

**SARASOTA/MANATEE MPO
PUBLIC TRANSPORTATION SYSTEM ANALYSIS**

EXECUTIVE SUMMARY

INTRODUCTION

This document presents a summary of the recommended public transportation system plan for the Sarasota/Manatee region. These recommendations have been developed by the Sarasota/Manatee Metropolitan Planning Organization (MPO) through its Public Transportation System Analysis (PTSA), a year-long planning process funded by the Florida Department of Transportation. The recommendations included in this system plan are based on a combination of technical analysis (market assessment and alternatives evaluation), interviews and meetings with key community representatives, such as employers, economic development specialists and social service agencies, and results of several public workshops.

The PTSA presents a long-range strategic vision for how the area's future public transportation system should be structured to best meet identified needs in a cost-effective manner. The analysis and recommendations in this document serve as the Transit Element of the MPO's 2025 Long Range Transportation Plan, and reflect the community's mobility needs, land use/redevelopment plans and economic objectives. This report presents details of the recommended public transportation system plan, including an estimate of costs, potential revenue sources, an implementation plan, and a recommended organizational framework.

A Steering Committee guided the work effort for the PTSA. This 16-member committee met regularly throughout the study to guide technical and policy analyses prepared by the consultant, and included representation from the MPO, its technical and citizens advisory committees and other stakeholder groups. Meetings were open to the public and often included citizens and others interested in the study.

The objective of the PTSA is to identify a strategy to help the Sarasota/Manatee region achieve a more balanced transportation system in the future, one that offers a greater variety of travel options to help reduce the need for the billion-dollar backlog of unfunded road construction projects identified in the MPO's adopted 2025 Long Range Transportation Plan and support community development plans. The premise behind a more balanced transportation

system is that an integrated and complementary set of transit strategies can satisfy the area's mobility and jobs access needs through more efficient and equitable use of public resources.

MOBILITY NEEDS

The area cannot sustain a road construction program that will keep pace with expected future congestion levels. Traffic forecasts identify sufficient demand to widen the area's bridges to eight or 12 lanes of capacity, but there is neither funding nor public support for such major construction projects. The region also has many six-lane roads, and the only way to add substantial capacity to these roadways is to build grade-separated interchanges, (e.g. US 19 in Pinellas County). The monetary cost for such interchanges is often prohibitive, requiring purchase of extensive rights-of-way for ramps and storm water retention. The community impacts can also be quite high, with wider, built-up roads creating visual blight, increasing traffic speeds, reducing access and separating neighborhoods and commercial areas. State policy precludes widening state roads beyond six lanes, largely because of these negative impacts and limited benefits to the transportation system.

Similarly, road-widening projects face increasing opposition from neighborhood groups and growth management advocates. While some new roads and additional capacity will be needed in the future, the region must diversify its transportation investments. Providing transportation options prolongs the system's useful life and increases accessibility for all citizens, not just those who are physically or financially able to operate a personal vehicle.

Public transportation, including vanpool, ridesharing and other demand management strategies, serves multiple markets. In the Sarasota/Manatee region, those markets include regular scheduled service for the urbanized area and services to increase the number of persons who can enter high concentration areas, such as downtowns, where roadway and parking space is limited. There is a strong relationship between transit service and parking requirements. As transit service is introduced to meet mobility needs in compact downtown areas, the opportunity for redevelopment and a more livable pedestrian with mixed land uses is greatly enhanced by reductions in the amount of space given to roadways and parking.

Public transportation in its various forms has been marginalized for many years in this region. The transit systems in the two counties have historically operated largely independently from each other, and currently provide substantially different service levels within their

respective counties. Existing transit service also provides limited opportunity for inter-county travel. A lack of public support and limited funding have led the two transit systems to focus on serving a core group of transit-dependent riders with a relatively few routes. As a result, those who use public transportation to reach jobs or school, or satisfy shopping and medical needs, generally face long waits and travel times. Long travel times discourage people who have travel options from using the system, thus robbing the system of potential users.

Through interviews with major employers in the region, recruitment and retention of employees is a constant challenge. Because of work shift schedules at area hospitals, hotels and industrial parks, many workers cannot get to work or home from work using public transportation. This situation effectively precludes many potential workers from the work force, and the inability to fully staff certain positions, due to high turnover, has a ripple effect throughout the employer's operation.

