time bus arrival signs and major stations on BRT routes and a web site for transit users. Interactive scheduling has already been implemented. PSTA tracks vehicle locations from their operation center.
Advanced traveler information systems	DMS are being implemented on ATMS routes. US 19 will gather travel times using vehicles as probes. Project will provide platform that will support 5.9 GHz being developed to support Vehicle Infrastructure Integration (VII).

Technology and Management Topic	Implementation Status and Comments
Expansion of transit capacity	Additional transit vehicles, Park-N-Ride lots, transfer stations will be implemented with the project are planned for BRT corridors to reduce bus headways and increase ridership.
Advanced, adaptive traffic signal control	Adaptive signal control is implemented in the US 19 and SR 60 corridors and additional segments are funded and will be implemented over the next 10 years.
Integrated corridor management	A demonstration project is planned for US 19 to optimize both transit and general traffic using managed lanes, signal priority, adaptive signal control and real-time traveler information.
Contactless fare collection	PSTA is planning to implement Contactless fare collection on BRT corridors.
Technologies which support pricing strategies.	A demonstration project is being planned using 5.9 GHz technology to support Vehicle Infrastructure Integration (VII). These technologies could be used for pricing strategies in the future.

**Synergy:** The Pinellas County Congestion Reduction Demonstration will take advantage and enhance the technologies already in place within the US 19 corridor. Using enhanced wireless communication to probe vehicles, travel times on US 19, a mostly signalized arterial, will be measured. Travel time information will be used as input to implement pricing policies. The project will also provide real-time travel times to automobile drivers and to bus arrival and travel times to transit riders. To date Pinellas County has expended \$11.3 million on ITS technology to address congestion of state roads, including US 19. An additional \$11.6 million is already programmed toward countywide ITS/ATMS projects.

Tolling/Pricing:

Pinellas county residents are not overwhelmingly in favor of tolling. In fact only 47% would strongly support a new toll expressway.

**Synergy:** The Pinellas County Congestion Reduction Demonstration will provide a means to test acceptance and benefits of congestion pricing based tolling on US 19, the highest volume non-freeway in the County.

Trails

The County has implemented county wide grade-separated bike and hiking trail system. This system has been design to improve recreational opportunities and to improve safety for trail users by separating trail users from roadway users where ever possible.

An example of the county’s commitment to the trail network is the Pinellas Trail. The Fred E. Marquis Pinellas Trail is a linear park and recreation trail currently extending from St. Petersburg to Tarpon Springs. The County's Parks & Recreation Department is responsible for the Trail's maintenance and operating costs. The Trail now extends from northernmost Pinellas County to the southern end of the county, offering Pinellas County citizens a diversified recreational and transportation facility. A total of 701,675 users accessed the Pinellas Trail in 2006, with a monthly average of 58,472 users.

***(iv) Congestion Pricing Measures & Affected Areas***

This section describes the “Jump-the-Queue Lanes” personal vehicle measures and pricing strategies to reduce congestion. Section (v), “Transit Services,” will describe Premium Transit Service enhancements,

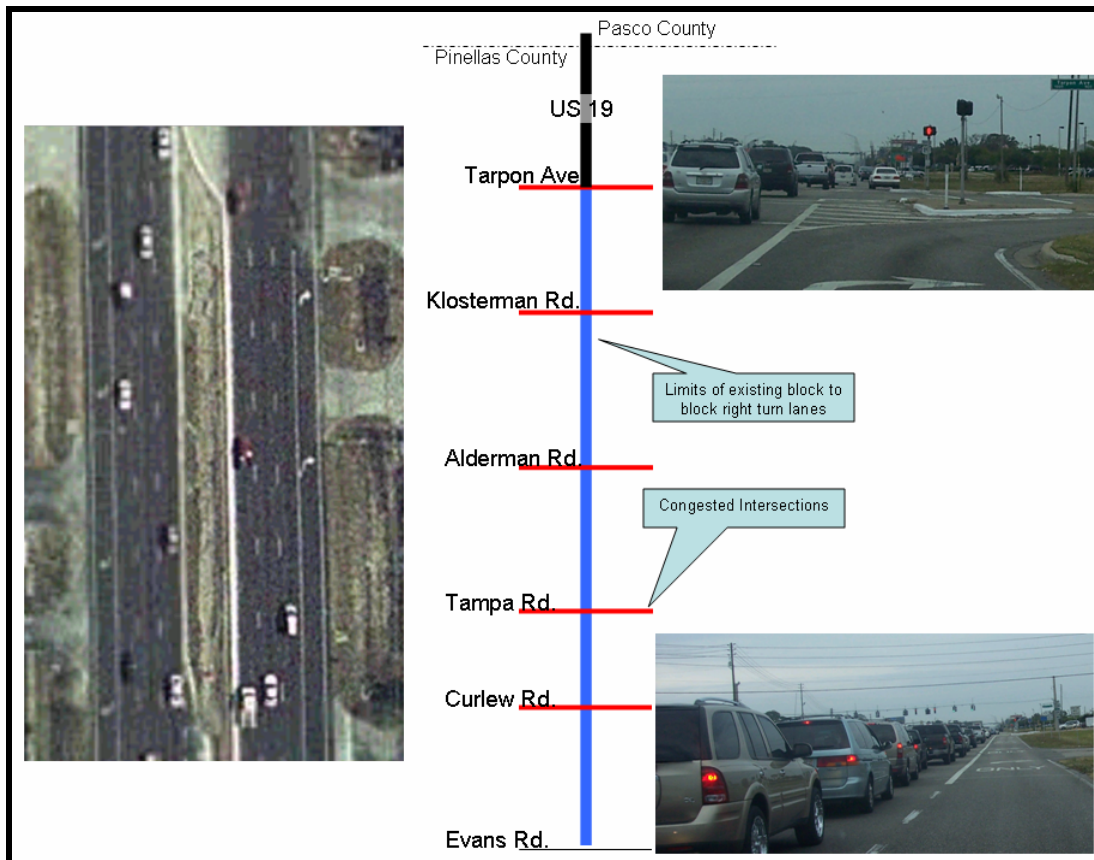
pricing strategies and congestion impacts. Section (vi), “Use of Technology,” will describe probe vehicles and others technologies that will support the Jump-the-Queue and Premium Transit Service.

This section provides a description of Phase 2 of the Pinellas County Congestion Reduction Demonstration. Phase 1 of the demonstration is described in Section (v). This section describes:

- US 19 Jump-the-Queue Lanes Description
- US 19 Jump-the-Queue Pricing Strategies
- US 19 Jump-the-Queue Congestion Pricing Impacts

US 19 Jump-the-Queue Lanes Description

The Pinellas County Congestion Reduction Demonstration will utilize “Jump-the-Queue” lanes at heavily congested intersections to allow transit vehicles and other vehicles to bypass long queues. Most of the infrastructure for the Jump-the-Queue Lanes will be implemented with Phase 1 of the demonstration. Auxiliary right turn lanes and congestion pricing will be implemented in Phase 2.



**Figure 3: US 19, Tarpon Road to Evans Road with Continuous Right-Turn Lanes**

Figure 3 shows the 8.75 mile north section of US 19 from Tarpon Springs Road to Evans Road. This section of US 19 has average daily traffic of 75,000 vehicles with intersections are experiencing Level of Service F for three hours during morning and three hours during evening peak period. This section of US 19 will be the focus of the congestion pricing strategies for the Pinellas County Congestion Pricing Demonstration. The aerial view on the left shows the typical right turn lane configuration. The lower picture at the right shows typical evening peak period congestion at any of the congested intersections

with the right turn lane approaching the intersection empty of traffic. The upper picture on the right shows typical channelization at the congested intersections that forces traffic in the right turn lanes to turn right. The Pinellas County Congestion Reduction Demonstration will modify the intersection channelization at the congested intersections to allow:

- Phase 1: Premium Transit Service to use the right turn lane to “Jump-the-Queue”, and
- Phase 2: Personal vehicles to use the right turn lane to “Jump-the-Queue” during peak periods.

A more complete description of Premium Transit Service and Premium Transit Service pricing strategies is contained in the next section of this application.

In order to fully implement the Jump-the-Queue lane for personal vehicles, it will be necessary to add right turn lanes at each of the congested intersections. The Figures 4 and 5 show an example before and after schematic design. Everything in Figure 5 will be in place during Phase 1a and 1b except the supplementary right turn lane.

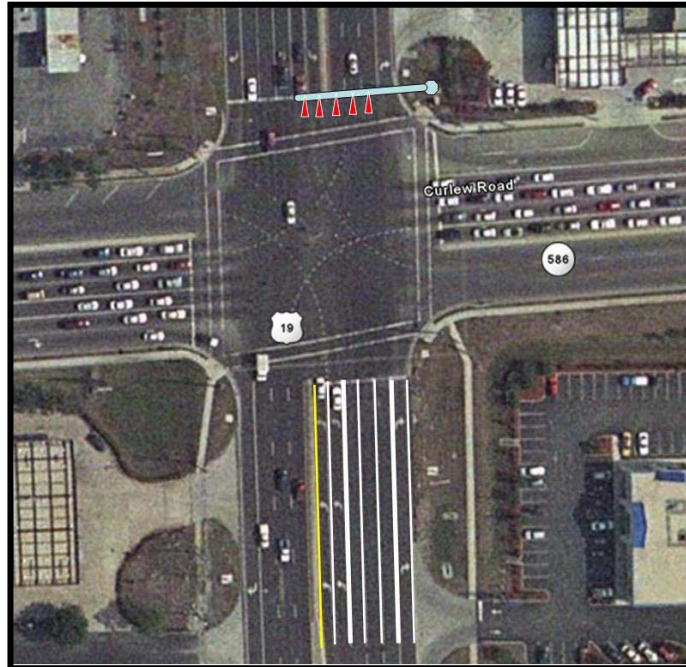
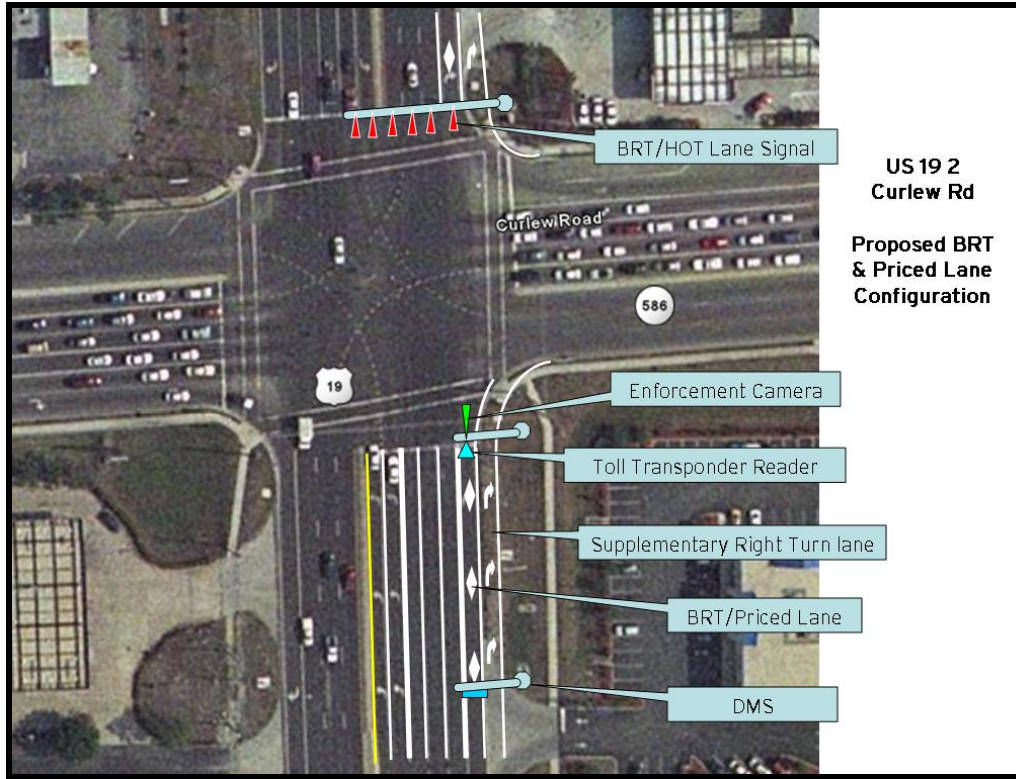


