Countywide Bus Rapid Transit Concept Plan

Final Report

Tindale-Oliver & Associates, Inc.
Planning and Engineering

1000 N. Ashley Dr.
Suite 100
Tampa, FL 33602
(813) 224-8862

In Association with:

CUTR
CENTER FOR URBAN TRANSPORTATION RESEARCH

KITTELSON & ASSOCIATES, INC.
TRANSPORTATION PLANNING / TRAFFIC ENGINEERING

Countywide Bus Rapid Transit Concept Plan

FINAL REPORT

Prepared For:

PINELLAS COUNTY METROPOLITAN PLANNING ORGANIZATION
600 Cleveland Street
Suite 750
Clearwater, Florida 33755
Ph (727) 464-8200, fax (727) 464-8201

Prepared By:

TINDALE-OLIVER & ASSOCIATES, INC
1000 North Ashley Drive
Suite 100
Tampa, Florida 33602
Ph (813) 224-8862, fax (813) 226-2106

In Association With:

KITTELSON & ASSOCIATES, INC.

CENTER FOR URBAN TRANSPORTATION RESTEARCH

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Section 1
INTRODUCTION

In June 2005, the Pinellas Mobility Initiative (PMI) Steering Committee developed and the Pinellas County Metropolitan Planning Organization (MPO) approved a Position Statement for the PMI that reflects a full intermodal approach to resolving transportation problems in Pinellas County. Consequently, detailed plans are being developed for various program elements, including the identification of corridors in the county that may be well-suited to support and benefit from expanded bus services such as bus rapid transit (BRT), limited-stop connector service, and express bus service.

The Pinellas County Bus Rapid Transit Plan has been prepared to delineate a conceptual bus network for Pinellas County that consists of a dynamic set of bus transportation modes operating in concert to improve mobility and accessibility to major activity centers throughout the county. The development of this plan is a continuing effort initiated by the MPO to develop a countywide intermodal approach to transportation that includes fixed-guideway, BRT, trolley, and enhanced bus services.

PLAN OBJECTIVES

Major objectives of the study are listed below:

- Conduct an assessment of major corridors in Pinellas County to determine the possibility of implementing enhanced bus services.
- Identify a conceptual bus network that combines traditional, enhanced, and premium bus services.
- Develop preliminary implementation plans for corridors with enhanced bus services within the bus network conceptual plan.
- Ensure consistency with the Locally Preferred Alternative (LPA) for premium transit service in Pinellas County adopted by the MPO in August 2003.
- Ensure consistency with the Position Statement for the PMI adopted in June 2005 by the PMI Steering Committee and the MPO, which stated that a full intermodal approach to transportation issues in the county was needed, including not only fixed guideway but also BRT, trolley, and enhanced bus services.
- Provide the initial building blocks for future BRT services in Pinellas County.

OVERVIEW OF PROJECT APPROACH

The project was originally scoped as a two-tier analysis of 28 corridors identified for inclusion in the study by the MPO. The result of this two-tier analysis was to be two high-priority corridors that

would ultimately constitute the county's initial BRT network. As the project proceeded into the prioritization phase, the PMI agreed that the study should be more comprehensive in terms of transit options and that a more global and inclusive approach should be taken to ensure consistency with the Pinellas Suncoast Transit Authority's (PSTA's) goal of doubling ridership over the next 10 years. Consequently, the application of an expanded list of enhanced bus service modes that includes express service and limited-stop service was integrated into the study. Most important was the refocus of the study from the technical merits of each individual study corridor to the connectivity, mobility, and accessibility between major activity centers in the county. The plan would now be developed in coordination with other planning efforts, i.e., the Tampa Bay Area Regional Transportation Authority (TBARTA) regional planning efforts and the Pinellas County MPO's Long Range Transportation Plan (LRTP) Update and would respond to the following:

- Major origins/destinations and where people desire to travel
- Existing and future major employment destinations
- Existing and future land use, especially areas focusing on transit supportive land use (multimodal transportation districts, concurrency exception areas, etc.)

The resulting land use approach to development of the plan served to focus the study effort on building a conceptual plan of enhanced bus services that serve the entire county and postponed the need to prioritize corridors until that concept was in place. To reach that end, six major tasks were performed as part of the study:

Task 1: Bus Network Service Concept – A bus network conceptual plan was developed based on the top 10 highest-performing PSTA corridors. Using these routes as a guide, nine corridors were selected for further evaluation and integration into an enhanced bus network for Pinellas County.

Task 2: Preliminary Corridor Implementation Plans – Preliminary implementation plans for the enhanced bus network conceptual plan corridors were prepared. Implementation plan elements include station types and locations, signal priority treatments, preliminary service plans, and other pertinent enhanced bus service elements.

Task 3: Preliminary Cost Estimates – Preliminary capital and operating cost estimates for the implementation of bus service enhancements were developed for the enhanced bus network.

Task 4: Public Involvement Plan – A public involvement plan was developed to support the enhanced bus network conceptual plan development that is consistent with the MPO's overall plan for public participation and coordinated with the MPO's long range transportation planning process.

Task 5: Public Education, Meetings, and Presentations – This task includes public meetings, committee meetings, workshops, and presentations to support the study. Efforts conducted in this task are consistent with the public involvement plan developed in Task 5.

Task 6: Draft and Final Report – A draft and final report were prepared to summarize the results of the study.

ORGANIZATION OF REPORT

This report documents the activities conducted during the study. Including this introduction, the report is organized into four sections.

Section 2 describes the development of the **Pinellas County Bus Network Concept** and the corresponding network preliminary implementation plans. A map series is included to illustrate the conceptual bus network and each corridor's preliminary implementation plan.

Section 3 documents **Preliminary Cost Estimates** for the conceptual bus network. Both operating and capital costs are included in the cost estimation process. The resulting cost estimates provide guidelines for future planning and programming efforts.

Section 4 identifies **Additional Planning Requirements** recommended for carrying forward the implementation of the bus network concept. Two planning tracks are provided that identify planning steps for various service modes proposed in the network plan.

Additionally, four appendices have been prepared that include supplemental detail in support of the preliminary implementation plans and cost estimates included in the report.

Section 2
Pinellas County Bus Network Concept

The bus network concept reflects the future of bus service in Pinellas County. A dynamic approach was used in development of that concept that included consideration of PSTA's top-performing transit corridors, existing and future land use patterns, and major activity centers in the county. In addition, preliminary implementation plans were prepared that indicate proposed service modes, station locations, and other infrastructure elements for each corridor within the conceptual bus service plan. This section documents the process used to develop the plan and includes the preliminary implementation plans resulting from that effort.

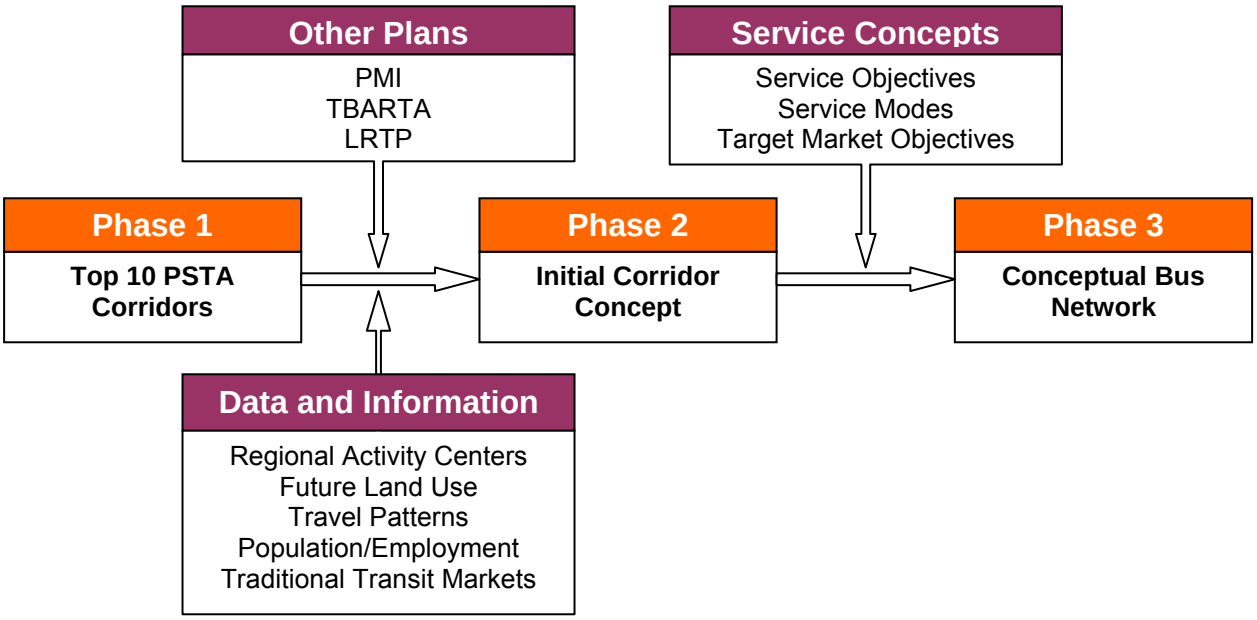
BUS NETWORK CONCEPT DEVELOPMENT

Development of the bus network conceptual plan was organized into three major phases:

- Phase 1: Assessment of the top 10 PSTA corridors
- Phase 2: Development of the initial corridor concept
- Phase 3: Definition of conceptual bus network

Figure 2-1 illustrates the three phases and the various informational items used to support the analysis process.

Figure 2-1: Conceptual Bus Network Development



Phase 1: Assessment of the top 10 PSTA corridors

One of the new directions outlined for PSTA in the 2008 Transit Development Plan (TDP) was emphasis on the top transit corridors in the county. The top 10 PSTA corridors are defined as those corridors on which the 10 most productive PSTA routes operate. Those 10 routes are illustrated in Map 2-1 and include Routes 4, 18, 19, 35, 52, 59, 60, 74, 79, and the Suncoast Beach Trolley. Improving service in these corridors will assist in achieving PSTA's 2008 TDP goal of doubling ridership over the next 10 years.

The basis of the enhanced bus network concept development process consisted of an assessment of the top 10 PSTA corridors. Using those corridors as the starting point for the network ensured consistency with PSTA's direction and goal to double ridership over the next 10 years. The assessment and review of these routes was performed to confirm the connectivity of these routes to existing and future transit-supportive land use and development.

Phase 2: Development of the Initial Corridor Concept

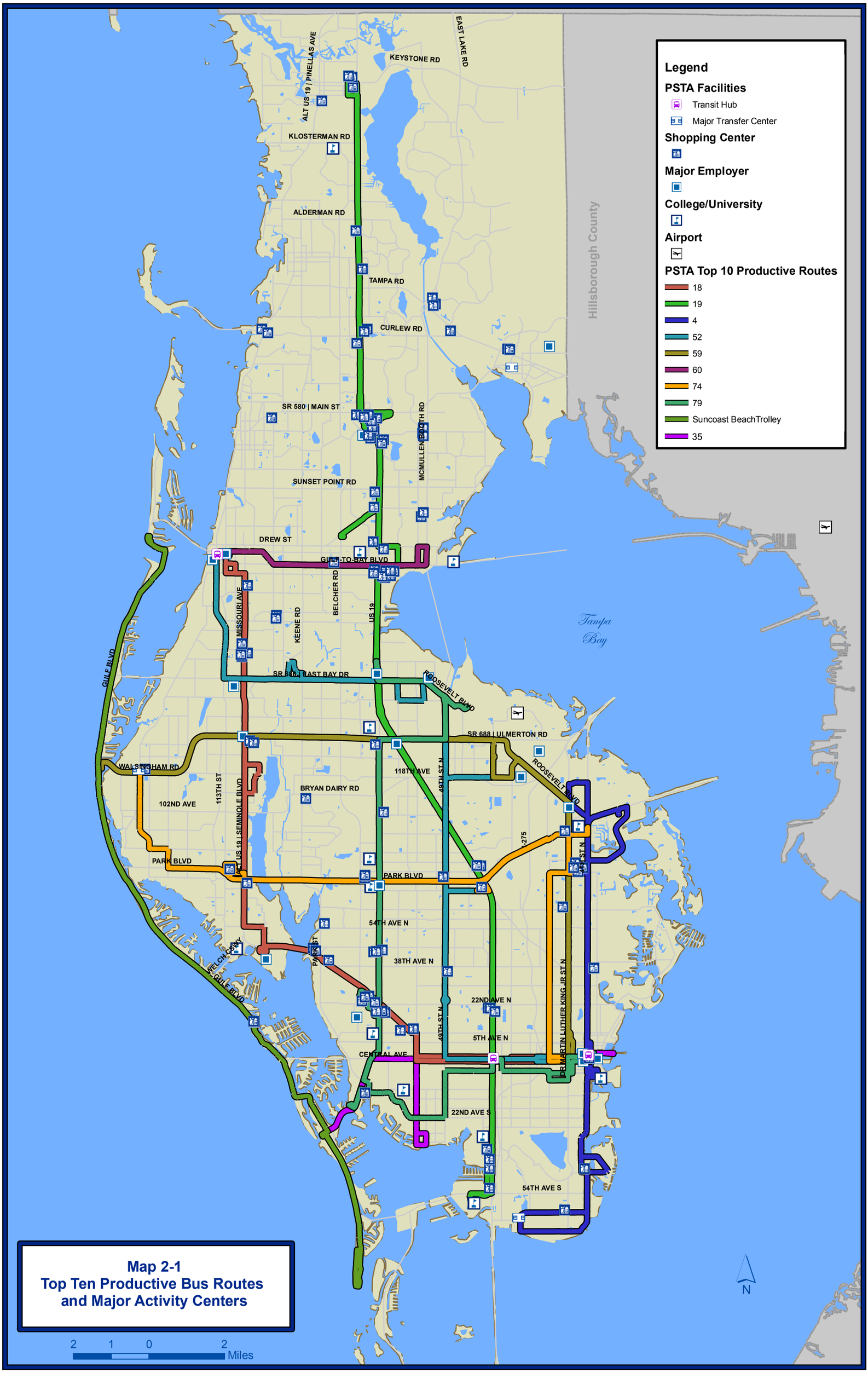
As directed by the PMI Steering Committee, a major focus of the enhanced bus network development process was to tie the network to transit-supportive land uses and markets. Consequently, a variety of planning documents and data was used to inform the process. Plans, data, and information used to realign, refine, and/or reconfigure the top 10 PSTA corridors into the initial corridor concept includes the following:

<u>Plans</u>

- Pinellas Mobility Initiative (PMI) Final Report
- Tampa Bay Area Regional Transit Authority (TBARTA) Master Plan (in process)
- Pinellas County MPO 2025 LRTP
- Pinellas County MPO 2035 LRTP (in process)

<u>Data and Information</u>

- TBARTA Regional Activity Centers
- Pinellas County Future Land Use
- Travel Patterns
- Existing Population and Employment Data
- Future Population and Employment Data
- Redevelopment Areas



Map 2-1
Top Ten Productive Bus Routes and Major Activity Centers

The resulting network provides connectivity, mobility, and accessibility between major activity centers in the county. That network, the initial corridor concept, is illustrated in Map 2-2.

It is important to note that an effort was made to provide consistency with ongoing regional transit planning efforts being performed by TBARTA. Regional activity centers for Pinellas County being used by TBARTA for the regional transit service master plan are divided into three tiers:

- **Tier 1 Regional Activity Centers** – Tier 1 activity centers reach a net density of employment of at least 50 jobs per acre in 2030 and received general consensus among TBARTA Land Use Working Group meeting attendees about designation as a Tier 1 activity center.

- **Tier 2 Regional Activity Centers** – Tier 2 activity centers reach a net density of employment of 20-50 jobs per acre in 2030 or contain lower density employment combined with other elements and received support from TBARTA Land Use Working Group attendees for designation as a Tier 2 activity center. Other elements considered include:

    - residential density of 6-10 people per acre
    - 1-5 hotel rooms per acre
    - special generators (airports, hospitals, shopping centers, arenas, convention centers, stadiums, colleges, and universities);
    - recent development proposals (Developments of Regional Impact (DRI) and subthreshold Planned Unit Developments (PUD) adopted since 2003)
    - local policy initiatives for incentivizing development (Comprehensive Plan Activity Centers, Community Redevelopment Areas, Transportation Concurrency Exception Areas, Multi-Modal Transportation Districts, and Enterprise Zones)

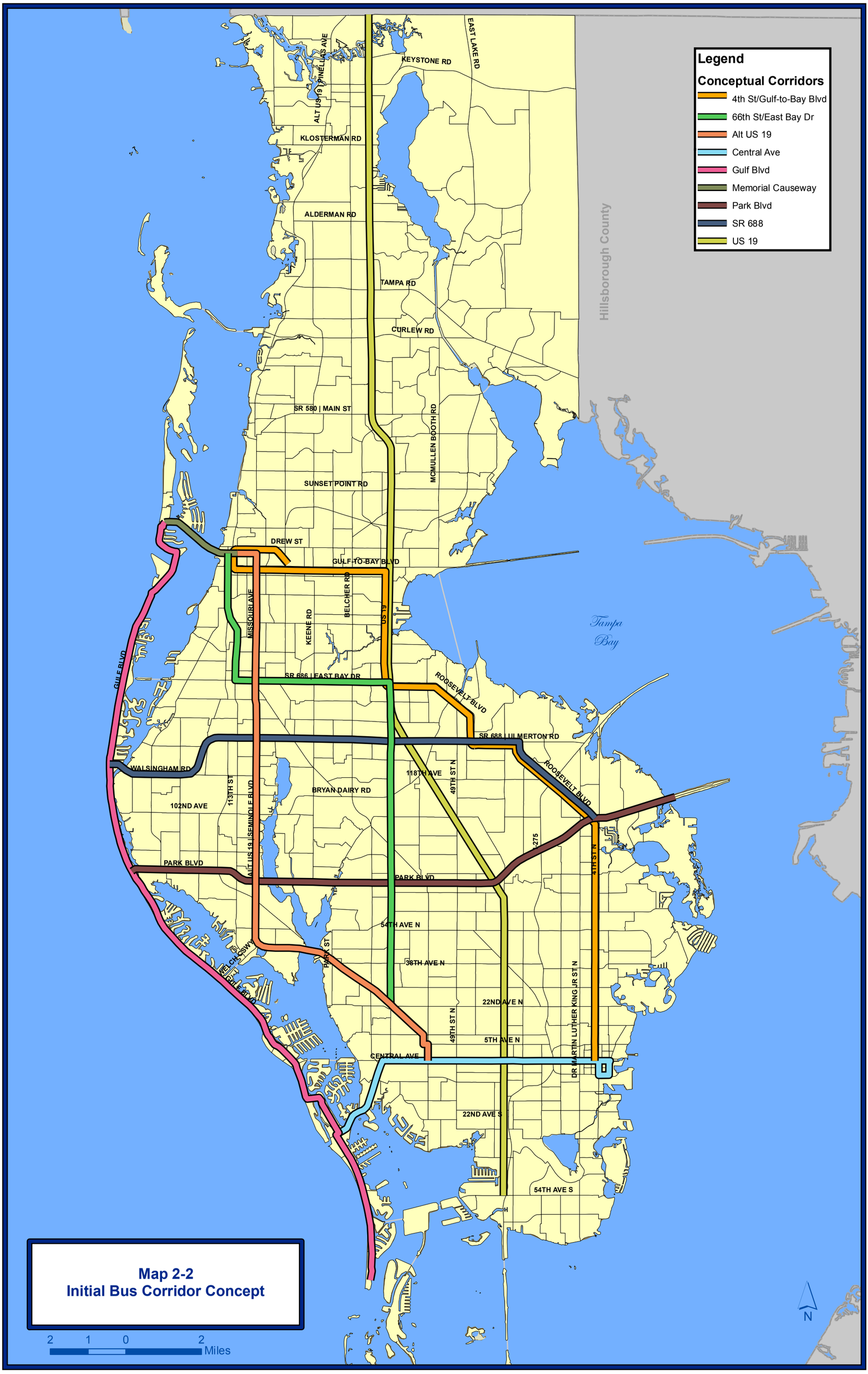
- **Tier 3 Regional Activity Centers** – Tier 3 activity centers reach a net density of employment of 4-20 jobs per acre in 2030 or contain lower density employment combined with other elements and received support from TBARTA Land Use Working Group Attendees for designation as a Tier 3 activity center. Other elements considered include:

    - residential density of 6-10 people per acre
    - 1-5 hotels rooms per acre
    - special generators
    - recent development proposals
    - local policy initiatives for incentivizing development

At the time of bus network concept development, the categories, or tiers, included the activity centers shown in Table 2-1.

Table 2-1: TBARTA Regional Activity Centers

Regional Activity Center	Tier
Downtown St. Petersburg	1
Gateway	1
Downtown Clearwater	1
St. Pete Beach	2
Central Ave/Central Plaza	2
Tyrone Square	2
Seminole	2
US 19/Roosevelt Blvd	2
Clearwater Beach	2
US 19/SR 60	2
Dunedin	2
St. Pete/Clearwater Airport	2
Countryside	2
Largo Mall	2
Bryan Dairy Industrial/Medical Complex	2
Downtown Largo	2
South St. Pete	3
Lealman	3
Madeira	3
Pinellas Park	3
Palm Harbor	3
Tarpon Springs	3
Eckerd College	3
Oldsmar	3
Safety Harbor	3
Indian Rocks Beach/Walsingham	3
Redington Shores/Park Blvd	3
Treasure Island	3
Parkside Mall	3


Legend
Conceptual Corridors
4th St/Gulf-to-Bay Blvd
66th St/East Bay Dr
Alt US 19
Central Ave
Gulf Blvd
Memorial Causeway
Park Blvd
SR 688
US 19
Hillsborough County
Tampa Bay
KEYSTONE RD
EAST LAKE RD
ALT US 19 | PINELLAS AVE
KLOSTERMAN RD
ALDERMAN RD
TAMPA RD
CURLEW RD
MCMULLEN BOOTH RD
SR 580 | MAIN ST
SUNSET POINT RD
DREW ST
GULF-TO-BAY BLVD
BELCHER RD
US 19
MISSOURI AVE
KEENE RD
GULF BLVD
SR 686 | EAST BAY DR
ROOSEVELT BLVD
SR 688 | ULMERTON RD
WALSINGHAM RD
113TH ST
ALT US 19 | SEMINOLE BLVD
102ND AVE
BRYAN DAIRY RD
118TH AVE
49TH ST N
275
PARK BLVD
54TH AVE N
38TH AVE N
22ND AVE N
5TH AVE N
CENTRAL AVE
22ND AVE S
54TH AVE S
DR MARTIN LUTHER KING JR ST N
Map 2-2
Initial Bus Corridor Concept
2 1 0 2
Miles
N

Phase 3: Definition of Conceptual Bus Network

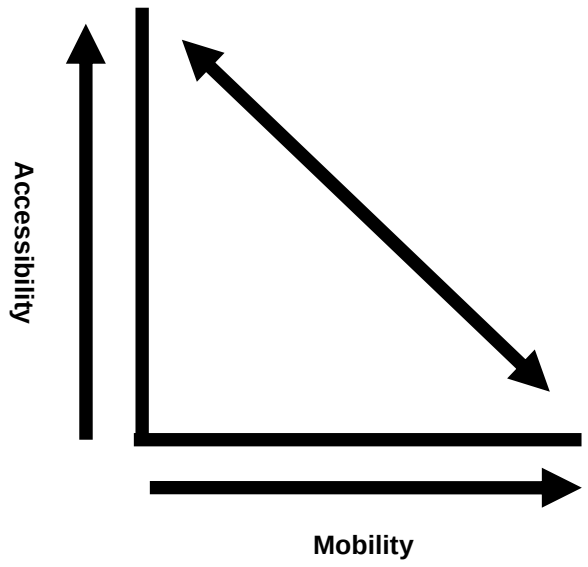
Service concepts were established to define the structure of the conceptual bus network and its individual components. The service concepts assisted in ensuring objectivity in the application of enhanced bus service elements. Enhanced bus service elements include service modes, running way facilities, and service plans, among others, and will be discussed later on in this section. Service concepts also help strengthen the relationship between land use and the various components of the bus network. Service concepts used to develop the network consist of operational objectives, service modes, and transit market objectives. They are defined as follows.

