2045

METROPOLITAN PLANNING ORGANIZATION
HERNANDO/CITRUS

Hernando/Citrus MPO
TRANSPORTATION PLAN

March 4, 2020

Technical Appendix

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Federal Strategies for Implementing Requirements for LRTP Updates for the Florida MPOs

January 2018

The Federal Highway Administration (FHWA), in cooperation with the Federal Transit Administration (FTA), developed this document to provide clarification to the Florida Department of Transportation (FDOT) and Florida's Metropolitan Planning Organizations (MPOs) regarding our expectations for meeting some of the requirements to be addressed in the next cycle of Long Range Transportation Plan (LRTP) updates. 23 CFR 450.306, 316 and 324 describe the basic requirements of the scope of the metropolitan transportation planning process, including a documented public participation plan, and development and content of the LRTPs respectively.

Addressing Current Requirements

The following information is presented to highlight notable areas for improvement, as well as those of potential concern, in order to proactively assist the MPOs in meeting federal planning requirements. These topic areas were selected based on a past history of issues observed with them through our general stewardship responsibilities, or through the oversight responsibilities via the Transportation Management Area (TMA) certification reviews. FHWA and FTA would be pleased to work with FDOT and the MPOs to discuss interpretation examples and/or statewide templates as appropriate to support implementation consistency. Additional areas of concern may be addressed on an individual MPO basis as needed throughout the LRTP development process. Citations noted refer to regulations published in the May 27, 2016 *Federal Register*.

Stakeholder Coordination and Input

Specific Public Involvement Strategies: MPOs are required to develop a written plan that documents and explicitly describes the procedures, strategies, and outcomes of stakeholder involvement in the planning process for all the MPOs products and processes, including, but not limited to, the timing of and timeframe for public/stakeholder input on the LRTP and its amendments. The MPOs should take the time to ensure their LRTP outreach strategies in their public participation plan (PPP), whether documented in an overall MPO PPP or one specifically for LRTP outreach, are clear, transparent, and accurately describes when and how their stakeholders can be involved in the process. To this end, having non-transportation professional(s) review the document and provide their understanding of when and how long the public comment periods occur for the various planning products can be helpful to ensure the information is being interpreted as intended. {23 CFR 450.316(a)(1)}

Public Involvement/Tribal/Resource Agency Consultation: Consultation on the MPO's planning products (including the LRTP) with the appropriate Indian Tribal governments and Federal land management agencies (when the planning area includes such lands) is required to be documented. The interaction documentation with these stakeholders needs to outline the roles, responsibilities and key decision points for consulting with other governments and agencies. MPOs should ensure that their plans and/or documentation include such procedures.

Additionally, State and local agencies responsible for land use management, natural resources, environmental protection, conservation and historic preservation are required to be consulted during the development of the

LRTP. This consultation consists of comparisons of state conservation plans/maps, and inventories of natural or historical resources with transportation plans, as appropriate and if available. This consultation process is also required to be documented, ideally in the public participation plan. Note that the Tribal governments and resource agencies mentioned above are also required to be involved in the development of the various consultation processes with these agencies. {23 CFR 450.316(a)(1), (c), (d), (e); 23 CFR 450.324(g)}

Measures of Effectiveness: Many MPOs have what appear to be very successful strategies for reaching out and incorporating public comment into their products and processes. However, there is no systematic confirmation or validation that the strategies are indeed working. MPOs are required to periodically review the effectiveness of the procedures and strategies described within the public participation plan (PPP). The PPP is also required to contain the specific measures used, the timing of, and the process used to evaluate the MPO's outreach and PPP strategies. Ideally, once the LRTP is developed, the outreach is evaluated, and then any needed changes to the outreach process are incorporated and documented in the PPP prior to the next LRTP update. {23 CFR 450.316(a)(1)(x)}

Fiscal Constraint

Project Phases: Projects in LRTPs are required to be described in enough detail to develop cost estimates in the LRTP financial plan that show how the projects will be implemented. For a project in the cost feasible plan, the phase(s) being funded and the cost must be documented. Additionally, the source of funding for each phase must be documented in the first 10 years of the LRTP. The phases to be shown in LRTPs include Preliminary Engineering (PE), Right of Way (ROW) and Construction. PE includes both the Project Development and Environment (PD&E) and Design phases. FHWA and FTA support the option of combining the PD&E and Design phases into an overall PE phase for these long range estimates. Boxed funds can be utilized as appropriate to document the financing of smaller projects, such as sidewalks, or early phases of projects, such as PD&E. However, the individual projects utilizing the box need to be listed, or at a minimum, sufficiently described in bulk in the LRTP (i.e. PD&E for projects in Years 2020-2025). {23 CFR 450.324(f)(9), (f)(11); 23 CFR 450.326(h)}

Full Time Span of LRTP (1st 5 Years): Plans are required to have at least a 20-year horizon. The effective date of the LRTP is the date of the MPO adoption of the plan. As such, the MPO is required to have an LRTP that includes projects from the date of adoption projected out at least 20 years from that date. The LRTP is a planning document that describes how the proposed projects will help achieve the regional vision. The Transportation Improvement Program (TIP), however, is a reflection of the investment priorities which are established in the LRTP. When adopting an updated LRTP, the projects in the previous LRTP are assessed and revised to acknowledge projects that have: 1) moved forward (these are typically removed from the updated LRTP), 2) shifted in time (these could be moved forward or back in implementation in the updated LRTP), and 3) been added or deleted based on the MPO's current priorities. The TIP is only a resource for determining which projects have moved forward. **The TIP, which is based on the previous LRTP, is not a substitute for the first 5 years of the updated LRTP.** Additionally, the TIP is a 4-year programming document that, in Florida, is adopted every year and thus expires annually. When LRTPs "include the TIP", it is a reference to a static and outdated document once the next TIP is incorporated into the Statewide Transportation Improvement Program (STIP), which occurs annually in Florida Therefore, the MPOs will need to show all of the projects, phases, and

estimates from the adoption date through the horizon year of the LRTP, which is considered the entire time period of the LRTP. In addition, funding sources need to be shown for all projects from the adoption date through the first 10 years. {23 CFR 450.324(a); 23 CFR 450.326(a)}

Technical Topics

SHSP Consistency: We have come a long way from "What is the Strategic Highway Safety Plan (SHSP)?" to having LRTPs address the safety of all users throughout the planning process. We have proactively and successfully encouraged the MPOs to include a safety element in their LRTPs and be consistent with the Florida SHSP. The changes to the planning regulations now require the goals, objectives, performance measures and targets of the Highway Safety Improvement Program (HSIP), which includes the SHSP, to be integrated into the LRTPs either directly or by reference. However, the specific priorities, strategies, countermeasures and projects of the HSIP are not required to be integrated. We continue to strongly encourage their incorporation where appropriate. {23 CFR 450.306(b)(2), (d)(4)(ii); 23 CFR 324(h)}

The link to FDOT's 2016 SHSP is: http://www.fdot.gov/safety/SHSP2012/FDOT_2016SHSP_Final.pdf

Freight: Florida's MPOs have been proactive in assessing and incorporating their freight needs. Freight shippers and providers of freight transportation services have been required to be incorporated into the stakeholder outreach that the MPO uses throughout the planning process and the LRTP to address the projected demand of goods transportation on the network. Changes to the planning requirements now also encourage the consultation of agencies and officials planning for freight movements. With the National Highway Freight Program a core funding category of federal funds, having a solid basis for incorporating freight needs and projecting the freight demands will be key to the LRTP's success for meeting its regional vision for the goods movement throughout the area. Additionally, the planning regulations now require the goals, objectives performance measures and targets of the State Freight Plan to be integrated into the LRTPs either directly or by reference. While freight is one of the planning factors, it deserves special emphasis, and will need to play a more prominent role in future LRTPs. The MPOs need to show a concerted effort to incorporate freight stakeholders and strategies into the next LRTP. {23 CFR 450.306(b)(4), (b)(6); 23 CFR 450.316(a); 23 CFR 450.324 (b), (f)(1), (f)(5)}

Environmental Mitigation/Consultation: For highway projects, the LRTP must include a discussion on the types of potential environmental mitigation activities and potential areas to carry out these activities. The environmental mitigation discussion in the LRTP must be developed in consultation with Federal, State and Tribal wildlife, land management and regulatory agencies. The LRTP discussion can be at a system-wide level to identify areas where mitigation may be undertaken (perhaps illustrated on a map) and what kinds of mitigation strategies, policies and/or programs may be used when these environmental areas are affected by projects in the LRTP. This discussion in the LRTP would identify broader environmental mitigation needs and opportunities that individual transportation projects might take advantage of later. MPOs should be aware that the use of ETDM alone is not environmental mitigation. The use of ETDM is considered project screening and is not a system-wide review of the planning area. Documentation of the consultation with the relevant agencies should be maintained by the MPO. {23 CFR 450.324(f)(10)}

Congestion Management Process: The management of congestion has played an increasing role in the operations of transportation networks. One of the key activities of the process is to evaluate the effectiveness of the strategies the process produces. The MPO must demonstrate that the congestion management process is incorporated into the planning process. The process the MPO uses can be documented separately or in conjunction with the LRTP. The process is required to: 1) provide for the safe and effective integrated management and operations of the transportation network; 2) identify the acceptable level of performance; 3) identify methods to monitor and evaluate performance; 4) define objectives; 5) establish a coordinated data collection program; 6) identify and evaluate strategy benefits; 7) identity an implementation schedule; and 8) periodically assess the effectiveness of the strategies. The congestion management process should result in multimodal system measures and strategies that are reflected in the LRTP and TIP. The new planning requirements provide for the optional development of a Congestion Management Plan (CMP) that includes projects and strategies that will be considered in the TIP. This optional plan is different than documenting the processes that the MPO uses to address the congestion management. The CMP, if used, needs to 1) develop regional goals, 2) identify existing transportation services and commuter programs, 3) identify proposed projects, and 4) be developed in consultation with entities that provide job access reverse commute or job-related services to low-income individuals. {23 CFR 450.322}

Americans with Disabilities Act (ADA) Transition Plans: Government agencies with 50 or more employees that have control over pedestrian rights of way (PROW) must have transition plans for ADA. Agencies with less than 50 employees that have control over PROW must have an ADA Program Access Plan, describing how they provide access for those with disabilities to programs, services and activities. MPOs that are a part of a public agency that has these responsibilities need to have a heightened awareness for these responsibilities and plans. However, all MPOs play an important role in ADA compliance by assisting agencies with sidewalk inventories, gap studies, etc. MPOs can also go a good deal further, but should at a minimum serve as a resource for information and technical assistance in local government compliance with ADA. {28 CFR 35.105; 28 CFR 35.150(d)}

Administrative Topics

LRTP Documentation/Final Board Approval: The date the MPO Board adopts the LRTP is the effective date of the plan. The contents of the product that the MPO adopts on that date includes at a minimum: 1) the current and projected demand of persons and goods; 2) existing and proposed facilities that serve transportation functions; 3) a description of performance measures and targets; 4) a system performance report; 5) operational and management strategies; 6) consideration of the results of the congestion management process; 7) assessment of capital investment and other strategies to preserve existing and future infrastructure; 8) transportation and transit enhancement activities; 9) description of proposed improvements in sufficient detail to develop cost estimates; 10) discussion of potential environmental mitigation strategies and areas to carry out the activities; 11) a cost feasible financial plan that demonstrates how the proposed projects can be implemented and includes system level operation and maintenance revenues and costs; and 12) pedestrian walkway and bicycle transportation facilities which are required to be considered, where appropriate, in conjunction with all new construction and reconstruction of transportation facilities, except where bicycle and pedestrian use are not permitted. FHWA and FTA expect that at the time the MPO Board adopts the LRTP, a

substantial amount of LRTP analysis and documentation will have been completed, and all final documentation will be available for distribution no later than 90 days after the plan's adoption. The Board and its advisory committees, as well as the public, should have periodically had opportunities to review and comment on products from interim tasks and reports that culminated into what is referred to as the final Plan. Finalizing the LRTP and its supporting documentation is the last activity in a lengthy process. All final documents are required to be made readily available for public review and to be made available electronically. The final document(s) should be posted online and available through the MPO office no later than 90 days after adoption date. The MPOs' schedules for this round of LRTP development are expected to allow ample time for the Board to adopt the final LRTP product no later than 5 years from the MPOs' adoption of the previous LRTP. These adoption dates have recently been confirmed with each MPO. {23 CFR 450.324 (a), (c), (f), (k)}

LRTP & STIP/TIP Consistency: The STIP and TIPs must be consistent with the relevant LRTPs as they are developed. FHWA and FTA staff will be checking for this consistency during the STIP approval process. The results of previous reviews indicate that emphasis is still needed to ensure that projects are accurately reflected in both the TIP and STIP and that these projects are flowing from and are found to be consistent with the MPO's LRTP. Additionally, when amendments to the STIP/TIP are made, the projects must also be consistent with the LRTP from which they are derived. When STIP/TIP amendments are received by FHWA and FTA, they will be reviewed for consistency with the applicable LRTP. Projects with inconsistencies between the STIP/TIP and the respective LRTP will not be approved for use of federal funds or federal action until the issue is addressed. {23 CFR 450.330; 23 CFR 450.218(b)}.

New Requirements

This section describes topics that may not currently be required by federal laws and rules to be addressed in LRTPs. As such, MPOs are not required to include these considerations in their current planning processes and plans. However, they will be required to be addressed for the next LRTP.

New Planning Factors: The MPO is required to address several planning factors as a part of its planning processes. The degree of consideration and analysis of the factors should be based on the scale and complexity of the area's issues and will vary depending on the unique conditions of the area. Efforts should be made to think through and carefully consider how to address each factor. There are two new planning factors that need to be considered in the next LRTPs: 1) improving the resiliency and reliability of the transportation system and reducing or mitigating stormwater impacts of surface transportation; and 2) enhancing travel and tourism. Florida has a strong history of proactively addressing these transportation areas. These experiences can be drawn upon to incorporate the new factors into the planning processes. {23 CFR 450.306(b)9, (b)(10), (c)}

Transportation Performance Management: As funding for transportation capacity projects becomes more limited, increasing emphasis will be placed on maximizing the efficiency and effectiveness of our current transportation system and the resources that build and maintain the system. As such, a performance-based approach to transportation decision making will be required for the FDOT and MPOs. As the MPOs and FDOT are aware, the performance measures required to be addressed in the LRTPs are documented in final rules that were published in the Federal Register on March 15, 2016 and January 18, 2017. The MPOs will set their targets

in accordance with the schedule established in these final rules. FDOT and the MPOs have flexibility as to the documentation and process used for setting the targets, as long as the targets are made publicly available once they are set. The next LRTPs (when updated or amended after May 27, 2018) will be required to describe the performance measures and the targets the MPO has selected for assessing the performance of the transportation system.

A system performance report will also be required to be included in the LRTPs. The report is a tool that evaluates and updates the condition of the transportation system in relation to the performance measures and targets. While guidance is still being developed, the report would include for each performance measure information such as: the target set; the baseline condition at the start of the evaluation cycle; the progress achieved in meeting the targets; and a trend-type comparison of progress with previous performance reports. Depending on the timing of the LRTP, the date of the target setting, and length of the evaluation cycle, the LRTPs initially amended/updated after May 27, 2018 may not have a full cycle of specific information to include. However, the LRTPs need to include the data that is available and discuss how the MPO plans to use the full information once it does become available. We recognize that these initial LRTPs will be developed during a transition period, and commit to working with the MPOs to ensure that the regulations are reasonably being addressed. {23 CFR 450.306(d)(4); 23 CFR 450.324(f)(3), (f)(4)}

For more TPM information and the tools tailored for Florida partners, please go to: https://www.fhwa.dot.gov/fldiv/tpm.cfm

Multimodal Feasibility: The transportation plan shall include both long-range and short-range strategies/actions that provide for the development of an integrated multimodal transportation system (including accessible pedestrian walkways and bicycle transportation facilities) to facilitate the safe and efficient movement of people and goods in addressing current and future transportation demand. {23 CFR 450.324}

Transit Asset Management: The MPO is required to set performance targets for each performance measure, per 23 CFR 450.306(d). Those performance targets must be established 180 days after the transit agency established their performance targets. Transit agencies are required to set their performance targets by January 1, 2017. If there are multiple asset classes offered in the metropolitan planning area, the MPO should set targets for each asset class. Planning for TAM/Roles and Responsibilities for MPOs and State DOTs can be found on the FTA website: https://cms.fta.dot.gov/sites/fta.dot.gov/files/planning-tam-fact-sheet.pdf

Emerging Issues

This section describes topics that may not currently be required by federal laws and rules to be addressed in LRTPs. As such, MPOs are not required to include these considerations in their current planning processes and plans. These issues are receiving considerable attention in national discussions. Each MPO has the discretion to determine whether to address these emerging topics in their LRTP at this time and the appropriate level of detail. Beginning to address these issues early on may potentially minimize the level of effort needed to achieve future compliance.

Mobility on Demand (MOD): Mobility on Demand (MOD) is an innovative, user-focused approach which leverages emerging mobility services, integrated transit networks and operations, real-time data, connected travelers, and cooperative Intelligent Transportation Systems (ITS) to allow for a more traveler-centric, transportation system- of-systems approach, providing improved mobility options to all travelers and users of the system in an efficient and safe manner. Automated vehicles (AV), now being called Automated Driving Systems (ADS) and Connected Vehicles (CV) are two components of the overall MOD model.

ADS (also known as self-driving, driverless, or robotic) are vehicles in which some aspect of vehicle control is automated by the car. For example, adaptive cruise control, where the vehicle automatically speeds up, slows down, or stops in response to other vehicle movements in the traffic stream is an automated vehicle function. Connectivity is an important input to realizing the full potential benefits and broad-scale implementation of automated vehicles. The preliminary five-part formal classification system for ADS is:

- Level 0: The human driver is in complete control of all functions of the car.
- Level 1: A single vehicle function is automated.
- Level 2: More than one function is automated at the same time (e.g., steering and acceleration), but the driver must remain constantly attentive.
- Level 3: The driving functions are sufficiently automated that the driver can safely engage in other activities.
- Level 4: The car can drive itself without a human driver

CV includes technology that will enable cars, buses, trucks, trains, roads and other infrastructure, and our smartphones and other devices to "talk" to one another. Cars on the highway, for example, would use short-range radio signals to communicate with each other so every vehicle on the road would be aware of where other nearby vehicles are. Drivers would receive notifications and alerts of dangerous situations, such as someone about to run a red light as they're nearing an intersection or an oncoming car, out of sight beyond a curve, swerving into their lane to avoid an object on the road.

Rapid advances in technology mean that these types of systems may be coming on line during the horizon of the next LRTPs. While these technologies when fully implemented will provide more opportunities to operate the transportation system better, the infrastructure needed to do so and the transition time for implementation is an area that the MPO can start to address in this next round of LRTP updates.

Resources for additional information:
Mobility on Demand: https://www.its.dot.gov/factsheets/pdf/MobilityonDemand.pdf
Autonomous Vehicles: https://www.its.dot.gov/research_areas/pdf/WhitePaper_automation.pdf
Connected Vehicles: https://www.its.dot.gov/cv_basics/index.htm
Transportation Planning Capacity Building Connected Vehicle Focus Area:
https://planning.dot.gov/focus_connectedVehicle.asp

Proactive Improvements

This section describes topics that are not currently required by federal laws and rules to be addressed in LRTPs nor are they required by the May 27, 2016 regulation changes. As such, MPOs are not required to include these considerations in their current planning processes and plans. These areas are intended to be a proactive change in the LRTPs to help Florida continue to make positive strides in long range planning.

New Consultation: There are two new types of agencies that the MPO should consult with when developing the LRTPs: agencies that are responsible for tourism and those that are responsible for natural disaster risk reduction. These consultations are a natural evolution of implementing the new planning factors for which Florida has experience in doing. {23 CFR 450.316(b)}

Summary of Public Involvement Strategies: Seeking out and considering the needs of traditionally underserved populations is a key part of any public involvement process. When the MPO carries out stakeholder involvement, they may use a variety of strategies. These strategies ultimately demonstrate that their planning process is consistent with Title VI and other federal anti-discrimination provisions in the development of the LRTP. In order to clearly demonstrate this consistency, the MPOs should summarize the outreach information. This information should be derived from the MPO's public involvement plan elements. The public involvement summary should be supported by more detailed information, such as the specific strategies used, feedback received and feedback responses, findings, etc. The detailed information should then be referenced and included in the form of a technical memorandum or report that can be appended to the LRTP, or included in a separate, standalone document that is also available for public review in support of the LRTP. {23 CFR 450.316(a)(1)(vii)}

Impact Analysis/Data Validation: In accordance with Title VI, MPOs need to have and document a proactive, effective public involvement process that includes outreach to low income, minorities and traditionally underserved populations, as well as all other citizens of the metropolitan area, throughout the transportation planning process. Using this process, the LRTP needs to document the overall transportation needs of the metropolitan area and be able to demonstrate how public feedback and input helped shape the resulting plan. Where some MPOs struggle in using data to assess likely impacts, other MPOs attempt to use data to assess the needs. Some look at a dollar spread among minority/non-minority areas to determine equity. This approach is probably not the best method to use, since higher dollar amounts might indicate capacity projects when the community needs more pedestrian connectivity, for example. We suggest using the data tools found at https://www.fhwa.dot.gov/environment/environmental_justice/resources/data_tools/. Additionally, as time passes it becomes more important to validate the 2010 census data being used. School Boards, emergency service agencies, tax rolls and staff knowledge are all good sources to ensure data quality. {23 CFR 450.316(a)(1)(vii); 23 CFR 420.324(e)}

FDOT Revenue Forecast: To help stakeholders understand the financial information and analysis that goes into identifying the revenues for the MPO, we recommend the MPO include FDOT's Revenue Forecast in the appendices that support the LRTP. {23 CFR 450.324(f)(11)(ii)}

Sustainability and Livability in Context: We encourage the MPO to implement strategies that contribute to comprehensive livability programs and advance projects with multimodal connectivity. MPO policies and practices that support an integrated surface transportation system for all users that is efficient, equitable, safe, and environmentally sustainable will improve transportation choices and connectivity for all users especially those walking and bicycling. Building partnerships with traditional and nontraditional stakeholders will facilitate the development and implementation of transportation projects that improve integration, connectivity, accessibility, safety and convenience for all users. The MPOs are encouraged to identify and suggest contextual solutions for appropriate transportation corridors within their area and utilize the flexibilities provided in the federal funding programs to improve the transportation network for all users. {23 CFR 450.306(b)}

Scenario Planning: The new planning requirements describe using multiple scenarios for consideration by the MPO in the development of the LRTP. If the MPO chooses to develop these scenarios, they are encouraged to consider a number of factors including potential regional investment strategies, assumed distribution of population and employment, a scenario that maintains baseline conditions for identified performance measures, a scenario that improves the baseline conditions, revenue constrained scenarios, and include estimated costs and potential revenue available to support each scenario. {23 CFR 450.324(i)}

Appendix A

FLORIDA TRANSPORTATION PLAN

Centennial
FDOT
1915 ★ 2015
FLORIDA TRANSPORTATION PLAN
POLICY ELEMENT
DECEMBER 2015
FloridaTransportationPlan.com
FTP
Florida Transportation Plan
SIS
Strategic Intermodal System

Three Elements of the Florida Transportation Plan

Vision Element *(August 2015)*

Trends, uncertainties, and themes that will shape the future of transportation in Florida (50 years)

Policy Element *(December 2015)*

Goals and objectives to guide the Florida Department of Transportation and partners toward the vision (25 years)

Coming Soon

Implementation Element *(2016)*

Emphasis areas with key actions (5-25 years)

Centennial FDOT 1915★2015

Produced by the Florida Department of Transportation.
For more information, please contact:
Office of Policy Planning – 850.414.4800
FloridaTransportationPlan.com

Introduction and Overview

Florida's transportation system faces significant opportunities and challenges over the next few decades. The Sunshine State's population and economy are projected to continue to expand at a strong pace, leading to growth in demand for moving people and freight. Changing demographic patterns –including high growth of both the baby boomer and millennial populations – along with a diversifying economy will reshape the transportation needs and preferences of residents, visitors, and businesses. Changing technologies – from automated vehicles to unmanned aerial vehicles to mobile commerce – will transform how we consume and provide transportation.

Working together, Florida's transportation partners have the opportunity to increase the safety and security of the transportation system; improve the efficiency and reliability of travel; and provide more transportation choices to meet the needs of our diverse population and economy. As we do so, we can support the state's broader economic development, quality of life, and environmental stewardship goals.

What Is the FTP?

The Florida Transportation Plan (FTP) is the single overarching statewide plan guiding Florida's transportation future. It is a plan for all of Florida created by, and providing direction to, the Florida Department of Transportation (FDOT) and all organizations that are involved in planning and managing Florida's transportation system, including statewide, regional, and local partners.

The FTP Policy Element is Florida's long-range transportation plan as required by both state and federal law. Florida law requires FDOT to work with transportation partners and the public to update the plan every five years. This update occurs as FDOT celebrates the 100th anniversary of its formation as the State Road Department, and points toward a future transportation system that embraces all modes of travel, innovation, and change.

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How do we adapt to changing trends and risks? 10

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How do we provide more transportation choices? 18

How do we strengthen our economic competitiveness? 22

How do we support quality places? 26

How do we protect our environment and conserve energy? 30

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Introduction and Overview

35 Member Steering Committee

4 Advisory Groups

3 Statewide Events

One Website with over **4k** Page views per month

13 Regional Forums or Workshops

350 Briefings to Partner Meetings

15,000 Event Participants

1 Plan for all of Florida

7 Long-Range Goals

30 Long-Range Objectives

All numbers estimated as of 12/31/2015

How Is the FTP Developed?

The FTP is a collaborative effort of state, regional, and local transportation partners in the public and private sectors. The development process included:

- A 35-member **steering committee** provided overall guidance for the process. The committee members represented all levels of government, multiple modes of transportation, business and economic development organizations, and community and environmental interests (see list of members on page 40). The committee met six times in 2015 in locations around Florida.
- Four **advisory groups** identified issues and potential strategies in the areas of Infrastructure and Growth Leadership, Innovation and Economic Development, Quality of Life and Quality Places, and the Strategic Intermodal System. These advisory groups involved steering committee members and 22 additional partners (see list of members on inside back cover). The groups were organized using the Six Pillars of Florida's Future Economy, which were developed by the Florida Chamber Foundation and incorporated into state, regional, and local plans. Each group met three times.
- A statewide summit, a statewide open house, a statewide webinar, 13 regional forums or workshops, over 350 briefings at regularly scheduled meetings of transportation partners, and an interactive website helped gather input and feedback from more than **15,000 participants** throughout this process. These partners and public involvement activities sought to make Floridians aware of the FTP update process; obtain input on trends, issues, and opportunities that should be considered during the plan update process; and gather feedback on draft plan elements.

In addition to the stakeholder and public input, the steering committee and advisory groups considered:

- Existing state, regional, and local visions and plans related to transportation, economic development, land use, and the environment;
- Available data on trends, conditions, and forecasts impacting transportation in Florida;
- A survey of millennials living inside and outside of Florida to document preferences for transportation and technology; and
- Five alternative futures for Florida's transportation system, which were intended to help understand and prepare for the range of possibilities facing Florida's transportation system.

In conjunction with the FTP update, FDOT is working with the steering committee, an additional advisory group, partners, and the public to update the Strategic Intermodal System (SIS) Policy Plan. The FTP provides guidance for other state, regional, and local plans, including the SIS Policy Plan. The SIS is the high-priority network of transportation facilities critical to Florida's economic competitiveness. The integrated update process ensures that FTP implementation focuses first and foremost on the transportation facilities most critical for connecting Florida's regions and connecting Florida to other state and nations.

Introduction and Overview

What Does the FTP Include?

This new Florida Transportation Plan includes three elements:

1. **The Vision Element** (released in August 2015) provides a longer-term view of major trends, uncertainties, opportunities, and desired outcomes shaping the future of Florida's transportation system during the next 50 years.
2. **The Policy Element** (this document) defines goals and objectives for Florida's transportation system over the next 25 years. The Policy Element establishes the policy framework for expenditure of state and federal transportation funds flowing through FDOT's work program. The Policy Element also provides guidance to other transportation partners as they develop and implement policies, plans, and projects.
3. **The Implementation Element** (to be developed in 2016) will define the roles of state, regional, and local transportation partners in implementing the FTP, including specific short- and medium-term actions and performance measures that will build on the *Indicators to Watch* identified in this document.

Transportation System Performance

The Policy Element is organized around seven long-range goals. The first four goals focus on the performance of Florida's transportation system:

- The goal of **safety and security for residents, visitors, and businesses** maintains the longstanding priority for ensuring the safety and security of transportation customers. This goal also addresses how transportation can support broader needs – for example, response to and recovery from extreme weather events or pandemics, or helping prevent human trafficking or spread of biological weapons.
- A second goal – **agile, resilient, and quality infrastructure** – is substantially enhanced from prior FTPs, which focused on maintaining Florida's infrastructure, primarily pavement and bridges, in good condition. This FTP addresses conditions for all modes and also emphasizes responsiveness to changing technologies and market trends, resiliency to risks, and customer service and other measures of quality.
- The goal of **efficient and reliable mobility for people and freight** shifts from a focus on reducing travel time and delay to making the entire transportation system more efficient and reliable, including all modes as well as supporting regulatory processes.
- This FTP includes a new goal of **more transportation choices for people and freight.** This goal recognizes widespread partner and public input on the need for a fuller range of options for moving people and freight, with emphasis on walking, bicycling, transit, and rail, as well as emerging mobility options such as shared and automated vehicles.

Transportation Support for Statewide Priorities

The next three goals focus on how transportation supports statewide priorities:

- The goal of **transportation solutions that support Florida's global economic competitiveness** maintains the state's recent emphasis on trade and logistics, while also supporting Florida's visitor industry and diversification into innovation industries. This also is the first FTP to focus attention on Florida's transportation workforce.
- The goal of **transportation solutions that support quality places to live, learn, work, and play** extends beyond prior efforts to avoid or minimize impacts of transportation on Florida's communities. The goal emphasizes how transportation decisions can contribute to stronger communities, including greater emphasis on transportation's contribution to public health and the changing needs of a diverse population.
- The goal of **transportation solutions that enhance Florida's environment and conserve energy** also extends beyond prior efforts to avoid, minimize, or mitigate potential impacts of transportation on the environment. This goal emphasizes how transportation decisions can enhance the environment by restoring and connecting natural systems, reducing the overall footprint of the transportation system, and conserving energy.

The goals are not listed in priority order. Indeed, the goals are interrelated, and all seven together create Florida's transportation future.

How Is the FTP Policy Element Organized?

The core of the Policy Element is organized around these seven goals (pages 6-33). For each goal area, the Policy Element addresses three questions:

- **Why does it matter?** A brief narrative highlighting the importance of each goal.
- **What do we want to achieve?** Four to five long-range objectives that support each goal, one to two indicators to watch to track progress toward each goal, and one to two examples of current initiatives related to each goal.
- **How will we get there?** A set of ideas and approaches for accomplishing each goal, with opportunities to continue key emphasis areas, embrace innovation, collaborate with our partners, serve our customers, and improve data and processes.

The final sections of the Policy Element discuss the transition to implementation (pages 34-37).

Goal: Safety and Security for Residents, Visitors, and Businesses

Why Does It Matter?

Highlights

Traffic fatalities are declining but remain high, especially for vulnerable road users

Transportation security issues are becoming more complex

Florida's transportation system needs to remain prepared for extreme weather and other emergencies

A key element of Florida's long-term transportation vision is a fatality-free transportation system. Traffic fatalities account for the majority of transportation-related deaths, with almost 2,500 people dying on Florida's highways in 2014. Many of these fatalities are the result of human behavior, such as impaired, distracted, or aggressive driving or failure to use safety equipment. With almost 100 million visitors a year and year-round sunny and warm weather, Florida ranks higher than its peers in deaths of vulnerable road users – bicyclists, pedestrians, and motorcyclists.

Both in Florida and nationally, traffic fatalities have declined overall in the last couple of decades due to safer vehicles, better road design, improved incident response, public education, and stronger enforcement. While these tools will continue to play a role in reducing fatalities, emerging technologies, like automated and connected vehicles and intelligent transportation systems, will play a larger role in the future. As Florida's transportation system becomes increasingly multimodal, emphasis on safety for other modes, like water, air, rail, bicycle, pedestrian, and transit, is increasingly important.

Another key element of Florida's long-term transportation vision relates to security – not only of the transportation system itself, but also supporting the security of our state as a whole. Continuing emphasis on homeland security to prevent terrorist attacks is critical. Florida's transportation system also is a conduit for criminal activity, including cargo theft, human trafficking, and drug and goods smuggling; and for biohazards, including infectious diseases and invasive species. As demand for moving people and freight continues to increase, addressing these security needs while also providing efficient and reliable customer service becomes more challenging. As more technology is incorporated into transportation, the scope of security broadens to include cybersecurity, data breaches, and system reliability.

Our transportation system also plays an essential role in preparing for, responding to, and recovering from emergencies like extreme weather events and catastrophic incidents. Our ability to evacuate residents and visitors, and provide medical supplies, food, and fuel to distressed communities depends on the transportation system. The ability of the transportation system to resume normal travel directly correlates to the ability of our communities to recover – economically and otherwise – after an emergency.

What Do We Want To Achieve?

Objectives

- ***Prevent transportation-related fatalities and injuries***
- ***Reduce the number of crashes on the transportation system***
- ***Prevent and mitigate transportation-related security risks***
- ***Provide transportation infrastructure and services to help prepare for, respond to, and recover from emergencies***

Indicators to Watch

Number of
Transportation-Related
Fatalities and Serious Injuries

Florida's Safety Plans and Programs

The state is committed to improving the safety of Florida's transportation system through various programs and plans. The Pedestrian and Bicycle Strategic Safety Plan is designed to focus funding and resources on the areas that have the greatest opportunity to reduce pedestrian and bicycle fatalities, injuries, and crashes. The plan provides guidance to FDOT, partners, and stakeholders to develop a safer environment for walking and bicycling. The Pedestrian and Bicycle Safety Plan is supported by the Safe Mobility for Life program, which is focused on the development of safety strategies for the state's aging population, and the Alert Today, Alive Tomorrow program, a media campaign reminding transportation customers to pay attention and follow the rules of the road.

Safety is Golden
Safe Mobility for Life Coalition

DRIVING DOWN FATALITIES

ALERT TODAY FDOT ALIVE TOMORROW

Goal: Safety and Security for Residents, Visitors, and Businesses

How Will We Get There?

What's New?

Safer environment for pedestrians, bicyclists, and other vulnerable road users

Automated and connected passenger and freight vehicles

Cybersecurity for transportation

Emphasis Areas

- Combine design, engineering, enforcement, education, and emergency response strategies to reduce fatalities, injuries, and crashes involving:
  - » **Vulnerable and at-risk road users,** including pedestrians, bicyclists, motorcyclists, aging road users, and teenagers;
  - » **Unsafe, distracted, and impaired** driver and operator behavior; and
  - » **Lane-departure and intersection crashes.**
- Increase safety and security for **public transportation users.**
- Increase safety and security for **users with limited mobility.**
- Increase the safety and security of **freight movement** using all modes, including safe and secure truck parking and other logistics facilities, and separation of or reduced conflict between freight and passenger vehicles.
- Increase the efficiency and capacity of **customs, immigration, and other security processes** at airports, seaports, and other hubs to accommodate growth in demand including peak flows related to larger vehicles.
- Provide transportation connectivity to Florida's **military facilities** to support their national security and emergency response functions.

Innovation

- Expand the use of **context-sensitive design** to improve safety for all customers, especially pedestrians and bicyclists.
- Continue to support research, testing, policy, and deployment activities to realize the anticipated safety benefits of **automated and connected vehicle** technologies.
- Use **technology, information, and operations** strategies for all modes to improve transportation security and emergency preparedness and response.
- Enhance transportation security systems to address **continuing, new, and emerging threats,** such as biosecurity, food security, invasive species, nuclear materials, and human trafficking.
- Provide more **diversity and redundancy** in the transportation system to allow alternatives for evacuation and response during emergencies.
- Reduce the vulnerability of transportation technologies to **hacking, cyberattacks, system failure,** and other disruptions.

Collaboration

- Continue to develop and implement **safety and security improvement plans** for all modes of transportation at the state, regional, and local levels, such as Florida's Strategic Highway Safety Plan.
- Strengthen state and local **enforcement and prosecutorial capabilities** to ensure compliance with transportation safety and security laws and regulations.
- Develop and implement comprehensive **emergency response and recovery plans** involving state, regional, and local transportation, law enforcement, and emergency management agencies.
- Coordinate transportation and land use decisions to ensure that transportation corridor improvements intended to enhance emergency evacuation and response are not used to promote additional **development in high hazardous areas** or areas not planned for growth.
- Identify opportunities to work with federal, military – and civil, state, and local partners and the private sector to integrate **new aviation and space technologies** while ensuring the safety and security of the airspace.

Customers

- **Educate all customers,** including visitors, about safety and security issues and improvement strategies for all modes.
- Enhance security regulations, processes, communications, information systems, and infrastructure to **improve customer service** and reduce customer wait time.

Data and Processes

- Support accurate, timely, and complete **data collection and reporting** of safety and security incidents and exposure for all modes.
- Identify risk factors and develop targeted plans that consider the **benefits and costs** of potential safety and security improvements.

Goal: Agile, Resilient, and Quality Infrastructure

Why Does It Matter?

Highlights

State highway and bridge condition remains a strength

Customer needs and expectations are rapidly changing

Infrastructure may need to adapt to extreme weather and other risks

Maintaining the transportation system in good condition is one of Florida's basic commitments to its residents, visitors, and businesses. The physical condition of Florida's transportation system is important to meet customer expectations for safe and reliable travel and to support the state's quality of life and economic competitiveness.

Maintaining these assets requires both routine activities, such as filling potholes, removing litter, and inspecting vehicles; and major preservation activities, such as resurfacing roadways and runways, maintaining channel depths, and rehabilitating rail lines, bridges, and bulkheads at seaports. Proactive maintenance can improve safety, reduce operating costs for customers, delay the need for costly reconstruction or replacement, and protect the public's investment in infrastructure.

The physical condition of Florida's state highways and bridges is among the best in the nation. Florida law requires FDOT to meet the annual needs for resurfacing of the State Highway System and for repair and replacement of bridges on the system. Florida has exceeded the statutorily defined targets for the state highway system pavement and state maintained bridges for the past several years. These excellent conditions may be more difficult to maintain in the coming decades due to increasing demand for moving people and freight, rising costs, funding constraints, changing environmental conditions, and the aging of Florida's infrastructure. Less information is available about the condition of local roads, but funding constraints have made even routine maintenance a challenge for many local governments.

Over time, the emphasis of Florida's maintenance and asset management activities will broaden to encompass all modes of transportation. In addition, the definition of what constitutes "good" or "quality" infrastructure is broadening to address operational performance and customer service. As customer needs, technologies, and the size and characteristics of passenger and freight vehicles change, so too will the expectations for the condition and performance of infrastructure. Some transportation hubs or corridors will face the challenges of accommodating significant increases in demand or significantly larger vehicles. Some hubs or corridors may shift over time to accommodate multiple modes or uses; still others may see a new emphasis serving a different function, such as local rather than through travel. Other facilities may reflect changing demand by reducing the number of road lanes and creating more space for sidewalks or bicycle paths. Because technologies and market trends are changing so quickly, agility in adapting plans will be essential.

As our economy becomes more globally integrated we are at a greater risk from global instability and market shifts. As our economy and transportation system become more dependent on technology, we are more at risk to cyberattacks. We must continue to be prepared for extreme weather events such as more frequent or severe tropical storms; flood risks in coastal areas resulting from high-tide events, storm surge, flash floods, stormwater runoff, and related impacts; changes in precipitation patterns and temperatures; and other environmental conditions that could impact transportation infrastructure, such as sinkholes. Ongoing research, collaboration, and innovative solutions are needed to ensure Florida's transportation system and the economy and communities it serves are prepared for and resilient to these and other risks.

What Do We Want To Achieve?

Objectives

Meet or exceed industry, state, national, or international standards for infrastructure quality, condition, and performance for all modes of transportation

Optimize the functionality and efficiency of existing infrastructure and right-of-way

Adapt transportation infrastructure and technologies to meet changing customer needs

Increase the resiliency of infrastructure to risks, including extreme weather and other environmental conditions

Indicators to Watch

Bridge, Pavement,
and other
Infrastructure Condition

I-4 Ultimate

The I-4 Ultimate project, made possible through a public-private partnership, will improve the existing Interstate 4 corridor to better connect communities, improve the economy, and enhance quality of life throughout the Central Florida region. Improvements will be made to a 21-mile section of the corridor between Kirkman Road and State Road 434 that will incorporate the use of recycled materials, bridge and interchange reconstruction, and intelligent transportation systems. The project includes the integration of tolled express lanes that will provide reliable travel conditions, reduced travel times, improved driver safety, and direct connections to key interchanges. Express lane tolling will be completely automated to further increase efficiency and reliability on the corridor. The I-4 Ultimate is the most recent in a series of projects to transform the state's major transportation corridors, including the I-95 Express and I-595 Express projects in Southeast Florida. Additional managed lanes projects are being planned in Tampa Bay, Jacksonville, and other areas.

Goal: Agile, Resilient, and Quality Infrastructure

How Will We Get There?

What's New?

Next-generation transportation corridors incorporating new technologies and design practices

Faster response to changing market trends, including the increasing size of passenger and freight vehicles and vessels and growing peak flows of people and freight

Adaptation of bridges, roads, and other infrastructure to be more resilient to risks

Emphasis Areas

- **Proactively manage transportation assets** to achieve acceptable conditions, expanding from our traditional focus on highways to encompass all modes.
- Plan and develop investments in **terminal and corridor capacity** that are consistent with regional and local visions and plans and are anticipated to provide economic benefits.

Innovation

- Lead the nation in the research, development, and deployment of **state-of-the-art materials, technology, and methodologies** for transportation infrastructure design, construction, maintenance, and operations.
- Develop **multimodal hubs** to provide access to multiple modes and services at a single location and accommodate larger or advanced commercial passenger and freight vehicles.
- Develop enhanced transportation corridors that:
  - » Incorporate and support **emerging technologies** such as connected vehicles or alternative fuel sources;
  - » Include managed or **special-use lanes;**
  - » Enable **separation** of freight and passenger vehicles, where appropriate, to improve safety and mobility;
  - » Enable **separation** of through and local trips, where appropriate, to improve safety and mobility;
  - » Support integration of compatible uses such as **utility infrastructure;** and
  - » Maximize use of existing right-of-way by providing flexible or **multi-level infrastructure.**
- **Retrofit, adapt, or provide more diversity** in the location of critical infrastructure to reduce vulnerability to extreme weather and other environmental conditions.

Collaboration

- **Assist local governments** in documenting the condition of road, transit, and other infrastructure and developing strategies to improve infrastructure quality, condition, and performance.
- Coordinate with local governments when making major infrastructure investment and development decisions to consider the **risks of investing** in areas vulnerable to extreme weather, flood risks, and other environmental conditions, including consideration of areas identified as priorities for mitigation of risks or adaptation of infrastructure in regional and local plans.
- **Coordinate with local governments** to determine how to use excess transportation capacity if demand decreases over time.

Customers

- Adapt planning, design, construction, maintenance, and operations practices to reflect **changing customer expectations,** new technologies, changes in the size and characteristics of vehicles, and locations of major developments.

Data and Processes

- Improve the availability and consistency of **infrastructure data** across modes and levels of government.
- Actively participate in setting and updating industry, national, and international standards and monitoring **global best practices** for infrastructure quality, performance, and condition.
- Implement FDOT's **Transportation Asset Management Plan** and expand this plan over time to include all modes; encourage local governments and other modal providers to develop asset management plans.
- **Incorporate the risks of extreme weather** and other environmental conditions into long-range planning, project development, design, operations, and asset management decisions for all modes.
- Continue to **support research** to better understand the potential impacts of extreme weather events, flood risks in coastal areas, and other climate trends on transportation infrastructure.
- **Reduce the time and improve the predictability** of the process for planning and developing major transportation projects.

Goal: Efficient and Reliable Mobility for People and Freight

Why Does It Matter?

Highlights

Travel delay on all modes impacts Florida's economic competitiveness and quality of life

Customers have increasing expectations for reliable travel for people and freight

Efficiency of regulatory processes may impact mobility

The efficiency and the reliability of transportation is increasingly important as Florida's economy and society move at the speed of life. Florida's residents and visitors experienced nearly 257 million person-hours of delay on the State Highway System in 2014 – a figure that does not include delay on local roads or other transportation modes. Delay affects freight activity as well, creating impacts on the state's economic competitiveness. Delay is down significantly from the peak of the last economic expansion, but appears to be trending upward again.

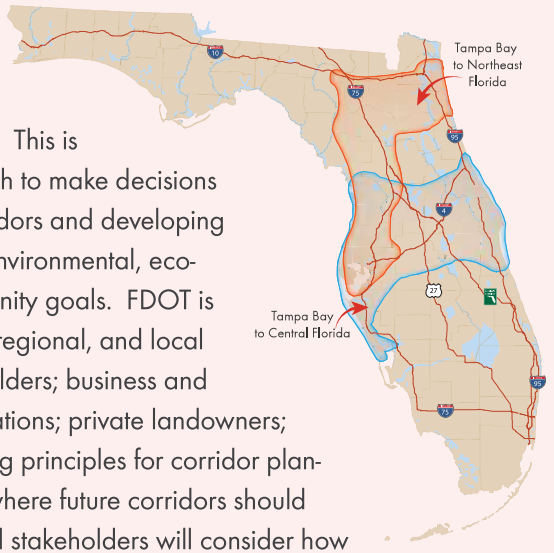
National studies suggest that about one-half of all highway congestion is related to nonrecurring sources, including crashes and other incidents, construction activity, and special events. The remainder is the result of bottlenecks, system deficiencies, and other recurring sources. Some level of congestion is a sign of a healthy economy, but our goal is to eliminate unnecessary delay and improve reliability.

Florida's residents, visitors, and businesses are signaling the importance of more reliable travel times and schedules. Today, about 81 percent of all highway travel during peak periods occurs at or near the posted speed limit. About 80 percent of all scheduled commercial air departures leave on time.

The efficiency of travel also is affected by regulatory processes, including commercial vehicle safety, weight, and agricultural inspections; permits and licenses; tolling and fare payment; and customs and immigration processes for people and freight entering the United States via Florida. Electronic tolling is a good example of how technology can be used to streamline and reinvent transportation-related regulatory transactions.

While the efficiency and reliability of individual trips and transactions is important to the customer, it also is important to look at the efficiency of the entire system. Florida's transportation system today operates with significant inefficiencies – from the large number of motor vehicles that carry only a single occupant and sit idle for most of each day to the large number of trucks and rail cars that enter the state full and leave empty. Emerging technologies and a changing economy create opportunities to more fully use the available capacity of Florida's transportation system to meet the state's changing needs.

Florida's Future Corridor Planning Process



The Future Corridors Planning Process is planning for Florida's major statewide transportation corridors over the next 50 years. This is a long-term, large-scale approach to make decisions about transforming existing corridors and developing new corridors in the context of environmental, economic development, and community goals. FDOT is collaborating closely with state, regional, and local agencies; environmental stakeholders; business and economic development organizations; private landowners; and the public to develop guiding principles for corridor planning and recommendations on where future corridors should be located. FDOT, partners, and stakeholders will consider how corridors relate to conservation, countryside, and centers when developing these recommendations.

What Do We Want To Achieve?

Objectives

- ***Reduce delays related to bottlenecks, gaps, and crashes and other incidents for all modes of Florida's transportation system***
- ***Increase the reliability of all modes of Florida's transportation system***
- ***Increase customer satisfaction with Florida's transportation system and regulatory processes for residents, visitors, and businesses***
- ***Increase the efficiency of the supply chain for freight moving to, from, and through Florida***
- ***Increase the efficiency and flexibility of transportation-related regulatory processes***

Indicators to Watch

Person- and **Freight-**
Hours of Delay

Percent of **passenger rail** and percent of **commercial air departures**
Occurring On Time

Automated and Connected Vehicles

Florida is on the cusp of a technological revolution in the transportation industry. Automated and connected vehicle technologies hold unprecedented opportunities to help reduce congestion and eliminate transportation related fatalities. FDOT is planning for the deployment of automated and connected vehicle technologies on public roadways with the establishment of the Florida Automated Vehicles initiative. This initiative was created to help build the framework for automated and connected vehicle implementation by engaging stakeholders, developing research and pilot projects, and creating awareness of the technologies.

Goal: Efficient and Reliable Mobility for People and Freight

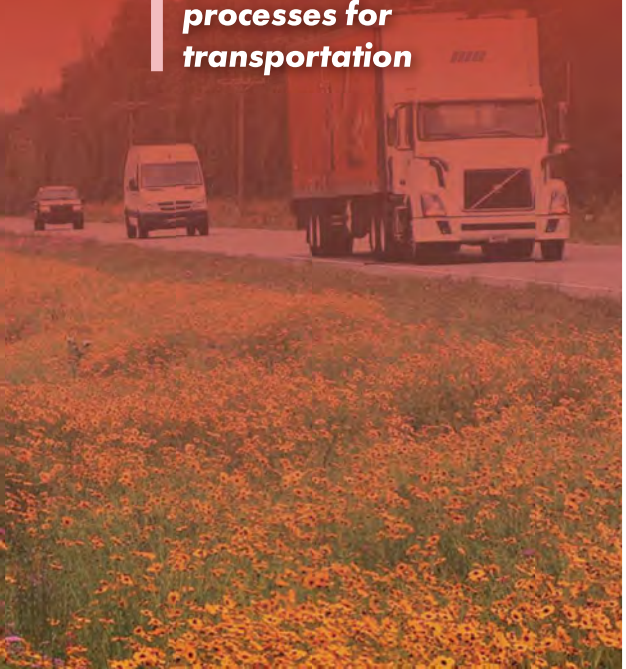
How Will We Get There?

What's New?

Seamless information, routing, and payment across modes

More efficient supply chain including real-time load matching

More efficient and predictable regulatory processes for transportation



Emphasis Areas

- Reduce delays associated with bottlenecks, crashes, work zones, special events, and other incidents through:
  - » **Improved management** of existing infrastructure;
  - » **"Quick fix" improvements;** and
  - » **Strategic investments** in additional system capacity.
- Continue the **Future Corridor Planning Process** to transform existing interregional corridors and to close interregional connectivity gaps, building on guiding principles developed cooperatively with state, regional, and local agencies and environmental stakeholders.
- Increase the **efficiency and capacity** of Florida's major airports, seaports, spaceports, and other freight and passenger terminals through strategic investments in new capacity and enhanced operations.
- Improve **last-mile connectivity** to Florida's major airports, seaports, spaceports, and other freight and passenger terminals from other modes.
- Increase the efficiency, capacity, and connectivity of major **truck, rail, and water corridors** through targeted capacity improvements, accommodations for heavy freight movement, and separation of freight and passenger traffic on shared corridors.

Innovation

- Use **emerging technologies** to reduce delay and improve reliability and customer service, such as:
  - » Intelligent transportation systems;
  - » Automated, connected, or shared vehicles;
  - » Origin to destination trip planning for all customers; and
  - » A universal, customer friendly payment system that works across transportation modes and jurisdictional boundaries.
- Increase the **efficiency of the supply chain** and distribution network to, from, and through Florida, including:
  - » Improving the balance of inbound and outbound freight flows by manufacturing more goods in Florida;
  - » Expanding intermodal logistics centers and other freight terminals;
  - » Enhancing real-time route planning, asset tracking, and load matching;
  - » Facilitating off peak freight movement; and
  - » Expanding use of new technologies such as automated and connected truck technologies and unmanned aerial vehicles.

Collaboration

- Continue to support the high-priority role of the **Strategic Intermodal System (SIS)** connecting Florida's regions and connecting Florida to other states and nations.
- Strengthen programs such as the **Transportation Regional Incentive Program (TRIP), Small County Outreach Program (SCOP), Small County Road Assistance Program (SCRAP),** and other programs that address regional and local mobility needs.
- Develop **multimodal corridor plans** that coordinate and leverage investments in the SIS, regional, and local transportation facilities.

Customers

- Protect and improve the **quality of the visitor experience** in Florida through safe, efficient, accessible, convenient, and comfortable transportation.
- Improve the clarity, readability, and design of **signage and other traveler information,** including multilingual or universal signage for a diverse resident and visitor population.
- Use **technology to enhance customer service,** such as providing schedule, incident, parking, and rerouting information to passengers.
- Improve the ability of businesses to accomplish transportation **regulatory transactions** through reducing transaction time, improving predictability, and adapting regulations and processes to reflect new technologies.
- Plan and develop Florida's infrastructure to better accommodate customers with **limited mobility.**

Data and Processes

- Adapt infrastructure **design and performance standards** to emphasize person and freight mobility rather than vehicle throughput.
- Establish a **framework for data sharing** to address emerging technologies such as automated and shared vehicles.
- Periodically reassess state and local **transportation-related laws and regulations** to reflect changing technologies and market trends.
- Actively participate in identifying potential enhancements to **federal regulatory processes** consistent with the goals and objectives of the Florida Transportation Plan.

Goal: More Transportation Choices for People and Freight

Why Does It Matter?

Highlights

Demand is growing for public transportation, walking, and bicycling

New mobility solutions and business models such as automated, connected, and shared vehicles are emerging

Changing business logistics practices, like mobile commerce and quick response-delivery, will impact choices for moving freight

This Florida Transportation Plan places a significant emphasis on providing more transportation choices for people and freight – an overarching concern of a wide range of transportation partners, stakeholders, and the public.

Roads and highways are the dominant form of transportation in Florida today. About 80 percent of all employees in the state drive to work alone. Trucking accounts for 80 percent of all tons of freight moved in the state. A total of 30 urban and 23 rural transit systems operate in Florida; few of these systems provide options beyond local bus service and few connect across county lines. Florida's railways, waterways, and airspace provide additional options in many parts of the state, with noteworthy gaps such as rail service in Northwest and Southwest Florida or commercial air service in most of rural Florida.

Changing demographics – including a larger aging population; a growing younger, technology-savvy population; and a growing foreign-born population – are increasing demand for a wider range of transportation options, including transit, walking, and bicycling. Changing development patterns could result in more population growth in dense urban areas, which tend to support a wider variety of transportation choices. Continued growth in the number of visitors is reinforcing demand for more travel options, including longer-distance rail, air, and water services.

More options are needed for residents and visitors who choose not to use a car, or are unable to drive due to disability, income, or age. At the same time, with growth in mobile commerce and changing logistics practices, businesses want efficient, convenient, and affordable choices for moving freight.

Over time, our mobility options will expand from traditional choices of highway, rail, and transit to a range of options, including new types of vehicles such as automated, connected, and shared vehicles, as well as newer public transportation services such as local circulators, personal rapid transit, and higher-speed intercity bus and rail services. In some cases, the mobility option will be to substitute technology for travel, with expanded use of telecommuting, distance learning, and similar systems. The emphasis of our transportation agencies may shift from building and operating infrastructure to catalyzing and managing a range of services.

New or expanded choices will be most effective where they support market demand or regional and community visions, and where there is information available to customers to make decisions. A key to success will be increasing connectivity and integration across modes and systems to support complete end-to-end trips. A second key to success will be coordination between transportation and land use decisions to support expanded transportation choices.

What Do We Want To Achieve?

Objectives

- ***Increase the use of new mobility options and technologies such as shared, automated, and connected vehicles***
- ***Increase the share of person trips using public transportation and other alternatives to single occupancy motor vehicles***
- ***Increase the number of quality options for visitor travel to, from, and within Florida***
- ***Increase the number of quality options for moving freight to, from, and within Florida***
- ***Increase the efficiency and convenience of connecting between multiple modes of transportation***

Indicators to Watch

Growth in

Public Transportation Ridership

Quality Modal Options

SunRail is a passenger rail system serving Central Florida. Once fully developed, SunRail will include 17 stations on a 61-mile corridor. SunRail trains feature quality amenities such as free Wi-Fi, power outlets with each seat, and luggage and bicycle storage. Many SunRail stations are located on regularly running bus routes and the downtown LYNX LYMMO bus rapid transit system, and provide customers with easy access to sidewalks, bike lanes, and recreational trails. Most stations are connected to park-and-ride facilities and Amtrak can be accessed from the Sanford, Winter Park, and Orlando Health SunRail stations. Future phases of the SunRail project will include double tracking, grade crossing improvements, the construction of additional stations to the north and south, and a connection to Orlando International Airport at an intermodal terminal where passengers can access air, intercity and commuter rail, local bus, and rental car options. SunRail is the state's most recent commuter rail system. Tri-Rail has been in operation in Southeast Florida for more than two decades, with expansion plans underway. Tampa Bay and Northeast Florida also are planning regional transit systems.

Goal: More Transportation Choices for People and Freight

How Will We Get There?

What's New?

More high-quality transportation choices that allow people to efficiently access their desired local and long-distance destinations

Seamless connectivity of infrastructure and information across different modes of transportation

More common use of technology as an alternative to transportation through teleconferencing and telemedicine

Emphasis Areas

- Increase the number of **high-quality options for walking and bicycling,** including buffered bike lanes, mixed use paths and off-road trails, and sidewalks and Americans with Disabilities Act (ADA)-compliant waiting areas for transit riders.
- Plan and develop transit, bicycle paths, and trails to deliver people within **walking distance of trip destinations.**
- Provide additional options for **shorter distance trips,** such as circulators and on-demand transit, that reflect regional and community visions.
- Improve the **efficiency and convenience of connections** among local transit systems, between local and regional transit systems, and between transit and other modes.
- Improve **public transportation services** within rural areas and between rural and urban areas.
- Expand **interregional travel options** for residents, visitors, and freight, including improved intrastate air, rail, transit, and water transportation services.

Innovation

- Improve **connectivity of data, technology, and business processes** between transportation modes and systems.
- Support research, development, and testing of **automated and connected vehicles** and other emerging technologies.
- Accommodate **telework, telepresence,** distance learning, distance medicine, and similar approaches for using communications technologies to substitute for travel.

Collaboration

- Provide publicly available transportation system, incident, construction schedule, and other data to support new **private sector business models,** such as bicycle and vehicle sharing, automated and connected vehicles, transportation apps, and ride services.
- Expand **public-private partnerships** for multimodal terminals and corridors and other modal and system linkages.
- Provide state support for capital investments in public transportation systems that are consistent with regional and community visions, and demonstrate a **regional and local commitment** to ongoing operations and maintenance funding as well as supporting land use changes.

Customers

- Provide quality transportation options, including the coordinated statewide human services transportation system, to meet mobility expectations from a **more diverse population** of residents and visitors, including people who are aging in place, have limited mobility, are unable to drive or own a car, or choose not to own a car.
- Improve **public awareness** of the choices available to residents and visitors for both short and longer-distance trips.

Data and Processes

- Develop additional **performance measures** for all modes of transportation, including modal connectivity.
- Anticipate and prepare for changes in technology, and **societal shifts** in transportation preferences and needs, and provide quality facilities and services to support them.

Why Does It Matter?

Highlights

Growing global trade and visitor activity require efficient transportation connections

Economic development strategies are emphasizing innovation industries relying on speed-to-market transportation

Transportation workforce will require more specialized skills

From the Flagler and Plant railroad lines to the Interstate Highway System, from the first seaports to Cape Canaveral Spaceport, transportation investment has been a foundation of Florida's economic growth. As the economy changes, several trends are reinforcing the importance of transportation to Florida's economic competitiveness:

- Florida is expected to add between 4 million and 8 million more residents by 2040, creating more demand for consumer goods and services.
- Florida hosted 99 million out-of-state visitors in 2014 – a total projected to increase to as high as 157 million by 2025. About one-half of Florida's visitors arrive via highway and other surface modes and about one-half arrive via air, using Florida's road and transit systems to reach destinations across the state.
- Freight tonnage moving to, from, and within Florida is expected to experience a 69 percent increase by 2040, due in part to the increasing role Florida's airports and seaports have in global trade.
- Florida's statewide economic development strategy focuses on clusters of innovation-oriented industries such as life sciences, aerospace, and information technology – all of which rely on access to a skilled workforce and speed-to-market delivery of goods.

Connectivity is the glue that makes Florida competitive in these growing industries, as well as traditional activities such as agriculture and the military. Connectivity is important at multiple scales to connect people to jobs; visitors to attractions; and businesses to suppliers, customers, and partners in interrelated industry clusters. Over time, Florida's economy is becoming more regional in scale, requiring connectivity between businesses, research institutions, and universities in broad economic regions. Providing better connectivity, including more transportation choices for making these connections, can help create an economy with the size and scale to compete globally.

Connectivity to global markets also is critical for Florida's trade and tourism industries. Growth in trade with Latin America, the Caribbean, and Africa, along with the widening of the Panama and Suez Canals, position Florida to be at a crossroads for north-south and east-west trade. Many of the goods consumed by Florida's 20 million residents and 100 million visitors each year enter the United States through seaports in other states. The state's transportation and economic development organizations are working to bring more goods directly to Florida's seaports, and to double the value of Florida-origin exports every five years.

All of these opportunities will require a skilled workforce. Florida currently has more than 540,000 private sector jobs in transportation, trade, and logistics, as well as a large transportation engineering and construction industry. Both state and national projections suggest a need for significant hiring in these sectors to support growth in demand as well as to prepare for retirement and turnover. In addition, the mix of workforce skills is expected to evolve, with greater emphasis on technology, operations, and asset management.

What Do We Want To Achieve?

Objectives

- ***Provide transportation infrastructure and services to support job growth in transportation-dependent industries and clusters***
- ***Increase transportation connectivity between Florida's economic centers and regions***
- ***Increase transportation connectivity between Florida and global and national trading partners and visitor origin markets***
- ***Increase the number of skilled workers in Florida's transportation-related industries***

Indicators to Watch

Value of
Florida Origin Exports
as a percent of Gross Domestic Product

Number of
Out-of-State Visitors

Freight Mobility and Trade Plan

Florida's Freight Mobility and Trade Plan (FMTP) is a comprehensive plan developed by FDOT with private and public sector partners. The FMTP identifies objectives and strategies for improving freight mobility and trade activity in Florida, along with more than 700 identified freight investment needs with a total cost of $32 billion. In support of the FMTP, FDOT has established an Office of Freight, Logistics, and Passenger Operations; appointed a freight coordinator for each district; and established a Trade and Logistics Academy to train FDOT and partner staff on freight-related issues. The FMTP is being closely coordinated with regional freight plans developed by FDOT Districts, metropolitan planning organizations, and other partners across the state.

Goal: Transportation Solutions that Support Florida's Global Economic Competitiveness

How Will We Get There?

What's New?

More direct service at Florida's seaports and airports

Transportation technology companies located in Florida and doing business worldwide

Targeted efforts to develop and retain transportation workforce

Emphasis Areas

- Improve the efficiency of connections between transportation hubs and existing and emerging **employment centers and visitor destinations.**
- Expand the options for connectivity between existing and emerging economic centers within common **economic regions.**
- Continue to plan proactively for **future statewide and interregional transportation corridors,** including coordination with regional visions, economic development and trade development plans, and land use plans.
- Improve terminal infrastructure and expand connectivity to other modes to make Florida's airports and seaports **more attractive for investment,** including opportunities for more direct international and domestic flights, ferry service and coastal shipping, home port and port-of-call cruise activity, and first-call import and last-call export ocean carrier service.
- Provide transportation connectivity to Florida's **military facilities** to support economic development, diversification, and privatization opportunities.

Innovation

- Invest in high-capacity public transportation systems that **connect Florida's urban centers.**
- Build on existing infrastructure assets to position Florida for enhanced public and private investments in the **commercial space industry.**
- Encourage private-sector companies involved in research, development, manufacturing, and service activities for **transportation equipment and technology** to locate and expand in Florida.
- Build transportation **workforce skills** to encourage innovation and support of adoption of new technologies that improve safety and mobility or increase the efficiency and reduce the cost of project delivery.

Collaboration

- Coordinate short-term transportation system maintenance, operations, and capacity decisions with **capital investment and job creation** activities involving Florida's statewide targeted industries.
- Coordinate long-term, strategic transportation investments to support development of statewide and regional **logistics, manufacturing, and innovation clusters,** consistent with the Florida Strategic Plan for Economic Development and regional economic development strategies.
- Formalize **institutional partnerships** and communication protocols between transportation, economic development, tourism development, and talent supply and educational organizations at the statewide, regional, and local levels.

Customers

- Document the transportation needs and requirements of Florida's **targeted industry sectors.**
- Collect and maintain data on **talent supply and demand,** including anticipated retirements of existing workforce, in transportation and related industries.
- Identify and close talent gaps in transportation related fields through targeted **workforce development,** retraining, attraction, and retention strategies.
- Create new or expand existing **centers of talent and innovation** in transportation-related fields.
- Adopt a comprehensive and aggressive outreach plan to attract businesses to Florida by **promoting the investments** the state has made in transportation infrastructure, technology, and workforce.

Data and Processes

- Continue to incorporate **economic development benefits** into transportation decision making processes.
- **Strengthen partnerships** and enable more efficient decision making at the scale of economic regions.
- Encourage transportation agencies and authorities to include **talent supply elements** in their long-range plans.

Why Does It Matter?

Highlights

Transportation solutions should reflect the context, needs, and values of our communities

Regional and community visions highlight the need for multimodal corridors connecting economic centers

Transportation decisions can contribute to improved public health and access to opportunity

Transportation decisions help shape our communities into places where we want to live, learn, work, and play. For the past several decades, our reliance on the motor vehicle has shaped our development patterns, with new growth often occurring on the fringes of existing urban development or along transportation corridors. A significant amount of the land available in urban areas is used for roads and parking, and in many cities, policies and standards focused on improving the flow of traffic have led to wider roads that create concerns about safety for pedestrians and bicyclists and appeal for retail, shopping, and other services.

We have an opportunity to rethink our transportation strategies to build stronger, more vibrant communities. A key principle is that our transportation plans should reflect the context, needs, and values of our communities. Many of Florida's cities and counties participate in long-range visioning processes, including large-scale regional visions developed for Central Florida, Tampa Bay, Northeast Florida, Southeast Florida, and the Heartland in primarily rural south Central Florida. These visioning processes reflect the diversity of each region and point to several common themes, including the importance of conserving regionally significant natural resources and agricultural lands; concentrating future growth in centers; and connecting these centers with multimodal transportation corridors. These visions also highlight the importance of choices – Florida's residents want to be able to choose where to live and are looking for a range of quality places from vibrant city centers to walkable neighborhoods to small towns and rural areas.

Transportation provides our residents with access to work, school, shopping, recreation, health care, arts and culture, and other resources. Transportation costs, combined with housing costs, are a key driver of whether Florida is an affordable place to live. As we continue to confront chronic poverty and unemployment, transportation can play a role creating access to opportunity for all of our residents.

Transportation decisions also can support the health and well-being of our residents. Limited physical activity in many communities is a key contributor to childhood and adult obesity and associated chronic diseases. Creating safer options for walking, bicycling, and other forms of active transportation can help improve public health. So too can providing better access to fresh food, parks, recreation, health care, and other resources.

A stronger link between transportation and land use decisions is a critical underpinning to achieve all of these outcomes. This will require closer coordination between transportation agencies and local governments, particularly at a regional scale.

What Do We Want To Achieve?

Objectives

- ***Plan and develop transportation systems that reflect regional and community values, visions, and needs***
- ***Provide convenient, efficient accessibility to the transportation system for Florida's residents and visitors***
- ***Increase customer satisfaction with Florida's transportation system***
- ***Provide transportation solutions that contribute to improved public health***

Indicators to Watch

Complete Streets

Complete Streets is a context-sensitive design concept that suggests roadways should be planned, designed, and operated consistent with surrounding community characteristics and roadway functions so that multiple modes of transportation and customers, regardless of age or ability, easily, comfortably, and safely can access and use the street. Complete Streets often involve wide sidewalks, bicycle lanes, landscaping, and bicycle and pedestrian amenities. Designing Florida's roadways in this way creates safer and more convenient environments for bicycle, pedestrian, and transit customers and is effective at increasing the use of these modes while accommodating the motor vehicle. Transportation facilities designed using Complete Streets strategies have shown positive economic impacts on the businesses located on or near the facility and improve community livability. Complete Streets designs also can encourage people to use active transportation, which can lead to improved public health.

How Will We Get There?

What's New?

Widespread use of Complete Streets, transit oriented development, and active transportation

Closer alignment of transportation and land use strategies

Greater consideration of community values in planning process

Emphasis Areas

- Plan for and **balance transportation** for the movement of people and freight with compatible land uses.
- Promote safe and comfortable walking, bicycling, and other forms of **active transportation** for all ages to improve public health.
- Incorporate sidewalks, crosswalks, shared use paths, and other accommodations to **improve accessibility** for all residents to jobs, schools, health care, food, parks, and other community resources.

Innovation

- Encourage **community design** and multi-modal transportation investments, including technology applications and multipurpose solutions that promote quality of life.
- Use nonhighway transportation modes and new technologies for moving people and goods to **reduce the need for road expansions** and potential negative impacts on communities.

Collaboration

- Continue to support regional and community **visioning processes,** and use these visions to guide transportation decisions.
- Continue to coordinate with local governments to better align transportation plans with existing and proposed **land use plans.**
- Coordinate with and provide technical assistance to local governments as they **create or retrofit mobility solutions** for their communities.

Customers

- Develop and implement **context-sensitive transportation solutions** that reflect community values, needs, and character, such as comprehensive solutions for corridors.
- Increase opportunities for residents to live in **compact urban settings** through creating an environment that supports transit and active transportation options, including walking and bicycling.
- Provide transportation options for visitors that promote **Florida's unique historic, cultural, and natural resources,** such as "Old Florida" historic roads, scenic highways, regional and interregional trails, and waterways.

Data and Processes

- Collect and monitor information on **community values** and transportation preferences.
- Expand practices for assessing the impacts of transportation decisions on **public health and access to opportunity.**
- Provide technical support to local governments to identify context sensitive solutions, including updates to **design, parking, zoning, access management,** and other policies and codes.

Why Does It Matter?

Highlights

Transportation solutions can contribute to a healthier, more sustainable environment

Florida continues to meet air quality standards, but water supply concerns are growing

Transportation can play a major role in conserving energy

Florida's natural environment is one of the most diverse in the world, and a key source of the state's quality of life and worldwide attraction to visitors. Florida's natural resources include 10.4 million acres of public and private conservation lands – almost 25 percent of the state's total land area; 2,400 species of mammals, birds, and fish; more than 4,200 native plants; 11,000 miles of rivers, streams, and waterways; and 1,350 miles of coastline – the most of any state.

Transportation decisions can impact the natural environment – either directly, by severing wildlife corridors and other natural systems or by increasing emissions or air quality pollutants – or indirectly, by facilitating growth and development in or near environmentally sensitive areas. Our transportation plans often focus on how we can avoid, minimize, or mitigate these impacts.

Moving forward, our goal is to align plans and coordinate decision making so transportation contributes to a healthier, more sustainable environment. This involves large-scale approaches to planning and mitigation, and earlier involvement of resource agencies and environmental stakeholders in the transportation planning process to help identify opportunities to advance mutual goals. At a project level, this could mean adapting corridor design practices to create wildlife crossings and bridge sensitive areas so natural systems continue to have needed connectivity; coordinating transportation and utility investments with land use decisions to reduce the overall footprint of infrastructure and development in the state; or taking steps to restore the function and character of the natural environment as part of reconstruction projects.

Florida has a long-standing commitment to maintaining air quality levels in compliance with National Ambient Air Quality Standards. Florida's air quality has continued to improve over the past decade even with growth in population and economic activity. Maximum concentrations, measured by the statewide air monitoring network, of carbon monoxide, nitrogen dioxide, ozone, and fine particles all declined from 2002 to 2013, while emissions of carbon dioxide, a greenhouse gas, were flat overall during this period. Impacts on water quality and availability are anticipated to become a more significant transportation planning issue in the years ahead.

Transportation also is a major consumer of energy in Florida. Between 2005 and 2013, Florida's transportation fuel consumption decreased by 7 percent. Consumption is expected to continue to decline as vehicles become more fuel efficient and customers choose to walk, bike, or take transit more often. A more diverse mix of fuels and energy sources can help improve air quality, reduce greenhouse gas emissions, and prepare for changing global and domestic markets.

What Do We Want To Achieve?

Objectives

Plan and develop transportation systems and facilities in a manner that protects, and where feasible, restores the function and character of the natural environment and avoids or minimizes adverse environmental impacts

Decrease transportation-related air quality pollutants and greenhouse gas emissions

Increase the energy efficiency of transportation

Increase the diversity of transportation-related energy sources, with emphasis on cleaner and more efficient fuels

Indicators to Watch

Emissions of
Air Quality Pollutants
and
Greenhouse Gases

Diverse Transportation Energy Sources

Florida's transportation partners are actively participating in efforts to expand the diversity of the state's transportation related energy sources. An early emphasis is on compressed natural gas (CNG), liquefied natural gas (LNG), and propane, which are clean burning, domestically produced, and relatively safer and lower priced alternatives. Florida offers a rebate program to businesses and agencies using CNG, LNG, or propane fueled vehicles in their fleets. JAXPORT, one of the nation's top 25 container ports, made a major investment in infrastructure and equipment necessary to support container ships using LNG fuel. These ships are expected to reduce emissions significantly compared to container ships relying on traditional fuel sources.

How Will We Get There?

What's New?

Large-scale planning and mitigation and careful coordination and collaboration to accomplish transportation and environmental goals together

Design of transportation facilities to accommodate wildlife corridors and, where possible, improve ecosystems

Solar highways and other approaches for generating energy from transportation infrastructure

Emphasis Areas

- Continue coordination between transportation planning and **environmental planning,** including wildlife corridors, water quantity and quality, air quality including greenhouse gas emissions, noise, and recreational space.
- **Minimize energy** used to build, maintain, and operate transportation infrastructure.

Innovation

- **Reduce the footprint** of Florida's transportation system by optimizing the use of existing transportation infrastructure, incorporating new technologies, and using permeable, recycled, and other "green" materials.
- Support more **diversity in transportation energy sources,** including greater use of renewable or low-emission sources, through research, collaboration, enhanced infrastructure, public-private partnerships, education, and incentives.
- Collaborate between the public and private sectors to **generate energy from transportation facilities,** infrastructure, and right of way, such as pavement charging systems, solar highways, solar rooftops, and solar panels in medians or on noise abatement walls and paths.

Collaboration

- Better align large-scale transportation and conservation planning to maintain, and where possible, **restore and enhance** the integrity and connectivity of regionally significant lands and waters and to avoid, to the extent feasible, negative impacts on these lands and waters.

Customers

- Maximize the availability and the use of **public transportation, active transportation, alternatives to highway freight movement,** and other innovative mobility options that can contribute to a reduction in energy consumption and greenhouse gas emissions.

Data and Processes

- Work with partners to identify and develop **additional performance measures and analysis tools** to better understand transportation's impact on the environment and energy.
- Encourage advanced, **large-scale approaches to environmental mitigation** that accomplish transportation and environmental stewardship goals together, such as coordination on land purchases and easements and water storage, treatment, and drainage.

Transition to Implementation

Guiding Principles

In many ways, the implementation of the FTP has already begun. The Policy Element highlights existing initiatives that support the goals and objectives of this plan – from bicycle and pedestrian safety programs to automated vehicle research to future corridor planning. These key activities will continue, while additional implementation activities begin.

Five cross-cutting issues related to innovation, collaboration, customer service, data and performance measures, and strategic investments could determine our success in implementation. The FTP Policy Element provides principles to guide implementation in each of those areas.

How do we embrace innovation in all aspects of transportation?

Transportation, like many other industries, is at the cusp of a revolution in which technology and innovation may reshape every business practice. Innovation is an underlying theme for addressing all seven goal areas. Because the pace of change is accelerating, Florida's transportation partners must take steps to:

- Position Florida as a **global leader** in innovation in all aspects of transportation.
- **Invest in research, development, and evaluation** of new technologies and practices.
- Support public and private efforts to create an **entrepreneurial environment** that attracts and retains talent and capital in the state.
- Encourage **private-sector leadership** in developing and deploying new technologies; provide **public-sector support** through strategies such as providing access to public infrastructure or data for testing and deployment purposes or providing incentives for adoption of new technologies.
- Become more nimble in **adapting public-sector plans, regulations, and standards** to incorporate new technologies and innovation.

How do we collaborate across sectors, jurisdictions, modes, and disciplines?

Transportation decisions in Florida are made by an array of partners, including FDOT, 27 metropolitan planning organizations, 10 regional planning councils, 67 counties, 411 cities, 53 transit operators, 15 public seaports, 129 public airports, 2 spaceports, many other authorities and special districts, and private sector entities. FTP implementation will require creating and sustaining an agile and efficient institutional infrastructure:

- Continue to **improve collaboration** across jurisdictions, agencies, levels of geography, modes, and sectors.
- Continue to **strengthen coordination** between transportation and land use, economic development, and environmental stewardship decisions.
- Strengthen planning and coordination at the scale of **economic regions,** so our transportation decisions reflect market trends and economic development opportunities.
- Formalize **institutional partnerships** among agencies and jurisdictions through agreements, regular meetings, and similar strategies to ensure collaboration sustains beyond electoral or business cycles.

How do we better serve our customers?

Transportation providers are shifting from building infrastructure to supporting mobility for people and freight. This shift requires more attention to customer needs and service, including:

- **Involve the public and stakeholders** early and often in the transportation planning process.
- Base transportation planning decisions on the **values and needs** of Florida's residents, visitors, and businesses.
- Increase emphasis on **"soft" infrastructure** such as traveler information, signage, and regulatory processes.
- Continue to measure and improve **customer satisfaction** with Florida's transportation system.

How do we improve research, data, performance measures, and planning processes?

An ongoing emphasis on research, data, and performance measurement will underscore all of the state's future transportation outcomes. This includes efforts to:

- Commit to an ongoing emphasis on research and data collection and analysis, including innovative uses of **new and emerging data sources.**
- Create a long-term strategy for **managing data as a critical resource** for transportation agencies, including data storage, sharing, privacy, and quality issues.
- Expand the use of or create additional **performance measures** to monitor system condition, guide investment decisions, and demonstrate progress in achieving the FTP goals and objectives.
- **Continuously improve** transportation plans and decision-making processes at all levels.

How do we maintain a focus on strategic investments during a time of constrained resources?

Achieving Florida's transportation vision requires long-term, sustainable investment by the public and private sectors. Strong state leadership, a diverse revenue base, and an innovative approach have positioned Florida better than many other states, although future investment needs remain significant. In support of FTP implementation, transportation partners should consider principles, including:

- View transportation as an essential function of government and an **investment in Florida's future.**
- Recognize and prepare for the declining role of the Federal Highway Trust Fund and motor fuel taxes; **position Florida as a leader** in the discussion on this issue.
- Continue to encourage a **diverse mix of transportation revenue sources,** including market-based choices and public-private partnerships.
- Maximize and **leverage available revenue sources** between the public and private sectors, across modes, and across agencies and jurisdictions.
- Support efforts by Florida's government and business leaders to ensure Florida is an **attractive place for private capital.**
- Understand how innovation may change transportation needs and facilitate **new partnerships** and investments.
- Take a **systems approach** to identifying and prioritizing investment needs; recognize the role of all modes and importance of connectivity.
- Focus resources on **strategic investment needs** consistent with the FTP goals and objectives, including the use of tools such as return on investment.

Transition to Implementation

Roles and Responsibilities

The FTP will be implemented through specific actions by government, private, and civic partners at the state, regional, and local levels. The FTP Policy Element serves as Florida's long-range transportation plan under both state and federal law; it is a framework to guide FDOT's investment decisions. For other partners, the FTP provides guidance that can be incorporated into policies, plans, and programs.

Roles and responsibilities of partners during FTP implementation will vary by level of geography, corresponding to the major types of trips flowing through Florida's transportation system.

State

FDOT will play the lead role implementing the FTP at the statewide level, working with other state agencies, commissions, and partners. As a key emphasis of FTP implementation, FDOT will complete the update the Strategic Intermodal System (SIS) Policy Plan in early 2016 for consistency with the FTP. The SIS includes the transportation hubs, corridors, and connectors that are most important to Florida's economic competitiveness because they connect Florida's regions or they connect Florida to other states and nations. The SIS serves as the state's highest priority for statewide mobility.

FDOT also will update and implement the Freight Mobility and Trade Plan and the statewide modal plans covering aviation, motor carriers, rail, and seaports and waterways to align with the FTP and SIS Policy Plan. In addition, FDOT will continue to advance key initiatives such as the Future Corridor Planning Process to plan for the future of the state's major transportation corridors.

Regional

Regional agencies including metropolitan planning organizations, regional planning councils, and groups of counties and cities will play the lead role in implementing the FTP at the regional scale. Regional collaboration will be critical to maintain and update long-range regional visions; align transportation, economic development, workforce development, and environmental stewardship decisions; and identify needed improvements to regionally significant transportation facilities that connect population and economic centers within common regions.

Reflecting the importance of these regional needs, the FTP calls for strengthened planning and partnerships at the scale of economic regions. It also calls for targeted investments in regional projects prioritized through these partnerships, such as the Transportation Regional Incentive Program (TRIP).

Local

Local governments will play the lead role in implementing the FTP within individual communities. The strong local role reflects the importance of making transportation decisions that reflect the context, values, and needs of each community. Local action will help align design, engineering, operational, land use, and other decisions to improve safety, accessibility, and reliability and create transportation solutions that build stronger communities.

Call to Action

The transportation decisions we make today will shape the future of our economy, communities, and environment over the next few decades. Working together, we have the opportunity to provide a safer and more secure system; increase the efficiency and reliability of travel for both people and freight; and expand transportation choices to meet the needs of our residents, visitors, and businesses.

To initiate FTP implementation, all transportation partners should commit to:

- Align other statewide, regional, and local transportation and related plans to reflect the FTP goals and objectives;
- Establish short-range objectives and actions for addressing the FTP goals and objectives during the next 5 to 10 years;
- Refine and, where needed, update existing planning processes and guidelines for consistency with the FTP goals and objectives; and
- Document and report progress on specific commitments made by each partner toward FTP implementation, including use of performance measures building on state and federal law.

FDOT will continue to work with partners to develop the FTP Implementation Element and to adjust strategies as needed to reflect changing trends and events. The FTP Steering Committee periodically will convene to review progress in implementing the FTP and address emerging or outstanding issues.

For more information or to provide comment on the FTP, please visit:

FloridaTransportationPlan.com

Glossary

Accessibility – Ability to reach desired destinations, activities, goods, and services.

Active Transportation – Any self propelled, human-powered mode of transportation, such as walking or bicycling.

Agile – The ability to move or adapt quickly and easily.

Asset Management – A process used for managing transportation infrastructure with the objective of improved decision making for resource allocation.

Autonomous Vehicle Technology – Technology installed on a motor vehicle that has the capability to drive the vehicle on which the technology is installed without the active control or monitoring by a human operator.

Bottleneck – A segment of a transportation facility that experiences significant operational deficiencies such as oversaturated congestion, when compared to the rest of the facility.

Capacity – The maximum number of vehicles that reasonably can be expected to traverse a point or a uniform section of a facility during a given period under prevailing conditions.

Community Livability – Those elements that contribute to welfare, health, convenience, mobility, and recreation and are valued by a specific community.

Complete Streets – Streets that are planned, designed, and operated consistent with surrounding community characteristics and roadway functions so that multiple modes of transportation and customers, regardless of age or ability, easily, comfortably, and safely can access and use the street.

Congestion – A condition in which traffic demand is sufficient to cause the level of service to be or at or below adopted standards.

Context Sensitive Solutions – A collaborative, interdisciplinary approach that involves all stakeholders to develop a transportation facility that fits its physical setting and preserves scenic, aesthetic, historic, and environmental resources, while maintaining safety and mobility. This approach considers the total context within which a transportation improvement project will exist.

Corridor – Any land area designated by the state, a county, or a municipality which is between two geographic points and is used or is suitable for the movement of people and goods by one or more modes of transportation.

Delay – Additional travel time beyond some norm experienced by a traveler; any additional travel time experienced by a traveler.

Economic Competitiveness – A state or region's ability to compete in global markets, as evidenced in the attraction of new businesses and the expansion of existing businesses.

Economic Development – Sustained increase in the economic standard of living of the population of a country (or any other defined geographic region), normally accomplished by increasing its stocks of physical and human capital and improving its technology.

Economic Regions – Regions that are defined by commuting patterns, supply chains, and other business-to-business relationships rather than by political boundaries or natural systems.

Emergency Preparedness, Management, and Response – Actions taken to prepare for, respond to, and recover from an incident threatening life, property, operations, or the environment (natural and man-made hazards).

Environmental Stewardship – A philosophical concept of government, the public, resource users and businesses all taking responsibility and working together to conserve natural resources.

Express Lanes – A type of managed lane with few access points using dynamic pricing through electronic tolling based on changing traffic conditions. Express lanes can be located on non-tolled facilities to manage congestion and provide more reliable trip times.

Goal – A long-term (20-50 years) desired result toward which programs and activities are ultimately directed.

Hub – Ports and terminals that move goods or people between Florida regions or between Florida and other origin/destination markets in the U.S. and the rest of the world.

Impacts – The effects of a transportation project, including direct (primary) effects, indirect (secondary) effects, and cumulative effects.

Incident – An event that causes a temporary, significant disruption in transportation services.

Intelligent Transportation Systems (ITS) – A wide range of advanced technologies and ideas, which, in combination, can improve mobility and transportation productivity, enhance safety, maximize the use of existing transportation facilities, conserve energy resources, and reduce adverse environmental effects.

Intermodal – Relating to the connection between any two or more modes of transportation.

Interregional – Relating to the connection between any two or more regions.

Intraregional – Relating to the connections that have both ends within a single region.

Load Matching – A tool used to increase efficiency in the supply chain by matching available freight loads with available freight vehicles scheduled to arrive in the same destination.

Maintenance – Activities undertaken to keep the state's transportation infrastructure and equipment operating as intended, to eliminate deficiencies, and to extend or achieve the expected life of facilities before reconstruction is needed.

Managed Lane – Highway facilities or a set of lanes where operational strategies are proactively implemented and managed in response to changing conditions.

Metropolitan Planning Organization and Transportation Planning Organization (MPO and TPO) – An organization made up of local elected and appointed officials responsible for developing, in cooperation with the state, transportation plans and programs in metropolitan areas containing 50,000 or more residents. MPOs are responsible for the development of transportation facilities that will function as an intermodal transportation system and the coordination of transportation planning and funding decisions.

Mobility – The movement of people and goods.

Mode – Any one of the following means of moving people or goods: aviation, bicycle, highway, paratransit, pedestrian, pipeline, rail (commuter, intercity passenger and freight), transit, space, and water.

Multimodal – More than one travel mode potentially including auto, bicycle, bus, pedestrian, aviation, rail, seaports, and transit.

Natural Environment – The surroundings not made by humans within which the transportation system operates. This includes both physical and ecological aspects, including traditional cultural resources.

Non-Highway Modes – Modes of transportation that do not utilize highway right-of-way. Examples include fixed guideway transit, air, rail, and water modes.

Objective – A long-term (20-50 years) general outcome that is achievable, measurable, and marks progress toward a goal.

Partners – Those parties with interests in transportation facilities and services including the public, local governments, metropolitan planning organizations, public and private sector users and providers, Native American Nations, the Florida Department of Transportation, and other federal and state agencies.

Performance Measurement – Includes the process of collecting analyzing, and reporting information regarding the performance of an aspect of the transportation system.

Public-Private Partnerships – A contractual agreement formed between a public agency and a private sector entity that allows for greater private sector participation in the delivery and financing of transportation projects.

Public Transportation – The transporting of people by conveyances, or systems of conveyances, available for use by the public. In Florida public transportation modes include transit, rail, water, and aviation.

Quality of Life – All of the characteristics of an area's living conditions, including such things as housing, education, transportation infrastructure, leisure time offerings, climate, employment opportunities, medical and health care infrastructure, and environmental resources.

Quick Fix Improvements – Low-cost solutions that can be applied on a short timeframe that have a significant positive impact on the transportation system.

Region – An area of distinctive communities, cities, and counties where residents share: a geographic identity and are socially, economically, and culturally interdependent; a capacity for planning and function; and a capacity to create competitive advantage.

Reliability – The percent of trips that meet a predetermined performance standard for time or speed.

Resilience – The ability for the transportation system to absorb the consequences of disruptions, to reduce the impacts of disruptions and maintain mobility.

Stakeholders – Individuals and groups with an interest in the outcomes of policy decisions and actions.