SYSTEM PLAN SUMMARY

To encourage a reasonable shift in travel mode share toward public transportation, the area's future transit system should offer more competitive travel times along major corridors linking centers of activity. Central to the report's recommendations is the concept that a family of public transportation strategies – from greatly improved fixed route bus service to ridesharing, vanpool programs, technology and development of transfer stations that are supported by transit-oriented land uses. Service should be tailored to local conditions, with smaller vehicles and flexible routing in low-density suburban areas, and more direct, frequent service on major roads.

The system plan recommendations are not presented as a single package that must be accepted in total. Rather, there is a building level of investment in public transportation that first introduces inter-county bus service, and then adds more elements over time. Initial investments for local agencies are relatively modest. These additional elements, such as express bus service, vanpool programs and higher capacity transit investments, would be introduced based on an evaluation of the previously introduced service. If it meets identified performance objectives, then subsequent steps should be taken. The overall system plan presents a vision for 2025 of how the recommended system should be structured, but like the MPO's Long Range Transportation Plan, updates will occur every five years to help evaluate and prioritize service elements.

Among the transit alternatives evaluated for the PTSA, Bus Rapid Transit (BRT) is recommended as an economically feasible long-term public transportation strategy for the Sarasota/Manatee region. This alternative provides the most cost-effective approach to meeting the region's future mobility needs and supporting community development objectives. BRT operates on a dedicated lane for buses (and other high occupancy vehicles such as carpools) with signal system priority features and signature buses that look dramatically different from typical transit vehicles. The initial BRT service should operate in the US 41 corridor between Ellenton and Sarasota Square Mall. The BRT corridor should be supported by an interconnecting grid of higher frequency, linear bus routes serving major arterial roads throughout the two counties.

A corridor is defined as an area of about ½ to one mile in width linking major origins and destinations. A corridor may include multiple streets or modes. For example, a portion of the recommended BRT system, therefore, may operate on a parallel facility such as Old Bradenton Road, Coconut Avenue or the CSX rail line, which are within the US 41 corridor.

Fixed route bus service on major corridors – arterial roads like Fruitville Road, Manatee Avenue and Bee Ridge Road – is recommended for operation seven days per week, with longer spans of service (such as from 5:30 AM to 10 PM), greater service frequency and stronger interconnections with other routes and travel modes. A key element of the recommended system plan is to provide strong intermodal linkages in downtown areas, redevelopment districts and other logical pedestrian-oriented areas where buses, bicycles, automobile parking, ferries/water taxis and other modes can connect for maximum system efficiency and effectiveness.

With the system plan recommendations, vehicle miles of travel (VMT) in the region would be reduced by nearly 12 percent. This is a substantial reduction that has a direct benefit to each household in terms of transportation costs. Even with the assumption that households would pay for the system plan through taxes, the system plan provides an estimated benefit of \$500 annually in transportation cost savings per household based on VMT reduction.

System Plan Elements

Three key principles guide the development of this recommended system plan. The principals reflect the work of previous study tasks to define the transit market, develop alternatives and evaluate viable transit strategies. The guiding principles for the MPO's transit system plan are:

1. Address existing and future traffic congestion “choke points” by providing expanded mobility options within constrained road segments, such as bridges and downtowns;
2. Support economic development, jobs access and center-city redevelopment by reducing parking needs through direct, convenient and fully accessible transit services linking residential areas to employment destinations, and
3. Integrate public transportation with land use through development of livable community centers that support transit, walking and bicycling, and help reduce air pollution.

Each of those principles entail development of a complementary set of public transportation services and policies, ranging from improved coordination of the Transportation Disadvantaged program, development of commute options like ridesharing and vanpools, and supporting strategies addressing parking, land use/design and traveler information.

The corridor that runs generally along US 41 and US 301 between Ellenton, through downtown Bradenton and downtown Sarasota, to the Sarasota Memorial Hospital and South Gate Plaza shopping center, serves as the backbone of region’s future public transportation system. This corridor is currently the economic and civic heart of the Sarasota/Manatee region, and is expected to contain more than 100,000 jobs in the future. Traffic congestion is projected to significantly worsen on roads within this corridor or on major roads leading into this corridor, such as SR 64, SR 70, University Parkway and Fruitville Road.