- **Operational Objectives** – Enhanced bus service elements should address mobility between and/or accessibility to/from transit-supportive land uses and development in the county.

    - **Mobility** – The ability to travel freely and/or quickly between origins and destinations.
    - **Accessibility** – The ability to travel among and provide access to/from various origins and destinations.

    Mobility and accessibility are traditionally used to define the functional classification of roadways. The relationship between the two is a negative correlation where one decreases whenever the other increases (See Figure 2-2).

Figure 2-2: Correlation Between Mobility and Accessibility



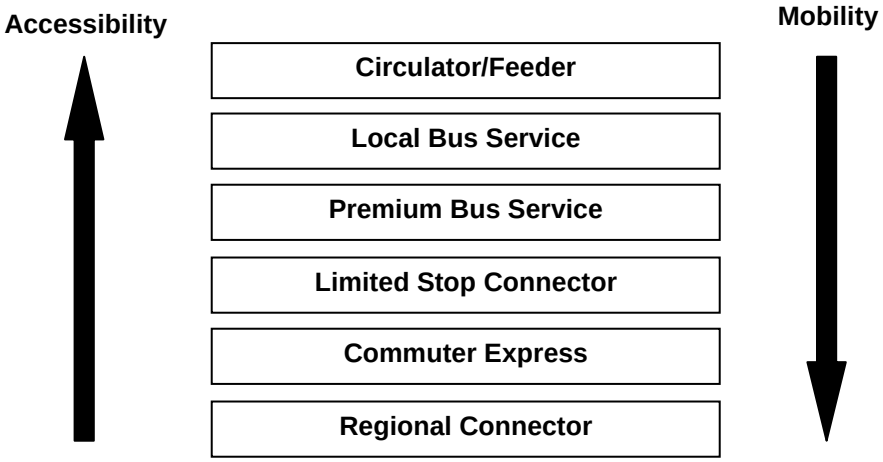
Consequently, the application of these concepts assists in determining the function of each bus network concept corridor and element. The application of these concepts is more readily understood in the following discussion about service modes.

- **Service Modes** – A bus service hierarchy was developed and applied to the conceptual bus network corridors. The bus services identified for the conceptual plan consist of the following service modes.

    - **Circulator/Feeder Service** – Provides circulation within activity centers and feeder service to transfer facilities where premium bus and other conceptual bus network services meet.
    - **Local Bus Service** – Serves as the traditional all-stop local bus service, similar to what PSTA currently provides.
    - **Premium Bus Service** – Reflects premium bus rapid transit service that integrates a host of premium bus service features and technology.
    - **Limited Stop Connector Service** – A variant of local bus service with wider stop spacing and faster travel speed.
    - **Commuter Express Service** – Designed to provide limited stop service to commuters during peak hours of travel.
    - **Regional Connector Service** – Provides regional connectivity to neighboring counties.

Figure 2-3 illustrates the bus service mode hierarchy and its relationship to the conceptual network's operational objectives: mobility and accessibility. Following the service mode hierarchy, improvements in mobility translate to decreased accessibility.

Figure 2-3: Service Mode and Operational Objectives



- **Transit Market Objectives** – Enhanced bus service elements should target and meet transit market needs within the county. Transit market objectives identified for the bus network concept include the following.

    - Tourism/Economic Development
    - Major Activity Center Connectivity
    - North-South Travel Patterns
    - East-West Travel Patterns
    - Commuter Travel
    - Downtown-to-Downtown Travel
    - Regional Connectivity
    - Premium Service Connectivity

Conceptual bus network corridors are designed to meet one or more of the noted target market objectives and are consistent with the noted service concepts. Map 2-3 illustrates the Pinellas County enhanced bus service concept plan. In that map, service modes are distinguished by color and connections to major activity centers in the area are shown. Implementation of the bus network concept should not preclude other investments or enhancements to transit service being programmed for the region. Consequently, Map 2-3 also illustrates the TBARTA Regional Master Plan corridors.

As a result of policy direction received from the PSTA Board, future premium/enhanced services are also illustrated on the bus service conceptual plan. These additional plan features reflect the possible future implementation of premium bus service in the north county area. Additional detail for that future service should be developed as the corridors continue to grow and develop.

In addition, Table 2-2 includes a corridor-by-corridor summary and indicates the relationship between the corridors and the noted service concepts. The table indicates the following characteristics.

- Target market objectives met by each corridor
- Service mode operating on each segment of each corridor
- Level of attainment for the plan's operational objectives

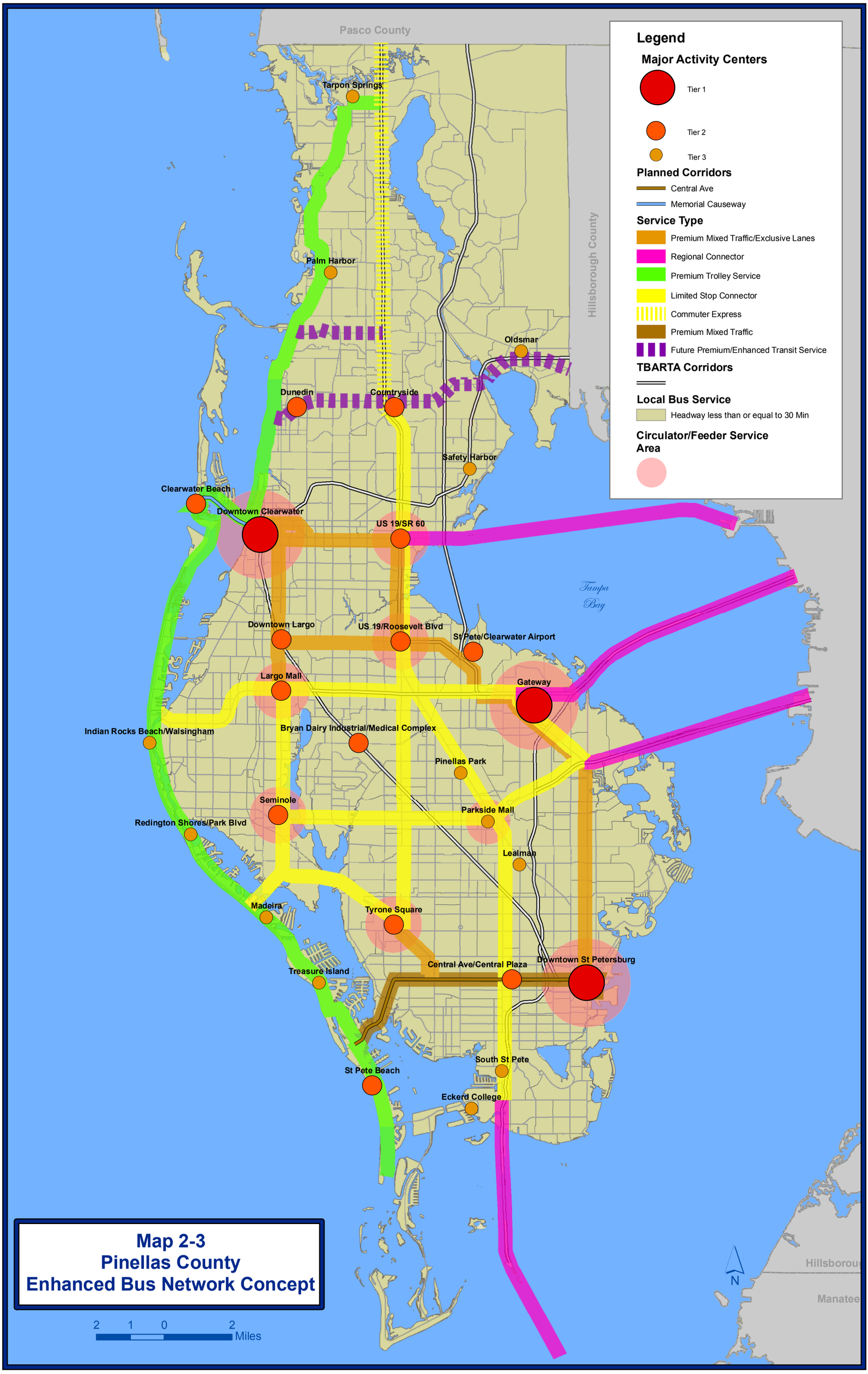

Pasco County
Hillsborough County
Tampa Bay
Legend
Major Activity Centers
Tier 1
Tier 2
Tier 3
Planned Corridors
Central Ave
Memorial Causeway
Service Type
Premium Mixed Traffic/Exclusive Lanes
Regional Connector
Premium Trolley Service
Limited Stop Connector
Commuter Express
Premium Mixed Traffic
Future Premium/Enhanced Transit Service
TBARTA Corridors
Local Bus Service
Headway less than or equal to 30 Min
Circulator/Feeder Service Area
Tarpon Springs
Palm Harbor
Oldsmar
Dunedin
Countryside
Safety Harbor
Clearwater Beach
Downtown Clearwater
US 19/SR 60
Downtown Largo
US 19/Roosevelt Blvd
St Pete/Clearwater Airport
Largo Mall
Gateway
Indian Rocks Beach/Walsingham
Bryan Dairy Industrial/Medical Complex
Pinellas Park
Seminole
Parkside Mall
Redington Shores/Park Blvd
Lealman
Madeira
Tyrone Square
Central Ave/Central Plaza
Downtown St Petersburg
Treasure Island
South St Pete
St Pete Beach
Eckerd College
Map 2-3
Pinellas County
Enhanced Bus Network Concept
2 1 0 2
Miles
N
Hillsborough
Manatee

Table 2-2: Pinellas County Conceptual Bus Network Objectives

	Corridor	Segment From	Segment To	Service Type	Operational Objectives	Target Market Objectives	Activity Centers Served
1	Central Ave	Downtown St. Petersburg	St. Pete Beach	Premium Mixed Traffic	Moderate Mobility Moderate Accessibility	Tourism/Economic Development Major Activity Center Connectivity Commuter Travel	Downtown St. Petersburg Central Ave/Central Plaza St. Pete Beach
2	US 19	Manatee County	54th Ave S	Regional Connector	High Mobility Low Accessibility	Major Activity Center Connectivity Regional Connectivity North-South Travel Commuter Travel	South St. Petersburg Central Ave/Central Plaza Lealman Pinellas Park US 19/Roosevelt US 19/SR 60 Countryside Palm Harbor Tarpon Springs
		54th Ave S Central Ave Park Blvd	Central Ave Park Blvd East Bay Dr	Limited Stop Connector	High Mobility Moderate Accessibility		
		East Bay Dr	Gulf-to-Bay Blvd	Premium Limited Stop Connector	High Mobility Moderate Accessibility		
		Gulf-to-Bay Blvd	Countryside Blvd	Limited Stop Connector	High Mobility Moderate Accessibility		
		Countryside Blvd	County Boundary	Commuter Express	High Mobility Low Accessibility		
3	Alt US 19	Central Ave	66th St N	Premium	Moderate Mobility Moderate Accessibility	Major Activity Center Connectivity Commuter Travel	Tyrone Square/St. Petersburg College Madeira Seminole Largo Mall Downtown Clearwater
		66th St N Park Blvd	Park Blvd Walsingham Rd	Limited Stop Connector	High Mobility Moderate Accessibility		
		Walsingham Rd East Bay Dr	East Bay Dr Downtown Clearwater	Premium	Moderate Mobility Moderate Accessibility		
4	4th St/Gulf-to-Bay Blvd	Central Ave	Gandy Blvd	Premium	High to Moderate Mobility Moderate Accessibility	Major Activity Center Connectivity Downtown-to-Downtown Travel Commuter Travel	Downtown St. Petersburg Gateway St. Pete/Clearwater Airport US 19/Roosevelt US 19/SR 60 Downtown Clearwater
		Gandy Blvd	Roosevelt Blvd	Premium Limited Stop Connector			
		Roosevelt Blvd	US 19	Premium			
		East Bay Dr	Gulf-to-Bay Blvd	Premium Limited Stop Connector			
		US 19	Downtown Clearwater	Premium			
5	66th St/East Bay Dr	Tyrone Blvd Park Blvd Ulmerton Rd	Park Blvd Ulmerton Rd East Bay Dr	Limited Stop Connector	High Mobility Moderate Accessibility	Major Activity Center Connectivity Commuter Travel	Tyrone Square/St. Petersburg College US 19/Roosevelt Downtown Clearwater
		66th St N	Missouri Ave	Premium	Moderate Mobility Moderate Accessibility		
6	Memorial Cswy	Myrtle Ave	Gulf Blvd	Premium	Moderate Mobility Moderate Accessibility	Tourism/Economic Development Commuter Travel	Downtown Clearwater Clearwater Beach
7	Park Blvd/Gandy Bridge	Hillsborough County	4th St N	Commuter Express	High Mobility Low Accessibility	Major Activity Center Connectivity East-West Travel Regional Connectivity Commuter Travel	Seminole Pinellas Park Gateway
		4th St N US 19 66th St N	US 19 66th St N Seminole Blvd	Limited Stop Connector	High Mobility Moderate Accessibility		
8	Ulmerton Rd/Howard Frankland Bridge/Walsingham Road	Hillsborough County	Roosevelt Blvd	Commuter Express	High Mobility Low Accessibility	Major Activity Center Connectivity East-West Travel Regional Connectivity Commuter Travel	Largo Mall St. Pete/Clearwater Airport Gateway
		Roosevelt Blvd (S. of Ulmerton Rd)	Roosevelt Blvd (N. of Ulmerton Rd)	Premium	Moderate Mobility Moderate Accessibility		
		Roosevelt Blvd (S. of Ulmerton Rd)	Gulf Blvd	Limited Stop Connector	High Mobility Low Accessibility		
9	Gulf Blvd/Alt US 19 (North of Clearwater)	Pass-a-Grille Clearwater Beach	Clearwater Beach Tarpon Springs	Enhanced Trolley Service	High Accessibility	Tourism/Economic Development Major Activity Center Connectivity North-South Travel Commuter Travel	St. Pete Beach Treasure Island Madeira Redington Shores/Park Blvd Indian Rocks Beach/Walsingham Clearwater Beach Downtown Clearwater Dunedin Palm Harbor Tarpon Springs
10	SR 580*	Alt US 19	Hillsborough County	Premium	Moderate Mobility Moderate Accessibility	Major Activity Center Connectivity Regional Connectivity East-West Travel	Dunedin Countryside Oldsmar
11	Curlew Rd*	Alt US 19	US 19	Premium	Moderate Mobility Moderate Accessibility	East-West Travel	
12	Local Bus Service	Pinellas County		Service Frequency ≤ 30 Minutes	High Accessibility Circulation	Major Activity Center Connectivity Premium Service Connectivity	All
13	Circulator/Feeder Service	Major Activity Centers		Circulator/Feeder Service	High Accessibility Circulation	Major Activity Center Connectivity Premium Service Connectivity	Downtown Clearwater US 19/SR 60 US 19/Roosevelt Largo Mall Seminole Pinellas Park Gateway Tyrone Square/St. Petersburg College Downtown St. Petersburg

*Future premium service implementation along SR 580 and Curlew Rd is based on policy direction received from the PSTA board and detailed implementation plans for these corridors are not included in this plan.

ENHANCED BUS SERVICE ELEMENTS

The following section provides an overview of enhanced bus service elements integrated into the bus network conceptual plan. The elements include the following:

- Running ways
- Stations
- Bus preferential treatments
- Operational parameters
- Fare collection systems
- Vehicle design
- Identity/image (branding)

A description of each element is provided and the method used to apply the service elements to the plan corridors is described. Recommendations for conceptual plan implementation are provided where appropriate.

Running Way Concepts

Premium bus service running ways range from mixed-traffic operation to fully grade-separated busways. They may be classified according to the degree of access control (traffic separation) or by type of facility. In many instances, running ways play a major role in determining the character and scale of the premium bus service. Many planning and design issues associated with premium bus service implementation are determined based on the type of running way to be used for the service.

For the conceptual plan, premium bus service running way concepts consist of two types: exclusive running ways and mixed-traffic operations. Because of the relatively low cost associated with mixed-traffic running way implementation, such an operation can serve as a precursor to exclusive running way facility development which generally requires a larger capital investment. Mixed-traffic operations can also function as a testing ground for future network development. Transit agencies can build their service incrementally where larger investments in transit infrastructure are made in corridors that exhibit high ridership levels or substantial transit-supportive development. Consequently, mixed-traffic is assumed to be the initial preferred running way facility type for bus network concept corridors where premium bus service is proposed. Exclusive running way facilities, in the form of arterial exclusive bus lanes, are presented as an optional feature. Implementation of arterial exclusive bus lanes and their associated costs are described in Section 3 of this report.

Station Locations

Stations function as the nucleus of activity where a variety of enhanced bus service components, such as fare collection, level boarding, safety, and branding, come together and work to create a

positive experience for the system user. Because of the significance of the transit station and the relationship stations hold with other elements, transit agencies have emphasized designing stations that meet operational needs and fit into the character of the surrounding community.

For the Pinellas County bus service conceptual plan, four station types were identified. Station types include simple stops, enhanced stations, transfer stations, and major transfer facilities. These station types, along with standard and optional infrastructure elements for each, are noted in Table 2-3. Additional station security features to consider that are not shown in Table 2-3 include security phones and video surveillance.

Table 2-3
Station Amenities & Infrastructure

Feature	Simple	Enhanced	Transfer Station	Major Transfer Facility
Sign & Pole	S	S	S	S
Route Designation	S	S	S	S
Sidewalk Connectivity	S	S	S	S
Benches	S	S	S	S
Shelter	O	S	S	S
Schedule Information	S	S	S	S
Information Kiosk	–	–	S	S
Park-and-Ride	–	–	O	O
Lighting	–	S	S	S
Real-Time Passenger Information	–	O	S	S
Level Boarding	–	S*	S	S

Key: S – Standard
O – Optional
*Dependent on site-specific characteristics

Application of station types to the conceptual bus network was premised on two factors: service mode and the intersection between network corridors. Table 2-4 summarizes the application of simple and enhanced station types by mode. Transfer stations and major transfer facilities are determined based on the number and type of enhanced services that intersect at any given location and the activity center at which those services meet, if any.

Table 2-4: Station Types by Mode

Station Type	Local Bus	Enhanced Trolley Service	Limited-Stop Connector	Premium Bus Service	Commuter Express	Regional Connector
Simple	S	S	S	-	S	S
Enhanced	O	O	O	S	O	O

Key: S – Standard
O – Optional

Station locations for premium bus service were identified based on major activity centers and station spacing guidelines for premium bus services identified in TCRP Report 90, *Bus Rapid Transit-Implementation Guidelines (2003)*. Station location and spacing strongly affect system patronage and system operating speeds. Basic transit planning principles can be applied to ensure system operating efficiencies. For example, premium bus service stations should be spaced far enough to achieve high operating speeds and minimize trip times and also maintain a moderate level of accessibility. Tables 2-5 and 2-6 provide suggested guidelines for bus service station spacing based on arrival mode to the station and on densities, respectively. In general, access to premium bus stations by pedestrians occurs most often in urban cores, and access to stations via automobiles is most often observed in the suburbs.

Table 2-5: Typical Premium Bus Service Station Spacing

Main Arrival Mode	Spacing (Miles)
Pedestrians	0.25-0.33
Bus	0.5-1.0
Automobile	2.0

Source: TCRP Report 90, *Bus Rapid Transit-Implementation Guidelines, 2003*

Table 2-6: Typical Stop Spacing by Density

Density Criteria	Environment	Spacing Range	Typical Spacing
80 units/acre	Central Core Areas of CBDs	300 ft - 1000 ft	600 ft
22 to 80 units/acre	Urban Areas	500 ft - 1200 ft	750 ft
4 to 22 unites/acre	Suburban Areas	600 ft - 2500 ft	1000 ft
less than 4 unites/acre	Rural Areas	650 ft - 2640 ft	1250 ft

Source: TCRP Report 19, *Guidelines for the Location and Design of Stops*

Station locations for limited stop connector service were based on the existing PSTA local bus stop inventory. Limited stop service is generally structured to provide access to every second or third local bus stop, thus improving scheduled running times by 10 to 15 percent over the local bus service. Station locations for commuter express and regional connector services were identified based on need.

Bus Preferential Treatments

Bus preferential treatments refer to intersection treatments that grant buses some level of preference or priority over other traffic traveling through the intersection. Three common types of intersection preferential treatments include:

- Queue jump
- Queue bypass lane
- Transit signal priority

A queue jump is where a bus would enter a right turn lane or an exclusive lane at an intersection to bypass the general traffic queue. The bus would then have an advance green signal indication to pull ahead of through-traffic back into the general traffic lanes. A queue bypass lane involves a bus entering a right turn lane or exclusive lane, then going straight through the intersection on the normal through-traffic green phase into a far side pullout, with no signal priority provided. Illustrations of queue jump and queue bypass lanes are shown in Figure 2-4.