State Highway System (SHS) – A network of approximately 12,000 miles of highways owned and maintained by the State of Florida or state-created authorities. Major elements include Interstate highways, Florida's Turnpike and other toll facilities operated by transportation authorities and arterial highways.

Strategic Intermodal System (SIS) – Florida's transportation system composed of facilities and services of statewide and interregional significance, including appropriate components of all modes.

Sustainability – Meeting the needs of the present without compromising the ability to meet the needs of the future.

Target Industry – An industry or group of industries identified as a priority for economic development and job creation activities. Enterprise Florida has identified nine statewide targeted industries.

Vehicle Miles Traveled (VMT) – The total number of miles traveled by vehicles using a roadway system.

Vulnerable Road Users – Bicyclists, pedestrians, and motorcycles.

Work Program – The five-year listing of all transportation projects planned for each fiscal year by the Florida Department of Transportation, as adjusted for the legislatively approved budget for the first year of the program.

FDOT would like to thank all those who participated in the FTP/SIS update process. Without partner and public input, this update would not be possible. Input received from Florida's Transportation Visioning Summit, Florida's Transportation Visioning Regional Forums, FTP/SIS Regional Workshops, the FTP/SIS Open House, partner presentations and working sessions, and the FTP/SIS Advisory Groups was crucial in developing the FTP Policy Element. Specifically, the FTP/SIS Steering Committee provides a leadership role to the FTP process as a whole and represents a wide variety of stakeholders.

FTP/SIS Steering Committee Members

Florida Department of Transportation, Richard Biter (Chair)

Metropolitan Planning Organization (MPO) Advisory Council, The Honorable Susan Haynie (Vice Chair)

AARP – Florida, Laura Cantwell

CareerSource Florida, Andra Cornelius

Enterprise Florida, Cori Henderson

Federal Highway Administration, James Christian

Florida Airports Council, Michael Stewart

Florida Association of Counties, The Honorable Doug Smith

Florida Chamber of Commerce, Alice Ancona

Florida Commission for the Transportation Disadvantaged, Steven Holmes

Florida Council of 100, Susan Pareigis

Florida Defense Alliance, Rocky McPherson

Florida Department of Economic Opportunity, Karl Blischke

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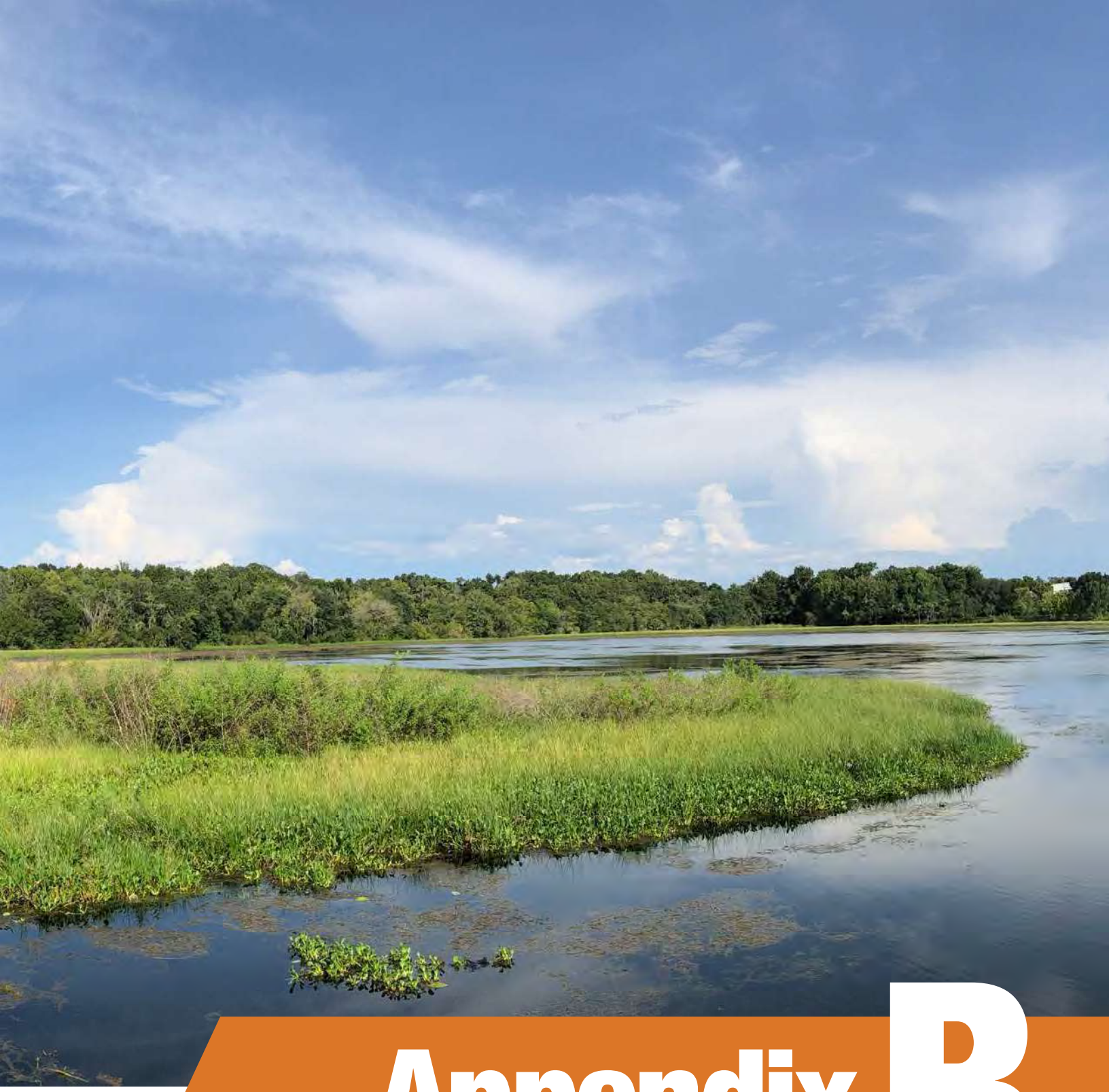
FTP Florida Transportation Plan

SIS Strategic Intermodal System



Appendix B

FDOT TRANSIT ASSET MANAGEMENT PLAN

Florida Department of Transportation

Transportation Asset Management Plan

June 28, 2019

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FDOT

Florida Department of Transportation

RON DESANTIS
GOVERNOR

605 Suwannee Street
Tallahassee, FL 32399-0450

KEVIN J. THIBAULT, P.E.
SECRETARY

June 28, 2019

The Honorable Elaine L. Chao
Secretary
U.S. Department of Transportation
1200 New Jersey Ave, SE
Washington, DC 20590

Dear Secretary Chao,

I approve this Transportation Asset Management Plan (TAMP), which outlines our processes used to improve or preserve the condition and performance of the National Highway System (NHS) pavement and bridge assets. The plan demonstrates the linkages between maintenance and planning and programming efforts, includes financial planning and investment strategies to support progress toward achievement of the State targets for asset condition and performance, and identifies potential risks that our agency faces related to pavement and bridge condition and how we mitigate those risks. The plan also discusses life-cycle planning for our pavement and bridge assets.

Florida has a well-established history of maintaining and preserving our highways and bridges in a state of good repair. Florida consistently ranks at or near the top in state rankings for infrastructure condition. In 2018, ninety-one percent of the pavements on the State Highway System (SHS), which contains the majority of the NHS, were in Good or Excellent condition. Less than one percent of the State's total bridges had posted weight restrictions.

The Department remains committed to providing a transportation system that meets customer expectations for safe and reliable travel and to support the state's quality of life and economic competitiveness. Our emphasis on preservation and maintenance is a major part of that commitment. The statutory guidance to maintain pavement and bridge condition, along with the use of analytical tools and formal policies, allows the state to support investment decisions and continue to meet targets for performance and infrastructure condition.

Sincerely,

Kevin J. Thibault, P.E.
Secretary

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Consistency Determination Checklist

Required Elements	Indicators the TAMP Meets Element Requirements in 23 U.S.C. 119(e) and 23 CFR Part 515	Requirement Met (Yes/No)	Location: Chapter/Page number
TAMP approved by head of State DOT (23 CFR 515.9(k)	Does the TAMP bear the signature of the head of the State DOT?	Yes	After cover page.
State DOT has developed its TAMP using certified processes (23 CFR 515.13(b))	Do the process descriptions align with the FHWA-certified processes for the State DOT? [If the process descriptions do not align with the FHWA-certified processes, the State DOT must request recertification of the new processes as amendments unless the changes are minor technical corrections or revisions with no foreseeable material impact on the accuracy and validity of the processes, analyses, or investment strategies. State DOTs must request recertification of TAMP development processes at least 30 days prior to the deadline for the next FHWA TAMP consistency determination as provided in 23 CFR 515.13(c).]	Yes	Chapter 5: Financial Plan and Investment Strategies Pg. 5-4 Chapter 6: Performance Gap Analysis Pg. 6-1 Data from other NHS Owners Pg. 6-3 Chapter 7: Risk Management Pg. 7-1 Chapter 8: Life-Cycle Planning Pg. 8-1
	Do the TAMP analyses appear to have been prepared using the certified processes?	Yes	See above.
TAMP includes the required content as described in 23 CFR 515.9(a)-(g) (23 CFR 515.13(b))	Does the TAMP include a summary listing of NHS pavement and bridge assets, regardless of ownership?	Yes	Chapter 4 Pg. 4-1, 4-6
	Does the TAMP include a discussion of State DOT asset management objectives that meets requirements?	Yes	Chapter 2 Pg. 2-1
	Does the TAMP include a discussion of State DOT measures and targets for asset condition, including those established pursuant to 23 U.S.C. 150, for NHS pavements and bridges, that meets requirements?	Yes	Chapter 3 Pg. 3-1 thru 3-5

Required Elements	Indicators the TAMP Meets Element Requirements in 23 U.S.C. 119(e) and 23 CFR Part 515	Requirement Met (Yes/No)	Location: Chapter/Page number
TAMP includes the required content as described in 23 CFR 515.9(a)-(g) (23 CFR 515.13(b)) (continued)	Does the TAMP include a summary description of the condition of NHS pavements and bridges, regardless of ownership, that meets requirements?	Yes	Chapter 4 Pg. 4-4, 4-8
	Does the TAMP identify and discuss performance gaps?	Yes	Chapter 6 Pg. 6-1 to 6-3
	Does the TAMP include a discussion of the life-cycle planning that meets requirements, including results?	Yes	Chapter 8 Pg. 8-5, 8-11 Chapter 5 Pg. 5-5
	Does the TAMP include a discussion of the risk management analysis that meets requirements?	Yes	Chapter 7 Pg. 7-8 thru 7-19
	Does the TAMP include the results of the evaluations of NHS pavements and bridges pursuant to 23 CFR part 667?	Yes	Chapter 7 Pg. 7-20 to 7-21
	Does the TAMP include a discussion of a 10-year Financial Plan to fund improvements to NHS pavements and bridges?	Yes	Chapter 5 Pg. 5-5
	Does the TAMP identify and discuss investment strategies the State intends to use for their NHS pavements and bridges?	Yes	Chapter 5 Pg. 5-10 to 5-13
	Does the TAMP include a discussion as to how the investment strategies make or support progress toward achieving and sustaining a desired state of good repair over the life cycle of the assets?	Yes	Chapter 5 Pg. 5-10 to 5-13
	Does the TAMP include a discussion as to how the investment strategies make or support progress toward improving or preserving the condition of the assets and the performance of the NHS related to physical assets?	Yes	Chapter 5 Pg. 5-10 to 5-13

Required Elements	Indicators the TAMP Meets Element Requirements in 23 U.S.C. 119(e) and 23 CFR Part 515	Requirement Met (Yes/No)	Location: Chapter/Page number
TAMP includes the required content as described in 23 CFR 515.9(a)-(g) (23 CFR 515.13(b)) (continued)	Does the TAMP include a discussion as to how the investment strategies make or support progress toward achieving the State's targets for asset condition and performance of the NHS in accordance with 23 USC 150(d)?	Yes	Chapter 5 Pg. 5-10 to 5-13
	Does the TAMP include a discussion as to how the investment strategies make or support progress toward achieving the national goals identified in 23 USC 150(b)?	Yes	Chapter 5 Pg. 5-14 thru 5-15
	Does the TAMP include a discussion as to how the TAMP's life-cycle planning, performance gap analysis, and risk analysis support the State DOT's TAMP investment strategies?	Yes	Chapter 5 Pg. 5-13 to 5-14

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Chapter 1 Introduction

The Florida Department of Transportation (Department) has a long history of leadership in the field of transportation asset management. Many national surveys consistently rate Florida as having the nation's best pavements and bridges. This focus, and a legislative mandate to maintain consistently high ratings for pavements and bridges, sets a standard for all the Department's transportation asset management practices.

The Department's asset management practices are mission-driven and are incorporated in the agency's goals, operating policies, plans, and procedures. This business practice allows the Department to bring together a variety of disciplines and stakeholders (internal and external), to achieve a common understanding and commitment to maintain or improve performance. It also demonstrates the Department's commitment to sustainable asset stewardship, effective use of resources, and justifications for funding.

In December 2015, Congress enacted legislation titled Fixing America's Surface Transportation Act or FAST Act. This law requires that each State transportation agency develop a risk-based Transportation Asset Management Plan (TAMP) for all pavements and bridges on the National Highway System (NHS).

The Department's continuous record of high performing pavements and bridges on the State Highway System (SHS), which includes the majority of the NHS (see Figure 1) affirms the strength of the agency's long-standing, existing asset management approach. This TAMP describes those processes and clarifies how they meet the FAST Act.

The Department's iterative, system-wide approach to programming and prioritizing pavement and bridges, addresses risk, prevents gaps, and is built on strong financial planning and investment strategies to ensure the right needs are addressed at the right time.

Therefore, the Department will continue to use its long-standing, existing asset management approach to manage the SHS and establish performance targets for the Federal Highway Administration (FHWA) performance measures for NHS pavements and bridges. The Department will coordinate on performance, to the extent practicable, with other NHS owners. However, local agencies will continue to manage the portions of the NHS that are not on the SHS.

Figure 1: State and National Highway Systems

Source: FDOT, Transportation Data & Analytics Office (As of May 2019)

To help facilitate the understanding of the Department's asset management program and practices, the TAMP has been organized in the following chapters:

Chapter 2- Asset Management Planning and Programming

Chapter 3- Performance Measures and Targets

Chapter 4- Asset Inventory and Conditions

Chapter 5- Financial Plan and Investment Strategies

Chapter 6- Performance Gap Analysis

Chapter 7- Risk Management

Chapter 8- Life-Cycle Planning

Chapter 9- Implementation

Chapter 2 Asset Management Planning and Programming

The Department considers asset management a central tenet of its long-range planning process and has a well-established philosophy, supported by statutes, to preserve its assets before adding capacity to the transportation system. This approach sets the framework for all capacity enhancements and service additions to the transportation network. As such, this philosophy serves as a solid foundation to meet and build upon federally required asset management focused practices.

Currently, there is no central group within the Department that manages all assets, but there are several groups throughout the organization dedicated to managing their respective assets by collecting quality data on asset condition, applying best-practice analytical models for use in predicting condition trends given different budget scenarios, and prioritizing capital projects on state-owned assets as well as those owned by others.

The principal objectives of the Department's TAMP are:

- Ensure the safety and security of transportation customers;
- Minimize damage to infrastructure from vehicles;
- Achieve and maintain a state of good repair for transportation assets; and
- Reduce the vulnerability and increase the resilience of critical infrastructure to the impacts of extreme weather and events.

These objectives are the foundation for performance measures related to asset management.

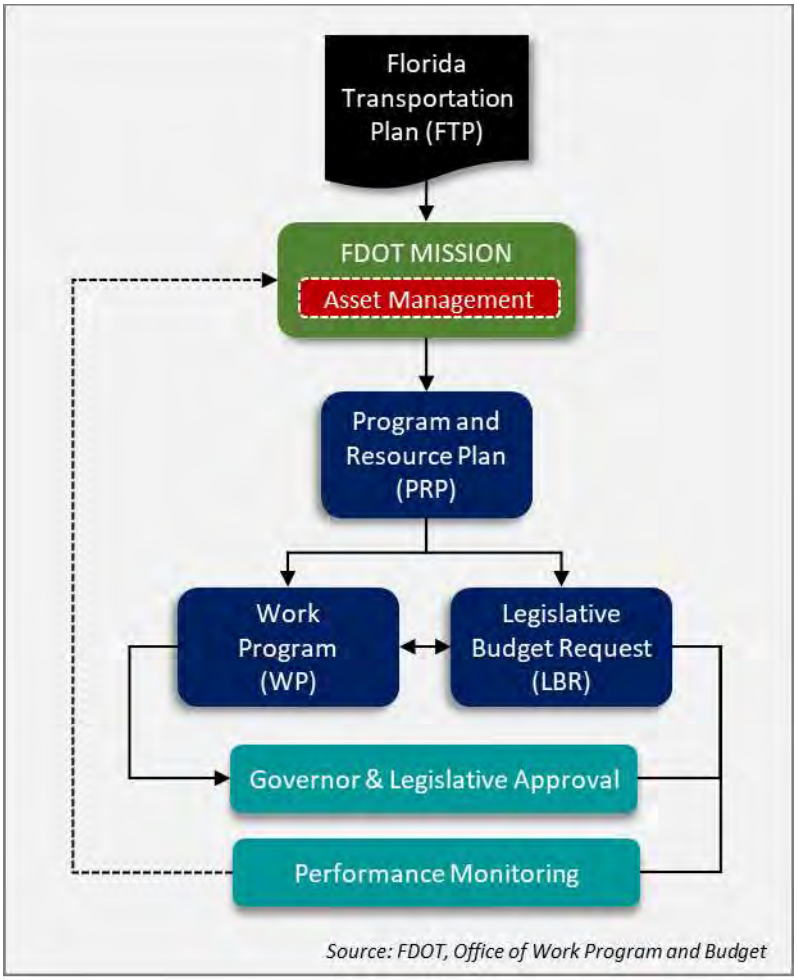
2.1 Relationship to Other Business Plans and Policies

Much of the Department's asset management story is told throughout existing policy statements and plans. These existing policy statements and plans guide the Department in its efforts to most effectively manage its transportation assets. The TAMP describes the interrelationship of these existing policy statements and plans. Figure 2 provides a graphical representation.

The **Florida Transportation Plan (FTP)** is the single overarching statewide plan that guides Florida's transportation future. It is a plan for all of Florida; providing policy direction to the Department and all organizations that are involved in planning, implementing and managing Florida's transportation system, including statewide, regional, and local partners.

The core component of the FTP is the Policy Element, which defines the goals, objectives, and strategies for Florida's transportation future over the next 25 years. It provides guidance to state, regional, and local transportation partners in making transportation decisions. The Policy Element also establishes the framework for expenditure of state and federal transportation funds flowing through the Department's Work Program.

Figure 2: FDOT Asset Management Process



Several of the goals in the Policy Element focus on the performance of Florida's Transportation System. These include:

- **Safety and security for residents, visitors and businesses.** This is one of Florida's longstanding priorities; to ensure the safety and security of transportation customers. This goal also addresses how transportation can support broader needs. For example, response to and recovery from extreme weather events.

- **Agile, resilient and quality infrastructure.** This goal not only addresses pavement and bridges, but the conditions for all modes and emphasizes responsiveness to changing technologies and market trends, resiliency to risks and customer service and other quality measures.

- **Efficient and reliable mobility for people and freight.** This goal shifts from a focus on reducing travel time and delay to making the entire transportation system more efficient and reliable, including all modes as well as supporting regulatory processes.

The goals and objectives of the FTP not only set the stage for performance reporting but also provide statewide policy guidance for accomplishing the Department's mission to protect the State's transportation infrastructure investment.

The **FDOT Mission** is to provide a safe transportation system that ensures the mobility of people and goods, enhances economic prosperity and preserves the quality of our environment and communities. The FDOT Mission is informed by the goals and objectives of the FTP, is supported by statutes and is the beginning of the Department's transportation asset management approach.

The **Program and Resource Plan (PRP)** provides the link between the FTP, the FDOT Mission, and the Department's numerous programs (as reflected in the project specific Work Program) and the Department's Legislative Budget Request (LBR). It contains the specific long-range goals and objectives from the FTP, as well as selected operating policies and performance measures, which guide the development of each program in the Department.

The Department produces a PRP, which consists of a complete 10-year projected budget for all major agency functions and programs. The PRP is a summary document that contains the approved program alternatives and funding levels by fiscal year to accomplish program goals and objectives within expected revenue. The PRP combines the Department's operating budget, fixed capital outlay buildings and grounds budget, debt service budget and Work Program details into a summary document.

The document reports the Department's planned budget in several different ways including by product area, product support, operations and maintenance, administration, etc. It also provides summary information by funding source. The PRP serves as a link between the FTP, a planning document, and the Adopted and Tentative Work Programs, documents listing all Department projects and expected spending out to a five-year horizon. The PRP establishes the programming framework by which the Work Program is developed.

The **Work Program (WP)** is a five-year plan that provides details on when and where specific projects and services will be provided and how these projects and services will be funded using available revenue.

The **Legislative Budget Request (LBR)** is the Department's request to the Governor and Legislature for spending authority to do the work of the agency for the next fiscal year.

Performance Monitoring is conducted using measures to show progress towards the attainment of the Department's goals and objectives.

Chapter 3 Performance Measures and Targets

Florida has a long-established and highly effective approach to preservation and maintenance of its pavement and bridge assets. The current practices for asset management are rooted in the Department's strong adherence to performance targets and an organizational philosophy, supported by legislative mandate, to maintain the existing infrastructure before pursuing capacity projects.

The Department is mandated by statute, s. 334.046, to preserve the state's transportation infrastructure to specific standards. The standards for pavements, bridges and maintenance were derived over time, from the Department's use of output measures and engineering input, to evaluate the performance of the transportation system, long before outcome based measures were required. For the purposes of this TAMP, the Department defines the State of Good Repair (SOGR) to be the Department's performance measures and targets for pavements and bridges on the SHS.

The Department utilizes strong management tools for pavements and bridges, coupled with a thorough reporting and review process to ensure systemwide performance meets target levels.

3.1 Pavement Assets

For the Department's performance measurement reporting for the SHS, the performance measure and target for pavements on the SHS is:

- Ensure at least 80 percent of the pavement on the SHS meets the Department standard.

Pavement meeting Department standards is defined as pavement for which each of the three rating factors (ride quality, crack severity and rutting) are scored 6.5 or above on a ten-point scale. Figure 3 shows the Department's criteria for assessing pavement condition compared to the criteria used by FHWA.

Figure 3: FDOT and FHWA Pavement Condition Rating Criteria

	Non-Deficient	Deficient
Ride Rating	**≥ 6.5 (IRI ≤125 in/mile)**	**< 6.5 (IRI > 125)**
Crack Rating	**≥ 6.5**	**< 6.5**
Rut Rating	**≥ 6.5 (Rut < 3/8 in)**	**< 6.5 (Rut > 3/8 in)**

FDOT

Note: Pavement ratings are averaged along the entire segment which varies in length. The segment is considered Deficient if any one of the three ratings are deficient. Crack rating is a combination of lengths and severities and is not comparable to the FHWA Cracking Percent.

	Good	Fair	Poor
IRI (in/mile)	< 95	95 - 170	> 170
Cracking Percent	< 5	5 - 15 (JPCP) 5 - 20 (Asphalt)	> 15 (JPCP) > 20 (Asphalt)
Rutting (in)	< 0.2	0.2 - 0.4	> 0.4

FHWA

Note: Pavement metrics are measured in 0.1-mile intervals. All three metrics must be rated Good for the 0.1-mile segment to be considered Good. Two of the three metrics must be rated as Poor for the interval to be considered Poor.

For the FHWA performance measurement reporting for pavements on the entire NHS, the Department will ensure:

- Percentage of Interstate pavements in Good condition: ≥ 60.0 percent
- Percentage of Interstate pavements in Poor condition: ≤ 5.0 percent
- Percentage of non-Interstate NHS pavements in Good condition: ≥ 40.0 percent
- Percentage of non-Interstate NHS pavements in Poor condition: ≤ 5.0 percent

Per the FHWA Rule (23 CFR 490.315), the minimum condition for Interstate pavements is that no more than 5 percent should be in Poor condition. There are no minimum condition requirements for the non-Interstate NHS pavements.

The table below shows the FDOT and FHWA performance measures and targets for pavements.

Table 1: Pavement Targets

FDOT Performance Measures	FDOT Target	FHWA Performance Measures	2-Year Target	4-Year Target
% of lane miles on SHS with pavement condition rating of either Excellent or Good.	80%	% of Interstate pavements in Good condition	-	≥ 60.0%
		% of Interstate pavements in Poor condition	-	≤ 5.0%
		% of non-Interstate NHS pavements in Good condition	≥ 40.0%	≥ 40.0%
		% of non-Interstate NHS pavements in Poor condition	≤ 5.0%	≤ 5.0%

Source: FDOT, State Materials Office.

The targets for FHWA pavement condition performance measures were established after review and analysis of the last three years of the Department's Interstate and non-Interstate NHS pavement condition survey data.

In the analyses of the pavement data, the federal regulation utilizes methodologies to measure rut depth and cracking that represent a significant departure from those currently used by the Department. Further, the FHWA pavement metrics are summarized in 0.1-mile intervals. All three metrics (IRI, cracking percent and rutting/faulting) must be rated Good for the 0.1-mile segment to be considered Good. To be rated as Poor, two of the three metrics must be rated Poor.

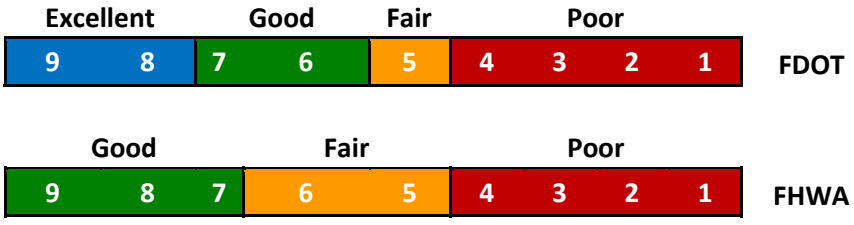
In contrast, the Department performs a visual estimate of the extent of cracking and measures rutting using three points along the roadway width (i.e., both wheel paths and the center of the roadway). In addition, these pavement measurements are averaged along the entire length of the segment which can vary in length. Pavement meeting the Department's standards is defined as pavement for which each of the three rating factors (ride quality, crack severity and rutting) are scored 6.5 or above on a ten-point scale. The segment is considered Deficient if any one of the three ratings are deficient. The Department's crack rating is a combination of lengths and severities as well as raveling and patching and is not comparable to the FHWA cracking percent which is the percentage of the area of the surface section exhibiting visible cracking attributed to fatigue cracking only.

The Department will collect the data to satisfy the federal requirements based on the required approaches and technologies in the regulations. The Department has not previously collected pavement condition data using these new methodologies. Therefore, in consideration of the differences in data collection requirements used by the Department and those mandated by the rule, as well as other unknowns and unfamiliarity associated with the new required processes, conservative 4-year targets for the Interstate and 2 and 4-year targets for the non-Interstate NHS pavement conditions were established. Once the Department has collected a sufficient amount of data using the methodologies and technologies required by the federal regulations, the Department may adjust its targets.

3.2 Bridge Assets

Florida uses the National Bridge Inventory (NBI) rating as its primary performance measure. NBI includes information on approximately 600,000 of the Nation's bridges located on public roads. It presents a state-by-state summary analysis of the number, location, and general condition of highway bridges within each state. The ratings are based upon inspection results on each of the bridge's primary elements: deck, superstructure, and substructure. Figure 4 shows the Department's criteria for assessing bridge condition and the criteria used by FHWA.

Figure 4: FDOT and FHWA National Bridge Inventory (NBI) Rating Criteria



For the Department's performance measurement reporting for bridges on the SHS, the performance measure and target using the Department's scale is:

- 90 percent of SHS bridges in "Excellent" or "Good" condition measured by number of bridges.

For FHWA performance measurement reporting for bridges on the entire NHS, the Department will ensure:

- Percentage of NHS bridges in Good condition measured by deck area: ≥ 50.0 percent
- Percentage of NHS bridges in Poor condition measured by deck area: ≤ 10.0 percent

Per the FHWA Rule (23 CFR 490.411), the minimum condition level for bridges is that only 10 percent or less of the total deck area of NHS bridges be classified as Structurally Deficient; in Poor condition.

The table below shows the FDOT and FHWA performance measures and targets for bridges.

Table 2: Bridge Targets

FDOT Performance Measures	FDOT Target	FHWA Performance Measures	2-Year Target	4-Year Target
% of bridges on SHS with condition rating of either Excellent or Good by number of bridges	90%	% of NHS bridges classified as in Good condition by deck area	≥ 50.0%	≥ 50.0%
		% of NHS bridges classified as in Poor condition by deck area	≤ 10.0%	≤ 10.0%

Source: FDOT, Office of Maintenance.

The targets for FHWA NHS bridge condition performance measures were established after review and analysis of the last five years of the Department's bridge data collected through the annual bridge inventory process.

The federal regulation criteria consider bridges to be in Good condition if the NBI rating is 7, 8, or 9 and to be in Poor condition if the NBI rating is 4 or less. The percentage of bridges in Good and Poor condition will be reported to FHWA as a percentage of deck area for all bridges on the NHS. In contrast, the Department considers bridges to be in Excellent condition if the NBI rating is 9 or 8; Good condition if the NBI rating is 6 or 7; Fair condition if the NBI rating is 5; and Poor condition if the NBI rating is 4 or less. The Department's internal process is to have no more than 10 percent of its bridges in Poor condition. The Department does not program any significant bridge work for bridges with a NBI rating of 5, 6, 7, 8 or 9, but does actively perform routine maintenance and repairs.

An evaluation of historical bridge data over the last few years show the condition of bridges on the NHS are slowly moving from Good condition to Fair condition (NBI 5 or 6 per FHWA definition), which is to be expected as the Department's bridge inventory is slowly growing older. However, the Department programs bridges for repair or replacement work to begin within 6 years of reaching deficient status (NBI 4) or becoming posted.

Recently the Department has formed a Bridge Performance Group consisting of FDOT Personnel and Industry to consider how data at the element level can be used to track bridge condition and the effectiveness of element level repairs over time. The goal is to determine when repairs are needed and which repairs are the most effective to extend the bridge service life. This will be an on-going effort to develop, monitor, and draw conclusions. It is anticipated that as data is collected, deterioration models will be refined, which should lead to long term cost savings and longer lasting bridges over time.

The Department identifies bridge maintenance needs during bridge inspections, and programs bridge maintenance and repair work to address these needs. The Department programs bridges for rehabilitation or replacement to begin within 6-years of being identified as being in Poor condition. The Department plans to continue with these internal processes, meet targets as established herein per FHWA criteria, and use the same targets for the 2 and 4-year cycle. At some point in the future, the Department may adjust its targets if the way the Department currently programs bridge work leads to consistent reporting results per FHWA criteria.

Chapter 4 Asset Inventory and Conditions

The practice of developing an inventory and condition assessment sets the stage for all other phases of asset management. Therefore, to manage transportation assets effectively, two fundamental questions need to be addressed. First, what facilities does the Department own and manage? Second, what condition are those assets in?

4.1 Pavement Assets

4.1.1 Inventory

The table below provides an inventory of the pavement assets by state (on-system) and local (off-system) ownership. The information is presented in centerline and lane miles for the SHS, NHS, Interstate and Non-Interstate NHS. Centerline miles represent the length of the road, while lane miles represent the length and lane count for a road. As previously stated, the SHS includes the majority of the NHS.

Table 3: Inventory Summary of Pavements

	SHS		NHS		Interstate		Non-Interstate NHS	
	Centerline Miles	Lane Miles	Centerline Miles	Lane Miles	Centerline Miles	Lane Miles	Centerline Miles	Lane Miles
On-System	12,103	44,424	8,208	34,474	1,495	8,495	6,713	25,979
Off-System			571	2,454			571	2,454
Total	**12,103**	**44,424**	**8,779**	**36,929**	**1,495**	**8,495**	**7,284**	**28,433**

Note: Due to rounding, totals in table may not agree.
Source: FDOT, Transportation Data & Analytics Office (As of December 2018).

For the off-system NHS, the table below shows the number of centerline and lane miles of pavement located within the Metropolitan Planning Organization (MPO). If the off-system mileage is not located within the MPO, the County is identified.

Table 4: Off-System Non-Interstate NHS Pavements

FDOT District	MPO/County	Non-Interstate NHS	
		Centerline Miles	Lane Miles
1	Charlotte County-Punta Gorda MPO	0.999	4.05
	Collier MPO	13.564	79.42
	Heartland Regional TPO	1.647	3.30
	Lee County MPO	27.144	125.79
	Polk TPO	0.636	1.42
	Sarasota/Manatee County MPO	16.439	77.48

FDOT District	MPO/County	Non-Interstate NHS	
		Centerline Miles	Lane Miles
2	Bradford County	3.766	7.53
	Columbia County	0.969	2.02
	North Florida TPO	11.847	34.02
3	Bay County TPO	2.881	5.86
	Capital Region TPA	2.779	6.73
	Florida-Alabama TPO	0.903	2.65
	Okaloosa-Walton TPO	0.488	0.98
4	Broward MPO	61.218	322.64
	Indian River County MPO	28.614	90.98
	Martin MPO	5.289	15.46
	Palm Beach TPA	73.697	422.43
	St Lucie TPO	36.790	137.69
5	MetroPlan Orlando	84.781	363.93
	Ocala/Marion County TPO	8.220	32.87
	River to Sea TPO	50.143	152.85
	Space Coast TPO	56.137	207.48
6	Miami-Dade TPO	25.993	113.22
7	Forward Pinellas	40.104	200.52
	Hernando/Citrus MPO	4.447	9.12
	Hillsborough MPO	6.531	17.07
	Pasco County MPO	4.689	17.19
	Total	**571**	**2,455**

Note: Due to rounding, totals in table may not agree.
Source: FDOT, Transportation Data & Analytics Office (As of December 2018).

The Department collects inventory and condition data for all roads functionally classified above local regardless of ownership. Internal Quality Assurance (QA) checks are performed daily by the Districts to ensure the integrity of the data. The entry of data into the Department's Roadway Characteristics Inventory (RCI) database is limited to twice a year, in June and December. This also safe guards the quality of the data for reporting purposes.

The Department reports annually on the data to FHWA through the Highway Performance Monitoring System (HPMS). The HPMS is used for assessing and reporting highway system performance under FHWA's strategic planning process. Roads that are part of the NHS also have additional data reporting requirements over the rest of the federal-aid highway system.

Therefore, depending on the update cycle, QA checks or when information is extracted from the Department's database, the data will vary over time.

4.1.2 State Highway System (SHS) Condition Based on FDOT Performance Measures

The Department conducts annual Pavement Condition Surveys (PCS) to monitor and report on the performance and condition of pavements on the SHS per Florida Statutes 334.24, 334.046 and 335.07 as well as the Federal Highway Administration (FHWA)/FDOT Federal Aid Partnership Agreement No. 700-000-005-a.

Ride Quality Rating:
The Department quantifies the pavement Ride Quality or Smoothness using the International Roughness Index (IRI). This index is derived from a pavement surface longitudinal profile as measured using vehicle-based equipment operating at highway speed. IRI is also the rating system required by FHWA in annual highway inventory summaries. It is generated using a standard algorithm (ASTM E1926) and varies from zero, indicating pavement in virtually perfect condition, to infinity. Higher scores indicate worse ride quality. Ranges of IRI are converted to a rating system with a scale from zero to ten (RR_{10}) with ten indicating a pavement in perfect condition.

Rut Rating:
The same vehicle based equipment used for Ride Quality measurements also measures rutting for flexible pavements in 1/8-inch increments of depth. Each rut depth increment deducts one point from a perfect total of 10. The overall rutting score for the road segment is equal to the average of the scores for each wheel path.

Crack and Defect Rating:
Due to the physical differences between flexible and rigid pavements, defect metrics differ. For flexible pavement, the defect is measured considering its type, severity and the extent, in percent, to which the road surface is affected by the defect.

The defect-predominate type is then used to establish a score based on its severity and extent for the areas inside and outside of wheel paths. These scores are added together and subtracted from ten to calculate the Crack Rating (CR). Higher values of CR indicate better condition.

For rigid pavement, the Department defines ten defect metrics: surface deterioration, spalling, patching, transverse cracking, longitudinal cracking, corner cracking, shattered slab, faulting, pumping, and joint quality. These metrics reflect both the natural deterioration of the concrete surface and structural components unique to concrete slabs, such as faulting (vertical displacement of joints) and joint quality. The metrics are weighted according to both standard and segment-specific priorities, and the result is deducted from 100 and divided by 10 to calculate the Crack/Defect Rating on a 10 scale.

<u>2018 Pavement Condition Survey (PCS) Results</u>
Pavement on the SHS is in Good condition. As shown in Figure 5, over 90 percent of the SHS pavements meet Department standards in calendar year (CY) 2018. Over the past ten years, performance has improved dramatically. A combination of factors, including enhanced design approaches, better selection of materials and improved construction practices as well as preventive maintenance efforts are responsible for this increase.

Figure 5: SHS Pavements Meeting FDOT Standards

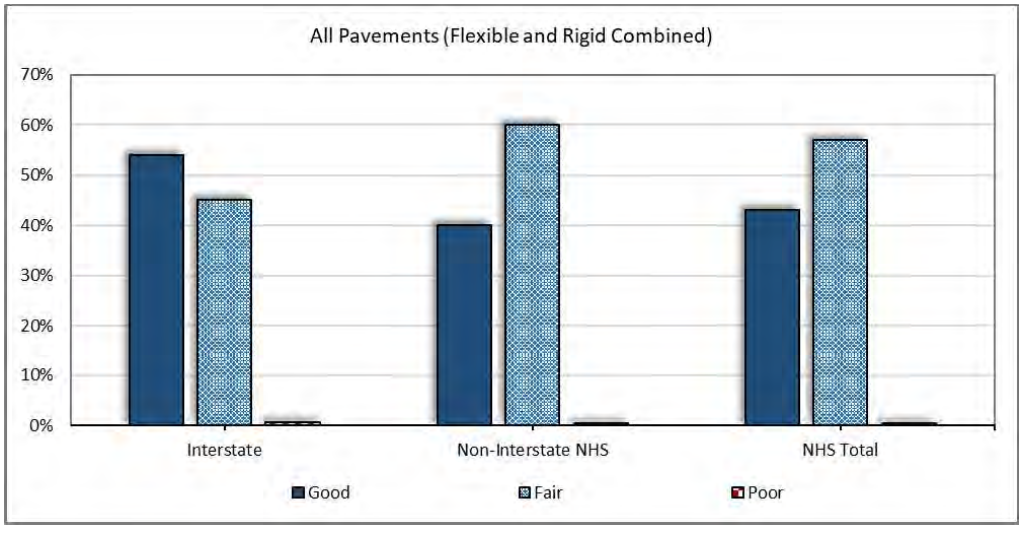
Currently, 91.3 percent of pavements on the SHS exceed FDOT standards.

Source: FDOT, State Materials Office.

4.1.3 National Highway System (NHS) Condition Based on FHWA Performance Measures

Figures 6 through 8 present the condition of the entire NHS pavements based on the FHWA performance measures. Data collected in CY2018, using the approaches and technologies mandated in the regulations, was used to generate the values. Off-system data was collected October through December 2018. Overall, the pavement on the NHS is in Good and Fair condition with relatively few lane miles in Poor condition. *Note: Approximately 5.9 percent of Interstate and 3.2 percent of Non-Interstate NHS lane miles were under construction; therefore, were not included.*

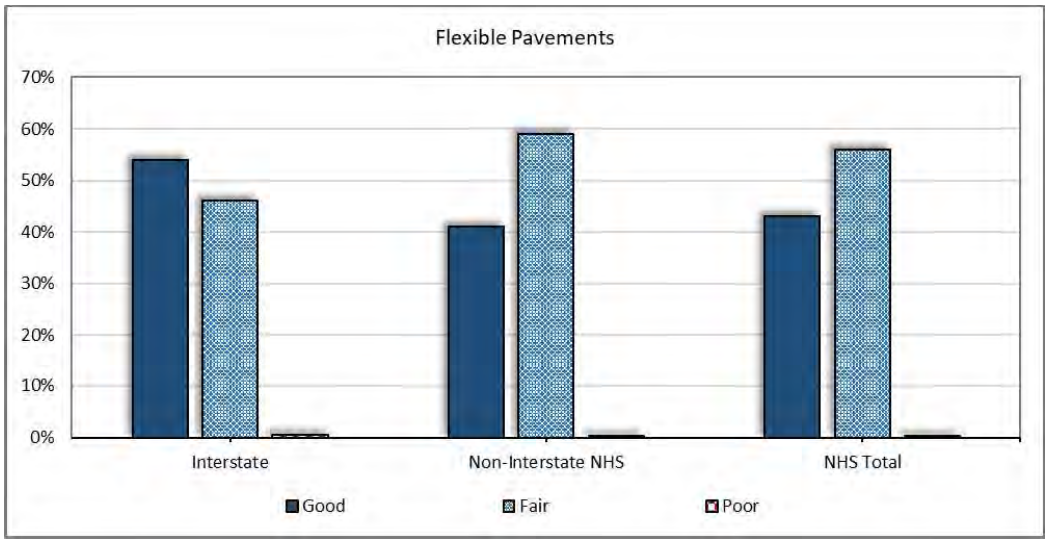
Figure 6: All Pavements (Flexible and Rigid Combined)



0.6 percent of all pavements on the Interstate are in Poor condition.

Source: FDOT, State Materials Office.

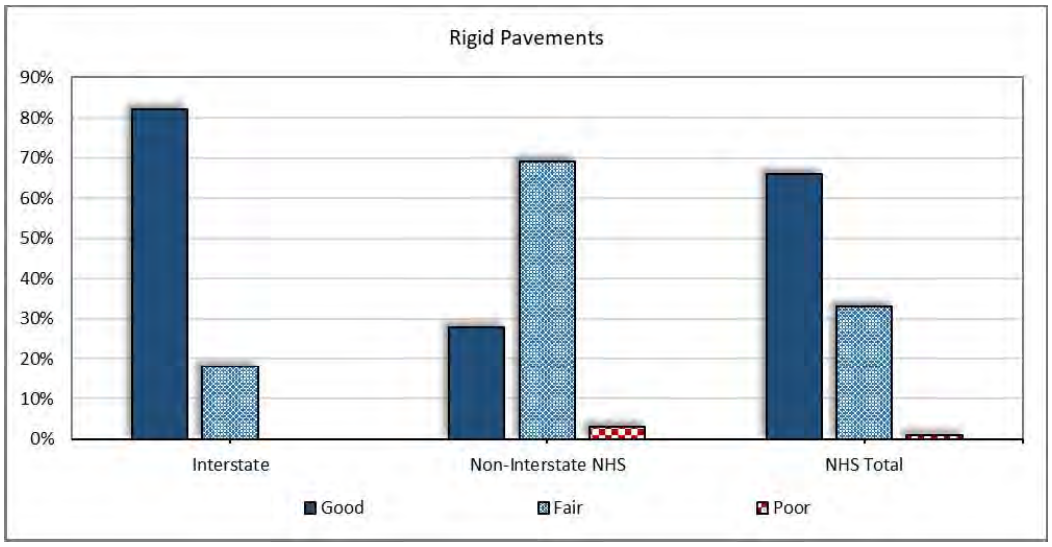
Figure 7: Flexible Pavements



0.6 percent of the flexible pavements on the Interstate are in Poor condition.

Source: FDOT, State Materials Office.

Figure 8: Rigid Pavements



None of the rigid pavements on the Interstate are in Poor condition.

Source: FDOT, State Materials Office.

4.2 Bridge Assets

4.2.1 Inventory

Bridges per federal definition have a clear opening of greater than 20 feet along the direction of the roadway between abutments, spring lines of arches, extreme ends of openings for multiple boxes, or extreme ends of openings for multiple pipes. The table below provides an inventory of the state and local bridges.

Table 5: Inventory Summary of Bridges

	Number of Bridges		Number of Bridges
State Owned Total	7,009	State Owned NHS	5,499
Locally Owned Total	5,531	Locally Owned NHS	159
Florida NBI Total	12,540	**NHS Total**	**5,658**

Source: FDOT, Office of Maintenance (As of May 2019).

For the locally owned NHS bridges, the table below shows the number of structures and corresponding deck area located within the Metropolitan Planning Organization (MPO). If the bridge is not located within the MPO, the County is identified.

Table 6: Off-System NHS Bridges

FDOT District	MPO/County	Number of NHS Bridge Structures	NHS Bridge Deck Area (Sq. Ft.)
1	Lee County MPO	5	617,436.00
	Sarasota/Manatee MPO	5	29,160.89
2	North Florida MPO	2	197,873.20
3	Capital Region TPA	2	3,709.05
	Florida-Alabama TPO	1	534.00
	Okaloosa-Walton TPO	3	29,879.60
4	Broward MPO	13	106,132.66
	Indian River County MPO	10	58,947.81
	Palm Beach County	1	4,779.00
	Palm Beach TPA	25	245,099.25
	St. Lucie TPO	10	105,621.63
5	Flagler County	2	11,268.10
	MetroPlan Orlando	21	211,957.44
	Ocala/Marion County TPO	2	10,344.00
	Orange County	4	49,450.76

FDOT District	MPO/County	Number of NHS Bridge Structures	NHS Bridge Deck Area (Sq. Ft.)
5	Osceola County	8	453,805.07
	River to Sea TPO	3	18,839.31
	Space Coast TPO	4	61,863.18
6	Miami-Dade TPO	7	694,914.05
7	Forward Pinellas	19	1,670,727.77
	Hillsborough MPO	1	35,352.80
	Total	**148**	**4,607,352**

Note: Due to rounding, totals in table may not agree.
Source: FDOT, Office of Maintenance (As of January 2019).

The Department collects inventory and condition data for the locally owned assets through the Department's bridge inspection program. Updates to the data occurs daily as a result of bridge inspections. The Districts also perform Quality Assurance (QA) reviews to ensure the integrity of the data and QAs for bridge inspection are performed yearly for each District by the Central Office.

Therefore, depending on the inspection cycles and QA checks, data from the Department's bridge management system database will vary over time.

4.2.2 State Highway System (SHS) Condition Based on FDOT Performance Measures

As shown in Figure 9, for the past decade over 90 percent of the State's bridges have met the Department's performance measures and targets. This established history demonstrates the state's bridges are in a state of good repair and do not exhibit signs of structural deterioration. In fact, less than 1 percent of the state's total bridges are posted with weight restrictions.

As of FY2017/18, 95.0 percent of state maintained bridges are in Good or Excellent condition.

Figure 9: SHS Bridges Meeting FDOT Standards

Source: FDOT, Office of Maintenance 2018 Annual Bridge Inventory Report.

4.2.3 National Highway System (NHS) Condition Based on FHWA Performance Measures

Table 7 shows the percentage of NHS bridge deck area in Good and Poor condition as defined by the FHWA scale. For state owned NHS bridges, 66 percent of the total NHS deck area is in Good condition and less than 2 percent is in Poor condition. For locally owned bridges, 69 percent of the total NHS deck area is in Good condition and none are in Poor condition.

Table 7: Percentage of NHS Bridge Deck Area in Good and Poor Condition

	Deck Area (ft^2)	Good Area (ft^2)	Percentage of Area in Good Condition	Poor Area (ft^2)	Percentage of Area in Poor Condition
State Owned NHS	127,238,250	84,142,970	66.1%	1,579,416	1.2%
Locally Owned NHS	4,450,844	3,081,681	69.2%	0	0%
NHS Total	**131,689,094**	**87,224,651**	**66.2%**	**1,579,416**	**1.2%**

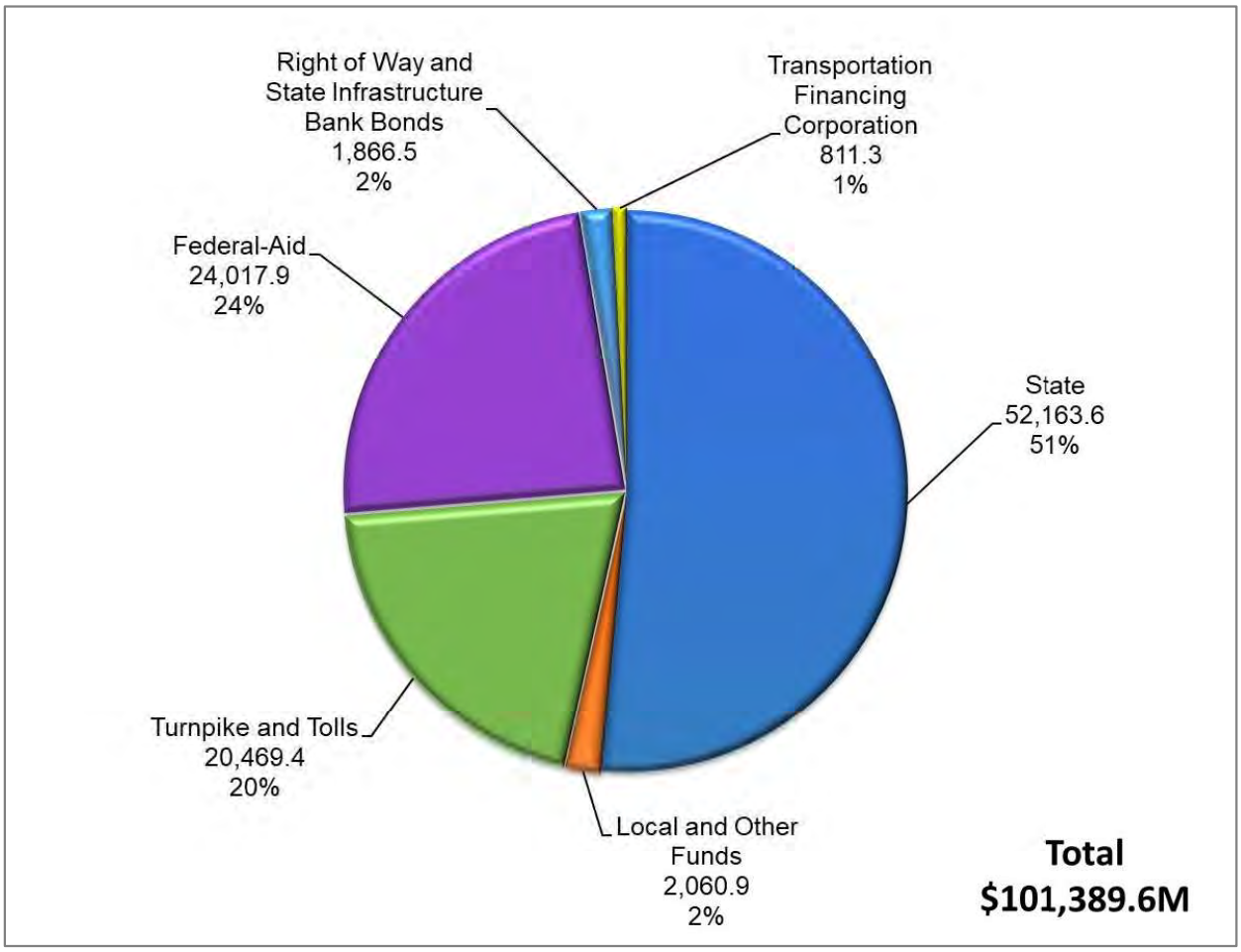
Source: FDOT, Office of Maintenance (As of May 2019).

As noted previously, depending on when information is extracted from the Department's bridge management system, the data will vary over time because it's continuously updated.

Chapter 5 Financial Plan and Investment Strategies

The largest source of funding for Florida's asset management activities is state-generated revenues. Other major sources, as shown in Figure 10, come from federal-aid, tolls, right of way bonds, state infrastructure bank, local and other, and transportation financing corporation.

Figure 10: Total Funding by Source (FY2018-2027)



Source: FDOT, Office of Work Program and Budget.

Transportation revenue receipts from fuel taxes make up over 50 percent of the revenue portfolio; state fuel taxes are indexed to offset the impacts of inflation each January. Based on movement in the Consumer Price Index (CPI), Florida's State Highway Fuel Sales Tax and the State Comprehensive Enhanced Transportation System (SCETS) Tax are adjusted annually. The other major fuel tax sources are not adjusted annually, however, and their buying power diminishes over time.

The remaining revenue portfolio is comprised of motor vehicle registration fees, tag and title fees, documentary stamp taxes, and Turnpike and other Department owned toll facilities.

5.1 Systemwide Valuation

Pursuant to the Governmental Accounting Standards Board Statement No. 34 (GASB-34)[1], Basic Financial Statements – and Management's Discussion and Analysis – for State and Local Governments, the state has adopted an alternative process to account for its roadways, bridges and other infrastructure assets included in the SHS. Under this alternative method, the Department has made the commitment to maintain these assets at levels established by the Department and approved by the Florida Legislature.

In order to utilize this method, the state is required to:

- Maintain an asset management system that includes an up-to-date inventory of eligible infrastructure assets.
- Perform condition assessments of eligible assets and summarize the results using a measurement scale.
- Estimate each year the annual amount to maintain and preserve the assets at the condition level established and disclosed by the state.
- Document that the assets are being preserved approximately at, or above, the established condition level.

The state does expense certain maintenance and preservation costs. However, no depreciation expense is reported for these assets, nor are amounts capitalized in connection with improvements that lengthen the lives of these assets, unless the improvements also increase their service potential.

As required, the Department maintains an inventory of these assets and performs periodic condition assessments to establish that the predetermined condition level is being maintained. In addition, the Department makes annual estimates of the amounts that must be expended to maintain these assets at the predetermined condition levels.

5.1.1 State (On-System) Assets

The table below shows the value of the SHS (which contains the majority of the NHS) infrastructure assets for roadways and bridges and the turnpike.

Table 8: Value of State (On-System) Assets

	Value	Work in Progress	Right of Way	Total
Roadways & Bridges	$49,939,441,710	$2,699,656,141	$14,044,103,250	$66,683,201,101
Turnpike	$9,614,944,000	$1,790,327,000	$1,159,158,000	$12,564,429,000
				$79,247,630,101

Source: FDOT, Office of the Comptroller (As of June 30, 2018).

[1] This statement establishes new financial reporting requirements for state and local governments throughout the United States. For the first time, governments' audited financial statements contain information about the full cost of providing public services, including infrastructure.

5.1.2 Local (Off-System) Assets

For consistency and to align with the Department's methodology, the value of the off-system pavements and bridges was determined as follows.

Using the Department's value for roadways and bridges in Table 8, average cost per centerline mile was determined. Note, the Department does not segregate its roadway and bridge values, so the number derived is the total average cost per centerline mile for on-system roadways and bridges. This average cost was then applied to the total off-system (local) centerline miles in order to determine the value of the off-system roadways and bridges. The value of the off-system right of way was estimated similarly.

Calculation of Average Costs

Roadway and Bridge Costs per CLM	=	(FDOT R&B) ÷ CLM
where: FDOT R&B	=	value of FDOT roadways and bridges
CLM[2]	=	number of on-system centerline miles
Roadway and Bridge Costs per CLM	=	**($49,939,441,710) ÷ (12,103 CLM)**
	=	**$4,126,203.56 cost per CLM**
Right of Way Costs per CLM	=	(FDOT ROW) ÷ CLM
where: FDOT ROW	=	value of FDOT right of way
CLM	=	number of on-system centerline miles
Right of Way Costs per CLM	=	**($14,044,103,250) ÷ (12,103 CLM)**
	=	**$1,160,381.99 cost per CLM**

Table 9: Value of Local (Off-System) Assets

	Off-System Centerline Miles	Cost per Centerline Mile	Total
Roadways and Bridges	571	$4,126,203.56	$2,356,062,234
Right of Way	571	$1,160,381.99	$662,578,117
			$3,018,640,351

Sources: FDOT, Office of the Comptroller and Transportation Data & Analytics Office.

[2] The number of CLM for the SHS, as of 6/30/2018, was 12,106. This number was used by the FDOT, Office of the Comptroller to derive values for the on-system assets. It differs from Table 3, which shows 12,103 CLM as of 12/31/2018.

5.2 Investment Priorities and Direction

To preserve transportation infrastructure investments, the Department resurfaces and rehabilitates roads; inspects, repairs, and replaces bridges; and conducts routine maintenance activities such as patching, mowing, litter removal, maintenance of pavement markers and sign replacement. Regular maintenance and preservation of the transportation system keeps it operating efficiently, extends its useful life, and postpones the need for costly reconstruction or replacement.

Included in Florida Statutes are requirements which must be considered as the Department plans and develops an integrated, balanced statewide transportation system. Preservation of the existing transportation infrastructure is of the upmost importance. Section 334.046(4), Florida Statutes, specifies that preserving the state's transportation infrastructure includes:

- Ensuring that 80 percent of the pavement on the State Highway System (SHS) meets Department standards;
- Ensuring that 90 percent of Department-maintained bridges meet Department standards; and
- Ensuring that the Department achieves 100 percent of the acceptable maintenance standard on the SHS.

To adhere to the statutory guidelines, the Department prioritizes funding allocations to ensure the investments made in the current transportation system are adequately preserved and maintained before funding is allocated for capacity improvements. Thus, the Department addresses both preservation and capacity needs systematically. This approach is specified in the FTP, as well as in Florida Statutes as noted above.

Every July 1, the Secretary of the Department adopts the Five-Year Work Program. While the Department implements the projects planned for the first year of the Adopted Work Program, it also starts developing the Work Program for the next cycle, which begins with the last four years of the Work Program just adopted with a new fifth year added. The process of developing the next Five-Year Work Program involves a series of Program Planning Workshops which are held in May and June of each year.

These annual workshops provide an opportunity for the Executive Team (i.e., FDOT Secretary, Assistant and District Secretaries) to set priorities, provide direction, and make funding decisions. The primary objective of these workshops is to determine the level of funding to be allocated over the next 5 to 10 years, which is documented in the 10-year PRP, to preserve the existing transportation system, covering maintenance, resurfacing, bridge repair and bridge replacement.

During the workshops, presentations are made which provide an assessment of prior years' performance, projection for future performance, and recommended funding levels which ensures all preservation related performance objectives will be met annually as outlined in the Five-Year Work Program and beyond. Executive direction on funding level and priority is also provided during the workshops.

After funding levels and allocations have been established, discussions on project selection and prioritization commences. Local projects are included in those discussions.

The state's 27 Metropolitan Planning Organizations (MPOs) develop their list of priority projects in coordination with the Department's District Offices. In non-metropolitan areas, the Department programs projects in cooperation with affected local officials and Regional Transportation Planning Organizations, where applicable.

The Department programs transportation projects into the Work Program based upon local priority, funding availability, and project schedules. The Department's assessment of needs includes an identification of highly congested roadways, safety and security considerations, access to business and industry, links to military facilities and improvements to major economic assets such as seaports, airports and rail facilities. Project needs are identified by the Departments District Offices in conjunction with local officials with responsibility for transportation. The Department also consults with non-MPO local officials to ensure consideration is given to the special needs of seniors and individuals with disabilities in meeting their transportation needs.

These project priorities serve as the basis for the district-wide prioritization process. The Department's Central Office reviews the District's programming of projects to ensure adherence to the Department's policies and procedures, established performance measures, and federal requirements. The final list of projects that result from the project selection and prioritization process becomes the Department's Five-Year Work Program.

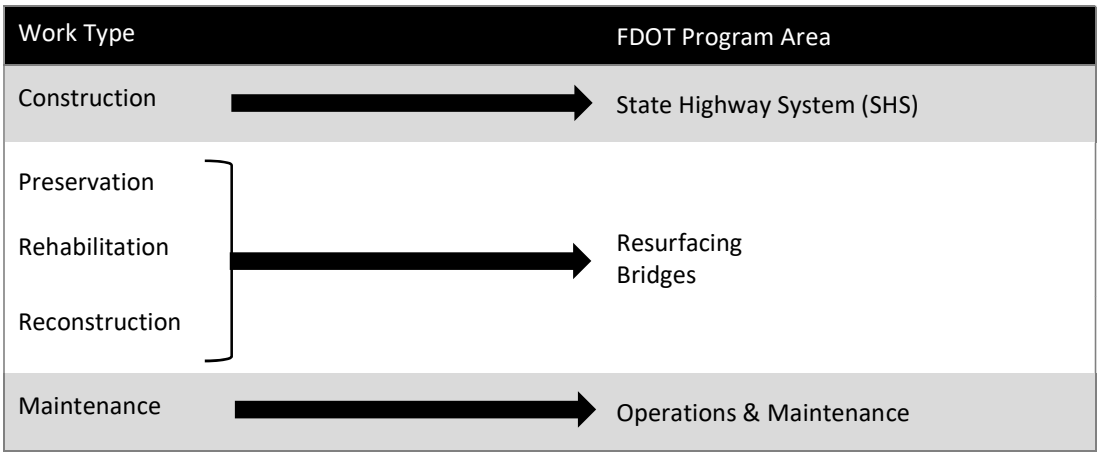
The Department has quantitative measures which describe the current condition of the system, such as the percentage of pavement that meets Department standards, the percentage of bridges which meet Department standards, and the maintenance condition rating (or percent of desired maintenance rating achieved).

5.3 National Highway System (NHS) Funding Allocations

The Department does not typically break-out funding allocations by work type; instead, financial investments are reported and organized by Program Area. This format (Program Area) matches the format used in the Department's Program and Resource Plan (see Appendix A) which contains the approved program alternatives and funding levels by fiscal year to accomplish program goals and objectives within expected revenue.

To assist with understanding of the Department's Program Areas, a cross-walk is provided (see Figure 11) to show which Program Area(s) corresponds to the work types.

Figure 11: Work Type Crosswalk



Source: FDOT, Office of Work Program and Budget.

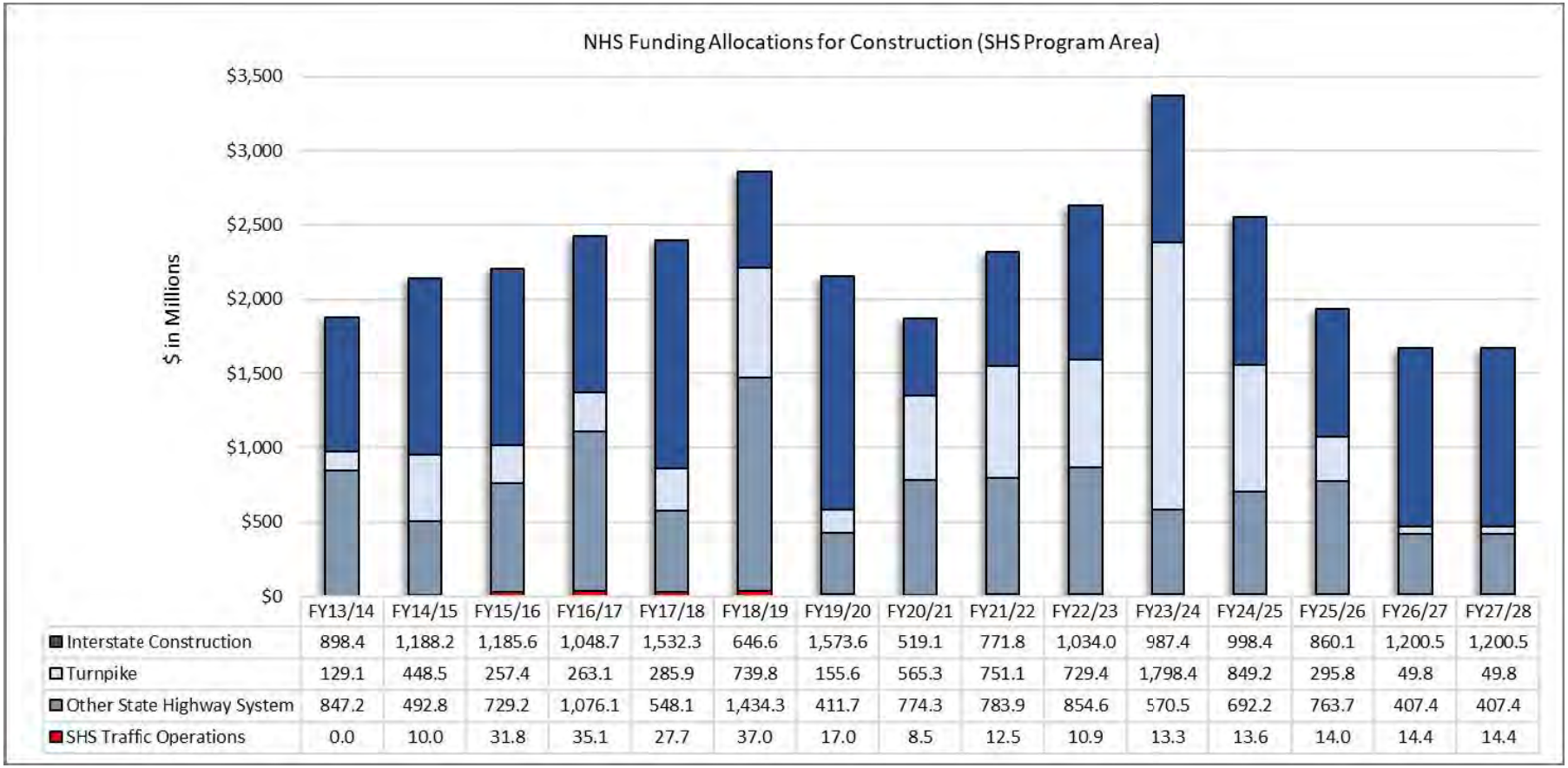
The Department's State Highway System (SHS) Program Area corresponds to the Construction work type. The scopes of work included in this area are the construction, addition or improvement of lanes, interchanges, entry/exit ramps, feeder roads, toll collection facilities and motorist service facilities which are on or planned to be on the SHS. Functionally obsolete bridges needing widening to meet standards or for capacity improvements within a transportation corridor are also included.

The Department's Resurfacing and Bridge Program Areas correspond to the Preservation, Rehabilitation and Reconstruction work types. The Resurfacing program provides for pavement resurfacing, rehabilitation, minor reconstruction, and pavement milling and recycling. These projects are intended to preserve the structural integrity of the highway pavements. The Bridge program policies direct the Department's resources to the repair or replacement of bridges with some degree of structural deterioration.

The Department's Operations and Maintenance Program Area corresponds to the maintenance work type. This program provides for highway repairs, roadside upkeep, drainage management and traffic services.

The NHS funding allocations for Construction, Preservation, Rehabilitation and Reconstruction work types were extracted from the SHS, Resurfacing and Bridge Program Areas (see Figures 12 through 14). For Maintenance, it is the policy of the Department to annually provide sufficient funding to ensure 100 percent of the maintenance standards on the SHS, which includes the majority of the NHS, are achieved. Maintenance activities are handled by in-house staff, as well as through consultant contracts. At this time, the specific Maintenance funding allocations for the NHS are not available. The Department plans to review the Operations and Maintenance Program Area to better accommodate the work type reporting requirements in future updates of the TAMP.

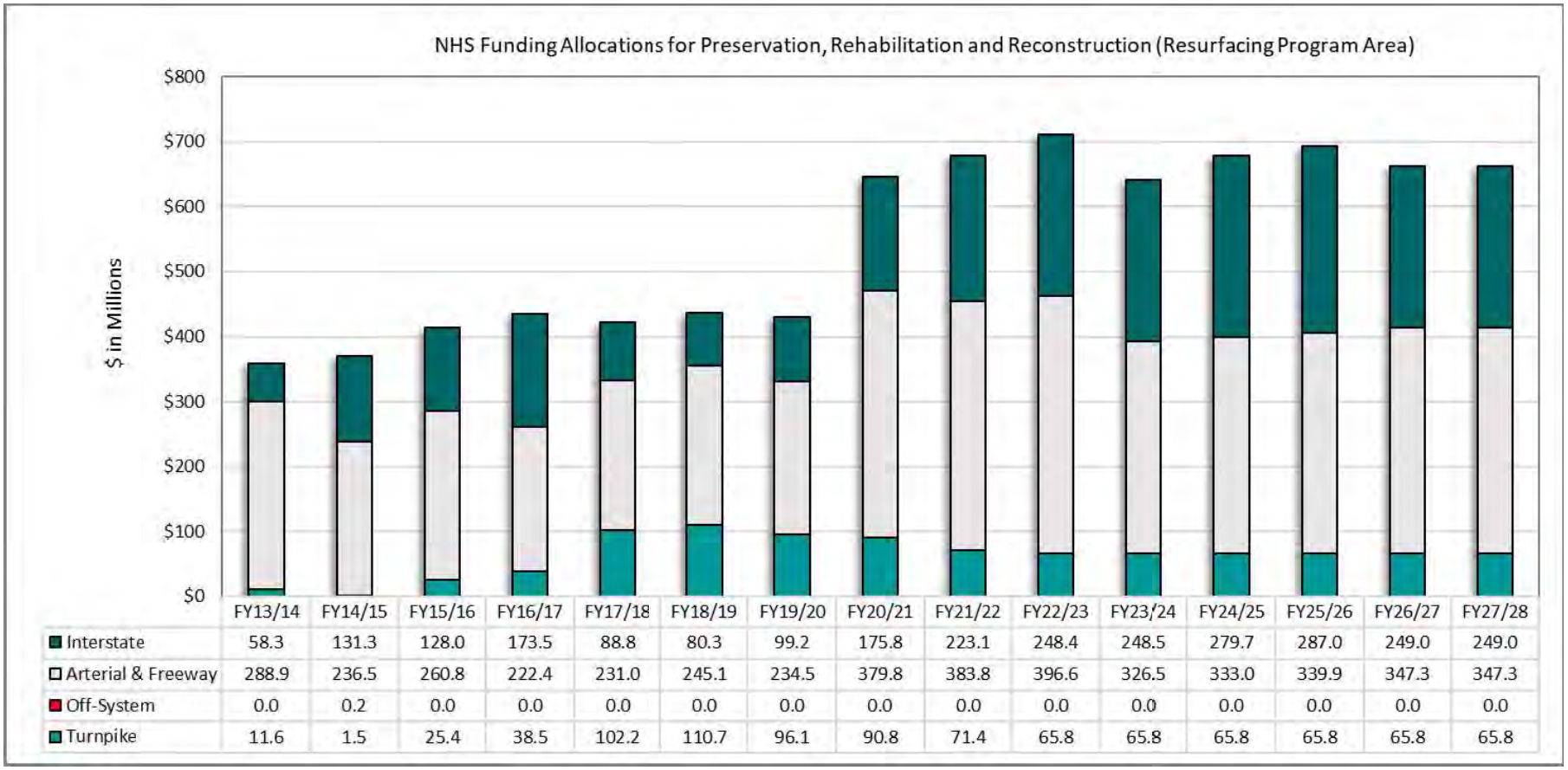
Figure 12: NHS Funding Allocations for Construction (SHS Program Area)



	FY13/14	FY14/15	FY15/16	FY16/17	FY17/18	FY18/19	FY19/20	FY20/21	FY21/22	FY22/23	FY23/24	FY24/25	FY25/26	FY26/27	FY27/28
Interstate Construction	898.4	1,188.2	1,185.6	1,048.7	1,532.3	646.6	1,573.6	519.1	771.8	1,034.0	987.4	998.4	860.1	1,200.5	1,200.5
Turnpike	129.1	448.5	257.4	263.1	285.9	739.8	155.6	565.3	751.1	729.4	1,798.4	849.2	295.8	49.8	49.8
Other State Highway System	847.2	492.8	729.2	1,076.1	548.1	1,434.3	411.7	774.3	783.9	854.6	570.5	692.2	763.7	407.4	407.4
SHS Traffic Operations	0.0	10.0	31.8	35.1	27.7	37.0	17.0	8.5	12.5	10.9	13.3	13.6	14.0	14.4	14.4

Source: FDOT, Office of Work Program and Budget.

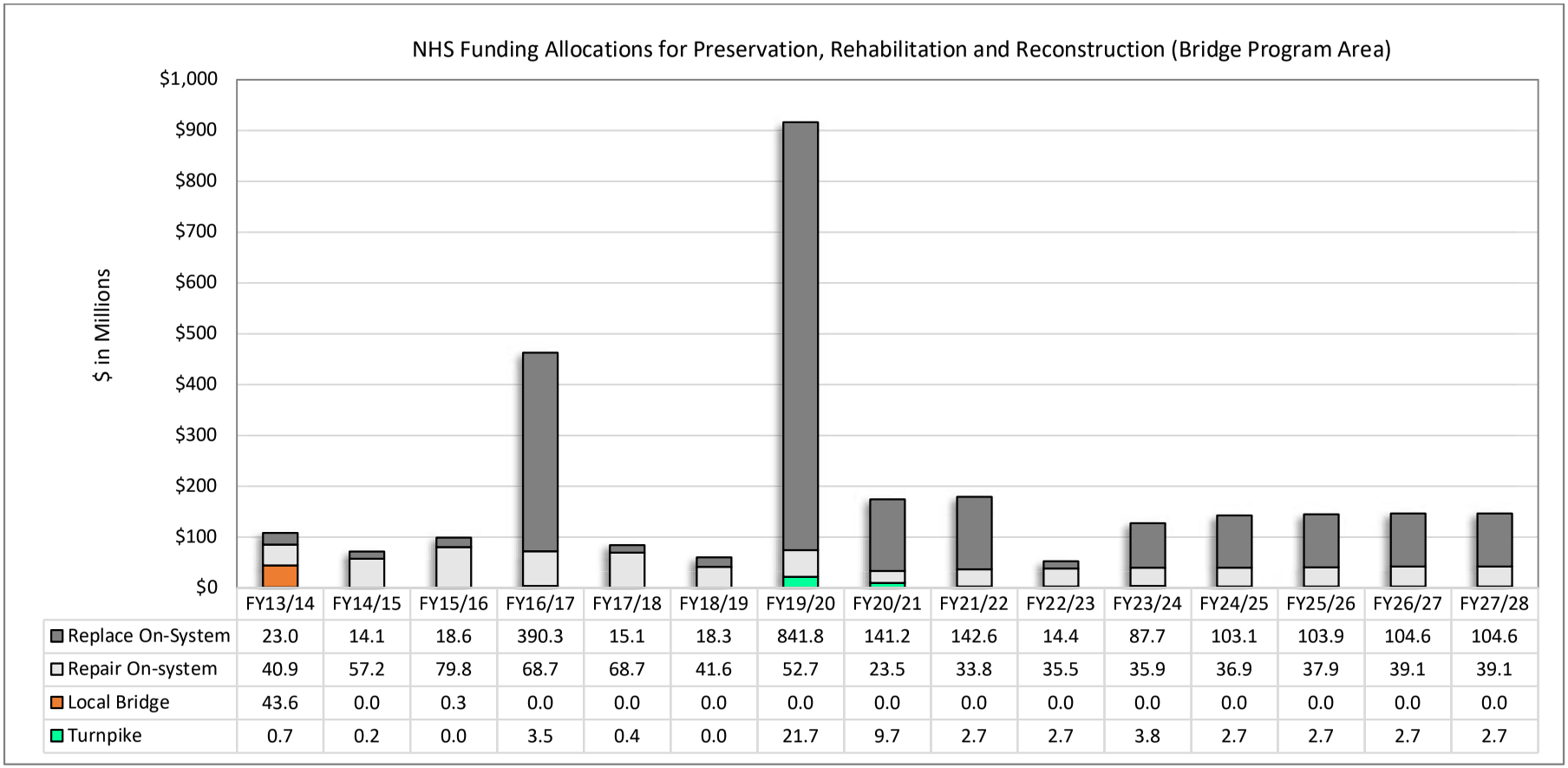
Figure 13: NHS Funding Allocations for Preservation, Rehabilitation and Reconstruction (Resurfacing Program Area)



	FY13/14	FY14/15	FY15/16	FY16/17	FY17/18	FY18/19	FY19/20	FY20/21	FY21/22	FY22/23	FY23/24	FY24/25	FY25/26	FY26/27	FY27/28
Interstate	58.3	131.3	128.0	173.5	88.8	80.3	99.2	175.8	223.1	248.4	248.5	279.7	287.0	249.0	249.0
Arterial & Freeway	288.9	236.5	260.8	222.4	231.0	245.1	234.5	379.8	383.8	396.6	326.5	333.0	339.9	347.3	347.3
Off-System	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Turnpike	11.6	1.5	25.4	38.5	102.2	110.7	96.1	90.8	71.4	65.8	65.8	65.8	65.8	65.8	65.8

Source: FDOT, Office of Work Program and Budget.

Figure 14: NHS Funding Allocations for Preservation, Rehabilitation and Reconstruction (Bridge Program Area)



	FY13/14	FY14/15	FY15/16	FY16/17	FY17/18	FY18/19	FY19/20	FY20/21	FY21/22	FY22/23	FY23/24	FY24/25	FY25/26	FY26/27	FY27/28
Replace On-System	23.0	14.1	18.6	390.3	15.1	18.3	841.8	141.2	142.6	14.4	87.7	103.1	103.9	104.6	104.6
Repair On-system	40.9	57.2	79.8	68.7	68.7	41.6	52.7	23.5	33.8	35.5	35.9	36.9	37.9	39.1	39.1
Local Bridge	43.6	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Turnpike	0.7	0.2	0.0	3.5	0.4	0.0	21.7	9.7	2.7	2.7	3.8	2.7	2.7	2.7	2.7

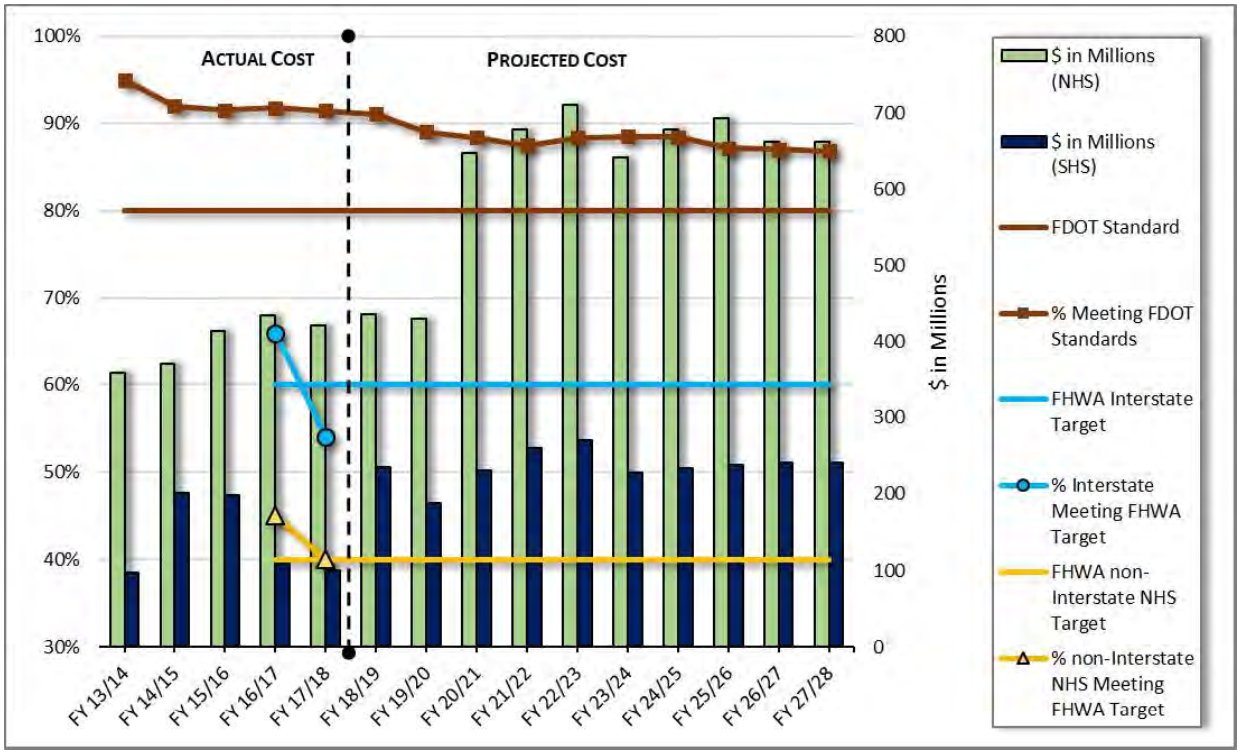
Source: FDOT, Office of Work Program and Budget.

5.3.1 Pavement Allocation

The Department allocates funds to ensure at least 80 percent of pavement on the SHS, which includes the majority of the NHS, meets Department standards (the SOGR). The amount of funding allocated is informed by the Department's top priority risks and the analysis conducted using the Department's Pavement Management System (PMS, Chapter 8). The PMS uses current inventory as well as system growth projections to aid in forecasting future deficient lane mile levels for budgeting purposes.

As shown in Figure 15, over 90 percent of the SHS has met Department standards over the past five years and over 80 percent of the SHS is projected to meet Department standards through FY2028. The funding in FY2018 is "locked". Generally, the allocations for the Interstate and Turnpike are not adjusted, unless the condition changes. For Arterials, FY2019 and 2020 are also "locked" however FY2021 and 2022 can be adjusted; meaning the amount that goes to each FDOT District may change but generally not the total allocation amount. These investment strategies allow the Department to meet the SHS pavement condition standards by balancing resurfacing needs with SHS pavement deterioration rates. These strategies also help support progress towards achieving the established Interstate and non-Interstate NHS pavement targets, since the SHS includes the majority of the NHS. As more data and information is collected and analyzed using the required approaches and technologies mandated in the federal regulations (which is a significant departure from those currently used by the Department) the Department expects to have better insight into performance of the NHS that will help inform future funding estimates to meet the established targets.

Figure 15: Pavement Projected to Meet Standards and Targets & Amount of Funding Planned



Note: Funding shown includes local (off-system) roads. Sources: FDOT, Office of Work Program and Budget, PRP for July 1, 2018 Adopted, Resurfacing Program Area and State Materials Office.

While the Department is very proud of how well the pavement has been performing over the years, it is important to consider the impact of improved materials, design and construction practices on pavement life and manage the investment accordingly and appropriately. During the annual program planning workshops a few years ago, the actual pavement condition was near 95 percent. During that time, the Department reduced the amount of funding set aside for resurfacing for a couple of years, then began ramping it back up beginning in FY2021.

Over $800 million per year has been set aside for resurfacing work to begin in FY2021. Of course, the pavement condition is evaluated every year and projections are made for future conditions. Resurfacing funds will be adjusted appropriately to ensure the statutory requirements and progress towards achievement of the established Interstate and non-Interstate NHS pavement targets are met and that all pavement on the SHS, which includes the majority of the NHS, are safe for travel.

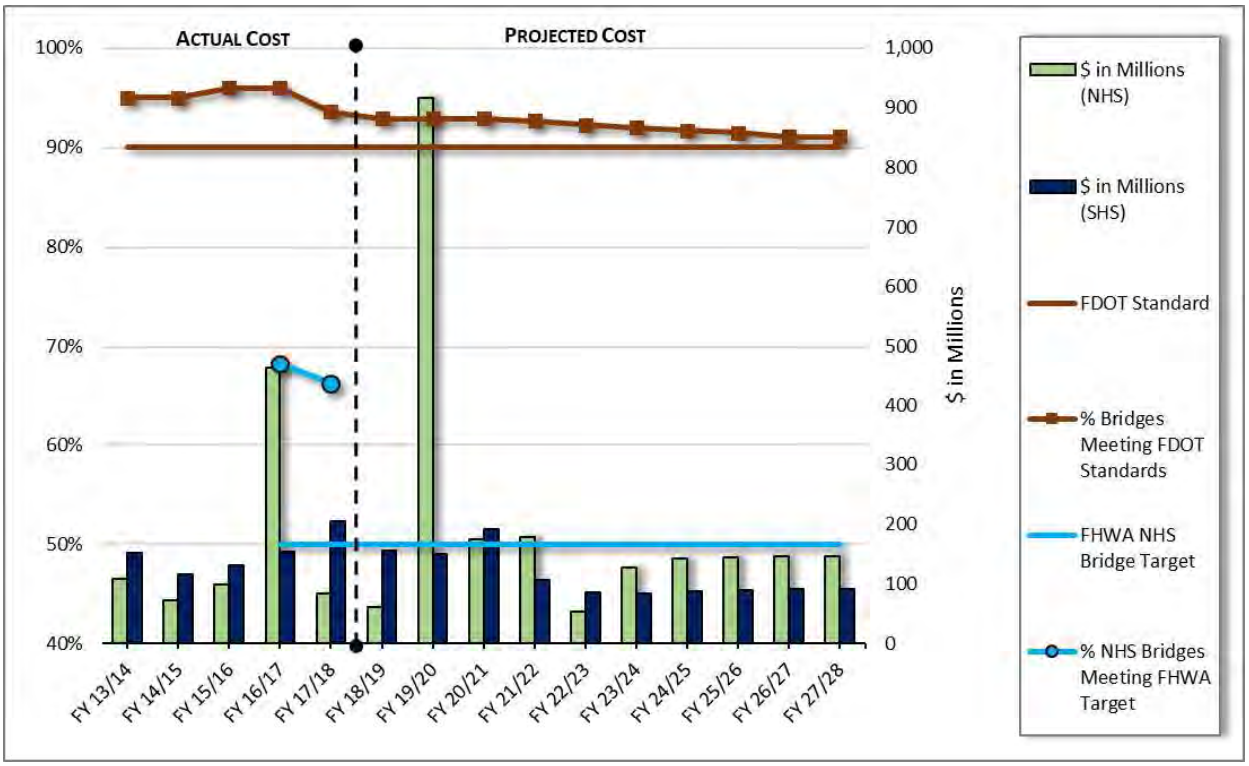
5.3.2 Bridge Allocation

The Department allocates funds to ensure at least 90 percent of Department maintained bridges meet Department standards (the SOGR) and that all bridges which are open to the public are safe for travel. The amount of funding allocated is informed by the Department's top priority risks and bridge management system, AASHTOWare™ Bridge Management Software (BrM, Chapter 8). The BrM contains historical data. It also stores and processes bridge inventory and condition data for on and off-system assets that is collected during each inspection event and after construction that results in changes to the inventory. This information aids in forecasting future funding estimates based on current inventory and condition data.

As shown in Figure 16 below, the Department's investment strategies have kept bridges in a SOGR over the past five years and bridge conditions are projected to remain above the 90 percent standard in the future. Bridges are inspected at least once every two years. Bridges in poor condition are inspected more frequently. Funds are set aside for both bridge repairs and replacements. Routine repairs help extend the life of the Department's bridges. Each year the five-year allocation of bridge repair funding is evaluated to ensure all the needed repairs can be accomplished with the funding provided. In addition, the Department has a policy that a structure is programmed for corrective action within six years of being identified as structurally deficient or weight restricted.

The cost of replacing bridges varies significantly. Some bridges can exceed $500 million and require significant planning and coordination with the impacted residents and governments. Funding for bridge replacement is "locked" for all years except for the new 5th year. The Department adds any bridge which needs to be replaced to the new 5th year when developing the Work Program. Over $150 million has been set aside each year for bridge repair and replacement. Funding is then added to the new 5th year as needed to address bridges which need to be replaced.

Figure 16: Bridges Projected to Meet Standards and Targets & Amount of Funding Planned



Note: Funding shown includes local (off-system) bridges. The spike in FY17 is for the $423 million Pensacola Bay Bridge that was let to contract. The spike in FY20 reflects the planned replacement of the northbound span of the Howard Frankland Bridge in Tampa, which is estimated to cost $730 million. Sources: FDOT, Office of Work Program and Budget PRP for July 1, 2018 Adopted, Bridge Program Area and State Materials Office.

These investment strategies allow the Department to keep bridges in a SOGR and support progress towards achieving the established NHS bridge targets. As more information is collected and analyzed using the approach mandated in the federal regulations, the Department expects to have better insight into performance of NHS bridges that will aid future funding estimates to meet the established targets.