Figure 4: US 19 at Curlew - Existing Conditions



**Figure 5: US 19 at Curlew – Proposed Jump-the-Queue Lane Configuration**

Technologies (such as dynamic message signs (DMS), toll readers, and enforcement cameras) required to operate the Jump-the-Queue Lane will be described in the Use of Technology section of this application.

#### *Jump-the-Queue Lanes Congestion Pricing Strategies*

PSTA Route 19 transit vehicles will be given first priority access to the Jump-the-Queue Lanes.

Initially the Pinellas County Congestion Reduction Demonstration will use transponders specifically for this project that do not have interoperability with other toll roads in the Tampa Bay region. As the Demonstration progresses, it may be possible to allow generic toll transponder access.

Carpools and vanpools will be given preferential access to the Jump-the-Queue lanes and will pay the applicable tolls for use of the lane. When demand for the Jump-the-Queue lane approaches limits where travel time advantages are being lost, access will be limited to registered carpool and vanpool vehicles.

Personal, single-occupant vehicles will also be able to use the Jump-the-Queue lane to bypass congestion. Personal vehicles will be tolled for the right to use the Jump-the-Queue lane.

Pricing strategies will be based on congestion, travel time, and time saving by using the Jump-the-Queue lane. The more time saved, the higher the price. The less time saved, the lower the price. During peak periods, this section of US 19 can take 30 minutes or longer in travel time, in spite of the 50 mile-per-hour speed limit. It is hoped that travel times for vehicles using the Jump-the-Queue lane will be 10 to 12 minutes during peak periods. Pricing strategy will also take into consideration the need to keep the lane flowing at a high level of service to support Premium Transit Service. One scenario for pricing policy would be to use a value of time of \$12.00 per hour. A travel time savings of 20 minutes would suggest the upper limit on the pricing might be \$4.00 for a vehicle traveling the entire corridor under this scenario.

Peak period pricing would be charged per intersection the Jump-the-Queue lane is used. If the toll were set at \$4.00 for the corridor, a fee of \$0.80 would be charged for each of the 5 congested intersections or, if congestion significantly varies, the rate could also be varied at each intersection.

Jump-the-Queue Lanes Traffic Congestion Impacts

The average daily traffic on US 19 is 75,000 vehicles per day. With implementation of the Jump-the-Queue Lanes pricing strategies, annual savings due to delay is estimated to be over \$1,700,000 per year or just under 13% compared to existing conditions. Similarly, the annual savings in fuel costs is estimated to be nearly \$900,000 per year. Table 4, below, provides additional details about the congestion reduction benefits of the Jump-the-Queue Lanes element of the Pinellas County Congestion Reduction Demonstration.

**Table 4: Jump-the-Queue Lane Congestion Impacts**

	Existing	Demo	Impacts
<b>Characteristics</b>			
Regular Lanes Each Direction	3	3	N/A
Continuous Right Turn Lanes Each Direction	1	0	N/A
Jump-the-Queue Lanes Each Direction	0	1	N/A
Average Daily Traffic Regular Lanes	75,000	72,000	(3,000)
Average Daily Traffic Jump-the-Queue Lanes	-	3,000	3,000
Total Average Daily Traffic	75,000	75,000	-
<b>Delay Impacts</b>			
Delay per vehicle regular lanes (sec)	225	198	(27)
Delay per vehicle Jump-the-Queue Lanes (sec)	225	15	(210)
Delay per day, regular lanes (hrs)	4,688	3,960	(728)
Delay per day Jump-the-Queue Lanes (hrs)	-	125	125
Total Delay All Lanes - Daily (hrs)	4,688	4,085	(603)
<b>Cost of Delay Impacts</b>			
Cost of daily delay (\$12/hour)	\$ 56,250	\$ 49,020	\$ (7,230)
Cost of delay - annually (\$12/hour, 240 days/year)	\$ 13,500,000	\$ 11,764,800	\$ (1,735,200)
<b>Fuel Usage Impacts</b>			
Daily fuel usage regular lanes (gal)	9,375	7,920	(1,455)
Daily fuel usage Jump-the-Queue Lanes (gal)	0	250	250
Total daily fuel usage (gal)	9,375	8,170	(1,205)
<b>Fuel Cost Impacts</b>			
Daily fuel costs (\$3/gal)	\$ 28,125	\$ 24,510	\$ (3,615)
Annual fuel costs (\$3/gal, 240 days/year)	\$ 6,750,000	\$ 5,882,400	\$ (867,600)

**(v) Transit Services**

The Premium Transit Service Vehicles will use the Jump-the-Queue lane to maintain headways and ensure travel time consistency. There will be no fee to transit riders for this enhancement. This section describes:

- PSTA Premium Transit Service Enhancements
- Premium Transit Service Pricing Strategies
- Premium Transit Service Impacts on Congestion

PSTA Premium Transit Service Enhancements

The PSTA Premium Transit Service will involve specific enhancements designed to increase ridership through shorter headways and more reliable travel times. These enhancements include:

- Provide 18 additional high quality, hybrid, easily recognizable buses to decrease headways from 20 minutes to 10 minutes at all times on PSTA Route 19 (US 19) from Tarpon Springs on the north to either Ulmerton Road or 70<sup>th</sup> Avenue North on the South;
- Use of the Jump-the-Queue Lanes from Tarpon Road to Evans Road to shorten travel times and improve travel time reliability;
- Implement transit signal priority US 19 and the RT TRACS adaptive signal timing software, including signals at interchanges with crossroads with transit stops, to assist with travel time reliability and headway maintenance;
- Improve key transit stations to handle additional transit vehicles;
- Provide kiosks to provide real-time Premium Transit Service arrival times and travel times at major stops and transfer stations; and,
- Provide on-bus Wi-Fi for free Internet access for Premium Transit Service passengers to increase rider loyalty and productivity.

Technologies required to operate the Premium Transit Service on US 19 will be described a later section of this application.

#### Premium Transit Service Pricing Strategies

Beginning in year two of the Pinellas County Congestion Demonstration, Premium Transit Service will be implemented in two phases: Phase 1a and 1b.

- **Phase 1a** will have a 12-month duration and will demonstrate the benefits of all the transit pricing only. Basic fare for the Premium Transit Service during Phase 1a is expected to be \$2.50 per ride. Discount fares of \$40 for 20 rides will also be available. Pricing for riding US 19 system during peaks will be varied to test various pricing policies. It is expected that the full benefits of transit congestion pricing will not be realized until Phase 2b when additional buses are added to the fleet.
- **Phase 1b** will begin after the Phase 1a and will remain in effect for the duration of the four (4) year Pinellas County Congestion Reduction Demonstration. Phase 1B will include reduced bus headways and congestion pricing. Headways will be set at 10 minutes or less compared to 20 minutes today. Maximum price will be \$2.50 per ride. Price will be lowered based on congestion on the US 19 corridor from Tarpon Springs to Ulmerton Road: the higher the traffic congestion, the lower the fare. A converse strategy may also be applied. Rates may be kept higher if transit demand is at or over capacity. At this time the maximum fare reduction during peak congested times has not been determined but could approach “free” if needed to optimize the people throughput on US 19. It is expected the combination of additional vehicles, reduced headways and variable pricing will attract significant new riders to the US 19 Premium Transit Service.

#### Transit Enhancement Impacts on Congestion

Using the *Transit Boardings Estimation and Simulation Tool* (TBEST), PSTA estimates boardings on Route 19 (US19) Premium Transit Service, Phase 1b, will increase by 9,600 riders per day due to reducing headways from 20 minutes to 10 minutes.

TBEST is mandated by the Florida Department of Transportation for use in estimating aggregate route and system level measures of transit ridership. TBEST does not currently have a way to forecast potential

increases in ridership from the proposed transit pricing strategy, Phase 1b, or intangible enhancements such as Wi-Fi Internet service.

Nearly all of these new riders will be diversions from personal vehicles since Route 19 has limited “walkup” demand at most stations. If all the new daily riders are diversions from personal vehicles, the resultant traffic on US 19 will reduce from about 75,000 vehicles per day to about 65,400 or a reduction of about 12%. This would be a potential reduction of at least 500 vehicles in each peak hour.

The resulting congestion reduction impacts are very similar to the impacts that are expected due to the Jump-the-Queue lanes discussion as shown in Section (iv). The annual savings due to delay to traffic is estimated to be over \$1,700,000 per year or just under 13% compared to existing conditions. Similarly, the annual savings in fuel costs is estimated to be nearly \$900,000 per year. The impact of Transit Pricing Strategies is estimated to be an additional 20% to 40% increase in transit riders.

#### ***(vi) Use of Technology***

The goal of the Pinellas County Congestion Reduction Demonstration project is to use innovative technology to enhance transit service and to provide traveler information to both roadway and transit users to create a truly integrated ITS multimodal corridor. In order to accomplish these objectives, several technologies will be implemented, integrated, tested and evaluated. For this project there are four major groupings of technologies:

- Jump-the-Queue Lanes operation and enforcement technologies and software;
- Premium Transit Service technologies and software;
- Arterial travel time measurement technologies and software;
- Advanced arterial traveler information systems technologies and software; and,
- Communication and network enhancements to support the other technologies.