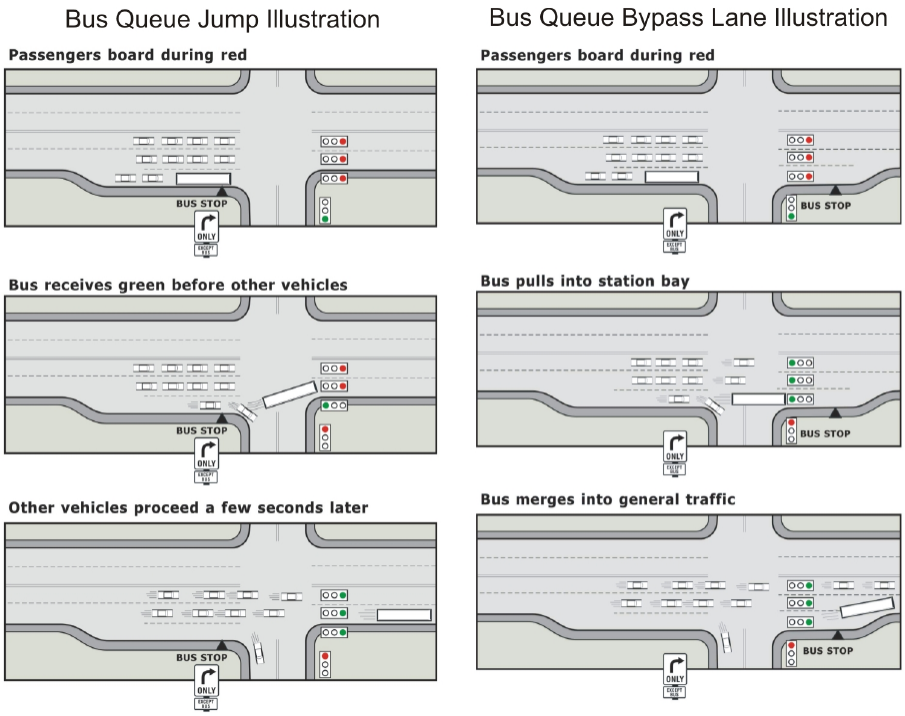
Analysis of bus queue jump and by-pass implementation is intersection-specific and depends on the current turn lane configuration and available right-of-way. Generally, most bus services are likely to benefit from implementation of either queue jump or by-pass techniques when the service does not run on dedicated running ways; however, these treatments require detailed evaluation that is more suitable for preliminary engineering studies.

Transit signal priority (TSP) is the process by which the traffic signal operation is altered slightly to provide advantage to the transit operations. TSP involves extending the green or truncating the red signal phase for the general traffic lanes to allow a bus to go through an intersection. Figure 2-5 illustrates the operating principles of TSP.

TSP can reduce bus travel delay by minimizing or eliminating traffic signal stops. TSP through intersections can be implemented in three different ways: passive, active, or real-time. Passive TSP implementations involve pre-timed traffic signal phasing adjustments based on the known bus travel times on sections of the route without detection of buses in the field. Active TSP implementations rely on transit vehicle relative location to a signalized intersection. Bus location information can be generated either from the vehicle itself or a centralized system. Active traffic signal adjustments are made only when the bus approaches the specific signal. Transit vehicle priority can always be granted or it can rely on the vehicle passenger loading and/or adherence to the schedule in a conditional application. Real-time or adaptive strategies respond to both bus and general traffic arrivals at an intersection or network of intersections. The traffic signal equipment needs to gauge the general traffic demands and be capable of optimizing signal timings in the field.

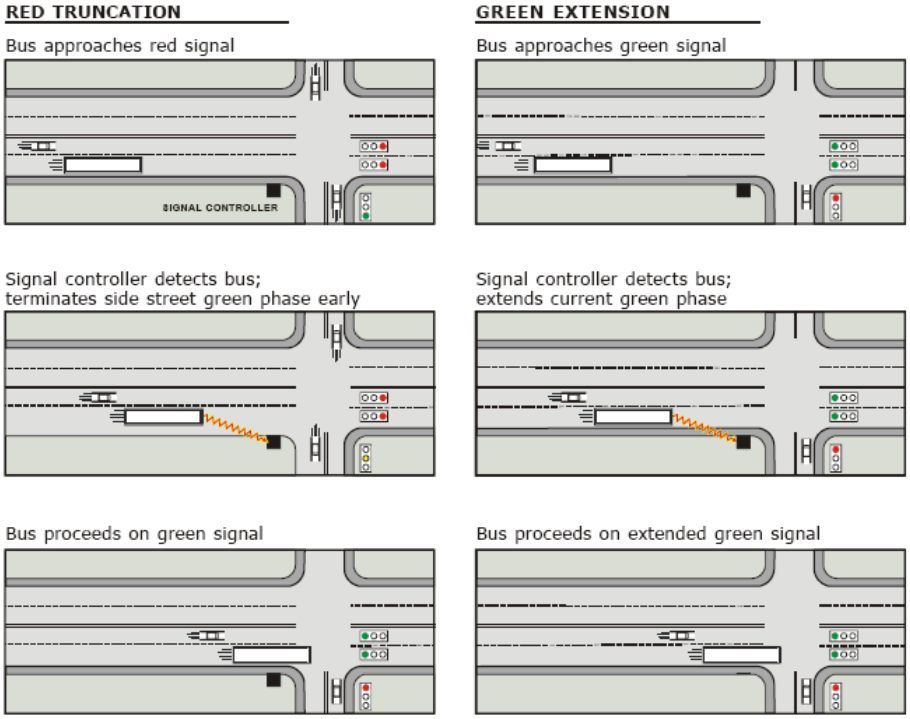
TSP can be implemented on a system-wide basis or locally at specific intersections. Three local transportation jurisdictions maintain traffic signals along the 10 study routes: Pinellas County, City of Clearwater, and City of St. Petersburg. The degree to which TSP could be implemented along a route depends on the traffic signal equipment in the field and the overall traffic system technology used by each jurisdiction. Pinellas County uses three different field controllers: PEEK 1880EL, PEEK 3000E, and Type 2070 Econolite ASC/2. The City of Clearwater uses the same type of equipment as the County. The City of St. Petersburg uses a centralized control system, CompuTran, with on-street NEMA Econolite ASC/2 controllers. Traffic signal controller TSP capabilities are summarized in Table 2-7.

Figure 2-4: Bus Queue Jump and Queue Bypass Lane



SOURCE: Kittelson & Associates, Inc.

Figure 2-5: Transit Signal Priority Illustration



Source: *Transit Capacity and Quality of Service Manual – 2nd Edition, 2003*

Table 2-7: Traffic Signal Controller TSP Capabilities

Controller	PEEK (Transyt) 1880EL	PEEK 3000E	Type 2070-Econolite ASC/2	NEMA Econolite ASC/2
Capable of implementing TSP	No	No	Yes	Yes
TSP functionality	None/Limited (pre-timed transit phases may be implemented on permanent bases)	None/Limited (pre-timed transit phases may be implemented on permanent bases)	Econolite ASC/2 software is equipped with TSP. The software would have to be purchased and tested for/by the County.	Econolite ASC/2 software is equipped with TSP. The software would have to be purchased and tested for/by the City.

Transit priority along a bus route does not only improve service reliability, but also highlights the service benefits to both the transit patrons and the adjacent traffic participants. Consequently, TSP should be considered at all intersections along the study routes. TSP implementation along the study routes was assessed based on controller type. Routes were broken up in sections of roadway with intersection traffic signal equipment capable of upgrades that support TSP operations or intersections that require new traffic signal equipment. Final system configurations, including traffic signal software or hardware, bus detectors, and bus equipment, depend on the implementation strategy agreed by the transit operator and the traffic signal maintaining agency. A route-by-route summary of bus preferential treatments is in included in Appendix B.

Operational Parameters

Operational parameters describe service frequencies, hours of service, and operating days for each conceptual plan service mode. These three elements should be carefully planned according to the basic operating nature of each mode. Tables 2-8 through 2-13 note the proposed service characteristics for each mode.

It should be noted that extended service hours for the proposed enhanced bus services have been developed as part of the Pinellas County MPO 2035 LRTP and TBARTA Master Plan. Since those plans were still under development at the completion of this study, the extended service hours were not incorporated into the Countywide Bus Rapid Transit Concept Plan.

Fare Collection System

There are generally two major fare collection methods, on-board fare collection and off-board fare collection. As the names of the two methods imply, on-board fare collection refers to collection of fares on the transit vehicle and off-board fare collection refers to the collection of fares off of transit vehicles. Off-board fare collection is most commonly conducted through the use of ticket vending machines (TVM).

Table 2-8: Service Characteristics for Limited-Stop Connector

Limited-Stop Connector	Operating Days		
	Weekday	Saturday	Sunday
Service Span	6:30 AM – 7:30 PM	6:30 AM – 7:30 PM	N/A
Service Frequency			
Peak	20 Minutes	20 Minutes	N/A
Off-Peak	30 Minutes	30 Minutes	N/A

Table 2-9: Service Characteristics for Premium Bus Service

Premium Bus Service	Operating Days		
	Weekday	Saturday	Sunday
Service Span	5:30 AM – 7:30 PM	5:30 AM – 7:30 PM	N/A
Service Frequency			
Peak	10 Minutes	10 Minutes	N/A
Off-Peak	15 Minutes	15 Minutes	N/A

Table 2-10: Service Characteristics for Commuter Express

Commuter Express	Operating Days		
	Weekday	Saturday	Sunday
Service Span	5:50 AM – 9:50 AM 3:30 PM – 7:05 PM	N/A	N/A
Service Frequency			
Peak	30 Minutes	N/A	N/A
Off-Peak	N/A	N/A	N/A

Table 2-11: Service Characteristics for Regional Connecter

Regional Connector	Operating Days		
	Weekday	Saturday	Sunday
Service Span	6:30 AM – 7:30 PM	6:30 AM – 7:30 PM	N/A
Service Frequency			
Peak	30 Minutes	30 Minutes	N/A
Off-Peak	30 Minutes	30 Minutes	N/A

Table 2-12: Service Characteristics for Gulf Blvd/Alt US 19 Trolley Service

Enhanced Trolley Service	Operating Days (Service north of Clearwater)		
	Weekday	Saturday	Sunday
Service Span	5:15 AM – 10:00 PM	5:15 AM – 10:00 PM	5:15 AM – 10:00 PM
Service Frequency			
Peak	30 Minutes	30 Minutes	30 Minutes
Off-Peak	30 Minutes	30 Minutes	30 Minutes

Table 2-13: Service Characteristics for Gulf Blvd/Alt US 19 Trolley Service

Enhanced Trolley Service	Operating Days (Service south of Clearwater)		
	Weekday	Saturday	Sunday
Service Span	5:15 AM – 12:20 AM*	5:15 AM – 12:20 AM*	5:15 AM – 10:00 PM
Service Frequency			
Peak	20 Minutes	20 Minutes	20 Minutes
Off-Peak	20 Minutes	20 Minutes	20 Minutes

*Enhanced trolley service will operate until 12:20 AM on Friday and Saturday only.

Off-board fare collection minimizes any delay related to on-board fare payment and allows for the implementation of multi-door boarding strategies. As a result, off-board fare collection systems have been shown to reduce station dwell times and, therefore, overall bus travel times. Off-board fare collection systems have proven to be costly. Capital costs include the purchase of specialized equipment, such as TVMs and fare processing software. In addition, associated maintenance of the equipment can contribute to additional operating costs for transit agencies.

A detailed comparison of various fare collection strategies is included in Table 2-14, which notes the difference in approaches to each alternative based on several parameters. Each strategy will have various issues and challenges that will need to be addressed if the particular fare collection option is integrated into the bus network concept system.

When applied to the conceptual plan, a combination of various fare collection strategies should be considered. Fare collection strategy recommendations and options include:

- Minimize cash usage on enhanced bus services through the use of period or multi-use fare passes to improve travel times.
- Ensure the transferability of fare media between modes. For example, if transferability is desired between all modes, fare media will need to function like a debit card. Such a service feature will require the purchase and placement of ticket vending machines (TVM) at strategic locations.
- Consider the use of off-board fare payment strategies to enhance the speed and reliability of premium bus service.
- Implement off-board fare payment strategies consistent with station and vehicle capabilities. For example, if cash usage is eliminated on premium bus service, ensure that stations are equipped with TVMs.
- Implement off-board fare payment strategies incrementally. Cashless on-board fare systems could serve as a precursor to a barrier-free off-board fare collection system, which could then serve as a precursor to a fare collection system that integrates barriers.
- Consider barriers only at major transfer facilities or at stations experiencing large passenger volumes initially to improve boarding and alighting efficiency.

Vehicle Design

Vehicles strongly impact nearly every aspect of transit system performance, from attraction of riders to operating and maintenance costs. For instance, vehicle design has been shown to affect the speed and reliability of transit service, which indirectly influence ridership and related benefits such as congestion reduction and air quality improvements. A vehicle's mechanical attributes also have an impact on operating and maintenance costs. In addition, proper door and interior

design (e.g., low floor, wide aisle, multiple doors) can have an impact on vehicle requirements, which may in turn reduce the number of drivers and maintenance staff needed.

Table 2-14: Fare Collection Strategies Comparison

Factor/Issue	On-Board Payment	Off-Board Payment		
		Conductor-Validated*	Proof-of-Payment (POP)*	Barrier
Equipment needed	Farebox, ticket processing units	TVMs, validators, hand-held readers	TVMs, validators, hand-held readers	Faregates, TVMs, add-fare machines
Station characteristics	NA	Open station	Open or on-street station	Requires space or gates and TVMs and defined entry/exit
Handling large passenger volumes	Slows boarding	Crowded cars can interfere with inspection	Crowded cars can interfere with inspection; may require high # of TVMs	Does not affect ability to collect fares
Customer convenience	Needs either prepayment (pass or multi-ride option) or exact change; possible queuing	No need to prepay or validate, no need for exact change, and no queuing (to pay or board)	Needs validation of multi-ride or stored-value tickets; possible queing to buy or validate, but not to board	Depends on types of payment accepted at gates (easiest if cash accepted); possible queing
Capital costs	Lowest costs; farebox, but no TVMs	Lower than POP; may be lowest (depending on # of TVMs used)	Lower than barrier, unless high volume; requires many TVMs	Cost of faregates high, but requires fewer TVMs than for POP (validation at faregate)
Operating costs	Lowest labor cost	Highest labor cost	Higher labor costs than barrier	Lower labor cost than POP

Source: TCRP Report 94, "Fare Policies, Structure, and Technologies" (2003)

* Conductor-validated systems are enforced after every stop by fare agents who may also collect fares. Proof-of-Payment systems are enforced using roving fare inspectors.

A growing trend among transit agencies is the consideration of environmentally-friendly vehicles that utilize alternative propulsion systems. Alternative propulsion systems include natural gas, hydrogen, electric, fuel cell, and hybrid electric systems that can combine diesel or natural gas with electric power.

To select appropriate vehicles for the bus network conceptual plan, a set of criteria and characteristics was prepared for each mode. The criteria and characteristics describe the ideal vehicle to be operated for each service mode, as noted in Table 2-15. In addition, an illustration of an example vehicle that meets the corresponding service mode's vehicle criteria and characteristics is shown. A specific vehicle (i.e., manufacturer) for each service mode is not delineated in this study. Vehicle selection and procurement will ultimately be determined when final design of the service occurs.

Table 2-15: Vehicle Criteria and Characteristics

Service Mode	Vehicle Criteria & Characteristics	Illustration
Premium Bus Service	1 Stylized design 2 Environmentally-friendly propulsion systems 3 High capacity 4 Interior or exterior bike racks 5 Comfortable seating arrangement 6 ITS application 7 Low floor recommended	
Regional Connector Commuter Express	1 "Coach"-style bus 2 Environmentally-friendly propulsion systems 3 Medium-to-high capacity 4 Comfortable seating arrangement 5 Exterior bike racks 6 Luggage storage	
Local Service Limited Stop Connector	1 Standard design 2 Environmentally-friendly propulsion systems 3 Medium-to-high capacity 4 Exterior bike racks	
Trolley	1 Fits into the character of community 2 Environmentally-friendly propulsion systems 3 Attractive to tourists/visitors market 4 Medium capacity 5 Interior decoration and craftsmanship 6 Exterior bike racks	
Circulator	1 Neighborhood friendly design 2 Environmentally-friendly propulsion systems 3 Low-to-medium capacity 4 Exterior bike racks	

Identity/Image ("Branding")

Creation of a unified system image and identity is very important in order to emphasize and market the unique features of premium bus service. Distinguishing those services from the local bus service can serve to attract more ridership. The general image associated with BRT should underline its unique attributes of speed, reliability, and identity. Distinctive logos, color combinations, and other graphic standards should be established for use on vehicles, at stations, and on printed materials.

At this time, PSTA uses separate color schemes to distinguish its express and commuter services from its local bus service. An example of the express bus service "brand" is illustrated in Figure 2-6.

Figure 2-6: PSTA Express and Commuter Bus Services Branding

There are a number of options for branding the various service modes proposed for the bus service conceptual plan. The noted options can be implemented individually or collectively.

- Create a separate brand for the premium bus service that distinguishes it from all other service modes. That brand design and color scheme should be developed to fit into bus wrapping schemes, marketing materials, and enhanced station shelter and signage.
- Use the same color scheme to distinguish commuter and express bus service from other service modes.
- Distinguish limited stop service from local bus service using a different route nomenclature. For example, local bus service and limited stop service on the US 19 corridor could be named Route 19 and Route 19X, respectively.
- Theme trolley services consistent with neighborhood character and surroundings as appropriate.

Although a set of service branding recommendations is provided here, a complete package of branding along with consumption ready marketing materials and information should be

determined once service is ready for implementation via a marketing plan developed by PSTA staff or a qualified marketing firm.

It is important to note that service mode branding is not limited to color schemes and logos. Distinction between services will also be determined by their service elements. Consequently, the discussion of service elements ties premium and enhanced service element characteristics to service modes as appropriate.

PRELIMINARY IMPLEMENTATION PLANS

Maps 2-4 through 2-11 illustrate the preliminary implementation plans for each of the conceptual plan corridors. The preliminary implementation plan maps show elements that vary by corridor. As such, the maps for each corridor implementation plan illustrate the following enhanced bus service elements.

- service modes
- running ways
- stations
- bus preferential treatments

Several of the described elements reflect system-wide bus service features. Those elements that are considered system-wide features and cannot be scaled to provide distinguishing corridor-to-corridor characteristics include the following

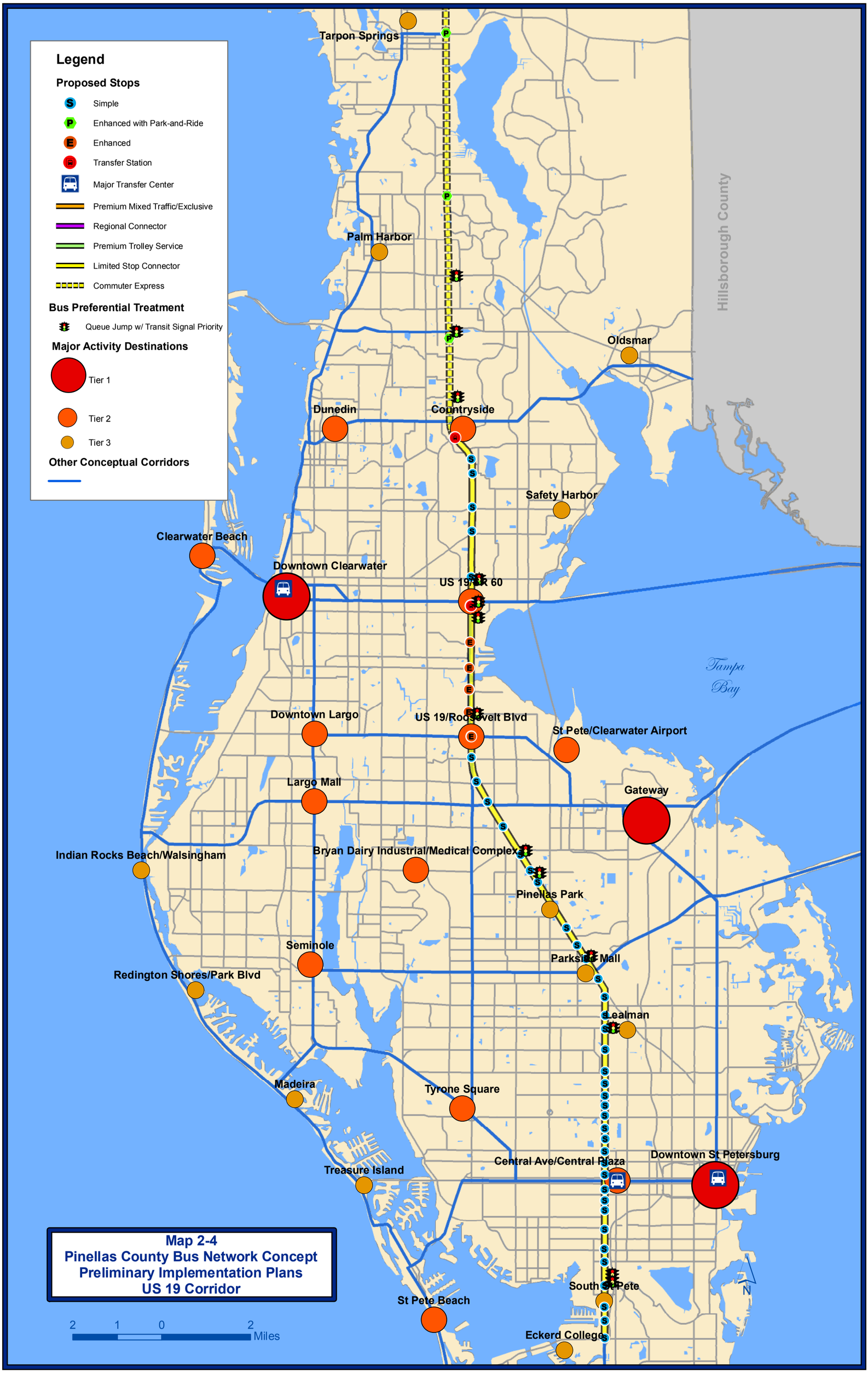
- branding
- vehicle design
- fare collection systems

It is important to note that the preliminary implementations plans currently serve as a general guideline; additional planning and engineering efforts may warrant variations from the specific elements identified for each corridor. Issues to consider when examining the implementation plans include the following.