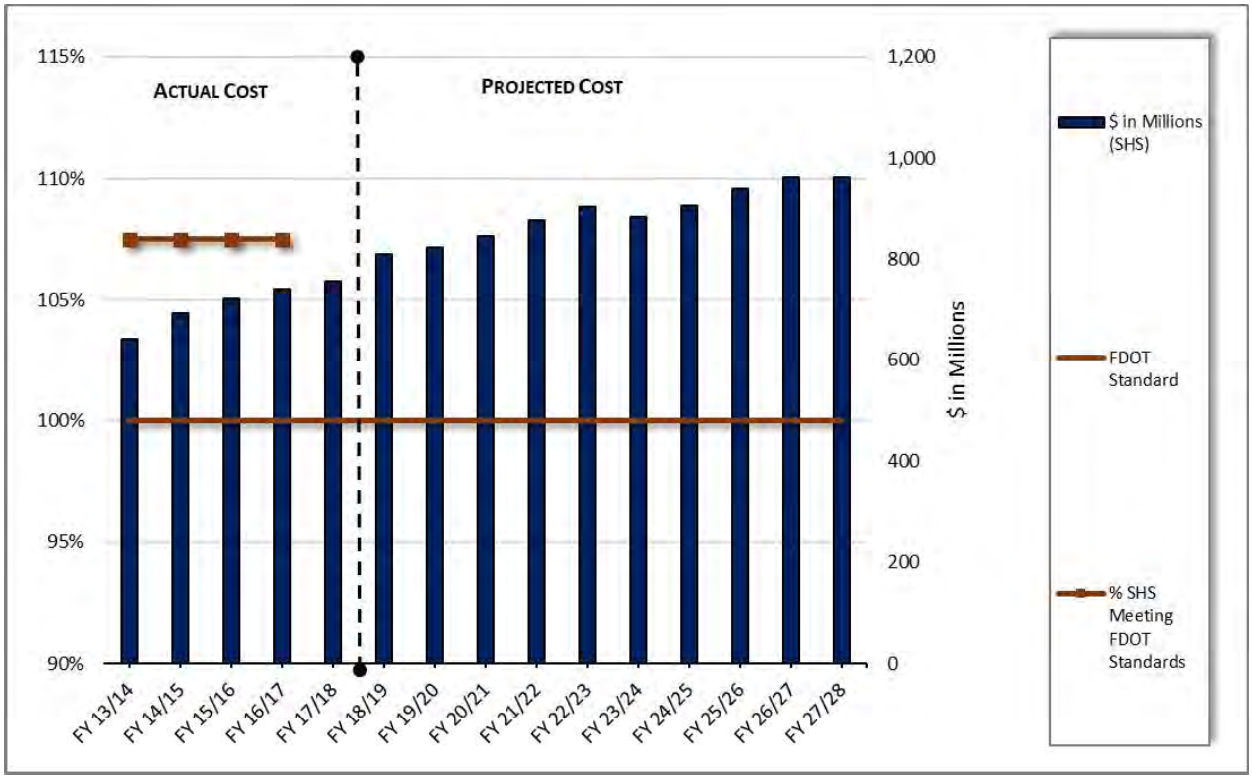
5.3.3 Maintenance Allocation

The Department is proud of the way the SHS, which includes the majority of the NHS, is maintained. The Maintenance Rating Program uses visual and mechanical evaluation of routine highway maintenance conditions to rate maintenance levels on the SHS.

The Department allocates funds to ensure 100 percent of the maintenance standard (the SOGR) is achieved. Funding allocations are adjusted each year to ensure this goal is reached. The acceptable maintenance standard is based on the Department's evaluation of its performance using the Maintenance Rating Program (MRP). This system grades five broad highway components (roadway, roadside, vegetation/aesthetics, traffic services, and drainage) and arrives at a maintenance rating of 0 to 100. The Department's standard is to achieve and maintain an overall maintenance rating of 80.

While the maintenance standard has been exceeded over the last five years, the objective is to continue to meet the standard. The Department projects the funding allocated for maintenance will be sufficient to achieve 100 percent of the standard in the future.

Figure 17: Maintenance Standard Projected to be Achieved & Amount of Funding Planned



Note: The Department does not project future maintenance conditions. Sufficient funding is provided annually to achieve 100 percent of the maintenance standards. Source: FDOT, Office of Work Program and Budget PRP for July 1, 2018 Adopted, Operations & Maintenance Program Area.

5.4 Investment Strategies and Risks

The Department continuously engages in efforts of identification and response to top priority risks at the Agency, Program and Asset Levels to ensure pavements and bridges on the SHS, which includes the majority of NHS, are in a SOGR (see Chapter 7). These risks are considered and incorporated in the Department's financial plan and investment strategies.

Risks at the Agency Level affect the mission, vision and overall results of the asset management program. Risks involving impacts and uncertainty of revenue were identified as the top priority. As mandated by statute, the Department allocates funding directly "off the top" to keep the existing transportation system safe and to standards. If the Department were to experience impacts and uncertainty of revenue, capacity projects would be reprioritized and/or deferred. This would minimize the financial and budget risks associated with maintaining the SOGR for the SHS, which includes the majority of the NHS.

Risks at the Program Level affect the Department's ability to deliver projects and meet targets within a program. These risks include organizational and systematic issues, including revenue and economic uncertainties that cause projects to be delayed. Any impacts to funding, whether due to construction cost increases, supply chain disruptions, unfunded Federal mandates, directed investments or changes in priority would be mediated the same as described at the Agency Level; capacity projects would be deferred and other adjustments made, as necessary, to preserve the existing transportation system to standards. In addition to the "off the top" funding allocations, the Department monitors trends in construction cost indicators and indexes the costs of fuel and bituminous. Those changes are incorporated into estimates to allow time to prepare for possible increases/decreases in costs. This information is used in conjunction with the PMS and BrM system analyses to inform funding projections.

Risks at the Asset Level affect the condition of specific assets. Those identified as top priority involved hurricanes and other water-related damages. To address these risks, the Department first utilizes any available cash balances until reimbursements are received. If those balances are not sufficient to cover the short-term needs, the Department mitigates the risks as described at the Agency Level; capacity projects are deferred and other adjustments made, as necessary, to preserve the existing transportation system. Over the years, this has proven to be a very effective strategy. The Department would also seek reimbursement from the federal government for costs incurred by the weather-related events. The Department also periodically reviews and if necessary updates its design standards to enhance resiliency of the transportation system infrastructure. These enhancements are accounted for in the PMS and BrM systems which utilize cost information, inflation factors and other data when conducting analyses.

5.5 Summary

The primary source of funding for Florida's asset management activities comes from state-generated revenues. Approximately twenty-five percent of funding comes from federal sources. As mandated by statute, the Department allocates funding directly "off the top" to ensure investments made in the current transportation system are adequately preserved and maintained before funding is allocated for capacity improvements.

The amount of funding allocated is informed by the analyses conducted using the Department's pavement and bridge management systems which utilize historical data, current inventory and condition data, past funding allocations, performance history and other data as input to help optimize project selection for decision-makers. These systems ensure there is no gap between the existing conditions and SOGR of pavements and bridges on the SHS, which includes the majority of the NHS.

The Department's top priority risks at the Agency, Program and Asset Levels are also considered and incorporated into the financial plan and investment strategies. Any impacts to funding, whether due to construction cost increases, supply chain disruptions, unfunded Federal mandates, directed investments or changes in priority are mediated by reprioritizing or deferring capital projects and making other adjustments as necessary to preserve the existing transportation system to standards.

To date, Florida has achieved an envious state of being able to maintain performance on highways and bridges above Department standards. Even with planned modifications to the maintenance and resurfacing programs, the Department will continue to meet its objectives and performance standards for the SHS. This helps to support progress towards achievement of the established targets for the Interstate

pavements, non-Interstate NHS pavements and NHS bridges.

In doing so, the Department will continue to provide a safe transportation system that ensures the mobility of people and goods, enhances economic prosperity and preserves the quality of Florida's environment and communities. That is the mission of the Department, which reflects the national goals for the federal-aid highway program.

National Goals:

- **Safety**: to achieve a significant reduction in traffic fatalities and serious injuries on all public roads.
- **Infrastructure Conditions**: to maintain the highway infrastructure asset system in a state of good repair.
- **Congestion Reduction**: to achieve a significant reduction in congestion on the NHS.
- **System Reliability**: to improve the efficiency of the surface transportation system.
- **Freight Movement and Economic Vitality**: to improve the National Highway Freight Network, strengthen the ability of rural communities to access national and international trade markets and support regional economic development.
- **Environmental Sustainability**: to enhance the performance of the transportation system while protecting and enhancing the natural environment.
- **Reduced Project Delivery Delays**: to reduce project costs, promote jobs and the economy and expedite the movement of people and goods by accelerating project completion through eliminating delays in the project development and delivery process, including reducing regulatory burdens and improving agencies' work practices.

Chapter 6 Performance Gap Analysis

One of the Department's main responsibilities is to keep the SHS in a State of Good Repair (SOGR). The system currently is in excellent condition, based on many national surveys which consistently rate Florida as having the nation's best pavements and bridges. This is a direct result of the Department inspecting and maintaining the pavement and bridge assets to Department standards, which helps support progress towards achieving the established targets for asset condition and performance of the NHS, since the SHS includes the majority of the NHS.

6.1 Funding Gap

There is no gap between the existing and required funding levels to maintain pavements and bridges on the SHS, which includes the majority of the NHS, to standards.

As discussed previously, the Department's SHS measures and standards for pavements and bridges are mandated by Florida Statute. Through these statutory provisions, Florida has established a well-recognized approach to first preserve existing assets and protect the public's investment in its highways and bridges. The strong mandated measures and standards, coupled with the Department's commitment to adopting innovative approaches for meeting these condition standards, allow the Department to ensure a well-established and strong approach to maintenance and preservation activities.

The Department allocates funds "off the top" to ensure the Department's pavement and bridge standards are met, which supports progress towards meeting the established targets for FHWA performance measures for the NHS, since the SHS includes the majority of the NHS. Therefore, the financial and budget risks associated with maintaining a SOGR for pavements and bridges are minimized.

If funding shortages were to develop the Department will follow its established process of funding preservation activities ahead of capacity projects. That is, the priority will be to use available state funds for preservation activities on the SHS, which includes the majority of the NHS.

6.2 Pavement Condition Gap

There is no gap between the existing condition and SOGR of pavements on the SHS, which includes the majority of the NHS.

The Department's Pavement Management System (PMS) and practices ensures there is no gap between the existing conditions and SOGR conditions. The Florida Analysis System for Targets (FAST) which is the engine of the PMS is a key component to that success. FAST takes historical and current data, including system growth projections and uses customized regression equations to forecast future performance of the pavement. This information along with other data allows the Department to maintain pavements in the SOGR. This helps support progress towards achieving the targets established for FHWA performance measures for NHS pavements since the SHS includes the majority of the NHS. More detailed information on the Department's PMS is provided in Chapter 8.

The Department will ensure continued high levels of performance for pavement condition through strategies such as:

- Balance the programming of resurfacing projects in relation to needs and optimize the timing of projects through the pavement management system.

- Coordinate with the Department's Motor Carrier Size and Weight Office and the Florida Highway Patrol's Office of Commercial Vehicle Enforcement to minimize the illegal operation of overweight commercial motor vehicles on Florida's public roads and bridges. Facilitate training and technical assistance to support local governments in conducting pavement condition surveys and ratings.

- Identify and where practicable, implement practices which reduce the time and cost of preserving the SHS.

- Promote research, development, and deployment of state-of-the-art materials, technology, and methodologies for transportation infrastructure design, construction, maintenance, and operations.

- Incorporate the risks of extreme weather and other environmental conditions into planning, project development, design, and operations.

- Through the TAMP, coordinate the Department performance metrics with the FHWA performance metrics to ensure the FHWA performance target metrics are achieved.

6.3 Bridge Condition Gap

There is no gap between the existing condition and SOGR of bridges on the SHS, which includes the majority of the NHS.

The Department's bridge management system, AASHTOWare™ Bridge Management Software (BrM), ensures there is no gap between the existing conditions and SOGR conditions. Bridge inventory and condition data for both on and off-system assets is collected during each inspection event and after construction that results in changes to the inventory. This information is stored and processed in the BrM database. This data along with other research was used to develop the Department's current bridge deterioration curves. These curves are integral in helping the Department maintain bridges in the SOGR, which helps support progress towards achieving the targets established for FHWA performance measures for NHS bridges. More detailed information on the Department's BrM system is provided in Chapter 8.

For bridges, the Department will ensure continued progress to maintain its core measures of bridge condition through strategies such as:

- Program priority repair projects for all Department-maintained bridges in the Work Program.

- Program the replacement or repair of all structurally deficient Department-maintained bridges and those bridges posted for weight restriction within six years of deficiency identification.

- Program the replacement of all other Department-maintained bridges designated for economy replacement within nine years of identification.

- Coordinate with the Department's Motor Carrier Size and Weight Office and Florida Highway Patrol's Office of Commercial Vehicle Enforcement to reduce the illegal operation of overweight commercial motor vehicles on Florida's public roads and bridges.

- Continue to monitor bridges scheduled to be replaced and make interim repairs, as necessary, to safeguard the traveling public.

- Pursue research, development, and deployment of state-of-the-art materials, technology, and methodologies for transportation infrastructure design, construction, maintenance, and operations.

- Incorporate the risks of extreme weather and other environmental conditions into planning, project development, design, and operations.

- Through the TAMP, coordinate the Department performance metrics with the FHWA performance metrics to ensure the FHWA performance target metrics are achieved.

6.4 State Highway System (SHS) vs. National Highway System (NHS)

There is a small percentage of off-system (locally owned) pavement and bridge assets that are part of the NHS but are under the jurisdiction of the local governments and located within the boundaries of the Metropolitan Planning Organizations (MPOs). For pavement, it's approximately 6.5 percent of the total NHS centerline miles and for bridges, it's approximately 2.8 percent of the total NHS bridges and 3.4 percent of the total NHS bridge deck area.

The Department collects data for the locally owned assets through its pavement and bridge management systems. This information is used to inform the list of local priority projects, which are developed by the MPOs in coordination with the Department's District Offices. These project priorities serve as the basis for the districtwide prioritization process, which feeds into the development of the statewide Work Program.

This helps to ensure the Department is adequately addressing the needs of the entire NHS (both on-system and off-system). State and/or federal funds are used by the Department to supplement local agencies' efforts for managing and maintaining their assets. So, even if the off-system assets were to fall below standards, the risk associated with not meeting the FHWA performance measures and targets would be minimal.

Chapter 7 Risk Management

Different industries use many different definitions of risk and risk management. Many consider risks to include both possible threats and possible opportunities for mitigation. The International Organization for Standardization defines risk as "the effect of uncertainty on objectives" and notes that uncertainty could be positive or negative. Other definitions equate risk to variability or to the chance that desired outcomes won't be achieved.

The Department defines risk as the probability of certain outcomes related to rare, but expected outside influences. The Department is committed to considering risk as an integral part of its asset management program. Therefore, Risk Management as used in the Department is a continuous process whereby data is collected and evaluated with relation to established goals and objectives. In fact, the FTP recommends that the Department incorporate the risk of service interruption into its priority-setting process.

So, risks will be identified at the agency, program and asset levels. Agency level risks are risks that affect the mission, vision and overall results of the asset management program. For example, legislative actions or economic changes. Program level risks are risks that affect the Department's ability to deliver projects and meet targets within a program. For example, construction cost variations, materials price volatility or data quality. Asset level risks are risks that affect the scope, cost, schedule, quality of projects or the condition of specific assets. They relate to specific projects. For example, cost overruns, material and workmanship deficiencies, or climatic events.

7.1 Risk Identification

In preparation for the Asset Management Plan final rule, the Department hired a consultant team in 2014 to conduct a literature review of previously published information from the Department and FHWA to refine and confirm the risks to be included and presented in the TAMP. These included, among others:

- *Development of Risk Models for Florida's Bridge Management System (Sobanjo and Thompson, 2013);*
- *Unknown Foundation Bridges Pilot Study (2010);*
- *Risk-Based Management Guidelines for Scour at Bridges with Unknown Foundations, NCHRP Document 107 (2006);*
- *Federal Highway Administration, Executive Strategies for Risk Management by State Departments of Transportation – Executive Summary (2011);*
- *Federal Highway Administration, Risk-Based Transportation Asset Management Literature Review (2012);*
- *Life-Cycle Engineering, Accounting for Risk in Your Asset Management Strategy (2013);*

- *Federal Highway Administration, Risk-Based Transportation Asset Management Report 1: Evaluating Threats, Capitalizing on Opportunities (2012);*

- *Federal Highway Administration, Risk-Based Transportation Asset Management Report 2: Examining Risk-Based Approached to Transportation Asset Management (2012);*

- *Federal Highway Administration, Risk-Based Transportation Asset Management Report 3: Achieving Policy Objectives by Managing Risks (2012);*

- *Federal Highway Administration, Risk-Based Transportation Asset Management Report 4: Managing Risks to Critical Assets (2013); and*

- *Federal Highway Administration, Risk-Based Transportation Asset Management Report 5: Managing External Threats through Risk-Based Asset Management (2014).*

After extracting information from this literature, telephone conversations were held with representatives from the pavement, bridge, maintenance, and financial group in April 2014. The consultant team reviewed a draft list of risks, and developed a preliminary risk register with representatives from the pavement and bridge sections of the Department in May 2014.

7.2 Risks and Risk Rating Scale

Agency-Level risks identified included:

- State and Federal funding are significantly reduced across the board for transportation.
- State funding is reduced to the Department due to poor public perception of the agency.
- Flexibility with Federal funding is reduced due to failure to meet regulatory standards.
- Funds are not sufficient for capital and maintenance projects due to inflation in construction costs.
- Funds are not sufficient for capital and maintenance projects due to failure to accurately predict funding.
- Funds are not sufficient for capital and maintenance projects due to failure to accurately predict costs.
- Asset management at the Department is inefficient or ineffective due to a lack of communication with staff.

Program-Level risks identified included:

- The Department's ability to efficiently deliver programs is undermined due to unfunded Federal mandates.
- The Department's ability to efficiently deliver programs is undermined due to diversion of funds to high-profile projects.
- The Department's ability to efficiently deliver programs is undermined due to staff turnover and loss of expertise/experience.
- The Department's ability to efficiently deliver programs is undermined due to poor data management systems and strategies.

- The Department's ability to efficiently deliver programs is undermined due to poor management.
- The Department's ability to deliver programs is impacted by a new statute requiring capacity-related investment.
- FDOT's ability to efficiently deliver programs is undermined due unpredicted variation in construction costs.

Other program-level risks include: failure to manage their physical assets for the long-term as official policy; legislative mandates such as "worst first" that could detract from sound asset management; or internal bureaucratic resistance to asset management that can be addressed only by senior leadership.

Asset-Level risks identified included:

- Assets are damaged or destroyed due to flooding (often associated with hurricanes).
- Assets are damaged or destroyed due to tornadoes.
- Assets are damaged or destroyed due to wildfires.
- Assets are damaged or destroyed due to vehicle impacts and/or hazardous materials spill.
- Assets are damaged or destroyed due to retaining wall failure or landslides.
- Bridges are damaged or destroyed due to scour.
- Assets are damaged or destroyed due to failure of ITS and traffic safety equipment.
- Bridges fail for reasons other than impacts and scour.
- Culverts and other drainage facilities fail (blockages or overtopping) unexpectedly
- Sinkholes emerge under or near roadway sections compromising foundation
- The Department's ability to construct/maintain assets is compromised due to unanticipated increase of project scope.

Other potential asset-level risks include: premature asset failures caused by faulty construction or materials; chance failures caused by unpredicted events such as barges or roadway vehicles striking bridges or truck fires weakening bridges; abrupt failures caused by climatic or seismic events such as flooding, landslides, hurricanes or tornados; failures caused by inadequate maintenance; decision failures caused by inaccurate data or models; operational failures caused by process breakdowns; or demand failures caused by unanticipated vehicle loadings.

Although the concept of risk management sometimes is viewed as obscure, tools to identify and evaluate risks can be very simple. A risk register can serve as a tool for evaluation and analysis of risk management elements. The register is a simple excel spreadsheet that lists the risks that have been considered, including their rankings. Risks can be scored using a risk rating scale as shown in Table 10 where 5 is high and 1 is low. The risks are scored in terms of consequence, where 5 is catastrophic and 1 is negligible.

Table 10: Risk Rating Scale

		Consequence (Level/Descriptor)				
Likelihood		1	2	3	4	5
Level	Descriptor	Negligible	Minor	Major	Critical	Catastrophic
1	Low	1	2	3	4	5
2	Medium Low	2	4	6	8	10
3	Medium	3	6	9	12	15
4	Medium High	4	8	12	16	20
5	High*	5	10	15	20	25

Following the May 2014 meeting, a project team conversation in June 2014 identified a need for a risk survey to develop consensus Department scores for ranking risk priorities. Prior to the distribution of the risk survey, the consultant team held a teleconference with the Department project managers to identify and introduce the risk survey. The risk survey was distributed to over 70 Department managers and executives in August 2014.

7.3 Risk Survey Information and Results

The purpose of the risk survey was to solicit broad input to the creation of a risk register and identify high-scoring risks. The survey was distributed via email and was completed on a Qualtrics platform with each of the 26 identified risks available for scoring across likelihood and severity rankings of 1 through 5.

Thirty responses were received in August 2014. The consensus scores were determined by using the mode (most popular single response) when possible. When a mode was not easily identifiable, the research team applied professional judgment using the following criteria:

- If 3 and 4 were equally popular, 3 was taken as consensus
- If 2 was more popular than 5;
- If 3 and 5 were equally popular, consensus was 4; and
- If 1, 3, and 5 were equally popular, consensus was 3.

The results are presented in the risk register shown in Table 11.

Table 11: Risk Register

	Event/Occurrence	Likelihood	Consequence Score				Other Considerations					Risk Score
			Safety	Mobility	Asset Damage	Other Financial Impact	Funding	Insurance	Regulatory	Political	Reputation	
Agency Risks												
A	State and Federal funding are significantly reduced across the board for transportation.	2	3	4	3	4	√		√	√		8
B	State funding is reduced to FDOT due to poor public perception of the agency.	1	2	4	1	3	√		√	√	√	3
C	Flexibility with Federal funding is reduced due to failure to meet regulatory standards.	1	2	2	2	2	√		√	√	√	2
D	Funds are not sufficient for capital and maintenance projects due to inflation in construction costs.	2	2	4	3	4	√	√	√	√	√	7
E	Funds are not sufficient for capital and maintenance projects due to failure to accurately predict funding.	2	2	4	3	3	√			√	√	7
F	Funds are not sufficient for capital and maintenance projects due to failure to accurately predict costs.	1	2	4	3	3		√		√	√	3
G	Asset management at FDOT is inefficient or ineffective due to a lack of communication with staff.	1	2	1	1	1	√			√	√	1
Program Risks												
H	FDOT's ability to efficiently deliver programs is undermined due to unfunded Federal mandates.	2	3	4	2	3	√		√		√	7
I	FDOT's ability to efficiently deliver programs is undermined due to diversion of funds to high-profile projects.	1	3	3	3	3	√	√		√	√	4
J	FDOT's ability to efficiently deliver programs is undermined due to staff turnover and loss of expertise/experience.	3	3	3	2	3				√	√	9
K	FDOT's ability to efficiently deliver programs is undermined due to poor data management systems and strategies.	1	3	3	3	3						3
L	FDOT's ability to efficiently deliver programs is undermined due to poor management.	2	3	3	3	3			√		√	7
M	FDOT's ability to deliver programs is impacted by a new statute requiring capacity-related investment.	2	3	3	2	3	√	√		√	√	6
N	FDOT's ability to efficiently deliver programs is undermined due to unpredicted variation in construction costs.	2	3	3	2	3	√	√			√	6

	Event/Occurrence	Likelihood	Consequence Score				Other Considerations					Risk Score
			Safety	Mobility	Asset Damage	Other Financial Impact	Funding	Insurance	Regulatory	Political	Reputation	
Asset Risks												
O	Assets are damaged or destroyed due to hurricanes.	4	4	4	4	4		√		√	√	18
P	Assets are damaged or destroyed due to flooding (often associated with hurricanes).	4	4	4	4	4		√		√	√	18
Q	Assets are damaged or destroyed due to tornadoes.	2	1	2	3	2		√			√	5
R	Assets are damaged or destroyed due to wildfires.	2	2	2	3	1	√	√		√	√	5
S	Assets are damaged or destroyed due to vehicle impacts and/or hazardous materials spill.	3	2	2	3	2	√	√			√	8
T	Assets are damaged or destroyed due to retaining wall failure, landslides, or rockfalls.	1	1	2	2	1		√	√		√	2
U	Bridges are damaged or destroyed due to scour.	2	2	3	4	3	√	√			√	7
V	Assets are damaged or destroyed due to failure of ITS and traffic safety equipment.	1	2	2	1	1		√			√	2
W	Bridges fail for reasons other than impacts and scour.	1	3	3	4	2	√	√		√	√	4
X	Culverts and other drainage facilities fail (blockages or overtopping) unexpectedly.	3	2	3	4	2	√	√			√	9
Y	Sinkholes emerge under or near roadway sections compromising foundation.	3	3	3	3	2				√	√	9
Z	FDOT'S ability to construct/maintain assets is compromised due to unanticipated increase of project scope.	2	1	2	1	3	√	√			√	4

Based on the survey findings, the highest scored risks were hurricane related at the asset level, involving wind and flooding damage. Respondents considered these risks both very likely and very damaging. Less severe asset-level risks included vehicle impacts, bridge scour, culvert failures, and sinkholes (flooding related).

At the agency level, risks involving uncertainty of funding and cost prediction scored highest. At the program level, risks were generally consistently scored as approximately equally severe, however, loss of expertise was considered more likely than others due to retirements, attrition, or other factors.

7.4 Risk Workshop

A Risk Workshop was held in Tallahassee, Florida on August 27, 2014 to finalize the risk register and identify priority items for further consideration in the context of the TAMP. The objectives of the Risk Workshop were to:

- Orient participants to the risk-based elements of the TAMP;
- Identify and assess the threats and possible opportunities that affect delivery of the Department's activities;
- Prioritize risks;
- Understand possible risk treatments (mitigations); and
- Finalize the Risk Register.

The August 2014 Risk Workshop was attended by representatives from the pavement, bridge, planning, and executive management levels. The research team used audience response systems to ensure that the scores represent a consensus value for prioritization of risks. Slides were presented with the risk register and the participants were asked to rank the risk items at the agency, program, and asset levels.

During the conversation, three other potential risks were identified that should receive detailed attention in the final TAMP. These were:

1. Workforce issues as they relate to labor and management conflicts. This risk is particularly important in the transit industry, as a mostly union workforce is present.
2. Additional and near continual rainfall that does not cause flooding can affect pavement conditions. This risk was discussed in relationship to above average rainfalls and saturation conditions.
3. Limited natural resources (such as lime rock and other aggregates) due to construction demand or supply chain disruptions can causes increases in cost of materials/construction.

While these risks were not included in the initial risk register, workshop participants think they are an important consideration in the context of the TAMP. As the TAMP is designed to be revisited regularly, the risk registers and prioritizations also should be viewed as snapshots in time. Workshop participants also discussed some potential mitigation efforts to address key risk items. For example, to address staff turnover, FDOT uses an intentional knowledge management approach of pairing seasoned veteran staff with younger, new staff. This approach allows for some knowledge transfer prior to retirements.

At the workshop, the following risks were prioritized as most important for inclusion in the TAMP. The risks are presented in priority order in each classification.

Agency Level
1. State and Federal funding are significantly reduced across the board for transportation.
2. Funds are not sufficient for capital and maintenance projects due to inflation in construction costs.
3. Funds are not sufficient for capital and maintenance projects due to failure to accurately predict funding.

Program Level
1. Unpredicted variation in construction costs.
2. Unfunded Federal mandates.
3. Staff turnover and loss of experience/expertise.
4. Poor management.
5. New infrastructure initiatives.

Asset Level
1. Hurricane Damage.
2. Damage or Destruction due to Flooding.
3. Bridges are damaged or destroyed due to scour.
4. Culverts and other drainage facilities fail (blockages or overtopping) unexpectedly.
5. Sinkholes emerge under or near roadway sections compromising foundation.
6. Assets are damaged or destroyed due to vehicle impacts and/or hazardous materials spill.

7.5 Next Steps

Since the list of prioritized risks were developed prior to the rule being finalized, the Steering Committee will review the information with representatives from the pavement, bridge, planning, and executive management levels to determine if any changes are needed. Once the review has been completed, each risk will be discussed in greater detail and a basic approach for addressing the risk will be presented in the final TAMP. To develop these mitigation strategies, the Steering Committee will work with the various offices within the Department to outline high-level response approaches.

The risk register and prioritization effort will be revisited periodically, likely every two years, to update and verify risk planning efforts. By regularly revising the risks, the Department will be well positioned to address emerging issues that impact its ability to provide continuity of service.

7.6 Risk Review and Assessment

In early 2019, the risks and related scores were reviewed by select subject matter experts. In some cases, the scores changed; in other cases, the scores did not change. In one instance, a new risk was identified. Also, some risks were re-stated to clarify meaning or were combined with other risks that were similar.

The results of the review are shown in the Revised Risk Register presented in Table 12.

Table 12: Revised Risk Register

	Event/Occurrence	Likelihood	Consequence Score				Other Considerations					Risk Score
			Safety	Mobility	Asset Damage	Other Financial Impact	Funding	Insurance	Regulatory	Political	Reputation	
Agency Risks												
A	State and Federal funding are significantly reduced across the board for transportation.	2	3	4	3	4	√		√	√		8
B	State funding is reduced to FDOT due to poor public perception of the agency.	1	2	4	1	3	√		√	√	√	3
C	Flexibility with Federal funding is reduced due to failure to meet regulatory standards.	1	2	2	2	2	√		√	√	√	2
D	Funds are not sufficient for capital and maintenance projects due rising costs.	2	2	4	3	4	√	√	√	√	√	8
E	Revenue is not sufficient for capital and maintenance projects due to failure to accurately predict funding.	2	2	4	3	3	√			√	√	7
F	Funds are not sufficient for capital and maintenance projects due to failure to accurately predict costs.	1	2	4	3	3		√		√	√	3
G	Asset management at FDOT is inefficient or ineffective due to a lack of communication with staff.	1	2	1	1	1	√			√	√	1
new	FDOT incurs extensive short-term operating and maintenance costs after extreme weather events.	4	3	3	3	3	√			√	√	14
Program Risks												
H	FDOT's ability to efficiently deliver programs is undermined due to unfunded Federal mandates.	2	3	4	2	3	√		√		√	7
I	FDOT's ability to efficiently deliver programs is undermined due to diversion of funds to high-profile projects.	3	3	3	3	3	√	√		√	√	11
J	FDOT's ability to efficiently deliver programs is undermined due to workforce issues in the transportation industry.	4	4	4	2	3				√	√	14
K	FDOT's ability to efficiently deliver programs is undermined due to poor data management systems and strategies.	1	3	3	3	3						3
L	FDOT's ability to efficiently deliver programs is undermined due to poor management.	2	3	3	3	3			√		√	7
M	FDOT's ability to efficiently deliver programs is impacted by a change in investments or priorities (i.e., preservation).	3	3	3	2	3	√	√		√	√	10
N	FDOT's ability to efficiently deliver programs is undermined due to construction costs or supply chain disruption.	3	3	3	2	3	√	√			√	9

	Event/Occurrence	Likelihood	Consequence Score				Other Considerations					Risk Score
			Safety	Mobility	Asset Damage	Other Financial Impact	Funding	Insurance	Regulatory	Political	Reputation	
Asset Risks												
O	Assets are damaged or destroyed due to hurricanes.	4	4	4	5	4	√	√		√	√	20
P	Assets are damaged or destroyed due to flooding, sea level rise and wet weather events.	4	4	4	5	4	√	√		√	√	20
Q	Assets are damaged or destroyed due to tornadoes.	2	1	2	3	2		√			√	5
R	Assets are damaged or destroyed due to wildfires.	2	2	2	3	1	√	√		√	√	5
S	Assets are damaged or destroyed due to vehicle impacts and/or hazardous materials spill.	3	2	2	3	2	√	√			√	8
T	Assets are damaged or destroyed due to retaining wall failure, landslides, or rockfalls.	1	1	2	2	1		√	√		√	2
U	Bridges are damaged or destroyed due to scour.	2	2	3	4	3	√	√			√	7
V	Assets are damaged or destroyed due to failure of ITS and traffic safety equipment.	1	2	2	1	1		√			√	2
W	Bridges fail for reasons other than impacts and scour.	1	3	3	4	2	√	√		√	√	4
X	Culverts and other drainage facilities fail (blockages or overtopping) unexpectedly.	3	2	3	4	2	√	√			√	9
Y	Sinkholes emerge under or near roadway sections compromising foundation.	3	3	3	3	2				√	√	9
Z	FDOT'S ability to construct/maintain assets is compromised due to unanticipated increase of project scope.	2	1	2	1	3	√	√			√	4

The Risk Score in the Revised Risk Register does not necessarily correlate with the priority order of the risk in each category. Risks were prioritized based on discussions, subject matter expertise and experience. The prioritized lists were presented to and approved by Executive Management. The prioritized risks are shown below by category and include an explanation of each risk as well as the Department's mitigation strategies to address the risks.

7.6.1 Agency Level Risks

The agency level risks affect the mission, vision and overall results of the asset management program. In total, eight risks were identified; four involving uncertainty of revenue had high risk scores. Based on discussions and experience, the four high scoring risks were prioritized as follows.

1. **State and Federal funding are significantly reduced across the board for transportation.**
   Mitigation Strategy:
   It is the Department's mission to provide a safe statewide transportation system that ensures the mobility of people and goods, enhances economic prosperity, and preserves the quality of the environment and communities. Safety is the highest priority and is a primary consideration in everything the Department does. Section 334.046, Florida Statutes, specifies prevailing principles which must be considered as the Department plans and develops a safe statewide transportation system. Highest among the prevailing principles is preservation of the existing transportation infrastructure. The statutes also provide quantitative performance measures which must be met concerning pavement condition, bridge condition and maintenance condition. The Department is required to preserve the state's transportation infrastructure to these specific standards. These priorities are ingrained into the Department's mission and business processes. As a result, funding is taken "off the top" to ensure pavement, bridge and maintenance targets are met first before any capacity projects are undertaken. Therefore, if revenues were negatively impacted due to reductions in state or federal funding, the Department would make every effort to honor the capacity projects already in the queue; however, capacity projects that have not been started would be deferred and other adjustments made, as necessary, to preserve the existing transportation system.

2. **Funds are not sufficient for capital and maintenance projects due to rising costs.**
   Mitigation Strategy:
   As stated above, the Department is required to preserve the state's transportation infrastructure to these specific standards. Inflation in construction costs would increase the budgetary load of projects and reduce the number of projects that the State could afford. So, projects would be deferred and other adjustments made, as necessary, to ensure the existing transportation system is preserved to required standards.

3. **Revenue is not sufficient for capital and maintenance projects due to failure to accurately predict funding.**
   Mitigation Strategy:
   The State's Revenue Estimating Conference (REC) typically meets three times a year to consider the forecast of revenues flowing into the State Transportation Trust Fund (STFF). Predictions of revenue are very conservative and actual collections are constantly evaluated in relation to the projections so that adjustments can be made. The largest source of funding for the asset management activities is

state-generated revenues, which rely on fuel tax. The state fuel tax is indexed to the Consumer Price Index (CPI) so it grows as the economy improves. The state also has a robust toll system that helps significantly with revenues. Federal funds account for about 25 percent of revenues and is tied to the most current federal legislation (the FAST Act) through FY2020. Following the FAST Act, beginning in FY2021, the Department predicts the amount of federal revenue by taking the amount of funding in the last year of the FAST Act (FY2020), holding it flat into the future (no inflation factors applied). Therefore, if revenues were negatively impacted due to failures to accurately predict the amount of funding available, the Department would employ the same tactics used for the other risks identified in this section (including weather and reduced allocations); capacity projects would be reprioritized and possibly deferred and other adjustments made, as necessary, to keep the existing transportation system safe and in a State of Good Repair (SOGR).

4. **FDOT incurs extensive short-term operating and maintenance costs after extreme weather events.**
   Mitigation Strategy:
   While the department may be reimbursed for emergency response and recovery efforts, the Department first utilizes any available cash balances until reimbursements are received. If the projected available cash does not appear to be sufficient to cover these short-term funding needs, the Department would begin deferring capacity related projects. Dealing with the emergency event and restoring roads and bridges as quickly and safely as possible to the first responders and travelling public becomes the top priority in the area where damage has occurred. Resources are reallocated to ensure operating and maintenance costs associated with the event are covered.

7.6.2 Program Level Risks

Risks at the program level affect the Department's ability to deliver projects and meet targets within a program. The risks include organizational and systematic issues as well as revenue and economic uncertainties that in general cause projects to be delayed. These causes are not related to any specific project. In total, seven risks were identified. However, based on discussions and subject matter expertise, only four were determined to be of significance and prioritized as follows.

1. **FDOT's ability to efficiently deliver programs is undermined due to construction costs or supply chain disruptions.**
   Mitigation Strategy:
   Any impacts to funding at the Program level, whether due to construction cost increases or supply chain disruptions would be mediated as described above at the Agency level; capacity projects would be deferred and other adjustments made, as necessary, to preserve the existing transportation system. The Department also monitors trends in construction cost indicators and incorporates changes into its estimates to allow time to prepare for possible future increases or decreases in costs. These construction cost indicators are discussed quarterly at the Executive Performance Review Meetings. The Department also recognizes that the costs of certain materials frequently increase and decrease causing uncertainty in the calculation of project bids which may result in higher construction costs. To address this uncertainty, the Department provides stability by indexing the costs of fuel and bituminous. The details of this process are addressed in the Standard Specifications for Road and Bridge Construction. Also, at times, the Department has explored procuring contracts for the supply and stockpiling of construction materials to ensure ongoing availability of materials for its projects

during supply disruptions. If a need arises, the Department may contract for the supply and stockpile of materials.

2. **FDOT's ability to efficiently deliver programs is undermined due to workforce issues in the transportation industry.**
   Mitigation Strategy:
   The Department recognizes that its people are its most important resource so staff recruitment and retention are critical elements for the Department to meet its Mission and Vision and achieve a SOGR. The Department has an established Mentoring Program which is managed by the Organizational Development Office. In addition, each office practices knowledge management through succession planning and the documentation of desk procedures and processes. The Department also has an informal cross training process to allow individuals to fill a role in another office for a period to support knowledge retention and succession planning. The Department recognizes that it must rely on the success of its partners in the transportation industry in order for the Department to meet its Mission and Vision and achieve a SOGR. To assist its partners, the Department actively coordinates and participates in Construction Career Days throughout the state to educate high school students on career opportunities in the transportation industry. The Department is committed to encouraging small businesses and disadvantaged businesses through its Small Business Enterprise and Disadvantage Business Initiative programs.

3. **FDOT's ability to efficiently deliver programs is undermined due to unfunded Federal mandates.**
   Mitigation Strategy:
   Unfunded mandates put a strain on state budgets by imposing sanctions if money is not diverted to cover them. Any impacts to funding, including unfunded mandates would be mediated as described above at the Agency level; capacity projects would be deferred and other adjustments made, as necessary, to ensure the existing transportation system is preserved to standards first before addressing the unfunded mandates.

4. **FDOT's ability to efficiently deliver programs is impacted by a change in investments or priorities (i.e., preservation).**
   Mitigation Strategy:
   A sudden mandate for specific investments would divert funds planned for other elements of the Work Program to the designated investment; likewise, any change in the Department's priorities from the current priorities of safety, preservation and capacity could affect future project selection. Any impacts to funding, including a change in investments or priorities would be mediated as described above at the Agency level; capacity projects would be deferred and other adjustments made, as necessary, to ensure the existing transportation system is preserved to standards first before addressing any changes in investments or priorities.

7.6.3 Asset Level Risks

Risks at the asset level relate to specific projects. These risks affect the scope, cost, schedule or the condition of the specific assets. In total, twelve risks were identified; six involving hurricanes and other water-related damages had high risk scores. Based on discussions, subject matter expertise and experience the six were prioritized as follows.

1. **Assets are damaged or destroyed due to hurricanes.**
   Mitigation Strategy:
   To maintain the system in a SOGR, the Departments engages in the continuous effort of identification and response to areas of risk involving the state's pavement and bridge assets. Hurricanes and other water-related damages are of particular concern. Hurricanes damage with high winds, rainfall and flooding. Although hurricanes and other intense storm events are endemic to Florida and cannot be prevented, the Department manages the impacts of flooding and other extreme weather risks on the Department assets—particularly those deemed most critical to mobility, economy, evacuation, etc. To address the risks associated with these occurrences, the Department has developed and implemented the following mitigation strategies.

   - **Protect/Harden.** Enhance the resilience of infrastructure by developing or enhancing natural (e.g., wetlands) buffers; building engineered protection (e.g., levees); or updating design standards (e.g., higher capacity drainage, greater freeboard requirements, etc.). The Department regularly considers hurricane probability in bridge design and this could be incorporated in its pavement selection processes as well.

     - **Hurricane and Tornado Wind Loads.** In 2004, Hurricane Charley moved through southwest Florida. Because of the high wind speeds many of the sign structures, signal lights, and other ancillary structures in the path of the storm experienced massive failure. In response, the Department developed new design criteria for ancillary structures based on updated wind loads. Changes included redefining the wind load boundary map, and depth and size of foundations. The ancillary structure design standards were also updated to reflect the new design criteria.

     - **Wave Vulnerability.** In September of 2004, Hurricane Ivan struck the western panhandle of Florida and destroyed a large portion of the I-10 Bridge over Escambia Bay. In August 2005 Hurricane Katrina struck the Gulf Coast and destroyed bridges in Mississippi and Louisiana. The cause of this bridge destruction was determined to be wave uplift and horizontal forces due to wave action. Shortly after the destruction of the I-10 Bridge over Escambia Bay, the Department began research to determine the magnitude of forces capable of destroying bridges due to wave action, and conditions under which these forces can be generated. Research into the I-10 bridge collapse and two independent studies of wave action in the Keys and in Tampa Bay, allowed researchers to predict the climatic and bathometric conditions under which bridge destroying waves can be generated. Some of the factors that affect storm surge are bay bathymetry, storm direction, storm duration, fetch, tides, current, horizontal channel restrictions, etc. Storm surge will vary depending upon these parameters. A study of bridges in Tampa Bay determined that depending upon storm surge, wave height and current speed, many bridges in Florida could be destroyed by wave action, and there is no practical way to strengthen them. Subsequent to these studies, the Department determined the location of all wave vulnerable state bridges in Florida, and developed Emergency Response Plans (ERP). ERPs plan for possible damage to or loss of bridges and include detour plans, emergency contacts, utility disruption, boat landings, ferry slips, airport locations, resource availability, etc. New bridges are designed to clear storm surge or to resist wave action forces.

- **Manage/Maintain.** The Department will continue to prioritize operations and maintenance activities that contribute to risk mitigation (e.g., culvert maintenance) and develop emergency response plans that emphasize active monitoring and management (e.g., bridge scour monitoring) before, during, and after flooding events. The 2013 State of Florida Enhanced Hazard Mitigation Plan addresses the prioritization of operations in the event of a hurricane.

- **Develop redundancy.** The Department will continue to prepare for intermittent loss of service by developing alternate routes or services through system expansion and/or by instituting emergency detour plans and support infrastructure (such as ITS). In most current infrastructure development planning efforts, redundancy is considered.

- **Abandon/Relocate.** In accordance with federal rulemaking, the Department will develop a policy to address the most vulnerable infrastructure, including the possibility of relocating roadways, bridges, or other assets to lower risk areas.

    - **"Florida Scenic Highways" and "National Scenic Byways" Designated Routes** – It must be noted that the majority, if not all, of Florida's most vulnerable pavements have been designated as a "Florida Scenic Highway". The Florida Scenic Highways Program was established to showcase the outstanding intrinsic resources (cultural, historic, archaeological, recreational, natural and scenic) that can be found along Florida's highway system. There are 26 Florida Scenic Highways. Of these, 5 are further designated at a federal level as National Scenic Byways, and 1 is designated as an All-American Road. These roads will never be closed nor relocated as they are too important to the tenets which warrant their designations. As such, they will also be given re-building priority when damage occurs due to hurricanes, flooding or other wet-weather events.

        - US 98/SR 30 – Big Bend Scenic Highway; *American Byway*
        - US 90/SR 30 – Pensacola Scenic Bluffs Highway
        - US 1/A1A – Historical Coastal Byway, and Scenic Highway; *American Byway*
        - US 1/A1A – Florida Keys Scenic Highway; *American Byway; All-American Road*

2. **Assets are damaged or destroyed due to flooding, sea level rise and wet weather events.**
   Mitigation Strategy:
   Flooding, sea level rise and other wet weather events can undermine roadways and bridges, can increase scour on bridge piers and can carry debris which causes impact damage to assets. The Department's mitigation strategy is explained above.

3. **Bridges are damaged or destroyed due to scour.**
   Mitigation Strategy:
   Scour is the wearing and erosion of soil around bridge piers through the movement of water. In the early 1990's the FHWA mandated that all states evaluate all bridges over water for scour susceptibility. A subsequent letter from the FHWA dated January 9, 2008 mandated all bridges with insufficient foundation data, identified as an Unknown foundation, must also be resolved. Bridges with foundations in water bodies have been evaluated with HEC 18 (Evaluating Scour at Bridges) where sufficient foundation data is available. Where sufficient foundation data is not available, bridges with foundations in water bodies have been evaluated with a special evaluation methodology

developed for the Department and documented in Procedural Manual (discussed in detail in the "Unknown Foundations" paragraph below): Reclassify Unknown Foundation Bridges. Foundations found to be unstable through evaluation were identified as scour critical. For each scour critical bridge, a flood/scour event mitigation Plan of Action is developed, including either a monitoring plan or installation of scour countermeasures as warranted.

- **Unknown Foundations.** Due to historical events involving the failure of bridges over water due to scouring of the foundations, the FHWA mandated that all states evaluate all foundations located in a water body for scour. This includes those foundations where necessary data for a standard evaluation is not available, otherwise known as an unknown foundation. To address the unknown foundation bridges, a special evaluation program was implemented involving the "Risk Based Management Guidelines for Scour at Bridges with Unknown Foundations" (NCHRP Web Only Document 107) risk of failure methodology to classify bridges based on probabilistic cost. In addition, other risk based methodologies were used to determine pile embedment and pile capacity including: Historical pile driving data; artificial neural network analysis; and reverse engineering. The Department developed Action Plans for all Unknown Foundation and Scour Critical Bridges to be able to respond to the possible loss of these structures.

4. **Culverts and other drainage facilities fail (blockages or overtopping) unexpectedly.**
Mitigation Strategy:
Severe blockages or immense rainfall can cause failures. In addition, the potential for collapse due to loading or structural failure can impact roadway networks. Culverts and other drainage facilities fail (blockages or overtopping) unexpectedly. Severe blockages or immense rainfall can cause failures in pavement. In addition, the potential for collapse due to loading or structural failure can impact roadway networks. Although the Department cannot prevent the intense precipitation events that may instigate culvert failure, the agency does manage its culverts to mitigate the risk of failure, including:

- **Maintenance.** Even when properly sized, culverts may fail if they are clogged with silt or debris.

- **Drainage Design Guidelines.** Particularly for higher functional classification facilities, design guidelines will be modified for the installation of drainage infrastructure intended to handle more significant (lower recurrence interval) flooding events and/or for the substitution of more resilient designs (such as box culverts or bridges in place of cylindrical culverts). Upgrades could be performed during the normal asset renewal cycle, or, for example, as a component of projects to enhance fish passage.

    - One external risk that has been identified is that FEMA funding will only replace drainage structures "in kind". This often leads to the Department only repairing or replacing damaged structures back to their original condition due to the race to get the facility back open to traffic as fast as possible.

5. **Sinkholes emerge under or near roadway sections compromising foundation.**
Mitigation Strategy:
Sinkholes, either naturally occurring or due to infrastructure issues (water pipe seepage) compromise pavement integrity and are potentially catastrophic events. Failures occur rapidly. Sinkholes emerge

under or near roadway sections compromising foundations. Depending on whether sinkholes are natural or artificial in origin, the Department will employ various strategies to help manage risk. Options differ depending on whether sinkholes are natural or artificial:

- **Natural Sinkholes.** Natural sinkholes form most commonly where karst geology is present—typically associated with soluble rocks such as limestone or gypsum. Soluble subsurface rocks can, over time, erode due to percolation of surface water or underground flows. The Department will mitigate natural sinkhole risk by monitoring conditions where assets sit atop karst geology (and, presumably, where sinkholes have appeared in the past)—although this strategy is likely only sustainable for a select few critical assets. The Department will continue to work with other partners such as the Florida Geological Survey to identify possible strategies to minimize risks associated with sinkholes.

- **Artificial Sinkholes.** Artificial sinkholes occur most frequently in urbanized areas due to sewer or water pipe leaks, which erode subsurface stabilizing materials, or when large diameter pipes fail structurally. Over time, the Department manages these risks by developing additional information on the subsurface elements. Communities with subsurface water and wastewater pipes can be encouraged to develop a robust inventory of subsurface infrastructure, with information on age and condition, that—with knowledge of typical deterioration curves—could help identify high risk facilities. Large diameter pipes beneath critical infrastructure may be monitored remotely, by camera, and major new pipes could feature fiber optics or other Nano-sensing technology to alert the Department of significant leaks or imminent structural failures.

6. **Assets are damaged or destroyed due to vehicle impacts, fire, deterioration and/or hazardous materials spill**.
   Mitigation Strategy:
   Vehicle impacts to bridges can cause serious damage. Damage can also be caused by water borne vessels such as cargo ships if they hit a bridge.

   - **Over-Height and Overweight Vehicles.** Over-height vehicles impact bridges causing damage. Overweight vehicles have the potential to damage the bridge by exceeding the safe load carrying capacity of the bridge. Some over-height and overweight vehicles travel without obtaining a permit or exceed the allowable dimensions or weight limits of the permit, thereby increasing the possibility of damage to the transportation system. Florida Statute 316.550 grants the Department the authority to issue permits for over-dimensional and overweight vehicles on the state and national networks. Florida Administrative Code 14-26.00411 requires haulers to survey routes to determine that their over-dimensional vehicles (for height, width and/or length) can safely traverse their permitted route, and requires haulers to carry a copy of the Survey Letter onboard for vehicle heights greater than 15 feet and for vehicle widths greater than 16 feet. Over-dimensional and overweight vehicles are processed through the Department's Permit Application System (PAS). For overweight vehicle blanket and trip permits, PAS automatically determines which of the Departments' 6 bridge restriction maps is appropriate. Trip permits with heavier overweight vehicles that exceed map weight parameters are processed using the Department's Automated System for Approximate Bridge Evaluation program to determine an appropriate route and operational parameters. On rare occasions, the Department will use refined analysis to determine parameters under which an overweight vehicle can safely pass. Over-dimensional

vehicles that exceed 16 feet width require District input to make sure there are no maintenance operations, construction operations or other events scheduled that could limit the width of the roadway prior to granting the permit. Enforcement for over-dimensional and overweight vehicles is provided through the Department's Motor Carrier Size and Weight Office that operates the weigh-in-motion scale facilities, and through the Florida Highway Patrol's (FHP) Commercial Vehicle Enforcement Unit. Bridges impacted by vehicles are repaired and third-party reimbursement is sought.

- **Ship Impact.** On May 9, 1980, a cargo ship struck the Sunshine Skyway Bridge (I-275 over Tampa Bay). The impact caused a collapse of the I-275 southbound lane across the ship channel span and an adjacent pier, which resulted in the deaths of 35 people. This tragedy brought focus to the safety of bridges that cross navigable waterways. The replacement for the Sunshine Skyway Bridge was designed to be capable of resisting forces caused by predicted ship impact. Simultaneous with the replacement effort for the old Skyway Bridge, the Department began research to develop design criteria that will enable a bridge to absorb impact from the largest tonnage vessel utilizing the waterway. The resulting design criteria determines the tonnage in conjunction with the statistical possibility of a vessel impacting a bridge during its lifetime that would cause a bridge to collapse. The criteria that was developed includes lower magnitude loads for portions of the bridge farther away from channel spans, based on statistics, and design criteria that allows bridge damage without causing a collapse. The outcome was that all bridges built over navigable waterways since the collapse of the old Sunshine Skyway bridge have been designed to resist ship impact. The design criteria developed by the Department was the basis of the American Association of State Highway and Transportation Officials (AASHTO's) current ship impact design criteria. Due to the magnitude of ship impacts in Tampa Bay, protective dolphins were used to prevent ships from striking the channel piers for the new Sunshine Skyway Bridge.

Hazardous materials can include both those which are explosive or combustible as well as those which are corrosive. The corrosive materials can cause permanent damage to the pavement surface.

- **Fire.** Fires can occur in several areas around a bridge and there are various possible causes of these fires. The common areas where fires occur are: on the deck; under the deck; around columns; and movable bridge control houses. Causes of fires can be: overturned tanker trucks; tanker trucks colliding with bridge elements; and combustion of flammable materials stored around the bridge. The prevention of fires around the control house is handled with fire suppression systems and safe operating practices. The mitigation of fire due to stored materials has been addressed by effective policies and practices reducing or eliminating the possibility of fire. The overturning and impact of tanker trucks around a bridge are random events that are addressed by placement of crash tested barriers around vulnerable bridge elements, and by the quick and effective response to an event through performance based asset maintenance contracts. When a bridge is damaged by a fire, the Department uses its emergency contracting process to expedite the restoration of normal traffic flows.

- **Deterioration.** Deterioration occurs to bridges as they age. Most of deterioration is due to corrosion due to chlorides causing the corrosion of steel members or steel reinforcement. During routine inspection defects are identified, repairs are recommended and action is taken. Some repairs (e.g. repair of leaking joints) prevent or delay the start of corrosion. Addressing protective

systems to ensure that they are effective will also minimize deterioration. In addition, repairing small deteriorated areas prevents the need for costlier repairs that would occur later. The Department seeks to prevent or minimize deterioration through improved design. These include increased concrete cover in aggressive environments, the use of denser concrete and using corrosion proof or corrosion resistant reinforcement for reinforced concrete and prestressed concrete elements.

The Department can exert control over aspects of the HAZMAT transportation process, including:

- **Endorsements.** The Florida Department of Highway Safety and Motor Vehicles (DHSMV) already has a process in place for providing HAZMAT endorsements to CDL holders. If warranted, this process will be reevaluated and made more stringent.

- **Registration.** Currently, under the Hazardous Materials Transportation Authorization Act (HMTAA), anyone who transports a highway-route controlled quantity of hazardous materials must register with the FDOT. The Department (the Secretary, specifically) has the discretionary power to require anyone transporting any quantity of hazardous materials to register with FDOT, meaning that the Department can, in principle, lower the hazardous materials quantity thresholds to reduce spill risks.

- **National Hazardous Materials Route Registry (NHMRR).** Currently, routes designated for the transport of hazardous materials are available from the National Hazardous Materials Route Registry (created by the Federal Motor Carrier Safety Administration). The Department could further restrict routes, selecting a subset of the NHMRR—potentially with different routes for different types of materials—that reduce risk and exposure.

- **Penalties.** Currently, fines for violating the HMTAA are limited to $55,000 per day, and imprisonment is limited to 5 years in the instance that a violation results in bodily injury (10 years if it results in death). The Department could explore options for increasing the maximum allowable fine and/or recategorizing the associated criminal penalties to permit longer sentences.

- **Enforcement.** The Department could work with local, state, and federal law enforcement to more aggressively identify and prosecute violators, with particular emphasis on protecting critical facilities and/or high population areas.

7.7 Periodic Evaluation of Facilities Repeatedly Requiring Repair and Reconstruction Due to Emergency Events (23 CFR Part 667)

Pursuant to 23 CFR Part 667, the Department identified and conducted statewide evaluations to determine if there were reasonable alternatives to NHS roads, highways and bridges that required repair and reconstruction activities on two or more occasions due to emergency events. The evaluations covered the period January 1, 1997 through December 31, 2017 and excluded tribally owned and federally owned roads, highways and bridges.

For NHS roads and highways, SR-5/US-1 (Overseas Highway) in Monroe County sustained washouts and developed sinkholes from hurricanes (Table 13).

Table 13: Permanent Repairs on NHS Roads & Highways (2 or more Occurrences)

FDOT District	County	Route Name	Event	Landfall Date
6	Monroe	SR-5/US-1	Hurricane Wilma	10/24/2005
			Hurricane Irma	09/09/2017

Although the entire stretch of the Overseas Highway in the Florida Keys is susceptible to storm damage, the District identified the stretch of roadway around mile marker (MM) 75 as the most critical segment for hurricane damage. This area is known as the Sea Oats Beach/The Fills area.

The embankment for the Overseas Highway is built over sandy and organic soft soil which is classified as extremely weak embankment strength. There is also a high-water clearance issue for this state road throughout the Florida Keys (high-water fluctuates with the ocean tides). This is a contributing factor to the recurring damage.

A permanent solution could include a combination of a pavement design that includes a geotechnical component along with the raising of the Overseas Highway. A conservative pavement design restricted to asphalt base only (B-12.5) would help mitigate the design high water issue, increasing the clearance between the base and the water table, with facilitation of maintenance of traffic and constructability as secondary benefits.

The geotechnical component could consist of soil reinforcement with biaxial geogrid compatible with asphalt base to prevent differential settlements and future roadway washouts in hurricane conditions. The optimal pavement design with soil reinforcement, would have an estimated construction cost of approximately $ 832,270 /per mile.

Ultimately, the District recognizes the permanent way to address future sea level rise and hurricane damage to the pavement is to raise the Overseas Highway. In order to plan for this effort, the District is currently undertaking an evaluation of sea level rise in Monroe County to determine what the future Design High Water (DHW) could be along the Overseas Highway. The District has also programmed a project (FM: 443307-2) to address the design of the project to raise the Overseas Highway along MM 75. This project, once construction funds are programmed, could let in early 2026.

In the meantime, a project is currently being designed to add enhanced erosion protection along the Sea Oats Beach/Fills area as an interim improvement until the raising of the road is realized. This project is expected to let in May 2020.

For NHS bridges, none of Florida's NHS bridges were found to have sustained permanent repairs on two or more occasions due to an emergency event. The Department did flag projects with permanent repairs occurring only once to assist with future updates to 23 CFR Part 667.

7.8 Summary

The Department continuously engages in efforts of identification and response to top priority risks at the Agency, Program and Asset Levels to ensure pavements and bridges on the SHS, which includes the majority of NHS, are in a SOGR.

If the Department were to experience impacts and uncertainty of revenue, capacity projects would be reprioritized and/or deferred to minimize the financial and budget risks. The Department also monitors trends in construction cost indicators to allow for better estimates, indexes the cost of fuel and bituminous and periodically reviews and updates design standards to enhance the resiliency of the transportation infrastructure.

These strategies are included in the Life-Cycle Planning for the pavement and bridge assets to help inform funding projections.

Chapter 8 Life-Cycle Planning

The overriding principle in project selection is meeting established performance standards. The Department has a well-established philosophy, codified in statute, to direct funding and to maintain performance standards. The life cycle approaches described here supplement that decision making process, ensuring that Florida's pavements and bridges remain at or above established standards, which also helps support progress towards achieving the targets established for asset condition and performance of the NHS, since the SHS includes the majority of the NHS.

8.1 Pavement Assets

The Department uses an in-house-developed Pavement Management System (PMS) to manage its pavement assets. As explained in Chapter 4, every year pavement condition surveys are conducted to monitor and collect the performance and condition of the entire SHS, which includes the majority of the NHS, in support of the Department's pavement management program. The pavement data is processed and stored in the PMS which contains more than 40 years of historic pavement condition data.

The Department also collects data for state and locally owned assets through the Highway Performance Monitoring System (HPMS). This data is used for assessing and reporting highway system performance under FHWA's strategic planning process and is provided to the local owners upon request.

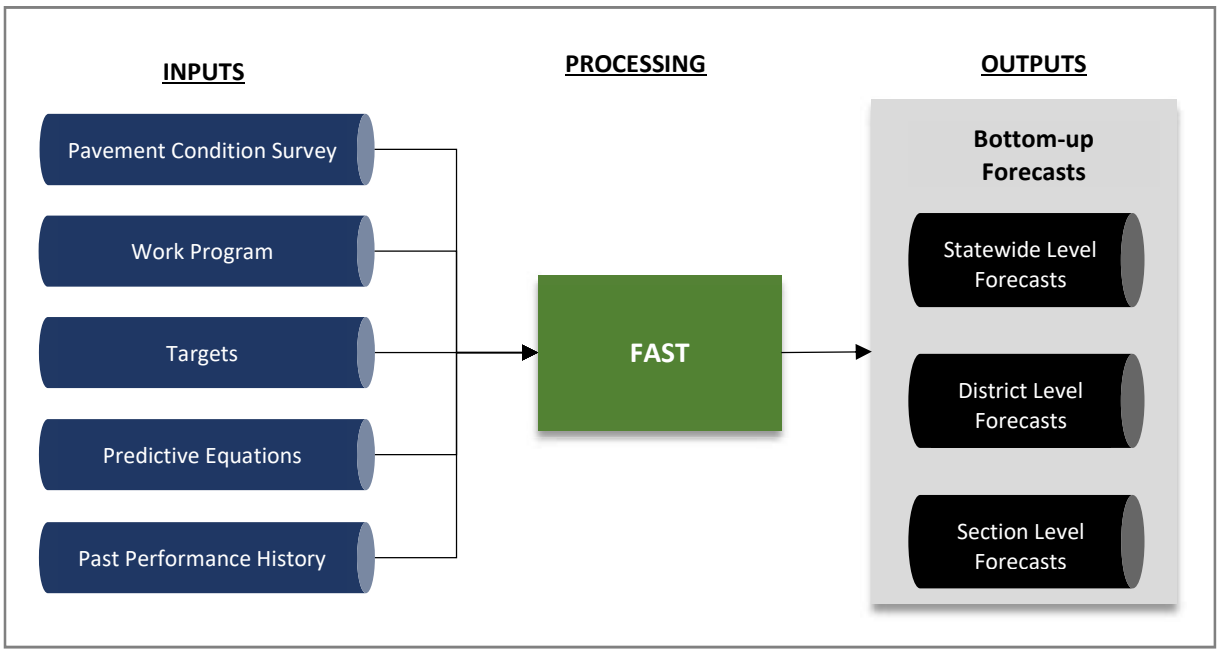
With such robust historic information, the Department has a very good understanding of how its pavements deteriorate. So, the rate of deterioration is balanced by the rate of resurfacing. Projects are chosen in accordance with the criteria of safety, preservation of the system, ride and other metrics as needed to maintain the integrity of the SHS, which includes the majority of the NHS.

Prior to 2009, the Department used a formulaic approach to pavement resurfacing project selection (target setting). Based on average pavement life, this approach dictated that approximately 5.3 percent of the statewide lane-miles be resurfaced based on deficiencies.

The Florida Analysis System for Targets (FAST) was created to provide a stronger analytic approach to the resurfacing program to meet the 80 percent non-deficient statewide standard. FAST is the predictive engine of the Department's PMS. One of the inputs to FAST is the Work Program, which includes projects from all the modal offices as well as the Metropolitan Planning Organizations (MPOs). This allows FAST to better prioritize pavement projects in conjunction with planned projects from the other offices.

Based on historical performance information in each district, FAST relies upon customized regression equations to forecast performance. Crack ratings and other predictive indicators are also used to estimate the optimal allocations. This allows for a more detailed forecast analysis, allowing pavement management staff to run a variety of funding scenarios with a Benefit-to-Cost algorithm, to help optimize project selection for decision-makers. FAST also provides the ability to calculate future resurfacing allocations based on current inventory, top priority risks, forecasted conditions including system growth projections, impact analysis for the funding scenarios, and has improved section level condition forecasts across the SHS, which includes the majority of the NHS.

Figure 18: Florida Analysis System for Targets (FAST)



Source: Source: FDOT, Pavement Management Office.

The Department currently designs pavements with a standard design life of 20 years. This allows for statewide consistency in pavement life, although there have been expected differences between pavements in the various regions of the State.

For economic valuation, the Department assumes the following:

- A discount rate of 3.5 percent on all pavement treatments.
- A construction cost inflation rate as shown in Table 14 below. The construction cost inflation factors may be adjusted due to site-specific factors.
- No depreciation expense is reported for Florida infrastructure assets, nor are amounts capitalized relating to improvements that lengthen the lives of such assets, unless the improvements also increase their service potential.

The Department tracks the capital costs of pavement projects as well as the costs to maintain pavement to a specific level of service. However, reliable cost data for maintenance, subsequent stages of construction, or corrective work and salvage value are not always available.

The Department selects pavement materials based on life cycle costs. The selection of pavement type is a process in which the highway engineer or administrator makes a judgment on many factors such as traffic, soils, weather, materials, construction, economic costs, maintenance, and environment. The pavement type selection may be dictated by an overriding consideration for one or more of these factors.

Table 14: FDOT Work Program Highway Construction Cost Inflation Factors, 2017-2037

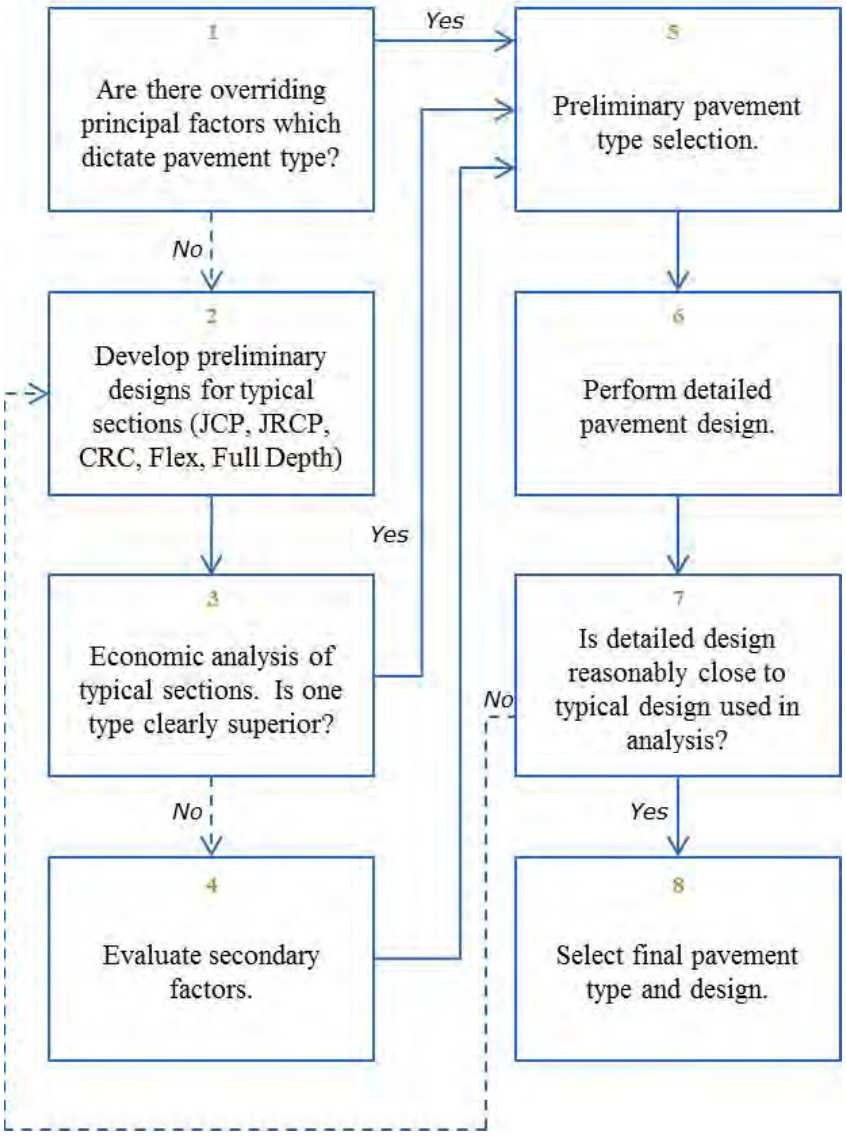
Year	Inflation Factor	Present Day Cost (PDC) Multiplier	Year	Inflation Factor	Present Day Cost (PDC) Multiplier
2019	Base	1.000	**2030**	3.3%	1.381
2020	2.6%	1.026	**2031**	3.3%	1.427
2021	2.6%	1.053	**2032**	3.3%	1.474
2022	2.7%	1.081	**2033**	3.3%	1.523
2023	2.8%	1.111	**2034**	3.3%	1.573
2024	2.9%	1.144	**2035**	3.3%	1.625
2025	3.0%	1.178	**2036**	3.3%	1.679
2026	3.1%	1.214	**2037**	3.3%	1.734
2027	3.2%	1.253	**2038**	3.3%	1.791
2028	3.3%	1.295	**2039**	3.3%	1.850
2029	3.3%	1.337			

Source: FDOT, Office of Work Program and Budget and Office of Policy Planning (Fiscal Year 2019 is July 1, 2018 to June 30, 2019) as of April 24, 2019.

Where there are no overriding factors and several alternate pavement treatments or types would serve satisfactorily, the Department uses cost comparison to assist in determining pavement type. These comparisons include the initial cost of the pavement and the cost to maintain the service level desired. It should be recognized that such procedures are not precise since reliable cost data for maintenance, subsequent stages of construction, or corrective work and salvage value are not always available, and costs often need to be projected to some future point in time.

Figure 19 below, shows the typical approach for pavement selection decision making within the Department. In stage three of the process, the economic costs are considered, including the maintenance cost component. User costs are not considered in this analysis. Costs are compared based on the net present value incorporating the construction cost inflation and discount rate.

Figure 19: Pavement Type Selection Process



Source: Adapted from Pavement Type Selection Manual, October 2013

The Department selects pavement type based on life cycle costs, with a few exceptions as described by AASHTO. Replacement or reconstruction is required when an asset has reached the end of its service life and can no longer be extended through resurfacing, repair, or rehabilitation. New resurfacing projects are programmed three years into the future and resurfacing dollars are allocated for the new 5th year of the Five-Year Work Program based on expected pavement condition ratings.

8.1.1 Pavement Results

Because most Florida pavements experience deterioration initiating near the surface (e.g. top-down cracking and raveling), it has been the Department's standard practice to mill and resurface. The pavement condition rating that "triggers" a resurfacing project for the Work Program is set such that the cracks have not propagated down to the base so water is not saturating the base layers by the time the pavement is resurfaced.

The Department has previously justified the policy of not performing "preventive maintenance" on the SHS, which contains the majority of the NHS, by life cycle cost analysis and lack of data quantifying the estimated life of all preventive maintenance treatments. The Department's average mill and resurfacings can be considered "thin overlays" and prior to FHWA changing their definition of "pavement preservation", the majority of the Department's mill and resurfacings qualified as such.

The mill and resurfacing policy has proven to be the best use of taxpayer dollars and provides the Department additional confidence that the forecasting models used in pavement management for budgeting purposes are as accurate as possible. See Chapter 5, section 5.3 for funding allocations for the NHS.

8.2 Bridge Assets

The Department uses AASHTOWare™ Bridge Management Software (BrM), formerly Pontis, to inform bridge management decision making. BrM 5.2.2 is the Department's current production version. It has the capability to collect inspection and inventory data, and with the Department's customization, produce inspection reports and other reports required by the Department. There is an updated version the software (BrM 5.3) that the Department is reviewing. It has additional features including performing various life cycle cost analysis and benefit cost analysis.

The Department collects inventory and condition data for state as well as locally owned assets through the Department's bridge inspection program. Data is provided to the local bridge owners upon request. The bridge inspection program plays an integral part in the asset management of the bridge inventory in that much of the data concerning bridge condition and performance is gathered from inspections. Also, bridge repair work and bridge replacements based on condition are initiated through the inspection process.

Inspectors use the Department's Bridge Inspection Field Guide to ensure bridges are inspected consistently and systematically. Bridges are inspected at least once every two years to assess their condition and to identify structures that require further maintenance, rehabilitation, or replacement. Bridges in Poor condition are inspected more frequently. The exception to this are a class of low risk bridges that will be inspected every four years. Special inspections are conducted after major weather events, such as floods and hurricanes.

The inventory and condition data collected is stored in the bridge management system database. The data is updated during each inspection event and after construction that results in changes to the inventory data. The Department processes the data using BrM, therefore each time the models are run, the results reflect the most current inventory. Customized bridge inspection, inventory and other frequently used

standard reports have been developed. In addition, the Department collects state specific data which is also stored in the database.

From 1998 through December 2016 the Department inspected bridges with the Commonly Recognized Elements (CoRe) for bridge inspections. This data and other research was used to develop the Department's bridge deterioration curves.

The Department recently moved to the new AASHTO Bridge Management Elements (BME) for bridge inspections. With this move, a research project was performed to create a starting point to predict deterioration of the BMEs. Once several cycles of element condition have been collected, the deterioration models will be updated. This will allow the Department to predict future deterioration of the bridges using BrM or other appropriate software.

In terms of benefit/cost, the Department does perform benefit cost analysis over the life cycle of the bridge assets. The analysis includes "no action" options and is conducted using the most suitable software based on the type of evaluation.

For example, for a system level analysis of a bridge (either District or Statewide) the objective is to coordinate the overall bridge inventory condition with the budgetary needs. The Office of Maintenance will periodically perform statewide system analysis to review overall system performance versus budgetary needs.

This includes looking at tradeoffs between funding and performance of the system or various subsets of the system. The District Structures Maintenance Offices in each District also periodically performs a districtwide system analysis to assist each District in managing its bridge inventory.

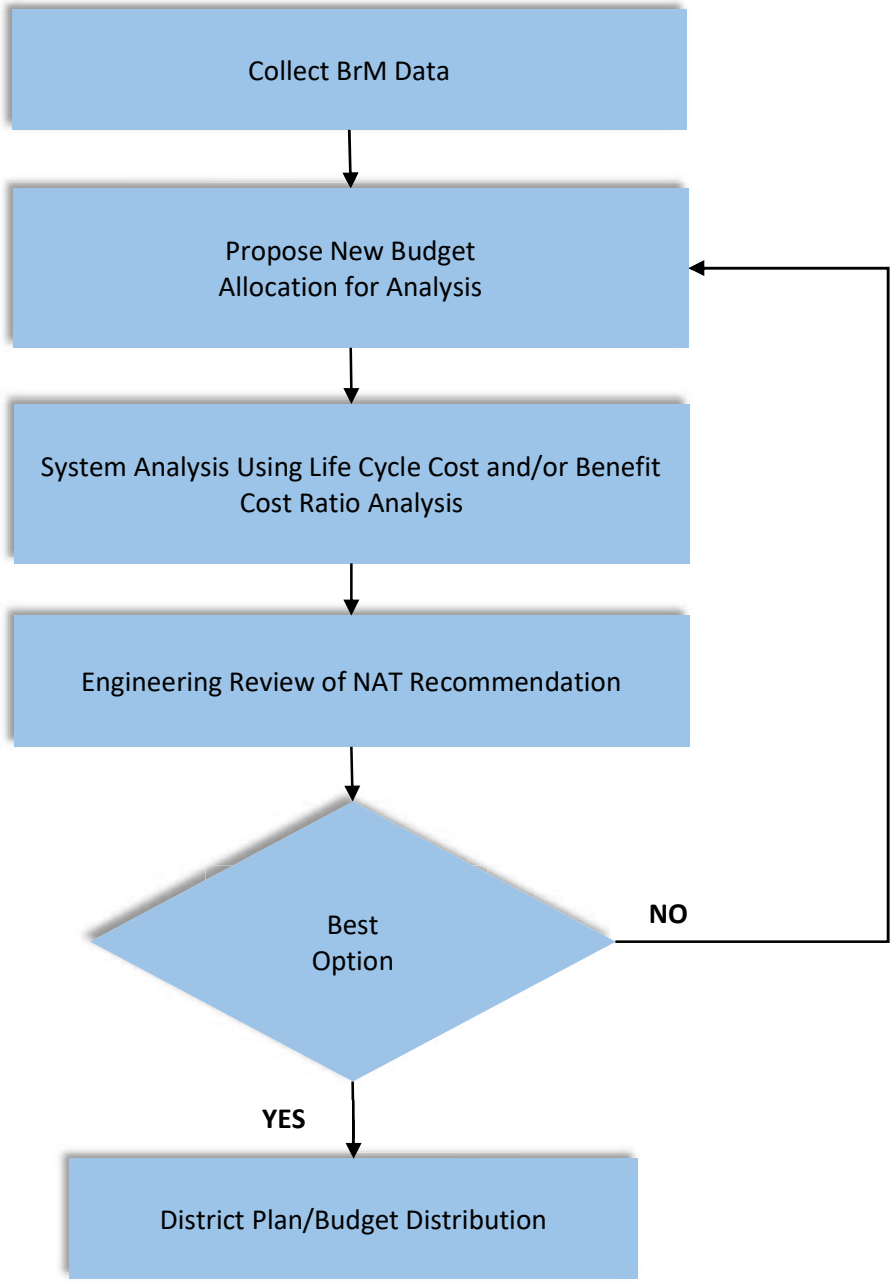
This level of analysis may also provide a general view of weaknesses and strengths in the inventory, and areas of work to emphasize to achieve maximum performance. The Department will evaluate the system analysis capabilities of the BrM Bridge Management System to determine if it meets the needs of the Department. The Department may also use the Network Analysis Tool (NAT) which is a decision support tool developed through Department sponsored research.

The NAT is an excel based application that combines the results of the Project Level Analysis Tool (PLAT) to provide a network level perspective on the tradeoffs between funding and performance of the entire bridge inventory or a specified portion of the inventory.

The inventory analyzed may be broken down by District, Functional Class, or Structure Type. Various performance measures may be analyzed such as percent Good/Excellent condition, health index, paint health index, or life cycle costs. In addition, the application allows for the use of specific budgets or desired performance levels.

A flow chart of the system level analysis process is shown in Figure 20.

Figure 20: Bridge - System Level Performance Analysis



Source: FDOT, Office of Maintenance.

Please refer to the next page for a description of the flowchart elements.

Flowchart Element Descriptions

Collect BrM Data – The data in BrM is collected as part of the bridge inspection process. This data is an input into analyses performed by various software.

Propose New Budget Allocation for Analysis – The analysis process uses an assumed budgetary value input into the system. Because of the analysis, the budget may change to support the performance objectives.

System Analysis Using Life Cycle Cost and/or Benefit Cost Ratio Analysis – The System Analysis may utilize one or both Life Cycle Cost Analysis or Benefit Cost Ratio Analysis to produce its conclusions. This process is run internally.

Engineering Review of Network Analysis Tool (NAT) Recommendations – District or Central Office personnel will consider the recommendations to objectives, priorities, and budgetary restraints. If the recommendations are acceptable, the program will proceed. If the recommendations are not acceptable, input parameters are modified and the analysis is rerun for new recommendations.

District Plan/Budget Distribution – Once the recommendations are accepted, a budget will be established and work need priorities will be established.

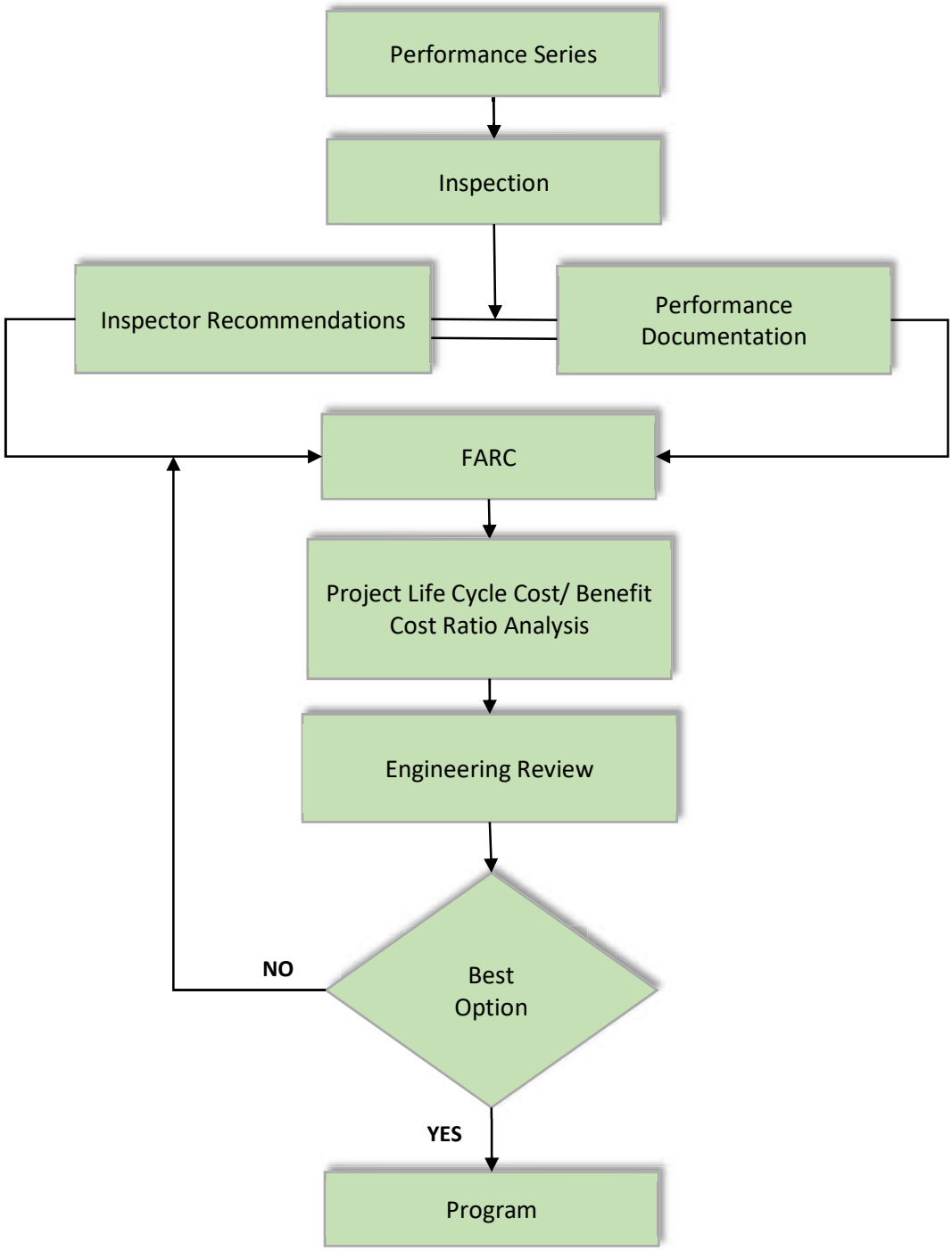
The Department uses the Project Level Analysis Tool (PLAT) to conduct bridge project level analysis. This is also an Excel based tool that was developed through Department sponsored research. It uses data from the BrM database and performs life cycle analysis at the bridge level. PLAT automatically analyzes three scenarios; do nothing, repair and replace.

Risks of natural and man-made hazards are quantified as social costs to the public and the Department. User costs due to functional deficiencies and delays are estimated. Benefits are determined by the reduction in social and user costs due to the actions performed. This is compared to the costs of the proposed project to determine a benefit cost ratio.

PLAT also allows the user to customize and evaluate the impact of the timing of projects. The user can place proposed projects in any year of a ten-year period and the tool will project the element level deterioration until the project is executed. The elements that are part of the project are assumed to return to Good condition (or state 1) and deterioration is assumed to begin again. This allows the user to observe the associated impacts of the project and adjust as necessary.

Figure 21 below illustrates the Department's project level analysis for bridges.

Figure 21: Bridge - Project Level Performance Analysis



Source: FDOT, Office of Maintenance.

Please refer to the next page for a description of the flowchart elements.

Flowchart Element Descriptions

Performance Series – The performance of the bridge as an entire system, or the individual bridge elements is measured against numerous external affects. A Performance Series is an incremental change in the bridge condition that can be measured, as a result of these external affects. These conditions can act slowly, such as with rusting steel, or they can act quickly, such as with wave impact from storm surge. The Series represents a chronological history of the system, sub-system or element performance based on condition or functionality. With regard to risk management, the Performance Series represents the fundamental unit of measure for establishing risk and Life-Cycle Costs.

Inspection – The bridge inspection process identifies changes in bridge element condition, performance of bridge preservation systems, and performance of the bridge system and bridge elements. Through the generated bridge inspection report the updated inspection information is recorded into the BrM system.

Inspector Recommendations - The Inspection Report lists work need recommendations based on the inspection observations. These work needs may involve either structural repairs or preservation needs.

Performance Documentation – Historical documentation relating to structural performance of the bridge elements for the specific bridge and related bridges will be accessed and used in the decision-making process.

FARC – The Feasible Action Review Committee (FARC) consists of District bridge maintenance personnel and, as necessary, asset maintenance personnel. The Committee's primary purpose is to identify, prioritize, and schedule bridge (and other ancillary structure) work needs. As part of the decision-making process the FARC will utilize input from various sources, including modal plans. The FARC will have responsibility for executing the final decisions concerning bridge work needs.

Project Life Cycle Cost and Benefit Cost Ratio Analysis – As part of the decision-making process the FARC will reference BrM and PLAT asset management programming concerning Life Cycle Cost and Benefit Cost Ratio Analysis. Results of the analyses will be recorded and referenced in the final decision process.

Engineering Review – The FARC will coordinate with District production and operations management during the Project Level decision-making process. Decisions will be modified as necessary to align with the goals and objectives of the District and the FTP. The FARC will record results of the coordination meetings.

Best Option – The FARC will consider input from: the inspectors; bridge element performance history; Life Cycle Cost and Benefit Cost Ratio Analysis; and District and State planning goals and objectives. The FARC will decide whether the work action sufficiently satisfies all inputs. If the work action sufficiently satisfies the requirements, the work action is prioritized and programmed. If the work action does not satisfy the requirements, the committee will consider an alternative course of action.

Program – The District Bridge Maintenance Office will assign the work action for disposition to the appropriate group: maintenance yard; internal personnel; consultant or asset maintenance contractor. A key component of the Department's bridge management system is the consideration of short and long-term budgeting needs for bridge repair and replacement. These needs are developed at the District level and are based on the bridge inspection process and NBI inspection data stored in the BrM system. Each District bridge maintenance office conducts periodic meetings to review inspector recommendations from inspection reports and to identify work needs. The work needs are then prioritized by District staff and candidate construction projects are created, including project budgets. The Department's Central Office collects all the District bridge work needs and creates a statewide Bridge Work Plan. That statement of needs is submitted to the Office of Work Program and Budget and is included for discussion at the Department's annual summer Program Planning Workshops for development of the Five-Year Work Program.

8.2.1 Bridge Results

To optimize project selection, the Department uses the NAT and PLAT in conjunction with the BrM 5.2.2 to analyze tradeoffs between funding and performance of the bridge inventory. For bridges, the Department defines the financial investment categories as follows.

- **Construction:** complete replacement of existing bridge structure.
- **Reconstruction:** major repairs of existing bridge structure based on the original design standards.
- **Rehabilitation:** major repairs of existing bridge structure based on the current design standards.
- **Preservation:** work performed to protect or extend the service life of the bridge structure, such as painting; crack sealing; joint repair or replacement; or scour countermeasures.
- **Maintenance:** minor repair or replacement of bridge components such as patching spalls; lubrication of moving parts; replacement of lost or damaged parts; or deck cleaning.

See Chapter 5, section 5.3 for funding allocations for the NHS.

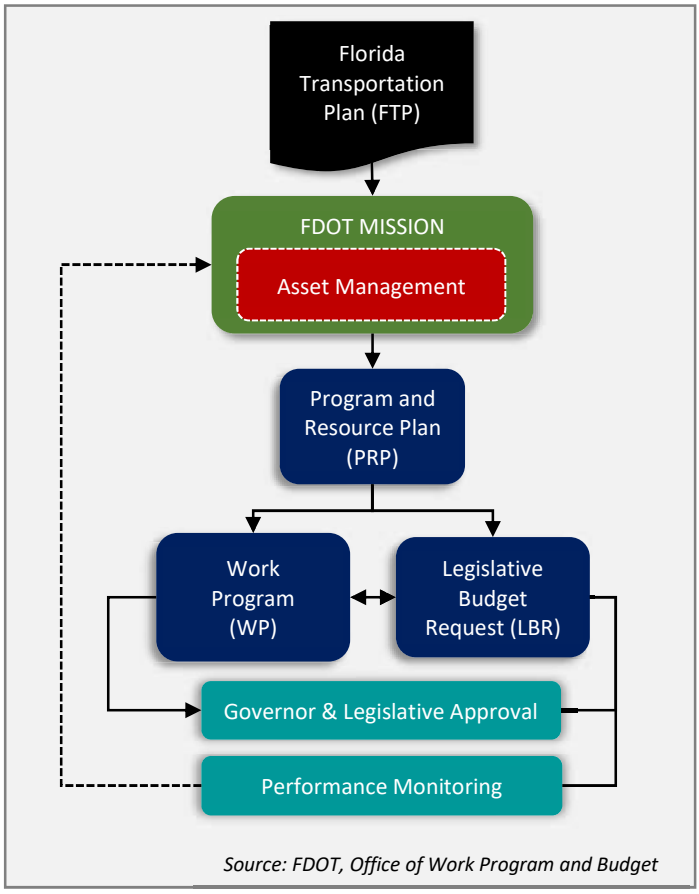
Chapter 9 Implementation

Implementation of the processes described in this TAMP are ongoing as they are the Department's current approach to asset management for the SHS, which includes the majority of the NHS. It's how the Department does business (see Figure 22).