The Federal Highway Administration (FHWA) and the Florida Department of Transportation (FDOT) require the use of a Systems Engineering Process for development and implementation of technologies for transportation purposes. This section will also summarize the Systems Engineering Process that will be employed.

This section describes each of the technologies that will be implemented on US 19 to support the Pinellas County Congestion Reduction Demonstration.

#### ***Jump-the-Queue Lanes Operation and Enforcement Technologies and Software***

To be implemented on US 19 from Tarpon Road through Evans Road at congested intersections.

- ***Toll transponder readers***, verification;
- ***Toll transponders***, with automatic vehicle location and vehicle to roadside communication;
- ***Volunteers*** who employ toll transponders and vehicle to roadside communication to provide travel time information. Volunteers who will use the non-tolled lanes will receive the technology at no cost and will not be charged for using the regular lanes;
- ***Toll transponder registration*** for priority high-occupancy vehicles such as Premium Transit Service vehicles, carpools and vanpools. This would be to the large extent a separate group from the volunteers who are providing travel time probe information;

- **Toll fee collection** and backroom processing; and,
- **Automatic video enforcement** at and in advance of the congested intersections with Jump-the-Queue lanes. Enforcement will be used to discourage use of the lanes by vehicles without transponders and to discourage persons from using the right turn lanes and trying to cut into traffic at the last minute to avoid the tolls. This latter goal may be more difficult since some people in the right turn lane will have entered the roadway mid block and are legitimately trying to enter the general purpose lanes. It should be noted the County Sheriff and local police departments have also expressed a willingness to provide enforcement.

A key component of the Jump-the-Queue Lanes will be dynamic message signs (DMS). These signs will be used to provide pricing in advance of each congested intersection from Tarpon Road to Evans Road. Pricing will be the default messages during times the Jump-the-Queue Lanes are open to personal vehicles. Other times the pricing DMS could be used for travel time and incident messages. Existing DMS in the US 19 demonstration corridor will be supplemented with new DMS spaced one (1) to (2) miles apart in each direction from Tarpon Road to Ulmerton Road or 70<sup>th</sup> Avenue North. The DMS will display real-time travel times to designated points along the corridor. The DMS will be controlled from the Traffic Control Center (TCC) and will be used to display traffic incident, emergency and other alerts.

#### Premium Transit Service Technologies and Software

- **Data sharing**, center to center wireless communication, between the TCC and the Transit Management Center;
- **Automatic Vehicle Location (AVL)**: Hardware and software for integrated on-board technology and communication package including automated vehicle location (AVL), schedule data, and other features to support existing PSTA and demonstration project capabilities. (Note PSTA buses currently have these capabilities but they are stand-alone packages and can not be upgraded or integrated in their current configuration);
- **Lane control strategies** for bus-only lane through intersection channelization;
- Hardware and software for **high-speed wireless (WiFi) Internet access** for bus patrons.
- **Additional Buses**: 18 additional hybrid vehicles are envisioned to reduce transit headways from 20 to 10 minutes during extended peak period. These buses will be typical PSTA buses except they may have a “branded” color/pattern on the exterior. The buses will also have an integrated ITS technology package for AVL, communication and other technologies currently used by PSTA, integrating nearly 10 stand-alone systems. The new buses, equipped with free Wi-Fi internet access, will also help promote ridership along this test route.
- **Transit Signal Priority**: Transit signal priority will be designed to support maintaining transit schedules through adaptive and non-adaptive signalized intersections.
- **Transit Fare Kiosks**: Four (4) or five (5) fare payment kiosks will be installed at the major transit stations along the US 19 demonstration. The 5<sup>th</sup> kiosk is needed if the south limit is extended to 70<sup>th</sup> Avenue North.
- **Real-Time Bus Arrival & Travel Time**: Signs will be placed at stops along the US 19 demonstration corridor from Tarpon Springs to either Ulmerton Road or 70<sup>th</sup> Avenue North to advise transit patrons of arrival times of the next bus and estimated travel times to major destinations.

#### Arterial travel time measurement technologies and software

Building on the platform of the US 19 ATMS, the fiber-optic communication network, and the TCC, a number of new technologies will be implemented in the US 19 corridor from Tarpon Avenue to Ulmerton Road or to 70<sup>th</sup> Avenue North.

- **Vehicle Probes**: Probe technology will consist of a digital graphic display, GPS, WiFi send/receive

capability. These technologies will be used to measure vehicle speed, location, time and a confidential identification number to send this information to the TCC where it will be processed into corridor travel times.

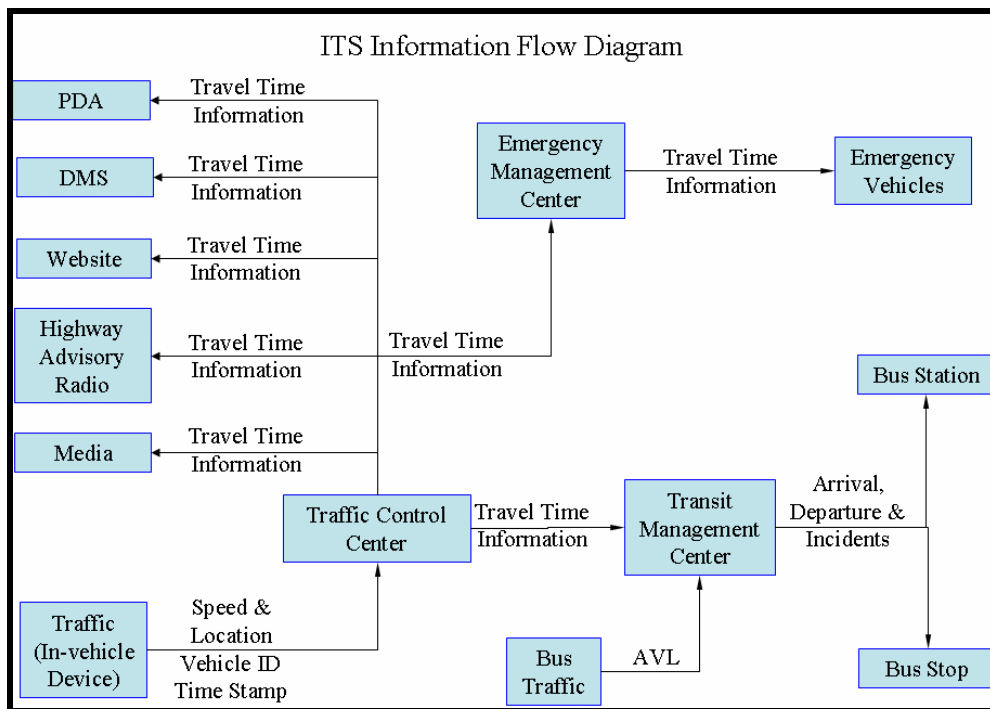
- **Arterial Travel Times:** In-vehicle probe devices to support collection and dissemination of arterial travel times and travel information;

Advanced arterial traveler information systems technologies and software

Vehicle probe data will be used for traveler information and as the measure for setting pricing amounts in accordance with the Premium Transit Service and Jump-the-Queue congestion pricing strategies. Additionally, travel times will be output to road side devices such as DMS and HAR and in-vehicle devices such as a navigation system.

- **Dynamic Message Signs (DMS):** Roadside devices such as DMS to support dissemination of real-time arterial travel times (note, existing US 19 DMS and highway advisory radio (HAR) installed with Phase 1 of the ATMS will be included in this test);
- **Traffic software updates:** Existing adaptive control and central system software will be enhanced to include phase adjustments for transit signal priority and for automated travel time calculations and dissemination to DMS and HAR including sharing information with local, regional and statewide traveler information service providers such as Tampa Bay 511 and local media. Software updates may also be needed for archival of data collected with the demonstration systems;
- **Transit bus arrival times:** A combination of probe data and transit AVL will be used to predict Premium Transit Service arrival times at kiosks at major stations; and,
  - **Web-based traveler information:** Travel times will be posted to a County traveler information website and shared with other traveler information service providers.

Figure 6, below, provides an architecture for flow of information to traveler information systems.



**Figure 6: Project ITS Architecture - Information Flows for Traveler Information**

Communication and Network Enhancements to Support the Other Technologies

- **2.4 GHz for initial Roadside to Vehicle communication** (migrating to 5.9 GHz as equipment becomes available), and for in-bus WiFi Internet access. 2.4 GHz technology will be used initially for vehicle probes, in-vehicle traveler information and for bus transit signal priority requests, basically for all communication between the vehicle and the roadside;
- **4.9 GHz for public safety data communication;**
- 5.8 GHz radio communication for Center to Center communication; and,
- **5.9 GHz radio technologies for Roadside to Vehicle** communication in support of future Vehicle Infrastructure Integration (VII) and future alternative pricing strategies; and,
- **Vehicle-to-vehicle (V2V)** repeater technologies (also utilizing 5.9 GHz);
- **Roadside aggregation** to the fiber backbone and designated repeater points for seamless wireless mesh network.

**Table 5: Pinellas County Demonstration – Communication Elements**

Wide-Area Wireless (Mobile) Communications	Fixed-Point to Fixed-Point Communication	Dedicated Short Range Communication
2.4 GHz wireless communication	Fiber optic communication network	2.4 GHz wireless communication
Internet	5.8 GHz wireless network	5.9 GHz wireless communication
	4.9 GHz wireless network	

Communication Network Description

All of the transit and traffic operational improvements require a means to communicate between the vehicles (cars and buses on the roadway), the roadside, the intersections, the toll collections/enforcement equipment, and the various control centers (PSTA, TCC). The ideal solution, from a communication network standpoint, would be to use a single integrated network that meets the needs and requirements of all four of the above technologies.

The primary technological candidate for this project would be equipment that utilizes the licensed 5.9 GHz frequency band allocated by the FCC for use with Intelligent Transportation Systems and Public Safety First Responders. Unfortunately, due to the fact the 5.9GHz communications standards are currently being developed, commercial products supporting this technology are not readily available.

The relevant standard, IEEE 802.11p (Wireless Access for the Vehicular Environment i.e. WAVE), final working group letter ballot (Draft 3) was released on August 2007, with IEEE sponsor ballots and final approval due in March 2009. Typically, equipment manufactures start to develop products around the same time that the relevant standard gets through the working group letter ballot process. Therefore it is expected that 5.9 GHz products will be available sometime during the 4-year life of this project and may be available for near future implementation.