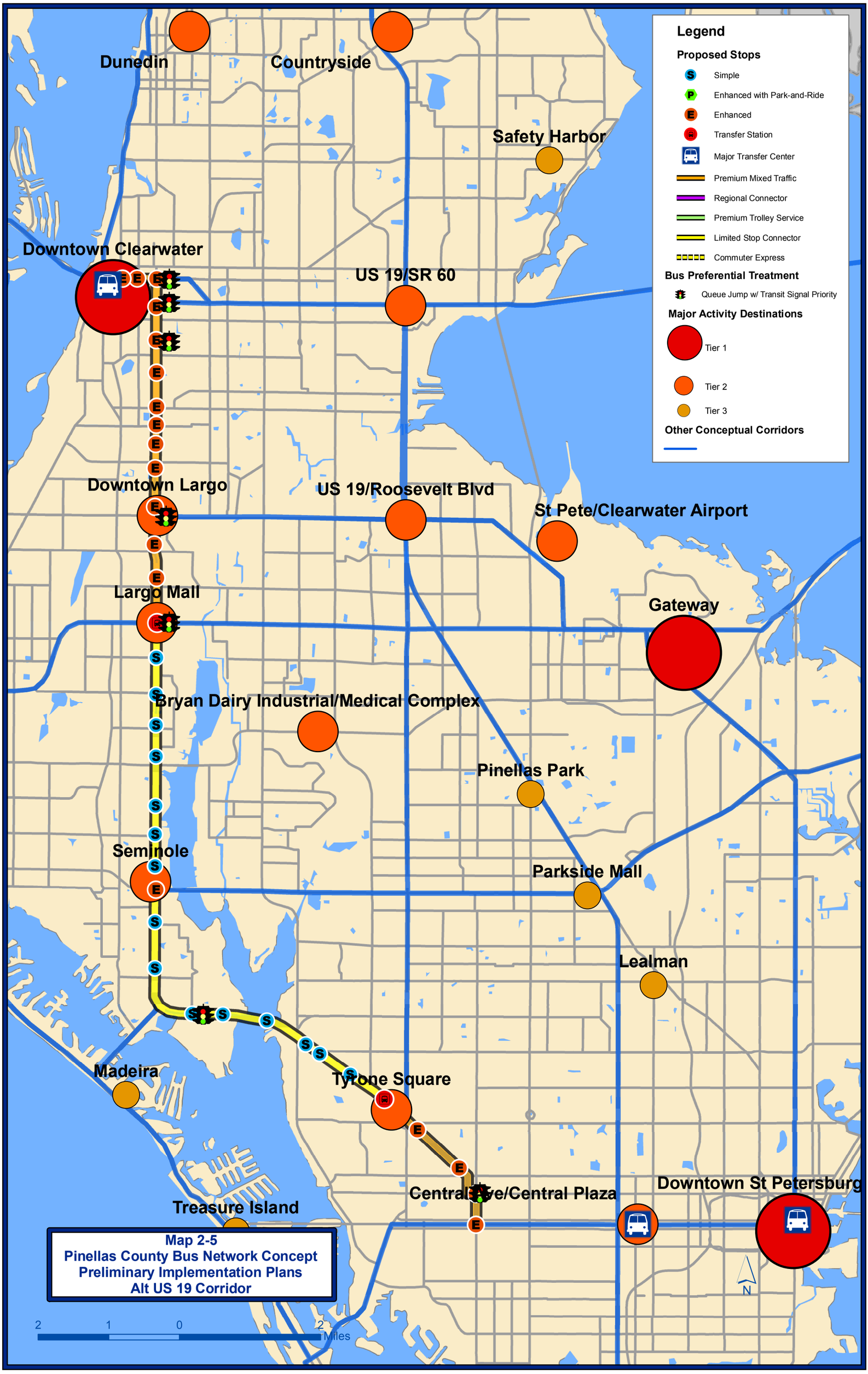
- Alternative parallel corridors may need to be considered as an optional corridor alignment in the case of prohibitive right-of-way acquisition costs or high-cost engineering and construction costs.
- Limited-stop service assumes service to every second or third local bus stop. To further improve travel times, the number of limited-stop stations can be further reduced. A closer examination of limited-stop station location and spacing can be determined by preparing detailed operational plans for each corridor or service route.

- Although not studied in detail in this report, regional connectors are intended to be developed via enhancements to existing regional transit service or implementation of new regional transit service based on the corridor and future arrangements with neighboring counties.
- Park-and-ride facilities are assumed to be joint-use facilities. The purchase and construction of park-and-ride facility land and infrastructure are not assessed as part of the overall project costs and should be determined by market conditions. Additional planning work will be required to assess potential markets and determine the opportunity for more park-and-ride facilities.
- Transit signal priority, combined with the use of queue jump lanes, is proposed to be implemented at a number of intersections. A final determination of intersection treatments should be determined for each intersection using detailed intersection analyses.
- The exact location of stops (i.e., far-side, near-side, mid-block) is not specified for every station. Transfer station and facility locations are indicated only in general terms in the vicinity of the major activity centers to which they connect. Specific station location and design should be determined as part of a preliminary engineering effort.
- There is assumed to be a base local service with a frequency of 30 minutes or less operating throughout the county. This underlying local service will serve as the all-stop service, providing the highest level of access to destinations in the county among all service modes.
- Local bus service is assumed to include circulator service to major activity destinations as illustrated in the bus network conceptual plan. Specific circulator service and alignments unique to each individual activity center will need to be developed on a case-by-case basis with or without changes to the underlying local bus service, as appropriate.

In addition to the map series, Map 2-12 summarizes weekday peak frequencies throughout the network. Tables 2-16 and 2-17 summarize station and bus preferential treatment locations for each corridor, respectively, and Table 2-18 compares the number of stations served by the conceptual bus network services and PSTA's local bus service. Additionally, Appendix A includes a list of stations for each corridor and notes the station spacing determined between all stops on the network.



Map 2-4
Pinellas County Bus Network Concept
Preliminary Implementation Plans
US 19 Corridor


Legend
Proposed Stops
Simple
Enhanced with Park-and-Ride
Enhanced
Transfer Station
Major Transfer Center
Premium Mixed Traffic
Regional Connector
Premium Trolley Service
Limited Stop Connector
Commuter Express
Bus Preferential Treatment
Queue Jump w/ Transit Signal Priority
Major Activity Destinations
Tier 1
Tier 2
Tier 3
Other Conceptual Corridors
Dunedin
Countryside
Safety Harbor
Downtown Clearwater
US 19/SR 60
Downtown Largo
US 19/Roosevelt Blvd
St Pete/Clearwater Airport
Largo Mall
Gateway
Bryan Dairy Industrial/Medical Complex
Pinellas Park
Seminole
Parkside Mall
Lealman
Madeira
Tyrone Square
Central Ave/Central Plaza
Downtown St Petersburg
Treasure Island
Map 2-5
Pinellas County Bus Network Concept
Preliminary Implementation Plans
Alt US 19 Corridor
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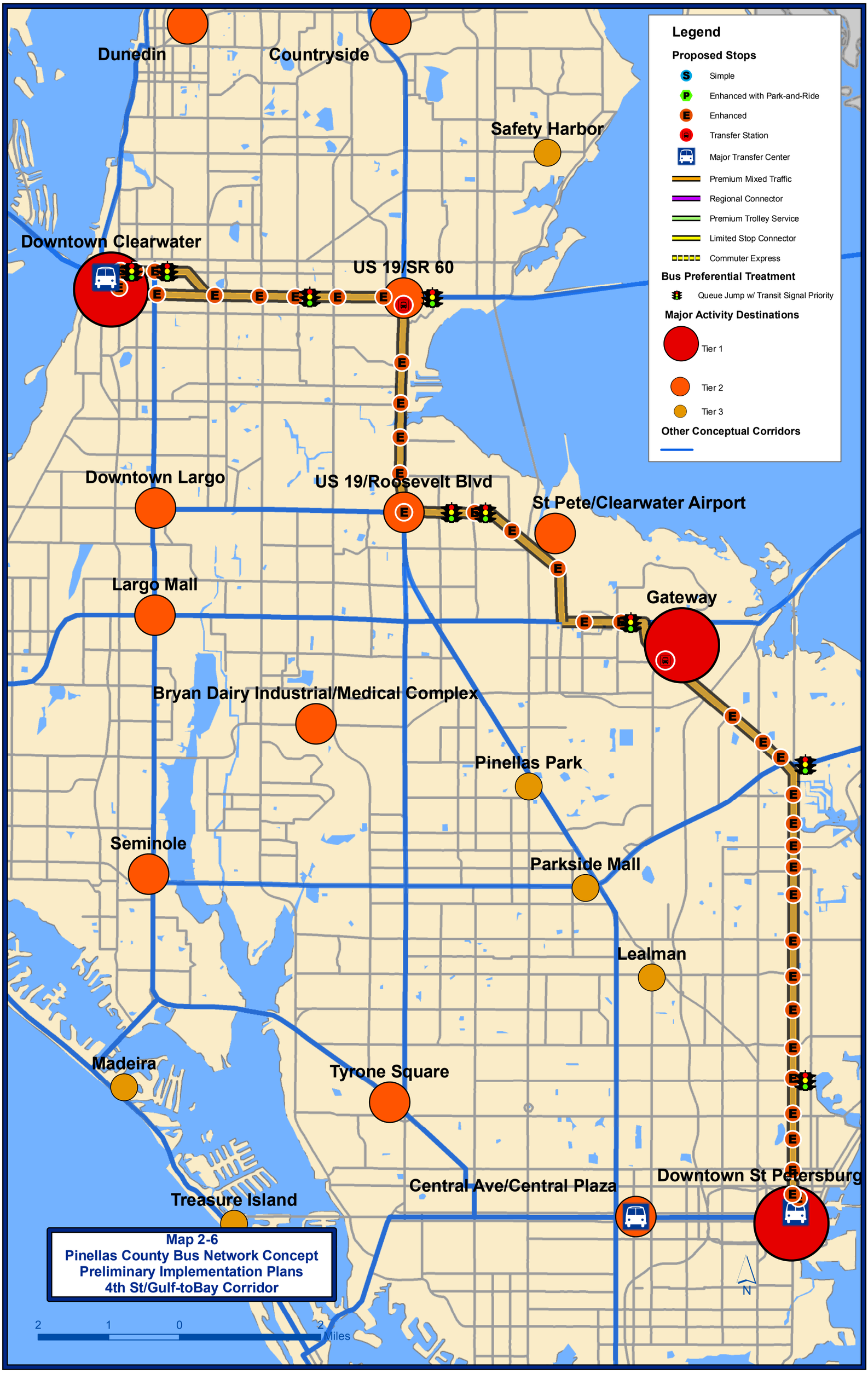
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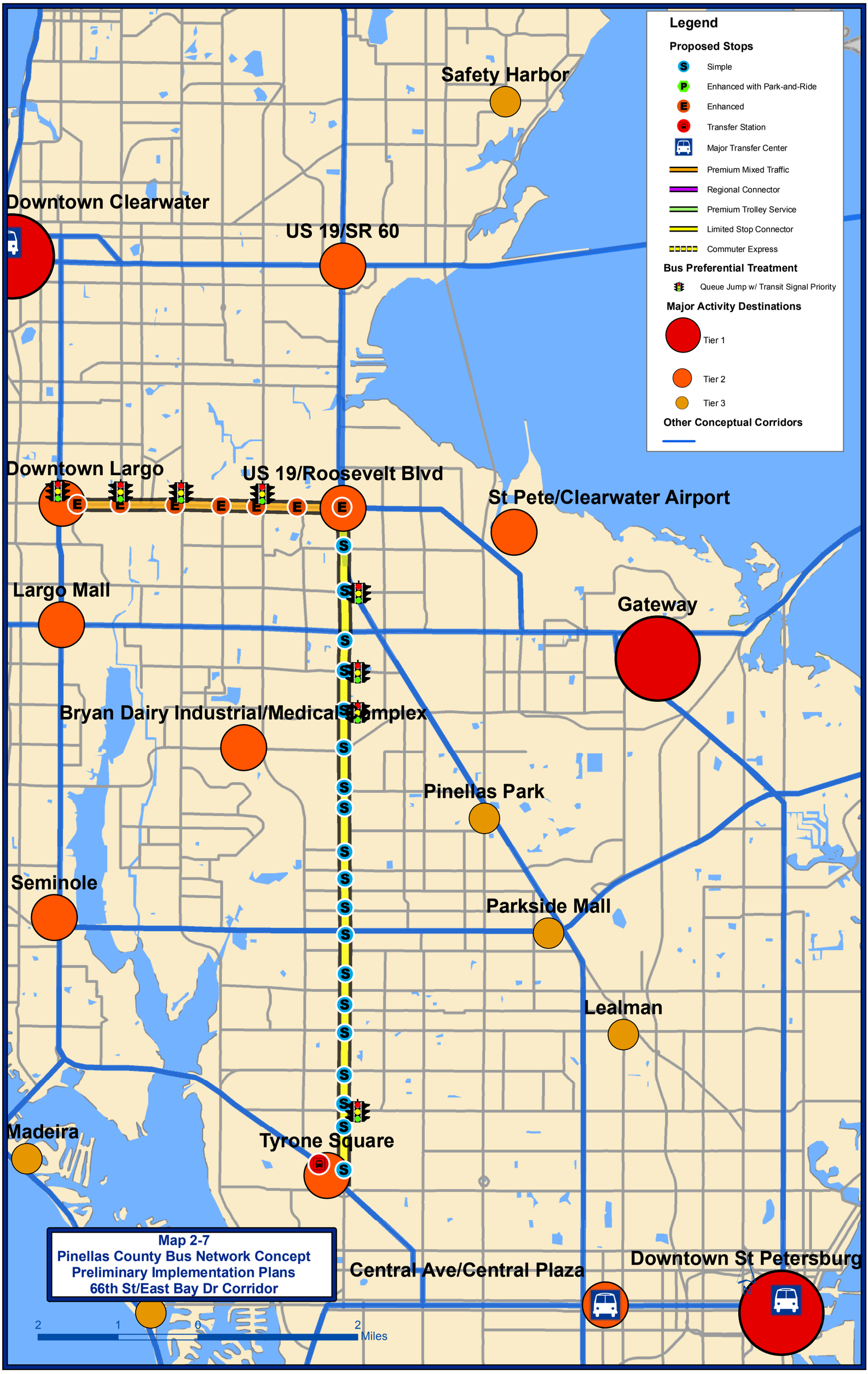
Enhanced
Transfer Station
Major Transfer Center
Premium Mixed Traffic
Regional Connector
Premium Trolley Service
Limited Stop Connector
Commuter Express
Bus Preferential Treatment
Queue Jump w/ Transit Signal Priority
Major Activity Destinations
Tier 1
Tier 2
Tier 3
Other Conceptual Corridors
Dunedin
Countryside
Safety Harbor
Downtown Clearwater
US 19/SR 60
Downtown Largo
US 19/Roosevelt Blvd
St Pete/Clearwater Airport
Largo Mall
Gateway
Bryan Dairy Industrial/Medical Complex
Pinellas Park
Seminole
Parkside Mall
Lealman
Madeira
Tyrone Square
Central Ave/Central Plaza
Downtown St Petersburg
Treasure Island
Map 2-6
Pinellas County Bus Network Concept
Preliminary Implementation Plans
4th St/Gulf-toBay Corridor
2 1 0 2
Miles
N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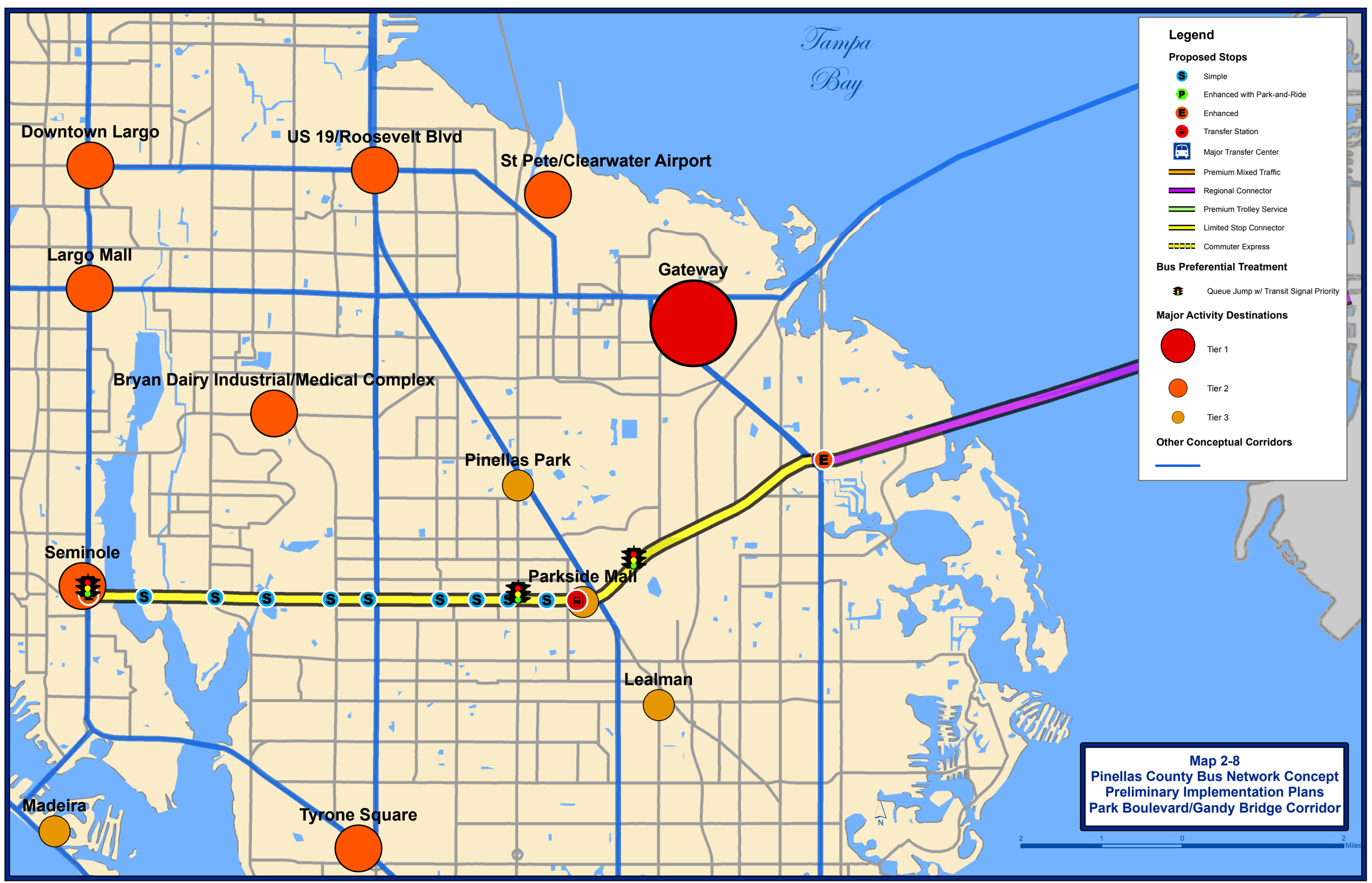
Proposed Stops
Simple
Enhanced with Park-and-Ride
Enhanced
Transfer Station
Major Transfer Center
Premium Mixed Traffic
Regional Connector
Premium Trolley Service
Limited Stop Connector
Commuter Express
Bus Preferential Treatment
Queue Jump w/ Transit Signal Priority
Major Activity Destinations
Tier 1
Tier 2
Tier 3
Other Conceptual Corridors
Safety Harbor
Downtown Clearwater
US 19/SR 60
Downtown Largo
US 19/Roosevelt Blvd
St Pete/Clearwater Airport
Largo Mall
Gateway
Bryan Dairy Industrial/Medical Complex
Pinellas Park
Seminole
Parkside Mall
Lealman
Madeira
Tyrone Square
Central Ave/Central Plaza
Downtown St Petersburg
Map 2-7
Pinellas County Bus Network Concept
Preliminary Implementation Plans
66th St/East Bay Dr Corridor
2 1 0 2 Miles