To meet the Federal requirements for the risk-based asset management plan, the Department's leadership established a Steering Committee to facilitate the development and oversee the review and updating of the TAMP. The committee is co-championed by the Director, Office of Maintenance and the Department's Performance Coordinator and includes representatives from the following offices and organizations:

- Office of Work Program and Budget
- Public Transit Office
- Office of Policy Planning
- State Materials Office
- Bridge Office
- Office of Information Systems
- Pavement Management Office
- Office of Maintenance
- Safety Office
- Transportation Data and Analytics Office
- Metropolitan Planning Advisory Council (MPOAC)

Figure 22: FDOT Asset Management Process



Source: FDOT, Office of Work Program and Budget

The Department's Performance Management Policy (Topic No. 000-525-052-b) links performance measures to planning and programming decision making.

This helps to inform decisions and provides feedback on the transportation system performance, agency operations and program outcomes.

Performance management encompasses asset management and performance measurement reflecting the Department's priorities for accountability and stewardship of resources.

As stated in the policy, the Department will implement performance management agency-wide by:

- Regularly reporting on performance measures spanning the Department's operations including, but not limited to, transportation system performance measures, production measures and mission-related measures;

- Establishing and maintaining transportation system performance core measures that align with our mission, priorities, and long-term goals;

- Ensuring that our asset management efforts include useful measures of performance;

- Building performance measures into our plans and programs to advance performance-based planning and programming practices;

- Establishing and tracking future performance targets;

- Collaborating among Central Office and District Office staff, including a yearly performance measurement workshop to begin an annual cycle of performance report development;

- Collaborating with MPOs, transit operators and other stakeholders as appropriate for a coordinated approach to performance measurement; and

- Consistently reporting and communicating performance results to be used in informing planning and programming decision making.

Furthermore, because performance management depends on reliable data, Department program and office managers are responsible for coordinating the measures they use to achieve consistent reporting of measures.

In the long-term, the Steering Committee will meet as necessary to:

- Review the TAMP to ensure Department policies and processes are current; and
- Update and resubmit every 4 years per rule requirements for FHWA process certification/re-certification

This schedule will support continued improvement of the Department's asset management practices and enable the Department to continue to provide solid stewardship of Florida's transportation assets.

References

The Florida Department of Transportation Mission

The Florida Transportation Plan (FTP)

The Program and Resource Plan (PRP)

The Work Program (WP)

23 Part 667: Statewide Evaluations

FDOT Transportation Asset Management Plan (TAMP)

Appendix A: Program and Resource Plan Summary FY2018/19 to FY2026/27

19Adopt01
WORK PROGRAM
FILE: 1-July-2018

FLORIDA DEPARTMENT OF TRANSPORTATION
2017/18 PROGRAM AND RESOURCE PLAN SUMMARY
FISCAL YEARS 2018/19 TO 2026/27
(MILLIONS OF $)

OWPB
5-July-2018
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(Excludes Hurricanes)	ACTUAL	PLAN	First Five Years						Next Four Years					10 YR.
PROGRAM AREAS	16/17	17/18	18/19	19/20	20/21	21/22	22/23	TOTAL	23/24	24/25	25/26	26/27	TOTAL	TOTAL
I. PRODUCT	5,957.0	5,755.4	8,430.9	6,849.9	5,901.7	6,206.6	6,560.7	**33,949.8**	7,364.3	6,559.6	5,872.3	5,544.7	25,340.9	**65,046.1**
A. State Highway System (SHS)	3,023.9	3,075.0	3,868.6	2,984.1	2,720.8	3,226.5	3,667.6	16,467.7	4,432.7	3,519.6	2,787.6	2,419.8	13,159.7	32,702.3
B. Other Roads	303.2	336.0	547.8	360.2	308.6	266.8	266.6	1,750.0	323.1	328.2	333.7	339.4	1,324.4	3,410.4
C. Right of Way Land	440.5	358.4	1,094.2	550.8	469.0	409.3	322.1	2,845.3	275.2	290.0	279.1	277.0	1,121.3	4,325.0
D. Aviation	241.9	224.3	388.4	225.0	257.1	207.3	244.4	1,322.3	251.4	258.6	266.2	274.3	1,050.6	2,597.1
E. Transit	329.4	340.8	862.6	466.1	425.4	401.9	439.6	2,595.6	462.2	471.0	480.3	490.2	1,903.6	4,840.1
F. Rail	143.4	201.5	340.2	212.6	109.1	127.7	140.8	930.5	165.4	169.6	174.0	178.8	687.9	1,819.8
G. Intermodal Access	41.6	100.5	67.8	46.8	69.8	86.1	90.4	360.8	71.9	73.8	75.8	109.9	331.3	792.6
H. Seaports	138.4	163.2	174.3	129.5	132.6	116.5	117.1	670.1	132.4	135.9	139.7	143.7	551.8	1,385.0
I. Safety	135.5	144.4	201.0	191.4	166.6	139.4	154.1	852.5	170.5	170.5	171.2	171.6	683.8	1,680.7
J. Resurfacing	542.7	522.6	671.2	617.9	877.0	939.0	980.7	4,085.8	868.6	912.4	931.3	902.9	3,615.1	8,223.4
K. Bridge	616.4	288.8	214.9	1,065.4	365.7	286.1	137.2	2,069.3	210.8	230.0	233.5	237.1	911.4	3,269.5
II. PRODUCT SUPPORT	1,654.2	1,635.6	2,239.2	1,624.0	1,398.6	1,370.9	1,533.8	**8,166.5**	1,623.5	1,469.7	1,425.1	1,392.8	5,911.1	**15,713.1**
A. Preliminary Engineering	978.6	949.3	1,244.5	855.9	755.6	687.5	775.5	4,319.1	782.5	765.5	744.1	732.7	3,024.7	8,293.1
B. Construction Eng. Inspection	379.2	419.2	588.1	477.9	386.6	409.1	489.8	2,351.6	542.0	401.0	372.8	340.7	1,656.5	4,427.2
C. Right of Way Support	88.7	80.9	147.0	94.2	76.9	83.8	80.3	482.1	76.2	79.9	79.5	84.8	320.4	883.3
D. Environmental Mitigation	29.8	13.8	35.7	14.7	3.6	10.3	3.5	67.8	8.0	7.6	7.8	8.0	31.4	113.1
E. Material & Research	42.5	44.2	48.9	46.5	47.9	49.3	50.7	243.3	52.6	54.2	56.0	57.8	220.6	508.2
F. Planning & Environment	123.0	115.9	161.1	120.5	112.9	115.3	117.9	627.8	145.5	144.0	146.8	150.0	586.2	1,329.9
G. Public Transport. Ops.	12.4	12.3	13.8	14.3	14.9	15.5	16.1	74.7	16.8	17.5	18.2	18.9	71.3	158.3
III. OPER. & MAINTENANCE	1,203.8	1,248.2	1,407.2	1,398.9	1,446.6	1,474.4	1,493.0	**7,220.1**	1,483.4	1,588.3	1,559.9	1,673.7	6,305.4	**14,773.6**
A. Operations & Maintenance	741.7	756.1	809.3	823.4	846.7	876.2	903.3	4,258.9	884.4	905.3	939.1	962.1	3,690.9	8,705.9
B. Traffic Engineering & Opers.	169.4	187.3	231.9	215.9	239.7	236.5	229.7	1,153.6	231.2	236.7	242.5	248.7	959.1	2,300.0
C. Toll Operations	292.7	304.7	366.0	359.7	360.2	361.7	360.1	1,807.6	367.8	446.3	378.3	462.9	1,655.4	3,767.8
IV. ADMINISTRATION	144.3	151.9	154.5	177.9	183.8	189.9	196.3	**902.4**	199.7	207.1	214.8	222.9	844.5	**1,898.8**
A. Administration	87.0	89.8	91.3	94.1	97.5	101.0	104.7	488.6	108.5	112.5	116.6	120.9	458.5	1,036.9
B. Fixed Capital Outlay	8.2	3.2	2.3	20.4	20.4	20.4	20.3	83.8	17.0	17.5	18.0	18.6	71.2	158.1
C. Office Information Systems	49.1	59.0	60.9	63.4	65.9	68.5	71.3	330.0	74.1	77.1	80.2	83.4	314.8	703.8
TOTAL PROGRAM	8,959.2	8,791.1	12,231.8	10,050.6	8,930.7	9,241.8	9,783.9	**50,238.8**	10,670.8	9,824.7	9,072.1	8,834.1	38,401.8	**97,431.7**
V. OTHER	177.0	183.8	223.9	290.0	388.9	453.1	487.2	**1,843.1**	496.1	482.6	478.1	474.4	1,931.1	**3,958.0**
A. Local Govt. Reimbursement	1.3	2.6	17.8	0.0	8.7	0.0	11.9	38.4	5.1	5.2	5.3	9.4	25.1	66.1
B. Other	175.8	181.2	206.1	290.0	380.2	453.1	475.3	1,804.7	490.9	477.4	472.7	464.9	1,906.0	3,891.8
TOTAL BUDGET	9,136.3	8,974.9	12,455.7	10,340.6	9,319.6	9,694.9	10,271.1	**52,081.9**	11,166.9	10,307.3	9,550.2	9,308.5	40,332.8	**101,389.6**
HIGHLIGHTS:														
1. Construction	4,449.6	4,171.1	5,274.1	5,052.9	4,273.9	4,694.6	5,040.8	24,336.3	5,833.2	4,984.2	4,276.6	3,885.8	18,979.8	47,487.2
2. FLP (w/o TD Commission)	840.3	975.4	1,773.3	1,027.2	941.2	886.8	979.6	5,608.0	1,030.5	1,056.0	1,083.1	1,144.1	4,313.8	10,897.1
3. Product Support Consultant	1,277.8	1,284.6	1,760.2	1,255.9	1,051.1	1,005.4	1,163.0	6,235.7	1,219.3	1,056.9	1,002.7	956.4	4,235.3	11,755.7
a. Preliminary Engineering	873.4	845.1	1,143.2	750.5	646.0	573.5	656.9	3,770.0	659.1	637.3	610.7	593.9	2,501.0	7,116.1
b. Construction Eng. Inspection	379.2	419.2	588.1	477.9	386.6	409.1	489.8	2,351.6	542.0	401.0	372.8	340.7	1,656.5	4,427.2
c. Right of Way Support	25.3	20.4	28.9	27.6	18.5	22.8	16.3	114.1	18.2	18.7	19.2	21.8	77.8	212.3

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WORK PROGRAM
FILE: 1-July-2018
(Excludes Hurricanes)

FLORIDA DEPARTMENT OF TRANSPORTATION
2017/18 PROGRAM AND RESOURCE PLAN SUMMARY
FISCAL YEARS 2018/19 TO 2026/27
(MILLIONS OF $)

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	ACTUAL	PLAN	First Five Years						Next Four Years					10 YR.
PROGRAM AREAS	16/17	17/18	18/19	19/20	20/21	21/22	22/23	TOTAL	23/24	24/25	25/26	26/27	TOTAL	TOTAL
I. PRODUCT	5,957.0	5,755.4	8,430.9	6,849.9	5,901.7	6,206.6	6,560.7	**33,949.8**	7,364.3	6,559.6	5,872.3	5,544.7	25,340.9	**65,046.1**
A. State Highway System (SHS)	3,023.9	3,075.0	3,868.6	2,984.1	2,720.8	3,226.5	3,667.6	**16,467.7**	4,432.7	3,519.6	2,787.6	2,419.8	13,159.7	**32,702.3**
1.Interstate Construction	1,102.5	1,658.7	864.4	1,914.0	992.7	1,072.0	1,436.2	6,279.3	1,371.4	1,386.7	1,194.7	1,667.5	5,620.3	13,558.3
2.Turnpike	293.6	447.9	807.4	182.8	666.9	885.3	859.7	3,402.0	2,119.5	1,000.9	348.6	58.6	3,527.7	7,377.6
3.Other State Highway System	1,529.2	892.6	2,101.0	830.9	1,007.6	1,215.0	1,324.6	6,479.1	884.3	1,073.0	1,183.7	631.5	3,772.5	11,144.2
4.SHS Traffic Operations	98.6	75.8	95.8	56.5	53.7	54.1	47.1	307.2	57.5	59.0	60.5	62.2	239.2	622.2
B. Other Roads	303.2	336.0	547.8	360.2	308.6	266.8	266.6	**1,750.0**	323.1	328.2	333.7	339.4	1,324.4	**3,410.4**
1.Other Traffic Operations	0.0	0.5	2.1	0.0	0.4	0.0	0.0	2.5	0.5	0.5	0.5	0.5	1.9	4.9
2.Construction	160.3	171.9	359.8	224.2	173.5	133.7	131.2	1,022.3	182.5	183.7	185.0	186.4	737.6	1,931.8
3.County Trans. Programs	142.8	138.6	185.9	136.0	134.6	133.2	135.4	725.2	140.1	144.0	148.2	152.6	584.9	1,448.7
4.Economic Development	0.0	25.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	25.0
C. Right of Way Land	440.5	358.4	1,094.2	550.8	469.0	409.3	322.1	**2,845.3**	275.2	290.0	279.1	277.0	1,121.3	**4,325.0**
1.State Highway System	343.9	250.0	886.7	409.9	375.3	389.3	289.1	2,350.4	234.5	244.8	243.8	241.6	964.6	3,565.0
2.Other Roads	18.4	20.8	49.6	19.8	8.2	14.5	27.0	119.0	26.5	30.7	20.4	20.0	97.7	237.5
3.SHS Advance Corridor	78.2	87.4	157.9	121.1	85.5	5.4	6.0	375.9	14.2	14.5	14.9	15.3	59.0	522.3
4.Other Advance Corridor	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
D. Aviation	241.9	224.3	388.4	225.0	257.1	207.3	244.4	**1,322.3**	251.4	258.6	266.2	274.3	1,050.6	**2,597.1**
1.Airport Improvement	177.1	148.6	236.4	144.6	159.8	138.7	172.2	851.7	155.6	160.0	164.7	169.6	649.9	1,650.2
2.Land Acquisition	0.5	6.9	1.2	1.3	0.1	1.9	0.0	4.5	0.8	0.9	0.9	0.9	3.5	14.9
3.Planning	31.3	36.1	100.1	44.3	59.7	37.9	41.4	283.4	58.5	60.2	62.0	63.9	244.5	564.0
4.Discretionary Capacity	33.0	32.6	50.7	34.8	37.6	28.7	30.8	182.7	36.5	37.6	38.7	39.9	152.7	368.0
E. Transit	329.4	340.8	862.6	466.1	425.4	401.9	439.6	**2,595.6**	462.2	471.0	480.3	490.2	1,903.6	**4,840.1**
1.Transit Systems	129.5	121.8	304.5	191.5	153.0	112.1	140.6	901.8	158.2	160.8	163.6	166.6	649.3	1,672.8
2.Trans.Disad.-Department	19.4	16.5	46.5	24.5	24.3	25.0	25.8	146.0	27.1	27.2	27.3	27.4	109.1	271.7
3.Trans.Disad.-Commission	54.4	54.9	59.9	52.8	52.8	52.8	52.8	271.3	52.8	52.8	52.8	52.8	211.4	537.5
4.Other	13.9	15.0	44.5	33.6	45.8	54.7	55.2	233.8	46.1	47.1	48.1	49.2	190.6	439.4
5.Block Grants	92.8	95.4	99.9	103.3	108.3	114.4	119.6	545.6	108.9	112.1	115.4	119.0	455.5	1,096.5
6.New Starts Transit	19.4	37.2	307.3	60.4	41.1	42.8	45.6	497.2	69.0	70.9	72.9	75.0	287.7	822.2
F. Rail	143.4	201.5	340.2	212.6	109.1	127.7	140.8	**930.5**	165.4	169.6	174.0	178.8	687.9	**1,819.8**
1.High Speed Rail	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2.Passenger Service	123.2	187.5	326.5	200.4	98.9	117.5	130.6	873.9	154.7	158.9	163.3	168.0	644.9	1,706.4
3.Rail/Highway Crossings	15.8	13.2	12.2	11.4	9.4	9.4	9.4	51.9	9.9	9.9	9.9	9.9	39.5	104.5
4.Rail Capital Imp./Rehab.	4.4	0.7	1.4	0.8	0.8	0.8	0.8	4.7	0.8	0.8	0.9	0.9	3.4	8.8
G. Intermodal Access	41.6	100.5	67.8	46.8	69.8	86.1	90.4	**360.8**	71.9	73.8	75.8	109.9	331.3	**792.6**
H. Seaport Development	138.4	163.2	174.3	129.5	132.6	116.5	117.1	**670.1**	132.4	135.9	139.7	143.7	551.8	**1,385.0**

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WORK PROGRAM
FILE: 1-July-2018
(Excludes Hurricanes)

FLORIDA DEPARTMENT OF TRANSPORTATION
2017/18 PROGRAM AND RESOURCE PLAN SUMMARY
FISCAL YEARS 2018/19 TO 2026/27
(MILLIONS OF $)

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PROGRAM AREAS	ACTUAL 16/17	PLAN 17/18	First Five Years 18/19	19/20	20/21	21/22	22/23	TOTAL	Next Four Years 23/24	24/25	25/26	26/27	TOTAL	10 YR. TOTAL
I. Safety	135.5	144.4	201.0	191.4	166.6	139.4	154.1	**852.5**	170.5	170.5	171.2	171.6	683.8	**1,680.7**
1.Highway Safety	106.3	112.4	157.5	161.3	136.4	109.4	124.2	688.8	138.1	138.1	138.7	139.1	554.0	1,355.2
2.Rail/Highway Crossings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3.Grants	29.3	32.0	43.5	30.1	30.2	30.0	30.0	163.7	32.4	32.4	32.4	32.4	129.8	325.5
J. Resurfacing	542.7	522.6	671.2	617.9	877.0	939.0	980.7	**4,085.8**	868.6	912.4	931.3	902.9	3,615.1	**8,223.4**
1.Interstate	173.6	88.8	94.3	114.7	178.1	237.6	264.5	889.3	264.7	297.9	305.6	265.1	1,133.3	2,111.4
2.Arterial & Freeway	329.3	331.6	448.5	400.2	600.6	625.3	646.1	2,720.7	532.0	542.6	553.8	565.8	2,194.2	5,246.5
3.Off-System	1.2	0.0	7.0	1.0	1.0	0.0	0.0	9.1	1.8	1.8	1.8	1.8	7.3	16.3
4.Turnpike	38.5	102.2	121.3	102.0	97.2	76.1	70.1	466.6	70.1	70.1	70.1	70.1	280.4	849.3
K. Bridge	616.4	288.8	214.9	1,065.4	365.7	286.1	137.2	**2,069.3**	210.8	230.0	233.5	237.1	911.4	**3,269.5**
1.Repair-On System	125.1	91.9	118.2	104.0	80.2	81.7	85.9	469.9	86.7	89.1	91.7	94.4	361.9	923.7
2.Replace-On System	438.5	147.9	63.0	895.0	257.8	167.3	16.9	1,400.0	102.9	120.9	121.8	122.7	468.3	2,016.3
3.Local Bridge	49.3	48.5	32.3	41.4	14.8	33.9	31.2	153.6	16.8	16.8	16.8	16.8	67.1	269.2
4.Turnpike	3.5	0.4	1.5	25.0	12.9	3.2	3.2	45.8	4.5	3.2	3.2	3.2	14.1	60.3
II. PRODUCT SUPPORT	1,654.2	1,635.6	2,239.2	1,624.0	1,398.6	1,370.9	1,533.8	**8,166.5**	1,623.5	1,469.7	1,425.1	1,392.8	5,911.1	**15,713.1**
A.Preliminary Engineering	978.6	949.3	1,244.5	855.9	755.6	687.5	775.5	**4,319.1**	782.5	765.5	744.1	732.7	3,024.7	**8,293.1**
1.In-House	105.2	104.2	101.4	105.4	109.6	114.0	118.6	549.1	123.3	128.3	133.4	138.7	523.7	1,177.0
2.Consultant	873.4	845.1	1,143.2	750.5	646.0	573.5	656.9	3,770.0	659.1	637.3	610.7	593.9	2,501.0	7,116.1
B.Construction Eng. Inspection	379.2	419.2	588.1	477.9	386.6	409.1	489.8	**2,351.6**	542.0	401.0	372.8	340.7	1,656.5	**4,427.2**
1.In-House	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2.Consultant	379.2	419.2	588.1	477.9	386.6	409.1	489.8	2,351.6	542.0	401.0	372.8	340.7	1,656.5	4,427.2
C.Right of Way Support	88.7	80.9	147.0	94.2	76.9	83.8	80.3	**482.1**	76.2	79.9	79.5	84.8	320.4	**883.3**
1.In-House	26.8	27.4	27.6	28.8	29.9	31.1	32.3	149.7	33.6	35.0	36.4	37.8	142.8	320.0
2.OPS	36.7	33.0	90.4	37.8	28.5	29.8	31.6	218.3	24.4	26.2	23.9	25.2	99.7	351.0
3.Consultant	25.3	20.4	28.9	27.6	18.5	22.8	16.3	114.1	18.2	18.7	19.2	21.8	77.8	212.3
D.Environmental Mitigation	29.8	13.8	35.7	14.7	3.6	10.3	3.5	**67.8**	8.0	7.6	7.8	8.0	31.4	**113.1**
E.Materials & Research	42.5	44.2	48.9	46.5	47.9	49.3	50.7	**243.3**	52.6	54.2	56.0	57.8	220.6	**508.2**
1.In-House	29.6	29.4	30.9	32.2	33.5	34.8	36.2	167.6	37.6	39.2	40.7	42.3	159.9	356.9
2.Applied Research	12.9	14.9	17.9	14.3	14.5	14.5	14.5	75.7	14.9	15.1	15.3	15.5	60.7	151.3
3.Consultants/Grants	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
F.Planning & Environment	123.0	115.9	161.1	120.5	112.9	115.3	117.9	**627.8**	145.5	144.0	146.8	150.0	586.2	**1,329.9**
1.In-House	25.1	27.3	33.0	34.3	35.7	37.1	38.6	178.6	40.1	41.7	43.4	45.1	170.3	376.2
2.Consultants/Grants	97.9	88.5	128.2	86.2	77.2	78.2	79.4	449.2	105.3	102.3	103.4	104.9	415.9	953.6
G.Public Transport. Ops.	12.4	12.3	13.8	14.3	14.9	15.5	16.1	**74.7**	16.8	17.5	18.2	18.9	71.3	**158.3**

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PROGRAM AREAS	ACTUAL 16/17	PLAN 17/18	First Five Years 18/19	19/20	20/21	21/22	22/23	TOTAL	Next Four Years 23/24	24/25	25/26	26/27	TOTAL	10 YR. TOTAL
III. OPER. & MAINTENANCE	1,203.8	1,248.2	1,407.2	1,398.9	1,446.6	1,474.4	1,493.0	**7,220.1**	1,483.4	1,588.3	1,559.9	1,673.7	6,305.4	**14,773.6**
A. Operations & Maintenance	741.7	756.1	809.3	823.4	846.7	876.2	903.3	**4,258.9**	884.4	905.3	939.1	962.1	3,690.9	**8,705.9**
1.In-House	229.0	232.7	229.2	238.3	247.9	257.8	268.1	1,241.3	278.8	290.0	301.6	313.6	1,184.0	2,658.1
2.M&O Contracts	489.0	495.1	543.1	556.2	571.5	589.5	607.7	2,868.1	577.5	592.4	608.6	624.8	2,403.3	5,766.5
3.Consultants/Contracts	23.7	28.3	37.0	28.8	27.4	28.9	27.4	149.5	28.0	22.9	28.9	23.7	103.6	281.3
B. Traffic Engineering & Opers.	169.4	187.3	231.9	215.9	239.7	236.5	229.7	**1,153.6**	231.2	236.7	242.5	248.7	959.1	**2,300.0**
1.In-House	24.6	25.0	24.9	25.9	26.9	28.0	29.1	134.9	30.3	31.5	32.8	34.1	128.7	288.6
2.Consultants/Grants	144.8	162.3	207.0	189.9	212.7	208.5	200.6	1,018.7	200.9	205.2	209.7	214.6	830.4	2,011.4
C. Toll Operations	292.7	304.7	366.0	359.7	360.2	361.7	360.1	**1,807.6**	367.8	446.3	378.3	462.9	1,655.4	**3,767.8**
1.In-House	34.7	32.4	31.5	32.8	34.1	35.5	36.9	170.8	38.4	39.9	41.5	43.1	162.9	366.1
2.Ops. Contracts/Transfers	178.6	202.0	243.0	245.6	248.8	252.9	255.9	1,246.3	256.3	257.3	259.3	261.3	1,034.2	2,482.5
3.Consultants/Contracts	79.4	70.4	91.5	81.3	77.2	73.3	67.3	390.5	73.1	149.1	77.6	158.5	458.3	919.2
IV. ADMINISTRATION	144.3	151.9	154.5	177.9	183.8	189.9	196.3	**902.4**	199.7	207.1	214.8	222.9	844.5	**1,898.8**
A. Administration	87.0	89.8	91.3	94.1	97.5	101.0	104.7	**488.6**	108.5	112.5	116.6	120.9	458.5	**1,036.9**
1.In-House	79.8	80.9	81.6	84.9	88.3	91.8	95.5	441.9	99.3	103.2	107.4	111.7	421.6	944.4
2.Contractual Services	7.2	8.9	9.7	9.2	9.2	9.2	9.2	46.7	9.2	9.2	9.2	9.2	36.9	92.5
B. Fixed Capital Outlay	8.2	3.2	2.3	20.4	20.4	20.4	20.3	**83.8**	17.0	17.5	18.0	18.6	71.2	**158.1**
1.Construction	7.4	2.2	1.7	19.9	19.9	19.9	19.9	81.2	16.5	17.0	17.5	18.0	69.0	152.4
2.Design Consultants	0.8	1.0	0.6	0.5	0.5	0.5	0.5	2.6	0.5	0.5	0.5	0.6	2.1	5.7
C. Office Information Systems	49.1	59.0	60.9	63.4	65.9	68.5	71.3	**330.0**	74.1	77.1	80.2	83.4	314.8	**703.8**
TOTAL PROGRAM	8,959.2	8,791.1	12,231.8	10,050.6	8,930.7	9,241.8	9,783.9	**50,238.8**	10,670.8	9,824.7	9,072.1	8,834.1	38,401.8	**97,431.7**
V. OTHER	177.0	183.8	223.9	290.0	388.9	453.1	487.2	**1,843.1**	496.1	482.6	478.1	474.4	1,931.1	**3,958.0**
A. Local Govt. Reimbursement	1.3	2.6	17.8	0.0	8.7	0.0	11.9	38.4	5.1	5.2	5.3	9.4	25.1	66.1
B. Central Mobile Equipment	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C. Miscellaneous	175.8	181.2	209.1	290.0	380.2	453.1	475.3	1,807.7	490.9	477.4	472.7	464.9	1,906.0	3,894.8
D. Offset-Administered Funds	0.0	0.0	(3.0)	0.0	0.0	0.0	0.0	(3.0)	0.0	0.0	0.0	0.0	0.0	(3.0)
TOTAL BUDGET	9,136.3	8,974.9	12,455.7	10,340.6	9,319.6	9,694.9	10,271.1	**52,081.9**	11,166.9	10,307.3	9,550.2	9,308.5	40,332.8	**101,389.6**

Appendix B: Historical Program and Resource Plans FY2008/09 to FY2017/18

18-HISTORY
PROGRAM PLAN HISTORY

PROGRAM AND RESOURCE PLAN SUMMARY
FISCAL YEARS 2008/09 TO 2017/18
($ IN MILLIONS)

PROGRAM AREAS	08-09	09-10	10-11	11-12	12-13	13-14	14-15	15-16	16-17	17-18
I. PRODUCT	3618.0	3475.0	3837.1	4484.6	4342.1	5691.4	5817.0	5746.5	5957.0	5755.4
A. Intrastate** - Exp.	***819.9***	***1080.1***	***1295.5***	***1217.0***	***2054.5***	***3134.0***				
B. Other Arterials** - Exp.	***729.3***	***647.6***	***471.6***	***747.2***	***239.0***	***395.0***				
A. State Highway System (SHS)							3,082.1	2,883.9	3023.9	3075.0
B. Other Roads							350.8	275.4	303.2	336.0
C. Right Of Way	378.1	206.6	148.1	240.1	253.1	342.1	385.8	421.3	440.5	358.4
D. Aviation	205.0	160.6	121.9	190.7	181.4	181.6	320.9	349.6	241.9	224.3
E. Transit	306.1	299.9	346.8	497.5	338.7	376.3	449.7	507.1	329.4	340.8
F. Rail	100.8	58.8	275.6	330.4	71.5	113.4	177.5	119.9	143.4	201.5
G. Intermodal Access	93.2	49.3	57.1	146.6	99.7	36.0	35.3	86.0	41.6	100.5
H. Ports	53.5	46.9	52.3	118.2	113.9	259.9	134.2	106.2	138.4	163.2
I. Safety	71.5	136.6	130.5	117.3	110.8	136.6	121.8	154.3	135.5	144.4
J. Resurfacing	608.0	545.4	581.7	523.8	525.9	455.8	570.8	612.7	542.7	522.6
K. Bridge	252.6	243.1	356.0	355.8	353.5	260.7	187.9	230.3	616.4	288.8
L. Trans. Outreach Prog.										
II. PRODUCT SUPPORT	1076.9	1031.4	1096.9	1327.3	1375.6	1360.0	1479.2	1640.5	1654.2	1635.6
A. Prel. Eng.	563.3	557.7	593.8	790.1	758.3	721.6	831.5	931.7	978.6	949.3
B. Const Eng Insp.	278.5	250.7	289.4	304.7	368.0	343.0	365.9	427.8	379.2	419.2
C. R/W Support	61.0	55.3	54.5	63.9	72.7	77.8	77.0	96.2	88.7	80.9
D. Environ. Mitigation	30.9	22.4	8.9	20.3	9.3	42.0	41.8	27.1	29.8	13.8
E. Material & Res.	37.6	42.5	43.9	41.0	39.3	43.8	40.1	42.0	42.5	44.2
F. Planning	94.7	91.6	94.1	97.1	116.3	119.1	110.6	103.7	123.0	115.9
G. Pub. Trans Oper./FLP	10.8	11.1	12.4	10.2	11.8	12.8	12.3	12.0	12.4	12.3
III. OPERAT.& MAINT.	875.8	1052.9	1046.7	890.8	970.3	942.2	1076.2	1133.8	1203.8	1248.2
A. Routine Maint.	571.5	655.8	676.1	610.0	636.4	641.2	694.6	723.3	741.7	756.1
B. Traffic Eng.	73.1	71.6	75.0	81.8	82.1	100.1	124.0	141.2	169.4	187.3
C. Toll/Turnpike Ops.	194.9	286.6	254.5	166.9	223.2	192.6	257.6	269.4	292.7	304.7
D. Motor Carr. Comp.	36.3	38.8	41.2	32.0	28.6	8.2				
IV. ADMINISTRATION	143.6	138.2	147.2	116.0	123.9	137.9	143.2	150.3	144.3	151.9
A. Admin.	105.8	105.4	96.2	78.3	80.4	81.9	85.3	86.0	87.0	89.8
B. Fixed Capital	7.9	8.1	9.4	2.1	5.6	16.3	16.5	18.2	8.2	3.2
C. Office Info Sys.	29.8	24.6	41.5	35.6	37.8	39.7	41.4	46.0	49.1	59.0
TOTAL PROGRAM	5714.2	5697.5	6127.9	6818.7	6811.8	8131.5	8515.6	8671.1	8959.2	8791.1
V. OTHER	200.2	207.2	203.0	206.1	200.5	177.6	172.8	178.4	177.0	183.8
A. Local Govt. Reimb.	64.3	49.3	45.1	22.4	39.2	12.0	0.8	1.0	1.3	2.6
B. Off Information Systems** - Exp.										
C. Other** - Exp.										
B. Other	135.8	157.9	157.9	183.7	161.3	165.6	172.0	177.4	175.8	181.2
TOTAL BUDGET	5914.3	5904.7	6330.9	7024.9	7012.3	8309.1	8688.4	8849.5	9136.3	8974.9
HIGHLIGHTS:										
1. Hwy & Br(incl R/W)	2859.5	2859.4	2983.4	3201.2	3536.8	4724.2	4699.3	4577.9	5062.2	4725.1
2. Construction	2342.8	2500.1	2720.5	2858.3	3171.0	4194.1	4129.6	3967.0	4449.6	4171.1
3. PTO Total (W/O TDC)	651.6	513.1	751.7	1181.3	696.9	855.6	1054.0	1117.8	840.3	975.4
4. Prod.Supt.Consult	755.4	722.2	794.2	1021.1	1040.8	984.0	1111.7	1281.9	1277.8	1284.6
5. Program less Trnpk.	5199.7	5232.7	5813.9	6264.5	5701.9	7378.8	7495.4	7782.7	8075.2	7679.0
6. Cash Balance	411.8	312.0	437.3	558.9	710.8	1167.9	677.8	630.4	347.7	462.8

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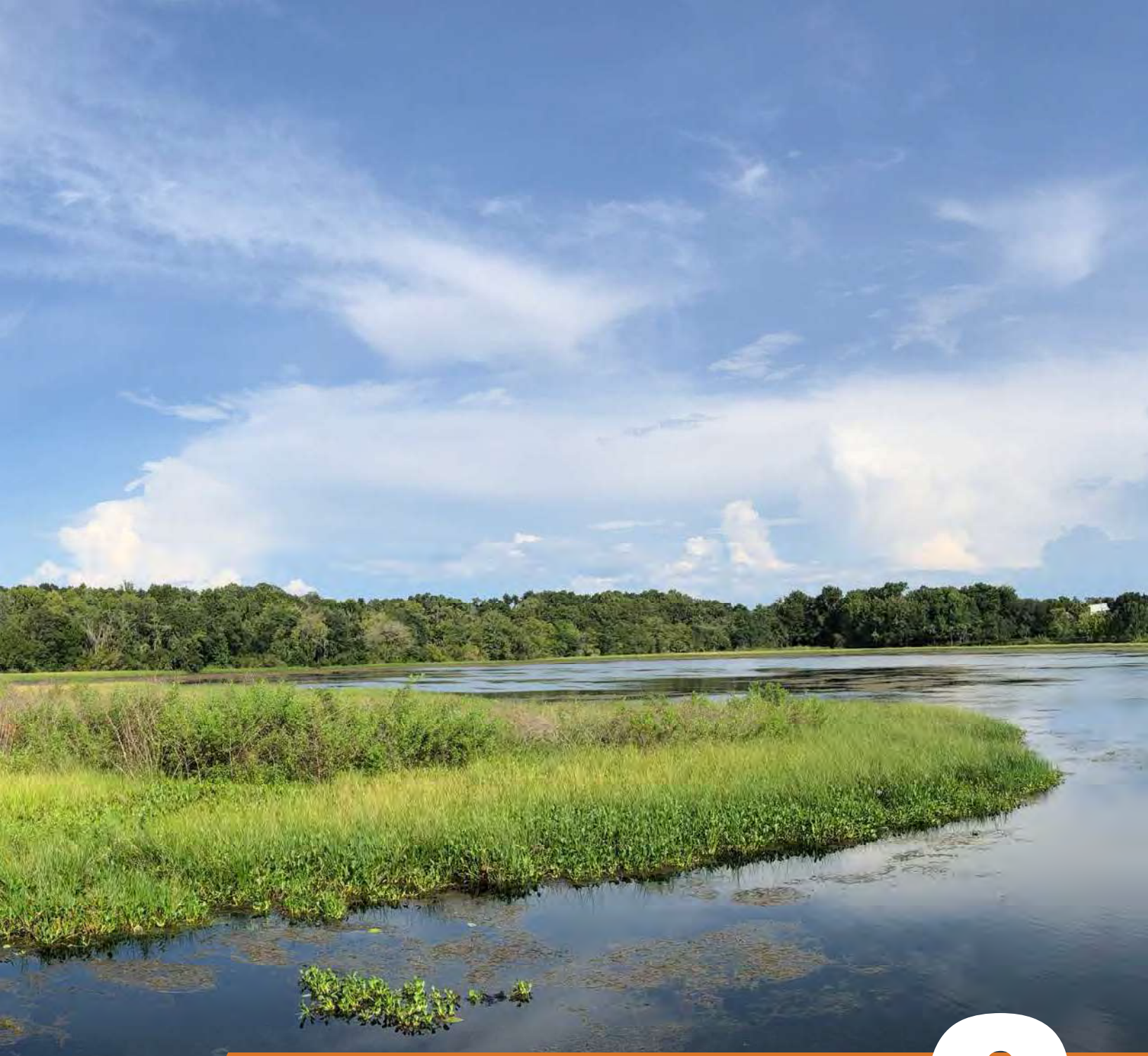

Appendix C

2045 HERNANDO/CITRUS SOCIO-ECONOMIC FORECAST DATA

Appendix C1:
Hernando Population and Dwelling Unit Forecast 2015 to 2045

TAZ	Planning Area	Household Population							Dwelling Units						
		2015	2020	2025	2030	2035	2040	2045	2015	2020	2025	2030	2035	2040	2045
2501	2	150	184	214	242	270	296	322	80	98	114	129	144	158	172
2502	2	1,754	2,060	2,329	2,584	2,832	3,065	3,298	1,116	1,311	1,482	1,644	1,802	1,950	2,098
2503	1	1,683	1,907	2,103	2,288	2,468	2,637	2,806	1,038	1,176	1,297	1,411	1,522	1,626	1,730
2504	1	696	724	748	771	793	813	833	612	637	658	678	697	715	733
2505	1	664	671	677	683	689	694	699	585	591	596	601	606	610	614
2506	1	661	678	693	708	721	734	747	344	353	361	369	376	383	390
2507	1	1,597	1,644	1,685	1,724	1,761	1,797	1,833	1,023	1,053	1,079	1,104	1,128	1,151	1,174
2508	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2509	1	1,216	1,266	1,310	1,352	1,394	1,432	1,470	580	604	625	645	665	683	701
2510	1	705	761	810	857	902	946	990	404	436	464	491	517	542	567
2511	1	6	6	6	6	6	6	6	4	4	4	4	4	4	4
2512	1	1,109	1,127	1,143	1,159	1,175	1,188	1,201	494	502	509	516	523	529	535
2513	1	916	930	942	952	962	972	982	468	475	481	486	491	496	501
2514	1	4	133	243	349	451	550	645	1	35	64	92	119	145	170
2515	1	385	392	398	404	410	416	420	270	275	279	283	287	291	294
2516	1	119	119	119	119	119	119	119	97	97	97	97	97	97	97
2517	1	114	159	198	236	273	308	343	81	113	141	168	194	219	244
2518	1	522	526	530	534	537	540	543	363	366	369	372	374	376	378
2519	2	540	1,514	2,374	3,191	3,988	4,742	5,496	250	701	1,099	1,477	1,846	2,195	2,544
2520	2	61	94	122	148	174	198	222	28	43	56	68	80	91	102
2521	5	26	87	141	191	241	288	335	15	50	81	110	139	166	193
2522	2	501	547	586	623	658	693	728	229	250	268	285	301	317	333
2523	2	356	356	356	356	356	356	356	172	172	172	172	172	172	172
2524	5	397	397	397	397	397	397	397	164	164	164	164	164	164	164
2525	5	102	102	102	102	102	102	102	47	47	47	47	47	47	47
2526	2	236	523	775	1,013	1,244	1,464	1,684	102	226	335	438	538	633	728
2527	2	647	662	675	686	697	708	719	304	311	317	322	327	332	337
2528	2	109	109	109	109	109	109	109	45	45	45	45	45	45	45
2529	2	410	701	956	1,197	1,431	1,653	1,873	196	335	457	572	684	790	895
2530	2	1,142	1,605	2,010	2,392	2,765	3,118	3,469	508	714	894	1,064	1,230	1,387	1,543
2531	2	1,201	1,201	1,201	1,201	1,201	1,201	1,201	500	500	500	500	500	500	500
2532	2	181	181	181	181	181	181	181	75	75	75	75	75	75	75
2533	5	303	303	303	303	303	303	303	122	122	122	122	122	122	122
2534	5	300	357	408	454	500	544	588	136	162	185	206	227	247	267
2535	5	108	345	553	751	943	1,125	1,304	41	131	210	285	358	427	495
2536	2	93	244	377	502	624	738	852	35	92	142	189	235	278	321
2537	2	50	97	139	178	217	253	289	18	35	50	64	78	91	104
2538	2	-	117	221	318	413	501	589	-	52	98	141	183	222	261
2539	2	859	859	859	859	859	859	859	348	348	348	348	348	348	348
2540	2	387	387	387	387	387	387	387	153	153	153	153	153	153	153
2541	5	298	298	298	298	298	298	298	134	134	134	134	134	134	134
2542	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2543	2	970	1,176	1,357	1,527	1,694	1,852	2,008	541	656	757	852	945	1,033	1,120
2544	2	-	377	707	1,019	1,322	1,607	1,892	-	168	315	454	589	716	843
2545	1	403	469	549	625	697	765	833	195	241	282	321	358	393	428
2546	1	242	228	228	228	228	228	228	102	102	102	102	102	102	102
2547	1	393	384	394	402	410	418	426	144	149	153	156	159	162	165
2548	1	95	95	95	95	95	95	95	42	42	42	42	42	42	42
2549	1	258	258	258	258	258	258	258	91	91	91	91	91	91	91
2550	1	657	657	657	657	657	657	657	301	301	301	301	301	301	301
2551	1	319	319	319	319	319	319	319	127	127	127	127	127	127	127
2552	1	646	664	680	694	708	722	736	330	339	347	354	361	368	375
2553	1	1,768	1,786	1,799	1,812	1,825	1,838	1,850	1,197	1,209	1,218	1,227	1,236	1,245	1,253
2554	1	141	186	223	260	295	327	359	57	75	90	105	119	132	145
2555	5	91	91	91	91	91	91	91	33	33	33	33	33	33	33
2556	4	569	732	874	1,010	1,141	1,263	1,385	252	324	387	447	505	559	613
2557	4	30	184	319	447	571	689	807	14	86	149	209	267	322	377

Appendix C1:
Hernando Population and Dwelling Unit Forecast 2015 to 2045

TAZ	Planning Area	Household Population							Dwelling Units						
		2015	2020	2025	2030	2035	2040	2045	2015	2020	2025	2030	2035	2040	2045
2558	4	-	211	395	570	741	900	1,059	-	94	176	254	330	401	472
2559	4	96	392	651	897	1,135	1,360	1,585	50	204	339	467	591	708	825
2560	1	479	498	539	578	617	654	691	219	242	262	281	300	318	336
2561	1	433	515	608	697	784	865	946	197	249	294	337	379	418	457
2562	1	2	6	10	14	18	22	26	1	3	5	7	9	11	13
2563	1	751	863	996	1,121	1,244	1,359	1,474	284	345	398	448	497	543	589
2564	1	-	36	68	97	126	153	180	-	16	30	43	56	68	80
2565	1	18	249	453	645	831	1,008	1,182	6	83	151	215	277	336	394
2566	1	-	13	24	35	46	57	68	-	6	11	16	21	26	31
2567	1	2,138	2,157	2,172	2,187	2,202	2,216	2,230	1,658	1,673	1,685	1,697	1,709	1,720	1,731
2568	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2569	1	256	371	470	565	658	744	830	116	168	213	256	298	337	376
2570	1	13	13	13	13	13	13	13	7	7	7	7	7	7	7
2571	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2572	1	6	6	6	6	6	6	6	2	2	2	2	2	2	2
2573	1	1,840	1,847	1,854	1,861	1,868	1,874	1,880	1,246	1,251	1,256	1,261	1,266	1,270	1,274
2574	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2575	1	25	27	27	27	27	27	27	11	12	12	12	12	12	12
2576	4	269	269	269	269	269	269	269	186	186	186	186	186	186	186
2577	4	227	227	227	227	227	227	227	110	110	110	110	110	110	110
2578	4	200	206	210	214	218	222	226	100	103	105	107	109	111	113
2579	4	41	54	66	77	88	98	108	55	72	88	103	118	131	144
2580	5	81	631	1,117	1,579	2,029	2,455	2,881	34	265	469	663	852	1,031	1,210
2581	5	166	304	424	539	651	758	865	65	119	166	211	255	297	339
2582	5	-	61	115	167	217	264	311	-	27	51	74	96	117	138
2583	5	8	424	792	1,141	1,482	1,802	2,122	3	159	297	428	556	676	796
2584	5	445	450	455	460	465	467	469	188	190	192	194	196	197	198
2585	5	146	146	146	146	146	146	146	57	57	57	57	57	57	57
2586	6	1,018	1,020	1,020	1,020	1,020	1,020	1,020	542	543	543	543	543	543	543
2587	5	210	210	210	210	210	210	210	91	91	91	91	91	91	91
2588	5	1,130	1,413	1,662	1,897	2,126	2,344	2,560	571	714	840	959	1,075	1,185	1,294
2589	5	394	400	404	408	412	416	420	210	213	215	217	219	221	223
2590	6	1,342	1,429	1,506	1,578	1,648	1,715	1,782	540	575	606	635	663	690	717
2591	6	605	605	605	605	605	605	605	293	293	293	293	293	293	293
2592	6	2,389	2,792	3,147	3,483	3,812	4,122	4,432	995	1,163	1,311	1,451	1,588	1,717	1,846
2593	6	147	147	147	147	147	147	147	57	57	57	57	57	57	57
2594	4	536	633	717	797	877	950	1,023	438	517	586	651	716	776	836
2595	6	785	940	1,076	1,206	1,332	1,452	1,572	381	456	522	585	646	704	762
2596	6	517	517	517	517	517	517	517	232	232	232	232	232	232	232
2597	6	1,737	1,826	1,904	1,977	2,050	2,120	2,190	644	677	706	733	760	786	812
2598	6	346	452	546	634	722	803	884	166	217	262	304	346	385	424
2599	6	8	48	83	116	149	180	211	6	36	62	87	112	135	158
2600	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2601	1	1,348	1,417	1,475	1,531	1,585	1,637	1,689	628	660	687	713	738	762	786
2602	1	10	10	10	10	10	10	10	4	4	4	4	4	4	4
2603	1	353	355	357	359	361	363	365	213	214	215	216	217	218	219
2604	1	2,510	2,549	2,583	2,614	2,643	2,672	2,701	1,039	1,055	1,069	1,082	1,094	1,106	1,118
2605	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2606	1	-	29	54	79	102	125	148	-	13	24	35	45	55	65
2607	1	970	1,026	1,075	1,122	1,167	1,209	1,251	414	438	459	479	498	516	534
2608	1	47	51	55	59	63	65	67	24	26	28	30	32	33	34
2609	1	130	134	138	142	146	150	154	62	64	66	68	70	72	74
2610	1	566	573	580	584	588	592	596	260	263	266	268	270	272	274
2611	1	50	50	50	50	50	50	50	29	29	29	29	29	29	29
2612	1	160	160	160	160	160	160	160	98	98	98	98	98	98	98
2613	1	246	246	246	246	246	246	246	103	103	103	103	103	103	103
2614	4	15	14	14	14	14	14	14	6	6	6	6	6	6	6

Appendix C1:
Hernando Population and Dwelling Unit Forecast 2015 to 2045

TAZ	Planning Area	Household Population							Dwelling Units						
		2015	2020	2025	2030	2035	2040	2045	2015	2020	2025	2030	2035	2040	2045
2615	4	416	416	416	416	416	416	416	192	192	192	192	192	192	192
2616	4	385	385	385	385	385	385	385	170	170	170	170	170	170	170
2617	1	1,194	1,225	1,252	1,279	1,304	1,329	1,354	535	549	561	573	584	595	606
2618	1	1,014	1,037	1,056	1,075	1,092	1,109	1,126	528	540	550	560	569	578	587
2619	1	4,281	4,342	4,395	4,445	4,493	4,539	4,585	1,956	1,984	2,008	2,031	2,053	2,074	2,095
2620	1	2,103	2,146	2,184	2,220	2,256	2,289	2,320	879	897	913	928	943	957	970
2621	1	2,281	2,354	2,417	2,478	2,537	2,591	2,645	971	1,002	1,029	1,055	1,080	1,103	1,126
2622	1	1,230	1,284	1,331	1,374	1,417	1,457	1,497	549	573	594	613	632	650	668
2623	1	1,365	1,459	1,540	1,616	1,690	1,761	1,832	536	573	605	635	664	692	720
2624	1	2,248	2,481	2,687	2,879	3,068	3,246	3,422	819	904	979	1,049	1,118	1,183	1,247
2625	1	1,645	1,666	1,685	1,702	1,719	1,736	1,753	846	857	867	876	885	894	903
2626	3	1,601	1,708	1,802	1,891	1,978	2,058	2,138	701	748	789	828	866	901	936
2627	4	533	609	676	739	802	860	916	237	271	301	329	357	383	408
2628	4	701	1,229	1,691	2,127	2,552	2,952	3,350	396	694	955	1,201	1,441	1,667	1,892
2629	4	12	106	190	269	344	416	486	7	62	111	157	201	243	284
2630	1	1,410	1,421	1,430	1,439	1,448	1,457	1,466	631	636	640	644	648	652	656
2631	1	829	853	875	895	915	933	951	408	420	431	441	451	460	469
2632	1	1,782	1,802	1,820	1,836	1,852	1,866	1,880	877	887	896	904	912	919	926
2633	1	1,727	1,953	2,153	2,341	2,525	2,697	2,869	855	967	1,066	1,159	1,250	1,335	1,420
2634	1	2,356	2,568	2,753	2,928	3,099	3,260	3,419	1,158	1,262	1,353	1,439	1,523	1,602	1,680
2635	1	4,020	4,190	4,339	4,481	4,618	4,746	4,874	1,725	1,798	1,862	1,923	1,982	2,037	2,092
2636	1	507	777	1,014	1,236	1,454	1,657	1,860	212	325	424	517	608	693	778
2637	1	4,106	4,233	4,345	4,450	4,552	4,650	4,748	1,684	1,736	1,782	1,825	1,867	1,907	1,947
2638	1	498	499	523	546	569	590	611	311	330	346	361	376	390	404
2639	3	1,254	1,327	1,390	1,451	1,510	1,566	1,620	536	567	594	620	645	669	692
2640	3	16	89	153	213	271	326	381	11	61	105	146	186	224	262
2641	1	1,584	1,635	1,681	1,725	1,767	1,805	1,843	831	858	882	905	927	947	967
2642	1	1,670	1,693	1,714	1,733	1,752	1,769	1,786	875	887	898	908	918	927	936
2643	1	246	246	246	246	246	246	246	208	208	208	208	208	208	208
2644	1	1,968	1,995	2,018	2,041	2,064	2,085	2,106	942	955	966	977	988	998	1,008
2645	1	1,525	1,528	1,531	1,532	1,533	1,534	1,535	1,166	1,168	1,170	1,171	1,172	1,173	1,174
2646	1	1,762	1,768	1,773	1,778	1,783	1,788	1,793	1,118	1,122	1,125	1,128	1,131	1,134	1,137
2647	1	1,064	1,087	1,108	1,128	1,148	1,166	1,184	595	608	620	631	642	652	662
2648	1	2,123	2,148	2,170	2,191	2,212	2,231	2,250	1,343	1,359	1,373	1,386	1,399	1,411	1,423
2649	1	2,223	2,260	2,293	2,326	2,357	2,386	2,415	1,011	1,028	1,043	1,058	1,072	1,085	1,098
2650	1	2,493	2,554	2,607	2,658	2,709	2,756	2,803	1,176	1,205	1,230	1,254	1,278	1,300	1,322
2651	1	1,955	1,990	2,020	2,048	2,076	2,102	2,128	900	916	930	943	956	968	980
2652	1	1,381	1,403	1,420	1,437	1,454	1,469	1,484	636	646	654	662	670	677	684
2653	1	2,331	2,376	2,414	2,450	2,486	2,519	2,552	1,047	1,067	1,084	1,100	1,116	1,131	1,146
2654	1	1,401	1,425	1,445	1,465	1,485	1,505	1,523	633	644	653	662	671	680	688
2655	1	1,177	1,204	1,229	1,252	1,275	1,295	1,315	517	529	540	550	560	569	578
2656	1	221	224	227	230	233	233	233	87	88	89	90	91	91	91
2657	1	8	12	16	20	24	28	32	4	6	8	10	12	14	16
2658	1	1,856	1,861	1,866	1,871	1,876	1,881	1,886	759	761	763	765	767	769	771
2659	1	2,596	2,605	2,612	2,619	2,626	2,633	2,640	1,176	1,180	1,183	1,186	1,189	1,192	1,195
2660	1	1,303	1,332	1,359	1,384	1,409	1,432	1,455	627	641	654	666	678	689	700
2661	1	1,626	1,662	1,694	1,724	1,754	1,782	1,810	759	776	791	805	819	832	845
2662	1	1,082	1,097	1,110	1,121	1,132	1,143	1,154	509	516	522	527	532	537	542
2663	1	1,465	1,478	1,489	1,500	1,511	1,522	1,533	662	668	673	678	683	688	693
2664	1	319	321	323	325	327	329	331	143	144	145	146	147	148	149
2665	1	970	1,012	1,050	1,084	1,118	1,150	1,182	484	505	524	541	558	574	590
2666	1	1,495	1,550	1,597	1,642	1,684	1,724	1,764	599	621	640	658	675	691	707
2667	1	1,873	1,927	1,974	2,018	2,062	2,104	2,146	758	780	799	817	835	852	869
2668	1	1,441	1,515	1,579	1,641	1,701	1,756	1,811	627	659	687	714	740	764	788
2669	1	5	63	115	165	212	257	302	2	28	51	73	94	114	134
2670	3	28	298	536	760	979	1,186	1,390	11	124	223	316	407	493	578
2671	1	874	891	906	921	936	949	962	409	417	424	431	438	444	450

Appendix C1:
Hernando Population and Dwelling Unit Forecast 2015 to 2045

TAZ	Planning Area	Household Population							Dwelling Units						
		2015	2020	2025	2030	2035	2040	2045	2015	2020	2025	2030	2035	2040	2045
2672	1	439	458	475	490	505	520	535	204	213	221	228	235	242	249
2673	1	1,626	1,650	1,672	1,692	1,712	1,729	1,746	750	761	771	780	789	797	805
2674	1	711	874	1,017	1,154	1,286	1,412	1,536	322	396	461	523	583	640	696
2675	1	132	355	550	735	915	1,085	1,255	52	140	217	290	361	428	495
2676	1	2,637	2,653	2,667	2,681	2,695	2,707	2,719	1,351	1,359	1,366	1,373	1,380	1,386	1,392
2677	1	892	913	933	951	969	985	1,001	546	559	571	582	593	603	613
2678	1	3,265	3,448	3,608	3,759	3,905	4,042	4,179	1,430	1,510	1,580	1,646	1,710	1,770	1,830
2679	1	2,924	3,332	3,696	4,041	4,377	4,694	5,008	1,049	1,199	1,330	1,454	1,575	1,689	1,802
2680	3	1,476	1,524	1,564	1,604	1,642	1,677	1,712	590	609	625	641	656	670	684
2681	3	1,168	1,462	1,720	1,962	2,197	2,419	2,641	521	652	767	875	980	1,079	1,178
2682	4	90	155	197	237	275	311	345	57	82	104	125	145	164	182
2683	4	951	1,252	1,392	1,525	1,654	1,777	1,900	508	582	647	709	769	826	883
2684	4	371	440	445	450	455	460	465	241	245	248	251	254	257	260
2685	4	1,046	1,291	1,356	1,415	1,474	1,529	1,584	638	676	710	741	772	801	830
2686	4	522	553	581	607	633	657	681	282	299	314	328	342	355	368
2687	4	280	297	313	327	341	355	369	162	172	181	189	197	205	213
2688	4	1,118	1,169	1,213	1,255	1,296	1,335	1,374	855	894	928	960	991	1,021	1,051
2689	4	410	506	588	668	745	818	891	175	216	251	285	318	349	380
2690	4	282	306	328	348	368	386	404	139	151	162	172	182	191	200
2691	4	224	224	224	224	224	224	224	169	169	169	169	169	169	169
2692	4	173	192	209	224	239	254	269	90	100	109	117	125	133	141
2693	4	657	686	711	734	757	778	799	342	357	370	382	394	405	416
2694	4	180	184	188	192	196	200	204	93	95	97	99	101	103	105
2695	4	191	197	203	209	215	219	223	103	106	109	112	115	117	119
2696	4	543	556	569	582	592	602	612	210	215	220	225	229	233	237
2697	4	155	188	216	242	268	292	316	71	86	99	111	123	134	145
2698	4	20	30	41	50	59	68	77	10	16	22	27	32	37	42
2699	4	78	154	220	283	344	402	460	51	101	144	185	225	263	301
2700	4	306	311	315	319	323	327	331	291	296	300	304	308	312	316
2701	4	616	651	681	711	741	769	797	266	281	294	307	320	332	344
2702	4	250	276	298	318	338	356	374	137	151	163	174	185	195	205
2703	4	844	906	961	1,013	1,065	1,114	1,163	555	596	632	666	700	732	764
2704	4	89	167	234	299	362	421	480	41	77	108	138	167	194	221
2705	4	281	331	376	419	462	501	540	151	178	202	225	248	269	290
2706	4	532	689	828	957	1,084	1,204	1,322	288	373	448	518	587	652	716
2707	4	227	248	266	282	298	314	330	87	95	102	108	114	120	126
2708	4	830	987	1,125	1,257	1,386	1,505	1,624	265	315	359	401	442	480	518
2709	3	1,354	1,354	1,354	1,354	1,354	1,354	1,354	498	498	498	498	498	498	498
2710	3	502	652	783	908	1,031	1,147	1,261	237	308	370	429	487	542	596
2711	3	409	543	661	773	883	987	1,091	205	272	331	387	442	494	546
2712	3	1,113	1,894	2,461	2,998	3,520	4,013	4,503	585	888	1,154	1,406	1,651	1,882	2,112
2713	3	356	394	394	394	394	394	394	160	160	160	160	160	160	160
2714	3	1,270	1,416	1,418	1,420	1,422	1,424	1,426	671	672	673	674	675	676	677
2715	3	186	186	186	186	186	186	186	88	88	88	88	88	88	88
2716	3	76	76	76	76	76	76	76	40	40	40	40	40	40	40
2717	3	18	268	489	699	904	1,098	1,294	10	149	272	389	503	611	720
2718	3	447	517	533	547	561	575	589	212	220	227	233	239	245	251
2719	3	294	327	327	327	327	327	327	141	141	141	141	141	141	141
2720	3	134	150	152	152	152	152	152	88	89	90	90	90	90	90
2721	3	179	199	199	199	199	199	199	95	95	95	95	95	95	95
2722	3	69	84	86	86	88	88	88	35	36	37	37	38	38	38
2723	3	120	145	145	145	145	145	145	67	67	67	67	67	67	67
2724	3	4	171	318	457	594	724	854	2	91	169	243	316	385	454
2725	3	177	304	392	474	556	634	712	63	93	120	145	170	194	218
2726	3	90	106	106	106	106	106	106	44	44	44	44	44	44	44
2727	7	1,094	1,235	1,359	1,476	1,590	1,699	1,808	531	599	659	716	772	825	878
2728	7	507	507	507	507	507	507	507	220	220	220	220	220	220	220

Appendix C1:
Hernando Population and Dwelling Unit Forecast 2015 to 2045

TAZ	Planning Area	Household Population							Dwelling Units						
		2015	2020	2025	2030	2035	2040	2045	2015	2020	2025	2030	2035	2040	2045
2729	7	490	523	551	579	605	631	657	211	225	237	249	260	271	282
2730	7	1,616	1,787	1,938	2,083	2,227	2,364	2,498	812	898	974	1,047	1,119	1,187	1,256
2731	7	209	209	209	209	209	209	209	67	67	67	67	67	67	67
2732	3	-	83	157	227	297	362	427	-	37	70	101	132	161	190
2733	7	-	49	94	137	180	221	262	-	22	42	61	80	98	116
2734	7	-	49	91	131	171	209	247	-	22	41	59	77	94	111
2735	3	13	85	150	211	270	325	380	7	46	81	114	146	176	206
2736	7	-	128	240	348	454	553	652	-	57	107	155	202	246	290
2737	7	8	86	156	222	288	350	412	4	43	78	111	144	175	206
2738	7	307	361	408	453	496	537	578	170	200	226	251	275	298	321
2739	7	-	85	161	233	305	372	439	-	38	72	104	136	166	196
2740	7	19	116	202	284	364	440	516	9	55	96	135	173	209	245
2741	7	53	129	198	262	326	388	450	23	56	86	114	142	169	196
2742	7	714	716	718	720	722	724	726	353	354	355	356	357	358	359
2743	7	1,002	1,127	1,239	1,347	1,453	1,551	1,651	511	575	632	687	741	791	842
2744	7	1,036	1,036	1,036	1,036	1,036	1,036	1,036	486	486	486	486	486	486	486
Total		**174,380**	**193,032**	**208,774**	**223,674**	**238,224**	**251,932**	**265,587**	**85,330**	**93,723**	**101,089**	**108,058**	**114,866**	**121,278**	**127,669**

Appendix C1:
Citrus Population and Dwelling Unit Forecast 2015 to 2045

TAZ	Planning Area	Household Population							Dwelling Units						
		2015	2020	2025	2030	2035	2040	2045	2015	2020	2025	2030	2035	2040	2045
2801	1	297	348	390	430	467	501	535	199	233	261	288	313	336	359
2802	1	3	6	9	12	15	18	21	1	2	3	4	5	6	7
2803	1	1,732	1,750	1,764	1,778	1,791	1,804	1,817	1,086	1,097	1,106	1,115	1,123	1,131	1,139
2804	4	1,278	1,284	1,290	1,296	1,300	1,304	1,308	594	597	600	603	605	607	609
2805	1	810	812	814	816	818	820	822	495	496	497	498	499	500	501
2806	4	463	464	465	466	467	468	469	321	322	323	324	325	326	327
2807	4	1,138	1,150	1,158	1,166	1,174	1,182	1,190	562	568	572	576	580	584	588
2808	4	600	619	634	649	662	675	688	286	295	302	309	315	321	327
2809	4	680	713	740	765	788	811	834	325	341	354	366	377	388	399
2810	3	4	5	6	7	7	7	7	4	5	6	7	7	7	7
2811	3	534	549	562	574	586	596	606	322	331	339	346	353	359	365
2812	3	609	619	627	634	641	646	651	444	451	457	462	467	471	475
2813	3	326	326	326	326	326	326	326	316	316	316	316	316	316	316
2814	3	633	640	646	652	657	662	667	623	630	636	642	647	652	657
2815	3	407	410	411	412	413	414	415	302	304	305	306	307	308	309
2816	3	637	638	638	638	638	638	638	508	509	509	509	509	509	509
2817	3	690	702	712	721	730	739	748	401	408	414	419	424	429	434
2818	3	724	728	730	732	734	736	738	607	610	612	614	616	618	620
2819	4	1,767	2,020	2,229	2,425	2,602	2,773	2,942	846	967	1,067	1,161	1,247	1,329	1,410
2820	4	960	1,133	1,275	1,410	1,534	1,652	1,767	432	510	574	635	691	744	796
2821	4	1,936	2,113	2,259	2,396	2,523	2,644	2,761	930	1,015	1,085	1,151	1,212	1,270	1,326
2822	4	1,916	2,220	2,468	2,706	2,922	3,128	3,314	895	1,037	1,153	1,264	1,365	1,461	1,555
2823	4	319	321	323	325	327	329	331	210	211	212	213	214	215	216
2824	4	931	984	1,027	1,068	1,105	1,140	1,175	475	502	524	545	564	582	600
2825	4	2,796	3,132	3,407	3,670	3,909	4,136	4,359	1,382	1,548	1,684	1,814	1,932	2,044	2,154
2826	4	840	1,030	1,185	1,332	1,468	1,595	1,720	389	477	549	617	680	739	797
2827	4	702	885	1,035	1,178	1,308	1,432	1,553	318	401	469	534	593	649	704
2828	4	667	797	905	1,006	1,100	1,189	1,275	278	332	377	419	458	495	531
2829	4	1,833	2,243	2,578	2,897	3,190	3,468	3,739	832	1,018	1,170	1,315	1,448	1,574	1,697
2830	4	437	466	489	512	533	553	573	223	238	250	262	273	283	293
2831	4	167	180	190	198	206	214	222	120	129	136	142	148	154	160
2832	4	277	285	293	300	307	314	321	168	173	178	182	186	190	194
2833	4	455	503	542	580	614	646	678	266	294	317	339	359	378	397
2834	4	1,446	1,528	1,596	1,660	1,718	1,774	1,828	727	768	802	834	863	891	918
2835	4	334	459	562	659	749	835	917	179	246	301	353	401	447	491
2836	4	2,186	2,521	2,758	2,974	3,157	3,321	3,481	1,050	1,211	1,325	1,429	1,517	1,596	1,673
2837	4	230	333	405	472	528	579	626	141	204	248	289	323	354	383
2838	4	1,055	1,193	1,293	1,386	1,464	1,537	1,607	633	716	776	832	879	923	965
2839	4	1,138	1,177	1,209	1,240	1,268	1,294	1,320	702	726	746	765	782	798	814
2840	4	429	500	558	615	667	716	765	265	309	345	380	412	442	472
2841	4	194	306	399	486	568	645	720	109	172	224	273	319	362	404
2842	5	330	342	352	362	370	378	386	168	174	179	184	188	192	196
2843	5	550	1,147	1,668	2,169	2,639	3,093	3,538	282	588	855	1,112	1,353	1,586	1,814
2844	5	1,184	1,271	1,350	1,425	1,497	1,565	1,631	677	727	772	815	856	895	933
2845	5	458	551	627	698	764	827	888	276	332	378	421	461	499	536
2846	5	453	618	753	882	999	1,110	1,219	274	374	456	534	605	672	738
2847	5	770	857	927	995	1,057	1,114	1,171	363	404	437	469	498	525	552
2848	5	1,013	1,194	1,343	1,483	1,611	1,734	1,854	600	707	795	878	954	1,027	1,098
2849	5	2,094	2,117	2,135	2,153	2,170	2,186	2,202	1,478	1,494	1,507	1,520	1,532	1,543	1,554
2850	5	5,201	5,326	5,430	5,529	5,619	5,704	5,788	3,114	3,189	3,251	3,310	3,364	3,415	3,465
2851	5	3,788	3,876	3,949	4,016	4,078	4,137	4,196	2,191	2,242	2,284	2,323	2,359	2,393	2,427
2852	5	249	275	296	316	335	352	369	174	192	207	221	234	246	258
2853	5	1,116	1,160	1,195	1,229	1,260	1,289	1,318	819	851	877	902	925	946	967
2854	5	2,718	2,983	3,203	3,411	3,600	3,781	3,958	1,323	1,452	1,559	1,660	1,752	1,840	1,926
2855	5	882	935	980	1,023	1,062	1,099	1,134	433	459	481	502	521	539	556
2856	5	3,339	3,513	3,657	3,794	3,918	4,036	4,152	2,067	2,175	2,264	2,349	2,426	2,499	2,571
2857	5	2,049	2,249	2,413	2,569	2,711	2,846	2,978	1,210	1,328	1,425	1,517	1,601	1,681	1,759

Appendix C1:
Citrus Population and Dwelling Unit Forecast 2015 to 2045

TAZ	Planning Area	Household Population							Dwelling Units						
		2015	2020	2025	2030	2035	2040	2045	2015	2020	2025	2030	2035	2040	2045
2858	5	726	805	871	933	988	1,041	1,093	421	467	505	541	573	604	634
2859	5	242	447	617	779	927	1,066	1,201	118	218	301	380	452	520	586
2860	5	2,536	2,743	2,914	3,077	3,226	3,367	3,504	1,264	1,367	1,452	1,533	1,607	1,677	1,745
2861	5	624	751	857	955	1,046	1,131	1,214	330	397	453	505	553	598	642
2862	5	563	593	617	641	662	683	704	301	317	330	343	354	365	376
2863	5	2,640	2,781	2,898	3,008	3,109	3,206	3,301	1,198	1,262	1,315	1,365	1,411	1,455	1,498
2864	5	643	664	680	696	711	724	737	431	445	456	467	477	486	495
2865	2	31	32	33	34	35	36	37	23	24	25	26	27	28	29
2866	2	372	372	372	372	372	372	372	272	272	272	272	272	272	272
2867	2	733	737	740	743	746	749	752	524	527	529	531	533	535	537
2868	2	2,143	2,150	2,156	2,162	2,166	2,170	2,174	1,463	1,468	1,472	1,476	1,479	1,482	1,485
2869	2	1,212	1,212	1,212	1,212	1,212	1,212	1,212	588	588	588	588	588	588	588
2870	2	145	145	145	145	145	145	145	133	133	133	133	133	133	133
2871	2	234	234	234	234	234	234	234	138	138	138	138	138	138	138
2872	2	498	498	498	498	498	498	498	381	381	381	381	381	381	381
2873	2	1,614	1,616	1,618	1,620	1,622	1,624	1,626	986	987	988	989	990	991	992
2874	2	2,912	2,938	2,959	2,980	3,000	3,018	3,036	1,783	1,799	1,812	1,825	1,837	1,848	1,859
2875	6	518	537	552	567	580	593	605	403	418	430	442	452	462	471
2876	6	514	541	563	583	602	620	638	378	398	414	429	443	456	469
2877	6	774	776	778	780	782	784	786	654	656	658	660	662	664	666
2878	6	1,019	1,024	1,028	1,032	1,036	1,039	1,042	782	786	789	792	795	797	799
2879	6	345	350	354	358	362	366	370	291	295	298	301	304	307	310
2880	6	146	153	158	163	168	173	178	83	87	90	93	96	99	102
2881	6	231	245	256	267	277	287	297	170	180	188	196	203	210	217
2882	6	144	151	157	163	167	173	177	101	106	110	114	117	121	124
2883	6	731	739	745	751	757	763	769	528	534	538	542	546	550	554
2884	7	646	666	683	700	715	730	745	443	457	469	481	491	501	511
2885	7	685	813	918	1,017	1,108	1,195	1,280	352	418	472	523	570	615	659
2886	7	1,389	1,467	1,532	1,595	1,652	1,707	1,760	710	750	783	815	844	872	899
2887	7	1,751	1,863	1,956	2,043	2,124	2,201	2,276	843	897	942	984	1,023	1,060	1,096
2888	7	1,676	1,831	1,943	2,047	2,135	2,215	2,293	822	898	953	1,004	1,047	1,086	1,124
2889	7	1,494	1,638	1,756	1,869	1,973	2,071	2,165	807	885	949	1,010	1,066	1,119	1,170
2890	7	1,771	1,915	2,034	2,147	2,250	2,347	2,442	911	985	1,046	1,104	1,157	1,207	1,256
2891	8	2,223	2,392	2,530	2,662	2,783	2,898	3,011	1,159	1,247	1,319	1,388	1,451	1,511	1,570
2892	8	367	442	504	562	617	668	717	201	242	276	308	338	366	393
2893	8	108	136	159	180	199	218	237	51	64	75	85	94	103	112
2894	8	140	180	212	244	272	298	324	70	90	106	122	136	149	162
2895	8	405	427	445	461	477	491	505	203	214	223	231	239	246	253
2896	8	1,107	1,135	1,159	1,181	1,201	1,221	1,241	563	577	589	600	610	620	630
2897	8	198	198	198	198	198	198	198	102	102	102	102	102	102	102
2898	8	52	52	52	52	52	52	52	27	27	27	27	27	27	27
2899	8	614	614	614	614	614	614	614	320	320	320	320	320	320	320
2900	8	146	146	146	146	146	146	146	86	86	86	86	86	86	86
2901	9	1,062	1,064	1,064	1,064	1,064	1,064	1,064	581	582	582	582	582	582	582
2902	9	473	592	690	783	868	948	1,028	218	273	318	361	400	437	474
2903	8	4,209	4,368	4,500	4,625	4,738	4,847	4,952	2,196	2,279	2,348	2,413	2,472	2,529	2,584
2904	8	2,874	2,914	2,948	2,980	3,010	3,038	3,066	1,354	1,373	1,389	1,404	1,418	1,431	1,444
2905	8	2,034	2,056	2,074	2,090	2,106	2,120	2,134	1,124	1,136	1,146	1,155	1,164	1,172	1,180
2906	8	4,521	4,738	4,905	5,060	5,197	5,325	5,450	2,711	2,841	2,941	3,034	3,116	3,193	3,268
2907	8	1,067	1,197	1,304	1,406	1,498	1,587	1,674	648	727	792	854	910	964	1,017
2908	8	624	638	648	658	668	676	684	309	316	321	326	331	335	339
2909	8	958	966	974	982	988	994	1,000	487	491	495	499	502	505	508
2910	8	2,055	2,240	2,392	2,535	2,666	2,792	2,915	1,190	1,297	1,385	1,468	1,544	1,617	1,688
2911	8	1,239	1,366	1,471	1,570	1,662	1,748	1,832	675	744	801	855	905	952	998
2912	8	24	44	61	78	93	108	123	13	24	33	42	50	58	66
2913	10	1,022	1,022	1,022	1,022	1,022	1,022	1,022	654	654	654	654	654	654	654
2914	10	1,135	1,185	1,226	1,266	1,303	1,337	1,369	773	807	835	862	887	910	932

Appendix C1:
Citrus Population and Dwelling Unit Forecast 2015 to 2045

TAZ	Planning Area	Household Population							Dwelling Units						
		2015	2020	2025	2030	2035	2040	2045	2015	2020	2025	2030	2035	2040	2045
2915	9	2,903	2,997	3,073	3,145	3,212	3,275	3,338	1,483	1,531	1,570	1,607	1,641	1,673	1,705
2916	10	2,399	2,411	2,421	2,431	2,440	2,447	2,455	1,198	1,204	1,209	1,214	1,218	1,222	1,226
2917	9	801	879	942	1,003	1,060	1,113	1,166	379	416	446	475	502	527	552
2918	9	2,497	2,581	2,650	2,715	2,776	2,833	2,890	1,188	1,228	1,261	1,292	1,321	1,348	1,375
2919	9	1,377	1,525	1,646	1,763	1,869	1,970	2,069	873	967	1,044	1,118	1,185	1,249	1,312
2920	10	4,064	4,108	4,145	4,180	4,212	4,243	4,274	2,654	2,683	2,707	2,730	2,751	2,771	2,791
2921	9	674	687	698	709	718	727	736	355	362	368	374	379	384	389
2922	9	3,293	3,331	3,363	3,393	3,421	3,447	3,473	1,664	1,683	1,699	1,714	1,728	1,741	1,754
Total		**139,141**	**148,564**	**156,255**	**163,552**	**170,208**	**176,517**	**182,678**	**78,556**	**83,534**	**87,597**	**91,454**	**94,967**	**98,297**	**101,558**

Appendix C2: Hernando Employment Forecast 2015 to 2045

TAZ	Planning Area	Industrial Employees							Commercial Employees						
		2015	2020	2025	2030	2035	2040	2045	2015	2020	2025	2030	2035	2040	2045
2501	2	-	8	14	20	24	27	26	1	2	2	2	3	4	5
2502	2	-	-	-	-	-	-	-	191	200	204	207	214	220	226
2503	1	38	38	38	38	38	38	38	11	19	22	24	30	36	42
2504	1	10	10	10	10	10	10	10	6	7	7	7	8	9	9
2505	1	9	9	9	9	9	9	9	16	16	16	16	16	16	16
2506	1	41	42	43	44	44	44	44	18	18	18	18	18	18	18
2507	1	114	114	114	114	114	114	114	27	29	30	31	33	35	37
2508	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2509	1	110	110	110	110	110	110	110	2	3	3	3	4	5	6
2510	1	4	4	4	4	4	4	4	5	6	6	6	7	8	9
2511	1	54	54	54	54	54	54	54	56	57	57	57	58	58	58
2512	1	6	6	6	6	6	6	6	911	911	911	911	911	911	911
2513	1	25	25	25	25	25	25	25	353	354	354	354	355	356	357
2514	1	40	40	40	40	40	40	40	43	46	47	48	51	53	55
2515	1	36	36	36	36	36	36	36	384	385	385	385	386	387	388
2516	1	10	11	12	13	13	13	13	6	6	6	6	6	6	6
2517	1	14	14	14	14	14	14	14	1,183	1,185	1,186	1,187	1,189	1,191	1,194
2518	1	-	-	-	-	-	-	-	18	20	21	21	22	23	24
2519	2	86	91	94	97	99	101	101	-	15	21	26	38	49	60
2520	2	-	2	3	4	5	6	6	-	1	1	1	1	1	1
2521	5	58	60	61	62	63	64	64	-	4	6	7	10	13	16
2522	2	5	19	29	39	45	51	50	4	7	8	9	11	13	15
2523	2	-	10	17	24	28	32	31	-	1	1	1	1	1	1
2524	5	189	250	295	338	360	380	376	16	18	19	20	21	22	23
2525	5	102	113	120	127	132	136	135	3	4	4	4	5	6	7
2526	2	2	3	3	4	4	4	4	3	8	10	12	16	20	24
2527	2	14	23	29	35	39	42	41	-	1	1	1	2	2	2
2528	2	-	3	5	7	8	9	9	-	3	4	5	7	9	11
2529	2	-	-	-	-	-	-	-	4	11	14	16	22	27	32
2530	2	2	10	15	20	23	26	25	6	13	16	18	23	28	33
2531	2	5	14	20	26	30	33	32	-	1	1	1	2	3	4
2532	2	2	4	5	6	7	8	8	1	2	2	2	2	2	2
2533	5	1	7	11	15	18	20	20	7	7	7	7	7	7	7
2534	5	448	628	735	842	896	956	1,037	16	18	19	19	20	21	22
2535	5	37	73	97	121	136	150	162	-	4	6	7	10	13	16
2536	2	6	6	6	6	6	6	6	14	16	17	18	20	22	24
2537	2	-	-	-	-	-	-	-	-	1	1	1	1	1	1
2538	2	-	-	-	-	-	-	-	-	2	3	3	4	5	6
2539	2	30	34	37	40	42	44	44	3	3	3	3	3	3	3
2540	2	-	13	22	31	36	41	40	-	-	-	-	-	-	-
2541	5	6	40	73	96	110	123	120	5	5	5	5	5	5	5
2542	2	-	3	5	7	8	9	9	-	-	-	-	-	-	-
2543	2	25	25	25	25	25	25	25	10	17	20	22	27	32	37
2544	2	-	-	-	-	-	-	-	-	5	7	8	12	16	20
2545	1	16	16	16	16	16	16	16	13	16	17	18	20	22	24
2546	1	2	3	4	5	5	5	5	1	1	1	1	1	1	1
2547	1	-	1	1	1	1	1	1	-	-	-	-	-	-	-
2548	1	-	2	3	4	5	6	6	-	-	-	-	-	-	-
2549	1	5	6	7	8	8	8	8	-	-	-	-	-	-	-
2550	1	19	21	23	25	26	27	27	-	-	-	-	-	-	-
2551	1	2	5	7	9	10	11	11	2	2	2	2	2	2	2
2552	1	4	4	4	4	4	4	4	-	-	-	-	-	-	-
2553	1	4	4	4	4	4	4	4	-	-	-	-	-	-	-
2554	1	56	56	56	56	56	56	56	-	1	1	1	1	1	1
2555	5	-	4	7	10	12	14	14	-	-	-	-	-	-	-
2556	4	5	7	8	9	10	11	11	2	7	9	10	14	18	22
2557	4	58	58	58	58	58	58	58	-	6	8	10	15	19	23

Appendix C2: Hernando Employment Forecast 2015 to 2045

TAZ	Planning Area	Industrial Employees							Commercial Employees						
		2015	2020	2025	2030	2035	2040	2045	2015	2020	2025	2030	2035	2040	2045
2558	4	-	1	1	1	1	1	1	-	4	6	7	10	13	16
2559	4	55	56	56	56	56	56	56	7	12	14	15	19	23	27
2560	1	9	9	9	9	9	9	9	3	4	4	4	5	5	5
2561	1	5	5	5	5	5	5	5	4	5	6	6	7	8	9
2562	1	97	97	97	97	97	97	97	188	190	191	192	194	196	198
2563	1	2	2	2	2	2	2	2	-	2	3	4	5	6	7
2564	1	5	5	5	5	5	5	5	-	1	2	2	3	4	5
2565	1	7	8	9	10	10	10	10	-	4	6	7	10	13	16
2566	1	5	5	5	5	5	5	5	12	13	14	14	15	16	17
2567	1	2	2	2	2	2	2	2	-	-	-	-	-	-	-
2568	1	14	14	14	14	14	14	14	99	100	101	101	102	103	104
2569	1	3	4	4	4	4	4	4	2	4	5	5	6	7	8
2570	1	5	5	5	5	5	5	5	376	377	377	377	378	378	378
2571	1	5	5	5	5	5	5	5	750	750	750	750	750	750	750
2572	1	153	153	153	153	153	153	153	70	71	71	71	72	73	74
2573	1	3	3	3	3	3	3	3	-	-	-	-	-	-	-
2574	1	12	12	12	12	12	12	12	138	139	140	140	141	142	143
2575	1	8	8	8	8	8	8	8	27	30	31	32	34	36	38
2576	4	17	17	17	17	17	17	17	19	22	23	24	26	28	30
2577	4	70	70	70	70	70	70	70	35	37	38	39	40	41	42
2578	4	24	25	26	27	27	27	27	7	10	11	12	14	16	18
2579	4	8	12	14	16	18	19	19	-	2	3	4	5	6	7
2580	5	20	29	35	41	45	49	48	-	91	129	157	227	294	361
2581	5	-	15	25	35	41	47	46	1	38	53	64	93	120	147
2582	5	10	10	10	10	10	10	10	-	18	26	31	45	58	71
2583	5	157	157	157	157	157	157	157	-	107	152	190	273	352	437
2584	5	36	67	91	112	125	137	135	13	16	17	18	20	22	24
2585	5	72	92	106	120	129	137	136	-	1	1	1	2	3	4
2586	6	84	103	116	129	137	144	143	4	5	5	5	6	7	8
2587	5	-	17	29	41	48	55	54	1	5	6	7	10	13	16
2588	5	14	20	24	28	31	33	33	2	8	11	13	18	23	28
2589	5	31	36	39	42	44	46	46	6	6	6	6	6	6	6
2590	6	114	157	186	225	243	259	282	34	38	40	41	44	47	50
2591	6	59	62	64	66	67	68	68	2	2	2	2	2	2	2
2592	6	73	100	119	138	150	161	159	7	14	17	19	25	30	35
2593	6	23	26	28	30	31	32	32	-	-	-	-	-	-	-
2594	4	110	111	112	113	113	113	113	-	4	6	7	10	13	16
2595	6	62	89	108	127	139	150	148	16	22	24	26	30	34	38
2596	6	36	45	51	57	61	64	63	3	3	3	3	3	3	3
2597	6	23	24	25	26	26	26	26	6	10	12	13	16	19	22
2598	6	39	40	41	42	43	43	43	7	11	12	13	16	19	22
2599	6	5	5	5	5	5	5	5	2	5	6	7	9	11	13
2600	1	18	18	18	18	18	18	18	81	84	85	86	88	90	92
2601	1	17	17	17	17	17	17	17	1	2	2	2	3	4	5
2602	1	5	5	5	5	5	5	5	-	-	-	-	-	-	-
2603	1	8	8	8	8	8	8	8	65	69	71	72	75	78	81
2604	1	14	14	14	14	14	14	14	-	-	-	-	-	-	-
2605	1	5	5	5	5	5	5	5	233	233	233	233	233	233	233
2606	1	7	7	7	7	7	7	7	814	814	814	814	814	814	814
2607	1	6	6	6	6	6	6	6	4	5	5	5	6	7	8
2608	1	5	5	5	5	5	5	5	15	15	15	15	15	15	15
2609	1	1	1	1	1	1	1	1	-	-	-	-	-	-	-
2610	1	16	17	17	17	17	17	17	-	-	-	-	-	-	-
2611	1	12	12	12	12	12	12	12	80	82	83	84	85	86	87
2612	1	-	1	2	3	3	3	3	3	3	3	3	3	3	3
2613	1	16	17	18	19	20	20	20	-	-	-	-	-	-	-
2614	4	-	-	-	-	-	-	-	57	58	59	59	60	61	62

Appendix C2: Hernando Employment Forecast 2015 to 2045

TAZ	Planning Area	Industrial Employees							Commercial Employees						
		2015	2020	2025	2030	2035	2040	2045	2015	2020	2025	2030	2035	2040	2045
2615	4	9	11	12	13	14	15	15	-	-	-	-	-	-	-
2616	4	18	20	21	22	23	24	24	-	-	-	-	-	-	-
2617	1	41	41	41	41	41	41	41	49	49	49	49	49	49	49
2618	1	5	5	5	5	5	5	5	7	7	7	7	7	7	7
2619	1	62	62	62	62	62	62	62	200	201	201	201	202	203	204
2620	1	36	36	36	36	36	36	36	19	20	20	20	20	20	20
2621	1	33	33	33	33	33	33	33	29	30	30	30	31	32	33
2622	1	9	9	9	9	9	9	9	-	1	1	1	2	3	3
2623	1	38	38	38	38	38	38	38	14	15	15	15	16	17	18
2624	1	17	18	19	20	20	20	20	15	19	20	21	24	27	30
2625	1	12	14	15	16	17	18	18	25	26	26	26	27	27	27
2626	3	90	94	97	100	102	103	103	3	5	6	6	7	8	9
2627	4	28	67	87	107	119	130	128	2	5	6	7	9	11	13
2628	4	89	95	99	103	105	107	107	5	17	22	25	34	42	50
2629	4	5	5	5	5	5	5	5	185	190	192	193	197	200	203
2630	1	16	16	16	16	16	16	16	24	28	30	31	34	37	40
2631	1	85	85	85	85	85	85	85	388	390	391	391	392	393	394
2632	1	13	13	13	13	13	13	13	8	9	9	9	10	11	12
2633	1	9	9	9	9	9	9	9	60	63	64	65	68	70	72
2634	1	125	125	125	125	125	125	125	159	162	163	164	167	170	172
2635	1	25	25	25	25	25	25	25	325	327	328	329	331	333	335
2636	1	13	13	13	13	13	13	13	-	3	4	5	8	10	12
2637	1	30	30	30	30	30	30	30	28	30	31	31	32	33	34
2638	1	4	4	4	4	4	4	4	323	324	324	324	324	324	324
2639	3	118	118	118	118	118	118	118	-	2	3	4	5	6	7
2640	3	210	211	212	213	214	214	235	16	54	70	81	110	137	164
2641	1	85	85	85	85	85	85	85	94	96	97	98	99	100	101
2642	1	22	22	22	22	22	22	22	72	72	72	72	72	72	72
2643	1	29	29	29	29	29	29	29	125	127	128	129	131	132	133
2644	1	24	24	24	24	24	24	24	297	299	300	301	302	303	304
2645	1	-	-	-	-	-	-	-	2	2	2	2	2	2	2
2646	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2647	1	12	12	12	12	12	12	12	188	189	189	189	190	191	192
2648	1	35	35	35	35	35	35	35	16	16	16	16	16	16	16
2649	1	28	28	28	28	28	28	28	4	4	4	4	4	4	4
2650	1	11	11	11	11	11	11	11	2	3	3	3	4	5	6
2651	1	5	5	5	5	5	5	5	22	22	22	22	22	22	22
2652	1	37	37	37	37	37	37	37	170	170	170	170	170	170	170
2653	1	80	80	80	80	80	80	80	80	81	81	81	81	81	81
2654	1	16	16	16	16	16	16	16	13	13	13	13	13	13	13
2655	1	53	53	53	53	53	53	53	41	42	42	42	42	42	42
2656	1	15	15	15	15	15	15	15	181	182	182	182	182	182	182
2657	1	47	47	47	47	47	47	47	148	150	151	152	154	156	158
2658	1	3	3	3	3	3	3	3	6	6	6	6	6	6	6
2659	1	16	16	16	16	16	16	16	3	3	3	3	3	3	3
2660	1	19	19	19	19	19	19	19	7	7	7	7	7	7	7
2661	1	27	27	27	27	27	27	27	1	1	1	1	1	1	1
2662	1	10	10	10	10	10	10	10	-	-	-	-	-	-	-
2663	1	17	17	17	17	17	17	17	138	138	138	138	138	138	138
2664	1	17	17	17	17	17	17	17	93	93	93	93	93	93	93
2665	1	5	5	5	5	5	5	5	1	2	2	2	2	2	2
2666	1	31	31	31	31	31	31	31	44	46	47	48	49	50	51
2667	1	35	35	35	35	35	35	35	25	26	26	26	27	28	29
2668	1	49	49	49	49	49	49	49	84	90	93	95	100	105	109
2669	1	14	14	14	14	14	14	14	-	15	21	25	36	47	58
2670	3	1,451	1,911	2,354	2,773	3,098	3,495	4,188	513	561	581	595	632	667	702
2671	1	-	-	-	-	-	-	-	2	2	2	2	2	2	2