Communication Network Technology

The communication network technology is based on representative, generally available wireless equipment and technologies that currently exist. The first stage of phase 1 is a technology selection where specific technologies and equipment will be evaluated and selected. For the purposes of scoping and estimating this proposal generic equipment will be discussed, in all cases at least two examples of real technology exist for any proposed “generic” solution.

The communication network will provide wireless (802.11 a/b/g) coverage for the proposed arterial roadway from Tarpon Ave. to Ulmerton Rd., a distance of approximately 18 mile, or 70<sup>th</sup> Avenue North, a

distance of nearly 23 miles. Except for a 2.5 miles section that is under construction, an existing fiber backbone is available at every intersection with additional access approximately every mile. The proposed network will use high powered, outdoor WiFi Access Point (AP) equipment to provide wireless coverage along this corridor to support the congestion mitigation technologies being tested. There are multiple products from several companies (Cisco, Motorola, Tropos Networks, SkyPilot) that are designed for this type of outdoor wireless mesh IP network.

These WiFi Access points typically provide standard 802.11 b/g WiFi access to clients that are within range of the AP. Both 802.11b and 802.11g use the 2.4 GHz unlicensed frequency band. The effective range of these APs is highly dependent on the RF environment, the power and quality of the APs transmitter/receiver and the type of client requiring connectivity. The range can be anywhere from 800 feet to distances of a mile or more.

In addition these APs are capable of forming a wireless, backbone “mesh” to allow traffic from several Access Points to be routed back to a wired network Point of Presence (POP). The wireless mesh layer can utilize either the 2.4 GHz or 5.8 GHz unlicensed bands or the 4.9 GHz licensed band (reserved for Public Safety First Responders). Typical products utilize one, two or all three of these frequency bands to support establishing a backbone wireless mesh. It is expected that as the 5.9 GHz standards are approved, this equipment will be enhanced to support the ITS standards with little modification. Note that the wireless interconnection of these Access Points is not standardized, some products use the 802.11a standard while other use proprietary protocols. This means that nodes employed for a wireless mesh will not interoperate with products from a different manufacturer.

The POP in this case is the fiber access at each intersection. The fiber network provides capacity injection to the wireless backbone as well as network connectivity between the client devices on the wireless network to fixed devices (traffic signal controllers, DMS, etc.) and control centers connected to the fiber backbone (Traffic Management Center, Transit Control Center, Sign Displays, etc.)

#### Communication Functional Requirements Assumptions

The communication network provides a single integrated network that allows communication between the vehicles (cars and buses on the roadway), the roadside, the intersections, bus kiosks, DMS, and the various control centers (PSTA, Traffic Management Center). The following high level requirements are assumed:

- **Test vehicle communication:** Telemetry information from the test vehicles (GPS position, vehicle ID, current speed, etc) is sent periodically to the traffic control center for the measurement of arterial travel times. Roadside condition and alerts are sent to the vehicle as required. Continuous coverage is not required for this application, the vehicle can go in and out of coverage areas as long as the vehicle can associate to an AP and transmit/receive stored telemetry information. Bandwidth requirements are low.
- **Bus communication, high speed Internet access:** Providing wireless Internet access to passengers traveling on the Bus Transit system requires continuous coverage for the length of the route. Bandwidth requirements are high but can be performed on a “best effort” basis.
- **Bus communication, telemetry:** Bus telemetry information is more than just position, ID and speed. It includes route information, low priority traffic signal preemption requests, estimated arrival, fare collection, route display, and text communication to/from the driver. Continuous coverage is required, bandwidth requirements are medium.

- **Low Priority traffic signal preemption:** Signal preemption will be accomplished by direct bus to signal intersection controller communication.
- **Kiosk Communication:** The bus control center must be able to communicate route information and bus arrival times to Kiosks over the wireless network. Bandwidth requirements are low
- **DMS communication:** The traffic control center must be able to communicate roadside conditions and accidents events to DMS over the wireless network. Bandwidth requirements are low.
- **Control center to control center communication:** Control centers must be able to communicate to the vehicles, buses, and between each other to coordinate location, preemption, travel times, and accident events. Bandwidth requirements are low to medium. Some video sharing will also be included within bandwidth constraints.
- **Toll Collection and Enforcement:** Toll collection and enforcement devices will need to be connected to the fiber backbone located at each intersection. Video surveillance of the back of vehicles approaching the intersection can be accommodated using high compression video cameras (e.g. H.264) connected to the wireless mesh network.
- **Security:** The wireless communication network must be able to prevent unauthorized access to the network. The only open access provided is to bus passengers accessing the Internet. Internet Wi-Fi access will be secured from the ITS/ATMS device network.
- **Availability:** One purpose of this study is to measure the availability of the network for this application in a long term operational network. While RF coverage is particularly hard to predict and fluctuates as conditions change, the goal for network equipment availability should be 99.999% or a down time of less than 6.5 seconds per week or just over five (5) minutes per year.

#### Overview of Proposed Network Solution

The proposed network solution will use high powered, outdoor WiFi Access Point (AP) equipment to provide wireless coverage along the proposed arterial roadway. The goal of the network is to provide a ubiquitous IP network covering the transportation corridor that allows IP connectivity between any devices on the network. As noted in the background section, there are multiple products from several companies (Cisco, Motorola, Tropos Networks, SkyPilot) that could be utilized for this network. For estimating and discussion purposes the proposed solution is based on products from Tropos Networks but it should be noted that final product decisions will be made as part of the technology investigation phase of the project.

The backbone of the wireless communication network is based on both fixed and mobile, dual radio wireless mesh network routers. These routers provide both access point functionality (2.4 GHz and 4.9 GHz) as well as the automatic establishment of wireless mesh backbone links using either/both 2.4GHz or 4.9 GHz. Policy based routing is used to enable ITS/Public Safety traffic to utilize either the 2.4/4.9 based on the best path/performance while simultaneously preventing any public use traffic (i.e. Internet access) from being routed over the 4.9 licensed band. The fixed node routers will be mounted on poles along the corridor, mobile nodes will be mounted on the buses.

The basic architecture to provide wireless coverage along the 18 mile corridor targets installing a fixed wireless router at approximately every ½ mile interval. Fixed nodes at the intersections will be directly connected to the fiber backbone while nodes between intersections will connect through the wireless backbone links to the nearest fiber connected router. The high powered mobile node routers mounted on

the buses will connect to the nearest fixed node as the bus travels along the corridor. With ½ mile spacing the buses should always be able to connect to 3-4 fixed nodes which should ensure high availability and continuous coverage for the buses (to be verified during the technology selection phase).

Non-continuous wireless network coverage for test vehicles traveling up and down the corridor is provided using PDA's with embedded WiFi and GPS. As vehicles travel within range of an access point, they will be associated and exchange telemetry information with the traffic control center.

Kiosks and DMS controllers that are not fiber connected will use low cost WiFi hubs to connect to the nearest fixed wireless router.

Connectivity to the traffic management control center is provided directly by the fiber backbone. Connectivity to the PSTA control center and CTC test lab (for network management/statistic collection) will be provided through separate point-to-point "last mile" wireless links to the respective sites. Both sites are within 1 mile of the fiber network.

Network Architecture:

The following diagram, Figure 7, provides the ITS Network Architecture. Figure 8 provides the Pinellas County Demonstration Physical Communication Architecture. The rest of this section provides a detailed description of the architecture with reference to these two figures.