Tampa Bay
Downtown Largo
US 19/Roosevelt Blvd
St Pete/Clearwater Airport
Largo Mall
Gateway
Bryan Dairy Industrial/Medical Complex
Pinellas Park
Seminole
Parkside Mall
Lealman
Madeira
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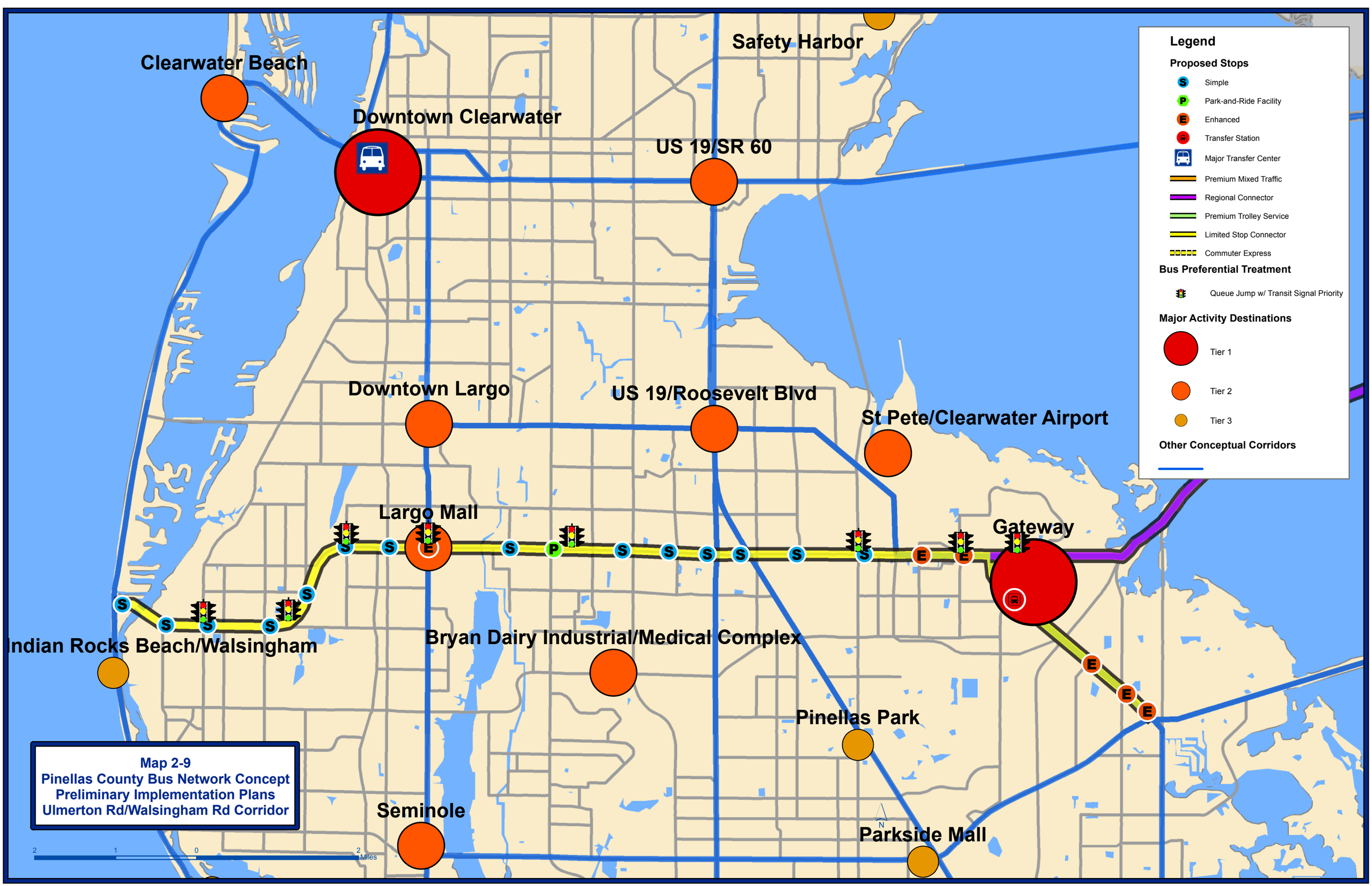
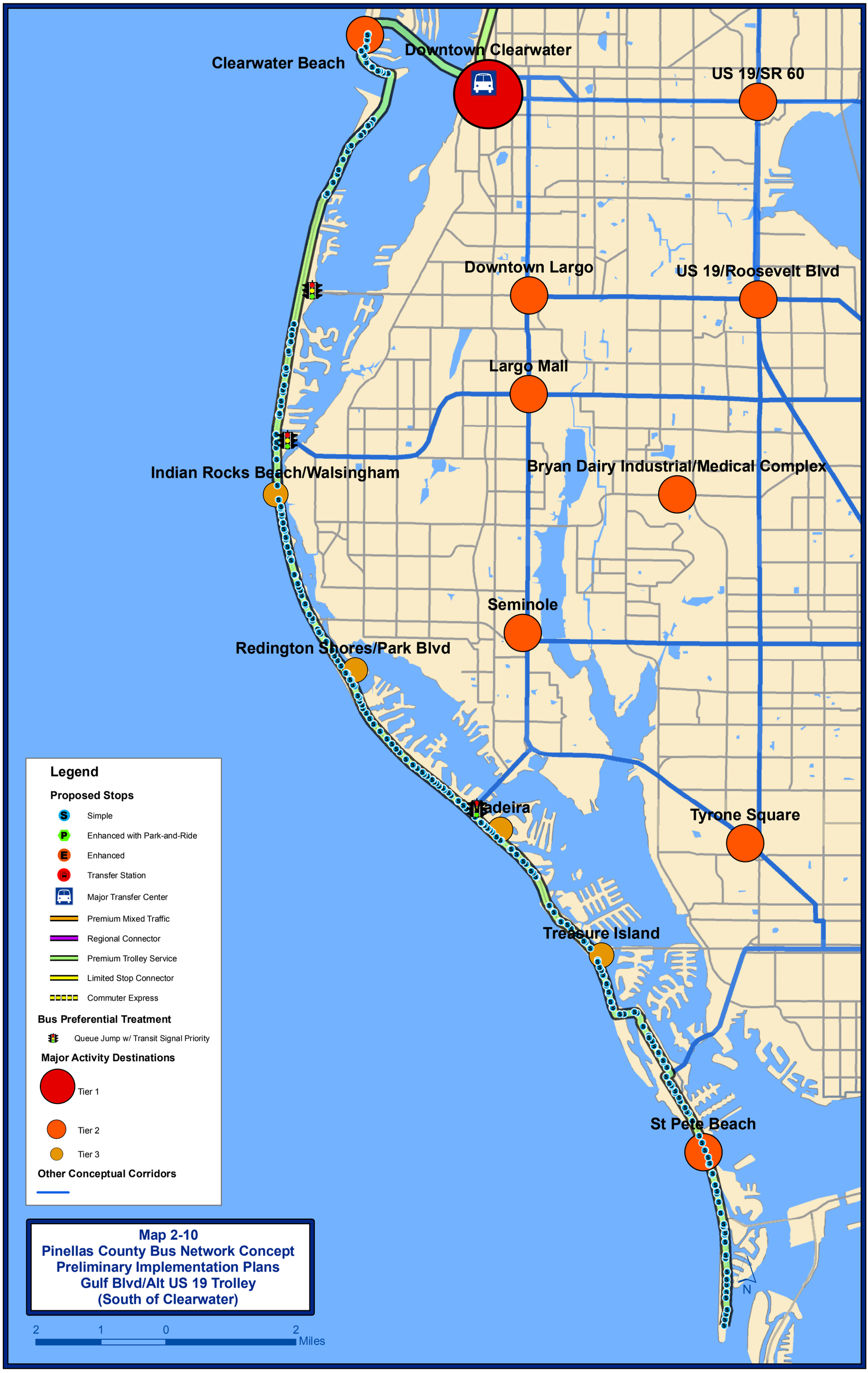
Simple
Enhanced with Park-and-Ride
Enhanced
Transfer Station
Major Transfer Center
Premium Mixed Traffic
Regional Connector
Premium Trolley Service
Limited Stop Connector
Commuter Express
Bus Preferential Treatment
Queue Jump w/ Transit Signal Priority
Major Activity Destinations
Tier 1
Tier 2
Tier 3
Other Conceptual Corridors
Map 2-8
Pinellas County Bus Network Concept
Preliminary Implementation Plans
Park Boulevard/Gandy Bridge Corridor
2 1 0 2
Miles


Clearwater Beach
Downtown Clearwater
Safety Harbor
US 19/SR 60
Downtown Largo
US 19/Roosevelt Blvd
St Pete/Clearwater Airport
Largo Mall
Gateway
Indian Rocks Beach/Walsingham
Bryan Dairy Industrial/Medical Complex
Pinellas Park
Seminole
Parkside Mall
Legend
Proposed Stops
Simple
Park-and-Ride Facility
Enhanced
Transfer Station
Major Transfer Center
Premium Mixed Traffic
Regional Connector
Premium Trolley Service
Limited Stop Connector
Commuter Express
Bus Preferential Treatment
Queue Jump w/ Transit Signal Priority
Major Activity Destinations
Tier 1
Tier 2
Tier 3
Other Conceptual Corridors
Map 2-9
Pinellas County Bus Network Concept
Preliminary Implementation Plans
Ulmerton Rd/Walsingham Rd Corridor
2 1 0 2 Miles
N


Clearwater Beach
Downtown Clearwater
US 19/SR 60
Downtown Largo
US 19/Roosevelt Blvd
Largo Mall
Indian Rocks Beach/Walsingham
Bryan Dairy Industrial/Medical Complex
Seminole
Redington Shores/Park Blvd
Madeira
Tyrone Square
Treasure Island
St Pete Beach
Legend
Proposed Stops
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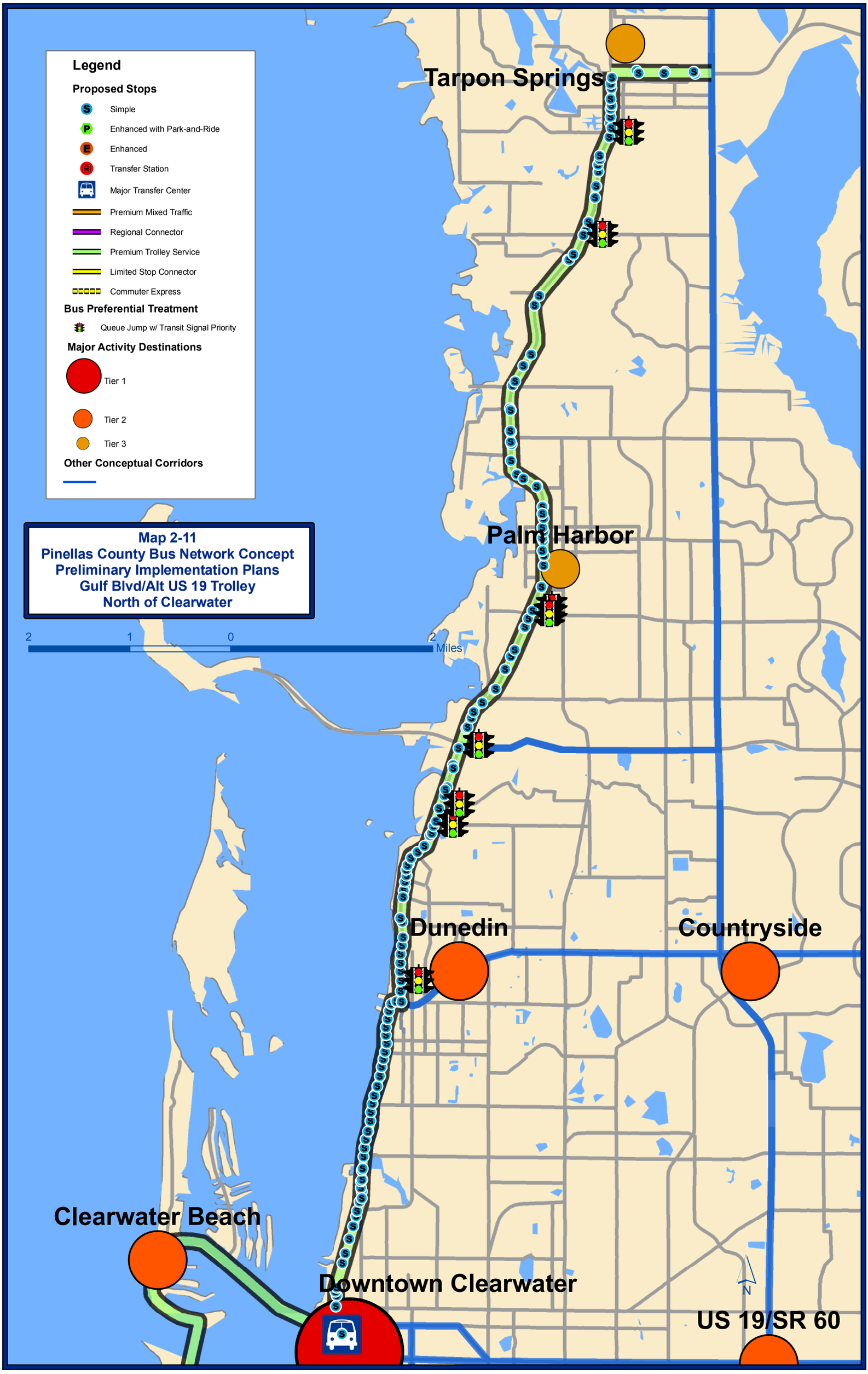
Enhanced with Park-and-Ride
Enhanced
Transfer Station
Major Transfer Center
Premium Mixed Traffic
Regional Connector
Premium Trolley Service
Limited Stop Connector
Commuter Express
Bus Preferential Treatment
Queue Jump w/ Transit Signal Priority
Major Activity Destinations
Tier 1
Tier 2
Tier 3
Other Conceptual Corridors
Map 2-10
Pinellas County Bus Network Concept
Preliminary Implementation Plans
Gulf Blvd/Alt US 19 Trolley
(South of Clearwater)
2 1 0 2
Miles
N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Proposed Stops
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Enhanced with Park-and-Ride
Enhanced
Transfer Station
Major Transfer Center
Premium Mixed Traffic
Regional Connector
Premium Trolley Service
Limited Stop Connector
Commuter Express
Bus Preferential Treatment
Queue Jump w/ Transit Signal Priority
Major Activity Destinations
Tier 1
Tier 2
Tier 3
Other Conceptual Corridors
Map 2-11
Pinellas County Bus Network Concept
Preliminary Implementation Plans
Gulf Blvd/Alt US 19 Trolley
North of Clearwater
2 1 0 2 Miles
Tarpon Springs
Palm Harbor
Dunedin
Countryside
Clearwater Beach
Downtown Clearwater
US 19/SR 60
N

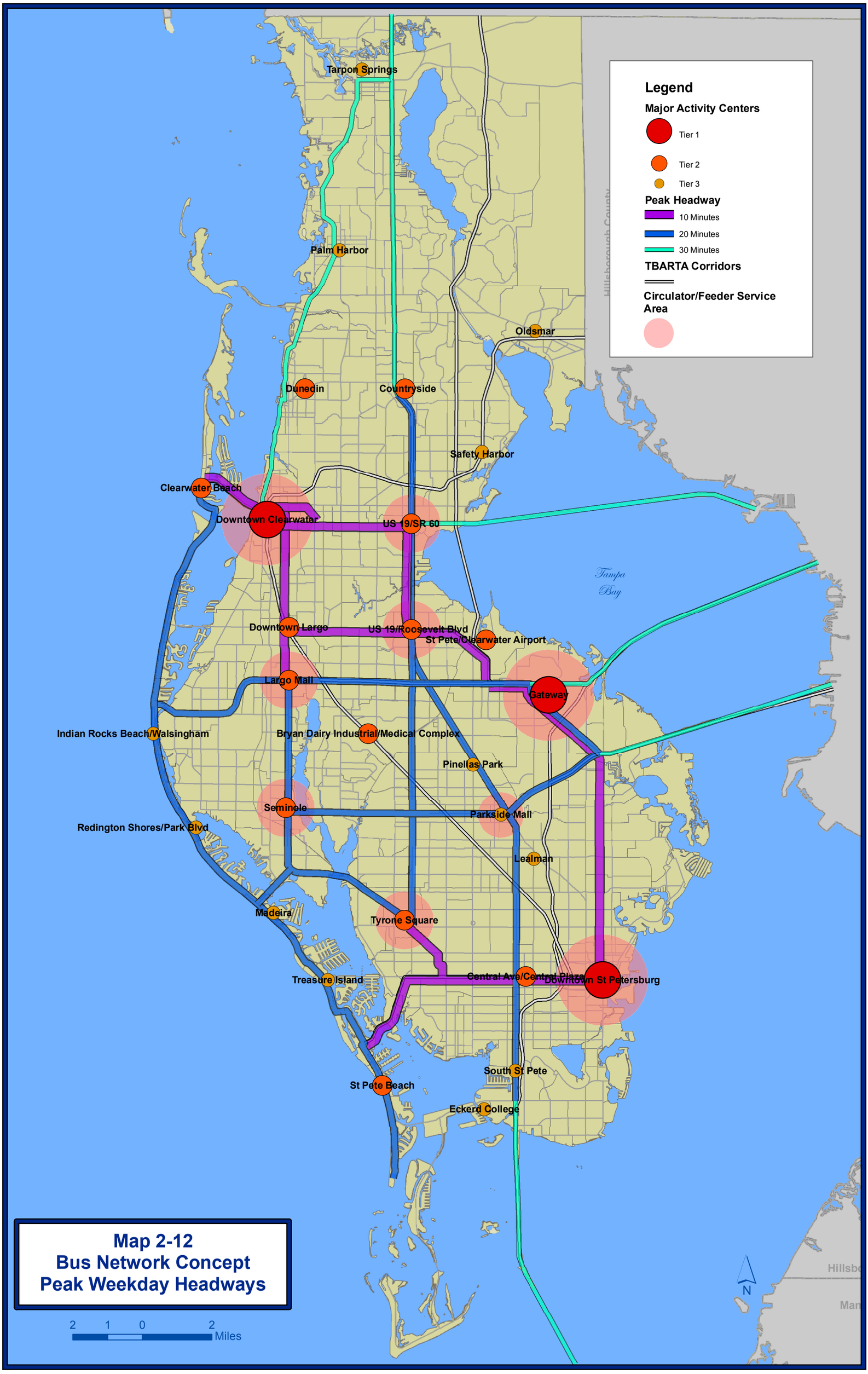

Legend
Major Activity Centers
Tier 1
Tier 2
Tier 3
Peak Headway
10 Minutes
20 Minutes
30 Minutes
TBARTA Corridors
Circulator/Feeder Service Area
Tarpon Springs
Palm Harbor
Oldsmar
Dunedin
Countryside
Safety Harbor
Clearwater Beach
Downtown Clearwater
US 19/SR 60
Tampa Bay
Downtown Largo
US 19/Roosevelt Blvd
St Pete/Clearwater Airport
Largo Mall
Gateway
Indian Rocks Beach/Walsingham
Bryan Dairy Industrial/Medical Complex
Pinellas Park
Seminole
Parkside Mall
Redington Shores/Park Blvd
Lealman
Madeira
Tyrone Square
Treasure Island
Central Ave/Central Plaza
Downtown St Petersburg
South St Pete
St Pete Beach
Eckerd College
Hillsborough County
Map 2-12
Bus Network Concept
Peak Weekday Headways
2 1 0 2
Miles
N

Table 2-16: Station Summary

Corridor	Simple Stop	Enhanced Stop	Enhanced Stop with Park-and-Ride	Transfer Station	Major Transfer Facility
US 19	80	10	3	2	0
Park Blvd	18	4	0	1	0
Alternate US 19	30	36	0	2	1
4th St/Gulf-to-Bay Blvd	0	69	0	2	2
66th St/East Bay Dr	38	14	0	0	0
Ulmerton Rd//Walsingham Road	30	12	0	1	0
Gulf Blvd (Trolley)	255	1	0	0	1
Alternate US 19 (Trolley)	178	0	0	0	1

Table 2-17: Bus Preferential Treatment Summary

Corridor	No. of Intersections Upgradable to TSP	No. of Intersections Requiring New Controllers
US 19	56	0
Park Blvd	8	13
Alternate US 19	7	28
4th Street/Gulf-to-Bay Blvd	41	20
66th Street/East Bay Dr	0	29
Ulmerton Road/Walsingham Road	3	22
Gulf Blvd/Alt US 19 (Trolley)	0	40

Table 2-18: Stop Number Comparison

Corridor	No. of Proposed Bus Network Concept Stops	No. of Local Service Stops
US 19	95	246
Park Blvd	23	66
Alternate US 19	69	196
4th St/Gulf-to-Bay Blvd	79	204
66th St/East Bay Dr	53	120
Ulmerton Rd/Walsingham Road	43	116

IMPLEMENTATION PLAN BENEFITS

The corridor implementation plans provide a number of individual and network benefits. Although each corridor is presented separately, the overall design of the network is one that integrates the characteristics of each individual corridor. When considered collectively, the result is a number of system-wide benefits. As such, the benefits of each corridor and their relationship to the overall objectives of the bus network concept plan are summarized below.

US 19

US 19 will serve as the major north-south corridor. In addition, regional connectivity will be provided to Pasco and Manatee counties. As the major north-south trunkline, service on US 19 has been designed to improve travel times through the county. Limited-stop service will improve travel time and maintain a moderate level of accessibility to the large number of activity centers and commercial areas found along the corridor.

Alternate US 19

The Alternate US 19 corridor will provide connectivity between Downtown Clearwater, Tyrone Square Mall, and the Central Avenue BRT. The corridor will serve as the major north-south corridor in the southwest part of the county and will connect to a number of conceptual bus network routes and service modes. The corridor is anticipated to be a major feeder to the larger network as it travels through several jurisdictions and connects to premium bus services on its north and south ends, and connects to three transfer centers: Downtown Clearwater, Largo Mall, and Tyrone Square Mall.

4th Street/Gulf-to-Bay Boulevard

Bus service along the 4th Street/Gulf-to-Bay Boulevard corridor will provide premium, medium-mobility bus rapid transit service between Downtown Clearwater and Downtown St. Petersburg. Connectivity to major activity centers along the corridor, such as Gateway Area and the St. Pete/Clearwater Airport, will be maintained by the rapid transit service along this corridor. The corridor provides the north-south BRT service in the county and distinguishes itself from US 19 in terms of quality of comfort and service, technology, and service branding.

66th Street/East Bay Drive

The 66th Street/East Bay Drive corridor will enhance north-south travel in the southern part of the county. The corridor will provide limited-stop bus service along 66th Street to Tyrone Square Mall. In addition, the corridor will connect to premium bus services on East Bay Drive and Tyrone

Boulevard and will connect to limited-stop service along US 19. Enhanced mobility and connectivity to other services and corridors will maintain this corridor as a viable and productive network route.

Park Boulevard/Gandy Bridge

As one of two east-west enhanced bus service corridors in the central core of the network, the Park Boulevard/Gandy Bridge corridor will serve to supplement existing local bus service by improving travel times and mobility for those traveling east-west in this part of the county.

Ulmerton Road/Walsingham Road

As one of two east-west enhanced bus service corridors in the central core of the network, the Ulmerton Road/Walsingham Road corridor will serve to supplement existing local bus service by improving travel times and mobility for those traveling east-west in this part of the county. The distinction between this corridor and the Park Boulevard/Gandy Bridge corridor is its extension and connectivity to the beach areas of Pinellas County.

Gulf Boulevard/Alternate US 19 (North of Clearwater)

The Gulf Boulevard/Alternate US 19 enhanced trolley service and its extension north to Tarpon Springs via Alternate 19 will serve a vital role in the economic development of and attraction to the beach areas in the county. Accessibility is the focus of the service along the corridor and major connections to other service on the conceptual bus network will be found at Downtown Clearwater, Indian Rocks Beach, Madeira Beach, and St. Pete Beach.

Section 3
Preliminary Cost Estimates

Capital and operating cost estimates were developed for each corridor based on the implementation plans identified in Section 2 of this report. The following section summarizes the preliminary cost estimates. Cost information is presented on a per-unit basis and as total costs for each mode of service by corridor. In addition, a range of costs is provided for those corridors that include premium bus service that accounts for implementation of alternative premium bus service enhancements.

CAPITAL COSTS

Capital costs presented in this section are based on data from FTA's *Characteristics of Bus Rapid Transit* (CBRT) document and Transit Cooperative Research Program (TCRP) Report 118, *BRT Practitioner's Guide* (2004). Table 3-1 summarizes the capital unit cost for each applicable transit component. These unit costs are applied to calculate total capital cost for each corridor based on the preliminary corridor implementation plan.

Table 3-1: Representative Component Development Unit Costs

Component	Unit	Cost/Unit
Running Way		
On-Street Bus Lane – New Construction Bus Lane – Striping Lane	 Per lane-mile Per lane-mile	 $4.7 million* $50,000
Transit Preferential Treatments		
TSP without new controller	Per intersection	$20,000
TSP with new controller	Per intersection	$22,500
Stations		
Simple	Per station	$21,000
Enhanced	Per station	$30,000
Transfer Station	Per station	$150,000
Major Transfer Center	Per Facility	$2,500,000
Vehicles		
Conventional Hybrid	Per vehicle	$545,000
Stylized Hybrid	Per vehicle	$570,000
Trolley Hybrid	Per vehicle	$587,000
Fare Collection		
Off-Board Magnetic Card Media	Per machine	$60,000
Passenger Information		
At-Station Information	Per sign	$6,000
AVL System Upgrade**	Per vehicle	$5,000

*Source: FDOT District 7 Transportation Costs (2008)

**PSTA's current AVL system may need to be upgraded to accommodate real-time passenger information.

Costs for optional premium bus service features are also included in the capital cost estimates. The premium bus service features include the construction of arterial exclusive lanes of travel and off-board fare collection equipment on corridors with proposed premium bus service.