Appendix C2: Hernando Employment Forecast 2015 to 2045

TAZ	Planning Area	Industrial Employees							Commercial Employees						
		2015	2020	2025	2030	2035	2040	2045	2015	2020	2025	2030	2035	2040	2045
2672	1	3	3	3	3	3	3	3	-	-	-	-	-	-	-
2673	1	17	17	17	17	17	17	17	3	3	3	3	3	3	3
2674	1	35	35	35	35	35	35	35	6	8	9	10	12	14	16
2675	1	12	12	12	12	12	12	12	19	22	23	24	26	28	30
2676	1	14	14	14	14	14	14	14	225	227	228	229	231	232	233
2677	1	-	-	-	-	-	-	-	87	89	90	91	93	95	97
2678	1	42	42	42	42	42	42	42	15	18	19	20	22	24	26
2679	1	54	54	54	54	54	54	54	123	129	131	133	138	142	146
2680	3	5	5	5	5	5	5	5	2	8	10	12	16	20	24
2681	3	37	37	37	37	37	37	37	23	28	30	31	35	38	41
2682	4	6	19	28	37	42	47	46	1	4	5	6	8	10	12
2683	4	62	62	62	62	62	62	62	40	47	50	52	58	63	68
2684	4	2	2	2	2	2	2	2	17	17	17	17	17	17	17
2685	4	158	229	263	307	328	353	349	53	84	97	106	130	153	175
2686	4	16	20	23	26	28	29	29	31	34	35	36	38	40	42
2687	4	5	5	5	5	5	5	5	-	-	-	-	-	-	-
2688	4	9	9	9	9	9	9	9	4	5	5	5	6	7	8
2689	4	46	46	46	46	46	46	46	50	69	77	83	98	112	126
2690	4	14	14	14	14	14	14	14	-	-	-	-	-	-	-
2691	4	5	5	5	5	5	5	5	129	137	140	142	149	155	161
2692	4	48	48	48	48	48	48	48	64	67	68	69	71	73	75
2693	4	43	43	43	43	43	43	43	156	160	162	163	166	169	172
2694	4	61	61	61	61	61	61	61	46	50	52	53	56	59	62
2695	4	6	7	8	9	9	9	9	9	12	13	14	16	18	20
2696	4	22	23	24	25	25	25	25	18	27	31	34	41	47	53
2697	4	89	89	89	89	89	89	89	4	5	5	5	5	5	5
2698	4	13	15	16	17	18	19	19	34	45	50	53	62	70	78
2699	4	5	5	5	5	5	5	5	607	631	641	648	667	685	702
2700	4	5	5	5	5	5	5	5	206	208	209	210	212	214	216
2701	4	32	32	32	32	32	32	32	118	134	141	146	158	170	182
2702	4	182	192	199	206	210	214	213	14	25	29	32	40	48	56
2703	4	26	27	28	29	29	29	29	257	260	261	262	264	266	268
2704	4	24	26	27	28	29	30	30	-	4	6	7	10	13	16
2705	4	5	12	17	22	25	28	27	2	8	10	12	17	21	25
2706	4	97	98	99	100	100	100	100	-	4	6	7	10	13	16
2707	4	12	27	37	47	53	59	58	2	5	6	7	9	11	13
2708	4	60	93	115	137	151	164	162	4	9	11	12	16	19	22
2709	3	59	82	98	114	124	133	131	29	32	33	34	36	38	40
2710	3	12	17	21	25	27	29	29	48	51	52	53	55	57	59
2711	3	33	36	38	40	41	42	42	-	4	6	7	10	13	16
2712	3	59	96	121	146	162	176	173	33	63	76	85	108	130	152
2713	3	57	78	92	106	115	123	121	-	1	1	1	2	3	4
2714	3	86	181	232	298	329	368	363	6	10	12	13	16	19	22
2715	3	65	79	88	97	103	108	107	5	6	6	6	7	8	9
2716	3	20	33	42	51	57	62	61	2	3	3	3	4	5	6
2717	3	20	21	21	21	21	21	21	-	100	141	172	249	322	395
2718	3	100	116	127	138	145	151	150	27	29	30	31	33	34	35
2719	3	54	81	99	117	129	139	137	-	1	2	2	3	4	5
2720	3	2	28	46	64	75	85	83	-	1	2	2	3	4	5
2721	3	-	26	43	60	71	81	79	2	3	4	4	5	6	7
2722	3	21	36	46	56	62	68	67	2	3	4	4	5	6	7
2723	3	10	20	26	32	36	40	39	-	1	1	1	1	1	1
2724	3	20	22	24	26	27	28	28	-	64	90	109	158	205	251
2725	3	33	37	40	43	45	47	47	2	24	33	39	56	72	88
2726	3	20	34	43	52	58	63	62	7	8	8	8	9	10	11
2727	7	9	18	24	30	34	38	37	115	119	121	122	125	128	131
2728	7	-	25	42	59	70	80	78	-	1	2	2	3	4	5

Appendix C2: Hernando Employment Forecast 2015 to 2045

TAZ	Planning Area	Industrial Employees							Commercial Employees						
		2015	2020	2025	2030	2035	2040	2045	2015	2020	2025	2030	2035	2040	2045
2729	7	-	14	24	34	40	45	44	-	1	2	2	3	4	5
2730	7	16	16	16	16	16	16	16	26	30	32	33	36	39	42
2731	7	10	15	23	31	39	47	47	10	10	10	10	10	10	10
2732	3	15	15	15	15	15	15	15	32	59	70	78	99	119	138
2733	7	5	5	5	5	5	5	5	464	480	487	492	505	517	529
2734	7	3	3	3	3	3	3	3	7	23	30	35	47	59	71
2735	3	-	-	-	-	-	-	-	-	28	40	48	70	91	111
2736	7	-	-	-	-	-	-	-	-	41	58	70	102	132	162
2737	7	10	10	10	10	10	10	10	-	29	41	49	71	92	113
2738	7	1,150	1,152	1,153	1,154	1,260	1,260	1,386	6	28	37	43	60	76	92
2739	7	282	282	282	282	282	282	282	-	28	40	48	70	90	110
2740	7	10	10	10	10	10	10	10	-	34	48	58	84	109	133
2741	7	7	10	12	14	15	16	16	-	25	35	42	61	79	97
2742	7	8	10	12	14	15	16	16	2	4	5	5	6	7	8
2743	7	15	25	32	39	43	47	46	15	18	19	20	22	24	26
2744	7	22	22	27	32	37	42	47	-	-	-	-	-	-	-
Total		10,145	11,933	13,253	14,570	15,521	16,416	17,309	14,000	15,390	15,958	16,360	17,427	18,432	19,434

Appendix C2: Hernando Employment Forecast 2015 to 2045

TAZ	Planning Area	Service Employees							Total Employees						
		2015	2020	2025	2030	2035	2040	2045	2015	2020	2025	2030	2035	2040	2045
2501	2	43	45	47	49	50	51	52	44	55	63	71	77	82	83
2502	2	278	340	382	423	458	492	506	469	540	586	630	672	712	732
2503	1	67	102	125	148	168	187	200	116	159	185	210	236	261	280
2504	1	19	24	28	32	35	38	39	35	41	45	49	53	57	58
2505	1	21	22	23	23	23	23	23	46	47	48	48	48	48	48
2506	1	115	116	117	118	119	120	120	174	176	178	180	181	182	182
2507	1	121	136	146	156	165	173	176	262	279	290	301	312	322	327
2508	1	-	15	25	35	44	52	55	-	15	25	35	44	52	55
2509	1	539	544	547	550	553	556	556	651	657	660	663	667	671	672
2510	1	42	47	50	53	56	58	59	51	57	60	63	67	70	72
2511	1	41	44	46	48	50	52	53	151	155	157	159	162	164	165
2512	1	436	438	439	440	441	442	442	1,353	1,355	1,356	1,357	1,358	1,359	1,359
2513	1	163	167	170	173	175	177	178	541	546	549	552	555	558	560
2514	1	29	43	53	62	70	78	81	112	129	140	150	161	171	176
2515	1	276	281	284	287	290	293	294	696	702	705	708	712	716	718
2516	1	18	18	18	18	18	18	18	34	35	36	37	37	37	37
2517	1	189	199	205	211	216	221	223	1,386	1,398	1,405	1,412	1,419	1,426	1,431
2518	1	81	88	93	97	101	105	107	99	108	114	118	123	128	131
2519	2	48	146	213	278	335	389	417	134	252	328	401	472	539	578
2520	2	-	9	15	21	26	31	33	-	12	19	26	32	38	40
2521	5	29	45	56	66	75	83	87	87	109	123	135	148	160	167
2522	2	3	11	17	23	28	33	35	12	37	54	71	84	97	100
2523	2	7	7	7	7	7	7	7	7	18	25	32	36	40	39
2524	5	3	150	250	347	431	511	544	208	418	564	705	812	913	943
2525	5	31	34	36	38	40	41	42	136	151	160	169	177	183	184
2526	2	1	24	39	54	67	79	84	6	35	52	70	87	103	112
2527	2	18	19	20	21	22	23	23	32	43	50	57	63	67	66
2528	2	-	11	19	26	33	39	42	-	17	28	38	48	57	62
2529	2	227	258	279	299	317	334	341	231	269	293	315	339	361	373
2530	2	11	39	58	77	93	108	114	19	62	89	115	139	162	172
2531	2	42	46	49	52	54	56	57	47	61	70	79	86	92	93
2532	2	8	10	11	12	13	14	14	11	16	18	20	22	24	24
2533	5	29	29	29	29	29	29	29	37	43	47	51	54	56	56
2534	5	47	54	58	62	66	70	71	511	700	812	923	982	1,047	1,130
2535	5	258	278	292	305	316	327	412	295	355	395	433	462	490	590
2536	2	23	33	40	47	53	58	60	43	55	63	71	79	86	90
2537	2	-	4	7	10	13	15	16	-	5	8	11	14	16	17
2538	2	-	7	12	16	20	24	26	-	9	15	19	24	29	32
2539	2	3	3	3	3	3	3	3	36	40	43	46	48	50	50
2540	2	9	38	57	76	92	107	113	9	51	79	107	128	148	153
2541	5	6	6	6	6	6	6	6	17	51	84	107	121	134	131
2542	2	448	462	471	480	488	495	595	448	465	476	487	496	504	604
2543	2	25	56	77	98	116	133	294	60	98	122	145	168	190	356
2544	2	-	29	49	68	85	101	304	-	34	56	76	97	117	324
2545	1	3	16	25	34	42	49	52	32	48	58	68	78	87	92
2546	1	12	13	13	13	13	13	13	15	17	18	19	19	19	19
2547	1	8	9	9	9	9	9	9	8	10	10	10	10	10	10
2548	1	-	2	3	4	5	6	6	-	4	6	8	10	12	12
2549	1	2	2	2	2	2	2	2	7	8	9	10	10	10	10
2550	1	2	2	2	2	2	2	2	21	23	25	27	28	29	29
2551	1	13	13	13	13	13	13	13	17	20	22	24	25	26	26
2552	1	12	19	24	29	33	37	39	16	23	28	33	37	41	43
2553	1	1	14	23	31	38	45	48	5	18	27	35	42	49	52
2554	1	1	3	5	7	8	9	10	57	60	62	64	65	66	67
2555	5	-	-	-	-	-	-	-	-	4	7	10	12	14	14
2556	4	6	27	41	55	67	78	83	13	41	58	74	91	107	116
2557	4	7	33	50	67	82	96	102	65	97	116	135	155	173	183

Appendix C2: Hernando Employment Forecast 2015 to 2045

TAZ	Planning Area	Service Employees							Total Employees						
		2015	2020	2025	2030	2035	2040	2045	2015	2020	2025	2030	2035	2040	2045
2558	4	-	17	29	40	50	59	63	-	22	36	48	61	73	80
2559	4	-	21	36	50	62	74	79	62	89	106	121	137	153	162
2560	1	27	30	32	34	36	38	39	39	43	45	47	50	52	53
2561	1	51	57	61	65	69	73	74	60	67	72	76	81	86	88
2562	1	426	436	443	450	456	462	464	711	723	731	739	747	755	759
2563	1	22	34	42	50	57	63	66	24	38	47	56	64	71	75
2564	1	-	7	12	17	21	25	27	5	13	19	24	29	34	37
2565	1	-	22	37	51	63	75	80	7	34	52	68	83	98	106
2566	1	1,490	1,495	1,499	1,502	1,505	1,508	1,509	1,507	1,513	1,518	1,521	1,525	1,529	1,531
2567	1	66	68	69	70	71	72	72	68	70	71	72	73	74	74
2568	1	291	297	301	305	309	312	313	404	411	416	420	425	429	431
2569	1	94	101	105	109	113	117	119	99	109	114	118	123	128	131
2570	1	105	108	110	112	114	116	117	486	490	492	494	497	499	500
2571	1	156	157	158	158	158	158	158	911	912	913	913	913	913	913
2572	1	129	134	137	140	143	145	146	352	358	361	364	368	371	373
2573	1	18	19	20	21	22	23	23	21	22	23	24	25	26	26
2574	1	33	39	43	47	50	53	54	183	190	195	199	203	207	209
2575	1	144	156	164	172	179	185	188	179	194	203	212	221	229	234
2576	4	223	236	245	254	261	268	271	259	275	285	295	304	313	318
2577	4	88	96	101	106	110	114	116	193	203	209	215	220	225	228
2578	4	728	738	745	751	757	762	764	759	773	782	790	798	805	809
2579	4	-	6	10	14	17	20	21	8	20	27	34	40	45	47
2580	5	131	445	659	866	1,047	1,218	1,292	151	565	823	1,064	1,319	1,561	1,701
2581	5	12	136	220	301	372	439	641	13	189	298	400	506	606	834
2582	5	-	62	104	145	181	215	236	10	90	140	186	236	283	317
2583	5	-	365	614	854	1,063	1,261	1,343	157	629	923	1,201	1,493	1,770	1,937
2584	5	2	5	7	9	11	13	14	51	88	115	139	156	172	173
2585	5	-	-	-	-	-	-	-	72	93	107	121	131	140	140
2586	6	9	32	47	62	75	87	92	97	140	168	196	218	238	243
2587	5	3	14	22	29	35	41	44	4	36	57	77	93	109	114
2588	5	44	70	87	104	119	133	139	60	98	122	145	168	189	200
2589	5	46	47	47	47	47	47	47	83	89	92	95	97	99	99
2590	6	35	41	45	49	52	55	56	183	236	271	315	339	361	388
2591	6	4	4	4	4	4	4	4	65	68	70	72	73	74	74
2592	6	82	109	127	145	160	175	181	162	223	263	302	335	366	375
2593	6	3	3	3	3	3	3	3	26	29	31	33	34	35	35
2594	4	56	74	86	98	108	118	122	166	189	204	218	231	244	251
2595	6	29	47	59	71	81	91	95	107	158	191	224	250	275	281
2596	6	14	14	14	14	14	14	14	53	62	68	74	78	81	80
2597	6	132	148	159	170	179	188	192	161	182	196	209	221	233	240
2598	6	21	36	46	56	65	73	77	67	87	99	111	124	135	142
2599	6	48	59	66	73	79	85	88	55	69	77	85	93	101	106
2600	1	97	109	117	125	132	138	141	196	211	220	229	238	246	251
2601	1	38	45	50	55	59	63	65	56	64	69	74	79	84	87
2602	1	57	60	62	64	66	68	69	62	65	67	69	71	73	74
2603	1	1,132	1,149	1,160	1,171	1,180	1,189	1,193	1,205	1,226	1,239	1,251	1,263	1,275	1,282
2604	1	171	173	174	175	176	177	177	185	187	188	189	190	191	191
2605	1	169	169	169	169	169	169	169	407	407	407	407	407	407	407
2606	1	67	70	72	74	76	77	78	888	891	893	895	897	898	899
2607	1	8	11	13	15	17	19	20	18	22	24	26	29	32	34
2608	1	36	38	39	40	41	42	42	56	58	59	60	61	62	62
2609	1	4	4	4	4	4	4	4	5	5	5	5	5	5	5
2610	1	14	14	14	14	14	14	14	30	31	31	31	31	31	31
2611	1	422	430	436	441	446	450	452	514	524	531	537	543	548	551
2612	1	8	8	8	8	8	8	8	11	12	13	14	14	14	14
2613	1	4	4	4	4	4	4	4	20	21	22	23	24	24	24
2614	4	13	19	23	27	30	33	34	70	77	82	86	90	94	96

Appendix C2: Hernando Employment Forecast 2015 to 2045

TAZ	Planning Area	Service Employees							Total Employees						
		2015	2020	2025	2030	2035	2040	2045	2015	2020	2025	2030	2035	2040	2045
2615	4	5	5	5	5	5	5	5	14	16	17	18	19	20	20
2616	4	-	-	-	-	-	-	-	18	20	21	22	23	24	24
2617	1	305	307	308	309	310	311	311	395	397	398	399	400	401	401
2618	1	37	41	44	47	49	51	52	49	53	56	59	61	63	64
2619	1	278	282	285	287	289	291	292	540	545	548	550	553	556	558
2620	1	98	100	102	103	104	105	106	153	156	158	159	160	161	162
2621	1	76	80	83	86	88	90	91	138	143	146	149	152	155	157
2622	1	14	20	24	28	32	35	36	23	30	34	38	43	47	48
2623	1	180	185	188	191	194	197	198	232	238	241	244	248	252	254
2624	1	31	50	63	75	86	96	100	63	87	102	116	130	143	150
2625	1	156	159	161	163	165	166	167	193	199	202	205	209	211	212
2626	3	20	26	30	34	38	41	42	113	125	133	140	147	152	154
2627	4	49	53	56	59	62	64	65	79	125	149	173	190	205	206
2628	4	129	178	211	243	271	297	308	223	290	332	371	410	446	465
2629	4	44	51	56	61	65	69	71	234	246	253	259	267	274	279
2630	1	68	87	100	113	124	134	138	108	131	146	160	174	187	194
2631	1	770	777	782	786	790	794	796	1,243	1,252	1,258	1,262	1,267	1,272	1,275
2632	1	51	55	58	61	63	65	66	72	77	80	83	86	89	91
2633	1	169	186	198	209	219	228	232	238	258	271	283	296	307	313
2634	1	647	668	683	697	709	721	726	931	955	971	986	1,001	1,016	1,023
2635	1	499	508	514	520	525	530	532	849	860	867	874	881	888	892
2636	1	116	133	144	155	165	174	244	129	149	161	173	186	197	269
2637	1	62	69	74	78	82	86	88	120	129	135	139	144	149	152
2638	1	147	150	152	154	155	156	261	474	478	480	482	483	484	589
2639	3	367	375	381	386	391	395	416	485	495	502	508	514	519	541
2640	3	425	557	647	734	810	881	911	651	822	929	1,028	1,134	1,232	1,310
2641	1	299	307	313	318	323	328	330	478	488	495	501	507	513	516
2642	1	475	477	478	479	480	481	481	569	571	572	573	574	575	575
2643	1	160	169	175	181	186	191	193	314	325	332	339	346	352	355
2644	1	293	301	306	311	315	319	321	614	624	630	636	641	646	649
2645	1	66	66	66	66	66	66	66	68	68	68	68	68	68	68
2646	1	2	3	3	3	3	3	3	2	3	3	3	3	3	3
2647	1	194	198	201	204	206	208	209	394	399	402	405	408	411	413
2648	1	270	272	273	274	275	276	276	321	323	324	325	326	327	327
2649	1	15	23	28	33	38	42	44	47	55	60	65	70	74	76
2650	1	51	55	58	61	64	66	67	64	69	72	75	79	82	84
2651	1	16	19	21	23	25	27	28	43	46	48	50	52	54	55
2652	1	277	278	279	280	281	282	282	484	485	486	487	488	489	489
2653	1	129	132	134	136	138	139	140	289	293	295	297	299	300	301
2654	1	214	216	217	218	219	220	220	243	245	246	247	248	249	249
2655	1	290	292	294	296	297	298	299	384	387	389	391	392	393	394
2656	1	628	631	633	635	636	637	638	824	828	830	832	833	834	835
2657	1	653	666	674	682	689	696	699	848	863	872	881	890	899	904
2658	1	104	104	104	104	104	104	104	113	113	113	113	113	113	113
2659	1	42	42	42	42	42	42	42	61	61	61	61	61	61	61
2660	1	97	99	100	101	102	103	103	123	125	126	127	128	129	129
2661	1	47	50	52	54	55	56	57	75	78	80	82	83	84	85
2662	1	6	7	8	9	9	9	9	16	17	18	19	19	19	19
2663	1	222	223	224	225	225	225	225	377	378	379	380	380	380	380
2664	1	292	298	302	306	309	312	313	402	408	412	416	419	422	423
2665	1	8	16	22	27	32	36	38	14	23	29	34	39	43	45
2666	1	79	87	92	97	102	106	108	154	164	170	176	182	187	190
2667	1	155	159	162	165	167	169	170	215	220	223	226	229	232	234
2668	1	97	119	134	148	160	172	181	230	258	276	292	309	326	339
2669	1	92	142	176	209	238	265	276	106	171	211	248	288	326	348
2670	3	1,616	1,780	1,891	1,999	2,093	2,182	2,221	3,580	4,252	4,826	5,367	5,823	6,344	7,111
2671	1	30	31	32	33	34	35	35	32	33	34	35	36	37	37

Appendix C2: Hernando Employment Forecast 2015 to 2045

TAZ	Planning Area	Service Employees							Total Employees						
		2015	2020	2025	2030	2035	2040	2045	2015	2020	2025	2030	2035	2040	2045
2672	1	7	8	9	10	11	12	12	10	11	12	13	14	15	15
2673	1	19	20	21	22	23	24	24	39	40	41	42	43	44	44
2674	1	19	30	38	45	51	57	60	60	73	82	90	98	106	111
2675	1	38	49	57	65	72	78	81	69	83	92	101	110	118	123
2676	1	357	367	374	380	386	391	393	596	608	616	623	631	637	640
2677	1	805	816	824	832	839	845	848	892	905	914	923	932	940	945
2678	1	44	55	63	70	77	83	86	101	115	124	132	141	149	154
2679	1	67	93	111	128	143	157	163	244	276	296	315	335	353	363
2680	3	14	38	54	70	84	97	102	21	51	69	87	105	122	131
2681	3	29	49	63	76	87	98	103	89	114	130	144	159	173	181
2682	4	20	29	35	41	46	51	53	27	52	68	84	96	108	111
2683	4	303	317	327	336	344	352	355	405	426	439	450	464	477	485
2684	4	481	482	482	482	482	482	498	500	501	501	501	501	501	517
2685	4	125	134	140	146	151	156	158	336	447	500	559	609	662	682
2686	4	409	410	410	410	410	410	410	456	464	468	472	476	479	481
2687	4	130	131	132	133	134	135	135	135	136	137	138	139	140	140
2688	4	77	81	84	87	89	91	92	90	95	98	101	104	107	109
2689	4	409	412	414	416	417	418	419	505	527	537	545	561	576	591
2690	4	35	37	38	39	40	41	41	49	51	52	53	54	55	55
2691	4	531	543	551	559	566	572	575	665	685	696	706	720	732	741
2692	4	756	756	756	756	756	756	756	868	871	872	873	875	877	879
2693	4	370	370	370	370	370	370	370	569	573	575	576	579	582	585
2694	4	1,026	1,026	1,026	1,026	1,026	1,026	1,026	1,133	1,137	1,139	1,140	1,143	1,146	1,149
2695	4	25	31	35	39	42	45	46	40	50	56	62	67	72	75
2696	4	206	208	210	212	213	214	215	246	258	265	271	279	286	293
2697	4	20	22	23	24	25	26	26	113	116	117	118	119	120	120
2698	4	525	530	534	538	541	544	545	572	590	600	608	621	633	642
2699	4	118	123	127	130	133	136	137	730	759	773	783	805	826	844
2700	4	96	96	96	96	96	96	96	307	309	310	311	313	315	317
2701	4	122	125	127	129	130	131	132	272	291	300	307	320	333	346
2702	4	220	280	321	361	396	429	443	416	497	549	599	646	691	712
2703	4	365	374	380	386	391	396	398	648	661	669	677	684	691	695
2704	4	143	160	172	183	193	202	329	167	190	205	218	232	245	375
2705	4	90	98	104	109	114	119	121	97	118	131	143	156	168	173
2706	4	1	26	43	59	73	86	92	98	128	148	166	183	199	208
2707	4	-	10	17	24	30	35	37	14	42	60	78	92	105	108
2708	4	59	71	79	87	94	100	103	123	173	205	236	261	283	287
2709	3	109	115	119	123	126	129	130	197	229	250	271	286	300	301
2710	3	38	49	56	63	69	75	77	98	117	129	141	151	161	165
2711	3	3	20	32	43	53	62	66	36	60	76	90	104	117	124
2712	3	53	161	234	305	366	424	448	145	320	431	536	636	730	773
2713	3	25	25	25	25	25	25	25	82	104	118	132	142	151	150
2714	3	46	46	46	46	46	46	46	138	237	290	357	391	433	431
2715	3	14	14	14	14	14	14	14	84	99	108	117	124	130	130
2716	3	3	3	3	3	3	3	3	25	39	48	57	64	70	70
2717	3	-	340	571	794	989	1,173	1,253	20	461	733	987	1,259	1,516	1,669
2718	3	80	85	88	91	94	97	98	207	230	245	260	272	282	283
2719	3	79	79	79	79	79	79	79	133	161	180	198	211	222	221
2720	3	36	36	36	36	36	36	36	38	65	84	102	114	125	124
2721	3	8	8	8	8	8	8	8	10	37	55	72	84	95	94
2722	3	-	1	2	3	4	5	5	23	40	52	63	71	79	79
2723	3	15	15	15	15	15	15	15	25	36	42	48	52	56	55
2724	3	-	216	362	504	628	745	798	20	302	476	639	813	978	1,077
2725	3	20	93	143	191	233	273	293	55	154	216	273	334	392	428
2726	3	1	1	1	1	1	1	1	28	43	52	61	68	74	74
2727	7	142	159	171	183	193	203	207	266	296	316	335	352	369	375
2728	7	-	-	-	-	-	-	-	-	26	44	61	73	84	83

Appendix C2: Hernando Employment Forecast 2015 to 2045

TAZ	Planning Area	Service Employees							Total Employees						
		2015	2020	2025	2030	2035	2040	2045	2015	2020	2025	2030	2035	2040	2045
2729	7	21	23	24	25	26	27	27	21	38	50	61	69	76	76
2730	7	98	127	147	166	183	199	206	140	173	195	215	235	254	264
2731	7	19	19	19	19	19	19	19	39	44	52	60	68	76	76
2732	3	11	103	165	225	278	328	349	58	177	250	318	392	462	502
2733	7	68	124	162	199	231	261	277	537	609	654	696	741	783	811
2734	7	-	54	91	127	158	188	200	10	80	124	165	208	250	274
2735	3	-	96	161	224	279	331	356	-	124	201	272	349	422	467
2736	7	-	140	235	328	409	485	653	-	181	293	398	511	617	815
2737	7	-	97	163	227	283	336	504	10	136	214	286	364	438	627
2738	7	7	81	131	180	223	263	280	1,163	1,261	1,321	1,377	1,543	1,599	1,758
2739	7	-	95	159	222	277	329	351	282	405	481	552	629	701	743
2740	7	-	115	193	269	335	397	423	10	159	251	337	429	516	566
2741	7	-	84	141	196	244	290	309	7	119	188	252	320	385	422
2742	7	14	20	24	28	32	36	37	24	34	41	47	53	59	61
2743	7	93	104	112	119	125	131	304	123	147	163	178	190	202	376
2744	7	6	6	6	6	6	6	6	28	28	33	38	43	48	53
Total		**31,555**	**36,443**	**39,766**	**42,980**	**45,783**	**48,425**	**51,058**	**55,700**	**63,766**	**68,977**	**73,910**	**78,731**	**83,273**	**87,801**

Appendix C2: Citrus Employment Forecast 2015 to 2045

TAZ	Planning Area	Industrial Employees							Commercial Employees						
		2015	2020	2025	2030	2035	2040	2045	2015	2020	2025	2030	2035	2040	2045
2801	1	17	42	63	86	91	96	104	8	9	8	7	8	9	10
2802	1	757	801	801	801	801	801	801	-	1	1	-	1	2	3
2803	1	58	69	77	85	90	94	98	1	4	3	1	3	5	7
2804	4	23	23	23	23	23	23	23	13	14	13	12	13	14	15
2805	1	31	31	31	31	31	31	31	10	11	11	11	12	12	12
2806	4	61	94	116	139	152	165	178	16	19	18	16	18	20	22
2807	4	26	56	76	97	109	121	132	24	26	25	24	26	28	29
2808	4	48	60	68	76	81	86	90	42	46	44	42	45	48	51
2809	4	19	19	19	19	19	19	19	4	5	5	4	5	6	7
2810	3	86	97	115	132	138	143	151	2	4	6	8	10	12	14
2811	3	22	42	56	70	78	86	94	129	132	133	134	137	140	143
2812	3	83	83	83	83	83	83	83	97	100	101	102	105	108	111
2813	3	-	-	-	-	-	-	-	4	6	8	10	12	14	16
2814	3	35	35	35	35	35	35	35	18	21	23	24	27	30	33
2815	3	73	73	73	73	73	73	73	223	226	228	229	232	235	238
2816	3	34	34	34	34	34	34	34	294	298	299	300	304	308	312
2817	3	22	22	22	22	22	22	22	496	512	509	503	516	528	539
2818	3	13	13	13	13	13	13	13	46	49	50	51	54	57	60
2819	4	9	9	9	9	9	9	9	56	60	58	55	59	62	65
2820	4	2	2	2	2	2	2	2	1	4	3	1	3	5	7
2821	4	11	11	11	11	11	11	11	5	8	7	5	8	10	12
2822	4	5	5	5	5	5	5	5	15	20	18	15	19	23	27
2823	4	102	134	156	178	191	203	215	7	8	8	8	9	9	9
2824	4	14	14	14	14	14	14	14	3	4	3	2	3	4	5
2825	4	75	75	75	75	75	75	75	14	22	19	14	20	26	31
2826	4	5	5	5	5	5	5	5	2	5	4	2	5	7	9
2827	4	1	1	1	1	1	1	1	2	5	4	2	4	6	8
2828	4	30	69	94	118	121	124	131	-	2	1	-	2	3	4
2829	4	32	32	32	32	32	32	32	22	30	27	22	28	34	40
2830	4	63	86	102	118	127	136	145	25	30	28	25	29	33	37
2831	4	120	120	120	120	120	120	120	140	144	143	141	144	147	150
2832	4	44	51	55	60	63	65	67	166	167	166	165	166	167	168
2833	4	73	104	125	147	159	171	183	73	75	74	73	75	77	79
2834	4	174	174	174	174	174	174	174	108	112	110	107	110	113	116
2835	4	7	7	7	7	7	7	7	-	3	2	-	2	4	6
2836	4	31	31	31	31	31	31	31	54	65	61	54	63	72	80
2837	4	10	10	10	10	10	10	10	-	7	4	-	6	12	17
2838	4	16	16	16	16	16	16	16	31	36	34	31	35	39	43
2839	4	57	57	57	57	57	57	57	16	18	17	16	17	18	19
2840	4	96	96	96	96	96	96	96	29	31	30	29	31	33	35
2841	4	66	66	66	66	66	66	66	306	316	312	306	314	321	328
2842	5	37	62	79	97	107	117	126	22	24	23	22	24	26	28
2843	5	31	31	46	57	69	80	90	1	59	126	191	269	345	421
2844	5	48	48	63	75	87	98	103	20	73	142	210	282	354	426
2845	5	141	183	212	241	258	275	291	1	4	3	1	4	7	9
2846	5	1	1	1	1	1	1	1	1	4	3	1	3	5	7
2847	5	218	218	218	218	218	218	218	15	15	15	15	15	15	15
2848	5	68	68	68	68	68	68	68	37	42	40	37	41	45	49
2849	5	48	48	48	48	48	48	48	17	19	18	17	19	20	21
2850	5	211	211	211	211	211	211	211	87	90	89	87	89	91	93
2851	5	35	35	35	35	35	35	35	173	175	174	173	175	176	177
2852	5	13	13	13	13	13	13	13	38	40	39	38	39	40	41
2853	5	7	7	7	7	7	7	7	32	33	33	32	33	34	35
2854	5	80	114	137	160	173	186	198	233	241	238	233	240	246	252
2855	5	43	43	43	43	43	43	43	19	21	20	19	21	23	25
2856	5	49	49	49	49	49	49	49	87	94	91	87	92	97	102
2857	5	32	32	32	32	32	32	32	17	23	21	17	22	26	30

Appendix C2: Citrus Employment Forecast 2015 to 2045

TAZ	Planning Area	Industrial Employees							Commercial Employees						
		2015	2020	2025	2030	2035	2040	2045	2015	2020	2025	2030	2035	2040	2045
2858	5	150	190	217	245	261	276	291	37	39	38	37	39	40	41
2859	5	43	59	70	81	87	93	99	9	17	14	9	15	21	27
2860	5	319	331	343	351	359	367	374	161	168	165	161	166	171	176
2861	5	2	2	2	2	2	2	2	1	3	2	1	2	3	4
2862	5	24	53	73	93	105	116	127	1,153	1,157	1,156	1,154	1,157	1,160	1,163
2863	5	89	89	89	89	89	89	89	112	115	114	112	114	116	118
2864	5	5	31	49	68	79	89	99	-	-	-	-	-	-	-
2865	2	110	143	166	189	203	216	229	28	30	29	28	29	30	31
2866	2	71	71	71	71	71	71	71	157	157	157	157	157	157	157
2867	2	5	5	5	5	5	5	5	13	14	13	12	13	14	15
2868	2	116	116	116	116	116	116	116	56	62	60	57	62	66	70
2869	2	9	9	9	9	9	9	9	28	29	29	29	30	31	32
2870	2	5	5	5	5	5	5	5	132	132	132	132	132	132	132
2871	2	1	1	1	1	1	1	1	314	314	314	314	314	314	314
2872	2	88	88	88	88	88	88	88	347	347	347	347	347	347	347
2873	2	109	109	109	109	109	109	109	10	10	10	10	10	10	10
2874	2	85	85	85	85	85	85	85	22	24	23	22	23	24	25
2875	6	17	13	19	24	29	34	38	31	35	33	30	33	36	39
2876	6	62	94	116	138	151	163	175	484	487	486	484	487	490	492
2877	6	16	16	16	16	16	16	16	28	29	29	28	29	30	31
2878	6	33	13	20	27	33	39	44	43	44	44	44	45	46	47
2879	6	20	20	20	20	20	20	20	77	78	78	77	78	79	80
2880	6	2	2	2	2	2	2	2	73	74	74	74	75	76	77
2881	6	183	214	235	257	270	282	294	84	87	86	84	86	88	90
2882	6	6	6	6	6	6	6	6	20	23	22	20	22	24	26
2883	6	24	24	24	24	24	24	24	-	1	1	1	2	3	4
2884	7	212	217	221	225	227	229	231	452	455	454	452	455	457	459
2885	7	91	98	102	107	110	112	114	251	256	254	251	255	258	261
2886	7	34	70	94	119	133	147	160	47	48	48	48	49	50	51
2887	7	155	187	209	231	244	256	268	31	34	33	31	33	35	37
2888	7	25	25	25	25	25	25	25	520	530	526	520	528	535	542
2889	7	40	62	77	92	101	110	118	17	20	19	17	19	21	23
2890	7	202	221	234	247	255	262	269	182	186	184	181	185	188	191
2891	8	48	78	98	119	131	142	153	50	54	53	51	54	57	60
2892	8	96	133	158	183	198	212	225	-	6	4	1	5	9	13
2893	8	99	132	154	176	189	201	213	-	2	1	-	1	2	3
2894	8	119	119	119	119	119	119	119	112	116	114	112	115	118	121
2895	8	92	143	179	214	238	260	281	2	2	2	2	2	2	2
2896	8	37	37	37	37	37	37	37	65	67	66	65	66	67	68
2897	8	32	32	32	32	32	32	32	309	309	309	309	309	309	309
2898	8	5	5	5	5	5	5	5	161	161	161	161	161	161	161
2899	8	2	2	2	2	2	2	2	2	2	2	2	2	2	2
2900	8	10	10	10	10	10	10	10	47	47	47	47	47	47	47
2901	9	92	92	92	92	92	92	92	190	190	190	190	190	190	190
2902	9	14	14	14	14	14	14	14	5	6	6	6	6	6	6
2903	8	163	163	163	163	163	163	163	178	184	182	178	183	188	193
2904	8	127	127	127	127	127	127	127	4	5	4	3	4	5	6
2905	8	89	115	133	151	162	172	182	286	289	288	286	288	290	292
2906	8	21	24	26	28	29	30	31	206	214	211	206	212	218	223
2907	8	8	8	8	8	8	8	8	-	3	2	-	2	4	6
2908	8	62	62	62	62	62	62	62	2	3	3	3	4	4	4
2909	8	82	82	82	82	82	82	82	2	3	3	3	4	5	5
2910	8	14	14	14	14	14	14	14	5	9	7	4	8	11	14
2911	8	2	2	2	2	2	2	2	-	5	3	-	4	8	11
2912	8	6	6	6	6	6	6	6	-	-	-	-	-	-	-
2913	10	11	11	11	11	11	11	11	96	96	96	96	96	96	96
2914	10	25	25	25	25	25	25	25	15	16	16	15	16	17	18

Appendix C2: Citrus Employment Forecast 2015 to 2045

TAZ	Planning Area	Industrial Employees							Commercial Employees						
		2015	2020	2025	2030	2035	2040	2045	2015	2020	2025	2030	2035	2040	2045
2915	9	47	47	47	47	47	47	47	16	17	16	15	16	17	18
2916	10	60	60	60	60	60	60	60	5	6	6	5	6	7	8
2917	9	54	54	54	54	54	54	54	27	27	27	27	27	27	27
2918	9	10	19	25	32	36	40	44	1	2	2	2	2	2	2
2919	9	205	243	269	296	312	328	343	66	71	69	66	70	74	78
2920	10	123	149	167	186	197	208	219	96	100	99	97	100	103	106
2921	9	58	58	58	58	58	58	58	1	1	1	1	1	1	1
2922	9	121	121	121	121	121	121	121	29	32	31	29	32	34	36
Total		**7,800**	**8,788**	**9,508**	**10,229**	**10,647**	**11,044**	**11,431**	**10,200**	**10,662**	**10,688**	**10,637**	**11,072**	**11,484**	**11,886**

Appendix C2: Citrus Employment Forecast 2015 to 2045

TAZ	Planning Area	Service Employees							Total Employees						
		2015	2020	2025	2030	2035	2040	2045	2015	2020	2025	2030	2035	2040	2045
2801	1	13	24	31	38	44	49	52	38	75	102	131	143	154	166
2802	1	10	16	20	24	27	30	31	767	818	822	825	829	833	835
2803	1	49	89	115	140	160	179	188	108	162	195	226	253	278	293
2804	4	27	34	38	42	45	48	49	63	71	74	77	81	85	87
2805	1	50	53	55	57	59	61	62	91	95	97	99	102	104	105
2806	4	32	49	60	70	78	86	91	109	162	194	225	248	271	291
2807	4	38	51	60	68	74	80	83	88	133	161	189	209	229	244
2808	4	73	95	110	124	135	145	151	163	201	222	242	261	279	292
2809	4	5	12	17	22	26	29	31	28	36	41	45	50	54	57
2810	3	13	33	46	58	68	77	81	101	134	167	198	216	232	246
2811	3	43	52	58	63	67	71	73	194	226	247	267	282	297	310
2812	3	60	68	73	78	82	86	88	240	251	257	263	270	277	282
2813	3	32	35	37	39	40	41	42	36	41	45	49	52	55	58
2814	3	222	230	235	240	244	248	251	275	286	293	299	306	313	319
2815	3	343	350	355	359	362	365	367	639	649	656	661	667	673	678
2816	3	560	572	580	588	594	600	603	888	904	913	922	932	942	949
2817	3	285	361	411	459	496	531	548	803	895	942	984	1,034	1,081	1,109
2818	3	36	44	49	54	58	62	64	95	106	112	118	125	132	137
2819	4	43	86	113	140	161	181	190	108	155	180	204	229	252	264
2820	4	39	65	82	98	111	123	129	42	71	87	101	116	130	138
2821	4	66	94	112	129	142	155	161	82	113	130	145	161	176	184
2822	4	112	161	192	222	246	268	344	132	186	215	242	270	296	376
2823	4	84	93	99	104	108	112	114	193	235	263	290	308	324	338
2824	4	708	758	790	821	845	868	879	725	776	807	837	862	886	898
2825	4	47	107	146	183	212	240	253	136	204	240	272	307	341	359
2826	4	123	152	171	189	203	216	241	130	162	180	196	213	228	255
2827	4	55	82	99	116	129	141	147	58	88	104	119	134	148	156
2828	4	109	129	142	155	165	174	202	139	200	237	273	288	301	337
2829	4	186	250	291	331	362	392	406	240	312	350	385	422	458	478
2830	4	85	149	190	230	261	290	304	173	265	320	373	417	459	486
2831	4	241	265	280	295	306	317	329	501	529	543	556	570	584	599
2832	4	384	392	397	402	406	410	443	594	610	618	627	635	642	678
2833	4	390	405	414	423	430	437	450	536	584	613	643	664	685	712
2834	4	310	341	361	380	395	409	416	592	627	645	661	679	696	706
2835	4	5	27	41	55	66	76	81	12	37	50	62	75	87	94
2836	4	114	213	277	339	387	434	461	199	309	369	424	481	537	572
2837	4	7	66	104	141	169	196	209	17	83	118	151	185	218	236
2838	4	858	908	940	971	995	1,018	1,029	905	960	990	1,018	1,046	1,073	1,088
2839	4	665	687	701	715	726	736	748	738	762	775	788	800	811	824
2840	4	551	648	711	771	818	863	883	676	775	837	896	945	992	1,014
2841	4	799	874	923	970	1,007	1,042	1,063	1,171	1,256	1,301	1,342	1,387	1,429	1,457
2842	5	68	82	91	100	107	114	117	127	168	193	219	238	257	271
2843	5	133	205	252	297	332	365	381	165	295	424	545	670	790	892
2844	5	77	97	110	123	133	142	146	145	218	315	408	502	594	675
2845	5	91	137	167	196	218	239	249	233	324	382	438	480	521	549
2846	5	20	43	58	73	84	95	100	22	48	62	75	88	101	108
2847	5	24	33	39	45	49	53	55	257	266	272	278	282	286	288
2848	5	120	151	171	190	205	219	226	225	261	279	295	314	332	343
2849	5	82	94	102	109	115	121	124	147	161	168	174	182	189	193
2850	5	534	558	574	589	601	612	617	832	859	874	887	901	914	921
2851	5	271	287	297	307	315	322	325	479	497	506	515	525	533	537
2852	5	379	405	422	438	451	463	469	430	458	474	489	503	516	523
2853	5	188	198	204	210	215	220	222	227	238	244	249	255	261	264
2854	5	367	422	458	493	520	546	625	680	777	833	886	933	978	1,075
2855	5	127	152	168	184	196	207	212	189	216	231	246	260	273	280
2856	5	533	581	612	642	665	687	697	669	724	752	778	806	833	848
2857	5	171	212	238	263	283	302	312	220	267	291	312	337	360	374

Appendix C2: Citrus Employment Forecast 2015 to 2045

TAZ	Planning Area	Service Employees							Total Employees						
		2015	2020	2025	2030	2035	2040	2045	2015	2020	2025	2030	2035	2040	2045
2858	5	172	191	203	215	224	233	240	359	420	458	497	524	549	572
2859	5	338	400	440	479	509	538	559	390	476	524	569	611	652	685
2860	5	201	243	270	296	316	335	344	681	742	778	808	841	873	894
2861	5	25	41	51	61	69	76	79	28	46	55	64	73	81	85
2862	5	189	211	225	239	250	260	265	1,366	1,421	1,454	1,486	1,512	1,536	1,555
2863	5	443	462	474	486	495	504	508	644	666	677	687	698	709	715
2864	5	13	15	16	17	18	19	19	18	46	65	85	97	108	118
2865	2	145	157	165	172	178	184	187	283	330	360	389	410	430	447
2866	2	535	535	535	535	535	535	535	763	763	763	763	763	763	763
2867	2	14	21	26	31	35	38	40	32	40	44	48	53	57	60
2868	2	308	340	360	380	395	410	418	480	518	536	553	573	592	604
2869	2	308	312	314	316	318	320	321	345	350	352	354	357	360	362
2870	2	113	113	113	113	113	113	154	250	250	250	250	250	250	291
2871	2	315	315	315	315	315	315	315	630	630	630	630	630	630	630
2872	2	1,005	1,005	1,005	1,005	1,005	1,005	1,005	1,440	1,440	1,440	1,440	1,440	1,440	1,440
2873	2	37	38	39	40	40	40	40	156	157	158	159	159	159	159
2874	2	100	109	115	121	126	130	133	207	218	223	228	234	239	243
2875	6	146	169	184	199	210	221	226	194	217	236	253	272	291	303
2876	6	110	130	143	155	165	174	179	656	711	745	777	803	827	846
2877	6	122	128	132	136	139	142	145	166	173	177	180	184	188	192
2878	6	72	76	78	80	82	84	85	148	133	142	151	160	169	176
2879	6	212	218	222	226	229	232	245	309	316	320	323	327	331	345
2880	6	160	165	168	171	173	175	176	235	241	244	247	250	253	255
2881	6	279	305	322	338	351	363	369	546	606	643	679	707	733	753
2882	6	27	43	53	63	71	78	82	53	72	81	89	99	108	114
2883	6	39	45	49	53	56	59	60	63	70	74	78	82	86	88
2884	7	750	769	781	793	802	811	815	1,414	1,441	1,456	1,470	1,484	1,497	1,505
2885	7	388	421	442	463	479	494	501	730	775	798	821	844	864	876
2886	7	146	159	167	175	181	187	190	227	277	309	342	363	384	401
2887	7	153	202	234	265	289	312	335	339	423	476	527	566	603	640
2888	7	314	372	410	446	474	501	536	859	927	961	991	1,027	1,061	1,103
2889	7	140	190	222	253	278	301	316	197	272	318	362	398	432	457
2890	7	183	216	238	259	275	290	297	567	623	656	687	715	740	757
2891	8	177	220	248	275	296	316	325	275	352	399	445	481	515	538
2892	8	242	293	326	358	383	407	418	338	432	488	542	586	628	656
2893	8	1,254	1,274	1,287	1,299	1,309	1,318	1,443	1,353	1,408	1,442	1,475	1,499	1,521	1,659
2894	8	266	294	312	330	344	357	368	497	529	545	561	578	594	608
2895	8	55	56	57	58	58	58	58	149	201	238	274	298	320	341
2896	8	265	274	280	286	291	295	297	367	378	383	388	394	399	402
2897	8	215	215	215	215	215	215	215	556	556	556	556	556	556	556
2898	8	634	634	634	634	634	634	742	800	800	800	800	800	800	908
2899	8	800	800	800	800	800	800	859	804	804	804	804	804	804	863
2900	8	1,959	1,959	1,959	1,959	1,959	1,959	1,959	2,016	2,016	2,016	2,016	2,016	2,016	2,016
2901	9	606	606	606	606	606	606	606	888	888	888	888	888	888	888
2902	9	96	101	104	107	109	111	112	115	121	124	127	129	131	132
2903	8	356	409	443	476	502	526	537	697	756	788	817	848	877	893
2904	8	50	58	63	68	72	75	78	181	190	194	198	203	207	211
2905	8	68	91	106	120	131	142	147	443	495	527	557	581	604	621
2906	8	624	692	736	779	812	844	859	851	930	973	1,013	1,053	1,092	1,113
2907	8	30	54	69	84	96	107	112	38	65	79	92	106	119	126
2908	8	25	28	30	32	34	35	36	89	93	95	97	100	101	102
2909	8	38	42	44	46	48	50	51	122	127	129	131	134	137	138
2910	8	18	53	76	98	115	131	139	37	76	97	116	137	156	167
2911	8	39	73	95	117	134	150	158	41	80	100	119	140	160	171
2912	8	-	4	6	8	10	12	13	6	10	12	14	16	18	19
2913	10	134	134	134	134	134	134	134	241	241	241	241	241	241	241
2914	10	191	196	199	202	205	207	208	231	237	240	242	246	249	251

Appendix C2: Citrus Employment Forecast 2015 to 2045

TAZ	Planning Area	Service Employees							Total Employees						
		2015	2020	2025	2030	2035	2040	2045	2015	2020	2025	2030	2035	2040	2045
2915	9	195	206	213	220	225	230	232	258	270	276	282	288	294	297
2916	10	99	107	112	117	121	125	127	164	173	178	182	187	192	195
2917	9	73	76	78	80	81	82	83	154	157	159	161	162	163	164
2918	9	40	49	55	61	66	70	72	51	70	82	95	104	112	118
2919	9	232	268	291	314	332	349	361	503	582	629	676	714	751	782
2920	10	311	343	363	383	398	413	433	530	592	629	666	695	724	758
2921	9	68	69	70	71	72	73	73	127	128	129	130	131	132	132
2922	9	101	129	147	164	178	191	207	251	282	299	314	331	346	364
Total		**27,820**	**30,700**	**32,558**	**34,359**	**35,763**	**37,094**	**38,395**	**45,820**	**50,150**	**52,754**	**55,225**	**57,482**	**59,622**	**61,712**

Appendix D

TAMPA BAY REGIONAL PLANNING MODEL GUIDE

Tampa Bay Regional Planning Model v8.0

Technical Report No. 2
User's Procedural Guide

April 24, 2015

FDOT

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Chapter 1 - **Overview and Introduction**

1.1 Introduction

This technical report serves as a "hands-on" User's Procedural Guide for applying and interpreting the results of the Tampa Bay Regional Planning Model (TBRPM) version 8.0 (v8.0) as used for planning activities such as Long Range Transportation Plans (LRTPs), Developments of Regional Impact (DRIs) and other planning studies in Florida Department of Transportation (FDOT) District 7 (D7). In this report, the model chain will be fully described in detail including: new features, required inputs, step-by-step procedures for setting up and running the model, outputs / reports produced by the model, procedures for interpreting and using the model outputs, and special considerations to be taken into account while applying the model and the interpretation of their results.

This report assumes that the readers have some familiarity with the standard modeling techniques used in Florida, the Florida Standard Urban Transportation Modeling Structure (FSUTMS), and CUBE Voyager software. For more details on modeling within FSUTMS and CUBE Voyager, refer to available FSUTMS based training courses offered by FDOT Central Office throughout the state, and the software documentation as provided by Citilabs, Inc.

1.1.1 Study Area

The TBRPM v8.0 has been developed for the planning activities under the Regional Transportation Analysis (RTA) for the Tampa Bay Area. The RTA is the cooperative and combined planning efforts of the Florida Department of Transportation (FDOT) District Seven (D7) and the Metropolitan Planning Organizations (MPOs) in the Tampa Bay Area. The study area for the TBRPM corresponds with the jurisdiction of the FDOT D7 and includes Hillsborough, Pinellas, Pasco, Hernando, and Citrus Counties of Florida. For model development and cohesion, the TBRPM Study Area boundary was expanded southward into the Northwestern part of Manatee County to include the Port Manatee area and the I-75 / I-275 loop and interchange. Due to the trip interchange between southern Hillsborough and Pinellas Counties it was deemed essential to include to the Port Manatee area to more accurately model travel patterns in the region. The RTA Study Area for the TBRPM is as depicted in **Figure 1.1**. For the 2010 Base Year, the RTA Study Area holds a population of over 2.9 million with a slightly less than 2% annual growth rate since 2000 when there was a population of just over 2.5 million.

1.1 Travel Demand Modeling

The TBRPM v8.0 is the modeling tool that the Regional Transportation Analysis (RTA) process uses in forecasting future travel demand. The following sections of this report explain, in general terms, how travel demand models operate and special operating characteristics of this model.

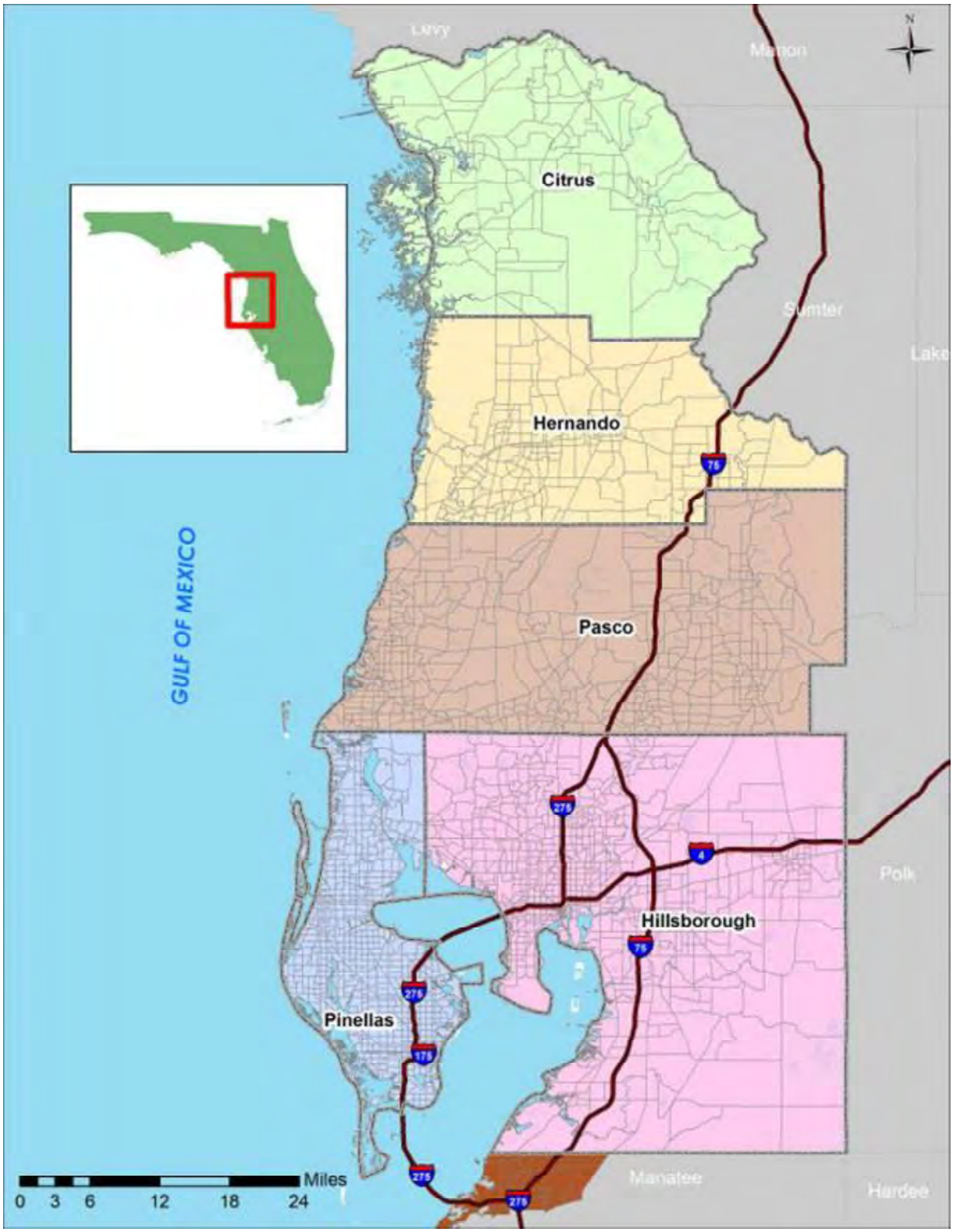


Figure 1.1 Tampa Bay Regional Planning Model (TBRPM) v8.0 Study Area

1.1.1 Travel Forecasting Process

In the TBRPM v8.0, like its previous historical versions, there are four basic steps to the process of its travel demand forecasting methodology (i.e. a 4-Step Model). These steps include the following:

1. Trip Generation
2. Trip Distribution
3. Mode Choice
4. Trip Assignment

These four steps allow trips in a given area to be estimated, distributed, and then assigned to specific transportation facilities, such as to either a highway or transit system. Even though these steps are called the basic four steps of the 4-Step Model, there have been many changes made to the TBRPM over the years which leave it far from just a basic model. This version of the model is the first generation as a Time-of-Day model which generally means that there is more than one assignment period for the highway forecasts. Other changes and the way they affect the modeling process for the TBRPM will be presented throughout this report.

1.1.2 Specific Forecasting Tools

There are many different travel demand modeling software packages available. For this current configuration, the model uses functionality mostly from the Voyager modeling engine, but also borrows some from TP+ and Voyager's PT module for transit modeling. TP+ is still used for its transit single path functionality which is more traditional for FSUTMS modeling than using the multi-path functionality of Voyager's PT, but PT is used for processing the transit network in a variety of ways including development of the various layers of walk and transit link connectors. Full details about the software used can be found on the Citilabs' website, www.citilabs.com, the software's manufacturer. More details of the software modules and how they are used will be discussed later in this report.

Florida Standard Urban Transportation Model Structure (FSUTMS)

Figure 1.2 shows the ten component modules of FSUTMS which are still the basis for the modules used to fulfill the four basic travel demand forecasting steps discussed above. These components, briefly described below, are processed in a series to complete the travel demand simulation and are as follows:

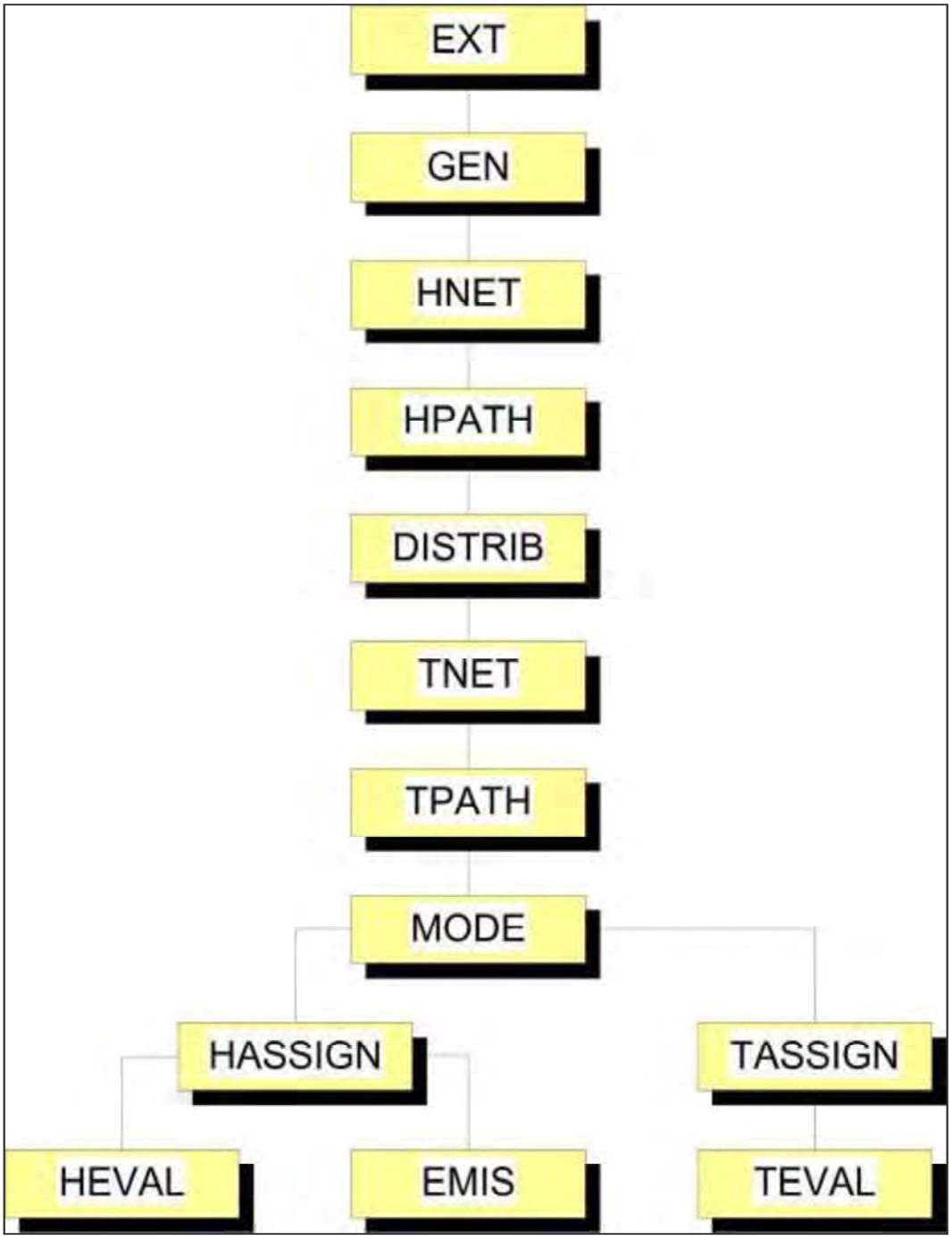


Figure 1.2 The Florida Standard Urban Transportation Modeling Structure (FSUTMS) Flowchart

EXT (EXTERNAL) creates the external-external trip table and begins the processing of the other external trip ends

GEN (GENERATION) calculates the zonal trip production and attraction trip ends

HNET (Highway Network) updates the highway networks and their attributes used for highway skimming

HPATH	(Highway Path) finds the minimum impedance, inter-zonal highway travel paths
DISTRIB	(DISTRIBUTION) creates the zone-to-zone person and vehicle trip tables by purpose
TNET	(Transit Network) builds the transit networks and attributes used for transit skimming
TPATH	(Transit Path) finds the minimum impedance inter-zonal transit travel paths
MODE	(Mode Choice) converts the person trips to transit mode of travel and highway vehicle trips
TASSIGN	(Transit Assignment) assigns the transit person trips to the transit system and produces summary statistics on the transit assignment model performance.
HASSIGN	(Highway Assignment - TOD) assigns the vehicle trips to the highway networks and produces summary statistics on the highway assignment model performance

Tampa Bay Regional Planning Model version 8.0 (TBRPM v8.0)

The TBRPM is the FSUTMS based model used for the Tampa Bay, FDOT D7 study area. The TBRPM v8.0 is the latest version of this model series and is based in the CUBE software environment. CUBE has several add-in functionalities within its environment that supports different types of modeling which can be chained together as the modeling structure. The TBRPM uses this environment and a select set of the CUBE functions to make up its modeling structure. However, the TBRPM v8.0 still processes some the model inputs in a similar manner as in previous historic model versions using legacy software executables. TBRPM v8.0 still uses two user programs, written in FORTRAN, which are still based on the TranPlan file formats for both Trip Generation (tbgenv36.exe) and auto connectors (Autocon.exe). A third, newer executable, handles the processing for developing the Mode Choice outputs (WCFMODE.exe). These programs will be described later in detail.

The FSUTMS components, as described above, are implemented in the TBRPM using the CUBE environment as CUBE modules or applications using the CUBE scripting language which makes calls to the Voyager or TP+ functionality as needed. The only exception to the ten steps above in the FSUTMS structure is that the HNET and HPATH steps have been combined into one application step in the TBRPM, *Highway Network*. CUBE applications are stored in .APP files which makes the model structure modular in nature and easier to organize.

The three modules on the FSUTMS Flowchart of **Figure 1.2**, **HEVAL**, **EMIS**, and **TEVAL**, are the final reporting modules under FSUTMS. These reporting modules house standard reports used for evaluation of the model and its results. The standard reports of these modules have been incorporated into the TBRPM using CUBE scripting and are part of the standard HTML reporting structure. These standard reports and the HTML reporting structure will also be addressed during each of the appropriate modules of the TBRPM.

1.2 Model Introduction / Overview

In this section, the physical structure of the TBRPM v8.0, as it exists in the computer, will be overviewed to describe the relevant importance of the files, file paths, and naming conventions used. Also, described will be the model keys or parameters that are part of the model structure, but are stored in the catalog file. The keys or parameters control major aspects of the model structure that are generally used for all model scenarios with some exceptions.

1.2.1 Model / File Structure

The TBRPM v8.0 model uses generally the same directory structure as its previous version TBRPM v7.x, where the ***Year_2010_Base*** scenario is paralleled with the other future year alternatives (directories): ***Year_2019_EC***, ***Year_2030_ICA***, and ***Year_2040_CA***. **Figure 1.3** depicts the new file structure of the TBRPM v8.0. The model is located under the model-specific folder called ***TBRPM_v8.0***. This folder is in the subdirectory of ***D7*** or the District 7 folder, of the ***FSUTMS*** parent folder on the C-drive.

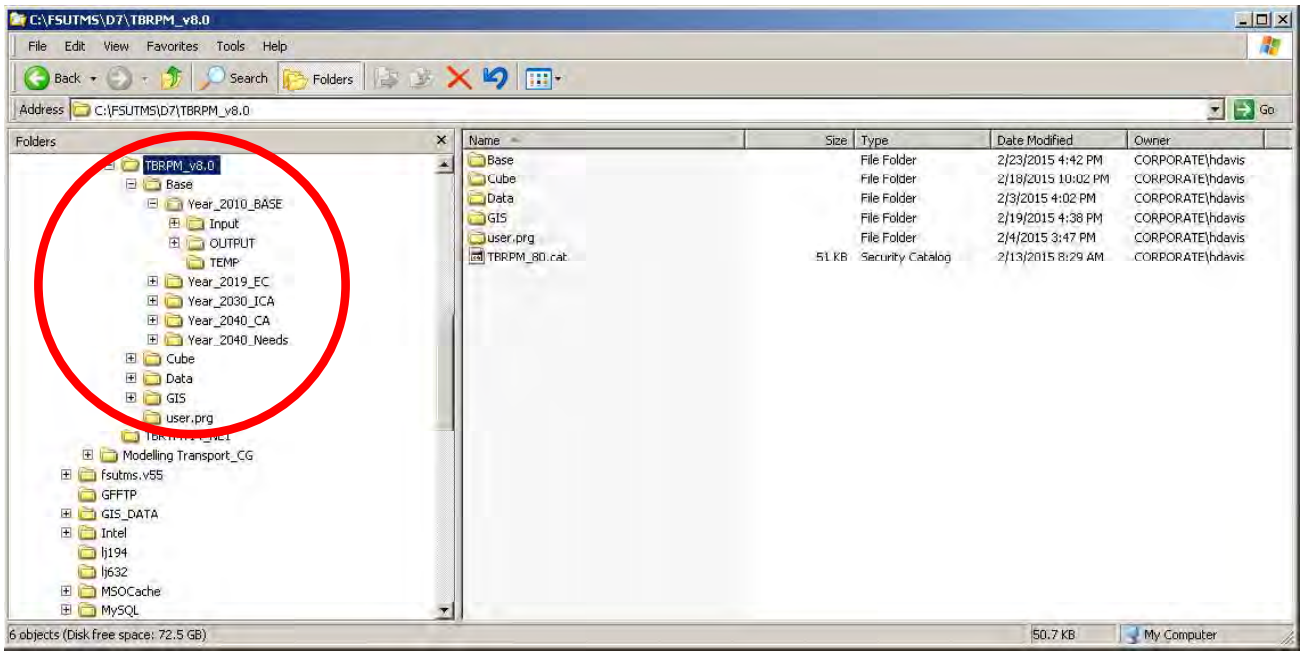


Figure 1.3 TBRPM v8.0 File Structure

In TBRPM v8.0, there are 5 general subdirectories as part of the model structure described below:

- **Base**: the ***Base*** directory contains all the common files being used by all scenarios as well as the scenarios themselves.
- **Year_2010_Base**: is an example of one of the scenario directories. Each scenario directory holds its own subdirectories; ***Input***, ***Output***, and ***Temp***. This scenario directory is named for the 2010 Base Year validation run.
- **Input**: the ***Input*** directory holds all the input files used for the scenario model run. Its subdirectory is ***Transit*** which holds the transit route, the optional node, station data, optional link, and mode choice parameter files.
- **Output**: the ***Output*** directory stores all the output files generated for the scenario model run including output dBase database, Cube matrix, and ASCII reporting files. Its subfolders include ***TOD*** which holds Time-of-Day outputs and temporary files and ***www*** which holds the HTML reporting structure for each scenario.
- **Temp**: the ***Temp*** directory holds other intermediate files used during a model run that are not typically needed for the final model results and are not considered as part of the necessary output files. But, they may be helpful in debugging any scenario run that has errors, so they are not immediately discarded.

- **Year_2019_EC**: includes ***Input***, ***Output***, and ***Temp*** directories to hold the files for the 2019 E+C highway and transit networks.
- **Year_2030_ICA**: includes ***Input***, ***Output***, and ***Temp*** directories to hold the files for 2030 Interim Year Cost Affordable highway and transit networks
- **Year_2040_CA**: includes ***Input***, ***Output***, and ***Temp*** directories to hold the files for 2040 Cost Affordable highway and transit networks.
- **CUBE**: the ***CUBE*** directory is the main working directory for the model which contains all of the application files, script files, some temporary input files, and some intermediate, printable output files of the most current model run.
- **DOC**: the ***DOC*** directory contains the updated .PDF version of the *TR1 - Validation Report* and *TR2 – User's Procedural Guide*, this report, and other documentation such as TBRPM v8.x Model Enhancements for future releases and the TBRPM v8.x Assignment Volumes Cheat Sheet which lists the attributes found on the final assigned highway network.
- **GIS**: the ***GIS*** directory contains all of the GIS shapefiles and other graphic images that are used for display in the model.
- **user.prg**: the ***user.prg*** directory contains all of the past and current user-defined programs used by the model.

As stated above, the ***Base*** directory not only holds the scenario subdirectories, but it also holds all of the common input files (i.e. .SYN files and dBase database files such as for the terminal time database, SPEEDCAP database, etc.) needed for all scenario runs. The scenario directories only hold the scenario specific files.

The ***TBRPM_v8.0*** folder which is the parent directory of the model also contains the CUBE catalog file, "TBRPM_80.cat". To properly access the CUBE model structure, the user should open this catalog file in CUBE to begin using the CUBE interface. The most common way to run a scenario in the TBRPM v8.0 is to execute the entire model chain for a selected scenario or even for all scenarios which can be run in a series. Model run times, however, are now much greater than the previous model v7.0 depending on the hardware being used. An older quad-core class machine will now take between 12-14 hours to run a single scenario depending on whether running for the 2010 Base Year or the 2040 Cost Affordable scenario. Also, the use of CUBE Cluster is now a must to achieve these resulting run times. CUBE Cluster allows portions of the model to run on multiple CPUs at once, in parallel, greatly enhancing run time efficiencies. Good news is that newer i-7 class PCs can have faster run times typically 4½ to 6½ hours since they run as 8-CPUs. A single application of one complete model scenario run will now use between 15-24GB of hard-disk space, also depending on the scenario being run.

1.2.2 File Format and Naming Conventions

In TBRPM v8.0, most of the input files used are still in the dBase database format with some still in text based formats. The TBRPM v8.0 generally follows the naming convention rules as recommended by the FDOT Central Office: using the same filename as in previous TBRPM models with the use of "_YYA", for input files, and "_AYY", for output files, with the ".DBF" extension for the dBase files. Here "YY" represents the last two-digits of the scenario year being run, and "A" is an alternative letter

to help designate multiple scenario alternatives of the same year. Scenario names can be any name as necessary but do need to adhere to certain length requirements, and cannot begin with a number. For the TBRPM, the scenario names begin with "Year", "_", and the actual year (i.e. 2010) with a brief cryptic description of the scenario alternative. The input and output files are then setup to use the convention described earlier.

1.2.3 Catalog Keys

The Cube software is designed with the use of a scripting language for model development that implements the use of parameter variables, also known as catalog "keys". There are a few keys that are built into the software to make it easier to access the main Cube file structures used, such as **{CATALOG_DIR}** and **{SCENARIO_DIR}**. Although the scenario directory key was designed by Citilabs to facilitate the file management for a variety of scenarios and alternatives, the TBRPM v8.0 was designed slightly different, this is to allow the 2010 Base Year scenario directory to be treated in parallel with the other scenario directories. So, the model was designed around a **{WORK_DIR}** key that the users must set or change as necessary to define the location of a scenario's input and output directories, especially for new user created scenarios. The following **Table 1.1** shows an example of how the **{WORK_DIR}** is used.

Table 1.1 TBRPM v8.0 Input / Output Directories

Catalog Key	Value (for example)	Description
{WORK_DIR}\Input\	C:\FSUTMS\D7\TBRPM_v8.0\Base\Year_2010_Base\Input\	Input directory
{WORK_DIR}\Output\	C:\FSUTMS\D7\TBRPM_v8.0\Base\Year_2010_Base\Output\	Output directory

The use of catalog keys helps increase the ease and efficiency of file management and is a good scripting practice. These keys allow for the variation needed between each scenario run to accomplish the same mode chain. The TBRPM v8.0 catalog keys can use different values for the 2010 Base Year (validation) model scenario than the other alternative model runs. In addition, the following catalog keys shown in **Table 1.2** should also be checked to make sure that they are appropriate for each scenario / alternative:

Table 1.2 TBRPM v8.0 Important Scenario Catalog Keys

Catalog Key	Value (for example)	Description
{Scen. Name}	YEAR_2010_Base	Built-in Scenario Name used by Cube
{SCENARIO_DIR}	C:\FSUTMS\D7\TBRPM_v8.0\ Base\Year_2010_Base \	Built-in Scenario Path used by Cube
{ALT}	A	Alternative Designation
{YEAR}	10	Last 2 digits of the scenario year
{TITLE}	Year 2010 Base Validated Network	Title used in HTML reporting for distinguishing scenario
{WORK_DIR}	C:\FSUTMS\D7\TBRPM_v8.0\ Base\Year_2010_Base \	Working Directory
{USERPRG}	C:\FSUTMS\D7\TBRPM_v8.0\ User.prg\	User defined program directory, should only be changed if root model directory is different
{ANALYSIS}	0 or 1	HEVAL Validation or Analysis run; default is 1 (Analysis Only), 0 runs both reports

Cube uses the built-in catalog key **{SCENARIO_DIR}** to define the base scenario and the other scenarios are then defined under that base scenario directory. By defining the **{WORK_DIR}** key and setting the value to "C:\FSUTMS\D7\TBRPM_v8.0\Base\Year_2010_Base \", the base scenario directory is moved to the folder ***Year_2010_Base*** under the ***Base*** directory and is paralleled with all other scenarios.

The catalog keys are all located in the either the "Key" window area of the Cube interface shown in **Figure 1.4** or on the scenario form shown in **Figure 1.5** which is accessed by double-clicking the scenario name in the left scenario window.

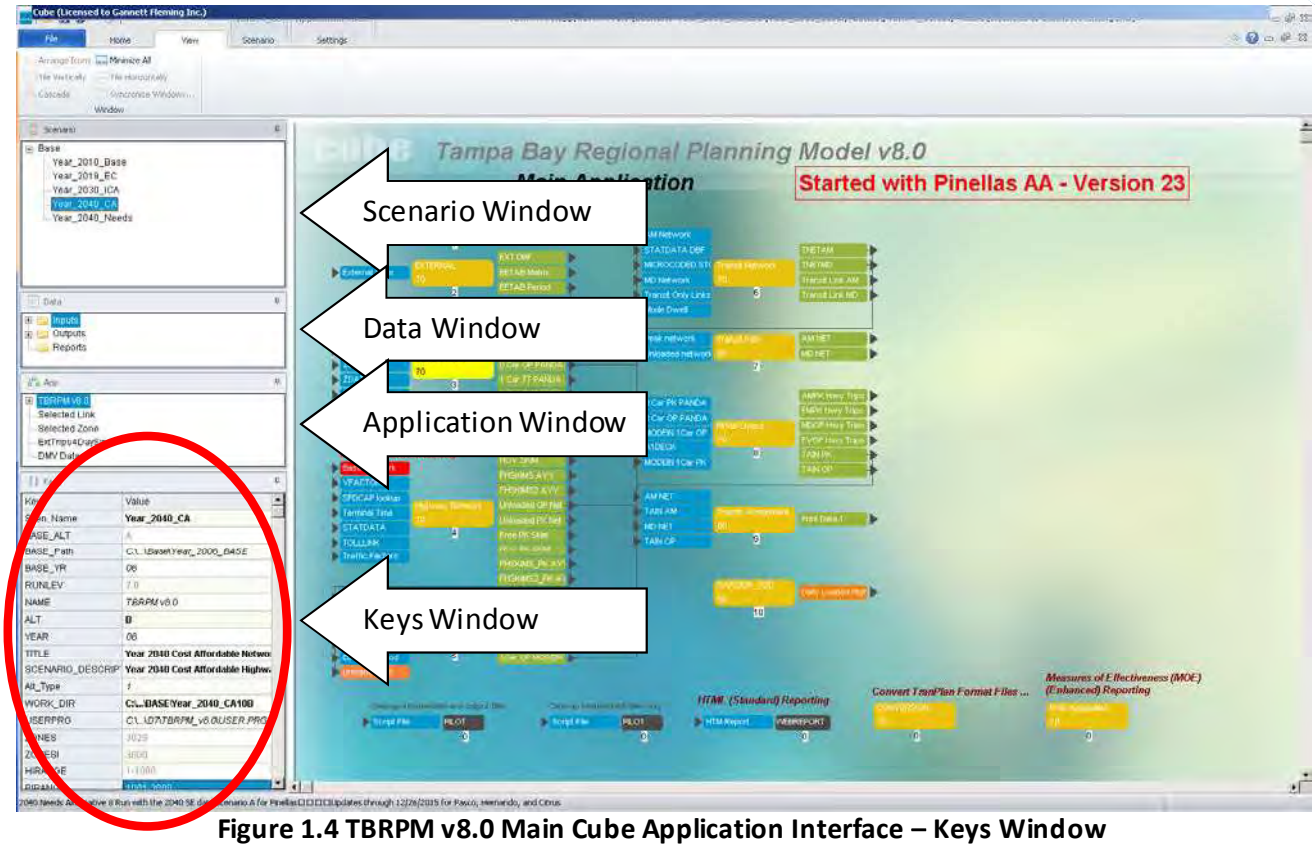


Figure 1.4 TBRPM v8.0 Main Cube Application Interface – Keys Window

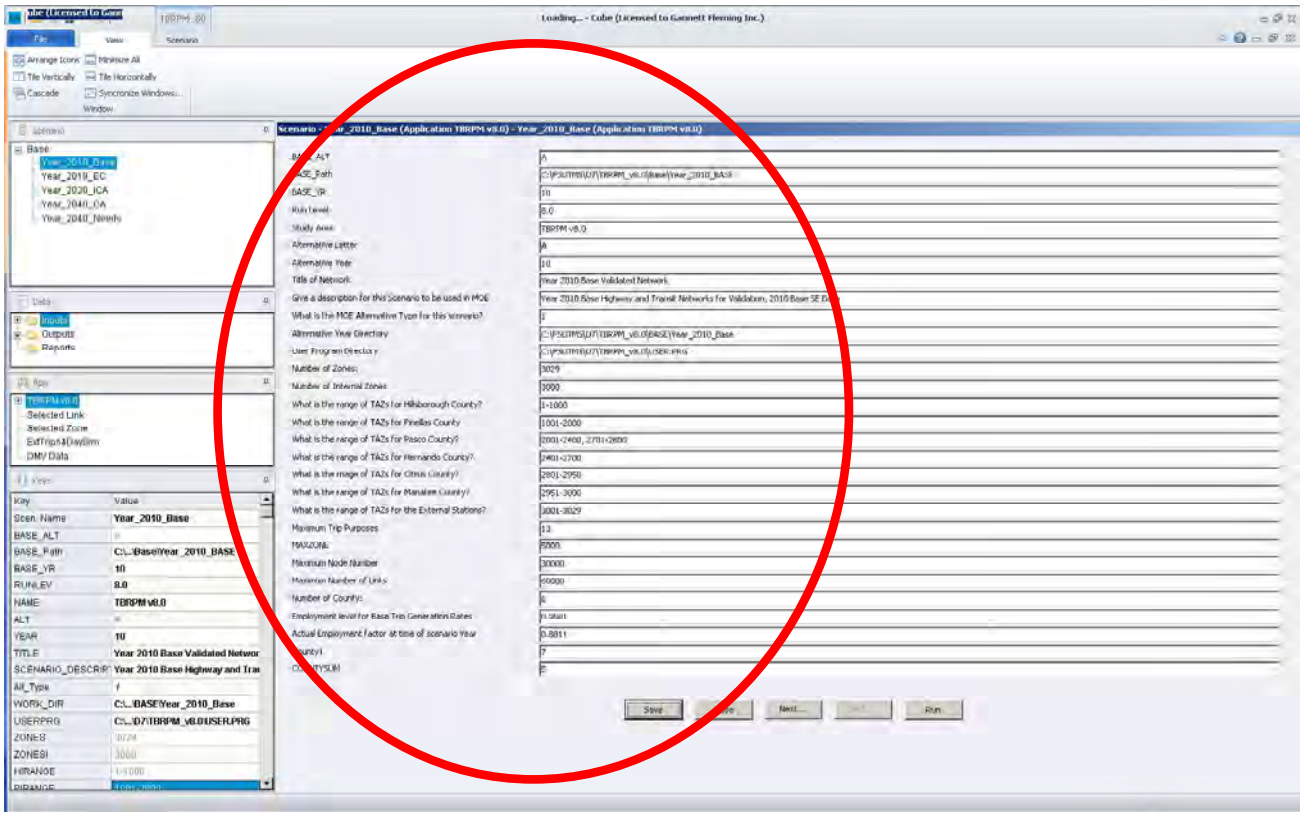


Figure 1.5 Scenario Run Form

The following tables, **Table 1.3** through **Table 1.10**, list the other catalog keys found in the model structure with a brief description for each. The keys are broken up into several tables based on their relevance in the model.

Table 1.3 Base Model Parameter Keys for All Scenarios

Catalog Key	Value (for example)	Description
{BASE_Path}	C:\FSUTMS\D7\TBRPM_v8.0\Base\Year_2010_Base \	Working Directory of the Base scenario used for comparison with others
{BASE_ALT}	A	Base Alternative Designation
{BASE_YR}	10	Last 2 digits of the Base scenario year
{Run Level}	8.0	Model Version
{Study Area}	TBRPM v8.0	Name for Modeling Area
{ZONES}	3029	Total number of all TAZs in the model
{ZONESI}	3000	Total number of internal TAZs available
{HIRANGE}	1-1000	Range of TAZs for Hillsborough County
{PIRANGE}	1001-2000	Range of TAZs for Pinellas County

Catalog Key	Value (for example)	Description
{PARANGE}	2001-2400, 2701-2800	Range of TAZs for Pasco County; was amended from TAZs previously in Hernando
{HERANGE}	2401-2700	Range of TAZs for Hernando County
{CIRANGE}	2801-2950	Range of TAZs for Citrus County
{MARANGE}	2951-3000	Range of TAZs for Manatee County Portion
{EXRANGE}	3001-3029	Range of External Stations / TAZs
{HINRANGE}	5001-10000	Node number grouping set aside for Hillsborough County
{PINRANGE}	10001-14000	Node number grouping set aside for Pinellas County
{PANRANGE}	14001-16000	Node number grouping set aside for Pasco County
{HENRANGE}	16001-17000	Node number grouping set aside for Hernando County
{CINRANGE}	17001-18000	Node number grouping set aside for Citrus County
{MANRANGE}	18001-20000	Node number grouping set aside for Pinellas County
{MAXPURP}	13	Number of trip purposes in trip generation
{MAXZONE}	5000	Maximum allowable number of TAZs
{MAXNODE}	30000	Maximum number of nodes allowed for the highway network
{MAXLINK}	60000	Maximum number of links allowed for the highway network
{COUNTY}	6	Number of Counties represented; portion of Manatee counts as 1
{COUNTYSUM}	5	The first five counties are used for the FDOT D7 summaries
{UNITS}	5280	The number of units per mile used for measurements on the networks
{ProcID}	TBRPM	Process ID used by Cube Cluster nodes
{MAXPROCS}	12	Maximum number of processors to use when starting Cube Cluster; by default only number of processors on machine is used
{PYTHON_LOC}	C:\Python27\ArcGIS10.1	Path used to local the Python install used for GIS processing of PCWALK and Transit networks

Table 1.4 Area Type, Mode Choice, Highway and Transit Assignment Script Parameters

Catalog Key	Value (for example)	Description
{closeTAZs}	4	Number of TAZs used for determining averages for area type calculations
{ATITER}	50	Number of iterations used in Distribution Gravity Model for Attraction closure
{Base Employment}	0.9581	Factor of the employed percentage of the workforce at the time of the Household and Attraction Surveys
{Actual Employment}	0.9581	Factor of the employed percentage of the workforce for the scenario test; Base Year uses 0.8811
{HWYOPCOST}	12.5	Cents per mile for "Auto Operating Costs" (AOC) used for Mode Choice utilities
{VOTAM}	10.00	Peak period "Value of Time" (VOT) in dollars used for calculating auto costs for KNR/PNR auto access links
{VOTMD}	5.00	Off-Peak period "Value of Time" in dollars used in calculating auto costs for KNR/PNR auto access links
{OVTRATIO}	2.25	"Out of Vehicle" time coefficient used in calculating auto costs for KNR/PNR auto access links
{AATRATIO}	1.5	Auto access drive time coefficient used in calculating auto costs for KNR/PNR auto access links
{OCCPNRACCESS}	1.2	Average auto occupancy used in calculating auto costs for KNR/PNR auto access links
{InflationFare}	1.0	Inflation factor to assess impact of higher than normal transit fares due to inflation; default is 1.0
{InflationAOC}	1.0	Inflation factor to assess impact of higher than normal "Auto Operating Costs" (AOC) due to inflation
{InflationPartCost}	1.0	Inflation factor to assess impact of higher than normal parking costs due to inflation
{MAXTIM}	600	Maximum transit path time allowed
{MAXMODE}	59	Highest Transit mode number
{LAYOVER}	5	Minutes used for layover time in number of busses needed calculation
{LPC}	0.1	Layover percentage used instead of minutes
{AVGWLKSPD}	2.5	Average walk speed in MPH used for walk connectors
{WALKACC}	1.0	Maximum cost in miles allowed for walk access links to each mode; MAXCOST={MAXMODE}*{WALKACC}
{MAXWLKACCLNKS}	99	Maximum number of walk access links to be generated to each mode; MAXNTLEGS={MAXMODE}*{MAXWLKACCLNKS}
{NODEMIN}	3030	Lowest node considered for generating a walk link

Catalog Key	Value (for example)	Description
{CBDSIDEWALK}	0.5	Maximum cost in miles used for walk access links around transit stations to other bus stops
{XFERACC}	0.6	Maximum cost in miles used for walk access links around transit stations to other nodes
{AVGWALK}	1.0	Average walk distance for transit access used for adjusting certain access connector distances and times
{MinPCW}	15	Minimum percent walk considered during re-walk access connector analysis
{OCC3HBW}	3.2	Average auto occupancy for 3+ person HBW vehicle trips
{OCC3HBNW}	3.3	Average auto occupancy for 3+ person HBNW vehicle trips
{OCC3NHB}	3.4	Average auto occupancy for 3+ person NHB vehicle trips
{CBD}	397	General TAZ number specifying the CBD location used by AutoCon.exe
{Special_Zones}	263, 482, 1341	Special care TAZs for airports and MacDill AFB in PCWALK analysis
{Carillon_Zones}	1349, 1350, 1436, 1754	TAZs of the Carillon Area
{TB_CBD_Zone}	372-386, 388-405, 408-410	TAZs of the Tampa CBD Area
{TIA_Zone}	262, 263, 288	TAZs of the Tampa Bay International Airport
{UCH_Zone}	122	TAZ of the University Community Hospital
{BG_Zone}	203	TAZ of the Busch Gardens Area
{VA_Zone}	133	TAZ of the Veteran's Hospital Area
{MC_Zone}	759	TAZ of the Moffit Cancer Center Area
{MAFB_Zone}	482	TAZ for the MacDill Air Force Base
{WSH_Zone}	292-295, 302-305, 307-312, 763-770	TAZs for the Westshore Area
{isMicroCode}	0	Flag used to indicate if micro-coded nodes are used for premium transit coding to generate fixed guideway to bus transit connectors
{IsPremiumTransit}	0	Flag used in generating walk access links for Choice Set 2 transit processing
{LockTripTable}	0	Flag for using a locked person trip table of a "No Build" scenario for use with FTA style multiple transit alternatives analysis

Catalog Key	Value (for example)	Description
{CHOICESET_METHOD}	0	Flag used to indicate using the "Charlotte / Choice Set" methodology of the Mode Choice
{RunUB}	0	Flag used to indicate whether to run user benefits in the Mode Choice
{ITER}	99	Number of iterations used in Highway Assignment for closure of User Equilibrium
{GAP}	0.0005	GAP closure criteria of User Equilibrium
{DAMPING}	1	Damping factor used for faster User Equilibrium; no longer used reset to 1 for default
{ACCELRATE}	2.5	Acceleration rate used for Toll Facility type 1 acceleration links for traffic to regain speed after toll booth; Deceleration links speed based on congested speed function
{CTOLL}	0.06	Default CTOLL value used for converting toll into travel time for distribution and highway assignment
{CTOLL1}	0.060	CTOLL value used for Hillsborough County trips originating in and using Hillsborough toll facilities
{CTOLL2}	0.067	CTOLL value used for Pinellas County trips originating in and using Pinellas toll facilities
{CTOLL3}	0.129	CTOLL value used for Pasco County trips originating in and using Pasco toll facilities
{CTOLL4}	0.135	CTOLL value used for Hernando County trips originating in and using Hernando toll facilities
{CTOLL5}	0.149	CTOLL value used for Citrus County trips originating in and using Citrus toll facilities
{CTOLL6}	0.078	CTOLL value used for Manatee County trips originating in and using Manatee toll facilities
{FromNode}	643	Origin TAZ used for highway network path tracing report
{ToNode}	462	Destination TAZ used for highway network path tracing report
{SkimZone}	462	TAZ used for travel time skim report from highway network
{SelectZone}	1, 3, 5, 7, 9	TAZ(s) used for Select Zone Analysis in Highway Assignment
{SelectLink}	L=17161-17162*	Link(s) used for Select Link Analysis in Highway Assignment
{RUNSELLINK}	0 (1-use select link)	Flag for turning on Select Link function which is run during Highway Assignment; runtime increases for each link specified

Catalog Key	Value (for example)	Description
{HOTTOLL_AM}	0.15	Fixed toll value used for Express Lanes processing in AM Peak period as cents / mile
{HOTTOLL_PM}	0.15	Fixed toll value used for Express Lanes processing in PM Peak period as cents / mile
{HOTTOLL_MD}	0.05	Fixed toll value used for Express Lanes processing in MD Off-Peak period as cents / mile
{HOTTOLL_EV}	0.05	Fixed toll value used for Express Lanes processing in EV Off-Peak period as cents / mile
{DiversionCurve}	0	Flag used to indicate whether to process highway assignment using the "Diversion Curve" methodology; greatly increases run time
{PARENT_DIR}	C:\FSUTMS\D7\TBRPM_v8.0\Base\Year_2010_Base\	Path used for "Diversion Curve" methodology assignment where vehicle tables are stored; used to preserve "normal" assignment run

1.2.4 Key Input Files

As described above, each scenario has its own input folder that stores the key input files that are needed for a model run. These files can be copied from one scenario and modified to best suit the network conditions to be tested. A list of the files in the ***Input*** folder that could be modified includes:

- ✓ ATYPES_YYA.SYN
- ✓ BASE_YYA.SHP
- ✓ BASE_YYA.NET
- ✓ EETrips_YYA.DBF
- ✓ TollLink_YYA.DBF
- ✓ Turn_OP_YYA.PEN
- ✓ Turn_PK_YYA.PEN
- ✓ VacAcres_YYA.DBF
- ✓ ZData1_YYA.DBF
- ✓ ZData2_YYA.DBF
- ✓ ZData3_YYA.DBF
- ✓ ZData3_0C.YYA
- ✓ ZData4_YYA.DBF
- ✓ ZData4_0C.YYA
- ✓ ZData5_YYA.DBF

A list of files in the ***Input/Transit*** folder of each scenario that could be modified includes:

- ✓ MicroCodedStops_YYA.DBF
- ✓ STATDATA_YYA.DBF
- ✓ TransitLink_YYA.DBF

- ✓ TROUTE_YYA_NonPrem.LIN
- ✓ TROUTE_YYA_Prem.LIN

Any other file in these two directories should not need modification, and even some of the modifiable files listed should only be changed if necessary (i.e. ZDATA 4 or ZDATA 5). This report will walk through the input files and their formats in the following chapters in the review of each model module.