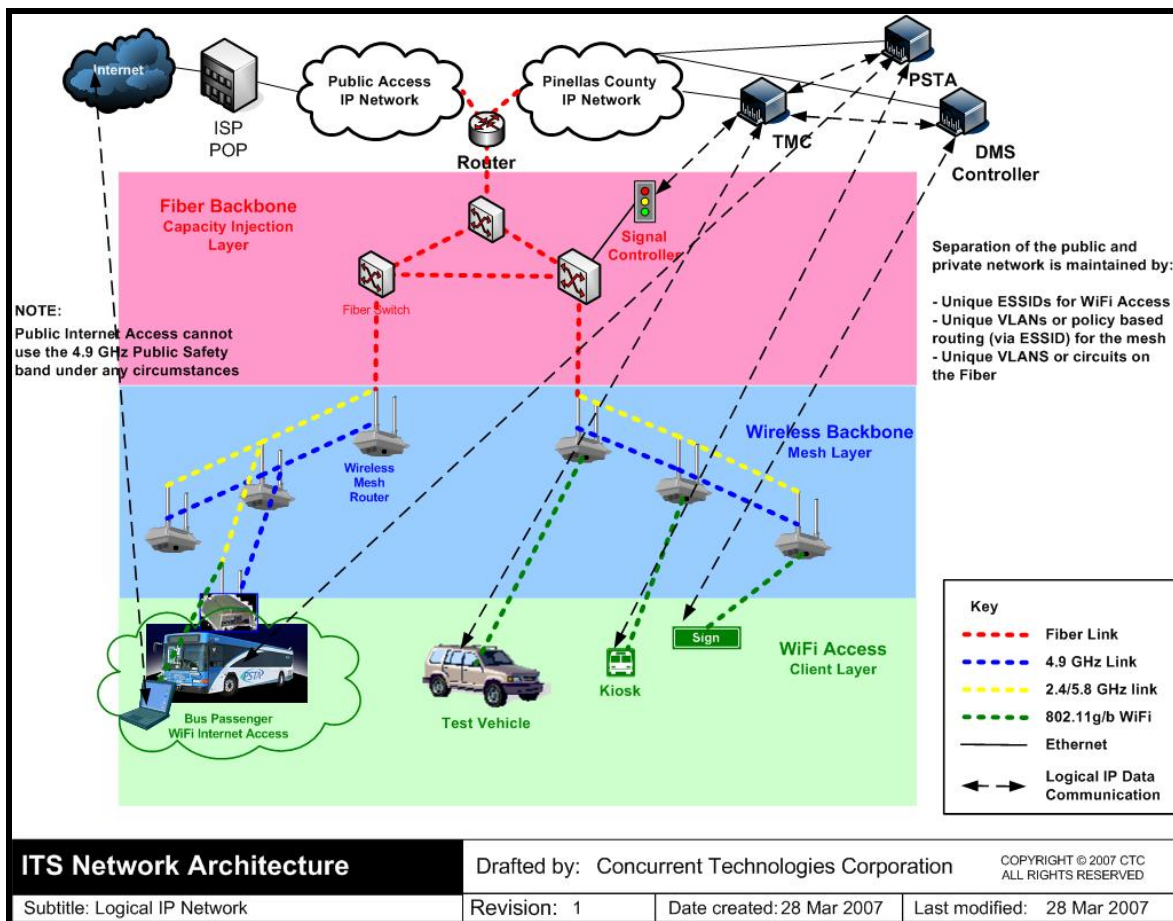
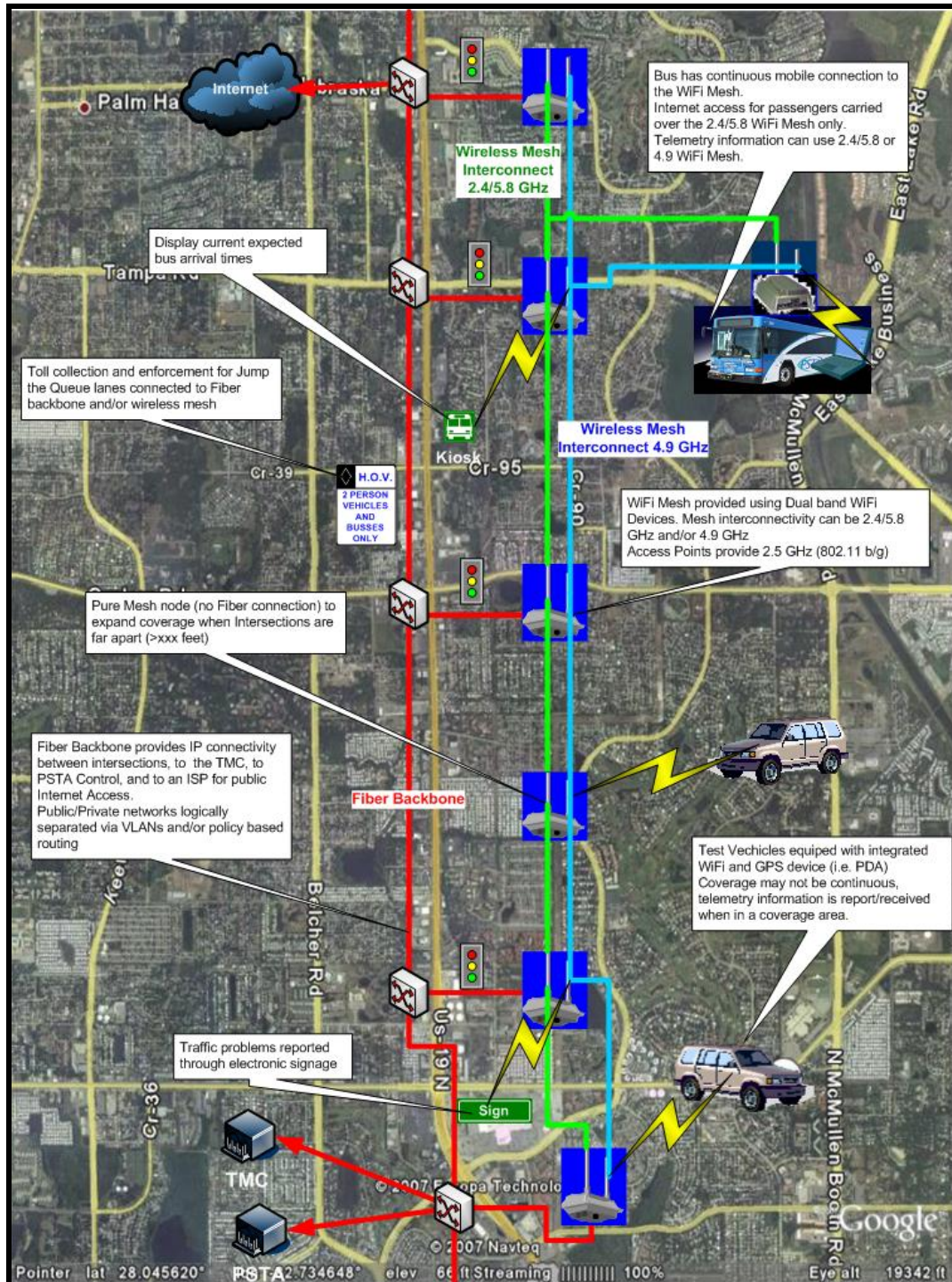


Figure 7: ITS Network Architecture



- **Fiber Backbone:** Traffic on the fiber backbone can be partitioned (based on public access and/or agency traffic) through any combination of the following: physically separate fiber links, logically separate VLANs, policy based routing.
- **Wireless Mesh Router Backbone:** The fixed wireless routers are installed at the intersections with connectivity to the fiber backbone network. Depending on the distance between intersections, one or two “wireless only” routers are installed between the intersections to fill in any coverage gaps. These routers serve two purposes, they provide continuous coverage for the mobile routers on the buses and they provide an alternate, redundant path to the fiber backbone. With ½ mile spacing, the failure of a single node should not impact network availability from the mobile routers.

The fixed wireless routers establish and maintain two logically separate IP networks: one network is based on wireless network trunks running over the 2.4 GHz frequency band; the second network uses wireless network trunks running over the 4.9 GHz band. The routers support policy based routing such that any combination of VLAN ID, wireless ESSID, IP src/dest address, MAC src/dest address can be used to partition the traffic so that non-Public Safety traffic is never routed over the 4.9 GHz licensed band. It should be noted that using dual band routers provides a further level of redundancy since ITS and Public Safety traffic can use either band. Link security is provided using AES encryption with pre-placed keys for all wireless trunks.

- **Bus Network Connectivity:** Bus connectivity to the wireless network is provided through a mobile wireless router mounted in the bus. Like the fixed routers, these mobile routes connect to the wireless mesh using both 2.4 GHz and 4.9 GHz wireless trunks. The router on the bus also provides wired Ethernet connectivity and 4.9 GHz WiFi access (for telemetry equipment on the bus) and 2.4 GHz WiFi access for public Internet access for bus passengers. Note the bus telemetry equipment could also share the 2.4 band if required.

Security is provided by either the physical security for the wired Ethernet or WPA with pre-shared keys for WiFi access. Public access uses an open SSID for public internet access.

- **Vehicle Network Connectivity:** Test vehicle connectivity is provided by using COTs PDA equipment with integrated GPS and WiFi client using the 2.4 GHz band. The use of external WiFi antennas will be determined during the technology investigation phase of the project. Their need will be dependent on the ability of the selected PDA to associate with the fixed wireless routers at highway speeds. While it’s possible to consider using 4.9 GHz WiFi for vehicle connectivity, the expense and lack of availability for PDA devices makes it a less viable option.

When a test vehicle gets within range of a roadside router, the PDA will establish an association and software running on the PDA will upload position, ID and speed data to the traffic control center. Any traffic alert information relevant to the current position of the test vehicle will likewise be sent down to the test vehicle (i.e. PDA). As with bus WiFi access, security is provided using WPA with pre-shared keys. Note that while this would not be a viable security solution for wide spread deployment, it should be manageable for the Pinellas County Congestion Reduction Demonstration. During phase two the “PDA in a test vehicle” will be phased out and replaced by a 5.9 GHz solution.

- **Control Center Connectivity:** The control centers for traffic and PSTA need to be connected to the fiber network. The inter-working of the devices and software programs at each center will need to be determined by policy based on the functional requirements and each agencies internal policy. Since the CTC test facility and the PSTA control center are not currently served by the backbone fiber

network, it is proposed that connecting these centers with wireless point-to-point links would serve as a demonstration of closing the last mile.

This connectivity will be established by using point-to-point Ethernet devices (Solectek, SkyPilot, Redline, etc.) at an expected modulation rate of 54 Mbps using the 5.8 GHz unlicensed frequency band. Using the 4.9 GHz band is also an option that will be explored during the technology selection phase of the project.

- ***Kiosk/Signage Connectivity:*** Providing wireless connectivity to the wireless backbone network from Kiosks and Signage location is provided using wireless access routers (i.e. linksys). WPA with pre-shared keys will provide security.

### Software Upgrades

The existing ATMS2 system is a complete software package consisting of three software components: Management Information System for Transportation (MIST®), Optimized Policies for Adaptive Control (OPAC), and ASC/2070 controller firmware. This system provides control and monitoring of advanced traffic signal controllers that operate under adaptive and non-adaptive modes, control and monitoring of DMS, control of CCTV cameras, data collection from video image detection (VID) cameras and distribution of system graphics and CCTV/TV video images onto a video display wall.

To support the County's Intelligent Multi-modal Corridor, Telvent Farradyne Inc. (TFI) will incorporate several new and innovative features into the existing MIST® -OPAC-ASC/2070 advanced traffic management system. These enhancements will increase the capability of the system to provide a highly advanced corridor management system along the US19 corridor.

- ***Ethernet-Based Communications for OPAC Devices:*** In the current system the OPAC devices communicate serially with MIST® and with the signal controllers. Under this protocol, the peer-to-peer data required for some of the algorithm's decision making is routed through the central MIST® software. The wireless communication infrastructure, described in earlier sections, will provide a state-of-the-art, Internet Protocol (IP) based system among various field devices, transit and probe vehicles, and the traffic management system. Ethernet-based communication among the OPAC devices will improve the latency in peer-to-peer communications and allow for an expansion in what data is exchanged and how it is used in order to better adapt to traffic conditions. The wireless, Ethernet communication system will also allow for the incorporation of other innovative functions, such as sharing detector data between intersection controllers and providing sophisticated tools for signal coordination among the intersections for priority vehicles as well as general purpose traffic.
- ***Distributed Peer-to-peer Communications:*** As previously mentioned, the current version of OPAC uses a centralized approach for peer-to-peer communications between intersection controllers. The MIST® central software polls each intersection once every 30 seconds for peer-to-peer data then uses a centralized network topology to distribute relevant phase data to neighbors. This design allows the use of existing communications infrastructure in many areas where there is no physical links between adjacent intersections. Obviously, in the event of communication failure between the central system and field controllers, the OPAC system is limited in its ability to explicitly coordinate timing along the corridor. Even without communication failure, the latency in peer-to-peer data may be 60 seconds, which limits what data is even useful to exchange.

With today's technology and introduction of fiber, wireless and other means of communications as well as use of Internet Protocol (IP), direct peer-to-peer communications between various field devices is achievable. The proposed enhancement via Ethernet will enable the adaptive system to

benefit from distributed data sharing, directly between the intersections. This will provide a great tool for coordination and synchronization between traffic signals, in particular during priority and preemption and for incident response. It also provides the capability for sharing detector data between intersection controllers, thereby reducing the cost of detectorization, which constitutes the main portion of the capital investment needed for installation of adaptive control systems. Under this enhancement, the controller firmware will also be modified to support peer-to-peer communications and detector data sharing between the intersections.