Optional Capital Costs

Optional running way infrastructure improvements consist of arterial exclusive lanes. An assessment of existing right-of-way and right-of-way requirements for designated bus lanes revealed a number of right-of-way constraints along several premium bus service segments. Consequently, right-of-way acquisition costs were determined to estimate the cost of implementing designated arterial lanes of travel along premium bus service segments with right-of-way constraints.

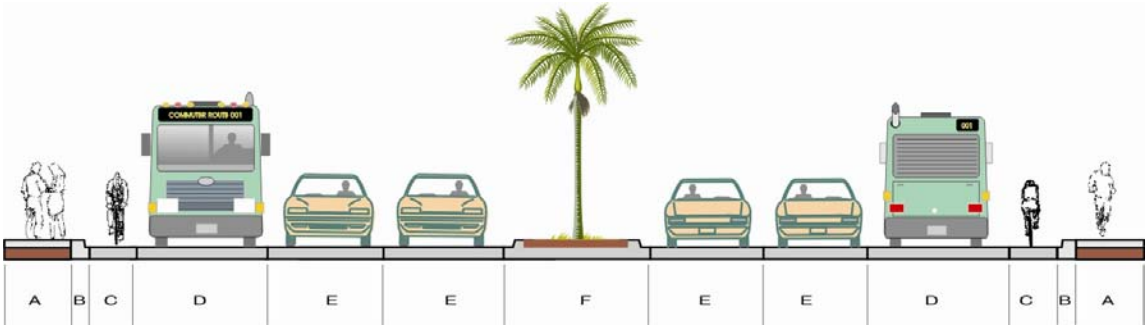
Market values from the Pinellas County Property Appraiser's office were obtained for those parcels of land along the premium bus service segments that did not meet the cross-section width assumption for curb side arterial bus lanes of travel. The cross-section width assumption was obtained from the FDOT District IV report, *Functional Classification of Transit* (2003), and reflects the right-of-way needed to implement concurrent flow bus lanes using a constrained right-of-way width requirement of 114 feet for existing four-lane roadways and 136 feet for existing six-lane roadways. Roadway features included within the 114 feet are noted in Table 3-2 and illustrated in Figure 3-1. Two additional 12-foot vehicle lanes of travel are added to the six-lane configuration.

Table 3-2: Concurrent Flow Curb Bus Lanes ROW Requirement

	Feature	ROW Requirement (ft)
A	Sidewalk (2)	6
B	Curb and Gutter (2)	2
C	Bike Lane (2)	4*
D	Bus Lane (2)	12
E	Vehicle Lane (4)	11
F	Median	22

*Minimum bike lane width

Figure 3-1: Concurrent Flow Curb Bus Lanes Typical Section



An analysis using geographic information systems (GIS) was performed to identify parcels of land from which right-of-way would need to be obtained. Using GIS, a right-of-way buffer was created and overlaid on the premium bus service corridors. Those parcels of land that intersected with the buffer were selected out for cost estimation. Market values from the Property Appraiser's office were then used to estimate the proportionate cost of the area of each parcel captured within the right-of-way buffer.

Associated fare collection capital costs were also estimated as an optional feature for the premium bus service operation. Capital costs for fare collection hardware was limited to the TVM costs. TVM costs were identified from TCRP Report 118, *BRT Practitioner's Guide* (2007). For costing purposes, one TVM was assumed to be installed at each premium bus service enhanced station.

Capital Cost Estimates

Capital cost estimates are presented for each mode for each study corridor. Included in the base estimates shown in Table 3-3 are vehicle, station, and transit signal priority costs for each of the respective modes. Local service headway improvement costs include the cost for additional vehicles needed to improve the service frequency of PSTA routes which do not currently operate on 30-minute headways. Optional premium bus service features include right-of-way acquisition, exclusive running way facility construction, and fare collection equipment. The incremental costs associated with implementation of optional premium bus service features are shown in Table 3-4. Table 3-5 combines base and optional capital costs. A capital cost detail by corridor is included in Appendix C.

OPERATING COSTS

Operating costs are based on two major assumptions for each service mode, operating speed and operating cost per revenue hour. In addition, the annual equipment maintenance cost for off-board ticket vending machines was assumed to be six percent and the annual fare inspector cost was assumed to be $75,000. It was estimated that one fare inspector was needed for every two peak vehicles. Fare equipment maintenance and inspector costs were applied as an optional premium bus service implementation feature.

- **Operating Cost per Revenue Hour** – Year 2007 PSTA system data were retrieved from the National Transit Database (NTD) to obtain the most current operating cost per revenue hour information. The applicable operating cost per revenue hour is $78.92.

Table 3-3: Preliminary Base Capital Cost Estimates

Service Mode	Preliminary Base Cost	Preliminary Base Cost with Contingency*
US 19		
Limited Stop Connector/Commuter Express	$10,265,000	$11,292,000
Alt US 19		
Limited Stop Connector	$4,053,000	$4,458,000
Premium Service	$4,928,000	$5,420,000
4th St/Gulf-to-Bay Blvd		
Premium Service	$15,140,000	$16,654,000
66th St/East Bay Dr		
Limited Stop Connector	$3,934,000	$4,327,000
Premium Service	$2,370,000	$2,607,000
Park Blvd/Gandy Bridge		
Limited Stop Connector	$3,851,000	$4,236,000
Ulmerton Rd/Walsingham Rd		
Limited Stop Connector	$5,645,000	$6,210,000
Gulf Blvd/Alt US 19 Trolley		
Trolley	$5,631,000	$6,195,000
Local Service Headway Improvement	$15,805,000	$17,386,000
Total	**$71,620,000**	**$78,783,000**

*A 10% contingency has been applied to the total capital cost for each corridor.

Table 3-4: Optional Features Capital Cost

Service Mode	Route Miles*	Running Way		Fare Collection Equipment	Total Optional Features Capital Cost	Total Optional Features Capital Cost with Contingency**
		Right-of-Way Acquisition	Running Way Construction			
Alt US 19						
Premium Service	7.4	$13,522,000	$69,388,000	$2,040,000	$84,950,000	$93,445,000
4th St/Gulf-to-Bay Blvd						
Premium Service	22.6	$40,423,000	$209,497,000	$4,140,000	$254,060,000	$279,466,000
66th St/East Bay Dr						
Premium Service	3.6	$1,742,000	$33,358,000	$840,000	$35,939,000	$39,533,000
Total	**33.6**	**$55,687,000**	**$312,243,000**	**$7,020,000**	**$374,950,000**	**$412,445,000**

*Indicates miles of premium bus service implementation only.

**A 10% contingency has been applied to the total capital cost for each corridor.

Table 3-5: Total Capital Cost Estimates

Service Mode	Preliminary Base Cost	Total Optional Features Cost	Total Capital Cost	Total Capital Cost with Contingency
US 19				
Limited Stop Connector/Commuter Express	$10,265,000	$0	$10,265,000	$11,292,000
Alt US 19				
Limited Stop Connector	$4,053,000	$0	$4,053,000	$4,458,000
Premium Service	$4,928,000	$84,950,000	$89,877,000	$98,865,000
4th St/Gulf-to-Bay Blvd				
Premium Service	$15,140,000	$254,060,000	$269,200,000	$296,120,000
66th St/East Bay Dr				
Limited Stop Connector	$3,934,000	$0	$3,934,000	$4,327,000
Premium Service	$2,370,000	$35,939,000	$38,309,000	$42,140,000
Park Blvd/Gandy Bridge				
Limited Stop Connector	$3,851,000	$0	$3,851,000	$4,236,000
Ulmerton Rd/Walsingham Rd				
Limited Stop Connector	$5,645,000	$0	$5,645,000	$6,210,000
Gulf Blvd/Alt US 19 Trolley				
Trolley	$5,631,000	$0	$5,631,000	$6,195,000
Local Service Headway Improvement	$15,805,000	$0	$15,805,000	$17,386,000
Total	**$71,620,000**	**$374,950,000**	**$446,570,000**	**$491,227,000**

- **Average Operating Speed** – Average operating speeds for all modes account for delays at stops and at signalized intersections. Local bus service was assumed to operate at 10 miles per hour (mph). Travel time improvements between local bus service and limited-stop service range between 10 and 15 percent. As such, 11.5 mph was assumed as a reasonable operating speed for the limited-stop service. Based on the Transit Cooperative Research Program Report 90 Volume 1: *Case Studies in Bus Rapid Transit* (2003), typical operating speeds for premium bus service range from 14 to 19 mph. For this study, an average of 15 mph has been applied to premium and commuter express bus services.

- **Farebox Maintenance** – As indicated in the capital costs section, one ticket vending machine will be applied to each premium bus service enhanced station. The annual maintenance cost is assumed at six percent of the capital cost which would cover TVM maintenance and repair and staff time.

Table 3-6 presents the assumptions used to estimate operating costs for each mode. In addition, the cost of improving local service headways to 30 minutes is also shown.

Table 3-6: Operating Cost Assumptions

Data	Mode			
	Local bus service	Limited Stop Connector	Premium Bus Service	Commuter Express
Operating Speeds	10 mph	11.5 mph	15 mph	15 mph
Operating cost per revenue hour	$78.92	$78.92	$78.92	$78.92

Using the noted base cost assumptions and the service plans for each service mode presented in Section 2 of this report, annual operating costs were estimated for each mode within each corridor. A total of 255 weekdays and 52 Saturdays were assumed for development of the annual operating cost estimates. Extended service hours developed as part of the Pinellas County MPO 2035 LRTP and TBARTA Master Plan are not included in the operating cost estimates since those plans were still under development at the completion of this study.

Table 3-7 summarizes the final annual operating cost estimate for each corridor. An operating cost detail by corridor is provided in Appendix D.

Table 3-7: Operating Cost Estimates*

Service Mode	Annual Operating Cost	Off-board Fare Collection Cost**	Total Annual Operating Cost
US 19			
Limited Stop Connector	$2,910,000	$0	$2,911,000
Commuter Express	$367,000	$0	$367,000
Alt US 19			
Premium	$1,615,000	$347,000	$1,962,000
Limited Stop Connector	$1,293,000	$0	$1,293,000
4th St/Gulf-to-Bay Blvd			
Premium	$4,955,000	$998,000	$5,954,000
66th St/East Bay Dr			
Premium	$779,000	$163,000	$942,000
Limited Stop Connector	$1,165,000	$0	$1,165,000
Park Blvd			
Limited Stop Connector	$1,299,000	$0	$1,299,000
Ulmerton Rd/Walsingham Rd			
Limited Stop Connector	$1,964,000	$0	$1,964,000
Gulf Blvd/Alt US 19 Trolley			
Trolley	$2,237,000	$0	$2,237,000
Local Service Headway Improvement	$11,412,000	$0	$11,412,000
Total	**$29,996,000**	**$1,509,000**	**$31,505,000**

* Costs rounded to nearest $1,000

**Includes equipment maintenance and fare inspector costs.

Section 4
Next Steps & Additional Planning Requirements

A series of action steps is identified in this section that serves as a guideline for the MPO to follow in developing the enhanced bus network concept. Illustrated in Figure 4-1 are two implementation tracks. One is structured for implementing premium bus service and the second is designed for the implementation of other enhanced bus services proposed in the bus network concept. A different implementation track is described herein for premium bus services because of specific funding potentially available through the Federal Transit Administration (FTA) for the type of service proposed for this service mode.

PREMIUM BUS SERVICE IMPLEMENTATION

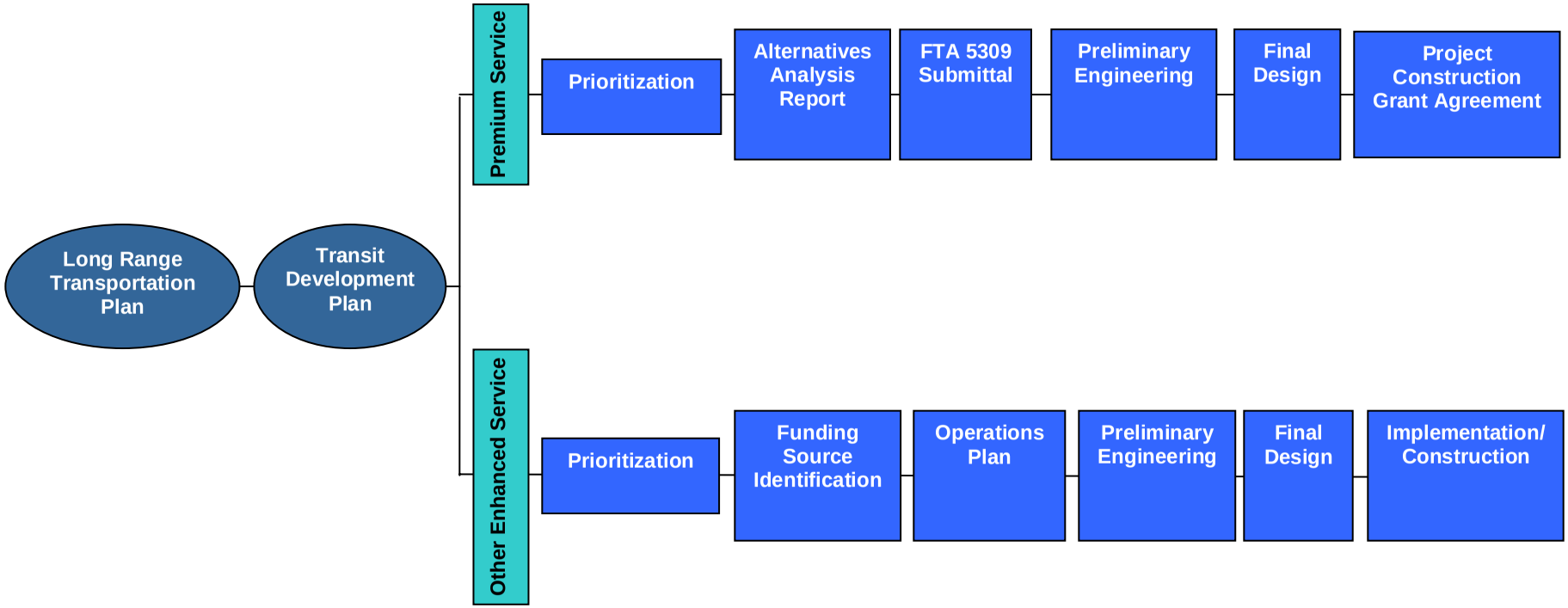
To prepare the outline of steps for premium bus service implementation, a review of the FTA's Section 5309 Capital Investment New Starts Grant Program was performed. That program provides capital funds on a competitive basis for new fixed guideway transit facilities, such as light rail transit lines, bus rapid transit, commuter rail, or heavy rail transit. The program also allocates funding on a competitive basis for smaller scale, less costly new transit starts under two programs, Small Starts and Very Small Starts.

Based on the type and scale of the service improvements considered for the premium bus service, Pinellas County should pursue capital funding under the Section 5309 Small Starts or Very Small Starts program. The Very Small Starts program distinguishes itself from the Small Starts program in that the total cost of the project must not exceed $50 million and must be less than $3 million per mile (excluding vehicles). The Small Starts program caps the total cost of eligible projects at $250 million. The second major distinction between the two programs is the requirement under Very Small Starts that existing corridor ridership expected to benefit from the premium transit service implementation exceed 3,000 per day.

To receive funding under either of the two programs, applicants must conduct a series of planning and analysis steps. Both programs follow a similar process but differ in terms of the project rating process and evaluation criteria. Additional detail on the rating process, criteria, and project development process planning and analysis steps can be obtained from FTA at: www.fta.dot.gov/planning/newstarts/planning_environment_222.html.

Implementing a premium bus service route with all optional features (i.e., exclusive running ways, off-board fare collection) may require completing a full New Starts application. That process is much more extensive and requires an expanded project justification and alternatives analysis.

Figure 4-1: Additional Planning Requirements



As indicated Figure 4-1, both tracks require inclusion of the bus service concept in the MPO's LRTP and PSTA's Transit Development Plan (TDP). Specifically, for New Starts funding, proof of inclusion in the local LRTP must be submitted as part of the grant application.

The typical project development process under the FTA New Starts program is 6 to 12 years. Considering that premium bus services in Pinellas County would fall under the Small Starts and/or Very Small Starts programs, that timeframe could be considerably shorter depending on the identification of local funding and the approval of a grant agreement through FTA.

OTHER ENHANCED BUS SERVICE IMPLEMENTATION

Other enhanced bus services proposed for the bus network concept include commuter express, limited-stop, and enhanced trolley services. Implementation of these services can follow traditional transit planning and implementation steps. Similarly, conventional local, state, and federal funding sources can be used to fund these services. Such funding sources include, but are not limited to, the following state and federal programs:

- FDOT Service Development Grants
- FDOT Corridor Grants
- FDOT Park-and-Ride Grants
- FDOT Intermodal Grants
- FTA Section 2316 Job Access and Reverse Commute (JARC) Program

Once integrated into the local LRTP and transit agency TDP, additional operational planning and engineering can be completed as funding is made available. Engineering elements would apply to the design and construction of new facilities, intersection improvements, and other roadway improvements necessary for safe and efficient bus service operation.

Appendix A
Corridor Station Detail

US 19 Corridor Stop Attribute Summary

Stop Type	Corridor	Major Activity Served	Stop Name	Distance (Mile)	Mode
Simple	US 19		US 19 & 54th Ave S	0.00	Limted Stop Connector
Simple	US 19		US 19 & 46th Ave S	0.39	Limited Stop Connector
Simple	US 19	South St. Petersburg	US 19 & 42nd Ave S	0.31	Limited Stop Connector
Simple	US 19		US 19 & 34th Ave S	0.48	Limited Stop Connector
Simple	US 19		US 19 & 26th Ave S	0.54	Limited Stop Connector
Simple	US 19		US 19 & 22nd Ave S	0.30	Limited Stop Connector
Simple	US 19		US 19 & 15th Ave S	0.44	Limited Stop Connector
Simple	US 19		US 19 & 9th Ave S	0.43	Limited Stop Connector
Simple	US 19		US 19 & 6th Ave S	0.22	Limited Stop Connector
Simple	US 19		US 19 & Carlisle Ave S	0.25	Limited Stop Connector
Simple	US 19	Central Ave	US 19 & 1st Ave	0.34	Limited Stop Connector
Simple	US 19		US 19 & Dartmouth Ave N	0.27	Limited Stop Connector
Simple	US 19		US 19 & 9th Ave N	0.26	Limited Stop Connector
Simple	US 19		US 19 & 13th Ave N	0.28	Limited Stop Connector
Simple	US 19		US 19 & 17th Ave N	0.24	Limited Stop Connector
Simple	US 19		US 19 & 22nd Ave N	0.29	Limited Stop Connector
Simple	US 19		US 19 & 26th Ave N	0.23	Limited Stop Connector
Simple	US 19		US 19 & 30th Ave N	0.22	Limited Stop Connector
Simple	US 19		US 19 & 34th Ave N	0.28	Limited Stop Connector
Simple	US 19		US 19 & 38th Ave N	0.28	Limited Stop Connector
Simple	US 19		US 19 & 46th Ave N	0.49	Limited Stop Connector
Simple	US 19	Lealman	US 19 & 54th Ave N	0.47	Limited Stop Connector
Simple	US 19		US 19 & 58th Ave N	0.31	Limited Stop Connector
Simple	US 19		US 19 & 65th Ave N	0.42	Limited Stop Connector
Simple	US 19		US 19 & 72nd Ave	0.44	Limited Stop Connector
Simple	US 19	Pinellas Park	US 19 & 78th Ave N	0.53	Limited Stop Connector
Simple	US 19		US 19 & 84th Ave N	0.37	Limited Stop Connector
Simple	US 19		US 19 & Mainlands Blvd	0.46	Limited Stop Connector
Simple	US 19		US 19 & 102nd Ave	1.22	Limited Stop Connector
Simple	US 19		US 19 & 110th Ave	0.31	Limited Stop Connector
Simple	US 19		US 19 & 116th Ave	0.42	Limited Stop Connector
Simple	US 19		US 19 & 126th Ave	0.75	Limited Stop Connector
Simple	US 19		US 19 & Ulmerton Rd	0.65	Limited Stop Connector
Simple	US 19		US 19 & 142nd Ave N	0.52	Limited Stop Connector
Simple	US 19		US 19 & 150th Ave N	0.56	Limited Stop Connector
Enhanced	US 19/4th St/Gulf to Bay Blvd	US 19/Roosevelt Blvd	US 19 & Roosevelt Blvd	0.55	Limited Stop Connector
Enhanced	US 19/4th St/Gulf to Bay Blvd		US 19 & Whitney Rd	0.48	Limited Stop Connector
Enhanced	US 19/4th St/Gulf to Bay Blvd		US 19 & Haines Bayshore Rd	0.51	Limited Stop Connector
Enhanced	US 19/4th St/Gulf to Bay Blvd		US 19 & Belleair Rd	0.49	Limited Stop Connector
Enhanced	US 19/4th St/Gulf to Bay Blvd		US 19 & Harn Rd	0.58	Limited Stop Connector
Transfer Station	US 19/4th St/Gulf to Bay Blvd	US 19/SR 60	US 19 & SR 60	0.81	Limited Stop Connector
Simple	US 19		US 19 & Drew St	0.66	Limited Stop Connector
Simple	US 19		US 19 & SR 590	1.04	Limited Stop Connector
Simple	US 19		US 19 & Sunset Point Rd	0.55	Limited Stop Connector
Simple	US 19		US 19 & 3rd Ave S	0.76	Limited Stop Connector
Simple	US 19		US 19 & Cypress Point	0.33	Limited Stop Connector
Transfer Station	US 19	Countryside	US 19 & Countryside Blvd	0.61	Commuter Express
Enhanced with Park N Ride	US 19		US 19 & Curlew Rd	2.27	Commuter Express
Enhanced with Park N Ride	US 19	Palm Harbor	US 19 & Alderman Rd	3.22	Commuter Express
Enhanced with Park N Ride	US 19	Tarpon Springs	US 19 & ETarpon Ave	3.68	Commuter Express
Average Stop Spacing				**0.62**	