1.2.5 Time of Day Structure

As discussed in the *TBRPM v8.0 Validation Report – TR No. 1*, the new TBRPM v8.0 is a Time-of-Day based model. This model structure has been previously used for Federal Transit Administration (FTA) style Alternatives Analysis (AA) Studies for both Pinellas and Hillsborough counties from which the TBRPM v8.0 has been modified and updated to 2010 Base Year conditions and applied for the 2040 Long Range Transportation Plans (LRTPs) for the FDOT D7 area and its MPOs. This Time-of-Day structure consists of daily traffic being replicated and forecasted over four (4) individual time periods instead of the usual single daily highway assignment. It also forecasts transit ridership over two distinct time periods for Peak and Off-Peak transit levels of service. The four (4) time periods of the model highway assignment are as follows:

1. AM Peak – 6:30AM to 9:00AM (2.5 hrs)
2. Midday (MD) Off-Peak – 9:00AM to 3:30PM (6.5 hrs)
3. PM Peak – 3:30PM to 6:30PM (3 hrs)
4. Evening (EV) and overnight Off-Peak – 6:30PM to 6:30 AM (12 hrs)

1.2.6 Time of Day Factors

The function of the Time-of-Day (TOD) for the TBRPM v8.0 is accomplished through a series of factors that have been calibrated to replicate the best levels of traffic for each of the four (4) time period assignments. As will be shown later, the first step of this four-step model, Trip Generation, is calibrated to replicate and forecast person trips by purpose at the daily level. It is at the second step, Distribution, where the daily trips are first divided into Peak and Off-Peak person trips using the Time-of-Day factors that are in the following tables, **Table 1.5** through **Table 1.10**. The actual process of distribution and mode choice where these TOD factors are used will be discussed in later chapters.

Table 1.5 Time of Day, Peak / Off-Peak Trip Split Factor Keys

Catalog Key	Value (for example)	Comment
{HBW-PK-HI}, {HBW-PK-PI}, {HBW-PK-OT}	0.5649	Split Factor for Home Based Work (HBW)* trips into Peak and Off-Peak periods; possible to use up to 3 factors regionally
{HBSH-PK-HI}, {HBSH-PK-PI}, {HBSH-PK-OT}	0.3074	Split Factor for Home Based Shopping (HBSH)* trips; possible to use up to 3 factors regionally
{HBSR-PK-HI}, {HBSR-PK-PI}, {HBSR-PK-OT}	0.3253	Split Factor for Home Based Social/Recreational (HBSR)* trips; possible to use up to 3 factors regionally
{HBSC-PK-HI}, {HBSC-PK-PI}, {HBSC-PK-OT}	0.6351	Split Factor for Home Based School (HBSC)* trips; possible to use up to 3 factors regionally
{HBO-PK-HI}, {HBO-PK-PI}, {HBO-PK-OT}	0.4619	Split Factor for Home Based Other (HBO)* trips; possible to use up to 3 factors regionally
{NHBW-PK-HI}, {NHBW-PK-PI}, {NHBW-PK-OT}	0.3930	Split Factor for Non-Home Based Work (NHBW)* trips; possible to use up to 3 factors regionally
{NHBO-PK-HI}, {NHBO-PK-PI}, {NHBO-PK-OT}	0.3333	Split Factor for Non-Home Based Other (NHBO)* trips; possible to use up to 3 factors regionally
{LTRK-PK}	0.3904	Split Factor for Medium Truck (MTRK)* trips
{HTRK-PK}	0.3154	Split Factor for Heavy Truck (HTRK)* trips
{TAXI-PK}	0.4500	Split Factor for Taxi* trips
{EI-PK}	0.2840	Split Factor for Occasional External-Internal (EI)* trips
{AIRP-PK}	0.3279	Split Factor for Airport (AIRP)* trips
{COL-PK}	0.5183	Split Factor for College/University (COL)* trips

*See Trip Generation Chapter for full trip type definitions used.

After Distribution and Mode Choice other TOD factors as follows are used to split the resulting vehicle trips into AM vs PM peak trips using a directional consideration, and also into MD vs EV trips with a directional consideration.

Table 1.6 Time of Day, AM / PM Period Trip Split Factor Keys

Catalog Key	Value (for example)	Comment
{AMPKSF-HBW-HI} {AMPKSF-HBW-PI} {AMPKSF-HBW-OT}	0.4725	Split Factor for Home Based Work (HBW)** trips into AM Peak and PM Peak periods (used after Mode Choice); possible to use up to 3 factors
{AMPKSF-HBNW-HI} {AMPKSF-HBNW-PI} {AMPKSF-HBNW-OT}	0.3773	Split Factor for Home Based Non-Work (HBNW)** trips into AM Peak and PM Peak periods (used after Mode Choice); possible to use up to 3 factors
{AMPKSF-NHB-HI} {AMPKSF-NHB-PI} {AMPKSF-NHB-OT}	0.2789	Split Factor for Non-Home Based (NHB)** trips into AM Peak and PM Peak periods (used after Mode Choice); possible to use up to 3 factors
{AMPKSF-LTRK}	0.5343	Split Factor for Medium Truck (LTRK)** trips into AM Peak and PM Peak periods
{AMPKSF-HTRK}	0.5667	Split Factor for Heavy Truck (HTRK)** trips into AM Peak and PM Peak periods
{AMPKSF-TAXI}	0.4755	Split Factor for Taxi** trips into AM Peak and PM Peak periods
{AMPKSF-EI}	0.4100	Split Factor for Occasional External-Internal (EI)** trips into AM Peak and PM Peak periods

**See Mode Choice Chapter for full trip type definitions used.

Table 1.7 Time of Day, AM / PM Production to Attraction Directional Trip Split Factor Keys

Catalog Key	Value (for example)	Comment
{AMPKPAF-HBW-HI} {AMPKPAF-HBW-PI} {AMPKPAF-HBW-OT}	0.9890	Split Factor for Home Based Work (HBW) trips into Production to Attraction (PtoA) and Attraction to Production (AtoP) directional trips for AM Peak period (used after Mode Choice); possible to use up to 3 factors
{AMPKPAF-HBNW-HI} {AMPKPAF-HBNW-PI} {AMPKPAF-HBNW-OT}	0.8820	Split Factor for Home Based Non-Work (HBNW) trips into Production to Attraction (PtoA) and Attraction to Production (AtoP) directional trips for AM Peak period (used after Mode Choice); possible to use up to 3 factors
{PMPKPAF-HBW}	0.0649	Split Factor for Home Based Work (HBW) trips into Production to Attraction (PtoA) and Attraction to Production (AtoP) directional trips for PM Peak period (used after Mode Choice)

Catalog Key	Value (for example)	Comment
{PMPKPAF-HBNW}	0.4484	Split Factor for Home Based Non-Work (HBNW) trips into Production to Attraction (PtoA) and Attraction to Production (AtoP) directional trips for PM Peak period (used after Mode Choice)

Table 1.8 Time of Day, MD / EV Period Trip Split Factor Keys

Catalog Key	Value (for example)	Comment
{MDOPSF-HBW}	0.6642	Split Factor for Home Based Work (HBW)** trips into MD Off-Peak and EV Off-Peak periods (used after Mode Choice)
{MDOPSF-HBNW}	0.6449	Split Factor for Home Based Non-Work (HBNW)** trips into MD Off-Peak and EV Off-Peak periods (used after Mode Choice)
{MDOPSF-NHB}	0.4616	Split Factor for Non-Home Based (NHB)** trips into MD Off-Peak and EV Off-Peak periods (used after Mode Choice)
{MDOPSF-LTRK}	0.7024	Split Factor for Medium Truck (LTRK)** trips into MD Off-Peak and EV Off-Peak periods
{MDOPSF-HTRK}	0.5906	Split Factor for Heavy Truck (HTRK)** trips into MD Off-Peak and EV Off-Peak periods
{MDOPSF-TAXI}	0.4755	Split Factor for Taxi** trips into MD Off-Peak and EV Off-Peak periods
{MDOPSF-EI}	0.6200	Split Factor for Occasional External-Internal (EI)** trips into MD Off-Peak and EV Off-Peak periods

**See Mode Choice Chapter for full trip type definitions used.

Table 1.9 Time of Day, MD / EV Production to Attraction Directional Trip Split Factor Keys

Catalog Key	Value (for example)	Comment
{MDOPPAF-HBW}	0.4972	Split Factor for Home Based Work (HBW) trips into Production to Attraction (PtoA) and Attraction to Production (AtoP) directional trips for MD Off-Peak period (used after Mode Choice)
{MDOPPAF-HBNW)	0.4988	Split Factor for Home Based Non-Work (HBNW) trips into Production to Attraction (PtoA) and Attraction to Production (AtoP) directional trips for MD Off-Peak period (used after Mode Choice)
{EVOPPAF-HBW}	0.4994	Split Factor for Home Based Work (HBW) trips into Production to Attraction (PtoA) and Attraction to Production (AtoP) directional trips for EV Off-Peak period (used after Mode Choice)
{EVOPPAF-HBNW}	0.2788	Split Factor for Home Based Non-Work (HBNW) trips into Production to Attraction (PtoA) and Attraction to Production (AtoP) directional trips for EV Off-Peak period (used after Mode Choice)

External to External (EE) trips are just split into the four (4) time periods using the following TOD factors since they are vehicle trips without a determining factor as to their directionality.

Table 1.10 Time of Day, External to External Trip Split Factor Keys

Catalog Key	Value (for example)	Comment
{EE-PK}	0.3157	Split Factor for External to External (EE) trips into Peak and Off-Peak trips
{EE-AMPK}	0.1294	Split Factor for External to External (EE) trips into AM Peak period trips
{EE-PMPK}	0.1862	Split Factor for External to External (EE) trips into PM Peak period trips
{EE-MDOP}	0.4243	Split Factor for External to External (EE) trips into MD Off-Peak period trips
{EE-EVOP}	0.2600	Split Factor for External to External (EE) trips into EV Off-Peak period trips

1.2.7 Highway Assignment

Highway assignment actually plays a role in two areas of the TBRPM v8.0; 1) Pre-assignment to prepare a congested skim for the AM Peak period, 2) final assignment for all four (4) time periods. The congested and un-congested skims of the highway network are also used for determining transit speeds for Mode Choice. After Mode Choice, the final highway assignment tables are prepared using the TOD factors from the previous section to convert the person and vehicle trips from their Production to Attraction (PtoA) format to an Origin to Destination (OD) format. These trip tables are then assigned to their appropriate highway network by period and are summarized by each period and "Daily" as discussed in the Highway Assignment chapter to come.

1.2.8 Transit Assignment

Transit Assignment is still a Peak and Off-Peak transit level of service assignment as has been in the historical daily models. However, the big difference is that in the "Daily" model only Home Base Work (HBW) trips were used for assignment in the Peak period transit level of service. Only HBW trips were allowed to use the Express Bus and Premium transit modes of the Peak service period. The new TBRPM v8.0 has a mix of the Home Based Work (HBW), Home Based Other (HBO), and the Non-Home Based (NHB) person trips in both Peak and Off-Peak periods. So, in the Peak period there are not just HBW trips to use the Express Bus and Premium transit modes. More about this will be explained in the Transit and Mode Choice modules. One thing that has not changed with respect to transit is that the trips being assigned to the transit network are still in the Production to Attraction (PtoA) format. So, HBW trips are representative of a person's trips only in the form of the home to work direction. Care is always needed when analyzing the model's transit results for this reason.

1.2.9 Key Output Files

Many of the modules for the TBRPM v8.0 have output files that are usually in turn inputs into the next module. However, there are several key outputs from the model that would seem to be the most useful in analyzing the final model results. Usually these are in the form of report files or networks. For the TBRPM v8.0, the continued use of the HTML reporting system has been adopted to maintain and store all of the necessary model reports. The next section describes some maintenance and installation issues that are necessary to view all of the reporting functions. Each scenario will have an ***Output/WWW*** folder that holds the final reports from each of the modules. These reports are accessed through the *INDEX.HTML* file within this directory which is also explained in the next section. Other key output files to look for are the "unloaded" and "loaded" networks within the model. If the "unloaded" networks are not being produced properly, then the model will fail. Issues with these networks will need to be addressed to produce the real outputs which are the "loaded" networks. From the final **HAASIGN_TOD** module, the ***HWYLOAD_DAILY_AYY.NET*** will be generated. This final network holds all of the model assigned volumes from each of the four (4) periods and summarizes them into a "Daily" set of volumes. This network will be described in detail in the Highway Assignment module chapter.

1.2.10 Standard Reporting

HTML formatted reporting functionality previously developed for the TBRPM v7.0, has been upgraded for the TBRPM v8.0, and is used to better present the model results using web based browser technology. The following describes the steps necessary to ensure the proper display of graphics in the web reports.

The ADOBE **SVG Viewer** is used in this model's reporting functionality and will need to be downloaded and installed as necessary. The SVG Viewer integrates with your web browser as a plug-in module. The SVG Viewer allows the user to interact with SVG images and is required to view web content that contains SVG.

The SVG Viewer program can be downloaded from http://www.adobe.com/svg/viewer/install/ for the latest SVG files to be correctly displayed in the web browser. The download used in this model is included in the TBRPM v8.0 package under the "User.prg" folder. At the time of this development, only Internet Explorer was supported for this viewer.

The following **Figure 1.6**, shows an overview of the Model Application interface and highlights where the HTML reports can be accessed from.

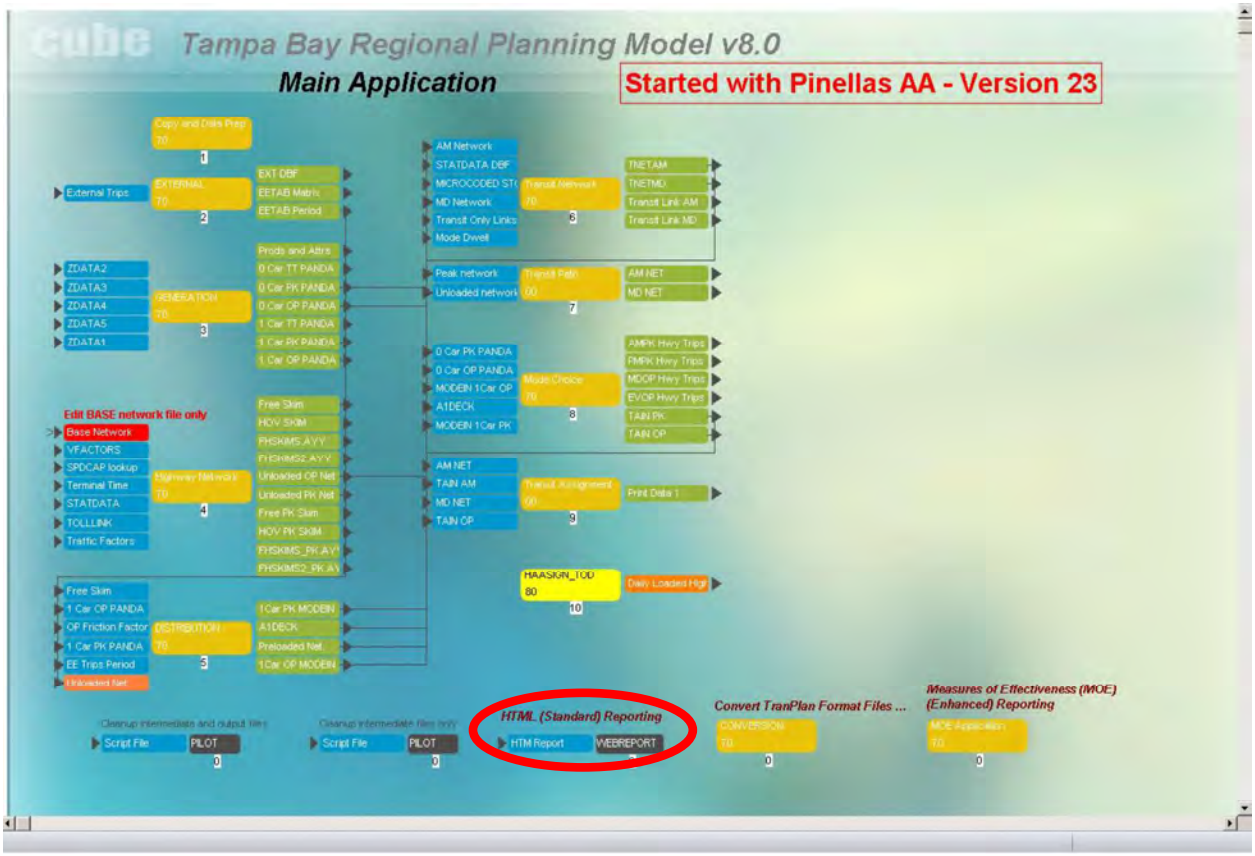


Figure 1.6 Model Application Interface

To access the HTML reporting system from within the Cube environment, a user program called WEBREPORT needs to be setup for Cube to access Internet Explorer. To set this up, copy the WEBREPORT.RSC from the model download package into the ***C:\Program Files\Citilabs\Cube\Resource\User*** directory or similar directory in which Cube is installed on the target machine.

If the file mentioned above is not available for download, follow the steps below to perform this manually:

On the Cube Voyager ***Home*** tab of the ribbon toolbar, as shown below in **Figure 1.7,** click the "User Programs" pulldown menu item and then the "User Program Settings…" button.

Figure 1.7 User Program Settings Location

Then on the pop-up window, shown in **Figure 1.8**, click the "Add…" button on the right side of the "User Program Settings" form.

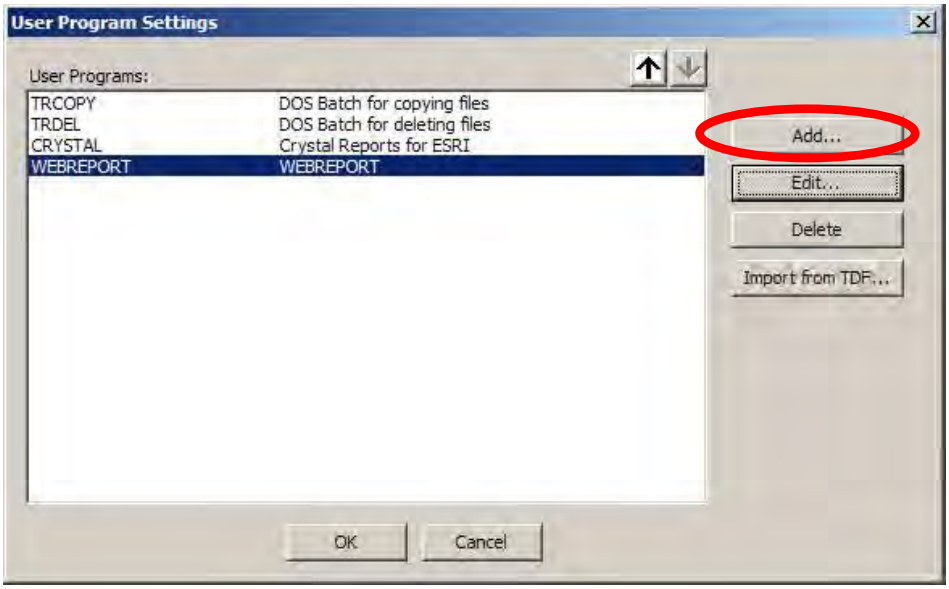


Figure 1.8 User Program Settings Window

Using the ***Program*** Tab of the form of the new pop-up window, shown in **Figure 1.9**, input the setup information as shown.

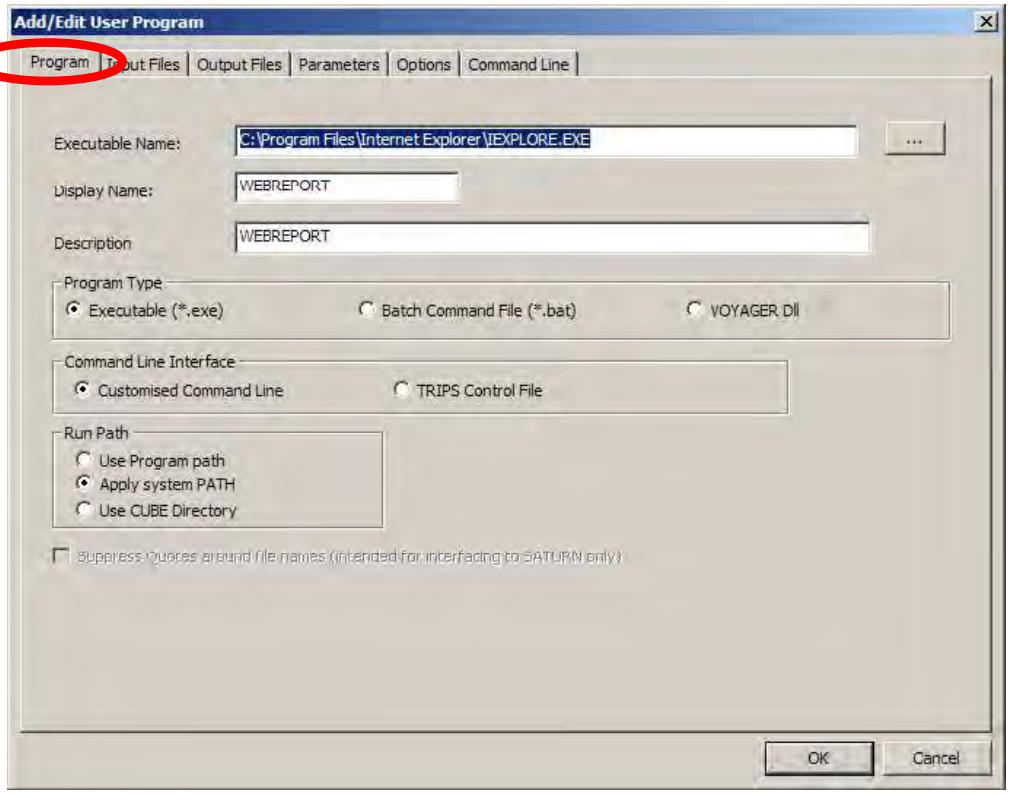


Figure 1.9 Add/Edit User Program Window

Using the ***Input Files*** tab on the same window, shown in **Figure 1.10**, click the "Add…" button. Then input the setup information in the pop-up window shown in **Figure 1.11**, and click the "OK" button.

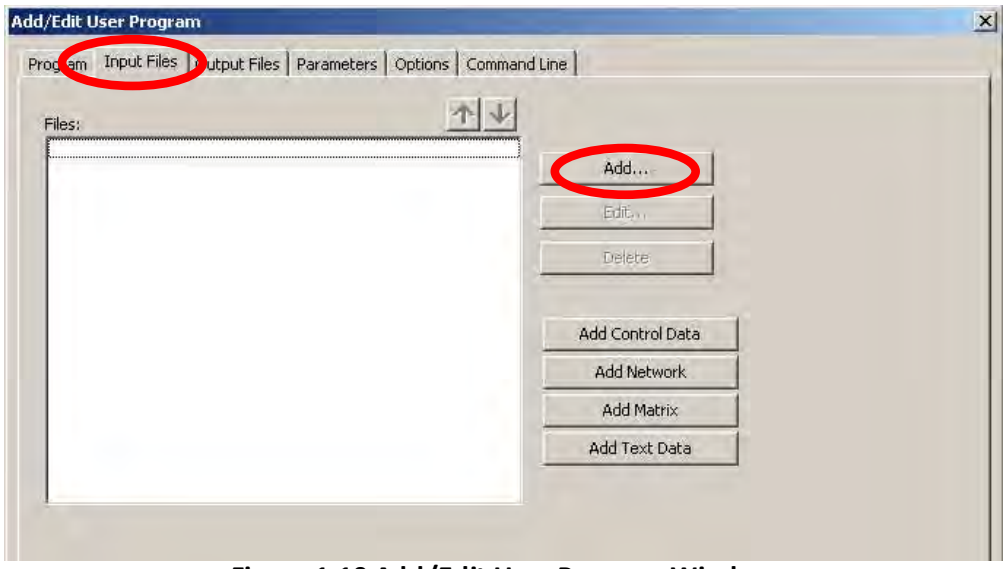


Figure 1.10 Add/Edit User Program Window

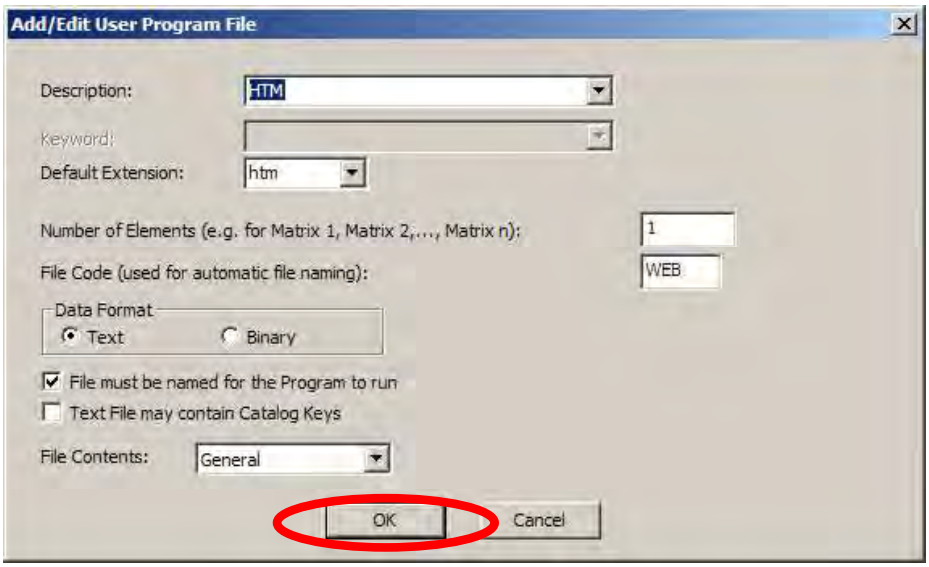


Figure 1.11 Add/Edit User Program File Window

Using the ***Command Line*** tab of the previous window, shown in **Figure 1.12**, enter the setup information shown. Then click the "OK" button to dismiss the window.

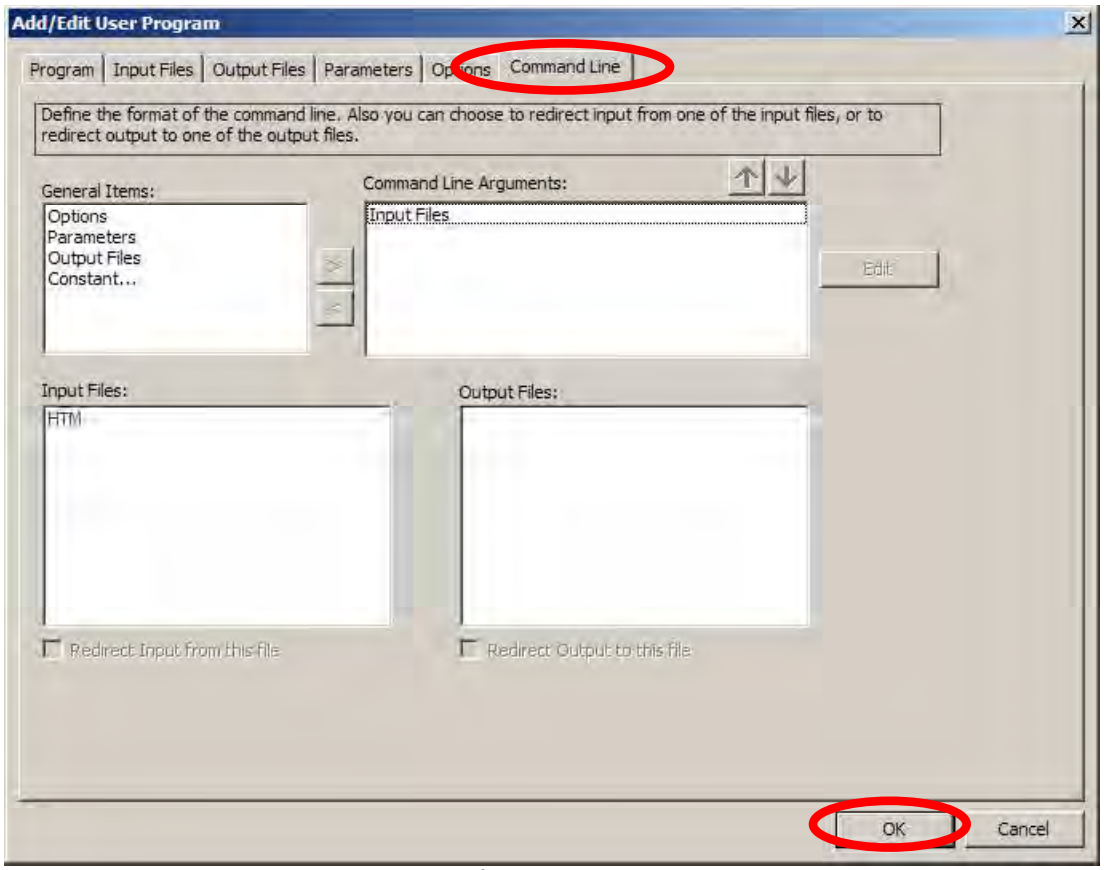


Figure 1.12 Add/Edit User Program Window

After this one time setup, the user can now double click the WEBREPORT box and then click the "Run" button on the pop-up window shown in **Figure 1.13**. The web browser will be launched showing the home page for the reporting system of the currently selected scenario.

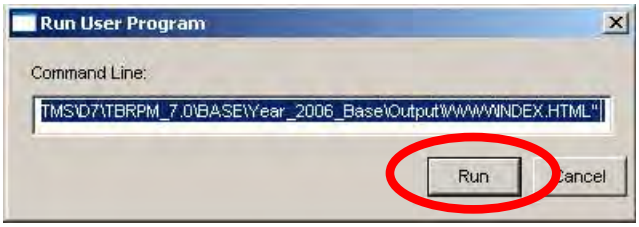


Figure 1.13 Run User Program Window

A second option to using the user program installation to open the reporting HTML is to just right-click the ***INDEX.HTML*** file and chose the "Open (Windows)" option. As long as the default internet explorer is Internet Explorer the reporting system will open properly.

Figure 1.14 Cube Right-Click Options for File Operations

A third option to open the model reporting, instead of using the Cube interface, is to locate the HTML formatted report within the ***OUTPUT\WWW*** directory of the selected scenario using Windows Explorer. For example, the base year scenario reporting home webpage is located as follows:

C:\FSUTMS\D7\TBRPM_v8.0\Base\Year_2010_Base\Output\www\index.htm

Double-clicking this file should also open the reports in Internet Explorer as shown in **Figure 1.5**. Once the webpage is open, the user can navigate through all of the model reports for each module from the menu bar on the left.

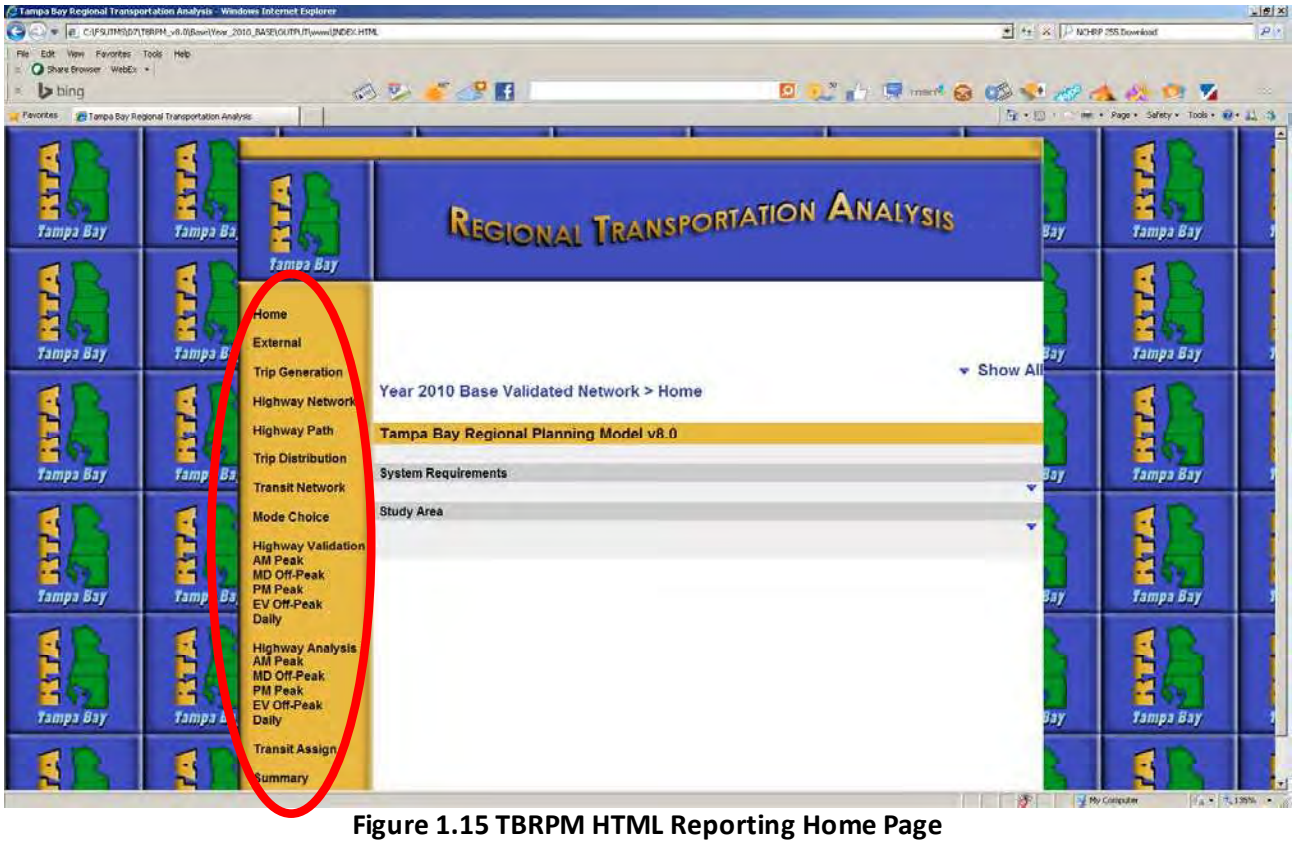


Figure 1.15 TBRPM HTML Reporting Home Page

Generally, the module reports each contains two components as shown in **Figure 1.16**. The first component provides a set of direct links to the primary input and output files for each module. The second component contains the individual reports and any graphical illustrations specific to each module. The following chapters will provide more detail about each module and its reporting functionality, as well as the file formats and examples of each.

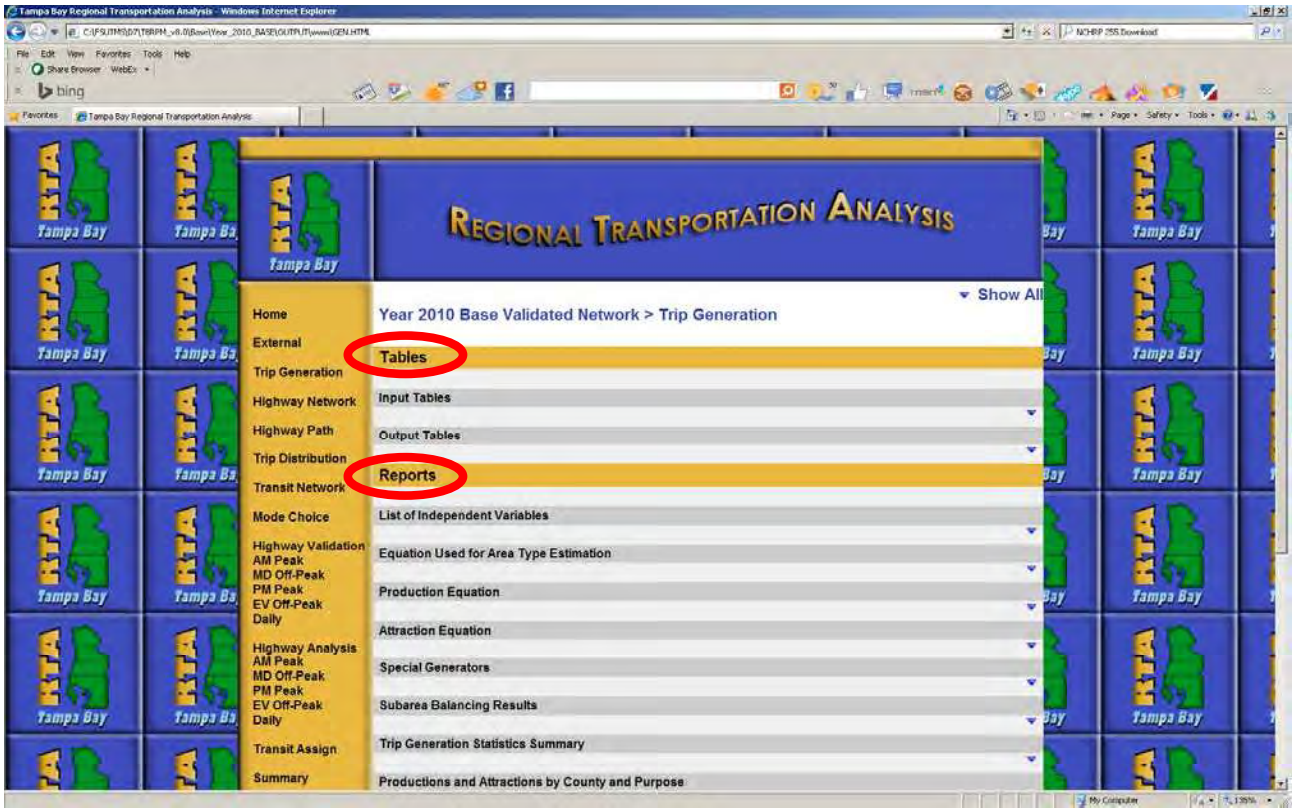


Figure 1.16 Example Report Page

1.3 Model Changes and Enhancements

Since the TBRPM v5.0, the conversion to the Cube Voyager software environment has required extensive testing and development to make the model results comparable with the previous TranPlan model results. This was due in part to the differences of the methodology needed to implement each module, especially the highway skim and assignment processes. Continued modeling efforts have been made to further the advances of the TBRPM structure through this version.

Trip Distribution

For conversion to Voyager, there were three major issues to address in Trip Distribution: gravity model calculation, friction factor lookup, and rounding issues. Details of the gravity model will be explained in ***Chapter 6 -Trip Distribution***.

Highway Assignment algorithm

Like previous model versions, TBRPM v8.0 uses the Cube Voyager built-in user equilibrium algorithm to assign trips into the highway network. This algorithm, although similar to TranPlan, does result in a different assignment than TranPlan with the same trip table assigned. The main difference in this version of course is that highway assignment is performed four times, once for each time pe riod. To make the results more comparable with TranPlan the following issues were addressed:

- Implementation of the Toll Facilities Model
- Correct Impedance Calculations
- Convergence Criteria
- Number of Iterations
- Maximum V/C Ratio Used for BPR Curve

Develop Select Link and Select Zone Application

In previous versions of the TBRPM, separate Select Link and Select Zone applications were developed for extra model analysis. In the TBRPM v8.0, both applications are built into the final highway assignment module to cut down on repetitive scripting for each application. There are two check boxes, shown in **Figure 1.17**, that are used for applying the "Select Link" or "Select Zone" processes in the TBRPM v8.0, independently. The location of the keys represented by these checkboxes in the ***Key Manager*** window is also highlighted. The reported volumes from either application will be described in ***Chapter 11 - Highway Assignment*** and the TBRPM v8.0 ***Assignment Volumes Cheat Sheet*** which is a quick reference guide to be supplied with the model download on the ***TBRTA.COM*** website.

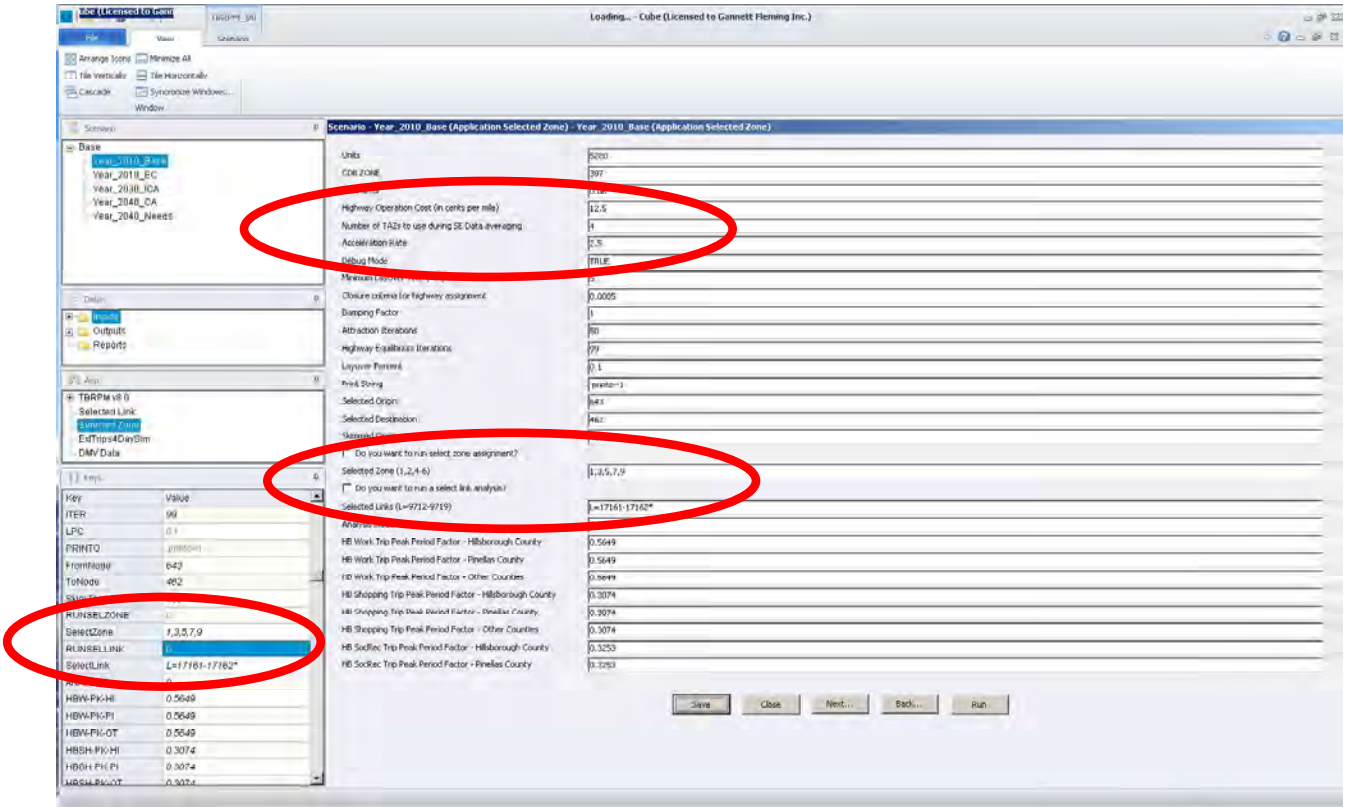


Figure 1.17 Example Scenario Window

Use of TRNBUILD for Transit Modeling

TRNBUILD, an alternative transit modeling tool to Voyager's Public Transport (PT) module, is based in a planning software package known as Transportation Planning Plus (TP+) which is also a part of the Cube software environment. It is still used in TBRPM v8.0 for the transit travel demand modeling, including building of the transit network, transit path finding and transit assignment.

For the TBRPM v8.0, new connector programs have been developed using Cube script for Peak and Off-Peak level of service Walk/Sidewalk connectors, replacing the old WALKCON.exe and SIDECON.exe user programs. There are also new treatments for transit connectors to "Premium" transit modes for use with "Choice Set" and "Traditional" Mode Choice application. These will be fully explained in the ***Transit Network*** and ***Transit Path*** modules, ***Chapter 7 -Transit Network*** and ***Chapter 8 -Transit Path***. With the new transit processes there is also an automated process for generating the ***PCWALK*** files needed for Mode Choice which is also explained in ***Chapter 7 -Transit Network***. For the highway connectors, the AUTOCON.exe is still being used to create the appropriate connectors for the Park-N-Ride (PNR) and Kiss-N-Ride (KNR) transit access modes.

Mode Choice Model

The Model's new Mode Choice application was used in the recent past for FTA AA Studies for Hillsborough and Pinellas and was adopted for use in the TBRPM v8.0 with some adjustments, mainly calibration for the 2010 transit targets. The adoption of this Mode Choice Model allows for the use of 12 different transit mode pathways in each time period, Peak and Off-Peak. The parameters used in the transit path skimming were also adjusted according to the Mode Choice Model coefficients.

Generate Standard Model Output Reports in a Web-Based Interface

HTML formatted reporting functionality was developed for the TBRPM v7.0 and enhanced for the TOD components of the TBRPM v8.0 and new transit and mode choice components to better present the model results using web browser technology.

These enhancements to the HTML reporting along with the other model changes will be detailed in **Chapter 2** - through **Chapter 10** - which outlines each model module in more detail. There are generally four components in each of the following chapters as follows:

1. **General Description**: introduces the module in detail
2. **Model Inputs and Outputs**: lists all of the input and output files for each module
3. **Model Procedure**: step by step description
4. **Model Output**: sample output of the module in HTML

Chapter 2 - **Copy and Data Preparation**

2.1 General Description

Within the Cube interface of the main TBRPM v8.0 application, as shown in **Figure 2.1**, the individual model modules can be viewed. The ***Copy and Data Prep*** (preparation) is the first module on the main TBRPM application interface. The function of this module is to delete the unnecessary files from any previous model run for the selected scenario, copy necessary input files to the model working directory, create necessary output folders, and start the Cluster modules needed for highway and transit assignment.

The ***PROFILE.MAS*** file, from the previous Cube TranPlan model, is still being copied from the scenario directory since one user-written program is in use in the model chain. This user program is the ***TBGEN36.exe*** for trip generation.

A time stamp file ***RUNTIME.PRN*** is being used in the TBRPM v8.0 to record the start and end run time for each module. The previous time stamp file is first deleted in this step and a new one is created in its place before this rest of the model chain begins. This gives the user a step by step timestamp for determining where the model may have stopped or which module runs the longest.

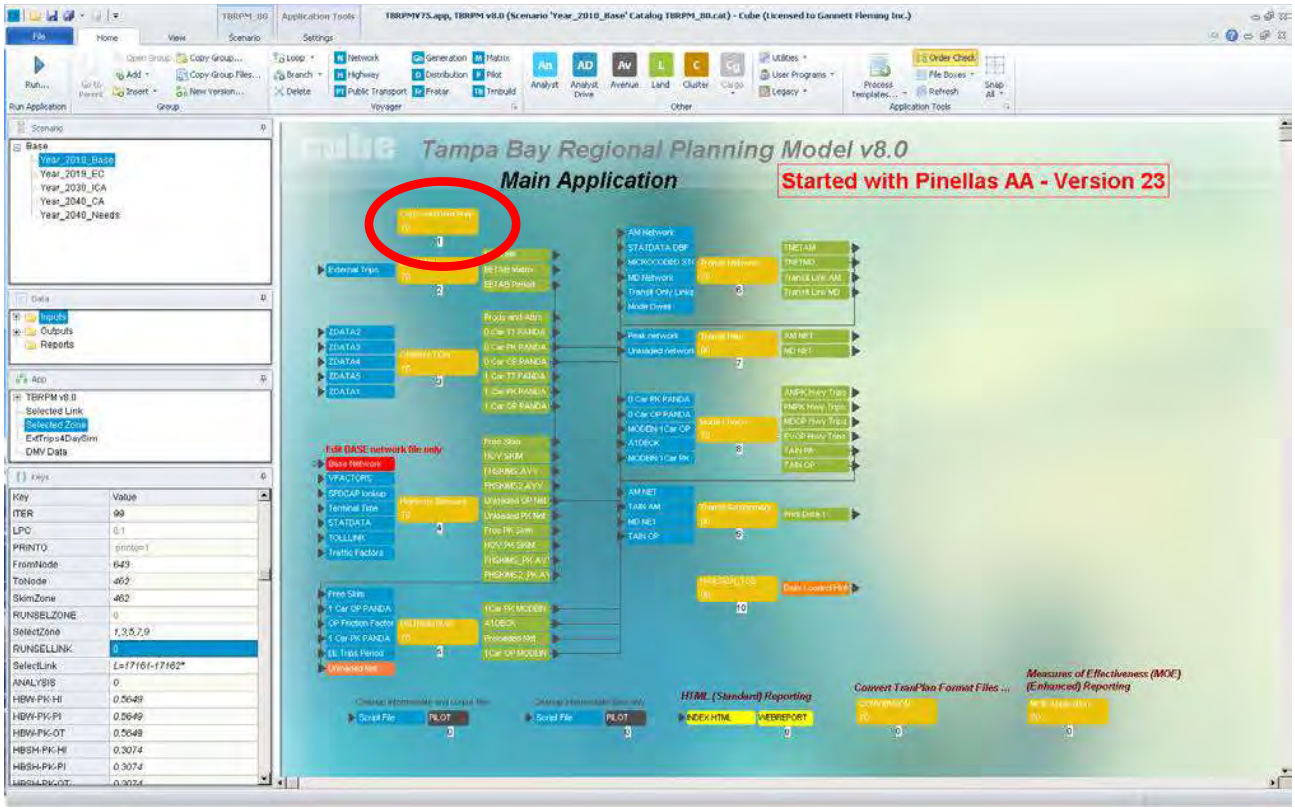


Figure 2.1 Main Application Window – Copy and Data Preparation

Chapter 3 - **External Trips**

3.1 General Description

The study area of the TBRPM v8.0 remains the same as TBRPM v7.0 and consists of external stations that represent portions of the network that occur outside of the model boundary cordon line in the highway network. The study area constitutes Hillsborough, Pinellas, Pasco, Hernando, and Citrus Counties and a representative portion of northwest Manatee County to accommodate the I-275 / I-75 traffic interchange. The external stations serve as points of entry or exit, to or from the study area. Six new external stations were added for the TBRPM v7.0 as compared to the previous TBRPM v6.x. The TBRPM v8.0, therefore, has a total of twenty nine (29) external stations. Each station was coded with a traffic analysis zone (TAZ) number between 3001 and 3029, as depicted in **Figure 3.1**.

EXTERNAL is the second module as shown on the TBRPM application interface in **Figure 3.2**. The function of this module is to produce a set of trip tables that specify the number of daily External-External (EE) vehicle trips passing between each pair of external traffic analysis zones (TAZs / external stations). The ***EETRIPS_YYA.DBF*** file, which is the input file into the External Trip Module, ***External***, contains the external trip data used to create the EE trip table dataset, ***EETABLE_AYY.MAT***. Separate trip tables are generated for autos, medium-duty trucks, and heavy trucks. *Note: medium-duty trucks were referred to as light trucks in previous model versions, but has been changed in this version to not be confused with light-duty trucks (i.e. personal pickups).*

Four key output files are generated in this module: a dBase formatted database, ***EXT.DBF,*** the EE trip table datasets, ***EETABLE_AYY.MAT*** and ***EETAB-PRD.AYY.MAT***, and a HTML formatted report, ***EXT.HTML***. The EE trip table, ***EETABLE_AYY.MAT***, is used later as input in the Distribution module, as well as after Mode Choice, in preparation of the vehicle trip tables being used for pre-assignment and final highway assignment. The HTML report for ***External*** contains five reports; 1) *ZDATA 4 – Total External Trip Ends*, 2) *Auto External to External (EE) Trip End Summary*, 3) *Medium Truck External to External (EE) Trip End Summary*, 4) *Heavy Truck External to External (EE) Trip End Summary*, 5) *External to External (EE) Trip End Summary (TOTALS)*. See section *3.4 Standard Output* for a full description of the reports.

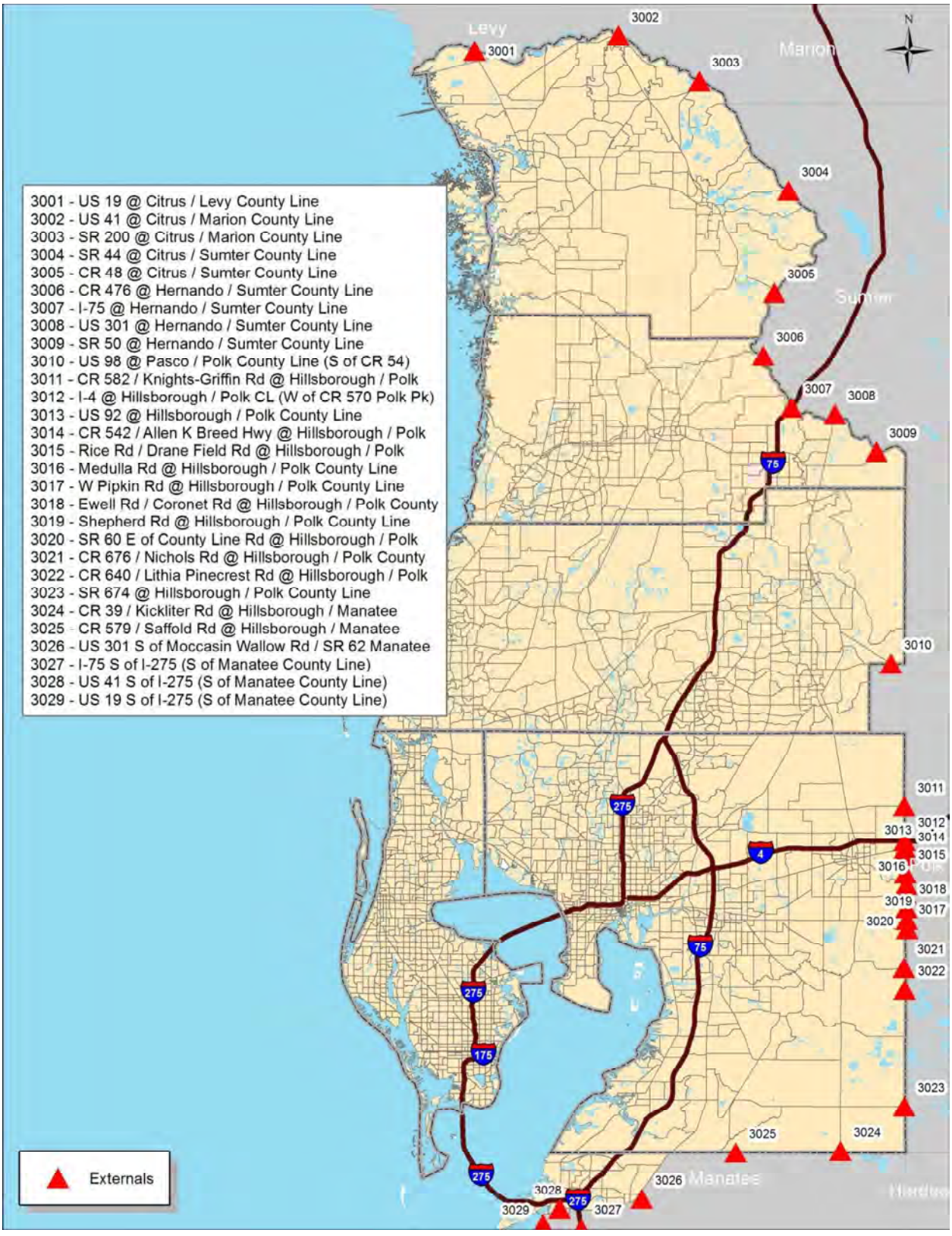


Figure 3.1 External Station Location Map

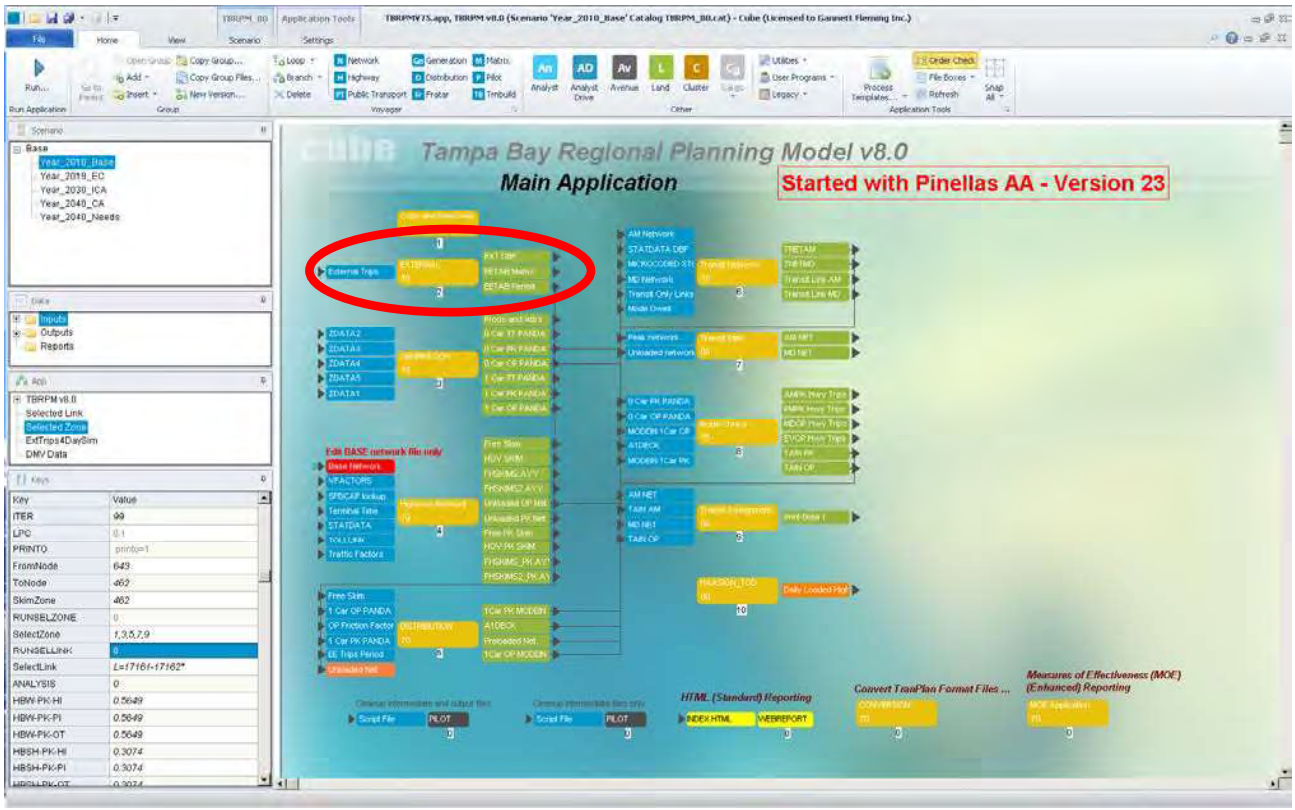


Figure 3.2 Main Application Window – External

3.2 Model Inputs and Outputs

Table 3.1 Model Inputs and Outputs

Input	Process	Output
EETRIPS_YYA.DBF	External	EETAB_AYY.MAT EXT.HTM EXT.DBF

INPUT:

EETRIPS_YYA.DBF Total EE vehicle trips between each external station pair, with three trip mode designations as follows:

Purpose 1 = autos
Purpose 2 = medium trucks
Purpose 3 = heavy trucks

The following table, **Table 3.2**, shows the attributes of the ***EETRIPS_YYA.DBF***.

Table 3.2 *EETRIPS_YYA.DBF* Attributes

Attribute	Value (for example)	Description
ORZ	3001-3029	Integer number designating origin TAZ / external station number
DSZ	3001-3029	Integer number designating destination TAZ / external station number
TYPE	1, 2, or 3	Integer number designating trip purpose or mode as stated above
TRIPS	50	Integer number designating the number of oneway EE trips between the ORZ and DSZ TAZs / external stations

OUTPUT:

EETAB_AYY.MAT The converted ***EETRIPS_YYA.DBF*** into a Cube Voyager formatted trip matrix with three matrixes; 1) Auto, 2) LTRK (Medium Truck), 3) HTRK (Heavy Truck).

EETAB-PRD.AYY.MAT The ***EETAB_AYY.MAT*** Cube Voyager trip matrix subdivided three matrixes; 1) Auto, 2) LTRK (Medium Truck), 3) HTRK (Heavy Truck) into the four (4) TOD time periods using the EE trip, period split factors. Matrixes include: AUTO_PK, LTRK_PK, HTRK_PK, AUTO_AMPK, LTRK_AMPK, HTRK_AMPK, AUTO_PMPK, LTRK_PMPK, HTRK_PMPK, AUTO_OP, LTRK_OP, HTRK_OP, AUTO_OPMD, LTRK_OPMD, HTRK_OPMD, AUTO_OPEV, LTRK_OPEV, HTRK_OPEV.

EXT.DBF Trip end summary in Database format which list the total trip ends for each trip purpose or mode for each external TAZ or station.

The following table, Table 3.3, shows the attributes of the ***EXT.DBF***.

Table 3.3 *EXT.DBF* Attributes

Attribute	Value (for example)	Description
PURP	Auto	Text of trip purpose / mode name
ZONE	3001-3029	Integer of external TAZ / station
ORIGIN	100	Integer number of EE trips originating outside of external TAZ / station
DEST	100	Integer number of EE trips destined outside of external TAZ / station

Attribute	Value (for example)	Description
TOTAL	200	Integer summary on number of total EE trip ends at external TAZ / station

EXT.HTM Trip end summary HTML reports for the external zones.

OUTPUT (other):

INDEX.HTML Text file used for beginning of HTML report generation.

ZDATA4.YYA Text conversion of ZDATA 4 for input into the trip generation, Fortran executable, ***TBGENV36.EXE***.

3.3 Model Procedure

The model processes of this module are shown in **Figure 3.3** as described below:

- Create HTML report index page, ***INDEX.HTML***, which includes system requirements and study area map.
- Create external trips percentage report and ZDATA 4 trip generation file from input file ***ZDATA4_YYA.DBF***.
- Record the **EXTERNAL** report generated time that will be used in step 5.
- Create ***EETAB_YYA.MAT***, which contains the three trip matrices: auto, light truck and heavy truck. The ***FSUTMS.CTL*** file is also created to be used in the Trip Generation program.
- Create the HTML formatted external trip report, ***EXT.HTML***, and database file, ***EXT.DBF***. Three XML files are also created to generated SVG graphics in the HTML report.
- SVG graphics are generated for auto, medium truck and heavy truck external trips. ***EXTERNAL*** module time stamp is recorded as the model run starting point.
- Copy FSUTMS.CTL to the working directory for Trip Generation.
- Create TOD EE trip tables in the form of the **EETAB-PRD.AYY.MAT** matrix file.

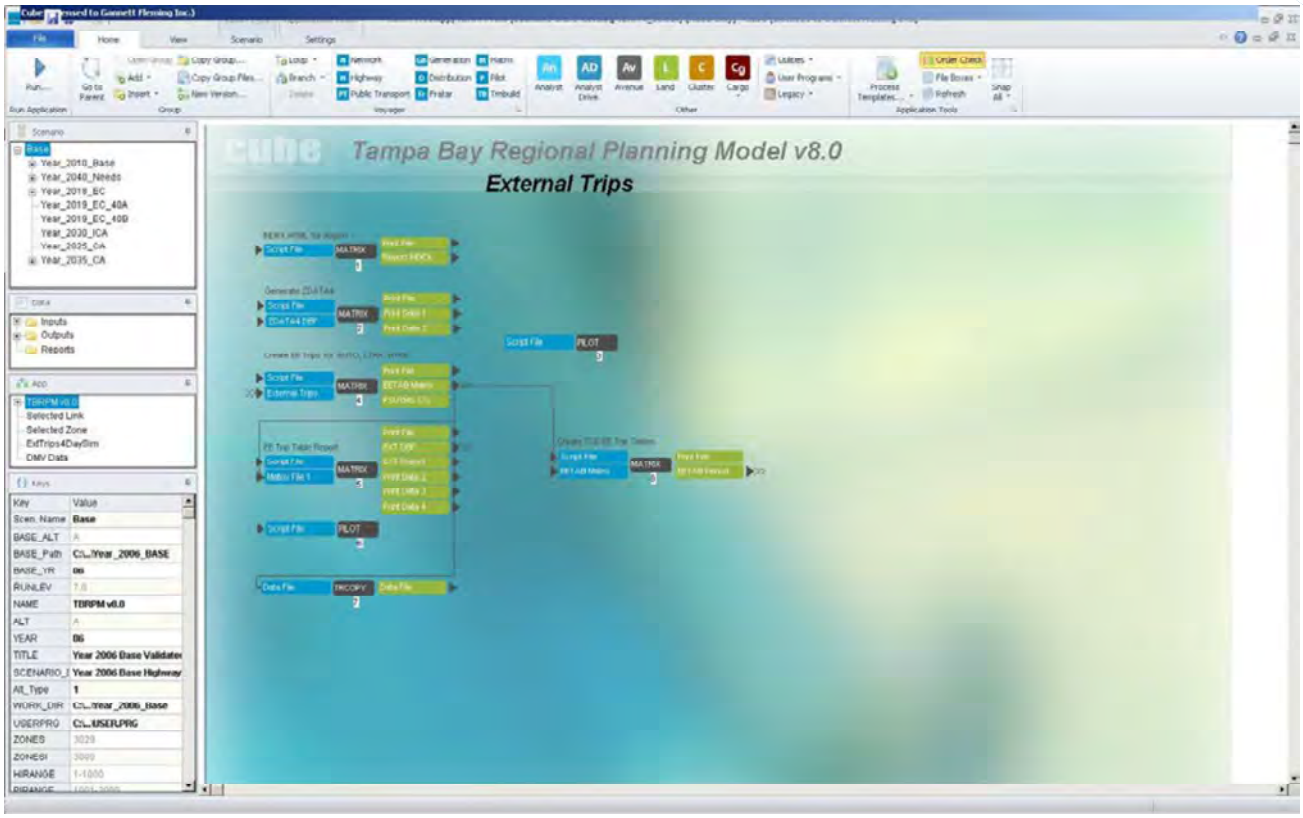


Figure 3.3 External Trips Module Flow

3.4 Standard Output

The HTML report for ***EXTERNAL***, shown in **Figure 3.4**, contains the five following reports:

- ***ZDATA 4 – Total External Trip Ends***
- ***Auto External to External (EE) Trip End Summary***
- ***Medium Truck External to External (EE) Trip End Summary***
- ***Heavy Truck External to External (EE) Trip End Summary***
- ***External to External (EE) Trip End Summary (TOTALS)***

These reports can be reviewed through clicking the hyperlink ***External*** on the left-hand menu bar of the HTML reporting web-page. If the report has not been opened, it can be accessed through the Cube interface as described back in *Chapter 1.2.10 Standard Reporting*.

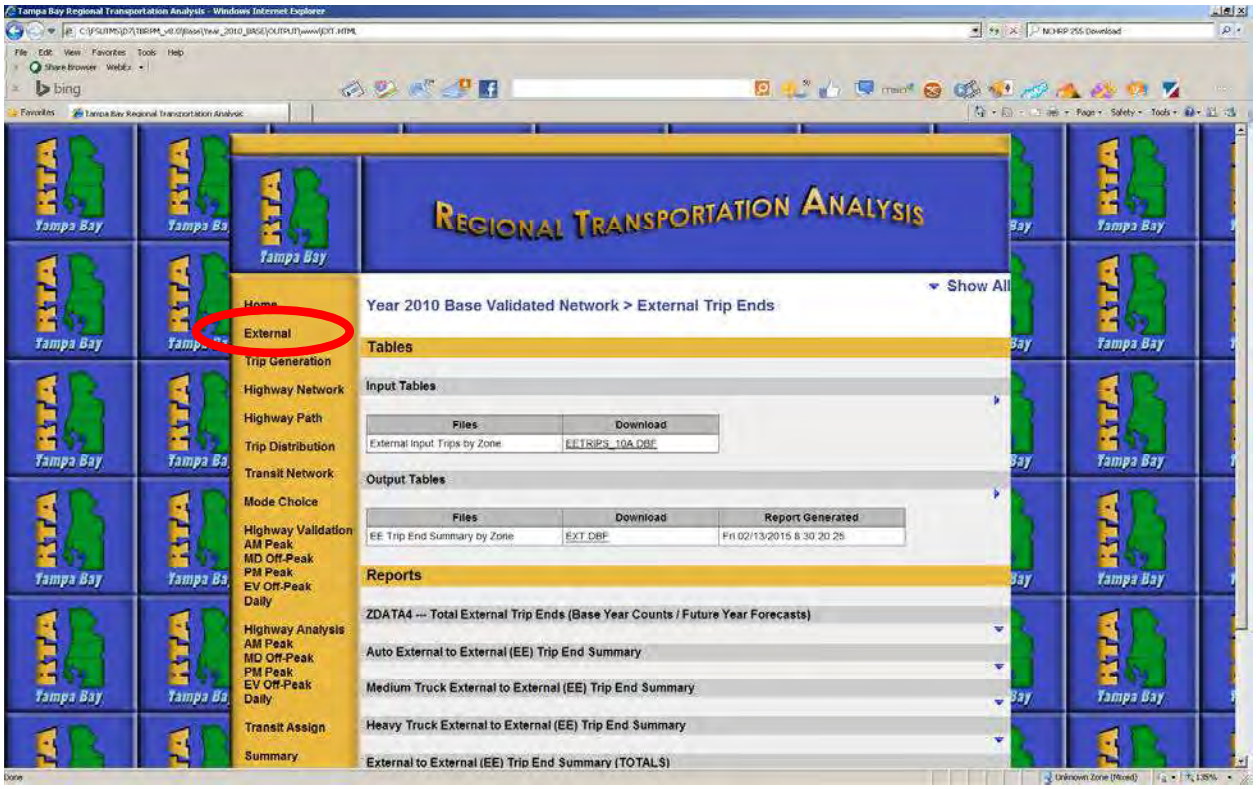


Figure 3.4 External Trips Module Standard Outputs

ZDATA 4 – Total External Trip Ends

The following table, **Table 3.4**, shows the attributes of the *ZDATA 4 – Total External Trip Ends Report*.

Table 3.4 *ZDATA 4 – Total External Trip Ends* Field Descriptions

Attribute	Type	Description
ZONE	Integer	TAZ number of external station
Description	Text	Description of external station location
Trip End Totals	Integer	Number of vehicles or trip ends at external station
Percent EE	Integer	Number of percent EE trips at external station
EE Trip Ends	Integer	Number of calculated EE Trip Ends at external station

A summary of all external stations is also reported at the end of this report.

The next four reports are the summary of the prepared EE trips from the ***EETRIPS_YYA.DBF*** input file. So, they have the same fields but are broken down by vehicle type where the forth report is the summary totals. Due to rounding in preparing the input file, the total trip ends may not exactly match the *ZDATA 4 – Total External Trip Ends* report.

Auto External to External (EE) Trip End Summary

See External to External (EE) Trip End Summary (TOTALS) report below

Medium Truck External to External (EE) Trip End Summary

See External to External (EE) Trip End Summary (TOTALS) report below

Heavy Truck External to External (EE) Trip End Summary

See External to External (EE) Trip End Summary (TOTALS) report below

External to External (EE) Trip End Summary (TOTALS)

Table 3.5 *External to External (EE) Trip End Summary (TOTALS)* Field Descriptions

Field	Type	Description
ZONE	Integer	TAZ number of external station
ORIGINS	Integer	Number of trips with their origin outside the external station location by vehicle type or total
DESTINATIONS	Integer	Number of trips with their destination outside the external station location by vehicle type or total
TOTAL	Integer	Number of total EE trip ends passing thorough the external station

Chapter 4 - **Trip Generation**

4.1 General Description

From **Figure 1.2,** we see that Trip Generation is the second step that occurs in the Florida Standard Urban Transportation Model Structure (FSUTMS) process. Trip Generation is the process or module that determines the number of trips ends that originate from (productions) or terminate in (attractions) each Traffic Analysis Zone (TAZ). For the TBRPM v8.0 model, **GENERATION** (Trip Generation) is the third module found on the CUBE interface as shown in **Figure 4.1**.

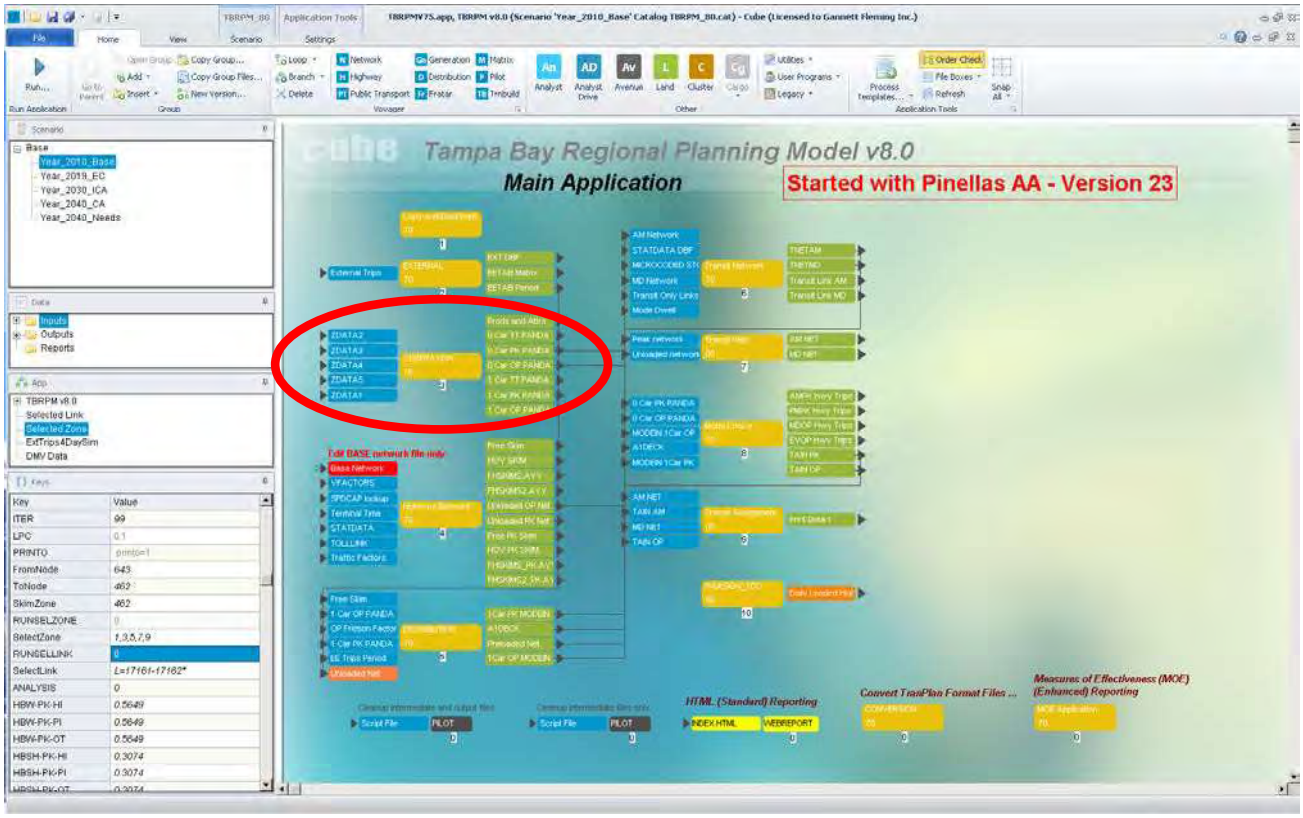


Figure 4.1 Model Application Interface – Trip Generation Module Location

Trip Generation is the determination of zonal travel demand by trip purpose. The process of Trip Generation found in the **GENERATION** module uses the demographic characteristics of each zone as input to estimate the number of daily person and vehicle trips produced and attracted by each TAZ by trip purpose. The trip generation model for the TBRPM requires five input datasets. The first zonal dataset, ***ZDATA1_YYA.DBF***, contains zonal data used for trip productions including population, dwelling units, vacancy rates, lifestyle by auto ownership, and hotel / motel units. The second Zonal Data set, ***ZDATA2_YYA.DBF***, contains zonal data for employment, school enrollment, trucks, and parking costs. Special traffic generator information (SpecialGen) is contained in the third Zonal Data

set, ***ZDATA3_YYA.DBF***. The fourth Zonal Data set, ***ZDATA4_YYA.DBF***, contains the external station descriptions, as detailed earlier in *Chapter 3 - External* Trips, the total external vehicle trips at each station, and the percent of those trips that are External-External (EE). The rest of the vehicle trips at the external stations are treated as External to Internal (EI) or Internal to External (IE) trips as dictated by the fifth zonal dataset. The fifth zonal dataset, ***ZDATA5_YYA.DBF***, contains the average auto occupancies by trip end type, production or attraction, by trip purpose, and the trip purpose percent of allocation to be used in generating the external person and vehicle trip ends.

An enhancement to the TBRPM Trip Generation Model as compared to other FSUTMS trip generation models includes the TAZ calculated area type which is based on land use and other demographic characteristics from the ZDATA input files. Land use percentage data for each zone is maintained in the ***VACACRES.YYA*** file. The data in this file is used to compute the zonal area type through calculations that also use the land use and demographic coefficients which are maintained in the ***ATCOEF.SYN*** file. The calculated results from the area type model designate 3 different evaluation scores based on the density calculations; 1 for CBD, 2 for CBD Fringe and Suburban, and 3 for Suburban Fringe and Rural. The maximum score determines the area type of the TAZ. The calculated area type for a zone can be overridden by updating the area type for that zone in the ***ATYPES.SYN*** input file. This area type determines the area type coefficient to be used during the trip generation of attractions to the TAZ by trip purpose.

A cross classification procedure is used that stratifies the trip generation rates by lifestyle categories. These lifestyle categories include retired households, working households without children, and working households with children by auto ownership. Other population categories considered in trip generation are seasonal residents, hotel/motel visitors, and group quarters' population. The trip generation rates for these lifestyle categories and the area type coefficients, mentioned above, are maintained in the ***GRATES.SYN*** file and are used to compute trip productions and attractions. The trip production and attraction equations are controlled through coefficients which are applied against the independent variables being used in the ***GRATES.SYN*** input file. To modify an equation for a trip purpose, for either productions or attractions, a record for a coefficient to be applied to one of the independent variables must be added, deleted, or modified for a particular trip purpose. The trip generation equations used by the TBRPM v8.0 have been formulated from both household and attraction surveys for the Tampa Bay area that have either been performed or updated over the last 10 years. These equations and their coefficients are reviewed / updated for each Long Range Transportation Plan (LRTP) cycle coinciding with each model update as warranted.

A more recent enhancement to the TBRPM Trip Generation Model is to classify the Hotel / Motel units into three area types: CBD, Medium Density and Low Density. Previously, Hotel / Motels were classified into the three classes; Business, Economy, and Resort. The distinctions of these classes were becoming harder to distinguish. So, a review of the Hotel / Motel equations and data led to a new survey. Based on the 2007/2008 Hotel / Motel survey that was conducted and analyzed, the new classifications would use an activity density calculation of the TAZ in which the Hotel / Motel units exist to classify their trip generation potential. The trips rates for Hotel / Motel units in the ***GRATES.SYN*** were then changed from business type coefficients to area type coefficients. This "Area Density" concept is calculated based on zonal land use and demographic characteristics from the

ZDATA input files and the usable land areas from the TAZ shapefile ***TBRPM_2010_TAZ.DBF***. This concept is similar to the TAZ Area Type concept described earlier, but it uses a different form of equations for the calculation and the results are grouped by density ranges and not 3 discrete values.

Three datasets, ***ATTRS.AYY***, ***PRODS.AYY***, and ***A1DECK.AYY***, are produced by the Trip Generation model. The trip productions by trip purpose for each zone are contained in the ***PRODS.AYY*** dataset, and the trip attractions by trip purpose for each zone are contained in the ***ATTRS.AYY*** dataset. The ***A1DECK.AYY*** file is a consolidation of zonal data. The information in the A1DECK file includes attraction zone's terminal time, daily parking cost, midday parking cost, percent of trips by auto ownership category, and an area type flag (ex. CBD) by zone. *Note: this file has now been replaced with a new formatted A1DECK_AYY.PRN file for Mode Choice which is produced in the DISTRIBUTION module and will be detailed in Chapter 6 - Trip Distribution.*

The ***PRODS.AYY*** and ***ATTRS.AYY*** files are converted into ***GEN_PANDA.DBF*** as the daily trip totals file. With the new TOD processes, a few more enhancements have been made to the end of the Trip Generation process. The TBRPM v8.0 still uses the same user-defined program ***TBGEN36.EXE*** for the trip generation calculations which has been used since the TBRPM v6.x models, but the final daily trip set is divided into a few categories for process in terms of TOD. The first division of the daily trips is by Zero-Car (0-Car) Household trips and One-Plus (1+) Car Household trips. These trips are then further sub-divided into Peak and Off-Peak trips for the two household classes which will be detailed in the next few sections.

All of the input files, ***ZDATA1-5_YYA***, are in stored in the dBase database format for editing, display, or use by other model modules. These files are converted back to the legacy text file formats as needed by user written programs. The Trip Generation model also uses several .SYN files located in the ***BASE*** directory under the ***TBRPM_v8.0*** model directory for parameters and other inputs. These files will be converted to another format later when the ***TBGEN36.EXE*** program is converted into Cube Voyager script.

4.2 Model Inputs and Outputs

An important aspect of the Trip Generation is the Traffic Analysis Zone (TAZ) structure. TAZs are the geographical unit in which the model study area is comprised. For the Tampa Bay area, the TAZ structure is oriented to the five counties which make up the FDOT D7 region. Traffic Analysis Zone (TAZ) numbering scheme for this regional model is shown below in **Table 4.1**.

Table 4.1 TAZ Numbering Scheme

County ID	County Name	Assigned TAZ Ranges	TAZs Numbers Used	TAZs Used	Available TAZs
1	Hillsborough	1-1000	1-794	794	795-1000
2	Pinellas	1001-2000	1001-1780	780	1781-2000
3	Pasco	2001-2400, 2701-2800	2001-2400, 2701-2715	415	2716-2800
4	Hernando	2401-2700	2401-2635	235	2636-2700
5	Citrus	2801-2950	2801-2911	111	2912-2950
6	Manatee	2951-3000	2951-2985	35	2986-3000
7	Externals	3001-3029	3001-3029	29	3030-5000
	Totals	**1-3029**		**2399**	**630**

Table 4.2 illustrates all of the input and output files associated with trip generation followed by a brief description of these files and any special considerations or checking that are required to ensure the integrity of the data.

Table 4.2 Model Inputs and Outputs

Input	Process	Output
PROFILE.MAS BALZ.SYN CBDZONES.SYN EXURBS.SYN GRATES.SYN ATCOEF.SYN LINKS.YYA XY.YYA VACACRES.YYA ATYPES.YYA ZDATA3_0C.YYA ZDATA4_0C.YYA	GEN (TranPlan Format)	PRODS.AYY ATTRS.AYY A1DECK.AYY GEN.OUT LUCHECK.OUT NRZONE.OUT

Input	Process	Output
ZDATA1_YYA.DBF ZDATA2_YYA.DBF ZDATA3_YYA.DBF ZDATA4_YYA.DBF ZDATA5_YYA.DBF	GEN (Voyager Format)	GEN_PandA.DBF GEN_SUM.DBF GEN_SOCECO.DBF GEN_TRIPRATES.DBF GEN_PANDA_SUM.DBF GEN.HTML GEN_PandA_0.DBF, GEN_PandA_1.DBF GEN_PandA_0_PK.DBF, GEN_PandA_1_PK.DBF GEN_PandA_0_OP.DBF, GEN_PandA_1_OP.DBF

INPUTS:

PROFILE.MAS Includes the TranPlan parameters for ***TBGENv3.6***

BALZ.SYN Used to set up trip balancing between the productions and attractions of each zone by sub area. Use of the dummy TAZs from another county would be cautioned against, but if necessary should be checked to ensure the use of the appropriate balancing group code.

CBDZONES.SYN Used to define the TAZs that compose the CBD areas throughout the region.

EXURBS.SYN Used to define Exurban area (Not used).

GRATES.SYN Area Type coefficients for attractions and Trip Generation rates used to compute trip productions and attractions. Area Type coefficients adjust the trip attraction rates based on the Area Type of the TAZ (i.e. 1 for CBD, 2 for Urban / Suburban, 3 for Suburban fringe / Rural).

ATCOEF.SYN This file contains coefficients and constants used for calculating the Area Type of each TAZ based on its land use characteristics (i.e. Dwelling Unit density per acre, Employment density per acre, % of vacant acres, % of residential acres, % of commercial / industrial acres, % of agricultural acres, ratio of Employment density / Dwelling Unit density, and Area Type constant).