Bus Rapid Transit

The framework for the system plan is built around a core investment in Bus Rapid Transit (BRT) operating in the US 41 corridor linking Ellenton and Palmetto with Bradenton, the airport area, downtown Sarasota, Sarasota Memorial Hospital and the Sarasota Square Mall. This system would entail use of a single lane of roadway designed exclusively for use by transit and other high occupancy vehicles with supporting transit infrastructure, such as shelters, sidewalks and pedestrian amenities, and information kiosks to display bus arrival times and connecting routes. At selected locations along the route, a bus pullout lane that would enable northbound and southbound vehicles to pass would augment the single lane for transit vehicles. Such locations should occur at key stops where adjacent land use provides a destination or useful transfer opportunity.

Transit service for the BRT mode is recommended to operate for long service periods into the evening at 15-20 minute frequency. Service during peak rush hours would be more frequent than during the off-peak period. This span of service would support work trips as well as those related to entertainment (e.g. theater, dining, etc.). If service proves successful within this primary corridor, expansion of the BRT south from Sarasota Square Mall to downtown Venice is recommended.

Bus Rapid Transit is also recommended for an east-west corridor linking the rapidly growing eastern edge of the urbanized area along I-75 with the employment, recreation and commercial areas to the west. The service could operate on either University Parkway or Fruitville Road, as both corridors include heavily-traveled six-lane arterial roads that connect higher density residential and employment centers. Furthermore, Amtrak has identified the Fruitville Road area for a future high-speed rail station, although the actual station location could be somewhere between Fruitville Road and University Parkway.

Fruitville Road is the stronger transit corridor given its direct access to downtown, redevelopment potential and density/intensity and proximity of adjacent land uses. University Parkway lacks transit-supportive land uses, but is the major future east-west commuting route, and links the emerging employment center of Lakewood Ranch with the Sarasota-Bradenton International Airport and surrounding industrial and institutional land uses. Whereas on Fruitville Road transit would need to make frequent stops, University Parkway has relatively few transit-oriented land uses and the service would benefit from the faster speeds and fewer stops offered by Bus Rapid Transit.

The market should determine whether Fruitville Road or University Parkway ultimately enjoys BRT service. Both corridors are recommended to have express/commuter-oriented bus service, and good local fixed route service operating with shorter headways and longer service periods to address different transit markets. To serve both areas and allow the market to determine whether a more intensive transit investment is made, a “U-shaped” route is recommended. This route would begin at the airport, where it would link with the Route 41 BRT system, continuing along University Parkway to I-75 and then turn south at the Lakewood Ranch business center east of I-75 to connect with Fruitville Road along a planned interconnecting road network. The service would connect with the Amtrak high speed rail



station, and then travel along Fruitville Road to downtown Sarasota and across the Ringling Causeway to Longboat Key. Service would operate in both directions to reduce time waiting for the bus. In selecting a preferred east/west BRT corridor, equal consideration will be given to University Parkway and Fruitville Road in future alignment studies based on demand and development patterns.

BRT is a cost-effective alternative to Light Rail Transit and other forms of fixed guideway investments. Development of the BRT system within the US 41 northern corridor is expected to be considerably less expensive than development of a fixed guideway system, even if such a system operated on existing CSX rail tracks. A well-designed BRT system with attractive signature buses and street amenities offers nearly all the competitive advantages of light rail at a fraction of the cost. Given the employment densities of the Sarasota/Manatee region, Light Rail Transit is not feasible within the study's 25-year time frame; however, a successful BRT application could lead to future conversion to Light Rail Transit.

The CSX Rail Corridor

Although not recommended as the highest priority, the Sarasota/Manatee MPO should leave open the possibility of using the existing rail tracks for some form of passenger rail transportation service in the future. The existing tracks lie in an area that is not as productive for transit as US 41 or even Old 301 and costs for rail transit are high; however, the tracks do link the region's major employment centers and opportunities for their lower cost use may present themselves in the future. It may be possible to develop joint use of the rail corridor for transit and bicycling, thus expanding intermodal access throughout the region.

Other Regional Services

It is recommended that the Sarasota/Manatee MPO support development of high-speed regional rail service in the Southwest Florida area between Naples/Fort Myers and Tampa. Amtrak and the Florida Department of Transportation have completed a feasibility study of high-speed passenger rail service in the I-75 corridor, which recommends service in operation by 2015 and three stations in the Sarasota/Manatee area at Jacaranda Boulevard, Fruitville Road and SR

64/Manatee Avenue. Such service would operate at speeds of up to 80 miles per hour, and could provide an important link of a statewide high-speed rail service.