- **Priority and Preemption:** In the event of an Emergency Vehicle (EV) or a bus approaching an intersection, the downstream intersections will be notified in advance to prepare for terminating the current phase and granting preemption or priority to the upcoming EV or bus. Adaptive system could play a significant role in providing priority to the EV or transit vehicles. By incorporating the proposed modifications to the OPAC algorithm, the control system can support three major functions associated with preemption/priority. These are: 1) a pre-priority phase clean-up if there are queued vehicles at the intersection blocking the emergency or transit vehicles, 2) running in the background during a preemption to estimate queue lengths for the conflicting phases (which is currently available), and 3) initiating post-preemption or post-priority timing to clear the queued vehicles while maintaining coordination among signals. A significant portion of this enhancement will be to improve queue estimate in order to provide pre- and post-preemption clearance and also to add a new module for receiving probe data and AVL signals from BRT buses, as described in the following section.
- **Probe Service Module:** A new ‘Probe Service’ module will be added to the MIST® central software to receive probe data from test vehicles and AVL data from BRT vehicles as well as EVs. The probe vehicles broadcast location (Lat/Long), direction, and speed every second or so. This data will be received by the Probe Service which determines what link the vehicle is on and sends the speed data to the MIST® server. MIST® then uses the data to calculate travel times for display on DMSs and other devices such as in-vehicle displays. The above data along with other system data, will also be used to determine whether and how to grant priority to buses that are behind schedule.
- **Congestion and Incident Mitigation and Response:** As described above, the enhanced OPAC system with distributed peer-to-peer communication can be used during planned or unplanned incidents to clear queued vehicles due to lane blockage and/or loss of capacity. The system can implement Local or Area-wide strategies to mitigate congestion due to the incident. Under a Local Strategy, OPAC can make timing decisions which account for the locally observed impacts of the incident, including reduced downstream capacity or upstream flows. The system also can apply Area-Wide strategies such as gating and capacity improvement to mitigate the congestion. Gating at the upstream boundaries of the incident area will reduce traffic flow into the bottleneck area. Capacity improvement will clear further downstream intersections to provide sufficient capacity for upstream queued vehicles to keep the traffic flowing.
- **Enhanced Monitoring and Control of the Field Devices:** Under this enhancement, both the ASC/2070 controller firmware and the OPAC firmware will be modified to support enhanced central system monitoring and command/control capabilities of both the adaptive OPAC system and the ASC/2070 controllers. These will include:
  - Develop a mechanism to change phasing sequence, if desired, when OPAC is in control. Currently when OPAC is in control, the controller reverts to the sequence it would run if it were in ‘Free’ (uncoordinated) operation.
  - Enhance the current interface for accessing the controller’s database to streamline the file management necessary for maintaining and sharing intersection database files among operating agencies and departments. The current interface between MIST® and the

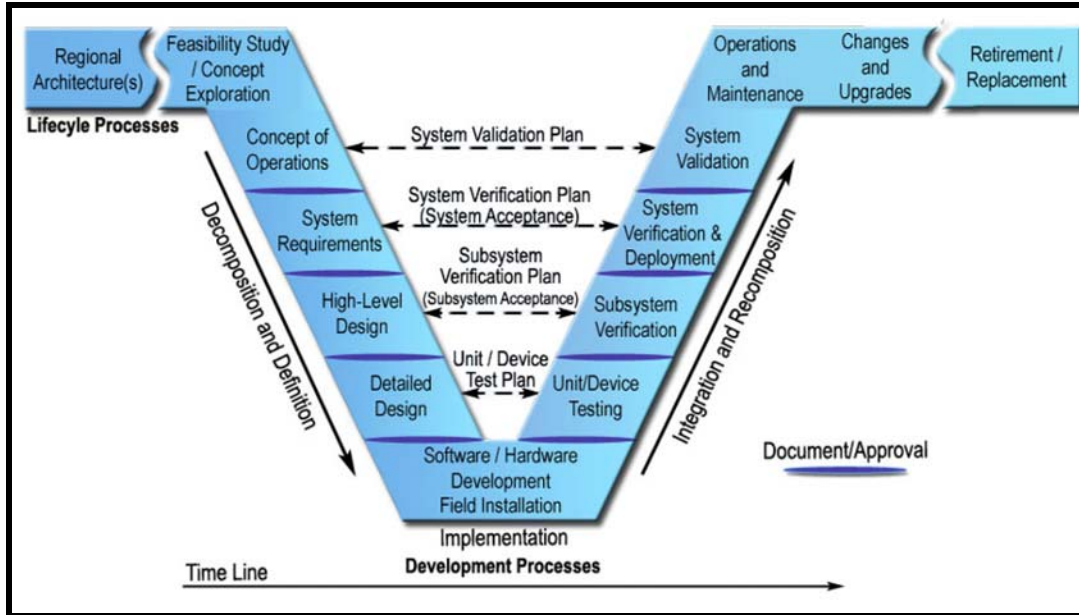
- ASC/2070 for uploading and downloading controller database parameters does not include some 'sensitive' parameters which are generally intended to be modified only by a technician familiar with the particular hardware and wiring at the intersection.
- Add the capability to upload controller field logs to the MIST® central system. Currently there are no such logs available to the central system.
  - Add the capability for multiple sets of operational parameters for the OPAC devices and mechanisms for commanding the use of certain sets, for example by time of day or in response to an incident.
- **Data Normalization and Database Enhancement:** The MIST® database needs to be modified to account for the new data and presentation of the subject data in a unique format for all users and applications. The database should provide different tools for data formatting and dissemination including what, how and where the data will be disseminated.
- **Measures of Effectiveness in Software:** There are various Measures of Effectiveness (MOEs) reported and/or generated by the central system and field devices. These may include:
- Speed, Occupancy and volume data from system detectors,
  - Priority, preemption, and BRT data reported via field controllers,
  - Bus Location information from AVL systems
  - Location, direction, and speed data from probe vehicles
  - Estimated stop, delay, and queue data from OPAC
  - Time-stamped and historical (smoothed) detector data stored in the MIST® Database

The above sources of data provide a wealth of information to support various applications described above as well as the following:

- Measures for air quality and emission calculations
- Improvement to the signal timing plans and traffic flow along the corridor
- Corridor management
- MOEs to evaluate system performance for various added features

#### Systems Engineering Process

- **Introduction:** The Pinellas County Congestion Reduction Demonstration will be developed using the FHWA Systems Engineering Guide. The Systems Engineering Process is also required by FDOT ITS development procedures. Typically the Systems Engineering Process is depicted by the "V" Diagram shown in Figure 9, below:



**Figure 9: System Engineering Process "V" Diagram**

All of the tasks from Project Management through testing and evaluation support are written in the context of the Systems Engineering Process and the specifics of the Pinellas County project.

- **Concept of Operations:** The COO will describe how each of these technologies in the demonstration will operate from a user and/or traveler perspective.
- **Functional Requirements – Requirements Matrix:** The Functional Requirements will describe the functions of each subsystem described in the COO. A matrix will be developed and maintained throughout the project to track accomplishment of each functional requirement. The matrix will be updated at each step in the Systems Engineering Process.
- **Technical Requirements:** Each Technical Requirement statement will describe a specific technical performance requirement related to the Functional Requirement. There will be one or more technical requirement for each functional requirement.
- **Detailed Design – Technical Specifications:** Technical Specifications will be used for procurement of parts, hardware and software needed for the Pinellas County Congestion Reduction Demonstration.
- **Procurement:** The phase runs for nearly 18 months due to the long lead time to purchase new buses. It is anticipated that the new buses will arrive to begin the Phase 1a of the demonstration project on time. Purchases will be made from vendor contracts and/or from direct quotes from three (3) or more vendors. Most installation will be included in the purchase contacts. The only exception to this method of procurement will occur if some pavement or island adjustments are required to allow the buses to use the right turn lane to by-pass through traffic at the intersections. This work will be advertised by competitive bids.
- **Initial Testing:** All of the communication technology and field devices will be tested in the laboratory prior to implementation in the field. As 5.9 GHz equipment becomes available, it will be tested in phase 2 and integrated into the project.
- **Full Scale Implementation:** As procurement and initial testing are accomplished, full scale implementation begins. Installation of communication devices and roadside devices such as DMS will be contracted to the vendors. As devices are installed they will be tested in the field to ensure compliance with the project requirements. A major element of the implementation phase will be recruiting travelers on US 19 to volunteer to be “probe” vehicles. We will need to install probe equipment in each volunteer’s vehicle that will include, at current thinking, a GPS antenna, a WiFi

antenna and an internet addressable personal digital assistant or mobile data terminal that could be programmed to provide speed, location, time and vehicle identification information at regular intervals as the vehicles travel on US 19 within the demonstration project. While privacy might be a concern for full-scale deployment, it should not be an issue for volunteers.

- ***Integration, Subsystem, System and Network Testing:*** As devices are installed, integration of field devices will begin. As integration is accomplished, testing of communication paths and data exchanges will be undertaken and compared to the Requirements Tracking Matrix. When 100% of the integration is completed, a full system test will be accomplished.
- ***Operations and Maintenance:*** Pinellas County will operate and maintain the ITS field devices along the roadway and the central system software modules developed for the demonstration project. Pinellas County will also operate and maintain the fiber-optic and wireless communication infrastructure and devices. PSTA will operate and maintain the existing bus fleet and the enhanced bus fleet on Route 19 as well as maintain the transit stations, transit fare kiosks, transit stop real-time information signs, and AVL software to support the demonstration project.

### ***(vii) Expedited Project Completion***

With the requested Federal funds, Pinellas County will be able to implement both Premium Transit Service and the Jump-the-Queue Lanes. Pinellas County will be able to develop arterial travel times and arterial traveler information for both personal vehicle travelers and transit users. The demonstration will, as shown in Sections (iv) and (v) significant increase transit ridership and improve traffic flow on US 19. The project will also complete the ITS field devices and communication on US 19 between Tarpon Road and Ulmerton, or to 70<sup>th</sup> Avenue North if that is the ultimate terminus of the Premium Transit Service. Federal funds allow Phase 2 to be implemented in the near term, rather than waiting until congestion is so bad the route is virtual grid lock.

As soon as possible after notice-to-proceed, the following early deliverables of Phase 1 are Planned:

- Implement and demonstrate transit signal priority on a signalized corridor utilizing adaptive signal control software. It is believed this will be the first time this will be demonstrated in the United States;
- Integration of the signal priority system into the central system RT TRACS software;
- Implementation and testing of the wireless corridor upon which the vehicle probe and transit data will be transmitted to the TCC; and,
- Bus pricing of the existing bus fleet on US 19 with the goal of reducing headways with technology before buses are added to the route.

These early deliverables will verify that transit signal priority does not cause failure of an adaptive control signal system and that reduced peak period transit pricing will increase riders. This last test will have limited scope since there is not adequate available transit seats to achieve all the anticipated benefits.