LINKS.YYA Legacy TranPlan file used by the ***TBGEN.EXE*** program to look-up the link area type which is used to determine the attraction zone terminal time which is later use by the mode choice program. This file and the ***XY.YYA*** file is converted from the ***BASE_YYA.NET*** network before the ***TBGEN.EXE*** is executed.

XY.YYA Legacy TranPlan file generated to contain the X and Y coordinates of the ANODE and BNODE of the LINKS.YYA.

ATYPES.SYN Used as default for the TAZ Area Type calculation in the GEN model. The Area Types used are, as above, 1-CBD, 2-Urban / Suburban, and 3-Suburban Fringe / Rural.

VACACRES.YYA **M**aintains each TAZ's base year available vacant, residential, industrial & commercial, agricultural and total land acres.

ZDATA1_YYA.DBF (Trip Production) – Data from local sources, available State of Florida sources, Census Bureau, and the Bureau of Economic and Business Resources (BEBR) which includes the following:

- Total Dwelling Units (DU)
- Percent of Vacant and Non-permanent (Seasonal) DUs
- Percent of Vacant DUs
- Permanent DU Population
- Group Quarter Population
- Percent of Auto Ownership (0, 1, 2 or 3+ auto) DUs by Retiree, Working w/o Children, and Working w/ Children
- Number of Business, Economy, and Resort Hotel / Motel Units; now converted into number of units by area type density
- Environment Justification Flag
- Urban Area Flag

The following table, **Table 4.3**, shows the attributes of the ***ZDATA1_YYA.DBF***.

Table 4.3 ZDATA1_YYA.DBF Attributes

Attribute	Description
CARD	Identifies ZDATA file type
COUNTY	County to which the TAZ belongs
DISTRICT	Identifies a subarea summarizing district to which the TAZ belongs
ZONE	Number of the TAZ
DU	Total Dwelling Units
PCTVNP	PerCenT of Vacant and Non-Permanent (Seasonal) DUs
PCTVAC	PerCenT of VACant DUs
POP	Permanent Population found in DUs
RET0	Percent of DUs classified as Retired Households (HH) with 0-car ownership
WNC0	Percent of DUs classified as Working HH No Children with 0-car ownership
WHC0	Percent of DUs classified as Working HH with Children with 0-car ownership
RET1	Percent of DUs classified as Retired HH with 1-car ownership

Attribute	Description
WNC1	Percent of DUs classified as Working HH No Children with 1-car ownership
WHC1	Percent of DUs classified as Working HH with Children with 1-car ownership
RET2	Percent of DUs classified as Retired HH with 2-car ownership
WNC2	Percent of DUs classified as Working HH No Children with 2-car ownership
WHC2	Percent of DUs classified as Working HH with Children with 2-car ownership
RET3	Percent of DUs classified as Retired HH with 3+ car ownership
WNC3	Percent of DUs classified as Working HH No Children with 3+ car ownership
WHC3	Percent of DUs classified as Working HH with Children with 3+ car ownership
BHU	Number of Business Motel Units; converted to units in High density area type
EHU	Number of Economy Motel Units; converted to units in Medium density area type
BHU	Number of Resort Motel Units; converted to units in Low density area type
GQPOP	Group Quarters population within TAZ
EJTAZ	Environment Justification (EJ) Flag marking TAZs with a 1 which have EJ population
URBAN	Urban Area Flag marking TAZs with a 1 which are in the Urban Area Boundaries

ZDATA 1 SE Checks: (In the HTML reports, these SE data checks are reported for the user's review.)

- ✓ Ratio of Population to Permanent DUs
- ✓ Percent of Vacant and Non-permanent DUs, either too high or too low
- ✓ Percent of Vacant DUs, either too high or too low
- ✓ Percent of Auto Ownership DUs by Retiree, Working w/o Children, and Working w/ Children should add to 100%
- ✓ Hotel / Motel Units - Location in TAZs

ZDATA2_YYA.DBF (Trip Attractions) – Data developed from local, InfoGroup, and Quarterly Census of Employment and Wages (QCEW) sources by FDOT and the MPOs.

- Employment by Industrial, Regional / Local Commercial, Regional / Local Service, and Total Employment - Data developed from Florida Agency for Workforce Innovation Labor Market Statistics, U.S. Department of Commerce Bureau of Economic Analysis, local sources, InfoGroup and QCEW
- School Enrollment for Kindergarten to College - Data from School Boards and Florida Department of Education
- Parking Costs (Long Term and Short Term) by TAZ
- Activity Center Code and Description

The following table, **Table 4.4**, shows the attributes of the ***ZDATA2_YYA.DBF***.

Table 4.4 ZDATA2_YYA.DBF Attributes

Attribute	Description
CARD	Identifies ZDATA file type
COUNTY	County to which the TAZ belongs
DISTRICT	Identifies a subarea summarizing district to which the TAZ belongs
ZONE	Number of the TAZ
IND_EMP	Industrial employment totals
COMM_REMP	Commercial Regional employment totals
COMM_LEMP	Commercial Local employment totals
SERV_REMP	Service Regional employment totals
SERV_LEMP	Service Local employment totals
TOT_EMP	Total employment for TAZ; should be the sum of the previous 5 columns
K12ENR	K through 12th grade school enrolment in TAZ where school is located
HIEDUC	Higher education enrolment in TAZ where a university or college is located
STPC	Short-term (3hr) parking costs within a TAZ; use auto cost utility for Mode Choice
LTPC	Long-term (daily) parking costs within a TAZ
ACTCTR	Activity center number used for compression summaries of trip tables
CTRLBL	Activity center name or description

The following **Table 4.5** shows the breakdown of employment by the North American Industry Classification System (NAICS) Codes used by the TBRPM. Subcategories are used to further refine the regional vs local employment number for the Commercial and Service categories.

Table 4.5 North American Industry Classification System (NAICS) Codes used for Employment Classes

Variable Description	Description	NAICS Code
Industrial	Agriculture, Mining and Extraction, Construction, Manufacturing, Freight and Warehousing, Wholesale Trade	11, 21, 22, 23, 31-33, 42, 482-487, 4882-4885, 4889, 492, 493, 562
Commercial	Comparative Retail and Convenience Retail	4411, 4412, 442-444, 448, 4511, 4521, 4529, 4531-4533, 4539, 454, 4413, 445-447, 4512, 722
Service	Air Transport, Office/Professional, Health, Government, Hotels, Other, Postal, Banking, Personal, Educational, Private Households	481, 4881, 51, 523, 525, 53-55, 5611, 5612, 5614-5619, 62, 71, 721, 813, 811, 92, 99, 491, 521, 522, 61, 812, 814

ZDATA 2 Checks:

- ✓ Employment by Industrial, Regional / Local Commercial and Regional / Local Service should add up to equal the total employment column
- ✓ Major Employers - Location in TAZs
- ✓ School Enrollment - Location in TAZs

ZDATA3_YYA.DBF (Special Generators) - Use with caution and requires reviewing the assignment results. These are records use to depict special TAZ areas of concern that Trip Generation may not fully generate either productions or attractions for due to "Special" land uses.

The following table, **Table 4.6**, shows the attributes of the ***ZDATA3_YYA.DBF***.

Table 4.6 ZDATA3_YYA.DBF Attributes

Attribute	Description
CARD	Identifies ZDATA file type
ZONE	Number of the TAZ
DESCR	Name of Special Generator within the TAZ (e.g. medical complex or warehouse)
P_or_A	Flag of trip end type to generate; "P" for production, "A" for attraction, "T" for total (used for purposes like truck trips where P's and A's should be equal)
PURP	Purpose number; 1 – HBW, 2 – HBSH, 3 – HBSR, 4 – HBSC, 5 – HBO, 6 – NHBW, 7 – NHBO, 8 – MTRK, 9 – HTRK, 10 – Taxi, 11 – EI (occasional), 12 – Col/Univ, 13 – ARPRT
OPERAND	Flag to indicate the operation to use for calculating "Special Generator" trips; "+" add trips in addition to TAZ Ps or As, "-" subtract trips from TAZ Ps or As, "T" replace TAZ trips as new total
TRIPS_DIFF	New allotment of trip ends for TAZ for the given purpose

ZDATA3_0C.YYA – a copy of the ZDATA 3 file that is zero-filled used as a dummy file for 0-Car household trips.

ZDATA4_YYA.DBF (EI Trips) - No changes should be made without review by FDOT.

- Total External Traffic Volumes
- Percent of External-External (EE) trips

The following table, **Table 4.7**, shows the attributes of the ***ZDATA4_YYA.DBF***.

Table 4.7 ZDATA4_YYA.DBF Attributes

Attribute	Description
CARD	Identifies ZDATA file type
ZONE	Number of the TAZ
DESCR	Name of External Station Location
TRIPS	Total vehicle trip ends at the External Station (traffic count / forecast volume)
EEPCT	Percent of trip ends to treated as External to External trips

ZDATA4_0C.YYA – a copy of the ZDATA 4 file that is zero-filled used as a dummy file for 0-Car household trips.

ZDATA5_YYA.DBF (EI Trips) - No changes should be made without review by FDOT.

- The average auto occupancy by trip purpose
- Trip end type (production / attraction flag)
- Trip purpose
- Percent of trips allocated for each trip purpose

The following table, **Table 4.8,** shows the attributes of the ***ZDATA5_YYA.DBF***.

Table 4.8 ZDATA5_YYA.DBF Attributes

Attribute	Description
CARD	Identifies ZDATA file type
ZONE	Number of the TAZ
AUTO_OCC	The implied auto occupancy for the external vehicle trip ends by purpose
P_or_A	Flag of trip end type to generate; "P" for production, "A" for attraction, "T" for total (used for purposes like truck trips where P's and A's should be equal)
PURP	Purpose number; 1 – HBW, 2 – HBSH, 3 – HBSR, 4 – HBSC, 5 – HBO, 6 – NHBW, 7 – NHBO, 8 – MTRK, 9 – HTRK, 10 – Taxi, 11 – EI (occasional), 12 – Col/Univ, 13 – ARPRT
PERCENT	Percent of the vehicle trip ends (traffic count at the external) to be applied as the given trip end type
DESC	Brief purpose description

It should be noted that the LINKS.YYA and XY.YYA files are no longer used in the highway network module for the Cube Voyager version of the model. However, since these files are utilized by the TBGEN36.EXE user program, it is necessary for them to be generated in this module. So, a preprocessing of the highway network is performed before the trip generation program is run.

OUTPUTS:

PRODS.AYY Trip productions by TAZ, by trip purposes for HBW, HBSH, HBSR, HBO, HBSCH, NHBW, NHBO, LT, HT, Taxi, EI, Airport, College / University and Total.

ATTRS.AYY Trip attractions by TAZ, by trip purpose for HBW, HBSH, HBSR, HBO, HBSCH, NHBW, NHBO, LT, HT, Taxi, EI, Airport, College / University and Total.

A1DECK.AYY TAZ attributes for mode choice calculations which include terminal times, parking costs, trip percentages by purpose, by auto ownership and CBD or Exurban flags.

GEN.OUT The Legacy Trip Generation report which summarizes trips by trip purpose for each TAZ and also includes a trip generation statistical summary. This report has been recreated and augmented in the HTML reporting system (see below).

LUCHECK.OUT A Trip Generation error checking report which depicts the error checking describe above for the ZDATA files. This is also recreated in the HTML reporting system.

NRZONE.OUT List of the three nearest zones for each TAZ used for the Area Type calculations.

GEN_PANDA.DBF The final trip productions and attractions file from Trip Generation by TAZ.

The following table, **Table 4.9,** shows the attributes of the ***GEN_PANDA.DBF***.

Table 4.9 GEN_PANDA.DBF Attributes

Attribute	Description
ZONE	Number of the TAZ
COUNTY	County to which the TAZ belongs
DISTRICT	Identifies a subarea summarizing district to which the TAZ belongs
HBWP	Daily Home Based Work Productions
HBWA	Daily Home Based Work Attractions
HBSHP	Daily Home Based Shopping Productions
HBSHA	Daily Home Based Shopping Attractions
HBSRP	Daily Home Based Social-Recreational Productions
HBSRA	Daily Home Based Social-Recreational Attractions

Attribute	Description
HBSCP	Daily Home Based School Productions
HBSCA	Daily Home Based School Attractions
HBOP	Daily Home Based Other Productions
HBOA	Daily Home Based Other Attractions
NHBWP	Daily Non-Home Based Work Productions
NHBWA	Daily Non-Home Based Work Attractions
NHBOP	Daily Non-Home Based Other Productions
NHBOA	Daily Non-Home Based Other Attractions
LRTKP	Daily Medium Truck Productions
LRTKA	Daily Medium Truck Attractions
HTRKP	Daily Heavy Truck Productions
HTRKA	Daily Heavy Truck Attractions
TAXIP	Daily Taxi Productions
TAXIA	Daily Taxi Attractions
EIP	Daily External to Internal (EI) Occasional Productions
EIA	Daily External to Internal (EI) Occasional Attractions
AIRPP	Daily Airport Productions
AIRPA	Daily Airport Attractions
COLP	Daily College / University Productions
COLA	Daily College / University Attractions
TOTALP	Daily Total Productions
TOTALA	Daily Total Attractions

GEN_SOCECO.DBF A social economic data error checking database file used to report TAZs that fall out of the ranges provided for the LUCHECK process.

The following table, **Table 4.10,** shows the attributes of the ***GEN_SOCECO.DBF***.

Table 4.10 GEN_SOCECO.DBF Attributes

Attribute	Description
ZONE	Number of the TAZ
COUNTY	County to which the TAZ belongs
DISTRICT	Identifies a subarea summarizing district to which the TAZ belongs
DU	Dwelling Units in the TAZ
OCCDU	Calculated Occupied Dwelling Units in the TAZ
POP	Permanent Population in the TAZ
POP_OCCDU	Ratio of the Permanent Population to Occupied DUs in the TAZ
VACDU	Calculated Vacant DUs in the TAZ

Attribute	Description
SEADU	Calculated Seasonal DUs in the TAZ
GQPOP	Group Quarters population
HMU	Calculated total Hotel / Motel Units in the TAZ
AUTO0HH	Calculated 0-Car HH percentage
AUTO1HH	Calculated 1-Car HH percentage
AUTO2HH	Calculated 2-Car HH percentage
AUTO3HH	Calculated 3+ Car HH percentage
EMP	Total employment in the TAZ
SCHOOL	Total educational enrolment in the TAZ
HBPROD	Home Based trip purpose productions in TAZ
TPROD	Total trip productions in the TAZ
TATTR	Total trip attractions in the TAZ
TPROD_OCDU	Ratio of the total trip productions / occupied DUs
HBPROD_OCDU	Ratio of the Home Based trip productions / occupied DUs
ATTR_EMP	Calculated total Attractions per employee in the TAZ

GEN_SUM.DBF A Trip Generation statistical summary by County including Population, Dwelling Unit, Occupied Dwelling Unit, Hotel / Motel, Educational Enrolment, and Employment Totals. A summary of key socio-economic ratios is also provided.

The following table, **Table 4.11,** shows the attributes of the ***GEN_SUM.DBF***.

Table 4.11 GEN_SUM.DBF Attributes

Attribute	Description
ModYear	Model Year of scenario run being summarized
ModAlt	Model Alternative of scenario
Item1	Item group being summarized (i.e. Population, Dwelling Units)
Item2	Sub-Item group being summarized (i.e. Permanent, Group Quarters, and Total Population)
HILLSBOR	Statistic for Hillsborough County
PINELLAS	Statistic for Pinellas County
PASCO	Statistic for Pasco County
HERNANDO	Statistic for Hernando County
CITRUS	Statistic for Citrus County
OTHER	Statistic for the portion of Manatee County
TOTAL	Statistic for the regional model

GEN_TRIPRATES.DBF A summary report of total productions / total occupied DU trip rates by county and by purpose.

The following table, **Table 4.12,** shows the attributes of the ***GEN_TRIPRATES.DBF***.

Table 4.12 GEN_TRIPRATES.DBF Attributes

Attribute	Description
ModYear	Model Year of scenario run being summarized
ModAlt	Model Alternative of scenario
Item1	Item group being summarized (i.e. Total Ps / Total OccDUs or Total As / Total Emp)
Item2	Purpose (i.e. HBW, HBSH, and HBSR etc.)
HILLSBOR	Statistic for Hillsborough County
PINELLAS	Statistic for Pinellas County
PASCO	Statistic for Pasco County
HERNANDO	Statistic for Hernando County
CITRUS	Statistic for Citrus County
OTHER	Statistic for the portion of Manatee County
TOTAL	Statistic for the regional model

GEN_PANDA_SUM.DBF A summary report of trip production and attraction subtotals by county.

The following table, **Table 4.13,** shows the attributes of the ***GEN_PANDA_SUM.DBF***.

Table 4.13 GEN_PANDA_SUM.DBF Attributes

Attribute	Description
ModYear	Model Year of scenario run being summarized
ModAlt	Model Alternative of scenario
Item1	Item group being summarized (i.e. Productions or Attractions)
Item2	Purpose (i.e. HBW, HBSH, and HBSR etc.)
HILLSBOR	Statistic for Hillsborough County
PINELLAS	Statistic for Pinellas County
PASCO	Statistic for Pasco County
HERNANDO	Statistic for Hernando County
CITRUS	Statistic for Citrus County
OTHER	Statistic for the portion of Manatee County
TOTAL	Statistic for the regional model

GEN.HTML The Trip Generation report in HTML format.

GEN_PandA_0.DBF The total Home-Based, person trips generated by 0-Car Households in Trip Generation.

The following table, **Table 4.14,** shows the attributes of the ***GEN_PandA_0.DBF***.

Table 4.14 GEN_PandA_0.DBF Attributes

Attribute	Description
ZONE	Number of the TAZ
COUNTY	County to which the TAZ belongs
DISTRICT	Identifies a subarea summarizing district to which the TAZ belongs
HBWP	Daily Home Based Work Productions
HBWA	Daily Home Based Work Attractions
HBSHP	Daily Home Based Shopping Productions
HBSHA	Daily Home Based Shopping Attractions
HBSRP	Daily Home Based Social-Recreational Productions
HBSRA	Daily Home Based Social-Recreational Attractions
HBSCP	Daily Home Based School Productions
HBSCA	Daily Home Based School Attractions
HBOP	Daily Home Based Other Productions
HBOA	Daily Home Based Other Attractions
TOTALP	Daily Total Productions
TOTALA	Daily Total Attractions

GEN_PandA_1.DBF The total person and vehicle trips generated in **Trip Generation** minus the Home-Based, person trips generated by 0-Car Households found in GEN_PandA_0.DBF. The attributes for ***GEN_PandA_1.DBF*** are the same as above for ***GEN_PandA.DBF,*** **Table 4.9**.

GEN_PandA_0_PK.DBF The Peak period Home-Based, person trips generated by 0-Car Households in **Trip Generation**. The attributes for ***GEN_PandA_0_PK.DBF*** are the same as above for ***GEN_PandA_0.DBF,*** **Table 4.14**.

GEN_PandA_1_PK.DBF The Peak period person and vehicle trips generated in **Trip Generation** minus the Peak period Home-Based, person trips generated by 0-Car

Households found in GEN_PandA_0_PK.DBF. The attributes for ***GEN_PandA_1_PK.DBF*** are the same as above for ***GEN_PandA.DBF,*** **Table 4.9**.

GEN_PandA_0_OP.DBF The Off-Peak period Home-Based, person trips generated by 0-Car Households in **Trip Generation**. The attributes for ***GEN_PandA_0_OP.DBF*** are the same as above for ***GEN_PandA_0.DBF,*** **Table 4.14**.

GEN_PandA_1_OP.DBF The Off-Peak period person and vehicle trips generated in Trip Generation minus the Off-Peak period Home-Based, person trips generated by 0-Car Households found in GEN_PandA_0_OP.DBF. The attributes for ***GEN_PandA_1_OP.DBF*** are the same as above for ***GEN_PandA.DBF,*** **Table 4.9**.

4.3 Model Procedure

Figure 4.1 shows the general model flow in the Cube environment for the Trip Generation Model found in the **GENERATION** module. The process of the **GENERATION** module is described in the rest of the section.

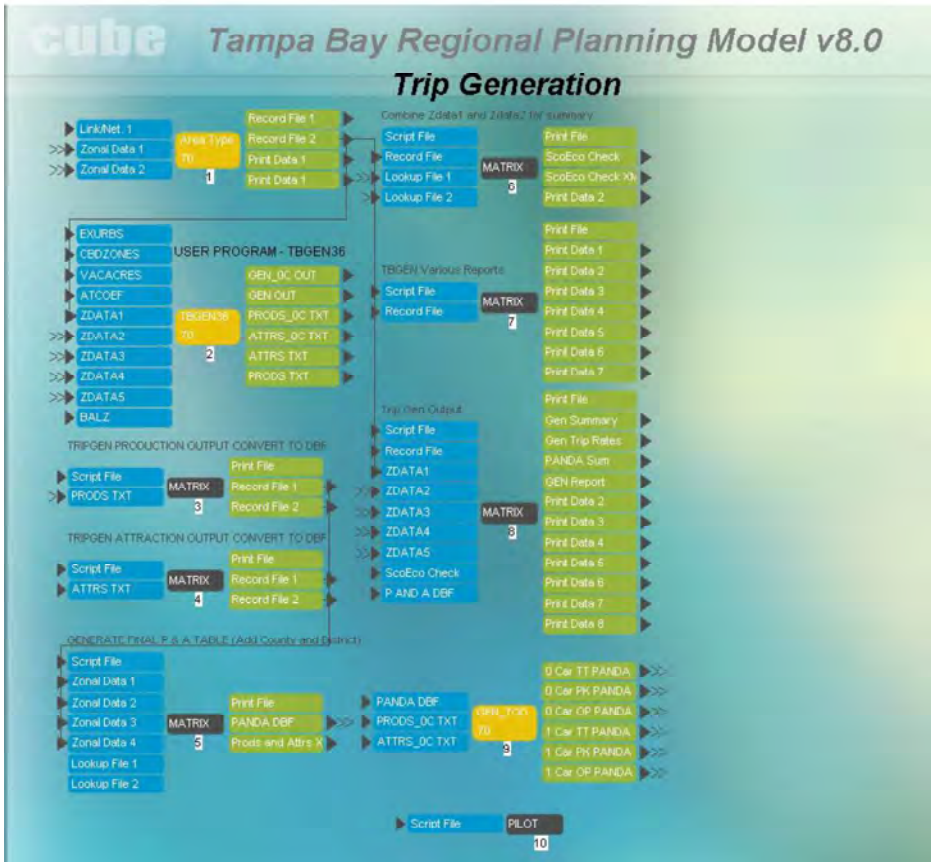


Figure 4.2 Trip Generation Model Flow

Calculate Dynamic Area Type

The first step of the GENERATION module is to calculate the Dynamic Area Type of the TAZs by using "area densities". The "area densities" are use in determining the two-digit Area Type for highway network links and classification of Hotel / Motel Units by density. In the latest TBRPM, TAZ density is the number one factor used for determining Hotel / Motel unit production rates. In previous models, the Hotel / Motel unit were classified by the types of Business, Economy, and Resort to determine their production rates, but with new surveys and analysis, TAZ activity density was identified to be a more important factor in productions.

The Dynamic Area Types are then defined by the "area density" and a set of recommended threshold values. The "area density" is calculated by dividing both population and employment for each TAZ by the land area of the TAZ and applying a factor to the employment density ratio based on the regional population to employment ratio. The final Dynamic Area Type is based on the addition of these two ratios and certain thresholds that the new value meets. A numeric determination of 1 to 5 is then used for the Dynamic Area Type; 1 being the highest density and 5 being the lowest. The TAZ list in the ***CBDZones.SYN*** file is used to identify the highest Area Type, 1, with the other Area Types distinguished by their densities of >40.0, >=18.5, >=2.5, and >0 for the Dynamic Area Types 2, 3, 4, and 5 respectively. The Dynamic Area Type determination is then applied two fold; 1) to the reclassification of Hotel / Motel Units for each TAZ and 2) as possible highway link Area Type changes.

The singular TAZ Area Type densities are used to update the ZDATA1 database file by rewriting it, classifying the updated Hotel / Motel units into one of three types: CBD (High Density), Medium Density, and Low Density. The Dynamic Area Types 1 and 2 are combined for the CBD (High Density) group, Types 3 and 4 are combined for the Medium Density group, and Type 5 is used for the Low Density group.

Secondarily, an average TAZ density within a 1 mile buffer of each TAZ is also calculated to be used in determining possible Area Type changes needed for the two-digit Area Type coding of the highway network links. Since most all highway links are on the boundary of two or more TAZs, the Area Type for each link is being considered with respect to those surrounding TAZs, and not just one TAZ. A change report by highway link is then generated based on the densities of the TAZs near each highway link with a suggested new Area Type for the link.

The detailed procedure flow used to calculate the Dynamic Area Types are shown in **Figure 4.3** below.

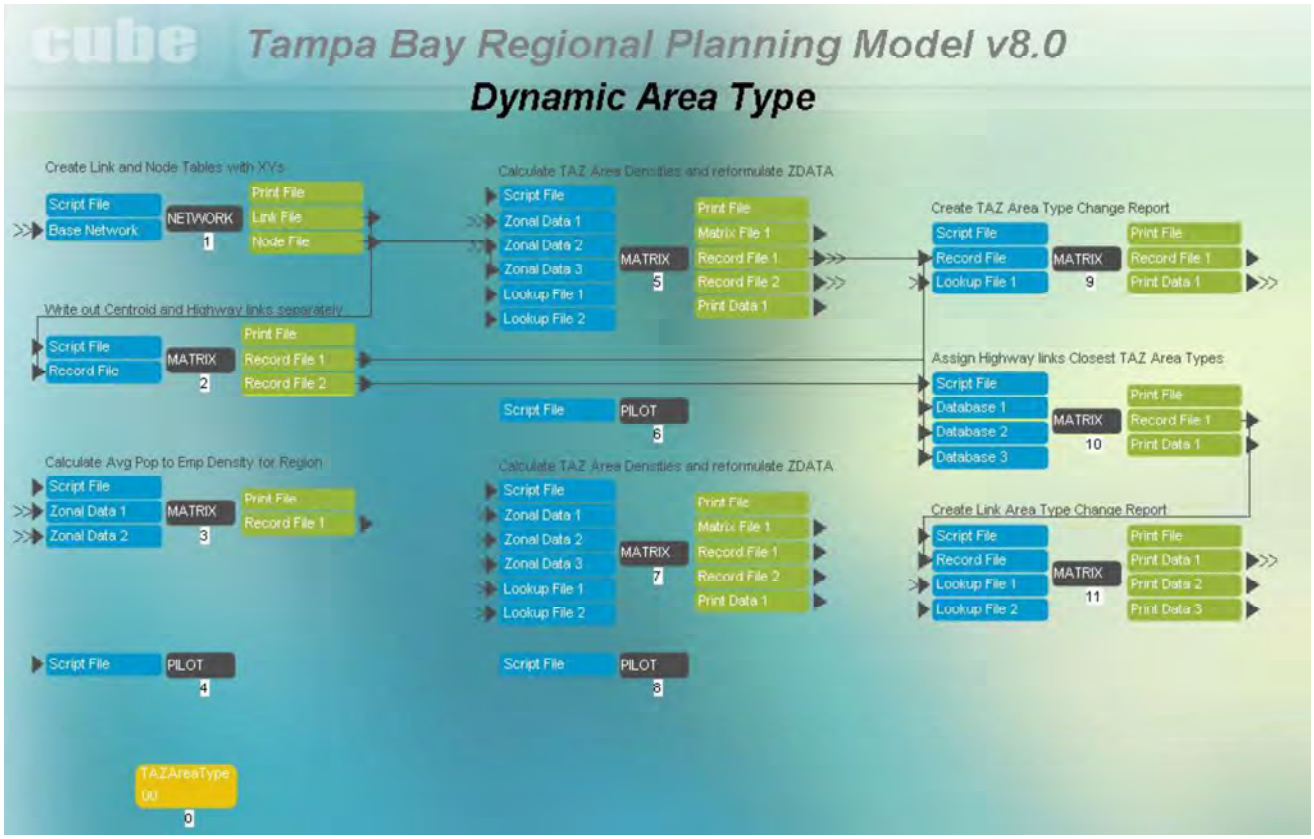


Figure 4.3 Dynamic Area Type Model Flow

Following the Dynamic Area Type model flow above:

- Mathematically calculate the mid-points for each link in the highway network. An output database, in dBase file format, is created containing the X and Y coordinates of each mid-point from each highway link.

- The highway links are separated out into centroid connectors and highway road links.

- Calculate the region wide average population to employment ratio to be used in the Dynamic Area Type calculator.

- Calculate the Dynamic Area Type density for each TAZ and the average TAZ density within 1 mile of each TAZ. Reformulate the Hotel / Motel units into the new ZDATA 1 input file using the Dynamic Area Types.

- Create TAZ Area Type change report, which is a comparison report of the Future Year ZDATA against the Base Year conditions based on the TAZ density changes.

- Assign each highway link, its calculated, suggested two-digit Area Type based on the closest TAZ's 1-mile average TAZ Area Type density.

- Create the Link Area Type change report which details the suggested Area Type change for each highway link as calculated.

The next major step in the **GENERATION** module is the execution of the user program TBGEN 3.6, as shown in **Figure 4.4** below.

Figure 4.4 TBGEN User Program Model Flow

Following the model flow above:

- ZDATA files and other parameter files are prepared and copied appropriately.

- The ***TBGEN36.exe*** user program is then launched to generate PRODS.AYY and ATTRS.AYY for 0-Car Households and for the normal Regional trip generation. The 0-Car Household trips are generated independently to distinguish them from the 1 Plus Car Household trips of the Regional totals. The input and output files involved in ***TBGEN36*** are shown in the Cube flowchart for reference. Only the ZDATA 1-2, dBase input files are to be edited as needed.

- All outputs are then copied, as appropriate, to the output folder of the scenario being processed.

Back in **Figure 4.2**, the **GENERATION** module continues with the following:

- Convert ***PRODS.AYY*** to database format. In the text output file one record contains the productions for the first ten trip purposes and the next record contains the productions of the last three trip purposes as a pair of records for each TAZ.

- Convert ***ATTRS.AYY*** to database format. In the text output file one record contains the attractions for the first ten trip purposes and the next record contains the attractions of the last three trip purposes as a pair of records for each TAZ.

- Combine the productions and attractions into one database ***GEN_PANDA.DBF***.

- Use ZDATA1, ZDATA2 and ***GEN_PANDA.DBF*** to generate the socio-economic summary for each zone, including occupied DU, population, car ownership, trip rates, etc. Total productions and attractions are obtained from ***GEN_PANDA.DBF*** to calculate the trip rates (total productions / occupied DU and total attractions / employment).

- Generate the various Trip Generation reports of equations used for area type estimation, the Trip Production and Attraction Equation report, the Special Generator report, and the Sub-Area Balance report into a format to be used by HTML.

- Trip Generation report ***GEN.HTM*** is created using the content of the output ***GEN.OUT*** from the FORTRAN trip generation user program. The dBase files ***GEN_SUM.DBF***, ***GEN_TRIPRATES.DBF***, and ***GEN_PANDA_SUM.DBF*** are then generated and contain the trip generation summary, trip rates by purposes, and the number of productions and attractions by county and trip purpose, respectively.

- The newest step added to the **GENERATION** module, splits the Regional trip Productions and Attractions into 0-Car and 1-Plus Car trip ends and also by Peak and Off-Peak periods, generating the six (6) P's and A's table used for the rest of the Time of Day based model.

- Create SVG files for HTML reporting and record the time stamp.

4.4 Standard Output

The following standard output reports are generated and displayed through the HTML based report pages shown in **Figure 4.5**:

- ***List of Independent Variables***
- ***Equation Used for Area Type Estimation***
- ***Production Equations***

- *Attraction Equations*
- *Special Generators*
- *Subarea Balancing Results*
- *Trip Generation Statistics Summary*
- *Productions and Attractions by County and Purpose*
- *Trip Rates*
- *Socio-Economic Data Check*
- *Productions by Zone*
- *Attractions by Zone*

Figure 4.5 Trip Generation HTML Reports

Chapter 5 - **Highway Network and Path**

5.1 General Description

The **Highway Network** module is the next step in the TBRPM v8.0 model chain. This module represents both the third and forth steps in the FSUTMS model chain. First, the Highway Network (HNET) step prepares the highway system characteristics described by the highway network and are summarized. Characteristics such as number of highway links, system miles, roadway classification, the number of lanes, speed, and capacity are all inputs into the model through the binary highway network. The model uses these inputs to determine the Free Flow speeds and capacities used by the highway system.

The fourth step in the FSUTMS model chain is Highway Path (HPATH), the path building module. In TBRPM v8.0, the HPATH step is incorporated into the **Highway Network** module. In this part of the module, the highway network is updated using its current input characteristics, and the uncongested travel time, distance, and impedances are skimmed. The HPATH part of the module identifies the minimum uncongested travel time path between each pair of zones for use later in the model chain. Path selection is an important part of the modeling process since it has a significant impact on the final distribution of the trips which were generated during the **GENERATION** module of the model. **Figure 5.1** show the overall **Highway Network** module flow.

The TBRPM v8.0 highway network follows a similar convention to that used in the last TranPlan based model version, but has been further augmented for use with the TOD based model, TBRPM v8.0. Due to certain processes, such as Trip Generation, requirements for most of the same files as used in TranPlan are still necessary, but they don't fully play the same roles. In TranPlan, the highway network was represented as a network of connected link segments and nodes, derived from the highway network file and stored as a separate links file, LINKS.YYA, and node coordinates file, XY.YYA. The following data files were then used to fully describe the highway network in TranPlan:

LINKS:	highway link characteristics,
XY:	highway node coordinates,
SPDCAP:	highway speeds and capacities,
TCARDS:	highway turn-prohibitors and time penalties,
TOLLLINK:	highway toll plaza characteristics,
VFACTORS:	parameters used to convert peak-hour capacity to daily capacity, also provides facility type specific CONFAC, UROAD factor and BPR coefficients and exponents for equilibrium congested speed equations.

TBRPM v8.0 actually uses an ArcGIS shapefile to store the highway network attributes which is then converted to a Cube Voyager binary network (BASE_YYA.NET) and does not rely on the text-based TranPlan format LINKS and XY files. When the user edits / changes the network, the "unbuild" operation from TranPlan is unnecessary in Cube Voyager. But, for other processes like Trip Genera-

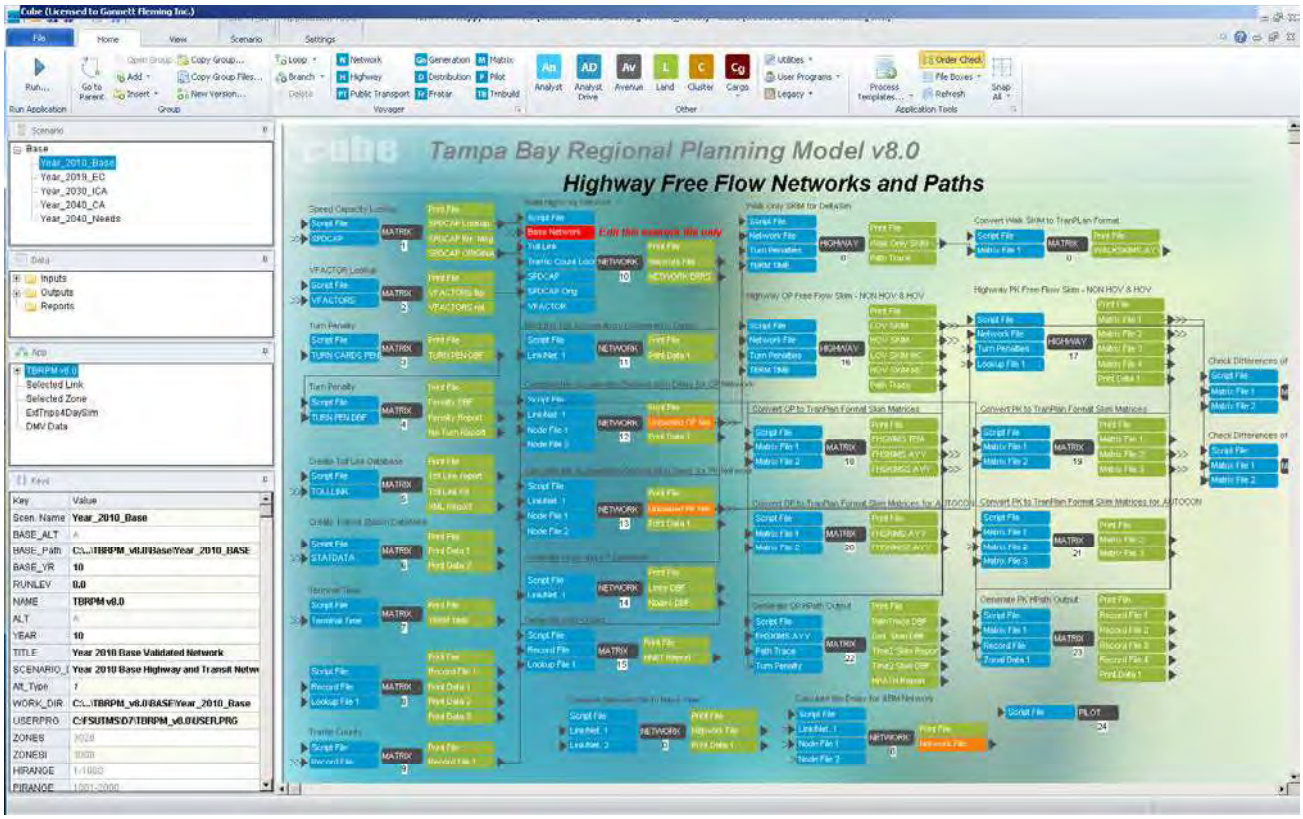


Figure 5.1 Highway Network Module Flowchart

tion, an "unbuild" operation is used to convert the binary network into links and node dBase files, which are also converted into the text-based TranPlan files needed by the legacy user programs.

Other TranPlan based files including ***SPDCAP***, ***TOLLLINK***, and ***VFACTORS*** were converted into dBase file formats to be used for the current model input. The dBase version of these files should be edited with any necessary changes to work within the Voyager model stream. Only the **TOLLLINK** file is actually recommended to be changed for scenario testing. The other two files have been calibrated for the current validation and should not be changed.

The TCARDS file is used in much the same way as in TranPlan, but is based in the Cube Voyager .PEN format. This file is now used as two separate files, ***TURN_PK_YYA.PEN*** and ***TURN_OP_YYA.PEN***, to allow for flexibility in the TOD base network coding and they can be edited in either a text editor, which maybe more difficult, or the Cube network edit window while displaying/editing the binary highway network as needed. For reporting purposes, the ***TURN_PK_YYA.PEN*** file is converted to dBase file format and is used in the HTML reporting. For TBRPM v8.0, there are three sets of turn prohibitors and time penalties used:

1. The first set consists of turn prohibitors. They block certain movements in traffic pathing and consist of inappropriate u-turns, off-ramp to on-ramp movements, or illegal left-turns.

2. The second set consists of time penalties that are used for deterring certain movements that are legal movements, but need to be restrained in some way during assignment.
3. The third set of penalties are also a group of time penalties, but they are used for distributional constraints within the model for legal traffic movements such as at county boundaries and bridges where people are not as willing to cross as the gravity model would have them.

In TBRPM v8.0, Cube Voyager scripts were developed to update the Voyager-based networks for speed and link travel times using the true shape distances derived from the ArcGIS shapefile. The associated Base Network shapefile, ***Base_YYA.shp***, is needed in each scenario input directory which holds the original true shape coordinates and distances. These distances are transferred to the Base Voyager Network when the network is built from the shapefile. The True Shape option in the Cube Network window should be used during network editing for proper display of the network link geometry. This allows for proper graphical display in Cube and helps keep the network to a minimal number of links for efficiency.

After the ***UNLOADED_PK.NET*** and ***UNLOADED_OP.NET*** files are prepared for use, Free Flow skims are generated for both the Peak and Off-Peak time periods. Because of the TOD nature of this model, two networks are used for processing the Free-Flow SKIMs. This is necessary to fully reflect path choices available during different times of the day. For most all facilities in the Tampa Bay area, except for one the Reversible Elevated Lanes (REL) of the Leroy Selmon Crosstown Expressway, facilities are available in both directions all day long. The REL facility by definition is only available in one direction at a time during various times of the day. To accommodate the REL effects on path choice, one network, the Peak network, shows the REL as inbound flow direction into downtown Tampa, where the Off-Peak network reflects an outbound flow away from downtown Tampa. This technique can be used to test other reversible facilities in this model structure, but only for facilities that would operate similarly to the REL. Otherwise the modeling process may need some modification.

5.2 Model Inputs and Outputs

Table 5.1 Model Inputs and Outputs

Input	Process	Output
BASE_YYA.NET SPDCAP_YYA.DBF VFACTORS_TOD.DBF TCARDS_PK_YYA.PEN TCARDS_OP_YYA.PEN TOLLLINK_YYA.DBF STATDATA_YYA.DBF FINAL_2010_TOD_Factors.DBF	HNET	NETWORK.ERR UNLOADED_BASE_YYA.NET UNLOADED_PK_YYA.NET UNLOADED_OP_YYA.NET LINKS.DBF XY.DBF HNET.HTML

Input	Process	Output
TCARDS_PK_YYA.PEN TCARDS_OP_YYA.PEN TERMTIME.DBF	HPATH	FREESKIM_AYY.MAT, FREESKIM_PK_AYY.MAT FREESKIM_HOV_AYY.MAT, FREESKIM_HOV_PK_AYY.MAT FREESKIM_MC_AYY.MAT, FREESKIM_MC_PK_AYY.MAT FREESKIM_HOV_MC_AYY.MAT, FREESKIM_HOV_MC_PK_AYY.MAT FHSKIMS_Autocon.AYY, FHSKIMS_Autocon_PK.AYY FHSKIMS2_Autocon.AYY, FHSKIMS2_Autocon_PK.AYY HPATH_TRACE.DBF, HPATH_TRACE_PK.DBF HPATH_DISTSKIM.DBF, HPATH_DISTSKIM_PK.DBF HPATH_TIME2SKIM.DBF, HPATH_TIME2SKIM_PK.DBF HPATH_TIME2SKIM2.DBF, HPATH_TIME2SKIM2_PK.DBF HPATH.HTML
	HPATH (TranPlan Format)	FHSKIMS.TEM, FHSKIMS_PK.TEM FHSKIMS.AYY, FHSKIMS_PK.AYY FHSKIMS2.AYY, FHSKIMS2_PK.AYY

INPUTS:

BASE_YYA.NET Voyager binary network file originally generated from the GIS "true shape" shapefile, BASE_YYA.SHP

The following table, **Table 5.3,** shows the attributes of the ***BASE_YYA.NET*** network file.

Table 5.2 BASE_YYA.NET Attributes

Attribute	Description
A	A-Node of highway link
B	B-Node of highway link
OBJECTID	ID of link in ArcGIS "True Shape" shapefile
LINK_ID	ID of link based on catenation of A-Node and B-Node used in GIS
Distance	Network Link distance in units of hundredths of miles calculated from GIS; used to build network distances from the shapefile by Cube
DistanceFT	Network Link distance in units of feet calculated from GIS
DistanceMI	Network Link distance in units of miles calculated from GIS
Time_	Placeholder for Free-Flow time updated by the **Highway Network** module
Time2	Placeholder for time
CAPACITY	Placeholder for Hourly per lane capacity updated by the **Highway Network** module
Area_Type	Area type of highway link used for Speed and Capacity lookup
Facl_Type	Facility type of highway link used for Speed and Capacity lookup

Attribute	Description
Screenline	Screenline locations in the highway network used for reporting; default is 99, other common number are used in highway statistics reporting in Highway Assignment
Num_Lanes	Number of directional lanes for a link; when converting to a network from the shapefile this number is used in both directions for two-way links and only in the direction digitized for a oneway link.
USER_	Dummy field not used
TOLL	Toll link number associated to the Toll Link file record
DIRCODE	Directional code of the link; based on the general direction of the road, 1-South-to-North/West-to-East, 2-North-to-South/East-to-West
ZONE_	User defined field identifier
CONSTRUCTI	Construction code; used in reporting highway differences from Base year during LRTP development - 1, 2, or 3 representing new lanes added
LANDUSE	User defined field
Location	County code of the link; 1-Hillsborough, 2-Pinellas, 3-Pasco, 4-Hernando, 5-Citrus, 6-Manatee
USECODE	User defined field
CORRIDOR	Used for Corridor reporting of major highway roadways in the Tampa Bay Area this field is associated to the ***Major_Corridors.DBF*** file in the ***BASE*** folder
C_Segment	Used in the Corridor reporting identifying segments of the major highway corridors is associated to the ***Corridor_Segments.DBF*** in the ***BASE*** folder
COSITE	Identifies link locations for the traffic count database ***Final_2010_TOD_Factors.DBF***
AADT	Annual Average Daily Traffic for a traffic count location updated from the traffic count database
PSWADT	Peak Season Weekday Average Daily Traffic for a traffic count location
DIR_COUNT	The PSWADT directional count for a traffic count location
SL_TAG	Flag for screenline based on the general traffic flow of the screenline links
CCC	Flag identifying links on the CCC regional highway network
EVAC	Flag identifying links of the evacuation routes on the highway network
Link_ID2	Text version of LINK_ID
SPD_LNK	Identifier used for linking segments used in speed surveys
SPD_LNK2	2nd identifier used for linking segments used in speed surveys
SHAPE_LENG	ArcGIS field used for calculating the GIS based length of a link
SITE1DIR	Used to link a traffic count by the direction of traffic flow
TWOWAY	Flag used for determining a link's oneway or two-way status from the Base shapefile; 0-Oneway and 2-Two-way

SPDCAP_YYA.DBF Free-flow (uncongested) speed and capacity lookup table specified by area type, facility type, and number of lanes

The following table, **Table 5.3,** shows the attributes of the ***SPDCAP_YYA.DBF***.

Table 5.3 SPDCAP_YYA.DBF Attributes

Attribute	Description
A_LOW	Area Type (AT) low range to apply Capacity and Speed to
A_HIGH	Area Type high range to apply Capacity and Speed to
F_LOW	Facility Type (FT) low range to apply Capacity and Speed to
F_HIGH	Facility Type high range to apply Capacity and Speed to
L_LOW	Number of Lanes (NL) low range to apply Capacity and Speed to
L_HIGH	Number of Lanes high range to apply Capacity and Speed to
SYMBOL1	*, +, or – used to adjust the capacity of the given AT, FT, NL combination; if not present use CAPACITY as specified
CAPACITY	Capacity or adjustment factor for the given AT, FT, NL combination
SYMBOL2	*, +, or – used to adjust the speed of the given AT, FT, NL combination; if not present use SPEED as specified
SPEED	Speed or adjustment factor for the given AT, FT, NL combination

VFACTORS_TOD.DBF	Factors file used to specify TOD period capacity factors and BPR curve parameters by Facility Type
TURN_PK_YYA.PEN	Peak period / network turn prohibitor and time penalty records
TURN_OP_YYA.PEN	Off-Peak period / network turn prohibitor and time penalty records
TOLLLINK_YYA.DBF	Toll link locations and designations with associated attributes such as toll cost, service times and delay

The following table, Table 5.4**,** shows the attributes of the ***SPDCAP_YYA.DBF***.

Table 5.4 TOLLLINK_YYA.DBF Attributes

Attribute	Description
TOLL	Toll location designation which is coded in the *TOLL* field of the highway network for general reference
TOLLTYPE	Toll type 1 designates whether deceleration and acceleration links are to be used for toll facilities that require car to slowdown to pay their toll; otherwise 2 should be used

Attribute	Description
A	A node of the toll link used when the Toll Link file is joined to the highway network so it must be accurate
B	B node of the toll link used when the Toll Link file is joined to the highway network so it must be accurate
PLAZADESC	Text description of toll location
PLZLNSMIN	Minimum number of lanes of the toll plaza open (not used)
PLZLNSMAX	Maximum number of lanes of the toll plaza open (not used)
CARTOLL	Toll value in dollars; weighted average dollars are currently used based on EZPAY vs cash toll prices. At time of calibration, assumption of 67% use EZPAY.

STATDATA_YYA.DBF Characteristics of transit stations, including park-and-ride and kiss-and-ride lots, and major transit centers

FINAL_2010_TOD_Factors.DBF File contains the records of the traffic counts for network Validation purposes by period and AADT. Three types of available traffic counts comprise the database records; 1) Class counts by TOD, 2) TOD counts, and 3) AADT. For Class and TOD counts there are generally 8 records for each count location; one record for each period and direction, unless the facility is one way. AADT counts generally only have 2 records for each count location, one for each direction unless the facility is one way. Where possible counts by TOD were used for comparison within the TOD periods, and all counts were used for a daily comparison.

The following table, **Table 5.5,** shows the attributes of the ***FINAL_2010_TOD_Factors.DBF***.

Table 5.5 FINAL_2010_TOD_Factors.DBF Attributes

Attribute	Description
COSITE	Traffic count identification label; FD_ used for FDOT counts, CI_ used for Citrus County, HE_ used for Hernando, HI_ used for Hillsborough, PA_ used for Pasco, and PI_ used for Pinellas
COSITEDIR	COSITE label plus a directional code; 1 for South to North or West to East, 2 for the opposite direction. Most counts are very directional in nature and not a 50/50 split, especially at the TOD level.
DESC	Text description of the count location where possible
County	County of the traffic count location
Year	Year the count was taken; for the TBRPM v8.0 counts ranged from 2009-2012 since all counts are not taken every year

Attribute	Description
Period	TOD period designation coded 1 through 4 for a TOD count and 0 for an AADT count; 1-AM, 2-MD, 3-PM, 4-EV. This allows for the count to selected for a given period network for comparison.
DIRCODE	General directional code of the count record; 1-South to North or West to East, 2-opposite direction
ANODE	A node of the highway link used to join the count records to the highway network; if a count link is broken in the network, ANODE and BNODE should be adjusted accordingly for the count records
BNODE	B node of the highway link used to join the count records to the highway network
CLSCNT	Flag for whether the count is a Classification count or not; 0-no, 1-yes. If a class count then auto, medium truck, and heavy truck percentages and counts will be available in the record
Auto_PCT	Percent of autos within the period, by direction, of the daily count
LT_PCT	Percent of medium trucks within the period, by direction, of the daily count
HT_PCT	Percent of heavy trucks within the period, by direction, of the daily count
TRK_PCT	Total Truck percent within the period, by direction, of the daily count
PD_VOL_PCT	Total period count percentage, by direction, of the daily count
AADT	Annual Average Daily Traffic count for the location; will be the same for all location records
PSWADT	Peak Season Weekday Average Daily Traffic; the adjusted seasonal count used for validation
AUTO	Auto portion of the count for the period, by direction, of the daily count
LT_TRK	Medium truck portion of the count for the period, by direction, of the daily count
HY_TRK	Heavy truck portion of the count for the period, by direction, of the daily count
PDDIR_CNT	Total period portion of the count, by direction
PDDIR_SPL	Directional count split percentage for the period
DLDIR_SPL	Daily direction count split percentage
DLTRK_PCT	Daily truck percentage of count location
DLTRK_SPL	Directional truck split of count location
DIR_COUNT	Daily directional count; directional split of the PSWADT
TRK_AADT	Daily truck portion of the AADT
TRK_PSWADT	Daily truck portion of the PSWADT
DLTRK_DIR	Daily directional truck split of the PSWADT
MOCF	Model Conversion Factor

TERMTIME.DBF Terminal times by area type

OUTPUTS:

NETWORK.ERR	Lists possible highway network coding errors by link where FT, AT, and number of lanes combinations are not found in the SPDCAP table
UNLOADED_BASE_YYA.NET	Updated highway network with free-flow speeds and travel times based on the ***BASE_YYA.NET*** base network for the scenario
UNLOADED_OP_YYA.NET	Updated highway network with free-flow speeds and travel times setup for the Off-Peak period where the RELs of the Lee Roy Selmon Crosstown are in the outbound configuration
UNLOADED_PK_YYA.NET	Updated highway network with free-flow speeds and travel times setup for the Peak period where the RELs of the Lee Roy Selmon Crosstown are in the inbound configuration
LINKS.DBF	Highway network links database
XY.DBF	Highway network nodes database
HNET.HTML	The HNET HTML report
FREESKIM _AYY.MAT	Free-flow (uncongested) inter-zonal travel impedances for LOV travelers in the Off-Peak period network
FREESKIM_PK_AYY.MAT	Free-flow (uncongested) inter-zonal travel impedances for LOV travelers in the Peak period network
FREESKIM_HOV_AYY.MAT	Free-flow (uncongested) inter-zonal travel impedances for HOV travelers in the Off-Peak period network
FREESKIM_HOV_PK_AYY.MAT	Free-flow (uncongested) inter-zonal travel impedances for HOV travelers in the Peak period network
FREESKIM_MC_AYY.MAT	Free-flow (uncongested) inter-zonal travel impedances for LOV travelers in the Off-Peak period network format used for Mode Choice
FREESKIM_MC_PK_AYY.MAT	Free-flow (uncongested) inter-zonal travel impedances for LOV travelers in the Peak period network format used for Mode Choice
FREESKIM_HOV_MC_AYY.MAT	Free-flow (uncongested) inter-zonal travel impedances for HOV travelers in the Off-Peak period network format used for Mode Choice

FREESKIM_HOV_MC_PK_AYY.MAT Free-flow (uncongested) inter-zonal travel impedances for HOV travelers in the Off-Peak period network format used for Mode Choice

FHSKIMS_Autocon.AYY Free-flow (uncongested) inter-zonal travel impedances for LOV travelers in the Off-Peak period network format used for Autocon program

FHSKIMS_Autocon_PK.AYY Free-flow (uncongested) inter-zonal travel impedances for LOV travelers in the Peak period network format used for Autocon program

FHSKIMS2_Autocon.AYY Free-flow (uncongested) inter-zonal travel impedances for HOV travelers in the Peak period network format used for Autocon program

FHSKIMS2_Autocon_PK.AYY Free-flow (uncongested) inter-zonal travel impedances for HOV travelers in the Peak period network format used for Autocon program

FHSKIMS.TEM Free-flow (uncongested) inter-zonal travel impedances in the Off-Peak period network TRANPLAN format for Gravity Model. (Includes terminal time, Intrazonal time, and max out the EE skim)

FHSKIMS_PK.TEM Free-flow (uncongested) inter-zonal travel impedances in the Peak period network TRANPLAN format for Gravity Model (Includes terminal time, Intrazonal time, and max out the EE skim)

FHSKIMS.AYY Free-flow (uncongested) inter-zonal travel impedances for LOV travelers in the Off-Peak period network TRANPLAN format. (No terminal time, no Intrazonal time)

FHSKIMS_PK.AYY Free-flow (uncongested) inter-zonal travel impedances for LOV travelers in the Off-Peak period network TRANPLAN format. (No terminal time, no Intrazonal time)

FHSKIMS2.AYY Free-flow (uncongested) inter-zonal travel impedances for HOV travelers in the Off-Peak period network TRANPLAN format. (No terminal time, no Intrazonal time)

FHSKIMS2_PK.AYY Free-flow (uncongested) inter-zonal travel impedances for HOV travelers in the Off-Peak period network TRANPLAN format (No terminal time, no Intrazonal time)

HPATH_TRACE.DBF	Path trace database from {FromNode} to {ToNode} using the Off-Peak period highway network
HPATH_TRACE_PK.DBF	Path trace database from {FromNode} to {ToNode} using the Peak period highway network
HPATH_DISTSKIM.DBF	Distance skim report database from {SkimZone} using the Off-Peak period highway network
HPATH_DISTSKIM_PK.DBF	Distance skim report database from {SkimZone} using the Peak period highway network
HPATH_TIME2SKIM.DBF	TIME skim report database from {SkimZone} using the Off-Peak period highway network
HPATH_TIME2SKIM_PK.DBF	TIME skim report database from {SkimZone} using the Peak period highway network
HPATH_TIME2SKIM2.DBF	TIME2 skim report database from {SkimZone} using the Off-Peak period highway network
HPATH_TIME2SKIM2_PK.DBF	TIME2 skim report database from {SkimZone} using the Peak period highway network
HPATH.HTML	The HPATH HTML report

5.3 Model Procedure

The initial steps of the **Highway Network** module, as shown in **Figure 5.1** below, updates the highway network attributes for processing and skimming as described in the following sections.

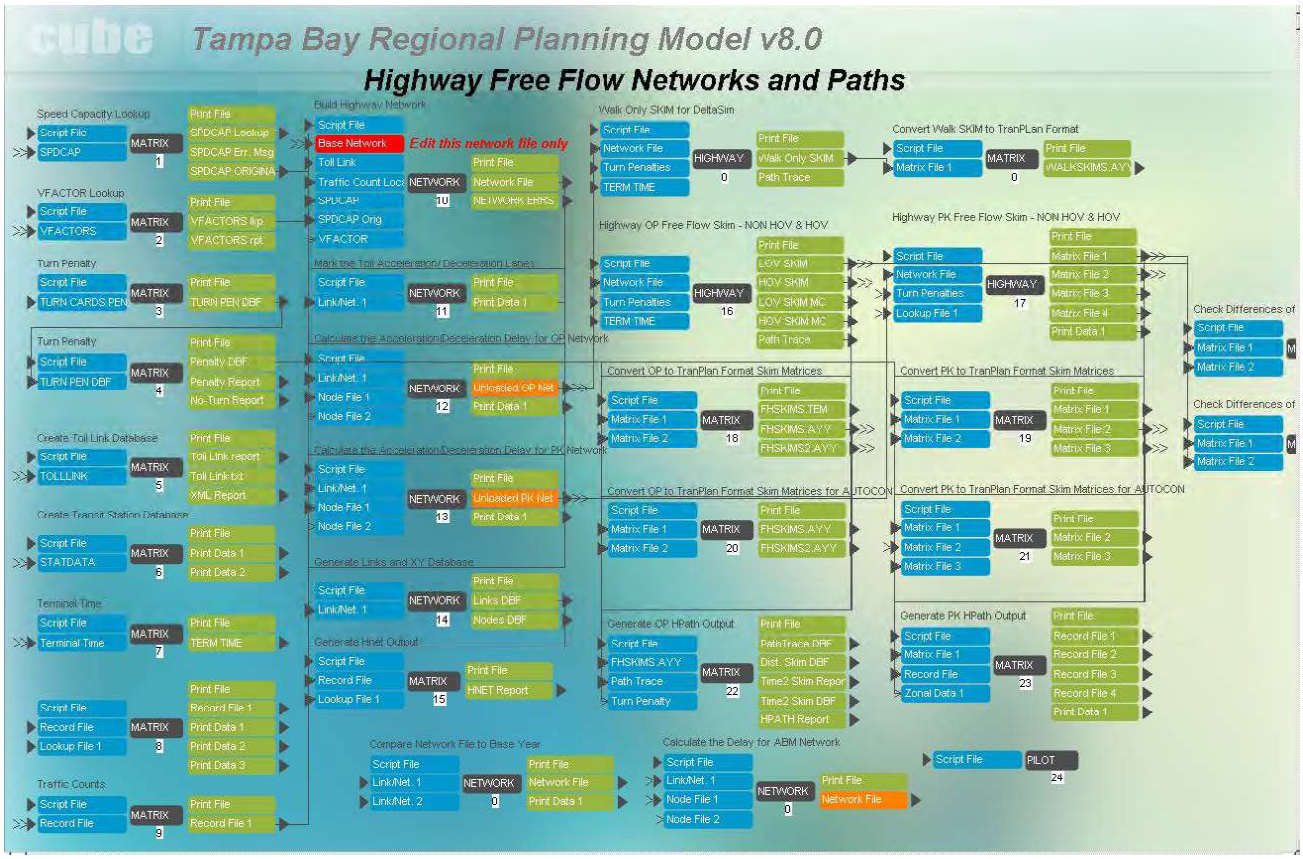


Figure 5.2 HNET Model Stream

Speed Capacity Lookup

The dBase SPDCAP file is used and converted into a lookup table for the Voyager NETWORK process. The value being looked-up is the combination of area type, facility type and number of lanes. It should be noted that in a Voyager script syntax, only one single lookup value can be used within a lookup table, and that the built-in functions of Voyager for speed and capacity lookups only allow for 1-digit Area and Facility Types. In order to lookup a combination of the area type, facility type and number of lanes for a link, a temporary value INDEXVAL is created for each combination specifying the effective speed and capacity. The lookup functionality then returns the proper speed and capacity to be applied to each link.

A text, column-delimited output file, ***SPDCAP.TXT***, is generated for the lookup function to be used in step 10, NETWORK, process. An error message file, ***SPDCAP.ERR***, is created for reporting erroneous speeds and capacities of the lookup table in the HNET web-based HTML report.

VFACTORS

The UROAD, CONFAC, BPRLOS, and BPREXP attribute / constants and coefficients are added to each link based on the lookup of the link Facility Type. The UROAD parameter is applied to highway capacities to calculate the "practical" capacity for each link. Generally, this is Level-of-Service (LOS) 'C'. The CONFAC parameter was used in the previous version of the model to factor the capacities

of each link in the highway network from hourly to daily equivalents, generally at LOS 'E', for computation of the daily volume over capacity ratios from the highway assignment. This TOD version of the model uses a similar process to convert the hourly capacities into period capacities to ratio with the period volumes using one of four CONFACs which are different for each period since each period represents a different number of hours of the day; CONFACAMP, CONFACPMP, CONFCMDP, and CONFACEVP.

A text, column-delimited output file VFACTORS.TXT is also generated as a lookup file for use in step 10, NETWORK, process and an output file VFACTORS.PRN is then created for reporting in the HNET HTML report.

Turn Prohibitors and Time Penalties

The ***TURN_PK_YYA.PEN*** and ***TURN_OP_YYA.PEN*** files, Voyager formatted turn penalty input files, are used with the two ***Unloaded_OP_YYA.NET*** and ***Unloaded_PK_YYA.NET*** network files when processing the networks paths. However, only the ***TURN_PK_YYA.PEN*** is currently used to generate a ***TCARDS*** dBase file for reporting. The ***TURN_PK_YYA.PEN*** and ***TURN_OP_YYA.PEN*** files use a free file format with the time penalties in minutes, and turn prohibitors represented with -1. In the ***TCARDS*** dBase file, all the time penalties are in hundredths of minutes for reporting purposes. The ***TURN_PK_YYA.PEN*** and ***TURN_OP_YYA.PEN*** files will be used in the step 18, MATRIX, process which is labeled HPATH Output. Time penalties and turn prohibitors are reported in the web-based HTML report in two separate output tables.

Toll Link Database

Attributes including the toll number, car toll, service time, toll plaza description, and etc. are added into the network for each toll link. A text, column-delimited output file ***TOLLLINK.TXT*** is generated for use as a lookup file in the step 10, NETWORK, process to join the toll data to the highway network and an output file ***TOLLLINK.PRN*** is then created for reporting in the HNET HTML report. ***TOLLLINK1.TXT*** is also created to be used later for mode choice and contains the same toll content as ***TOLLLINK.TXT*** except for the extra insertion of the 'CTOLL={CTOLL}' record that is used by the user program in Mode Choice.

Transit Station Database

Station data is used as a node input file in the step 10, NETWORK, process. It specifies the node numbers where the transit stations are located, and assigns the associated attributes such as station number, service area, available parking spaces, costs, and etc. to those nodes in the base network. Once it has been read in, these attributes will be saved in the network and carried forward through the rest of the model flow.

Terminal Time

In TBRPM 5.2, the terminal time was looked-up from the ***PROFILE.MAS*** based on the area type of each TAZ's centroid. In TBRPM v8.0, a terminal time database, ***TERMTIME.DBF***, has been created and stored in the ***BASE*** directory. A text, column-delimited ***TERMTIME.TXT*** file is created from the terminal time database for use as a lookup file in the step 16 and 17, HIGHWAY, processes for the Off-Peak and Peak networks.

Traffic Counts

A traffic count database is now used for adding traffic count information either Daily or by period to the highway network to reduce the complexity of manually coding the traffic counts in the base year highway network. A database file, ***TOD_FACTORS_DAILY_.DBF,*** is prepared from the input traffic count database ***Final_2010_TOD_FACTORS.DBF*** and is joined to the ***BASE_YYA.NET*** in the step 10, NETWORK, process to update the AADT, PSWDAT, and DIR_COUNT attributes described earlier.

Build the Highway Network

A Cube Voyager binary highway network, ***BASE_AYY.NET***, is the starting network used by the TBRPM v8.0 which has been originally built from the network shapefile described earlier. The LINKMERGE phase is invoked in this step. The toll link file ***TOLLLINK.TXT*** is used to update the link attributes in the base network which are toll links. The ***TOD_FACTORS_DAILY_.DBF*** is used to update the proper traffic count information. The station file ***STATDATA.TXT*** is used to update the node attributes of the nodes which are the transit stations with its information. The speeds and capacities for each link are looked-up and updated from the ***SPDCAP.TXT*** file. The travel times, TIME and TIME2, are calculated for each link from the input distance and speeds. And, the ***VFACTORS.TXT*** file is used to join the UROAD, CONFACs, and the other BPR attributes into the network.

Toll Acceleration / Deceleration Lanes

The highway links before and after the toll booth, where toll type=1, are marked as acceleration / deceleration lanes.

Calculate the Acceleration / Deceleration Delay – Peak and Off-Peak Network

In these steps, the final unloaded networks are prepared for the Peak and Off-Peak periods as described above; Peak network – inbound REL and Off-Peak network – outbound REL. Within these steps, the Acceleration / Deceleration Delay, for links leading to or away from a toll facility that has a toll type = 1, is calculated and saved in the link attribute DELAY for each acceleration and deceleration link. In a later step, the link attribute TOTALCOST is then updated with LINKCOST + DELAY. The unloaded networks, ***UNLOADED_OP_AYY.NET*** and ***UNLOADED_PK_AYY.NET***, are formed by ignoring the opposite direction of the RELs when the networks are written out depending on which network is being processed. These networks which are the output of the **HNET** module will be used for the rest of the mode chain.

The toll facilities are involved in the highway network from this step forward and their toll impedances are updated to each toll link along with the impedance of the non-toll highway links in this step. Generally, the Impedances for toll and non-toll facilities are calculated as follows:

IMPED = CTIME * TIME + CDIST * DIST (for non-toll links)
IMPED = CTIME * (SERVT+TIME) + CTOLL * TOLL (for toll links)

where:

CTIME = time coefficient
TIME = the travel time on the link

CDIST	= distance coefficient
DIST	= the link distance
SERVT	= service time at toll booths
CTOLL	= constant time value of toll
TOLL	= the link toll cost

In TBRPM, CTIME = 1.0, CDIST = 0, and CTOLL = 0.06 as the default. Therefore,

IMPED = TIME (for non-toll links)
IMPED = (SERVT+TIME) + CTOLL * TOLL (for toll links)

CTOLL has been expanded in this model version to six (6) parameters, plus the default, to accommodate varying CTOLL values across all of the counties in the model. Each county is known to have different average incomes from Census data. So, since CTOLL is a representation of the value of time based on disposable income, it is only fitting to vary that value of time in the model at some level to achieve a better validation and calibration.

As partially described above for the Toll Facilities Model, the acceleration and deceleration delay, before and after the toll booth where cash toll collection is required, is calculated here. The acceleration rate **a1** is always set to 2.5 mph / sec, and the deceleration rate **a3** is calculated by a linear interpolation between 6.2 mph / sec at an approach speed of 70 mph and 4.0 mph / sec at an approach speed of 30 mph. The constant acceleration rate is defined by the catalog key {ACCELRATE}.

The acceleration delay at the toll plaza is calculated as follows:

- Acceleration Delay at Plaza = Approach Speed / acceleration rate / 2

The deceleration delay at the toll plaza is calculated as follows:

- Deceleration Delay at Plaza = Approach Speed / deceleration rate / 2

The link attribute LINKCOST is used to represent the time impedance for all non-toll links as well as the toll equivalent time for toll links. The link attribute TOTALCOST includes the LINKCOST time and toll equivalent time plus the acceleration / deceleration delay for all links.

With the advent of the All Electronic Tolling or Toll-by-Plate, acceleration, deceleration, and toll service times do not have an impact on the network as before. This should be considered in network coding for other future toll facilities that maybe converted to all electronic tolling. Using a toll type = 2 would turn off the acceleration and deceleration calculations.

Generate the LINKS and XY Database

The LINKS and XY databases are created at this step for the Off-Peak network and stored in the scenario output directory for possible use in other steps.

Generate HNET Report

The output report for HNET includes the number of links by area type and facility type, the average speed by area type and facility type, the capacity by area type and facility type, and other basic network information reports including information about toll links, transit stations, VFACTORS, time penalties and turn prohibitors.

The Highway Path portion of the Highway Networks module is shown back in **Figure 5.1** on the right side of the figure.

Highway Free Flow Skims

At this step, terminal times are added to the model network for the skim times to be used in the gravity model during Trip Distribution. Previously in FSUTMS, a user program TTPREP was used to lookup the terminal time for each TAZ based on the area type of the centroid connectors. When there is only one centroid connector that exists for a TAZ there is no problem in determining the Area Type for the centroid. However, there is some confusion as to what the correct Area Type is when more than one centroid connector exists and each has a different Area Type designation. In TTPREP, when there is more than one link connected to the TAZ centroid, the Area Type was assigned based on the first entry in the network, or the link with the lowest network BNODE number not including the centroid number itself, and not the last entry or the one that had the highest network BNODE number. Some of the original FSUTMS conversions to Voyager had scripts that adopted the Area Type of the connector that had the highest BNODE number and so the results were different. For this version of the TBRPM v8.0, these skims are generated for the Peak and Off-Peak networks so they are both available for the **Distribution** module since the Peak and Off-Peak trips are distributed based on the available network travel times.

Convert to TranPlan Format Skim Matrices

The LOS matrices are converted into TranPlan format matrices to be used in the new Mode Choice user program, ***WCFMODE.EXE***. There are three TranPlan format LOS matrices that are generated for both the Peak and Off-Peak networks.

The units in the TranPlan matrices are in hundredths of miles and hundredths of minutes, while the units in Voyager matrices are in miles and minutes with 2-decimal point accuracy.

Generate HPATH Output

The HPATH web-based (HTML) report is generated along with detailed path trace reports from a designated origin and destination TAZ, specified using the catalog key {FromNode} and {ToNode}, for the Peak and Off-Peak networks.

Record the time stamp

The purpose of this step is to create the SVG files needed for the web-based reports and record the time stamp for when then current module has finished.

5.4 Standard Output

The HNET web-based reports include the following reports:

- ***Highway Network Area Type***
- ***Highway Network Facility Type***
- ***Number of Links by Area Type and Facility Type (Single Digit)***
- ***Number of Links by Area Type and Facility Type (Double Digit)***
- ***Average Speed by Area Type and Facility Type (Double Digit)***
- ***Average Capacity by Area Type and Facility Type(Double Digit)***
- ***VFACTORS (Detailed Report)***
- ***Toll Links (Detailed Report)***
- ***Transit Stations (Detailed Report)***
- ***Time Penalty (Detailed Report)***
- ***Turn Prohibitor (Detailed Report)***

Checks/Application

Facility types (FT), area types (AT), and number of lanes (NL) - using plots by annotation or by colors. Centroid Connectors should be verified against TAZ polygon locations, local street and land use maps.

All links should have facility type (FT), area type (AT), number of lanes (NL), link group (LG), screenline (SL), and geographic location (GL) codes. FIHS facilities should have corridor segment codes.

The HPATH web-based reports include the following reports:

- ***Highway OP Path for Selected Origin and Destination (Zone*** *{FromNode}* ***-*** *{ToNode}****)***
- ***Highway OP Skim from Zone*** *{SkimZone}* ***(Distance in Miles)***
- ***Highway OP Skim from Zone*** *{SkimZone}* ***(Time1 in Minutes)***
- ***Highway OP Skim from Zone*** *{SkimZone}* ***(Time2 in Minutes)***
- ***Highway PK Path for Selected Origin and Destination (Zone*** *{FromNode}* ***-*** *{ToNode}****)***
- ***Highway PK Skim from Zone*** *{SkimZone}* ***(Distance in Miles)***
- ***Highway PK Skim from Zone*** *{SkimZone}* ***(Time1 in Minutes)***
- ***Highway PK Skim from Zone*** *{SkimZone}* ***(Time2 in Minutes)***

Checks

- ✓ Add turn prohibitor or turn penalty records to the ***TCARDS_OP_YYA.PEN*** and ***TCARDS_PK_YYA.PEN*** files for any prohibited or extremely difficult movement when revising any network.
- ✓ Toll Facilities should be coded in the highway network with the appropriate toll Facility Type and with appropriate toll attributes (cost, service time and number of toll booths) in the **TOLLLINK_YYA.DBF** file.
- ✓ Use Cube to check the logical paths between two TAZs based on time or distances.

Chapter 6 - **Trip Distribution**

6.1 General Description

Trip distribution is the matching of zonal trip productions to zonal trip attractions. In FSUTMS this is accomplished through the use of a gravity model. The gravity model is based upon the concept that the desirability of traveling to a particular zone is directly related to the amount of activity in each potential destination zone, and inversely related to the perceived spatial separation (the highway impedance) between the production and the attraction zones. This spatial separation is measured in terms of travel time. The inverse relationship to highway impedance is assumed to be non-linear and is modified by "friction factors". The friction factor is an exponent of highway impedance analogous to the square of the distance that appears in the Newtonian gravity equation.

In addition to the matching of trip productions to trip attractions, the distribution module also performs other additional functions including:

- Pre-loading of the highway network
- Development of congested travel time skims for input into later steps of the model

The results of these functions, in turn, become inputs for transit network development and mode choice estimation. For the TBRPM v8.0, few things have changed from past model versions. This model now split the trips into Peak and Off-Peak periods before trip distribution based on NHTS and household survey rates. The Off-Peak trips are distributed using the Free-Flow skims generated for the Off-Peak unloaded network from the **HNET** / **HPATH** modules. The Peak trips are distributed using a feed-back loop scheme that first distributes the Peak trips using the Free-Flow skims from the Peak unloaded network. After the first peak distribution, the Peak trips are assigned to the Peak unloaded network. The loaded Peak network is skimmed as the first congested skims of a six (6) loop feed-back process. A new trip table is formulated for the congested skim and is feed-back into the distribution gravity model with the congested skims. When the six (6) loops are finished the final trip table and congested skims are passed into the **Mode Choice** module.

The following figure, **Figure 6.1**, shows the new **Trip Distribution** module flowchart. The upper boxes show the input Free-Flow matrixes and the **OP_DISTRIBUTION** module. Inside the black rectangle is the **PK_DISTRIBUTION** feed-back loop and module.

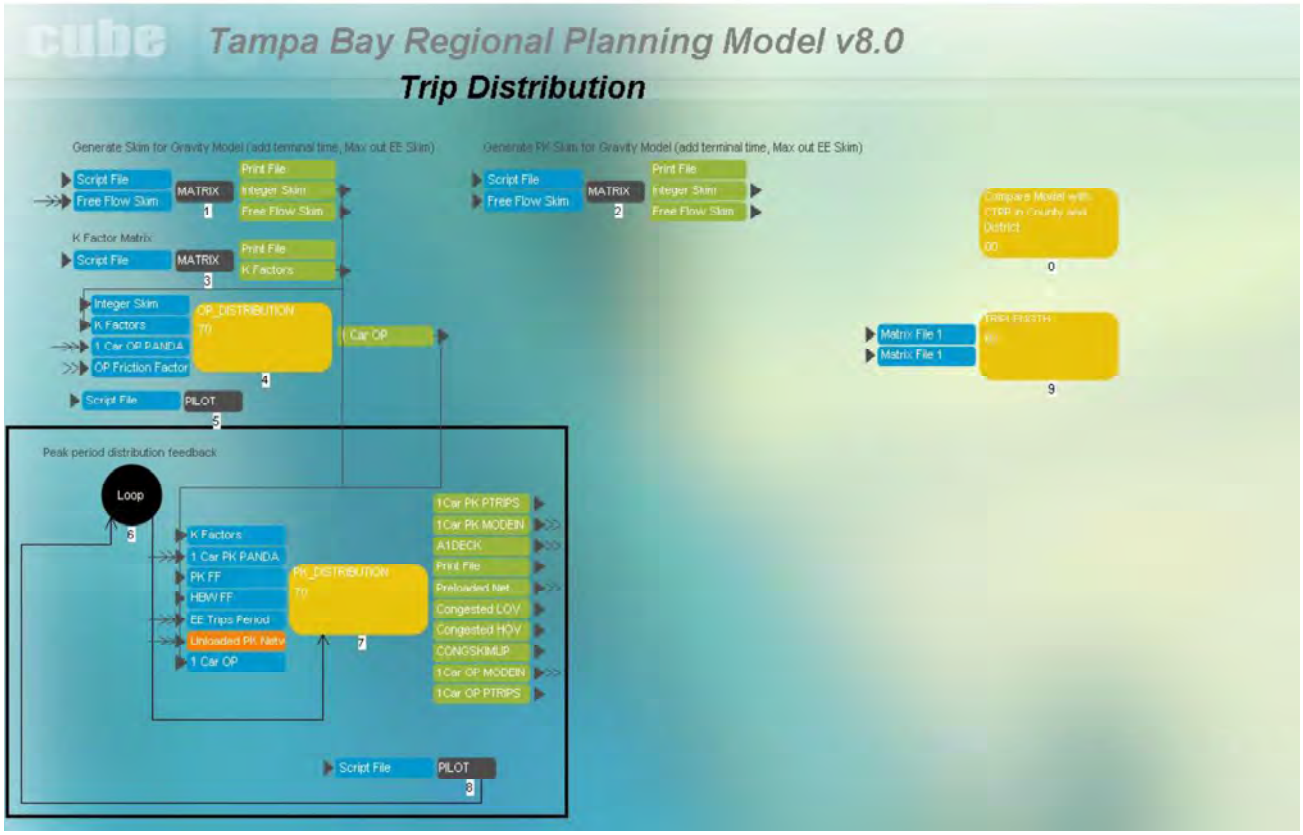


Figure 6.1 Trip Distribution Model Flow

6.2 Model Inputs and Outputs

The following table, **Table 6.1**, shows a list of input and output files vital to the **Distribution** module.

Table 6.1 Model Inputs and Outputs

Input	Process	Output
FREESKIM_AYY.MAT GEN_PANDA_1_OP.DBF FF_ALL.BDF	(Off-Peak) DISTRIBUTION	FREESKIMUP.MAT REPORT_FF_OP_SKIM_AYY.MAT

Input	Process	Output
FREESKIM_PK_AYY.MAT GEN_PANDA_1_PK.DBF FF_PK_U.DBF FF_HBW.CSV	(Peak) DISTRIBUTION	FREESKIMUP_PK.MAT, REPORT_FF_PK_SKIMAYY.MAT PTRIPS_1C_OP_AYY.MAT, PTRIPS_1C_PK_AYY.MAT MODEIN_1C_OP.TEM, MODEIN_1C_PK.TEM TTEIEE_1C_PK.TEM HTTB_1C_PK.TEM PRELOAD_1C_AMPK.NET CONGSKIM_TEM.MAT, CONGSKIM_HOV_TEM.MAT CONGSKIM_AYY.MAT, CONGSKIM_HOV_AYY.MAT CONGSKIM_MC_AYY.MAT, CONGSKIM_HOV_MC_AYY.MAT RHSKIMS.AYY, RHSKIMS2.AYY CONGSKIMUP.MAT RHSKIMS_AUTOCON.AYY, RHSKIMS2_AUTOCON.AYY

INPUTS:

FREESKIM_AYY.MAT Free-Flow skim file from HPATH used for input to develop final skim file used by the Off-Peak period distribution Gravity model. This file contains matrixes of TIME, DISTANCE, TERMTIME, TOLLTIMEEQ, TIME2, TOLLDOLLARS, SVCMINUTES, SVCSECONDS, and DELAY.

GEN_PANDA_1_OP.DBF Input file from **Trip Generation** module that contains the Off-Peak trip ends ready for distribution using the Off-Peak Free-Flow skims.

FF_ALL.BDF The Off-Peak distribution Friction-Factors used by the Gravity model to distribute the trip ends of the ***GEN_PANDA_1_OP.DBF*** by purpose.

FREESKIM_PK_AYY.MAT Free-Flow skim file from HPATH used for input to develop final skim file used by the Peak period distribution Gravity model for the first loop. This file contains matrixes of TIME, DISTANCE, TERMTIME, TOLLTIMEEQ, TIME2, TOLLDOLLARS, SVCMINUTES, SVCSECONDS, and DELAY.

GEN_PANDA_1_PK.DBF Input file from **Trip Generation** module that contains the Peak trip ends ready for distribution using the Peak Free-Flow skims.

FF_PK_U.DBF The Peak distribution Friction-Factors used by the Gravity model to distribute the trip ends of the ***GEN_PANDA_1_PK.DBF*** by purpose except for HBW.

FF_HBW.CSV The Peak distribution Friction-Factors used by the Gravity model to distribute the HBW trip ends of the ***GEN_PANDA_1_PK.DBF***.

OUTPUT:

FREESKIMUP.MAT Final Free-Flow skim file used by the Off-Peak period distribution Gravity model. This file contains the matrix TIME2 as integers.

REPORT_FF_OP_SKIM_AYY.MAT Final Free-Flow skim file used for reporting the Off-Peak period skims used by the distribution Gravity model. This file contains matrixes of TIME2 and DISTANCE.

FREESKIMUP_PK.MAT Final Free-Flow skim file used by the Peak period distribution Gravity model. This file contains the matrix TIME2 as integers.

REPORT_FF_PK_SKIM_AYY.MAT Final Free-Flow skim file used for reporting the Peak period skims used by the distribution Gravity model. This file contains matrixes of TIME2 and DISTANCE.

PTRIPS_1C_OP_AYY.MAT Final Off-Peak, person trip table for 1-Plus Car Households, after distribution and other adjustments, which holds the person trips in the same trip purposes from Trip Generation.

PTRIPS_1C_PK_AYY.MAT Final Peak, person trip table for 1-Plus Car Households, after distribution and other adjustments, which holds the person trips in the same trip purposes from Trip Generation.

MODEIN_1C_OP.TEM Off-Peak, person trip table for 1-Plus Car Households reduced to only three (3) purposes; 1) Home Based Work (HBW), 2) Home Based Non-Work (HBNW), and 3) Non-Home Based (NHB). This matrix is used for input into Mode Choice in a later step.

MODEIN_1C_PK.TEM Peak, person trip table for 1-Plus Car Households reduced to only three (3) purposes; 1) Home Based Work (HBW), 2) Home Based Non-Work (HBNW), and 3) Non-Home Based (NHB). This matrix is used in a preliminary Mode Choice during the Distributional feed-back loop.

TTEIEE_1C_PK.TEM Peak, vehicle trip table formed from the ***PTRIPS_1C_PK_AYY.MAT*** used to for the final vehicle trip table for pre-assignment.

HTTB_1C_PK.TEM Final Peak, highway trip table formed after the preliminary Mode Choice used in pre-assignment.

PRELOAD_1C_AMPK.NET Loaded pre-assignment network formulated after each highway assignment of the distributional feed-back loop.

CONGSKIM_TEM.MAT Restrained (congested) skims of cost, distance, and time impedances for network without HOV lanes to be used for distribution; includes distributional penalties (penalty set 3) from the ***Turn_PK_YYA.PEN.***

CONGSKIM_HOV_TEM.MAT Restrained (congested) skims of cost, distance, and time impedances for network with HOV lanes to be used for distribution; includes distributional penalties (penalty set 3) from the ***Turn_PK_YYA.PEN.***

CONGSKIM_AYY.MAT Restrained (congested) skims of cost, distance, and time impedances for network without HOV lanes.

CONGSKIM_HOV_AYY.MAT Restrained (congested) skims of cost, distance, and time impedance for network with HOV lanes.

CONGSKIM_MC_AYY.MAT Restrained (congested) skims of cost, distance, and time impedances for network without HOV lanes used for Mode Choice.

CONGSKIM_HOV_MC_AYY.MAT Restrained (congested) skims of cost, distance, and time impedance for network with HOV lanes used for Mode Choice.

RHSKIMS.AYY Equivalent restrained (congested) skims of cost, distance, and time impedances for network without HOV lanes used for Mode Choice with external to external travel time maxed out to 200 minutes.

RHSKIMS2.AYY Equivalent restrained (congested) skims of cost, distance, and time impedance for network with HOV lanes used for Mode Choice with external to external travel time maxed out to 200 minutes.

CONGSKIMUP.MAT Updated congested skims of time and distance, with terminal time added and external to external travel times maxed out to 200 minutes, used for the next distribution in the distributional feed-back loop.

RHSKIMS_AUTOCON.AYY Equivalent restrained (congested) skims of cost, distance, and time impedances for network without HOV lanes used for ***AUTOCON.EXE*** auto connector program.

RHSKIMS2_AUTOCON.AYY Equivalent restrained (congested) skims of cost, distance, and time impedances for network with HOV lanes used for ***AUTOCON.EXE*** auto connector program.

DIST.HTM Web-based Distribution Reports

6.3 Model Procedure

Figure 6.1 above shows the **Trip Distribution** module steps as described next.

Generate Skim for Gravity Model

In the first two steps of the **Trip Distribution** module, the LOS matrix ***FREESKIM_AYY.MAT*** and ***FREESKIM_PK_AYY.MAT*** which are generated by steps 16 & 17, Network, of the **Highway Network** module, are prepared for use by the gravity model of the distribution step. The impedance (TIME2) in these matrixes includes travel time, turn penalties, toll equivalent time, and acceleration / deceleration delay time. Terminal times are added to the time impedance and external to external travel times are maxed out at 200 minutes.

K Factor Matrix

The K Factor matrix is generated to limit the school trips to be contained only within each county.

OP Distribution

In this step, the Off-Peak trip distribution is performed. **Figure 6.2,** below, shows the only step of the **OP Distribution** module, Distribution. The Gravity Model is performed for all Off-peak, trip purposes of the ***GEN_PANDA_1_OP.DBF***. The output trip tables are produced using the Friction Factors file ***FF_ALL.DBF***. This file has been calibrated using the latest Household surveys for the Tampa Bay area.

Figure 6.2 Off-Peak Distribution Flowchart

Pilot

The next step prepares and copies the appropriate files for use in the **PK_Distribution** loop and module.

Loop

The trip distribution of Peak, 1-Plus Car Household trips starts with the initiation of the feed-back loop which is set for seven (7) loops of the **PK_Distribution** module. Only the first six loops run the full process of Distribution, Mode Choice, Pre-Assignment, and skimming as described below for the **PK_Distribution** module. The last loop, loop 7, performs one last distribution based on the final congested skims of the previous loop.

PK Distribution

Figure 6.3 below shows the **PK_Distribution** module flowchart.