Alternate US 19 Corridor Stop Attribute Summary

Stop Type	Corridor	Major Activity Served	Stop Name	Distance (Mile)	Mode
Enhanced	Alt US 19/66th St/East Bay Dr		Central Ave & 58th St N	0.00	Premium
Enhanced	Alt US 19/66th St/East Bay Dr		5th Ave N & 58th St N	0.44	Premium
Enhanced	Alt US 19/66th St/East Bay Dr		Tyrone Blvd N & 13th Ave N	0.65	Premium
Enhanced	Alt US 19/66th St/East Bay Dr		Tyrone Blvd N & 21st Ave N	0.61	Premium
Transfer Station	Alt US 19	Tyrone Square	Tyrone Blvd N & Tyrone Square	0.56	Premium
Simple	Alt US 19		Tyrone Blvd N & 73rd St N	0.77	Limited Stop Connector
Simple	Alt US 19		Tyrone Blvd N & 38th Ave N	0.52	Limited Stop Connector
Simple	Alt US 19		Tyrone Blvd N & Park St N	0.24	Limited Stop Connector
Simple	Alt US 19		Bay Pines Blvd & 86th Way N	0.66	Limited Stop Connector
Simple	Alt US 19		Bay Pines Blvd & 95th St N	0.64	Limited Stop Connector
Simple	Alt US 19		Bay Pines Blvd & 100th Way N	0.47	Limited Stop Connector
Simple	Alt US 19		Alt US 19 & Pineapple Rd	1.05	Limited Stop Connector
Simple	Alt US 19		Alt US 19 & 66th Ave	0.66	Limited Stop Connector
Enhanced	Alt US 19	Seminole	Alt US 19 & Park Blvd	0.39	Limited Stop Connector
Simple	Alt US 19		Alt US 19 & Temple Terrace	0.40	Limited Stop Connector
Simple	Alt US 19		Alt US 19 & 86th Ave N	0.45	Limited Stop Connector
Simple	Alt US 19		Alt US 19 & 94th Ave	0.41	Limited Stop Connector
Simple	Alt US 19		Alt US 19 & 102nd Ave	0.70	Limited Stop Connector
Simple	Alt US 19		Alt US 19 & 110th Ave	0.45	Limited Stop Connector
Simple	Alt US 19		Alt US 19 & Walsingham Rd	0.43	Limited Stop Connector
Simple	Alt US 19		Alt US 19 & 126th Ave	0.53	Limited Stop Connector
Transfer Station	Alt US 19	Largo Mall	Alt US 19 & Largo Mall	0.24	Limited Stop Connector
Enhanced	Alt US 19		Alt US 19 & 14th Ave SE	0.56	Premium
Enhanced	Alt US 19		Alt US 19 & 7th Ave SE	0.48	Premium
Enhanced	Alt US 19		Missouri Ave & 1st Ave NE	0.54	Premium
Enhanced	Alt US 19		Missouri Ave & Rosery Rd N	0.55	Premium
Enhanced	Alt US 19		Missouri Ave & Jasper St	0.34	Premium
Enhanced	Alt US 19		Missouri Ave & Wyatt St	0.27	Premium
Enhanced	Alt US 19		Missouri Ave & Belleair Rd	0.26	Premium
Enhanced	Alt US 19		Missouri Ave & South St	0.49	Premium
Enhanced	Alt US 19		Missouri Ave & Lotus Path	0.46	Premium
Enhanced	Alt US 19		Missouri Ave & Court St	0.47	Premium
Enhanced	Alt US 19		Missouri Ave & Cleveland St	0.33	Premium
Enhanced	Alt US 19		Cleveland St & MLK Jr Ave	0.34	Premium
Enhanced	Alt US 19		Cleveland St & Myrtle Ave	0.25	Premium
Transfer Center	Alt US 19		Park St & SGarden Ave	0.30	Premium
Average Stop Spacing				**0.48**	

4th St/Gulf to Bay Boulevard Corridor Stop Attribute Summary

Stop Type	Corridor	Major Activity Served	Stop Name	Distance (Mile)	Mode
Transfer Center	4th St/Gulf to Bay Blvd	Downtown St. Petersburg	Williams Park	0.00	premium
Enhanced	4th St/Gulf to Bay Blvd		3rd Ave N & 3rd St N	0.24	premium
Enhanced	4th St/Gulf to Bay Blvd		4th Ave N & 4th St N	0.30	premium
Enhanced	4th St/Gulf to Bay Blvd		4th St N & 6th Ave N	0.34	premium
Enhanced	4th St/Gulf to Bay Blvd		4th St N & 17th Ave N	0.45	premium
Enhanced	4th St/Gulf to Bay Blvd		4th St N & 22nd Ave N	0.36	premium
Enhanced	4th St/Gulf to Bay Blvd		4th St N & 30th Ave N	0.50	premium
Enhanced	4th St/Gulf to Bay Blvd		4th St N & 38th Ave N	0.43	premium
Enhanced	4th St/Gulf to Bay Blvd		4th St N & 45th Ave N	0.54	premium
Enhanced	4th St/Gulf to Bay Blvd		4th St N & 54th Ave N	0.47	premium
Enhanced	4th St/Gulf to Bay Blvd		4th St N & 62nd Ave N	0.51	premium
Enhanced	4th St/Gulf to Bay Blvd		4th St N & 72nd Ave N	0.66	premium
Enhanced	4th St/Gulf to Bay Blvd		4th St N & 77th Ave N	0.39	premium
Enhanced	4th St/Gulf to Bay Blvd		4th St N & 83rd Ave N	0.30	premium
Enhanced	4th St/Gulf to Bay Blvd		4th St N & 88th Ave N	0.32	premium
Enhanced	4th St/Gulf to Bay Blvd		4th St N & 94th Ave N	0.42	premium
Enhanced	4th St/Gulf to Bay Blvd		Roosevelt Blvd & Gandy Blvd	0.60	Premium/Limited Stop Connector
Enhanced	4th St/Gulf to Bay Blvd		Roosevelt Blvd & Dr MLK Jr St	0.34	Limited Stop Connector
Enhanced	4th St/Gulf to Bay Blvd		Roosevelt Blvd & Blue Heron Blvd	0.57	Premium/Limited Stop Connector
Transfer Station	4th St/Gulf to Bay Blvd	Gateway	Roosevelt Blvd & 28th St N	1.24	Premium/Limited Stop Connector
Enhanced	4th St/Gulf to Bay Blvd		Roosevlet Blvd & 34th St N	1.00	Limited Stop Connector
Enhanced	4th St/Gulf to Bay Blvd		Roosevelt Blvd & 40th St	0.52	Limited Stop Connector
Enhanced	4th St/Gulf to Bay Blvd	St. Pete/Clearwater Airport	Roosevelt Blvd & Terminal Blvd	1.11	premium
Enhanced	4th St/Gulf to Bay Blvd		Roosevelt Blvd & Bolesta Rd	0.85	premium
Enhanced	4th St/Gulf to Bay Blvd		Roosevelt Blvd & 58th St N	0.62	premium
Enhanced	US 19/4th St/Gulf to Bay Blvd	US 19/Roosevelt Blvd	Roosevelt Blvd & Dodge St	1.00	premium
Enhanced	US 19/4th St/Gulf to Bay Blvd		US 19 & Whitney Rd	0.56	Limited Stop Connector/Premium
Enhanced	US 19/4th St/Gulf to Bay Blvd		US 19 & Haines Bayshore Rd	0.51	Limited Stop Connector/Premium
Enhanced	US 19/4th St/Gulf to Bay Blvd		US 19 & Belleair Rd	0.49	Limited Stop Connector/Premium
Enhanced	US 19/4th St/Gulf to Bay Blvd		US 19 & Harn Rd	0.58	Limited Stop Connector/Premium
Transfer Station	US 19/4th St/Gulf to Bay Blvd	US 19/SR 60	US 19 & Gulf to Bay Blvd	0.81	premium
Enhanced	4th St/Gulf to Bay Blvd		Gulf to Bay Blvd & Old Coachman Rd	0.40	premium
Enhanced	4th St/Gulf to Bay Blvd		Gulf to Bay Blvd & Belcher Rd	0.65	premium
Enhanced	4th St/Gulf to Bay Blvd		Gulf to Bay Blvd & Hercules Ave	0.60	premium
Enhanced	4th St/Gulf to Bay Blvd		Gulf to Bay Blvd & Keene Rd	0.52	premium
Enhanced	4th St/Gulf to Bay Blvd		Gulf to Bay Blvd & Glenwood Ave	0.63	premium
Enhanced	4th St/Gulf to Bay Blvd		Gulf to Bay Blvd & Missouri Ave	0.82	premium
Enhanced	4th St/Gulf to Bay Blvd		Court St & Prospect Ave	0.63	premium
Transfer Center	4th St/Gulf to Bay Blvd		Dowtown Clearwater	0.34	premium
Enhanced	4th St/Gulf to Bay Blvd		Cleveland St & Myrtle Ave	0.39	premium
Enhanced	5th St/Gulf to Bay Blvd		Cleveland St & MLK Jr Ave	0.26	premium
Enhanced	6th St/Gulf to Bay Blvd		Missouri Ave & Cleveland St	0.26	premium
Average Stop Spacing				**0.55**	

66th Street/East Bay Drive Corridor Stop Attribute Summary

Stop Type	Corridor	Major Activity Served	Stop Name	Distance (Mile)	Mode
Transfer Station	66th St/East Bay Dr	Tyrone Square	Tyrone Square	0.00	Limited Stop Connector
Simple	66th St/East Bay Dr		66th St & 26th Ave N	0.61	Limited Stop Connector
Simple	66th St/East Bay Dr		66th St & 34th Ave N	0.54	Limited Stop Connector
Simple	66th St/East Bay Dr		66th St & 38th Ave N	0.29	Limited Stop Connector
Simple	66th St/East Bay Dr		66th St & 46th Ave N	0.36	Limited Stop Connector
Simple	66th St/East Bay Dr		66th St & 54th Ave N	0.53	Limited Stop Connector
Simple	66th St/East Bay Dr		66th St & 58th Ave N	0.35	Limited Stop Connector
Simple	66th St/East Bay Dr		66th St & 66th Ave	0.39	Limited Stop Connector
Simple	66th St/East Bay Dr		66th St & Park Blvd	0.49	Limited Stop Connector
Simple	66th St/East Bay Dr		66th St & 78th Ave	0.34	Limited Stop Connector
Simple	66th St/East Bay Dr		66th St & 85th Ave	0.36	Limited Stop Connector
Simple	66th St/East Bay Dr		66th St & 90th Ave	0.34	Limited Stop Connector
Simple	66th St/East Bay Dr		66th St & 98th Ave	0.55	Limited Stop Connector
Simple	66th St/East Bay Dr		66th St & 102nd Ave	0.26	Limited Stop Connector
Simple	66th St/East Bay Dr		66th St & Bryan Dairy Rd	0.50	Limited Stop Connector
Simple	66th St/East Bay Dr		66th St & 118th Ave N	0.47	Limited Stop Connector
Simple	66th St/East Bay Dr		66th St & 126th Ave N	0.50	Limited Stop Connector
Simple	66th St/East Bay Dr		66th St & Ulmerton Rd	0.38	Limited Stop Connector
Simple	66th St/East Bay Dr		66th St & 142nd Ave N	0.63	Limited Stop Connector
Simple	66th St/East Bay Dr		66th St & 150th Ave N	0.57	Limited Stop Connector
Enhanced	66th St/East Bay Dr		E Bay Dr &US 19	0.49	Premium
Enhanced	66th St/East Bay Dr		East Bay Dr & Newport Rd	0.56	Premium
Enhanced	66th St/East Bay Dr		East Bay Dr & Belcher Rd	0.52	Premium
Enhanced	66th St/East Bay Dr		East Bay Dr & 83rd St	0.44	Premium
Enhanced	66th St/East Bay Dr		East Bay Dr & Keene Rd	0.58	Premium
Enhanced	66th St/East Bay Dr		East Bay Dr & Highland Ave	0.69	Premium
Enhanced	66th St/East Bay Dr		East Bay Dr & Central Park Dr	0.54	Premium
Average Stop Spacing				**0.47**	

Park Boulevard Stop Attribute Summary

Stop Type	Corridor	Major Activity Served	Stop Name	Distance (Mile)	Mode
Enhanced	Park Blvd/Gandy Bridge		Gandy Blvd & 4th St	0.00	Limited Stop Connector
Transfer Station	Park Blvd/Gandy Bridge		Park Blvd & 40th St	3.60	Limited Stop Connector
Simple	Park Blvd/Gandy Bridge		Park Blvd & 44th St	0.37	Limited Stop Connector
Simple	Park Blvd/Gandy Bridge		Park Blvd & 50th St	0.48	Limited Stop Connector
Simple	Park Blvd/Gandy Bridge		Park Blvd & 55th St	0.39	Limited Stop Connector
Simple	Park Blvd/Gandy Bridge		Park Blvd & 60th St	0.46	Limited Stop Connector
Simple	Park Blvd/Gandy Bridge		Park Blvd & 66th St	0.89	Limited Stop Connector
Simple	Park Blvd/Gandy Bridge		Park Blvd & Belcher Rd	0.47	Limited Stop Connector
Simple	Park Blvd/Gandy Bridge		Park Blvd & 81th St	0.79	Limited Stop Connector
Simple	Park Blvd/Gandy Bridge		Park Blvd & Starkey Rd	0.64	Limited Stop Connector
Simple	Park Blvd/Gandy Bridge		Park Blvd & Seminole Isle Blvd	0.88	Limited Stop Connector
Enhanced	Park Blvd/Gandy Bridge	Seminole	Park Blvd & Seminole Blvd	0.64	Limited Stop Connector
Average Stop Spacing*				**0.60**	

* Excluding the outlier stop distance of 3.60 miles

Ulmerton Road/Walsingham Road Corridor Stop Attribute Summary

Stop Type	Corridor	Major Activity Served	Stop Name	Distance (Mile)	Mode
Enhanced	4th St/Gulf to Bay Blvd and Ulmerton/Walsingham		Roosevelt Blvd & Gandy Blvd	0.00	Premium/Limited Stop Connector
Enhanced	4th St/Gulf to Bay Blvd and Ulmerton/Walsingham		Roosevelt Blvd & Dr MLK Jr St	0.34	Limited Stop Connector
Enhanced	4th St/Gulf to Bay Blvd and Ulmerton/Walsingham		Roosevelt Blvd & Blue Heron Blvd	0.57	Premium/Limited Stop Connector
Transfer Station	4th St/Gulf to Bay Blvd and Ulmerton/Walsingham	Gateway	Roosevelt Blvd & 28th St N	1.24	Premium/Limited Stop Connector
Enhanced	Ulmerton Rd/Walsingham Rd		Ulmerton Rd & 34th St	0.94	Limited Stop Connector
Enhanced	Ulmerton Rd/Walsingham Rd		Ulmerton Rd & 40th St	0.52	Limited Stop Connector
Simple	Ulmerton Rd/Walsingham Rd		Ulmerton Rd & 49th St	0.71	Limited Stop Connector
Simple	Ulmerton Rd/Walsingham Rd		Ulmerton Rd & 58th St	0.84	Limited Stop Connector
Simple	Ulmerton Rd/Walsingham Rd		Ulmerton Rd & US 19	0.70	Limited Stop Connector
Simple	Ulmerton Rd/Walsingham Rd		Ulmerton Rd & 66th St	0.41	Limited Stop Connector
Simple	Ulmerton Rd/Walsingham Rd		Ulmerton Rd & 72nd St	0.48	Limited Stop Connector
Simple	Ulmerton Rd/Walsingham Rd		Ulmerton Rd & Belcher Rd	0.57	Limited Stop Connector
Simple	Ulmerton Rd/Walsingham Rd		Ulmerton Rd & Starkey Rd	0.85	Limited Stop Connector
Simple	Ulmerton Rd/Walsingham Rd		Ulmerton Rd & Lake Ave	0.54	Limited Stop Connector
Enhanced	Ulmerton Rd/Walsingham Rd	Largo Mall	Largo Mall	0.74	Limited Stop Connector
Simple	Ulmerton Rd/Walsingham Rd		Ulmerton Rd & 113th St	0.49	Limited Stop Connector
Simple	Ulmerton Rd/Walsingham Rd		Walsingham Rd & 119th St	0.59	Limited Stop Connector
Simple	Ulmerton Rd/Walsingham Rd		Ulmerton Rd & Glenwood Dr	0.83	Limited Stop Connector
Simple	Ulmerton Rd/Walsingham Rd		Walsingham Rd & 131st St	0.68	Limited Stop Connector
Simple	Ulmerton Rd/Walsingham Rd		Walsingham Rd & Oakhurst Rd	0.77	Limited Stop Connector
Simple	Ulmerton Rd/Walsingham Rd		Walsingham Rd & Hamlin Blvd	0.52	Limited Stop Connector
Simple	Ulmerton Rd/Walsingham Rd		Walsingham Rd & Gulf Blvd	0.63	Limited Stop Connector
Average Stop Spacing				**0.66**	

Appendix B
Bus Preferential Treatment Detail

US 19 Route

Queue Jump and Queue Bypass Opportunities

Along the US 19 route are a number of intersections that appear to have existing pavement in either turn lanes or shoulders that would be conducive to queue jump or queue bypass implementation. Intersections suitable for bus queue jump modifications include the following.

Route Roadway	Intersection	Direction
US 19	32nd Ave	Southbound
	54th Ave N	Northbound
	54th Ave N	Northbound
	80th Ave	Both Directions
	110th Ave	Northbound
	118th Ave	Northbound
	Whitney Rd	Northbound
	Druid Rd	Northbound
	Gulf-to-Bay Blvd	Northbound
	Drew St	Both Directions
	Republic Dr	Both Directions
	Curlew Rd	Both Directions
	Tampa Rd	Both Directions

The following locations were found to have sufficient pavement space on both the approach and departure sides of the intersections, which makes them good candidates for bus queue bypass implementations.

Route Roadway	Intersection	Direction
US 19	Shopping Center Access	Southbound
	70th Ave	Both Directions
	Mainlands Blvd	Northbound
	110th Ave	Southbound
	118th Ave	Southbound
	Haines Bayshore Rd	Both Directions
	Belleair Rd	Both Directions
	Nursery Rd	Both Directions
	Harn Blvd	Both Directions
	Enterprise Rd	Both Directions
	Countryside Blvd	Both Directions
	SR 580	Both Directions

US 19 and 4th Street/Gulf-to-Bay Boulevard routes overlap along US 19 between Roosevelt Boulevard and Gulf-to-Bay Boulevard. Implementing a bus queue bypass treatment at the following intersections would benefit both services.

- US 19 and Haines Bayshore Road
- US 19 and Belleair Road
- US 19 and Nursery Road
- US 19 and Harn Boulevard

TSP Potential Implementation

US 19 traffic signals are maintained by the City of St. Petersburg between Pinellas Bayway to 54th Avenue North, and by Pinellas County between 54th Avenue North and the Pasco County line. The city uses NEMA Econolite ASC/2 signal controllers connected to a CompuTran central control system. The county uses Type 2070 Econolite ASC/2 signal controllers and has implemented the OPAC adaptive control system. TSP could be implemented along the entire route by upgrading the software of the existing equipment and is recommended for the US 19 roadway section that would be serviced by the limited stop connector.

Alternate US 19 Route

Queue Jump and Queue Bypass Opportunities

Along the Alternate US 19 route are a number of intersections that appear to have existing pavement in either turn lanes or shoulders that would be conducive to queue jump or queue bypass implementation. Intersections suitable for bus queue jump modifications include the following.

Route Roadway	Intersection	Direction
Tyrone Blvd	5th Ave	Southbound
Bay Pines Blvd	100th Way N	Southbound
Seminole Blvd	Ulmerton Rd	Northbound
	Bay Dr	Both Directions
Missouri Ave	Shopping Center Access (Signal North of Lakeview Rd)	Both Directions
	Court St	Northbound
	Cleveland St	Northbound

The following locations were found to have sufficient pavement space on both the approach and departure sides of the intersections, which makes them good candidates for bus queue bypass implementations.

Route Roadway	Intersection	Direction
Tyrone Blvd	9th Ave	Southbound
	66th Ave	Both Directions
	38th Ave	Both Directions
	Park St	Northbound

The Alernate US 19 and 66th Street/East Bay Drive routes overlap along Missouri Avenue between East Bay Drive and Court Street. Implementing a bus queue jump treatment at the following intersections would benefit both services.

- Missouri Avenue and Lakeview Road
- Missouri Avenue and Court Street

TSP Potential Implementation

Alternate US 19 route traffic signals are maintained by the City of St. Petersburg on 58th Street and Tyrone Boulevard, and by Pinellas County on Bay Pines Boulevard, Seminole Boulevard, and Missouri Avenue. The City uses NEMA Econolite ASC/2 signal controllers connected to a CompuTran central control system. Previous discussions with the City indicated that a TSP system would require modifications to the centralized system or would be implemented at the

controller and would require the controllers to operate by losing coordination with the central control system for a cycle or two.

The County uses PEEK 3000E signal controllers on Bay Pines Boulevard and Seminole Boulevard. Missouri Avenue traffic signal controllers vary between PEEK 3000E and PEEK 1880EL. This type of equipment is not capable of upgrades that would implement TSP and would require new traffic signal controllers.

Implementing TSP is recommended along 58th Street and Tyrone Boulevard within the existing City of St. Petersburg signal system. TSP should also be considered along Bay Pines Boulevard, Seminole Boulevard, and Missouri Avenue, but is contingent on the County installing new traffic signal controllers.

4th Street/Gulf-to-Bay

Queue Jump and Queue Bypass Opportunities

Along the 4th Street/Gulf-to-Bay Boulevard route are a number of intersections that appear to have existing pavement in either turn lanes or shoulders that would be conducive to queue jump or queue bypass implementation. Intersections suitable for bus queue jump modifications include the following.

Route Roadway	Intersection	Direction
4th Street	30th Ave	Northbound
	Gandy Blvd.	Southbound
Roosevelt Blvd	34th St	Northbound
	58th St	Northbound
	62nd St	Southbound
Gulf-to-Bay Blvd	Shopping Center Access (East of US 19)	Westbound
	Hercules Ave	Eastbound
Cleveland St	Missouri Ave	Eastbound
	Myrtle Ave	Westbound
Court St	Missouri Ave	Westbound

The following locations were found to have sufficient pavement space on both the approach and departure sides of the intersections, which makes them good candidates for bus queue bypass implementations.

Route Roadway	Intersection	Direction
4th Street	30th Ave	Southbound
Roosevelt Blvd	Martin Luther King Jr. St	Both Directions
	16th St	Both Directions
	28th St	Both Directions
Ulmerton/Roosevelt	34th St	Southbound
	38th St	Both Directions
	40th St	Southbound
Roosevelt Blvd	46th St	Both Directions
Court St	Missouri Ave	Eastbound

The 4th Street/Gulf-to-Bay Boulevard route overlaps with the Ulmerton and US 19 routes along Roosevelt Boulevard and US 19. Implementing a bus queue bypass treatment at the following intersections would benefit all routes.