### ***(viii) Travelers Affected Daily:***

Sections (iv) and (v) provided anticipated impacts of separate components of the Pinellas County Congestion Reduction Demonstration. This section aggregates those benefits so that the overall impacts with both Phase 1 and Phase 2 in operation can be estimated.

Daily Travelers Impacted by Pinellas County Congestion Reduction Demonstration

Average daily traffic on US 19 is 75,000 vehicles per day. Of this amount at least 3,000 trips per day will be diverted to the Jump-the-Queue lanes during peak periods to avoid congestion and another nearly 10,000 persons will be diverted from personal cars to transit vehicles. Of these 10,000 persons, it is estimated about 3,000 will be diverted during peak congestion periods. While the general lanes will remain at Level of Service, the amount of time this level of service is experienced should be reduced and all vehicles will experience peak period delay approaching 8 minutes per trip.

The focus of early efforts for technology demonstrations will be the US 19 corridor and PSTA Route 19.

- Route 19 carried 21.29 passengers per hour and over 1,323,000 passengers in the last fiscal year (2005/2006).
- US 19 experiences Level of Service F for three (3) peak hours in each direction through the signalized intersections from Tarpon Avenue to Republic Drive.
- US 19 is a commuter route for the residential communities in Pasco County to the North and the widely scattered employment centers in Pinellas County including Clearwater and St. Petersburg.
- US 19 also connects to the bridges that connect Pinellas County with downtown Tampa and the Tampa International Airport and HARTLine Express bus transfer stations.
- The goal of the County and PSTA is to further improve travel in the corridor and to divert more trips to transit by improving transit headways and travel time reliability.
- Of the nearly 20% new riders on Route 19, studies indicate that about one-half diverted from use of personal automobile and the other half used the bus more often because it was more convenient.

Daily Travelers Paying Congestion Pricing Tolls – Transit and Personal Vehicles

As noted in Section (iv), about 3,000 vehicle per day will be diverted to the Jump-the-Queue Lanes.

Anticipated Effects of the ITS Congestion Mitigation Technologies

The County has already implemented an adaptive traffic control system on US 19. An evaluation of the impacts of that project has been evaluated already with the following findings:

**Table 6: Effects of Adaptive Control on US 19**

Performance Measure	Outcome
Travel Time	2-25% reduction overall 7.5% average reduction 25% peak period reduction
Fuel Consumption	\$600,000 annual savings
Benefit to Cost Ratio	7 to 1
Anecdotal Benefits	Smoother ride Less congestion Less red-light running Fewer erratic lane changes

The effects of the traveler information and transit enhancements are expected to be significant, as well. For real-time travel-time information, drivers and transit riders will feel more comfortable with the mode choice decisions. With the transit information, Wi-Fi Internet access, and transit signal priority it is expected transit use on US 19 could increase by another 10-20% during the demonstration period. This

would be a significant increase on the most heavily used transit route in the County. This increase in transit productivity is not expected to have any impact on US 19 traffic capacity by combining the RT TRACS adaptive control system with the transit AVL to optimize the signal priorities that are granted with minimal impact on traffic before, during or after the granting the priority.

*Plan for Monitoring, Data Collection, Data Analysis & Evaluation:*

Pinellas County fully supports the need to document the benefits of the Pinellas County Congestion Reduction Demonstration. A variety of data collection tools will be built into the project, including:

- Traffic volumes, speed and occupancy will be collected from vehicle detectors.
- Travel times on US 19 from GPS equipped probe vehicles.
- Transit travel times on US 19 from on-board GPS/AVL.
- PSTA has acquired automatic passenger counting technology that will allow before and after data to be efficiently collected for transit passengers.
- The County is also prepared to make live video streams from the traffic monitoring cameras available to the evaluator. The County does not record video but the evaluator would be given permission to do so if necessary for the evaluation.

The existing central system software collects ATMS data and will be updated to store signal priority and traveler information data. A data warehouse will be created to store non-video data and it will be made available to the independent evaluator as needed to support the evaluation effort. Data will be stored during the Pinellas County Congestion Reduction Demonstration period and for at least three (3) years after conclusion of the demonstration period.

***(ix) Research, Planning, and Experience to Date***

The Tampa-St. Petersburg metropolitan area is actively implementing ITS on both the freeway and major arterial networks. Freeway management systems include a regional traffic management center in Tampa, closed-circuit television (CCTV) and microwave vehicle detectors (MVDS) for traffic monitoring, and dynamic messages signs (DMS) for travel time and incident information. Arterial management systems include automated traffic management systems (ATMS), adaptive signal control systems, local traffic management centers, CCTV, MVDS and DMS. In the US 19 corridor, Pinellas County has already implemented an ATMS with adaptive signal control along with CCTV and DMS. Hillsborough County is nearing completion of an ATMS with adaptive control, DMS, CCTV and MVDS on Bruce B. Downs Blvd. Pasco County has also implemented an ATMS with adaptive signal control on US 19 north of Pinellas County.

The Pinellas County ATMS also includes an extensive fiber-optic communication backbone to support broadband field to center communication. The county is also a test bed wireless broadband Mesh Network for center to center communication. The fiber and wireless networks are the foundation upon which the Pinellas County CRDI project will build to create broadband, wireless roadside to vehicle (R2V) communication. The wireless R2V network will be used for both automobile and transit pricing and information exchange. Pinellas County has a functional traffic management center called the Traffic Control Center (TCC).



**Figure 10: Pinellas County Traffic Control Center (TCC)**

Figure 10 shows the TCC video display wall and operator consoles. The TCC currently provides advanced traffic management services on US 19 from Tarpon Springs to 54<sup>th</sup> Avenue North, stopping just short of the north city limit of the City of St. Petersburg. There are some gaps in coverage of CCTV, DMS and communication which will be addressed with the Pinellas County Congestion Reduction Demonstration.

PSTA is in early stages of planning for implementation of a county BRT network. PSTA is already tracking vehicles through GPS and real-time vehicle to center (V2C) communication. Their bus tracking system is stand-alone. The Pinellas County CRDI, through wireless R2V technologies, will allow bus tracking to be integrated with the PSTA routing, scheduling and incident management systems. The R2V network will allow other enhancements, as well, including wireless Internet access for bus riders and more precise bus arrival times at kiosks at major transit stops.

### ***(x) Other Time-Frame Considerations***

Key demonstration milestones are as follows:

- Phase 1a Demonstration – Six (6) months beginning one (1) year after notice to proceed:
  - Arterial travel times
  - Jump-the-Queue Lanes for Premium Transit Service
  - Premium Transit Service
- Phase 1b Demonstration – 18 months beginning with conclusion of Phase 1a
  - Arterial travel times
  - Jump-the-Queue Lanes for Premium Transit Service
  - Premium Transit Service
  - Transit Congestion Pricing

- Phase 2 Demonstration – 12 months beginning with conclusion of Phase 1b
  - Arterial travel times
  - Jump-the-Queue Lanes for Premium Transit Services and Congestion Pricing
  - Premium Transit Service
  - Transit Congestion Pricing
  - Personal Vehicle Congestion Pricing

The durations of each phase was selected to be able to measure impacts over several seasons. The 18 month duration of Phase 1b is partly to ensure that the impacts of Phase 1b are fully stabilized and to ensure there is adequate time to develop and implement Phase 2. At the conclusion of Phase 2, a decision will be made continue or cease the demonstration. The major factor in the decision will be the costs of operations compared to Congestion Pricing revenue. Also, some local legislation may be required to enable congestion pricing revenue to be applied to Jump-the-Queue Lanes and Premium Transit Service operations and maintenance.

There are several major activities and milestones. Table 7 describes these activities or tasks and the estimated duration from the notice to proceed. Each cell represents a half year and each “X” in the cell represents a month or part of a month needed to complete the task. “H1” would commence upon notice to proceed. For the actual project, a detailed Microsoft Project schedule will be established and maintained to keep the project on schedule and in budget.

**Table 7: Pinellas County Congestion Reduction Demonstration - Preliminary Schedule**

Major Tasks	Pinellas County CRDI Timeline							
	Year 1		Year 2		Year 3		Year 4	
	H1	H2	H3	H4	H5	H6	H7	H8
Notice to Proceed	X							
Jump-the-Queue Phase 1 Intersection Design	XXX							
Jump-the-Queue Phase 1 Technology Design	XXX							
Jump-the-Queue Phase 1 Communication Design	XXX							
Jump-the-Queue Phase 1 ATMS Software Dev.	XXXXXXX	XXXXXXX						
Jump-the-Queue Phase 1 Probe Vehicle Recruiting		XXXXXXX						
Jump-the-Queue Phase 1 Implementation	XXX	XXXXXXX						
Premium Bus Procurement	XXXXXXX	XXXXXXX						
Premium Bus Station Design	XXXX							
Premium Bus Station Implementation	XX	XXXXXXX						
Premium Bus Software Development	XXXXXXX	XXXXXXX						
Premium Bus Phase 1a, Enhanced Service Demo			XXXXXXX	XXXXXXX	XXXXXXX	XXXXXXX	XXXXXXX	XXXXXXX
Premium Bus Phase 1b Pricing Demo		XXXXXXX	XXXXXXX	XXXXXXX	XXXXXXX	XXXXXXX	XXXXXXX	XXXXXXX
Jump-the-Queue Phase 2 Intersection Design				XXXXXXX				

Major Tasks	Pinellas County CRDI Timeline							
	Year 1		Year 2		Year 3		Year 4	
	H1	H2	H3	H4	H5	H6	H7	H8
Jump-the-Queue Phase 2 Technology Design				XXXXXX				
Jump-the-Queue Phase 2 Communication Design				XXXXXX				
Jump-the-Queue Phase 2 Implementation					XXXXXX	XXXXXX		
Jump-the-Queue Phase 2 Pricing Demonstration							XXXXXX	XXXXXX

***(xi) Funding Support***

The estimated costs for the Pinellas County Congestion Reduction Demonstration are shown in Table 8. The table shows costs for the Jump-the-Queue Lane and Premium Transit Service on US 19 from Tarpon Springs to Ulmerton Road. Costs include program management, system engineering, design, implementation, operations and evaluation. The major costs are for addition transit vehicles, roadside and transit station technologies, transit station improvements, and minor roadway construction to support the demonstration. The Cost Estimate is spread over the four (4) years needed to complete the demonstration.