Vanpool and rideshare programs are recommended to link the Sarasota/Manatee region with larger population and employment centers in Pinellas County and Hillsborough County. Based on interviews with selected employers such as Home Shopping Network, Aegon and Raymond James Financial in Pinellas County's Mid-County Office and Industrial area, as much as 10 percent of the workers may reside in Manatee or Sarasota Counties. As the demand builds, express or commuter-oriented bus service is recommended.

Up to three express bus routes are ultimately recommended connect park-and-ride lots located near I-75 and I-275 in Manatee and Sarasota Counties with Pinellas and Hillsborough Counties. The routes should have a limited number of stops to provide competitive travel times with automobile travel. Candidate destination stops include the University of South Florida, downtown Tampa, the Westshore Employment Center, Rocky Point and Tampa International Airport, downtown St. Petersburg and selected locations in the Pinellas Mid-County. Express service would operate only in the peak hours, with 2-3 trips in the morning and 2-3 return trips in the afternoon, each at hourly intervals.

Inter-connecting Service

Supporting the BRT operating within the primary north-south corridor would be a series of east-west feeder bus routes linking the Gulf islands and the high-growth areas in the eastern part of the region. Trunk-line service should offer direct routes operating on such major roadways as US 301, SR 64/Manatee Avenue, SR 70/Cortez Road, SR 789/Fruitville Road, Bee Ridge Road and SR 72/Clark Road. On some corridors, such as Manatee Avenue and Fruitville Road, peak period service frequencies may be every 15-20 minutes, with 30-minute frequency during non-peak periods, seven days per week. Other corridors would operate every 30 minutes throughout the day. Hours of operation would be 16-18 hours per day.

Existing local bus routes would likely need to be restructured somewhat to avoid duplication with trunk line routes. Local bus service would need to serve neighborhoods and collector roads to improve access to the trunk line routes and regional transit services. Local bus service would operate at least every hour, with a shorter span of service than the trunk routes.

Currently, large 40-foot buses are more durable and cost effective than smaller, lighter transit vehicles (12 year average life span versus seven years). However, transit services must blend well into the surrounding land use pattern to attract users and to be effective. Smaller, more maneuverable vehicles may be appropriate on local circulator routes in neighborhoods or to penetrate into high-density condominium buildings. The higher maintenance costs and more frequent vehicle replacement may be a worthwhile trade-off to generate higher ridership levels.

Transfers and Terminals

The Sarasota/Manatee region does not focus on a single, dominant central business district. The area's coastal orientation, suburban development pattern and long distances between traditional and emerging population and employment centers is not well-suited for a radial-type transit system focused on a central downtown transit terminal. Instead, the transit systems serving the two counties should be restructured toward a timed-transfer operating system. As the area grows, it is likely to evolve into a multi-centered urban area focused on retail-oriented development clusters, a pattern that tends to favor timed-transfer bus service.

A pulse timed transfer system is designed to facilitate transfers between routes and foster improved transit access between outlying, suburban centers. Multiple routes converge at specific intervals (e.g. every 30 minutes), and depart simultaneously, thus reducing wait time for those who must transfer between routes. In primary transfer centers such as the Bradenton, Sarasota and Venice CBDs, as many as 8-10 routes may converge at each pulse interval. In secondary transfer centers, such as the DeSoto Mall, Lakewood Ranch Business Center or Gulf Gate Mall, 3-5 routes may converge. As the Sarasota/Manatee region grows, it is reasonable to expect there may be 15-20 separate transfer centers. At each terminal, there should be suitable transit infrastructure and a host of complementary services. It is important that the centers be developed as *dedicated* transfer facilities, rather than just a stop at the edge of a nondescript shopping mall parking lot. Land should be acquired, or at a minimum, long-term joint use agreements should be reached between landowners and the transit agency, for development of transit facilities.