- Roosevelt Boulevard and Martin Luther King Jr. Street
- Roosevelt Boulevard and 16th Street
- Roosevelt Boulevard and 28th Street
- Roosevelt Boulevard/Ulmerton Road and 34th Street
- Roosevelt Boulevard/Ulmerton Road and 38th Street
- Roosevelt Boulevard/Ulmerton Road and 40th Street
- Roosevelt Boulevard and 46th Street
- US 19 and Haines Bayshore Road
- US 19 and Belleair Road
- US 19 and Nursery Road
- US 19 and Harn Boulevard

TSP Potential Implementation

The 4th Street/Gulf-to-Bay Boulevard route traffic signals are maintained by the City of St. Petersburg on 4th Street, by Pinellas County on Roosevelt Boulevard, US 19, Gulf-to-Bay Boulevard, and Court Street; and by City of Clearwater on Cleveland Street. City of St. Petersburg uses NEMA Econolite ASC/2 signal controllers connected to a CompuTran central control system. The County uses PEEK 3000E and PEEK 1880EL signal controllers on Roosevelt Boulevard, and Type 2070 Econolite ASC/2 controllers on Gulf-to-Bay Boulevard and Court Street. The City of Clearwater uses PEEK 1880EL on Cleveland Street. Some intersections on this road are under construction to become roundabouts. TSP may not be implemented on Cleveland Street due to the combination of old traffic controller technology (PEEK 1880EL) and the introduction of roundabout intersections.

TSP should be implemented along 4th Street, Roosevelt Boulevard, and Gulf-to-Bay Boulevard. All roadway corridors along the 4th Street/Gulf-to-Bay Boulevard route may be upgraded to operate with transit priority with the exception of Roosevelt Boulevard. The County should prioritize future controller equipment renewal for Roosevelt Boulevard intersections that currently use PEEK controllers.

66th Street/East Bay Drive

Queue Jump and Queue Bypass Opportunities

Along the 66th Street/East Bay Drive route are a number of intersections that appear to have existing pavement in either turn lanes or shoulders that would be conducive to queue jump or queue bypass implementation. Intersections suitable for bus queue jump modifications include the following.

Route Roadway	Intersection	Direction
66th Street	38th Ave	Northbound
	118th Ave	Northbound
	126th Ave	Northbound
	142nd Ave	Northbound
East Bay Drive	Belcher Rd	Both Directions
	Starkey Rd	Both Directions
	Highland Ave	Westbound
	Seminole Blvd	Westbound

The following locations were found to have sufficient pavement space on both the approach and departure sides of the intersections, which makes them good candidates for bus queue bypass implementations.

Route Roadway	Intersection	Direction
66th Street	Tyrone Blvd	Both Directions
	Ulmerton Rd	Both Directions
	142nd Ave	Southbound

Premium mixed-traffic transit service may benefit the most from implementation of bus queue jump treatments, which can increase the service reliability and speed. The following intersections are good candidate locations for bus queue jump implementation.

- East Bay Drive and Belcher Road
- East Bay Drive and Starkey Road
- East Bay Drive and Highland Avenue
- East Bay Drive and Seminole Boulevard

TSP Potential Implementation

The 66th Street/East Bay Drive route traffic signals are maintained by Pinellas County. Both 66th Street and East Bay Drive feature a mix of PEEK 3000E and PEEK 1880EL controllers. TSP implementation along this route is contingent on the County renewing the traffic signal equipment.

Park Boulevard/Gandy Bridge

Queue Jump and Queue Bypass Opportunities

Along the Park Boulevard/Gandy Bridge route are a number of intersections that appear to have existing pavement in either turn lanes or shoulders that would be conducive to queue jump or queue bypass implementation. Intersections suitable for bus queue jump modifications include:

Route Roadway	Intersection	Direction
Park Boulevard	Seminole Blvd	Eastbound
	49th St	Both Directions
Gandy Boulevard	Grand Ave	Both Directions

The following locations were found to have sufficient pavement space on both the approach and departure sides of the intersections, which makes them good candidates for bus queue bypass implementations.

Route Roadway	Intersection	Direction
Park Boulevard	Seminole Blvd.	Westbound
	Seminole Isle Blvd	Westbound
Gandy Boulevard	I-275 NB Off-ramp	Both Directions
	94th Ave	Both Directions
	Martin Luther King Jr. St	Both Directions
	Roosevelt Blvd	Both Directions
	4th St	Both Directions
	Brighton Bay Blvd	Both Directions

Due to the relative low bus frequency on this route, implementation of bus queue jump or bypass treatments may create an adverse perception of the service from the adjacent traveling public. The perceived bus lane vacancy could also create long-term traffic enforcement issues and reduce the effectiveness of the treatment. Bus queue jump and bypass implementations should be considered on the Park Boulevard/Gandy Bridge route if the service frequency is increased above the 6 buses per hour.

TSP Potential Implementation

The Park Boulevard/Gandy Bridge route traffic signals are maintained by Pinellas County on Park Boulevard and the first signal east of US 19 on Gandy Boulevard. The City of St. Petersburg maintains the remaining traffic signals on Gandy Boulevard. The County maintained traffic signals use PEEK 3000E controllers. The City of St. Petersburg uses NEMA Econolite ASC/2 controllers connected to a CompuTran central control system. TSP should be implemented along the entire route length. However, TSP operations are contingent on the County renewing the traffic signal equipment along Park Boulevard.

Ulmerton Road/Howard Frankland Bridge/Walsingham Road

Queue Jump and Queue Bypass Opportunities

Along the Ulmerton Road/Howard Frankland Bridge/Walsingham Road route are a number of intersections that appear to have existing pavement in either turn lanes or shoulders that would be conducive to queue jump or queue bypass implementation. Intersections suitable for bus queue jump modifications include the following.

Route Roadway	Intersection	Direction
Ulmerton Road	Carillon Pkwy	Westbound
	34th St	Westbound
	49th St	Both Directions
	Tall Pines Dr.	Eastbound
	Seminole Blvd	Both Directions
	119th St	Westbound
	Walsingham Rd	Eastbound
Walsingham Road	Oakhurst Rd/Indian Rocks Rd	Westbound

The following locations were found to have sufficient pavement space on both the approach and departure sides of the intersections, which makes them good candidates for bus queue bypass implementations.

Route Roadway	Intersection	Direction
Ulmerton Road	Feather Sound Dr	Both Directions
	Carillon Pkwy	Eastbound
	34th St	Eastbound
	Stonybrook Dr	Both Directions
	40th St	Eastbound
	66th St	Both Directions
	Belcher Rd	Both Directions
	Starkey Rd	Both Directions
	110th St	Eastbound
	113th St	Both Directions
Walsingham Road	N/A	

The Ulmerton Road/Howard Frankland Bridge/Walsingham Road route overlaps with the 4th Street/Gulf-to-Bay Boulevard route. Implementing a bus queue bypass treatment at the following intersections would benefit both routes:

- Roosevelt Boulevard/Ulmerton Road and 34th Street
- Roosevelt Boulevard/Ulmerton Road and 38th Street
- Roosevelt Boulevard/Ulmerton Road and 40th Street
- Roosevelt Boulevard and 46th Street

Due to the relative low bus frequency on the remainder of the route, implementation of bus queue jump or bypass treatments may create an adverse perception of the service from the adjacent traveling public. The perceived bus lane vacancy could also create long-term traffic enforcement issues and reduce the effectiveness of the treatment. Bus queue jump and bypass implementations should be considered on the Ulmerton Road/Howard Frankland Bridge/Walsingham Road route if the service frequency is increased above the proposed six buses per hour.

TSP Potential Implementation

The Ulmerton Road/Howard Frankland Bridge/Walsingham Road route traffic signals are maintained by Pinellas County. Walsingham Road traffic signal controllers vary between PEEK 3000E and PEEK 1880EL. Ulmerton Road traffic signal controllers vary between Type 2070 Econolite ASC/2, PEEK 3000E, PEEK 1880EL. TSP should be implemented on this route. However, operations are contingent on the County replacing the PEEK traffic signal controllers with newer models that support TSP functionality.

Gulf Boulevard

Queue Jump and Queue Bypass Opportunities

Along the Gulf Boulevard route are a number of intersections that appear to have existing pavement in either turn lanes or shoulders that would be conducive to queue jump or queue bypass implementation. Intersections suitable for bus queue jump modifications include the following.

Route Roadway	Intersection	Direction
Gulf Boulevard	Madeira Way	Northbound
	5th Ave	Northbound
	Causeway Blvd	Northbound
	Skinner Blvd	Both Directions
	Michigan Blvd	Northbound
	Palm Blvd	Northbound
	Curfew Rd	Both Directions
	Tampa Rd	Northbound
	Illinois Ave	Southbound
	Klosterman Rd	Both Directions
	Meres Ave	Southbound

The following locations were found to have sufficient pavement space on both the approach and departure sides of the intersections, which makes them good candidates for bus queue bypass implementations.

Route Roadway	**Intersection**	**Direction**
Gulf Boulevard	Maritana Dr	Northbound
	107th St	Northbound
	150th St	Northbound
	Sunset Point Rd	Northbound
	Alderman Rd	Both Directions
	Road south of Cardinal Ave	Both Directions

Due to the relative low bus frequency on the remainder of the route, implementation of bus queue jump or bypass treatments may create an adverse perception of the service from the adjacent traveling public. The perceived bus lane vacancy could also create long-term traffic enforcement issues and reduce the effectiveness of the treatment.

TSP Potential Implementation

Gulf Boulevard route traffic signals are maintained by Pinellas County. Traffic signal controllers vary between PEEK 3000E and PEEK 1880EL. TSP could only be implemented on this route if the County upgraded all traffic signal controllers to newer equipment that supports TSP functionality.

Appendix C
Capital Cost Detail

US 19 Corridor Capital Cost Estimate

Limited Stop Connector/Commuter Express	Station				Vehicle		AVL	TSP Upgrade (per intersection)	TSP w/ New Controller (per intersection)	Optional Features	Total Capital Cost
	Simple	Enhanced	Enhanced with Park N Ride*	Transfer Station	Limited Stop Connector	Commuter Express					
Unit Cost	$21,000	$30,000	$30,000	$150,000	$545,000	$570,000	$5,000	$5,000	$22,500		
Number of Units	80	0	3	1	10	3	13	13	0	0	
Total Cost	$1,680,000	$0	$90,000	$150,000	$5,450,000	$1,710,000	$65,000	$65,000	$0	$0	**$10,265,000**

Alt US 19 Corridor Capital Cost Estimate

Service Mode	Station			Vehicle	AVL	TSP Upgrade (per intersection)	TSP w/ New Controller (per intersection)	Optional Features			Total Capital Cost
	Simple	Enhanced	Transfer Station					Running Way Construction (per lane mile)	Right-of-Way Acquisition	Fare Collection Hardware	
Limited Stop Connector											
Unit Cost	$21,000	$30,000	$150,000	$545,000	$5,000	$20,000	$22,500	$0	$0	$60,000	
Number of Units	30	2	1	5	5	4	17	0	0		
Total Cost	$630,000	$60,000	$150,000	$2,725,000	$25,000	$80,000	$382,500	$0	$0	$0	**$4,052,500**
Premium Service											
Unit Cost	$21,000	$30,000	$150,000	$570,000	$5,000	$20,000	$22,500	$4,700,000		$60,000	
Number of Units	0	34	1	6	6	3	11	14.76		34	
Total Cost	$0	$1,020,000	$150,000	$3,420,000	$30,000	$60,000	$247,500	$69,388,036	$13,521,790	$2,040,000	**$89,877,326**

4th St/Gulf-to-Bay Blvd Corridor Capital Cost Estimate

Service Mode	Station			Vehicle	AVL	TSP Upgrade (per intersection)	TSP w/ New Controller (per intersection)	Optional Features			Total Capital Cost
	Simple	Enhanced	Transfer Station					Running Way Construction (per lane mile)	Right-of-Way Acquisition	Fare Collection Hardware	
Premium Service											
Unit Cost	$21,000	$30,000	$150,000	$570,000	$5,000	$20,000	$22,500	$4,700,000		$60,000	
Number of Units	0	69	2	20	20	41	20	44 . 57		69	
Total Cost	$0	$2,070,000	$300,000	$11,400,000	$100,000	$820,000	$450,000	$209,496,939	$40,423,413	$4,140,000	**$269,200,352**

66th St/East Bay Dr Corridor Capital Cost Estimate

Service Mode	Station			Vehicle	AVL	TSP Upgrade (per intersection)	TSP w/ New Controller (per intersection)	Optional Features			Total Capital Cost
	Simple	Enhanced	Transfer Station					Running Way Construction (per lane mile)	Right-of-Way Acquisition	Fare Collection Hardware	
Limited Stop Connector											
Unit Cost	$21,000	$30,000	$150,000	$545,000	$5,000	$20,000	$22,500	$0		$60,000	
Number of Units	36	0	0	5	5	0	19	0			
Total Cost	$756,000	$0	$0	$2,725,000	$25,000	$0	$427,500	$0	$0	$0	**$3,933,500**
Premium Service											
Unit Cost	$21,000	$30,000	$150,000	$570,000	$5,000	$20,000	$22,500	$4,700,000		$60,000	
Number of Units	0	14	0	3	3	0	10	7.10		14	
Total Cost	$0	$420,000	$0	$1,710,000	$15,000	$0	$225,000	$33,357,959	$1,741,502	$840,000	**$38,309,461**

Park Blvd Corridor Capital Cost Estimate

Limited Stop Connector	Station			Vehicle	AVL	TSP Upgrade (per intersection)	TSP w/ New Controller (per intersection)	Optional Features			Total Capital Cost
	Simple	Enhanced	Transfer Station					Running Way Construction (per lane mile)	Right-of-Way Acquisition	Fare Collection Hardware	
Unit Cost	$21,000	$30,000	$150,000	$545,000	$5,000	$20,000	$22,500	$0	$0	$60,000	
Number of Units	18	4	1	5	5	8	13	0	0	0	
Total Cost	$378,000	$120,000	$150,000	$2,725,000	$25,000	$160,000	$292,500	$0	$0	$0	**$3,850,500**

Ulmerton Rd/Walsingham Rd Corridor Corridor Capital Cost Estimate

Limited Stop Connector	Station			Vehicle	AVL	TSP Upgrade (per intersection)	TSP w/ New Controller (per intersection)	Optional Features			Total Capital Cost
	Simple	Enhanced	Transfer Station					Running Way Construction (per lane mile)	Right-of-Way Acquisition	Fare Collection Hardware	
Unit Cost	$21,000	$30,000	$150,000	$545,000	$5,000	$20,000	$22,500	$0		$60,000	
Number of Units	30	2	0	8	8	3	22	0		0	
Total Cost	$630,000	$60,000	$0	$4,360,000	$40,000	$60,000	$495,000	$0	$0	$0	**$5,645,000**

Gulf Boulevard/Alternate US 19 (North of Clearwater) Capital Cost Estimate

Trolley	Station			Vehicle	AVL	TSP Upgrade (per intersection)	TSP w/ New Controller (per intersection)	Optional Features			Total Capital Cost
	Simple*	Enhanced	Transfer Station					Running Way Construction (per lane mile)	Right-of-Way Acquisition	Fare Collection Hardware	
Unit Cost	$21,000	$30,000	$150,000	$586,927	$5,000	$20,000	$22,500	$0	$0	$60,000	
Number of Units	28	0	0	7	7	0	40	0	0	0	
Total Cost	$588,000	$0	$0	$4,108,489	$35,000	$0	$900,000	$0	$0	$0	**$5,631,000**

Appendix D
Operating Cost Detail

Operating Cost Estimate Methodology

Once the base operating cost per revenue hour has been determined, the specific steps to estimate the service operating cost are provided below. Operating costs were estimated for specific service mode within each corridor.

- The base operating cost per revenue hour must be multiplied by the estimated revenue hours for the corresponding service mode running along each corridor to obtain the weekday and Saturday operating cost for each service mode. The total number of revenue hours (**T**) for each service mode is determined using one-way length (**L**), service span (**D**), peak hour service headway (**f1**), off-peak service headway (**f2**), average operating speed (**S**), and Formula 1. Average speeds have been determined in the last section for each service mode. Morning and evening peak hours also are assumed to a total of combined seven-and-half-hour duration.

$$\mathbf{T=}\left(\frac{2L}{f1\times S}\times 7.5\right)+\left(\frac{2L}{f2\times S}\right)\times(D-7.5) \qquad (1)$$

- Applying the corresponding parameters of each service mode to Formula 1 produces the weekday and Saturday revenue hours. The resulting revenue hours (**T**) are then multiplied by the previously determined operating cost per revenue hour (**C/R**) to obtain the average weekday and Saturday operating costs (**OCW**) and (**OCS**). The annual weekday operating cost (**OCWA**) can be obtained by multiplying the weekday operating cost (**OCW**) with the assumed service days per year (255) for all of the service modes. Using the same method and assumed Saturday service days per year (52), the annual Saturday operating cost (**OCSA**) is determined. Finally, the annual operating cost is obtained by adding annual weekday operating cost and annual Saturday operating cost.

Operating Cost Estimate for US 19 Corridor

Service Mode	Operating Cost per Revenue Hour for BRT (C/R)	Corridor Length (L)	Service Span (D)	Peak Hour Duration	Peak Hour Frequency (f1)	Off-Peak Hour Frequency (f2)	Average Speed (S)	Revenue Hours (T)	Weekday Operating Cost (OCW)	Service Days	Annual Weekday Operating Cost (OCWA)	Saturday Operating Cost (OCS)	Service Days	Annual Saturday Operating Cost (OCSA)	Total Annual Operating Cost
Limited Stop Connector	$78.92	21.31	13.00	7.50	20	30	11.50	125.00	$9,865	255.00	$2,515,499	$7,605	52.00	$395,439	$2,910,938
Commuter Express	$78.92	9.11	7.58	7.50	30	NA	15.00	18.22	$1,438	255.00	$366,670	$1,438	0.00	$0	$366,670

Operating Cost Estimate for Alt US 19 Corridor

Service Mode	Operating Cost per Revenue Hour for BRT (C/R)	Corridor Length (L)	Service Span (D)	Peak Hour Duration	Peak Hour Frequency (f1)	Off-Peak Hour Frequency (f2)	Average Speed (S)	Revenue Hours (T)	Weekday Operating Cost (OCW)	Service Days	Annual Weekday Operating Cost (OCWA)	Saturday Operating Cost (OCS)	Service Days	Annual Saturday Operating Cost (OCSA)	Annual Off-board Fare Collection Cost	Total Annual Operating Cost
Premium	$78.92	7.38	14.00	7.50	10	15	15.00	69.00	$5,445	255.00	$1,388,512	$4,349	52	$226,138	$347,000	$1,961,650
Limited Stop Connector	$78.92	9.46	13.00	7.50	20	30	11.50	55.49	$4,379	255.00	$1,116,688	$3,376	52	$175,544	$0	$1,292,232

Operating Cost Estimate for 4th St/Gulf-to-Bay Blvd Corridor

Service Mode	Operating Cost per Revenue Hour for BRT (C/R)	Corridor Length (L)	Service Span (D)	Peak Hour Duration	Peak Hour Frequency (f1)	Off-Peak Hour Frequency (f2)	Average Speed (S)	Revenue Hours (T)	Weekday Operating Cost (OCW)	Service Days	Annual Weekday Operating Cost (OCWA)	Saturday Operating Cost (OCS)	Service Days	Annual Saturday Operating Cost (OCSA)	Annual Off-board Fare Collection Cost	Total Annual Operating Cost
Premium	$78.92	22.65	14.00	7.50	10	15	15.00	211.76	$16,712	255.00	$4,261,491	$13,347	52	$694,041	$998,000	$5,953,532

Operating Cost Estimate for 66th St/East Bay Dr Corridor

Service Mode	Operating Cost per Revenue Hour for BRT (C/R)	Corridor Length (L)	Service Span (D)	Peak Hour Duration	Peak Hour Frequency (f1)	Off-Peak Hour Frequency (f2)	Average Speed (S)	Revenue Hours (T)	Weekday Operating Cost (OCW)	Service Days	Annual Weekday Operating Cost (OCWA)	Saturday Operating Cost (OCS)	Service Days	Annual Saturday Operating Cost (OCSA)	Annual Off-board Fare Collection Cost	Total Annual Operating Cost
Premium	$78.92	3.56	14.00	7.50	10	15	15.00	33.28	$2,627	255.00	$669,797	$2,098	52	$109,086	$163,000	$941,883
Limited Stop Connector	$78.92	8.53	13.00	7.50	20	30	11.50	50.03	$3,949	255.00	$1,006,908	$3,044	52	$158,287	$0	$1,165,195

Operating Cost Estimate for Park Blvd Corridor

Service Mode	Operating Cost per Revenue Hour for BRT (C/R)	Corridor Length (L)	Service Span (D)	Peak Hour Duration	Peak Hour Frequency (f1)	Off-Peak Hour Frequency (f2)	Average Speed (S)	Revenue Hours (T)	Weekday Operating Cost (OCW)	Service Days	Annual Weekday Operating Cost (OCWA)	Saturday Operating Cost (OCS)	Service Days	Annual Saturday Operating Cost (OCSA)	Total Annual Operating Cost
Limited Stop Connector	$78.92	9.51	13.00	7.50	20	30	11.50	55.78	$4,402	255.00	$1,122,590	$3,394	52	$176,472	$1,299,062

Operating Cost Estimate for Ulmerton Rd/Walsingham Rd Corridor

Service Mode	Operating Cost per Revenue Hour for BRT (C/R)	Corridor Length (L)	Service Span (D)	Peak Hour Duration	Peak Hour Frequency (f1)	Off-Peak Hour Frequency (f2)	Average Speed (S)	Revenue Hours (T)	Weekday Operating Cost (OCW)	Service Days	Annual Weekday Operating Cost (OCWA)	Saturday Operating Cost (OCS)	Service Days	Annual Saturday Operating Cost (OCSA)	Total Annual Operating Cost
Limited Stop Connector	$78.92	14.38	13.00	7.50	20	30	11.50	84.35	$6,657	255.00	$1,697,460	$5,132	52	$266,842	$1,964,302

Operating Cost Estimate for Gulf Boulevard/Alternate US 19 (North of Clearwater)

Service Mode	Operating Cost per Revenue Hour for BRT (C/R)	Corridor Length (L)	Service Span (D)	Peak Hour Duration	Peak Hour Frequency (f1)	Off-Peak Hour Frequency (f2)	Average Speed (S)	Revenue Hours (T)	Weekday Operating Cost (OCW)	Service Days	Annual Weekday Operating Cost (OWCA)	Saturday Operating Cost (OCW)	Service Days	Annual Saturday Operating Cost (OCSA)	Total Annual Operating Cost
Trolley	$78.92	15.65	14.75	7.50	30	30	10.00	92.32	$7,286	255.00	$1,857,837	$7,286	52	$378,853	$2,236,690