**Table 8: Pinellas County Demonstration – Cost Estimate**

Cost Items	Lead Agency, Consultant, Contractor	Year 1	Year 2	Year 3	Year 4	Total
<b>Jump-the-Queue Lane for Premium Transit and Congestion Pricing</b>						
Program Management	Pinellas County	\$ 214,000	\$ 214,000	\$ 214,000	\$ 214,000	\$ 856,000
ATMS Software Updates	Telvent-Farradyn	\$ 1,000,000		\$ 300,000	\$ -	\$ 1,300,000
System Engineering	HNTB	\$ 200,000	\$ 50,000	\$ 50,000	\$ 50,000	\$ 350,000
Technology Design	HNTB/CTC	\$ 200,000		\$ 200,000	\$ -	\$ 400,000
Toll System Design	HNTB/TBD	\$ -	\$ 500,000	\$ -	\$ -	\$ 500,000
Comm. Design	HNTB/CTC	\$ 250,000	\$ -	\$ 100,000	\$ -	\$ 350,000
Network Design	HNTB/CTC	\$ 150,000	\$ -	\$ 100,000	\$ -	\$ 250,000
Phase 1a/1b Road Design	TBD	\$ 100,000	\$ -	\$ -	\$ -	\$ 100,000
Phase 1a/1b Const.	TBD	\$ 500,000	\$ -	\$ -	\$ -	\$ 500,000
Technology, Network & Toll Implementation	HNTB, CTC, TBD	\$ 6,500,000	\$ -	\$ 2,000,000	\$ -	\$ 8,500,000
Phase 2 Road Design	TBD	\$ -	\$ 300,000	\$ -	\$ -	\$ 300,000
Phase 2 Const.	TBD	\$ -	\$ -	\$ 3,000,000	\$ -	\$ 3,000,000
Evaluation Support	HNTB/CTC	\$ -	\$ 100,000	\$ 100,000	\$ 100,000	\$ 300,000
<b>Premium Transit Service</b>						
Program Management	PSTA	\$ 224,000	\$ 224,000	\$ 224,000	\$ 224,000	\$ 896,000
Software Updates	Kittelson	\$ 800,000	\$ -	\$ -	\$ -	\$ 800,000
Technology Design	T-O	\$ 614,000	\$ -	\$ -	\$ -	\$ 614,000
Purchase Vehicles	PSTA, TBD	\$10,800,000	\$ -	\$ -	\$ -	\$ 9,900,000
Technology Implementation	TBD	\$ 1,500,000	\$ -	\$ 500,000	\$ -	\$ 2,000,000
Transit Stations	PSTA/TBD	\$ 2,600,000	\$ -	\$ -	\$ -	\$ 2,600,000
Operations (Operations Less Fares)	PSTA	\$ -	\$ 3,800,000	\$ 3,800,000	\$ 3,800,000	\$ 11,400,000
Evaluation Support	Kittelson	\$ -	\$ 100,000	\$ 100,000	\$ 1,000,000	\$ 1,200,000
<b>Project Total</b>		<b>\$25,652,000</b>	<b>\$ 5,288,000</b>	<b>\$10,688,000</b>	<b>\$ 5,388,000</b>	<b>\$ 47,016,000</b>

Table 9 describes funds needed to match Federal funding sources. The matching funds are a combination of cash, in-kind services and private sector contributions. Match requirements are distributed for each year based on 20% of the total estimated project cost. Match availability is also distributed for each year. A description of matching fund sources follows the table. Matching funds available exceed matching funds need in all four (4) years of the demonstration.

**Table 9: Pinellas County Demonstration - Matching Funds**

Matching Funds Description	Source	Year 1	Year 2	Year 3	Year 4	Total
County ITS Funds	County Tax	\$ 750,000	\$ -	\$ 250,000	\$ -	\$ 1,000,000
Toll Rev. Credits	FTA - 5307	\$ 2,160,000	\$ -	\$ -	\$ -	\$ 2,160,000
Transit Stations	WalMart	\$ 300,000	\$ -	\$ -	\$ -	\$ 300,000
Transit Stations	Boulder Dev.	\$ 2,000,000	\$ -	\$ -	\$ -	\$ 2,000,000
Existing Rt. 19 Ops.	PSTA	\$ -	\$ 1,900,000	\$ 1,900,000	\$ 1,900,000	\$ 5,700,000
Total Matching Funds Available		\$ 5,210,000	\$ 1,900,000	\$ 2,150,000	\$ 1,900,000	\$ 11,160,000
20% Matching Funds Required		\$ 5,130,400	\$ 1,057,600	\$ 2,137,600	\$ 1,077,600	\$ 9,403,200
Excess Matching Funds		\$ 79,600	\$ 842,400	\$ 12,400	\$ 822,400	\$ 1,756,800

Pinellas County matching funds for the above Federal grant programs include:

9<sup>th</sup> Cent Gas Tax

Pinellas County funds their Advanced Traffic Management System (ATMS) and Intelligent Transportation Systems (ITS) through a dedicated “9<sup>th</sup> Cent” Gas Tax. This 9<sup>th</sup> cent is dedicated to ATMS/ITS construction, operations and maintenance. With it the County has already implemented the first projects in their ATMS Strategic Plan and is paying for operations and maintenance of what has been implemented. The 9<sup>th</sup> Cent will be the source of the cash match for the roadway elements of the demonstration project on US 19. The 9<sup>th</sup> Cent Gas Tax generates about \$3,800,000 per year in total revenue to the County for ATMS/ITS construction, operations and maintenance. Approximately \$1,000,000 from this source has been committed for match of the roadway technology and communication elements of the Pinellas Congestion Reduction Demonstration.

Pinellas Suncoast Transit Authority (PSTA)

The soft match provided by PSTA will come from several sources:

- Operation and Maintenance Costs – Existing Buses: Operations and maintenance of the existing buses on US 19 is about \$1,900,000 per year above what fare revenue generates. Funding for operations of these buses is included in the PSTA annual operating budget.
- Operations and Maintenance Costs – New Buses: PSTA is planning to prepare a budget request for operations of the new buses once the US 19 demonstration project is completed. Since PSTA operations and maintenance is four years from the date of award of the demonstration project, funding for on-going operations and maintenance of the new buses beyond the four-year demonstration has not been funded at this time. PSTA’s bus maintenance facility is capable of handling the additional US 19 demonstration project buses without straining the facility or maintenance staff. Revenues received from transit riders will be used to offset costs for operations and maintenance.
- WalMart Transit Station: PSTA currently has set aside \$100,000 in their capital improvement budget for their share of this project. PSTA will construct the toilet facilities adjacent to the station.
- Crossroads Transit Station: PSTA plans to fund the \$200,000 PSTA share of this station in the next fiscal year capital budget. As of this date that budget has not been adopted by the PSTA Board of Directors.

Toll Revenue Credits

An optional source for local matching funds is the toll revenue credit program provided by 23 United States Code Section 120(J) and existing State of Florida policy for transit improvements. In Pinellas

County the toll revenue credits are routinely used to offset the local match for transit earmarks and for all formula grants (FTA Section 5307). The Pinellas County Metropolitan Planning Organization also uses toll revenue credits as match. The application does not include toll revenue credits but they could be applied if any of the soft matches proposed are disallowed.

WalMart

WalMart with their local developer, Lochrane Engineering, have committed to investing \$300,000 in property, paving and site improvements for a new transit station for their new store planned near the intersection of US 19 and Tarpon Avenue in Tarpon Springs. This station will be the northern hub for the US 19 demonstration project and provide connection to Pasco County transit services as well as to PSTA local buses serving passengers in the northern part of the County. The transit station was incorporated by the County Board of Commissioners into the building permit for the new WalMart store. It is expected the new WalMart and transit station improvements will be complete by the end of 2007.

Boulder Developers & Weingarten, Associates

Boulder Developers with Weingarten are developing the new Town Center in the vicinity of the Crossroads Mall near US 19 and East Bay Drive. As a part of their building permit approved by the Pinellas County Board of Commissioners, they will be constructing a new transit center. The transit center will be part of the mitigation for traffic impacts due to the new development as part of the Developers' Fair Share Contribution. The developer's costs for this new station show as in-kind match are estimated to be \$2,000,000 for land, concrete and facilities. In a recent letter from the developer, the actual cost of the transit facility is estimated to be \$2,500,000. The transit facility will be large enough to accommodate up to eight (8) buses at a time. Construction is expected to start in 2007 with completion in time for the US 19 demonstration project operations in 2009-2010. PSTA and the developer are in on-going negotiations about the details of the transit facility.

Table 10 shows the Federal funds needed for each of the four (4) years of the Pinellas County Congestion Reduction Demonstration. The table shows the amount of Federal funds that would nominally be available based on an 80% Federal share. The amount of the Federal funds needed is reduced by the amount of excess matching funds that are available to provide an amount called "Net Federal Funds Requested." Potential sources of Federal funds for which various features of the Pinellas County Congestion Reduction Demonstration would be eligible are described after the table. The total amount of Federal funds requested for this application is \$35,856,000.

**Table 10: Pinellas County Demonstration - Federal Funds**

	Year 1	Year 2	Year 3	Year 4	Total
80% Federal Funds Needed	\$20,521,600	\$ 4,230,400	\$ 8,550,400	\$ 4,310,400	\$ 37,612,800
Less Excess Match	\$ 79,600	\$ 842,400	\$ 12,400	\$ 822,400	\$ 1,756,800
Total Federal Funds Requested	\$20,442,000	\$ 3,388,000	\$ 8,538,000	\$ 3,488,000	\$ 35,856,000

All technology will be acquired through competitive processes using procedures meeting Federal, State and County law and procedures associated with the various funding sources.

The Pinellas County Congestion Reduction Demonstration substantially meets the eligibility requirements for several of the Federal programs described in the November 13, 2007 Federal Register Notice, including:

Transportation, Community, and System Preservation (TCSP) Program

The Pinellas County Congestion Reduction Demonstration will:

- Improve the efficiency of transportation on US 19;
- Reduce the impacts of US 19 traffic on the environment by reducing congestion;
- Reduce the need for costly capacity improvements to US 19 in the future;
- Ensure efficient access to jobs, services and centers of trade for persons in Pasco County and northern Pinellas County who depend on US 19;
- Encourage private sector development, including development of transit facilities at existing and new malls; and,
- May encourage additional public-private partnerships on future projects.

*Federal Transit Administration – Bus Program (49 U.S.C. 5309)*

The Pinellas County Congestion Reduction Demonstration will:

- Improve transit service on US 19 with spillover impacts to other routes, and
- Implement a congestion reduction demonstration that will use improved transit and pricing strategies to reduce the impacts of congestion on US 19 in Pinellas County

*Federal Transit Administration – Small Starts Program (49 U.S.C. 5309)*

The Pinellas County Congestion Reduction Demonstration will:

- Implement Premium Transit Services (BRT) on US 19 by providing additional buses and other amenities to attract additional riders from single occupant vehicles, and
- Implement comprehensive congestion reduction strategies on US 19, including congestion pricing

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