Supporting Transit Services and Policies

Complementing an improved system of fixed public bus routes and BRT is the development of supporting strategies and programs designed to encourage discretionary transit riders to choose alternatives to driving alone. These support services and policies include parking strategies, commute alternatives (rideshare matching, carpools, vanpools, telecommuting, etc.), guaranteed ride home programs, universal transit access and Advanced Public Transportation Systems (APTS). Each should be developed to help reduce peak hour demand on the area's highway network.

A Transportation Management Organization (TMO) has recently been formed in downtown Sarasota. The purpose of the TMO is to market commute alternatives and improved transit use in the downtown area to reduce congestion levels. Much of the work of a TMO is geared toward promotion of travel choices in the downtown area, as well as telecommuting. Membership in the TMO includes downtown businesses and public agencies.

Through the TMO in Sarasota and the future development of TMOs for Bradenton and possibly Venice, the region should pursue a policy of universal transit access in the downtown core areas. Business or agency participation in the TMO would allow employees to ride transit free within designated redevelopment districts. Operation of bus service within fare free zones may be subsidized through business contributions/developer contributions and allocation of funds from existing and potential new revenue sources.

In addition, the MPO and its member local governments should adopt policies requiring the construction of appropriate transit infrastructure (e.g., shelters, pull-off bays, pocket parks, etc.) as part of road widening projects. This requirement may be limited to roads where transit service is currently or projected to be at a certain level of service, but it ensures that the necessary ingredients for a more balanced transportation system are adequately included in the planning and design of roadway facilities.

Land Use

Providing good transit service is only one part of the equation to build an effective transit system. To encourage greater use of public transportation, area local governments must begin to work cooperatively toward development of transit-friendly land use plans and policies.

Specifically, to meet federal transit funding criteria land use plans and transit-oriented design standards must be developed for key transit corridors and areas surrounding designated transfer centers. Within the US 41 corridor, it is recommended that the two counties jointly prepare redevelopment plans. These plans would create a more intensive land use pattern leading to the creation of compact transit centers that include a clustering of different land uses, such as retail, apartments and offices around stations. It is recommended that transit centers be developed as quarter-mile zones or nodes, with a pedestrian scale street pattern and buildings located in relative close proximity to the street and to each other. At this scale, transit service can be effectively integrated into the walking range of most people – elderly, disabled and young alike. An example of this type of pedestrian scale and street interconnectivity is the Hillview neighborhood in Sarasota located immediately south and west of Sarasota Memorial Hospital.

PROJECTED COSTS AND REVENUES

Costs for capital and operations have been estimated for the recommended system plan. The costs have been developed as conservatively as possible, given the unknowns about specific alignment, station locations and right-of-way acquisition needs. The recommended system plan is projected to cost about \$390 million in capital costs, or \$11.6 million on an annualized basis. Annual operating costs are estimated to be about \$19 million. These costs are in addition to the costs to operate the current bus systems in Sarasota and Manatee Counties.

Costs for the Bus Rapid Transit recommendation include the Best Bus elements of an improved grid-like network of higher frequency bus routes on major corridors, along with necessary support programs for vanpool/carpool promotion and administration. The cost estimate also includes major stations, park-and-ride lots, expansion of the bus fleet by an additional 107 vehicles and associated operational costs, as well as roadway maintenance costs for the busway lane. The additional 107 vehicles would bring the combined bus fleet for the two counties to about 170 vehicles. This estimate does not include expansion of local bus routes based on the assumption that with the new service operating on major corridors, existing routes can be restructured to fill in gaps in local service areas at the neighborhood or community level. As the system grows, vehicle maintenance facilities will need to be upgraded and expanded to support the additional fleet. Increased maintenance costs are reflected in the operating cost estimate, but

it is difficult to estimate the cost of a new bus garage at this level of detail. Costs for such a maintenance facility are difficult to estimate, but could be about \$10-15 million.

As stated in the introduction, these costs would not occur at once, but would be phased in over time, depending on successful application of priority transit service elements, as described in the next section.

Revenue sources for transit are varied, and include state, local and federal sources. Federal and state funds are typically used for capital services and facilities, such as vehicle procurement, development of transit stations, administrative and maintenance facilities and land acquisition for garages. These funding sources usually require a local match of 25 percent. State funding also covers service development/demonstration and congested corridor programs, including operations. Typically, local sources must cover transit operations because of federal funding constraints. Local sources of funds include revenue from ridership, advertising, developer exactions, general revenue, gas taxes and grants. Federal funding criteria under the New Starts program for BRT requires a dedicated source of local funds. The analysis presented in this report outlines a potential local funding source of an increase in the sales tax by ½ penny. Such an increase would leverage more than \$1 billion in local, state and federal funds to fund the system plan recommendations. This is based on existing sales tax revenue collections.

IMPLEMENTATION PLAN

The first priority of the Sarasota/Manatee MPO for public transportation should be to fund improved inter-county transit service operating in the US 41 corridor. Within the next two years, it is recommended that the local transit agencies jointly pursue start-up funding from the Florida Department of Transportation to begin operation of a service route linking Ellenton, Palmetto, downtown Bradenton, the Sarasota-Bradenton International Airport, downtown Sarasota, Sarasota Memorial Hospital and the Sarasota Square Mall. The service should operate every 30 minutes between 5:30 AM until 7:30 PM. Additionally, express bus service operating within University Parkway to link residential areas with jobs should also occur in the immediate short term. Service development funds provided by FDOT in the amount of approximately \$8 - \$10 million could fund operating and capital costs for three years. At that point, the MPO and its local agency partners would evaluate the service to determine whether it should continue to be funded through other sources.

Concurrently, the MPO should initiate the required planning work for the development of the Bus Rapid Transit system for the US 41 corridor. This would entail preparation of an alternatives analysis to fully investigate the selection of a preferred alignment, location of stations and determination of environmental impacts. A detailed operations plan, cost estimate for the chosen alignment and financial plan are the primary products of the alternatives analysis.

INSTITUTIONAL ARRANGEMENTS

In the short term (next 2-6 years), the two transit systems should continue to operate as part of the respective county governments. To facilitate the development of regional inter-county transit service, the study recommends that the two counties form a transit policy board that operates through an interlocal agreement. The policy board would be a committee of the Sarasota/Manatee MPO involving city and county representatives with a major stake in regional transit services, meeting regularly to plan, fund and monitor the development of regional transit services and programs.

Each county will continue to operate its transit service within the existing structure. The interlocal agreement would identify and provide sufficient funding for the transit agency (either SCAT or MCAT) responsible for implementing regional service. The interlocal agreement would cover vehicle procurement, facilities development, maintenance, operations and sources and uses of funds needed for regional service. It is recommended that initial funding of regional service be through allocation of MPO planning funds, grants from federal and state sources for service development, and a share from each county. Coordination and funding of regional transit services may also fall under the purview of the West Central Florida MPO Chair's Coordinating Committee (CCC), which includes the Tampa Bay area MPOs and the Polk County TPO.

Within 5-7 years, it is recommended that the MPO and its partners pursue creation of an independent, inter-county transit authority to plan, fund and operate the public transportation system. Such an authority offers advantages over the current system of separate transit agencies operating within county government structures in terms of marketing/visibility; integration of planning, operations and capital construction activities; greater ability to deal with a range of complementary strategies, such as parking structures, transit facilities and terminals; and ability to secure funding on an equitable basis within a two- or three-county region. It is recommended that the authority would include more than just one travel mode – vanpools/carpools and other

services would be included. The Lynx system in the Orlando region is an example of this type of organization and set of modal responsibilities.

Subsequent to the creation of a regional transportation authority, it is recommended that the area pursue a dedicated source of transit development funding through reallocation and/or expansion of the gasoline or local sales tax. This is necessary to leverage federal and state funds to develop a Bus Rapid Transit system within the US 41 and east-west corridors. Without a committed source of local matching funds, it is not likely that the federal government will participate in funding of substantial transit investments in the region.

SUMMARY

This document provides an overview of the recommended public transportation system plan for the Sarasota/Manatee region. It is the product of a year's worth of public participation, technical analysis and detailed discussion with a diverse Steering Committee that includes technical staff, citizens and elected officials. The system plan outlines a 25-year vision for achieving a public transportation system that meets the area's mobility needs and provides a travel alternative within an expanding number of congested and constrained roadways. The Public Transportation System Plan is intended to serve as a long-range guide to the development of annual transportation priorities, much like the MPO's 2025 Long Range Transportation Plan guides the preparation of the Transportation Improvement Program (TIP) and the Florida Department of Transportation's Five Year Work Program. As comments are received on this draft, it will be revised and incorporated into the final report for the Public Transportation System Analysis.