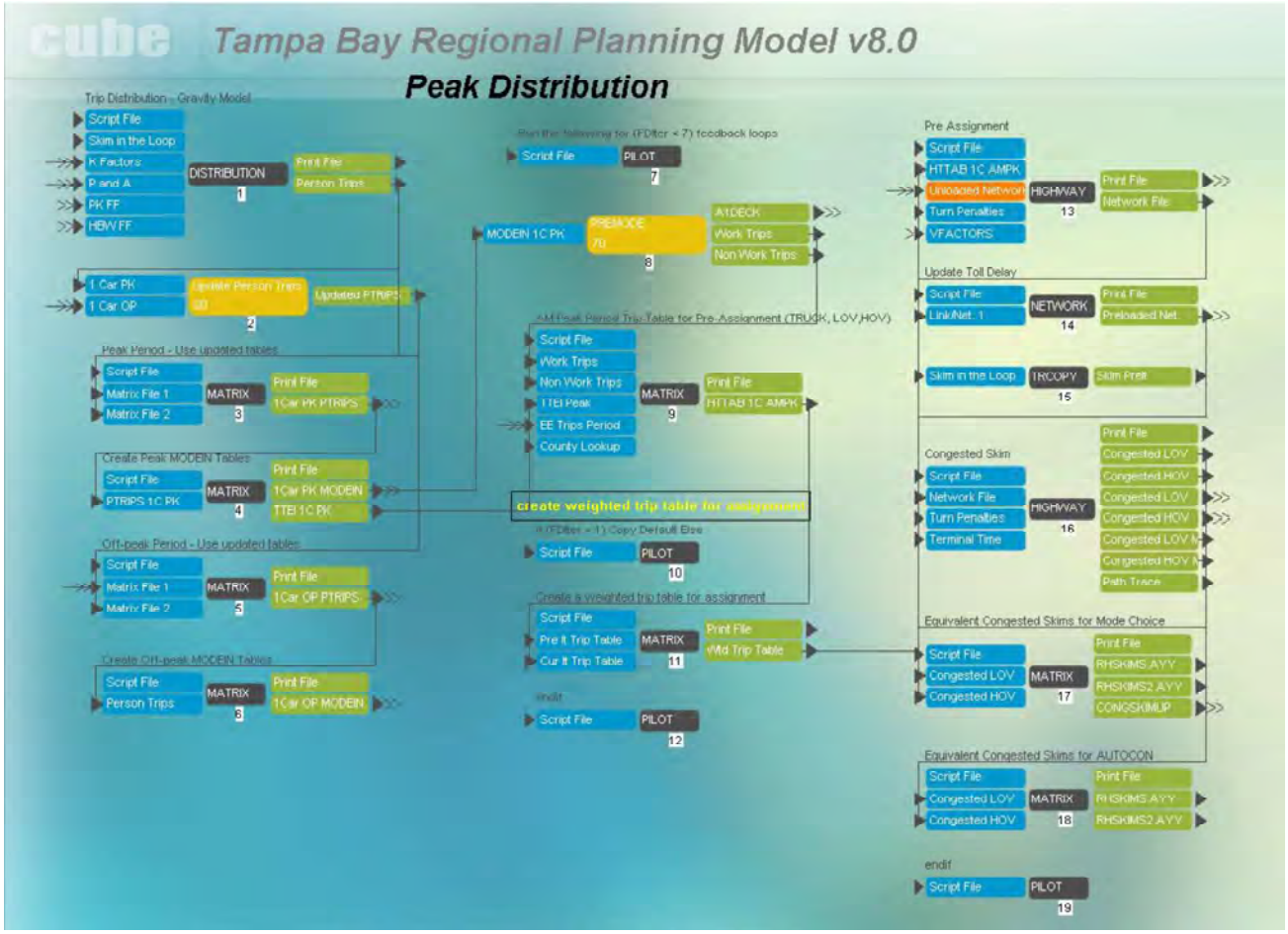


Figure 6.3 Peak Distribution Flowchart

The first step performs the Distribution of the Peak, 1-Plus Car Household trips of ***GEN_PANDA_1_PK.DBF.*** The output trip tables are produced using the Friction Factors file ***FF_PK_U.DBF*** and ***FF_HBW.CSV***. These files have been calibrated using the latest Household surveys for the Tampa Bay area.

Update Person Trips

Based on a series of extra Home Based Work and other data collected for the Tampa Bay area under the previous Alternative Analysis studies for Hillsborough (2009) and Pinellas (2010), a series of updates are performed on the resulting trip tables of the Peak and Off-Peak distribution steps. The data was collected at the zip code level so the adjustments made are effective on several TAZs in a group at a time. **Figure 6.4,** below, shows the Update Person Trips Flowchart.

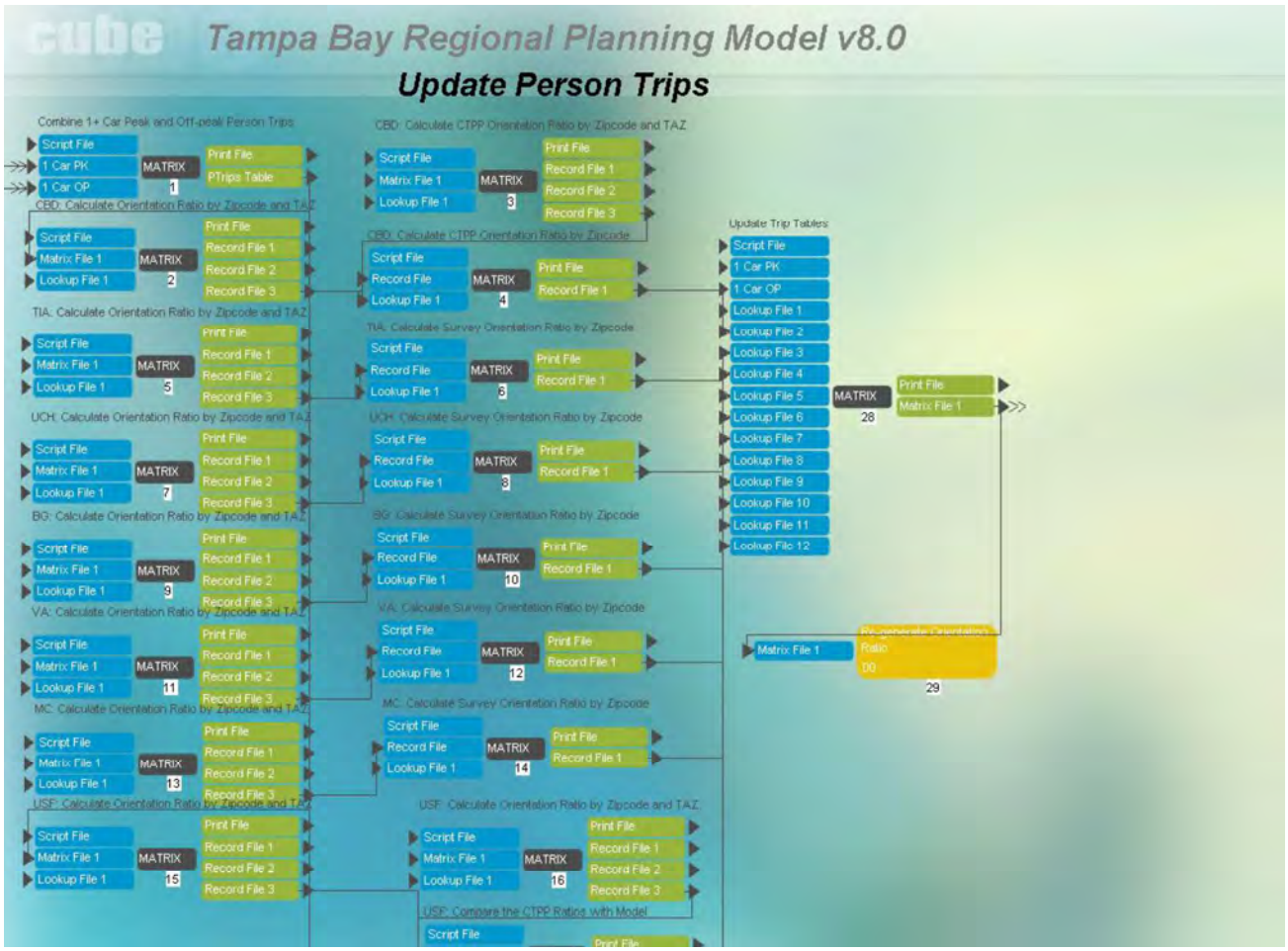


Figure 6.4 Update Person Trips Flowchart

Modein Tables

After the person trip tables are updated, the *MODEIN_1C_PK.TEM* and *MODEIN_1C_OP.TEM* trip tables are prepared for Mode Choice.

PREMODE

If the Peak Distribution loop is within the first 6 loops, a preliminary Mode Choice is performed in the **PREMODE** module. **Figure 6.5**, below, shows the flowchart of the **PREMODE** module.

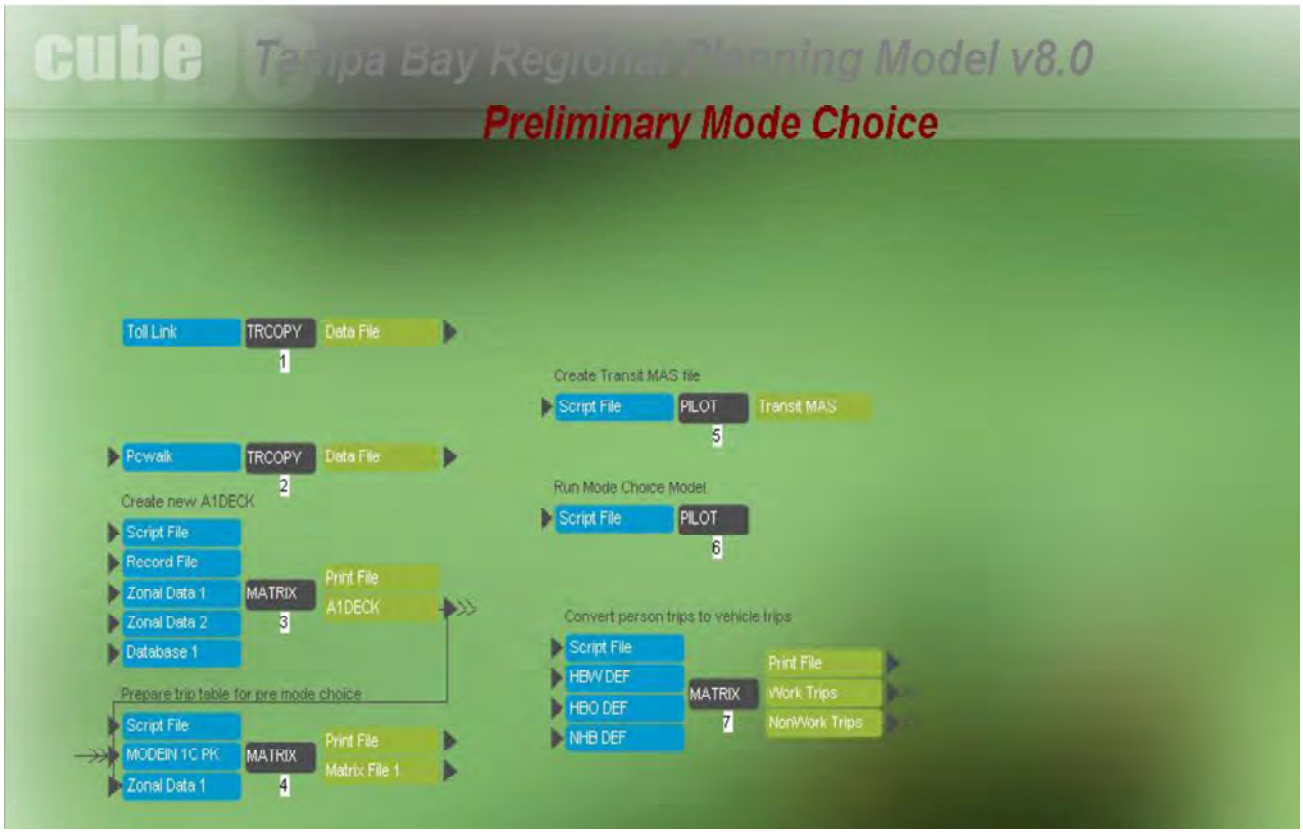


Figure 6.5 PREMODE (Preliminary Mode Choice) Module Flowchart

The **PREMODE** module first creates a new ***A1DECK_AYY.PEN*** based on the ***A1DECK.AYY*** file of the **Trip Generation** module, total productions, ***BALZ.DBF***, and ***ZDATA1.DBF***.

The new ***A1DECK_AYY.PEN*** is used to split the ***MODEIN_1C_PK.TEM*** trips by auto ownership to be used in the preliminary Mode Choice.

The preliminary Mode Choice parameters are setup in the ***Transit.MAS*** parameter file and the preliminary Mode Choice is run.

After the Mode Choice run, the person and vehicle trip tables by purpose are prepared from the Mode Choice results.

Peak Period Trip Table for Pre-Assignment

The final vehicle trip table is prepared and weighted based on the previous loop congested skims. If it is the first loop of the feed-back loops, then the table is not weighted.

Pre-Assignment

The ***PRELOAD_1C_AMPK.NET*** is prepared by running the highway assignment and updating the loaded network with new toll delays based on the loaded volumes. If it is the first loop of the feed-back loop, the assignment is a Free-Flow assignment of the Peak period vehicle trips. All of the following assignment loops are congested by the previous loop distribution and assignment.

Congested Skim

With the pre-assignment complete, a new set of congested skims is prepared and the skims used for distribution is updated to be used when the feed-back loop is re-started. Other equivalent skims to be used for Mode Choice in the later steps of the model are also prepared for the last loop of the feed-back loops. Other files are copied for preserving the outputs of the first six (6) loops or for resetting the files to be used in the next loop.

Trip Length

In the last loop of the Peak Distribution, a final trip table is prepared based on the last pre-assignment skims. Then in the **TRIPLENGTH** module, the generation of Off-Peak and Peak average trip lengths is performed for reporting in the ***DIST.HTML*** web-based system. In the last step of the module graphic charts of the trip length distributions are generated and the final time stamp for the full Distribution process is completed and recorded.

6.4 Model Output

The HNET web-based reports include the following reports:

- ***Off-Peak Highway Skim from {SkimZone} (free flow time + Term Time + Intrazonal)***
- ***Peak Highway Skim from {SkimZone} (free flow time + Term Time + Intrazonal)***
- ***Average Off-Peak Period Trip Lengths by Purpose (Free Flow)***
- ***Average Peak Period Trip Lengths by Purpose (Congested)***
- ***Average Off-Peak Period EE Trip Lengths (Free Flow)***
- ***Average Peak Period EE Trip Lengths (Congested)***
- ***Trip Length Frequency Distribution Figures (Tables Available in Detailed Report)***

Chapter 7 - **Transit Network**

7.1 General Description

The transit network module (Transit Network) builds connectors between TAZs, transit stops and stations while computing the speeds for all transit links that make up the transit route network. Transit connectors, also referred to as non-transit legs, provide the opportunities for trips to access transit service to/from TAZs.

The transit connectors consist of four types; walk, park-and-ride, kiss-and-ride, and sidewalk. The walk, park-and-ride, and kiss-and-ride connectors are also considered as access modes to transit implying that transit trips can reach stops and stations using either one of these modes. Walk is the only egress mode used in the model. Sidewalk connectors facilitate transfers between transit services at transit stations. The transit routes are coded in TRNBUILD format. The Public Transport (PT) module is used for generating walk, Kiss-and-Ride, and sidewalk connectors. The model internally converts the input TRNBUILD network to PT format for generating these connectors. The park-and-ride connectors are generated using the program AUTOCON.

The TBRPM v8.0 has the ability to differentiate between premium and non-premium transit services. The Mode Choice model can be run using two separate methods; "Traditional" and "Choice Set". These methods are explained in more detail under the Mode Choice section. If choice set method is used, the model generates additional connectors to/from stops and stations that are served by premium transit service only.

The transit speed computation in TBRPM v8.0 is considerably different than the previous version of the model. The transit services that operate in mixed traffic utilize highway speeds from the pre-loaded network. To account for stoppage at stops and stations, the model assigns an average dwell time to each stop on the service. For transit services that operate on dedicate right-of-way, travel speeds are required to be "hard coded" and additionally dwell time is assigned to each stop.

7.2 Model Inputs and Outputs

The following section describes the main inputs to and outputs from the Transit Network module.

Table 7.1 Model Inputs and Outputs

Input		Process	Output
PRELOAD_1C_AMPK.NET TransitLink_YYA.dbf MicroCodedStops_YYA.dbf STATDATA_YYA.dbf	UNLOADED_OP_10A.NET	Matrix / Network	HRLDXY_TLINK.NET, UNLOADED_TLINK.NET STATION_YYA.DAT PREMSTAT_YYA.DAT
HRLDXY_TLINK.NET TROUTE_YYA_PT.LIN STATION_YYA.DAT PREMSTAT_YYA.DAT TROUTE_YYA_PT_Prem.LIN	UNLOADED_TLINK.NET	Public Transport	NTLEG1PK_TEM.NTL, NTLEG1OP_TEM.NTL NTLEG5PK_AYY.NTL, NTLEG5OP_AYY.NTL NTLEG6PK_AYY.NTL, NTLEG6OP_AYY.NTL NTLEG3PK_AYY_C1.NTL, NTLEG3OP_AYY_C1.NTL NTLEG7PK_AYY_C1.NTL, NTLEG7OP_AYY_C1.NTL NTLEG1PK_AYY_C2.TEM, NTLEG1OP_AYY_C2.TEM NTLEG3PK_AYY_C2.NTL, NTLEG3OP_AYY_C2.NTL NTLEG7PK_AYY_C2.NTL, NTLEG7OP_AYY_C2.NTL
TROUTE_YYA_PT.LIN STATDATA_YYA.dbf RHSKIMS_AUTOCON.AYY FHSKIMS_AUTOCON.AYY	TROUTE_YYA_PT_Prem.LIN PREMSTAT_YYA.DAT	Autocon	NTLEG2PK_AYY_C1.NTL, NTLEG2PK_AYY_C2.NTL NTLEG2OP_AYY_C1.NTL, NTLEG2OP_AYY_C2.NTL
NTLEG1PK_TEM.NTL NTLEG5PK_AYY.NTL NTLEG6PK_AYY.NTL NTLEG3PK_AYY_C1.NTL NTLEG7PK_AYY_C1.NTL NTLEG1PK_AYY_C2.TEM NTLEG3PK_AYY_C2.NTL NTLEG7PK_AYY_C2.NTL NTLEG2PK_AYY_C1.NTL NTLEG2OP_AYY_C1.NTL	NTLEG1OP_TEM.NTL NTLEG5OP_AYY.NTL NTLEG6OP_AYY.NTL NTLEG3OP_AYY_C1.NTL NTLEG7OP_AYY_C1.NTL NTLEG1OP_AYY_C2.TEM NTLEG3OP_AYY_C2.NTL NTLEG7OP_AYY_C2.NTL NTLEG2PK_AYY_C2.NTL NTLEG2OP_AYY_C2.NTL	Matrix	WALKAM_AYY_C1.NTL, WALKAM_AYY_C2.NTL SIDEWALKAM_AYY.NTL, PNRAM_AYY_C2.NTL PNRAM_AYY_C1.NTL, KNRAM_AYY_C2.NTL KNRAM_AYY_C1.NTL, WALKMD_AYY_C2.NTL WALKMD_AYY_C1.NTL, PNRMD_AYY_C2.NTL SIDEWALKMD_AYY.NTL, KNRMD_AYY_C2.NTL PNRMD_AYY_C1.NTL KNRMD_AYY_C1.NTL
HRLDXY_TLINK.NET TROUTE_YYA_PREM.LIN TROUTE_YYA_NONPREM.LIN	UNLOADED_TLINK.NET	Matrix	TRANSITLINKAM.PRN, TRANSITLINKMD.PRN

INPUTS:

TROUTE_YYA_NonPrem.LIN Information about each non-premium transit route in the alternative. **Table 7.2** describes each attribute in the file.

Table 7.2 TROUTE_YYA_NonPrem.LIN Attributes

Attribute	Description
NAME	Name identifier used in reporting
MODE	Mode number
OWNER	Code corresponding to the agency operating the route
ONEWAY	T (for one-way); F (for two-way)
FREQ[1]	Peak period headway
FREQ[2]	Off-Peak period headway
LONGNAME	Descriptive text about the route
N	Sequence of node numbers defining the route alignment. Positive values indicate stops; negative values indicate non-stops

Table 7.3 shows the operator numbers and the corresponding transit agency for the TBRPM v8.0.

Table 7.3 TBRPM v8.0 Operator Numbers

Operator Number	Agency
10	HART
20	PSTA
30	PCPT
40	TBUS
50	CITRUS
60	TBARTA

Table 7.4 shows the mode numbers and the corresponding transit service for the TBRPM v8.0.

Table 7.4 TBRPM v8.0 Mode Numbers

Mode Number	Description	Premium / Non-Premium
10	HART local buses	Non-Premium
11	HART express bus	Non-Premium
12	HART premium bus / in-street BRT	Premium
13	HART fixed guideway BRT	Premium
14	HART streetcar & AGT	Non-Premium
15	HART light rail	Premium

Mode Number	Description	Premium / Non-Premium
16	HART commuter rail	Premium
17	HART project circulator	Premium
18	HART project mode premium BRT	Premium
19	HART project fixed-guideway mode	Premium
20	PSTA local bus	Non-Premium
21	PSTA express bus	Non-Premium
22	PSTA premium bus / in-street BRT	Premium
23	PSTA fixed guideway BRT	Premium
25	PSTA light rail	Premium
26	PSTA commuter rail	Premium
27	PSTA project circulator	Premium
28	PSTA project mode premium BRT	Premium
29	PSTA project fixed-guideway mode	Premium
30	PCTC local bus	Non-Premium
31	PCTC express bus	Non-Premium
40	TBUS/CITRUS local bus	Non-Premium
41	TBUS/CITRUS express bus	Non-Premium
51	REGL express bus	Non-Premium
55	REGL light rail	Premium
56	REGL commuter rail	Premium
57	REGL project circulator	Premium
58	REGL project mode premium BRT	Premium
59	REGL project mode rail	Premium

The transit routes that correspond to a non-premium mode are required to be included in TROUTE_YYA_NonPrem.LIN file while the routes that correspond to a premium mode are included in the TROUTE_YYA_Prem.LIN file.

TROUTE_YYA_Prem.LIN Information about each premium transit route in the alternative. The format of the file is similar to TROUTE_YYA_NonPrem.LIN described above.

TransitLink_YYA.DBF Contains information on transit only links. Table 7.5 describes each attribute in the file.

Table 7.5 TransitLink_YYA.DBF Attributes

Attribute	Description
A	A node of the link
B	B node of the link
FACL_TYPE	Link facility type; 49 for bus, 59 for walk links, 69 for fixed guideway
AREA_TYPE	Area type of the link
TMODE1	Transit mode number allowed on the link
TMODE2	Transit mode number allowed on the link
TMODE3	Transit mode number allowed on the link
TMODE4	Transit mode number allowed on the link
TMODE5	Transit mode number allowed on the link
TDIST	Link length in miles
TSPEEDAM	Peak period speeds in miles per hour
TSPEEDMD	Off-Peak period speeds in miles per hour
TWOWAY	2 for two-way links, 1 for one-way links
ROUTES	Descriptive text of the link

MicroCodedStops_YYA.DBF Contains information on nodes used by transit service that are not included in the highway network. Table 7.6 describes each attribute in the file.

Table 7.6 MicroCodedStops_YYA.DBF Attributes

Attribute	Description
N	Node Number
X	X coordinate of node
Y	Y coordinate of node
TSNAME	Descriptive text of the node

STATDATA_YYA.DBF Contains information on transit stations. Table 7.6 describes each attribute in the file.

Table 7.7 STATDATA_YYA.DBF Attributes

Attribute	Description
STATNO	Station Number
N	Node Number
TSZONE	TAZ closest to the node
TSRANGE	Maximum driving distance to access the station
TSPARK	Number of parking spaces
TSCOSTAM	Peak period parking cost
TSCOSTMD	Off-peak period parking cost
TSTYPE	1 for PNR and KNR, 4 for KNR only
TSPNRTERM	PNR Terminal time
TSKNRTERM	KNR Terminal time
PREM_STAT	1 for Premium station, 0 otherwise
TSNAME	Descriptive text for the station

ModeDwell.DBF Contains information on transit dwell time by mode. **Table 7.8** describes each attribute in the file.

Table 7.8 ModeDwell.DBF Attributes

Attribute	Description
MODE	Mode Number
PK_DWELL	Peak period dwell time
OP_DWELL	Off-peak period dwell time

OUTPUTS:

HRLDXY_TLINK.NET Highway network file to build the transit network

WALKAM_AYY_C1.NTL Peak (AM) Walk Access Connectors (1) if utilizing "traditional" mode choice; used for the "all travel" market, (2) if utilizing "choice set" mode choice; used for "choice set 1" travel market (riders that will use premium and/or non-premium transit service)

WALKAM_AYY_C2.NTL Peak (AM) Walk Access Connectors for "choice set 2" travel market (riders that will use only premium transit service)

WALKMD_AYY_C1.NTL Off-peak (MD) Walk Access Connectors (1) if utilizing "traditional" mode choice; used for the "all travel" market, (2) if utilizing "choice set"

	mode choice; used for "choice set 1" travel market (riders that will use premium and/or non-premium transit service)
WALKMD_AYY_C2.NTL	Off-Peak (MD) Walk Access Connectors for choice set 2 travel market (riders that will use only premium transit service)
PNRAM_AYY_C1.NTL	Peak (AM) Park-and-Ride Access Connectors (1) if utilizing traditional mode choice; used for the "all travel" market, (2) if utilizing choice set mode choice; used for "choice set 1" travel market (riders that will use premium and/or non-premium transit service)
PNRAM_AYY_C2.NTL	Peak (AM) Park-and-Ride Access Connectors for "choice set 2" travel market (riders that will use only premium transit service)
PNRMD_AYY_C1.NTL	Off-peak (MD) Park-and-Ride Access Connectors (1) if utilizing traditional mode choice; used for the "all travel" market, (2) if utilizing choice set mode choice; used for "choice set 1" travel market (riders that will use premium and/or non-premium transit service)
PNRMD_AYY_C2.NTL	Off-Peak (MD) Park-and-Ride Access Connectors for "choice set 2" travel market (riders that will use only premium transit service)
KNRAM_AYY_C1.NTL	Peak (AM) Kiss-and-Ride Access Connectors (1) if utilizing "traditional" mode choice; used for the "all travel" market, (2) if utilizing "choice set" mode choice; used for "choice set 1" travel market (riders that will use premium and/or non-premium transit service)
KNRAM_AYY_C2.NTL	Peak (AM) Kiss-and-Ride Access Connectors for "choice set 2" travel market (riders that will use only premium transit service)
KNRMD_AYY_C1.NTL	Off-peak (MD) Kiss-and-Ride Access Connectors (1) if utilizing traditional mode choice; used for the "all travel" market, (2) if utilizing "choice set" mode choice; used for "choice set 1" travel market (riders that will use premium and/or non-premium transit service)
KNRMD_AYY_C2.NTL	Off-Peak (MD) Kiss-and-Ride Access Connectors for "choice set 2" travel market (riders that will use only premium transit service)
SIDEWALKAM_AYY.NTL	Peak (AM) Sidewalk Connectors for transferring between transit routes
SIDEWALKMD_AYY.NTL	Off-Peak (MD) Sidewalk Connectors for transferring between transit routes
TRANSITLINKAM.PRN	Peak (AM) transit speeds by link

TRANSITLINKMD.PRN Off-Peak (MD) transit speeds by link

7.3 Model Procedures

Figure 7.1 shows the flowchart of the **Transit Network** module which is described below.

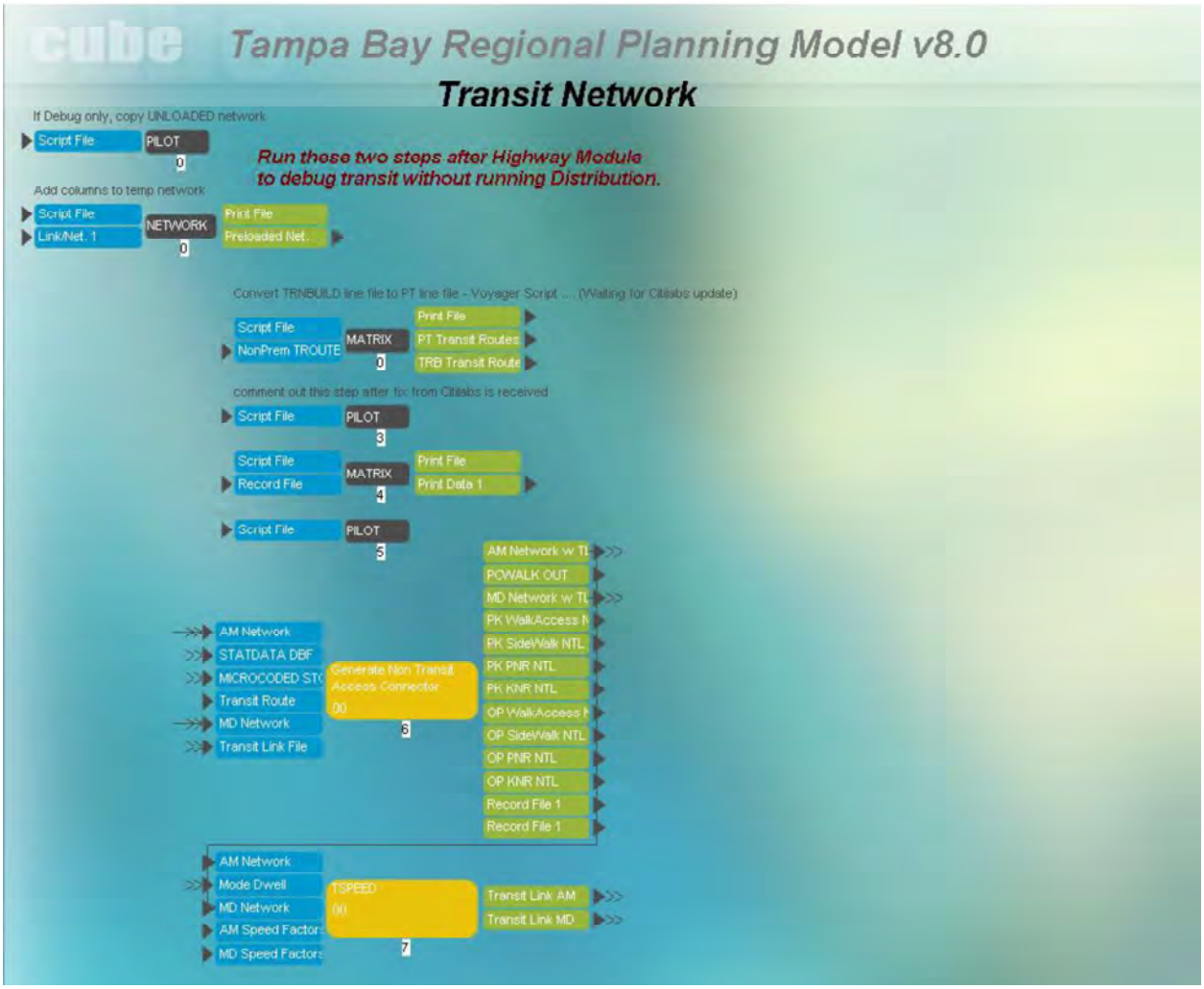


Figure 7.1 Transit Network Flowchart

Convert Transit Routes from TRNBUILD to PT Format

The input transit routes are coded in TRNBUILD format. In order to build Walk, Park-and-Ride, Kiss-and-Ride, and Sidewalk connectors, the model requires the transit routes in Voyager PT format. This conversion occurs at the beginning of **Transit Network** module in steps 1 through 3.

The **Transit Network** module has two sub modules; **Generate Non-Transit Access Connector** (step 4), and **TSPEED** (step 5). **Figure 7.2**, below, shows the **Generate Non-Transit Access Connector** flowchart with a brief description of the module following.

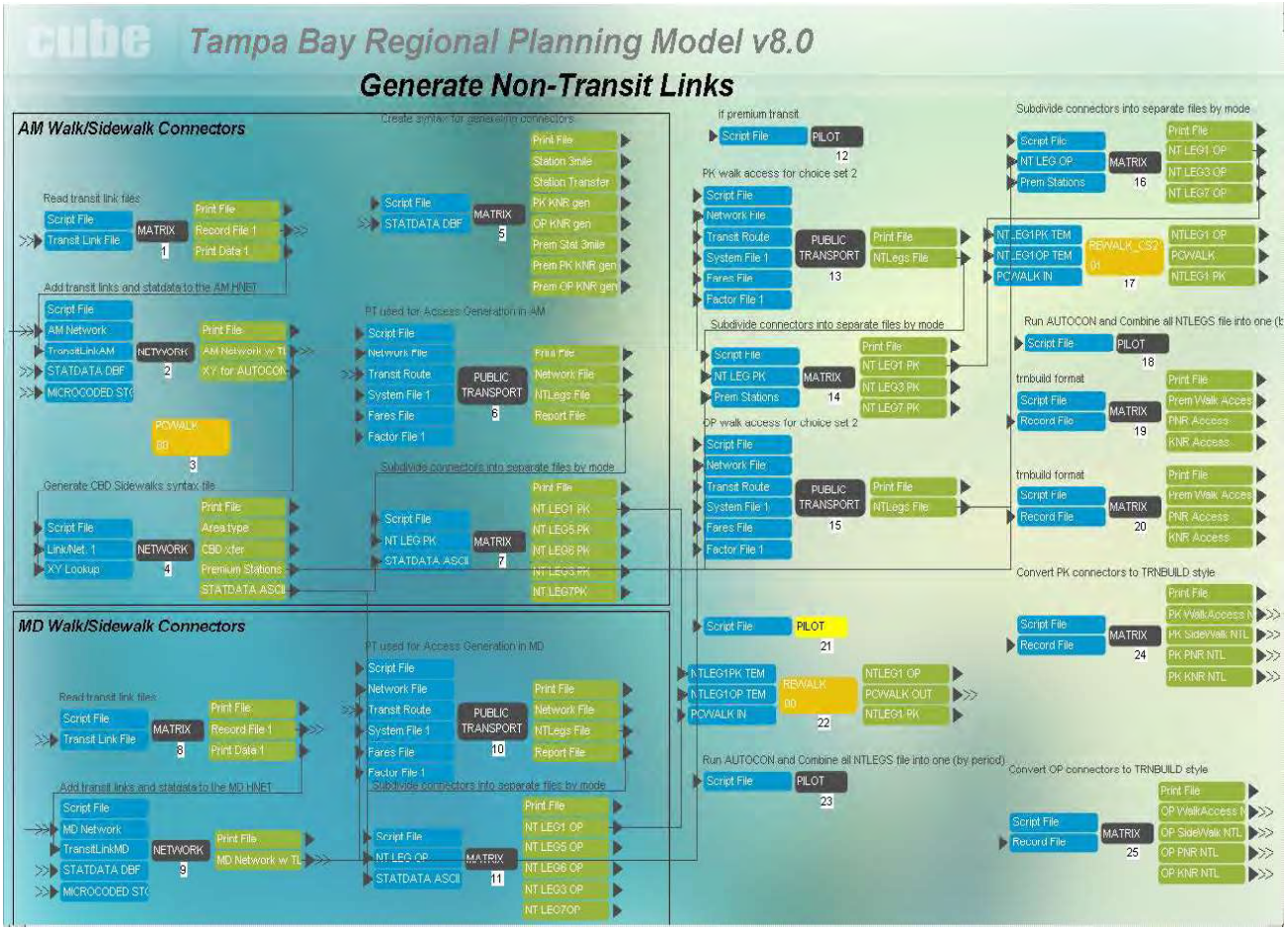


Figure 7.2 Generate Non-Transit Access Connector Flowchart

Generate Peak Period (AM) Network with Highway and Transit Only Links

In steps 1 and 2, the pre-loaded highway network and information from the micro-coded nodes, station data, and transit only link files are added to produce one network. The resulting network includes all highway and transit only links. This network is used for access connector generation and transit speed calculations.

PCWALK

A new process for **PCWALK**, step 3, has been added to the model to automate the capture of changes made in the transit network with respect to transit access coverages. **Figure 7.2**, below, shows the flowchart for the **PCWALK** module. The ***PCWALK*** files are important files to the transit access calculations that go into the Mode Choice process. These files identify the coverage areas of walk

access at both the production and attraction ends of trips in the model. The file ***PCWALK.YYA*** identifies the coverage area of TAZs with walk access to and from non-premium transit modes and the file ***PCWALK_prem.YYA*** does the same for premium transit modes. These files are located in the ***INPUT\TRANSIT*** folder for each scenario and are required inputs that match the transit network for accurate transit ridership forecasts. The process relies on the use of the ArcGIS engine with Python 2.7 scripting language. It is possible to and maybe needed to turn this process off if the model installation is not consistent with the recommended configuration for TBRPM v8.0. If the PCWALK process is turned off, it will be the user's responsibility to update the ***PCWALK*** files accordingly, only if they have substantial changes to the transit network for their scenario test. Otherwise, especially for transit specific alternative tests, the model may not produce the appropriate transit forecasts, e.g. if transit is being introduced into a new area of the model and there are no pre-existing transit coverage areas.

Figure 7.2 PCWALK Flowchart

Generate Peak Period (AM) Walk, Kiss-and-Ride, and Sidewalk connectors

In steps 4 through 7, the Walk, Kiss-and-Ride, and Sidewalk connectors are generated. The walk connectors connect TAZs to transit stops and can be no longer than 1 mile. The walk connectors between TAZs and transit stations can be no longer than 3 miles. The model also generates transfer connectors from station nodes (these are included in the STATDATA file) to other nodes. The maximum length for station-node transfer connectors is 0.5 miles. Transfer connectors are also generated for nodes in the CBD area and can be a maximum of 0.6 miles. The Kiss-and-Ride connectors connect TAZs to stations that are designated as Kiss-and-Rides (TSTYPE 1 or 6 in STATDATA file). The maximum length of Kiss-and-Ride connectors is 8 miles.

The different types of connectors (Walk, Kiss-and-Ride, and Sidewalk) are assigned to separate files in step 7.

Generate Off-Peak Period (MD) Network with Highway and Transit Only Links

Step 8 performs the same functions as step 2 of the Peak period. Instead of using the pre-loaded network, the unloaded network is used as an input and the micro-coded nodes, station data, and transit only link files are added to it.

Generate Off-Peak Period (MD) Walk, Kiss-and-Ride, and Sidewalk connectors

Steps 9 through 11 perform the same functions for the Off-Peak period as steps 4 through 7 for the Peak period.

Generate Peak Period (AM) and Off-Peak Period (MD) Walk, Kiss-and-Ride, Park-and-Ride and Sidewalk connectors for Premium Transit

Steps 12 through 21 are activated only if premium transit exists in the alternative and the catalog key "IsPremiumTransit" is turned on (set equal to 1). Access connectors for premium transit service for both Peak and Off-Peak periods are generated in these steps.

Steps 13 through 16 generate Walk, Kiss-and-Ride, and Sidewalk connectors for premium transit service only in a similar way as steps 4 through 7, and steps 9 through 11.

Step 17 makes adjustments to the ***PCWalk*** file and connectors based on percentage coverage in ***PCWalk*** and whether or not transit stops are near a TAZ. The logic used in this step is borrowed from the ***REWALK*** program from FSUTMS. Step 18 runs the ***AUTOCON*** program to generate Park-and-Ride connectors for premium only stations (where parking is permitted) for both peak and off-peak periods. Steps 19 and 20 convert the access connectors from Voyager PT format to TRNBUILD format.

REWALK for Peak Period (AM) and Off-Peak Period (MD)

Step 22 makes adjustments to the ***PCWalk*** file and connectors from steps 4 through 7, and steps 9 through 11 based on percent coverage in ***PCWalk*** and whether or not transit stops are near a TAZ. This replaces the ***REWALK*** program used in the FSUTMS framework.

Convert Peak Period (AM) and Off-Peak Period (MD) Connectors to TRNBUILD format

The Peak period and Off-Peak period access connectors generated in PT format above are converted to TRNBUILD format in step 24 (Peak period) and step 25 (Off-Peak period).

Figure 7.3, below, is a diagram which shows a sample of the Sidewalk connectors generated for the transit network. The green lines denote the Sidewalk connectors from the transit station at the Park Street Terminal to nearby transit stop nodes.

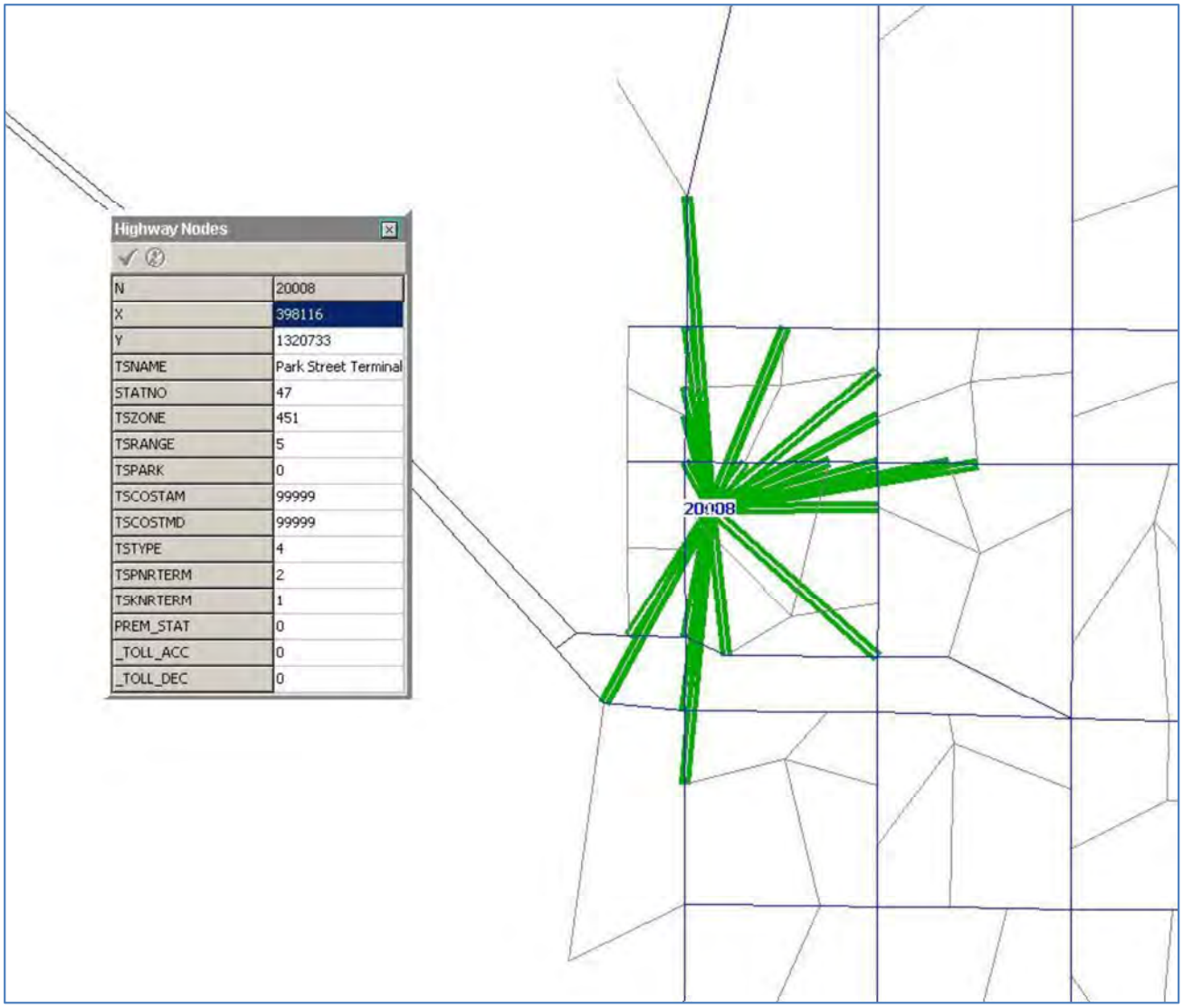


Figure 7.3 Sidewalk Connector Sample Diagram

Figure 7.4 shows a sample of Walk connectors from several TAZs to nearby transit stops.

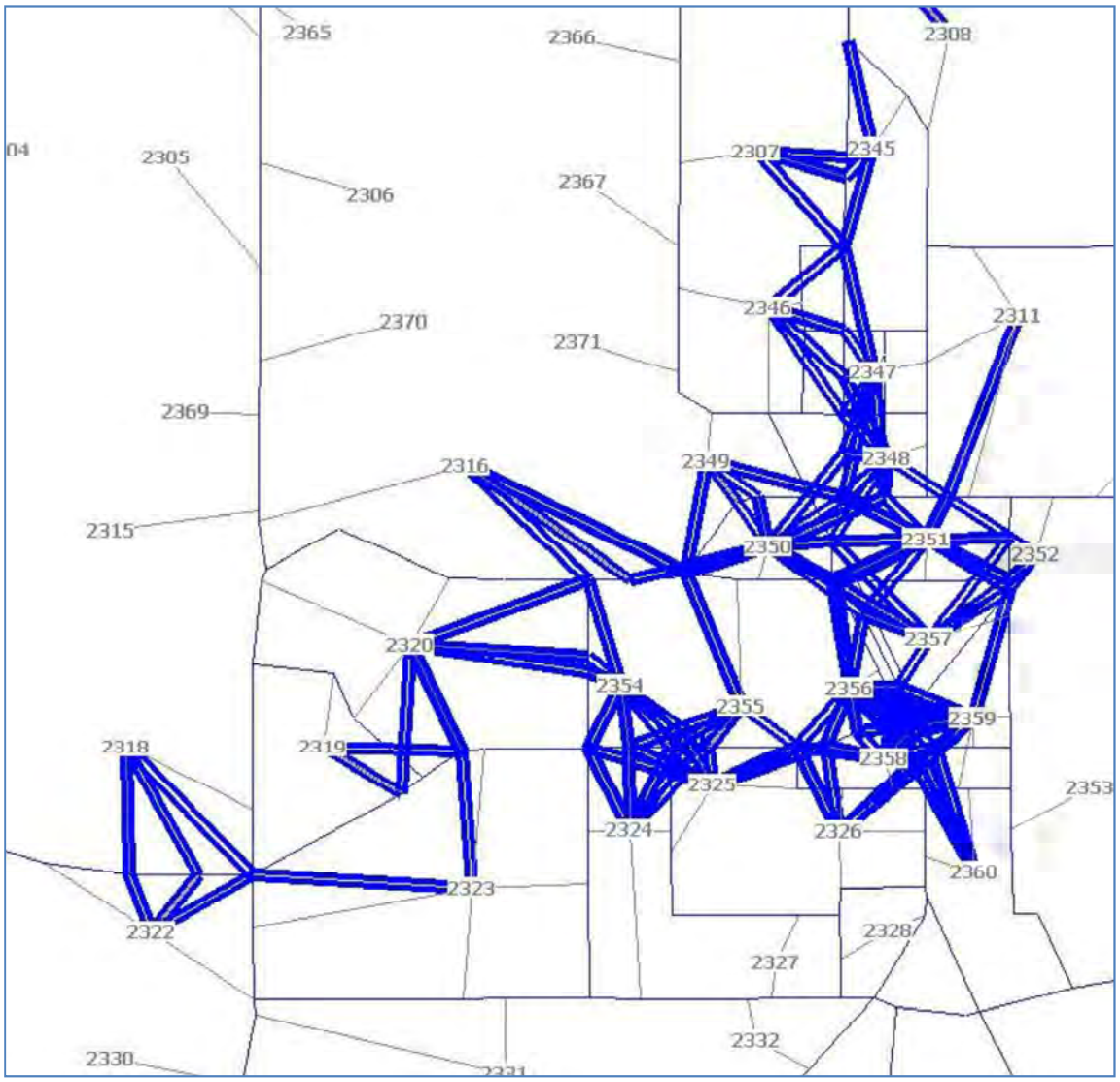


Figure 7.4 Walk Connectors Sample Diagram

Figure 7.5 shows a sample of Kiss-and-Ride connectors to select transit stations.

Figure 7.5 Kiss-and-Ride Connectors Sample Diagram

The **TSPEED** sub-module is the second sub-module in Transit Network Module. A flowchart depicting the **TSPEED** sub-module is shown in **Figure 7.6** and is followed by a brief description of the sub-module.

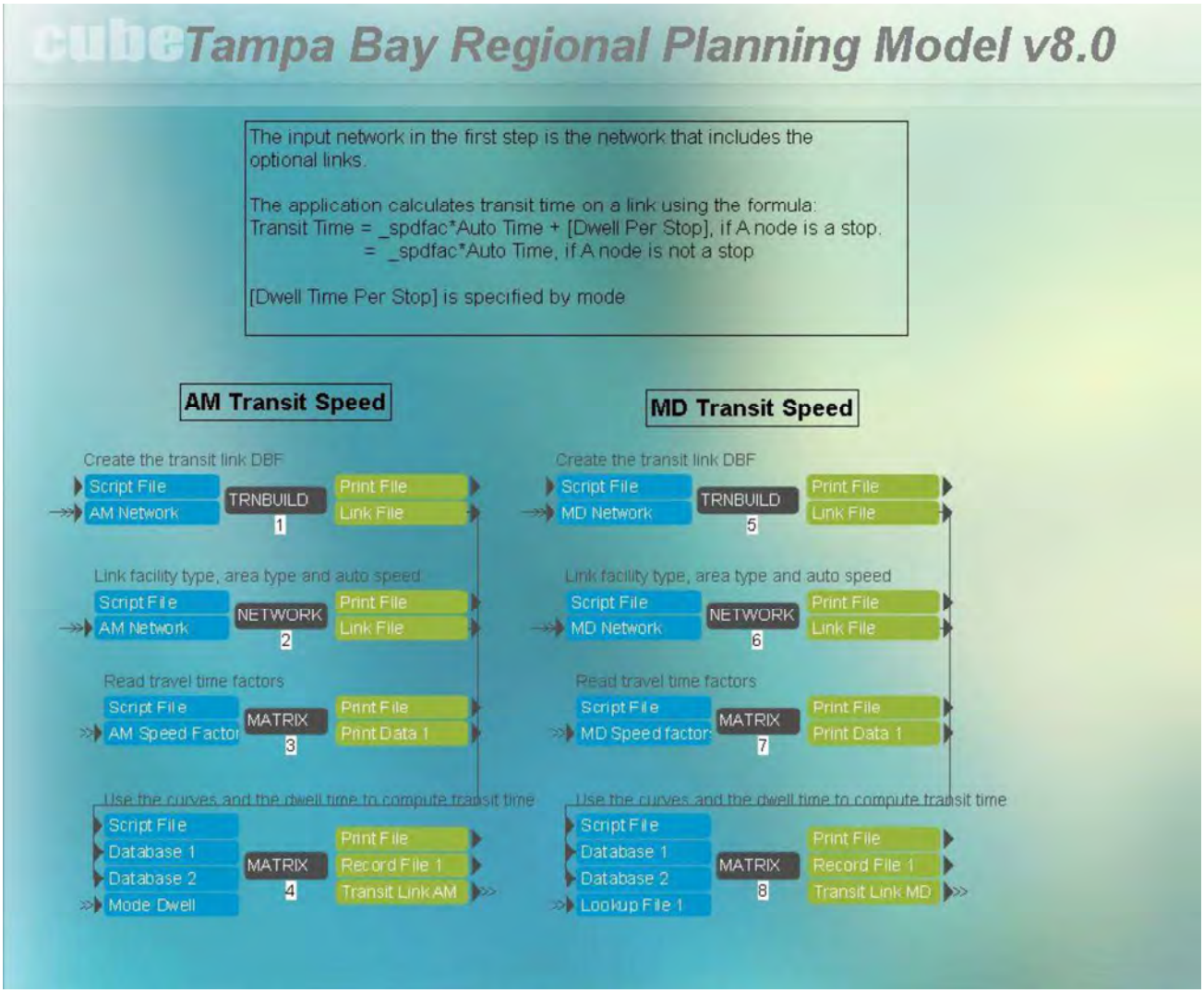


Figure 7.6 TSPEED Stream

Generate Peak Period (AM) Transit and Highway Links Database

Step 1 reads in the highway and transit networks, walk and sidewalk connectors, the transit route files and the fare file and generates a database containing each link in the transit network and access connectors. Step 2 generates a database containing highway speed for each link.

Read Peak Period (AM) Travel Time Factors

Step 3 reads in the travel time factors for transit. Currently all the factors are set to 1.0.

Compute Peak Period (AM) Transit Time

In Step 4, for each transit link in the database created in step 1, speed is looked up from the highway database created in step 2. Dwell time is factored in speed calculation if the origin node of the link is a stop. The output database contains transit speed for each link.

Generate Off-Peak Period (MD) Transit and Highway Links Database

Steps 5 and 6 perform the same functions for the off-peak period as steps 1 and 2 for the peak period.

Read Off-Peak Period (MD) Travel Time Factors

Step 7 performs the same functions for the off-peak period as step 3 for the peak period.

Compute Off-Peak Period (MD) Transit Time

Step 8 performs the same functions for the off-peak period as step 4 for the peak period.

7.4 Mode Outputs

The TNET web-based reports include the following reports:

- ***Peak (AM) Transit Supply Summary***
- ***Off-Peak (MD) Transit Supply Summary***
- ***Peak (AM) Transit Supply by Route***
- ***Off-Peak (MD) Transit Supply by Route***
- ***Peak (AM) Route Description (Route Information available in the Detailed Report)***
- ***Off-Peak (MD) Route Description (Route Information available in the Detailed Report)***

Chapter 8 - **Transit Path**

8.1 General Description

The **Transit Path** (**TPATH**) module uses the transit network attribute files generated by the **Transit Network** module to find the best transit paths between each TAZ pair using the TP+ TRNBUILD engine. This module generates the transit skim files, ***TSKIMAM1(-12).AYY*** and ***TSKIMMD1(-12).AYY***. The transit skims contain information about the access time, in-vehicle travel time, wait time, number of transfers, fare and distance.

The parameters for transit path finding were altered based on the adoption of HART and Pinellas Alternative Analysis (AA) studies' Mode Choice model.

8.2 Model Inputs and Outputs

Table 8.1 Model Inputs and Outputs

Input		Process	Output
HRLDXY_TLINK1.NET WALKAM_AYY_C1.NTL SIDEWALKAM_AYY.NTL PNRAM_AYY_C1.NTL KNRAM_AYY_C1.NTL WALKAM_AYY_C2.NTL PNRAM_AYY_C2.NTL KNRAM_AYY_C2.NTL TRANSITLINKAM.PRN TBRMFARE.YYA TROUTE_YYA.LIN TROUTE_YYA _Prem.LIN	UNLOADED_TLINK1.NET WALKMD_AYY_C1.NTL SIDEWALKMD_AYY.NTL PNRMD_AYY_C1.NTL KNRMD_AYY_C1.NTL WALKMD_AYY_C2.NTL PNRMD_AYY_C2.NTL KNRMD_AYY_C2.NTL TRANSITLINKMD.PRN	TRNBUILD	TSKIMAM1_AYY.mat, TSKIMMD1_AYY.mat TSKIMAM2_AYY.mat, TSKIMMD2_AYY.mat TSKIMAM3_AYY.mat, TSKIMMD3_AYY.mat TSKIMAM3_C2_AYY.mat, TSKIMMD3_C2_AYY.mat TSKIMAM4_AYY.mat, TSKIMMD4_AYY.mat TSKIMAM4_C2_AYY.mat, TSKIMMD4_C2_AYY.mat TSKIMAM5_AYY.mat, TSKIMMD5_AYY.mat TSKIMAM6_AYY.mat, TSKIMMD6_AYY.mat TSKIMAM7_AYY.mat, TSKIMMD7_AYY.mat TSKIMAM8_AYY.mat, TSKIMMD8_AYY.mat TSKIMAM8_C2_AYY.mat, TSKIMMD8_C2_AYY.mat TSKIMAM9_AYY.mat, TSKIMMD9_AYY.mat TSKIMAM10_AYY.mat , TSKIMMD10_AYY.mat TSKIMAM11_AYY.mat, TSKIMMD11_AYY.mat TSKIMAM11_C2_AYY.mat, TSKIMMD11_C2_AYY.mat TSKIMAM12_AYY.mat, TSKIMMD12_AYY.mat TSKIMAM12_C2_AYY.mat, TSKIMMD12_C2_AYY.mat

INPUTS:

TBRMFARE.YYA Fare by transit modes

TRANSITLINKAM.AYY Peak transit links (including transit only links) file in TRNBUILD format

TRANSITLINKMD.AYY Off-Peak transit links (including transit only links) file in TRNBUILD format

WALKAM_AYY_C1.NTL	Peak walk connectors file in TRNBUILD format
WALKAM_AYY_C2.NTL	Premium transit only, Peak Walk connectors file in TRNBUILD format
WALKMD_AYY_C1.NTL	Off-Peak Walk connectors file in TRNBUILD format
WALKMD_AYY_C2.NTL	Premium transit only, Off-Peak Walk connectors file in TRNBUILD format
PNRAM_AYY_C1.NTL	Peak Park-and-Ride connectors file in TRNBUILD format
PNRAM_AYY_C2.NTL	Premium transit only, Peak Park-and-Ride connectors file in TRNBUILD format
KNRMD_AYY_C1.NTL	Off-Peak Kiss-and-Ride connectors file in TRNBUILD format
KNRMD_AYY_C2.NTL	Premium transit only, Off-Peak Kiss-and-Ride connectors file in TRNBUILD format
SIDEWALKAM_AYY.NTL	Peak Sidewalk connectors file in TRNBUILD format
SIDEWALKMD_AYY.NTL	Off-Peak Sidewalk connectors file in TRNBUILD format
TROUTE_YYA.LIN	Transit line record file in TRNBUILD format (includes both premium and non-premium transit service)
TROUTE_YYA_Prem.LIN	Transit line record file in TRNBUILD format (premium transit service only)

OUTPUTS:

TSKIMAM1_AYY.mat	Peak period Walk to Bus skim
TSKIMAM2_AYY.mat	Peak period Walk to New Mode skim
TSKIMAM3_AYY.mat	Peak period Walk to In-Street BRT skim
TSKIMAM3_C2_AYY.mat	Peak period Walk to In-Street BRT skim (using premium only service)
TSKIMAM4_AYY.mat	Peak period Walk to Fixed Guideway skim
TSKIMAM4_C2_AYY.mat	Peak period Walk to Fixed Guideway skim (using premium only service)

TSKIMAM5_AYY.mat	Peak period Park-and-Ride to Bus skim
TSKIMAM6_AYY.mat	Peak period Park-and-Ride to New Mode skim
TSKIMAM7_AYY.mat	Peak period Park-and-Ride to In-Street BRT skim
TSKIMAM7_C2_AYY.mat	Peak period Park-and-Ride to In-Street BRT skim (using premium only service)
TSKIMAM8_AYY.mat	Peak period Park-and-Ride to Fixed Guideway skim
TSKIMAM8_C2_AYY.mat	Peak period Park-and-Ride to Fixed Guideway skim (using premium only service)
TSKIMAM9_AYY.mat	Peak period Kiss-and-Ride to Bus skim
TSKIMAM10_AYY.mat	Peak period Kiss -and-Ride to New Mode skim
TSKIMAM11_AYY.mat	Peak period Kiss -and-Ride to In-Street BRT skim
TSKIMAM11_C2_AYY.mat	Peak period Kiss-and-Ride to In-Street BRT skim (using premium only service)
TSKIMAM12_AYY.mat	Peak period Kiss -and-Ride to Fixed Guideway skim
TSKIMAM12_C2_AYY.mat	Peak period Kiss-and-Ride to Fixed Guideway skim (using premium only service)
TSKIMMD1_AYY.mat	Off-Peak period Walk to Bus skim
TSKIMMD2_AYY.mat	Off-Peak period Walk to New Mode skim
TSKIMMD3_AYY.mat	Off-Peak period Walk to In-Street BRT skim
TSKIMMD3_C2_AYY.mat	Off-Peak period Walk to In-Street BRT skim (using premium only service)
TSKIMMD4_AYY.mat	Off-Peak period Walk to Fixed Guideway skim
TSKIMMD4_C2_AYY.mat	Off-Peak period Walk to Fixed Guideway skim (using premium only service)
TSKIMMD5_AYY.mat	Off-Peak period Park-and-Ride to Bus skim

TSKIMMD6_AYY.mat Off-Peak period Park-and-Ride to New Mode skim

TSKIMMD7_AYY.mat Off-Peak period Park-and-Ride to In-Street BRT skim

TSKIMMD7_C2_AYY.mat Off-Peak period Park-and-Ride to In-Street BRT skim (using premium only service)

TSKIMMD8_AYY.mat Off-Peak period Park-and-Ride to Fixed Guideway skim

TSKIMMD8_C2_AYY.mat Off-Peak period Park-and-Ride to Fixed Guideway skim (using premium only service)

TSKIMMD9_AYY.mat Off-Peak period Kiss-and-Ride to Bus skim

TSKIMMD10_AYY.mat Off-Peak period Kiss -and-Ride to New Mode skim

TSKIMMD11_AYY.mat Off-Peak period Kiss -and-Ride to In-Street BRT skim

TSKIMMD11_C2_AYY.mat Off-Peak period Kiss-and-Ride to In-Street BRT skim (using premium only service)

TSKIMMD12_AYY.mat Off-Peak period Kiss -and-Ride to Fixed Guideway skim

TSKIMMD12_C2_AYY.mat Off-Peak period Kiss-and-Ride to Fixed Guideway skim (using premium only service)

The transit skim matrix contains 21 tables with each table including skim value of certain attribute. Table 8.2 shows the attributes that are included in the skim tables.

Table 8.2 Attributes Included in Transit Skim Matrices

Table Number	Description
1	Walk Access Time
2	PNR Access Time
3	KNR Access Time
4	Sidewalk Time
5	Bus Travel Time
6	Express Bus Travel Time
7	Project Circulator Travel Time
8	In-Street BRT Travel Time

9	Project Mode In-Street BRT Travel Time
10	Fixed Guideway Travel Time
11	Project Mode Fixed Guideway Travel Time
12	Initial Wait Time
13	Transfer Wait Time
14	Number of Transfers
15	Transit Fare
16	Distance on Bus
17	Distance on In-Street BRT
18	Distance on Fixed Guideway
19	Auto Access Distance
20	Distance on All Transit Modes
21	Boarding Node of First Transit Mode Used

8.3 Model Procedure

Figure 8.1, below, shows the **Transit Path** module's flowchart and is described following.

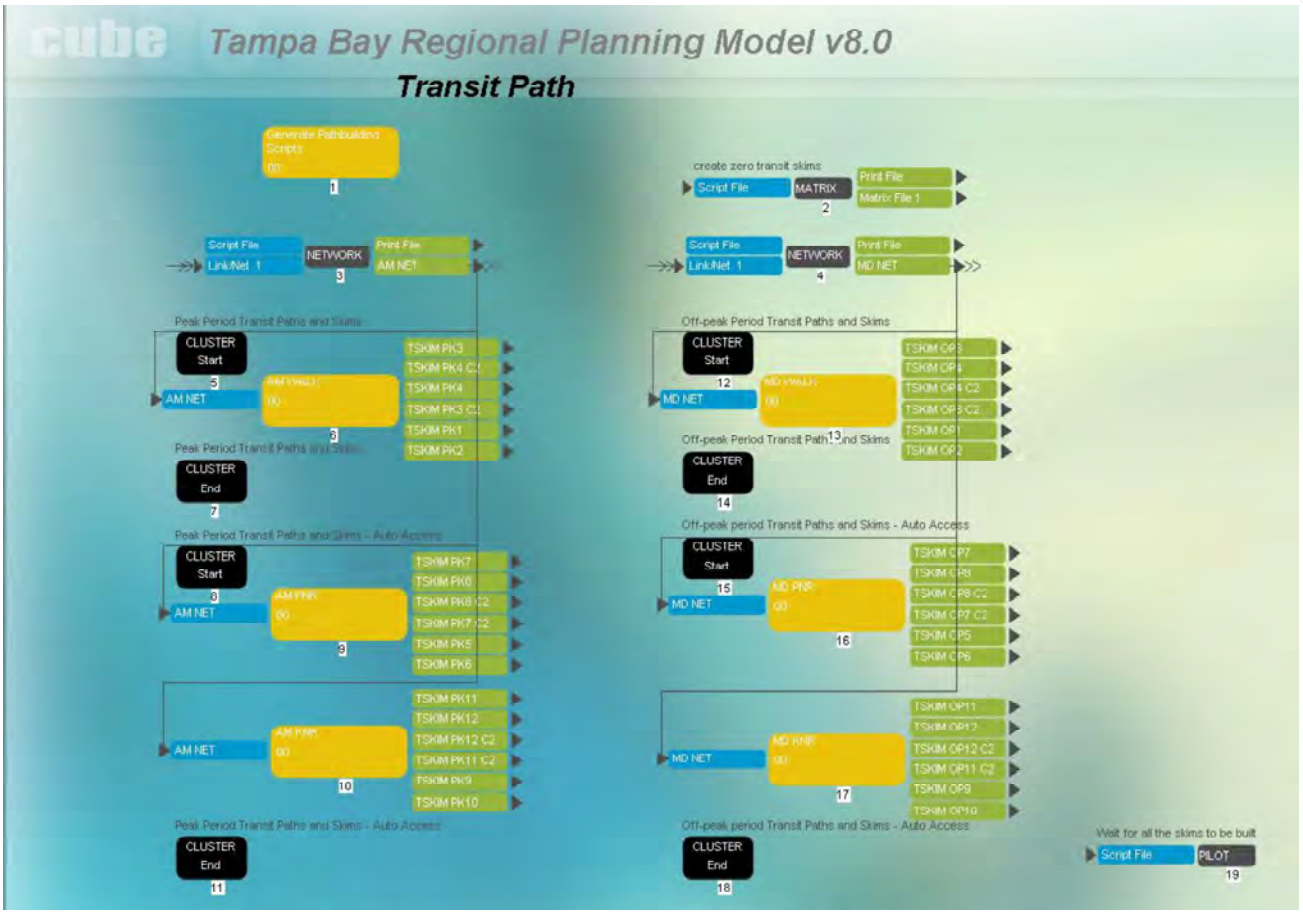


Figure 8.1 Transit Path Module Flowchart

The first step in the **Transit Path** module is the **Generate Path-Building Scripts** module. **Figure 8.2** shows the **Generate Path-Building Scripts** module flowchart.

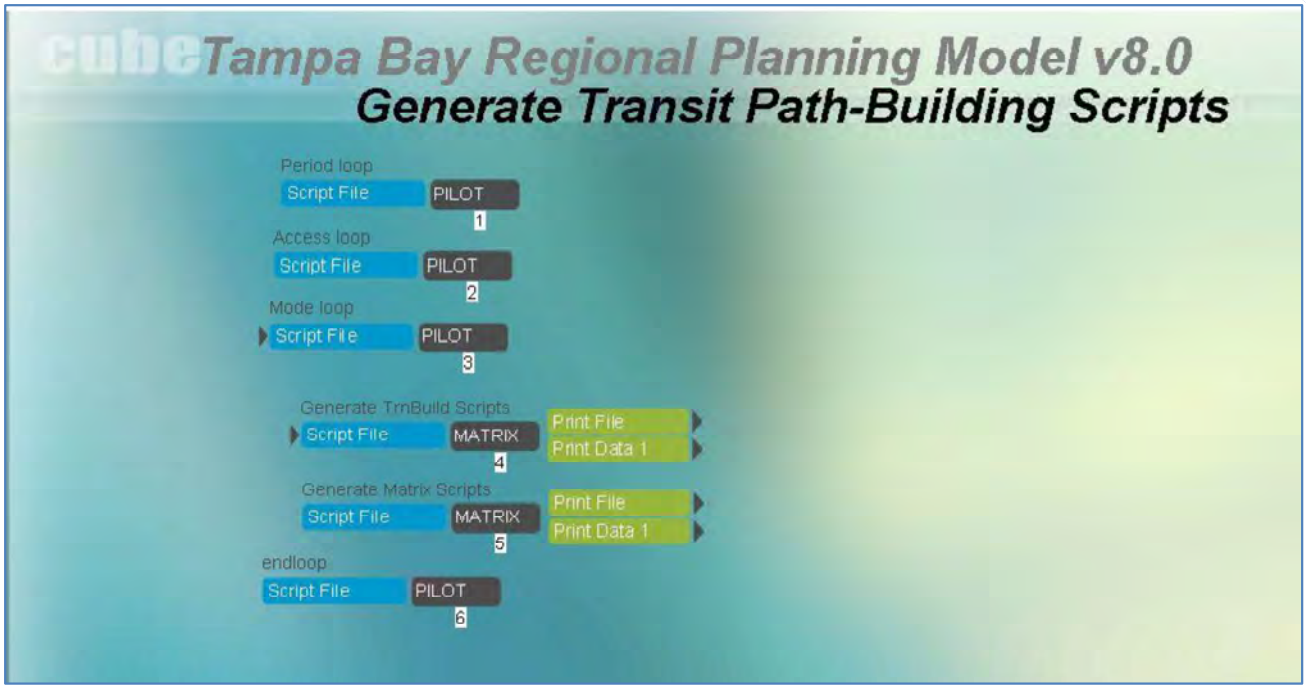


Figure 8.2 Generate Path-Building Transit Scripts Flowchart

Generate Path-Building Scripts

Steps 1, 2, and 3 run loops for time periods (Peak, Off-Peak), access modes (Walk, PNR, KNR), and transit modes (Bus, New Mode, In-street BRT, Fixed Guideway, In-street BRT premium only service, Fixed Guideway premium only service). For each combination of time period, access mode and transit mode, scripts used to produce the appropriate transit skims are generated within step 4. In step 5, scripts are generated to eliminate unreasonable transit paths from the skim files. Step 6 closes the loops for time periods, access modes, and transit modes.

Once the scripts have been generated, control goes back to the **Transit Path** module, above, in **Figure 8.1**.

Create Zero Transit Skims

Step 2 of **Transit Path** module creates a skim matrix with zero values for all origin-destination pairs as an initialization step.

Build Peak (AM) and Off-Peak (MD) networks for TPATH

In steps 3 and 4 networks are generated that contain all the links (highway and transit only links) for peak and off-peak periods respectively. These networks are used as one of the input files in the transit path builder.

Cluster Start and End

Steps 5, 7, 8, 11, 12, 14, 15, and 18 facilitate running transit path building simultaneously across multiple cores.

Step 6 in the **Transit Path** module is the **Peak (AM) Walk** module. **Figure 8.3** shows the **Peak (AM) Walk** module flowchart.

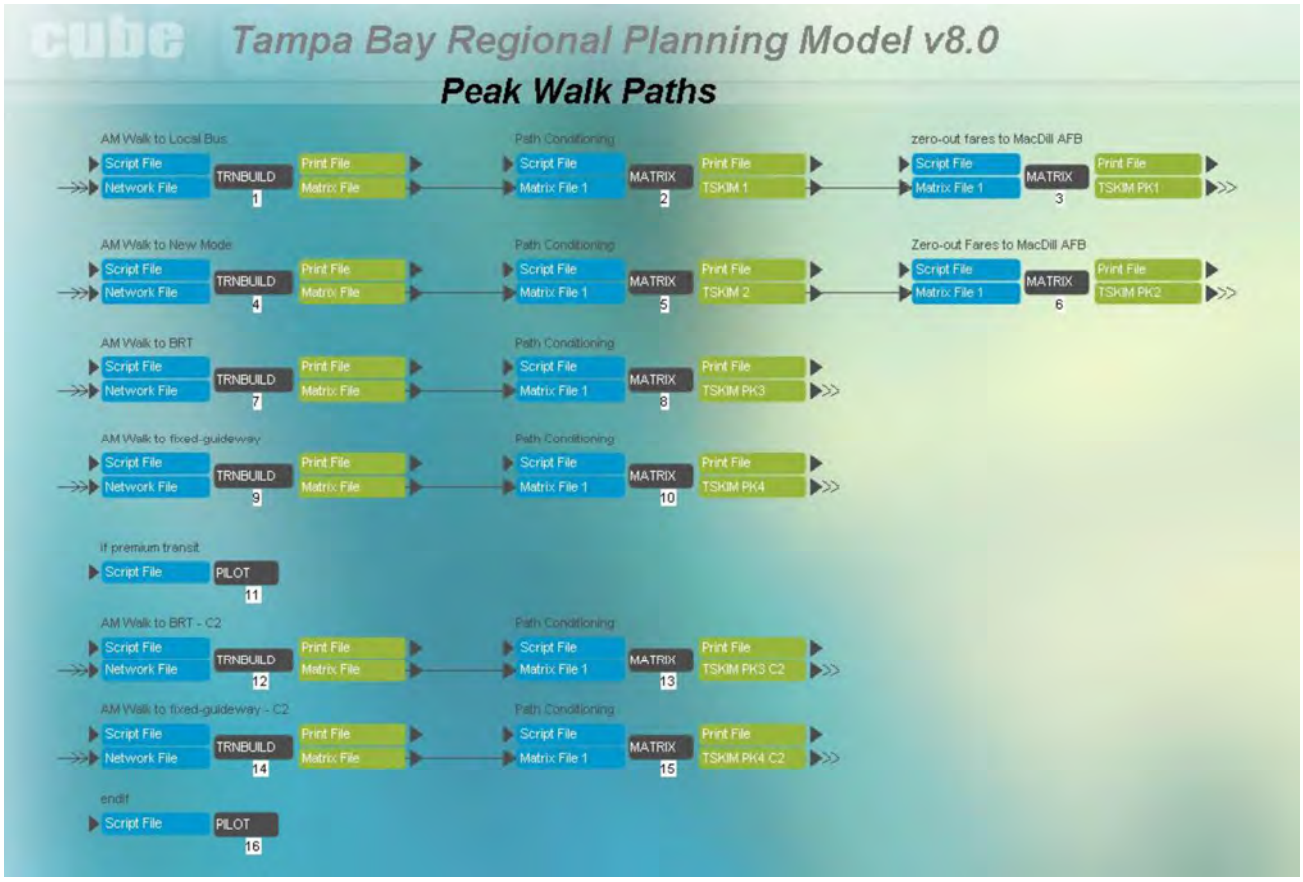


Figure 8.3 Peak (AM) Walk Paths Flowchart

Build Peak (AM) Walk to Bus Skim

Using the scripts produced in the **Generate Path-Building Scripts** module, step 1 builds the transit skims matrix for "Walk to Local Bus" path. The generated paths are no longer than 600 minutes. In Step 2, utilizing the scripts from **Generate Path-Building Scripts** module, removes unreasonable transit paths from step 1. The removed paths include the ones that require making more than 4 transfers.

MacDill Air Force Base has a Transportation Incentive Program in place that provides free monthly express HART passes to commuters who live in the Brandon, Valrico, Riverview and Fishawk areas

east of Tampa. In order to represent this in the model, step 3 sets the transit fare as zero for trips that use express bus service and are destined for MacDill Air Force Base.

Build Peak (AM) Walk to New Mode Skim

Steps 4 through 6 produce the "Walk to New Mode" skims in a similar method as steps 1 through 3 for walk to bus. The MacDill Air Force Base fare incentive program is included in the "Walk to New Mode" path as well since during the development of the 2040 Long Range Transportation Plan (LRTP) a ferry service was being considered (modeled as New Mode) that would provide free service for commuters to MacDill Air Force Base.

Build Peak (AM) Walk to In-Street BRT Skim

Steps 7 and 8 build transit skims and remove unreasonable paths for "In-Street BRT" paths in a similar method utilized by the "Local Bus" and "New Mode" paths.

Build Peak (AM) Walk to Fixed Guideway Skim

Steps 9 and 10 build transit skims and remove unreasonable paths for "Fixed Guideway" paths in a similar method utilized by the "Local Bus" and "New Mode" paths.

Build Peak (AM) Walk to In-Street BRT Skim C2 (Premium Only Service)

Step 12 and 13 are only run if premium service exists in the alternative. Transit skims are built utilizing only "In-Street BRT" service and no local bus or express bus services are included while generating the skims. These skims are utilized for "Choice Set 2" riders in **Mode Choice**.

Build Peak (AM) Walk to Fixed Guideway Skim C2 (Premium Only Service)

Step 14 and 15 are only run if premium service exists in the alternative. Transit skims are built utilizing "Fixed Guideway" and "In-Street BRT" service, no local bus or express bus services are included while generating the skims. These skims are utilized for "Choice Set 2" riders in **Mode Choice**.

The modules **AM PNR** (step 9), **AM KNR** (step 10), **MD Walk** (step 13), **MD PNR** (step 16), and **MD KNR** (step 17) all build transit skims in a similar method as the **Peak (AM) Walk** module described above.

8.4 Model Output

There is no HTML report for **TPATH**. TRNBUILD output files are reported instead such as the one found in **Figure 8.4**, below.

```
TRACE:   665-   Wait    Time Actual Percvd   Dist Total Lines (wt)   I-J= 665-397
M  1    6092     --   21.84  21.84  49.14     91    91
  11    6490   5.00   24.66  51.50  87.05    587   678 HART_025X
  11    5850  12.50   22.94  86.94 133.74    989  1667 HART_027X
   1     397     --    1.92  88.86 138.06      8  1675

B I M M :       2   5.00      1      11 (BOARDS IWAIT MODEI MODET1)
             TIME   DIST  NODE0  NODEL  XWAIT   FARE FAREMAT
MODE   1:   23.76     99    665    397     --     --     --
MODE  11:   47.60   1576   6092   5850  12.50     --     --
FARE    :     --     --    275    275 (MODEFARE MAXMODEFARE XFARE MAXXFARE)


TRACE:   665-   Wait    Time Actual Percvd   Dist Total Lines (wt)   I-J= 665-482
M  1    6092     --   21.84  21.84  49.14     91    91
  11    5165   5.00   61.59  88.43 123.98   2442  2533 HART_025X
   1     482     --    6.72  95.15 139.10     28  2561

B I M M :       1   5.00      1      11 (BOARDS IWAIT MODEI MODET1)
             TIME   DIST  NODE0  NODEL  XWAIT   FARE FAREMAT
MODE   1:   28.56    119    665    482     --     --     --
MODE  11:   61.59   2442   6092   5165     --     --     --
FARE    :     --     --    275    275 (MODEFARE MAXMODEFARE XFARE MAXXFARE)


TRACE:   769-   Wait    Time Actual Percvd   Dist Total Lines (wt)   I-J= 769-286
M  1    5672     --    3.60   3.60   8.10     15    15
  10   20001  20.00   15.12  38.72  70.22    276   291 HART_010B
  11    5549  12.50   21.06  72.28 115.03    780  1071 HART_200X
   1     286     --    6.24  78.52 129.07     26  1097

B I M M :       2  20.00      1      10 (BOARDS IWAIT MODEI MODET1)
             TIME   DIST  NODE0  NODEL  XWAIT   FARE FAREMAT
MODE   1:    9.84     41    769    286     --     --     --
MODE  10:   15.12    276   5672  20001     --     --     --
MODE  11:   21.06    780  20001   5549  12.50     --     --
FARE    :     --     --    260    175 (MODEFARE MAXMODEFARE XFARE MAXXFARE)


TRACE:   769-   Wait    Time Actual Percvd   Dist Total Lines (wt)   I-J= 769-298
M  1    5672     --    3.60   3.60   8.10     15    15
  10    5469  20.00   14.69  38.29  69.79    273   288 HART_010
   1     298     --    2.88  41.17  76.27     12   300
```

Figure 8.4 Transit Path Finding

Chapter 9 - **Mode Choice**

9.1 General Description

The **Mode Choice** module estimates the allocation of zone-to-zone person trips by purpose among the available modes of transportation. For the TBRPM8.0, the **Mode Choice** module serves two purposes; 1) distribution of 0-Car Household person trips, 2) conversion of person trips by purpose into modes of transit service available and highway trips. The nested logit mode choice model uses coefficients that quantify the sensitivity or elasticity of each modal choice variable to service changes. The **Mode Choice** outputs are used as an input into the **Transit Assignment** and the **Highway Assignment** modules.

An earlier version of the TBRPM v8.0 went through an update during the course of the HART and Pinellas AA studies within the last few years. The model now has the ability to model premium transit services using two different methods; "Traditional" and "Choice Set". The "Traditional" mode choice operates in a similar manner as previous versions of the model where all person trips chose from "all" modes of transportation available to them. In the "Choice Set" method, the set of total trips, or the trip market, is divided into two groups; "Choice Set 1" and "Choice Set 2". "Choice Set 1" is like the "Traditional" trip market and includes those travelers who are willing to chose from "all" modes of transportation available to them, while the "Choice Set 2" is made of travelers who chose from highway modes and who may chose only premium transit modes and do not consider non-premium transit modes for travelling.

9.2 Model Inputs and Outputs

Table 9.1 lists the inputs and outputs used for the Mode Choice user program.

Table 9.1 Model Input and Outputs

Input		Process	Output
GEN_PANDA_0_PK.DBF CONGSKIM_MC_AYY.MAT FF_ALL.DBF	GEN_PANDA_0_OP.DBF FREESKIM_MC_AYY.MAT	DISTRIBUTION / MATRIX	MODEIN_0C_PK.TEM, MODEIN_0C_OP.TEM
MODEIN_1C_PK.TEM MODEIN_0C_PK.TEM A1DECK_AYY.PRN	MODEIN_1C_OP.TEM MODEIN_0C_OP.TEM	MATRIX	MODEIN_PK7_C1.MTX, MODEIN_PK7_C2.MTX MODEIN_OP7_C1.MTX, MODEIN_OP7_C2.MTX

Input		Process	Output
MODEIN_PK7_C1.MTX MODEIN_PK7_C2.MTX TSKIMAM[1-12]_AYY.MAT CONGSKIM_MC_AYY.MAT PROFILE.MAS WCFHART_[TRAD/CS].SYN WCFPSTA_[TRAD/CS].SYN WCFPCPT_[TRAD/CS].SYN WCFOTHR_[TRAD/CS].SYN PCWALK_YYA_C1.DAT	MODEIN_OP7_C1.MTX MODEIN_OP7_C2.MTX TSKIMMD[1-12]_AYY.MAT FREESKIM_MC_AYY.MAT PCWALK_YYA_C2.DAT	WCFMODE	HBWPK_C1_AYY.MTX, HBWPK_C1_AYY.MTX HBOPK_C1_AYY.MTX , HBOPK_C1_AYY.MTX NHBPK_C1_AYY.MTX, NHBPK_C1_AYY.MTX HBWPK_C2_AYY.MTX, HBWPK_C2_AYY.MTX HBOPK_C2_AYY.MTX , HBOPK_C2_AYY.MTX NHBPK_C2_AYY.MTX, NHBPK_C2_AYY.MTX
HBWPK_C1_AYY.MTX HBOPK_C1_AYY.MTX NHBPK_C1_AYY.MTX HBWPK_C2_AYY.MTX HBOPK_C2_AYY.MTX NHBPK_C2_AYY.MTX	HBWPK_C1_AYY.MTX HBOPK_C1_AYY.MTX NHBPK_C1_AYY.MTX HBWPK_C2_AYY.MTX HBOPK_C2_AYY.MTX NHBPK_C2_AYY.MTX	MATRIX	TAIN_PK_AYY.MTX, TAIN_OP_AYY.MTX HWYTRIPS_AMPK_AYY.MAT , HWYTRIPS_MDOP_AYY.MAT HWYTRIPS_PMPK_AYY.MAT , HWYTRIPS_EVOP_AYY.MAT

INPUTS:

A1DECK_AYY.PRN Trip productions by TAZ for Home-Based Work (HBW), and Home-Based Other (HBO) purposes by 1-Car and 2-Plus Car Households.

GEN_PANDA_0_PK.DBF Trip production by TAZ for 0-Car Households for Peak period

GEN_PANDA_0_OP.DBF Trip production by TAZ for 0-Car Households for Off-Peak period

CONGSKIM_MC_AYY.MAT Congested highway skims

FREESKIM_MC_AYY.MAT Free-Flow highway skims

ZDATA1_YYA.DBF Zonal Data 1 file includes information about households and population (see Trip Generation)

ZDATA2_YYA.DBF Zonal Data 2 file includes information about employment and school/college enrollment (see Trip Generation)

MODEIN_1C_PK.TEM Peak period person trip table by purpose for 1-Plus Car Households

MODEIN_1C_OP.TEM Off-Peak period person trip table by purpose for 1-Plus Car Households

WCFHART_TRAD.SYN Hillsborough traditional mode choice constants and coefficients

WCFHART_CS.SYN Hillsborough choice set mode choice constants and coefficients

WCFPSTA_TRAD.SYN	Pinellas traditional mode choice constants and coefficients
WCFPSTA_CS.SYN	Pinellas choice set mode choice constants and coefficients
WCFPCPT_TRAD.SYN	Pasco traditional mode choice constants and coefficients
WCFPCPT_CS.SYN	Pasco choice set mode choice constants and coefficients
WCFOTHR_TRAD.SYN	Hernando/Citrus traditional mode choice constants and coefficients
WCFOTHR_CS.SYN	Hernando/Citrus choice set mode choice constants and coefficients
PCWALK_YYA_C1.DAT	Percent walk for all transit routes
PCWALK_YYA_C2.DAT	Percent walk for premium only transit routes

OUTPUTS:

MODEIN_0C_PK.TEM	Peak period person trip table by purpose for 0-Car Households
MODEIN_0C_OP.TEM	Off-Peak period person trip table by purpose for 0-Car Households
MODEIN_PK7_C1.MTX	Peak period person trip table for "Choice Set 1" (input to mode choice program)
MODEIN_PK7_C2.MTX	Peak period person trip table for "Choice Set 2" (input to mode choice program)
MODEIN_OP7_C1.MTX	Off-Peak period person trip table for "Choice Set 1" (input to mode choice program)
MODEIN_OP7_C2.MTX	Off-Peak period person trip table for "Choice Set 2" (input to mode choice program)
HBWPK_C1_AYY.MTX	Peak period Home Based Work (HBW) trips by mode and auto-ownership levels for "Choice Set 1" (output from mode choice program)
HBOPK_C1_AYY.MTX	Peak period Home Based Other (HBO) trips by mode and auto-ownership levels for "Choice Set 1" (output from mode choice program)

NHBPK_C1_AYY.MTX	Peak period Non-Home Based (NHB) trips by mode and auto-ownership levels for "Choice Set 1" (output from mode choice program)
HBWPK_C2_AYY.MTX	Peak period HBW trips by mode and auto-ownership levels for "Choice Set 2" (output from mode choice program)
HBOPK_C2_AYY.MTX	Peak period HBO trips by mode and auto-ownership levels for "Choice Set 2" (output from mode choice program)
NHBPK_C2_AYY.MTX	Peak period NHB trips by mode and auto-ownership levels for "Choice Set 2" (output from mode choice program)
HBWOP_C1_AYY.MTX	Off-Peak period HBW trips by mode and auto-ownership levels for "Choice Set 1" (output from mode choice program)
HBOOP_C1_AYY.MTX	Off-Peak period HBO trips by mode and auto-ownership levels for "Choice Set 1" (output from mode choice program)
NHBOP_C1_AYY.MTX	Off-Peak period NHB trips by mode and auto-ownership levels for "Choice Set 1" (output from mode choice program)
HBWOP_C2_AYY.MTX	Off-Peak period HBW trips by mode and auto-ownership levels for "Choice Set 2" (output from mode choice program)
HBOOP_C2_AYY.MTX	Off-Peak period HBO trips by mode and auto-ownership levels for "Choice Set 2" (output from mode choice program)
NHBOP_C2_AYY.MTX	Off-Peak period NHB trips by mode and auto-ownership levels for "Choice Set 2" (output from mode choice program)
HBWPK_All_AYY.MTX	Peak period HBW trips by mode
HBOPK_All_AYY.MTX	Peak period HBO trips by mode
NHBPK_All_AYY.MTX	Peak period NHB trips by mode
TAIN_PK_AYY.MTX	Peak period transit trips by mode
HBWOP_All_AYY.MTX	Off-Peak period HBW trips by mode
HBOOK_All_AYY.MTX	Off-Peak period HBO trips by mode
NHBOP_All_AYY.MTX	Off-Peak period NHB trips by mode

TAIN_OP_AYY.MTX	Off-Peak period transit trips by mode
AMPK-HBW_AYY.MAT	AM Peak Period HBW vehicle trips
AMPK-HBNW_AYY.MAT	AM Peak Period Home Based Non-Work (HBNW) vehicle trips
AMPK-NHB_AYY.MAT	AM Peak Period NHB vehicle trips
TRK-AMPK_AYY.MAT	AM Peak Period truck, taxi and EI vehicle trips
PMPK-HBW_AYY.MAT	PM Peak Period HBW vehicle trips
PMPK-HBNW_AYY.MAT	PM Peak Period HBNW vehicle trips
PMPK-NHB_AYY.MAT	PM Peak Period NHB vehicle trips
TRK-PMPK_AYY.MAT	PM Peak Period truck, taxi and EI vehicle trips
MDOP-HBW_AYY.MAT	MD Off-Peak Period HBW vehicle trips
MDOP-HBNW_AYY.MAT	MD Off-Peak Period HBNW vehicle trips
MDOP-NHB_AYY.MAT	MD Off-Peak Period NHB vehicle trips
TRK-MDOP_AYY.MAT	MD Off-Peak Period truck, taxi and EI vehicle trips
EVOP-HBW_AYY.MAT	EV Off-Peak Period HBW vehicle trips
EVOP-HBNW_AYY.MAT	EV Off-Peak Period HBNW vehicle trips
EVOP-NHB_AYY.MAT	EV Off-Peak Period NHB vehicle trips
TRK-EVOP_AYY.MAT	EV Off-Peak Period truck, taxi and EI vehicle trips
HWYTRIPS_AMPK_AYY.MAT	AM Peak Period vehicle trips for highway assignment
HWYTRIPS_PMPK_AYY.MAT	PM Peak Period vehicle trips for highway assignment
HWYTRIPS_MDOP_AYY.MAT	MD Off-Peak Period vehicle trips for highway assignment
HWYTRIPS_EVOP_AYY.MAT	EV Off-Peak Period vehicle trips for highway assignment

9.3 Model Procedure

Figure 9.1 and **Figure 9.2** below shows the Mode Choice module flowchart in two parts.

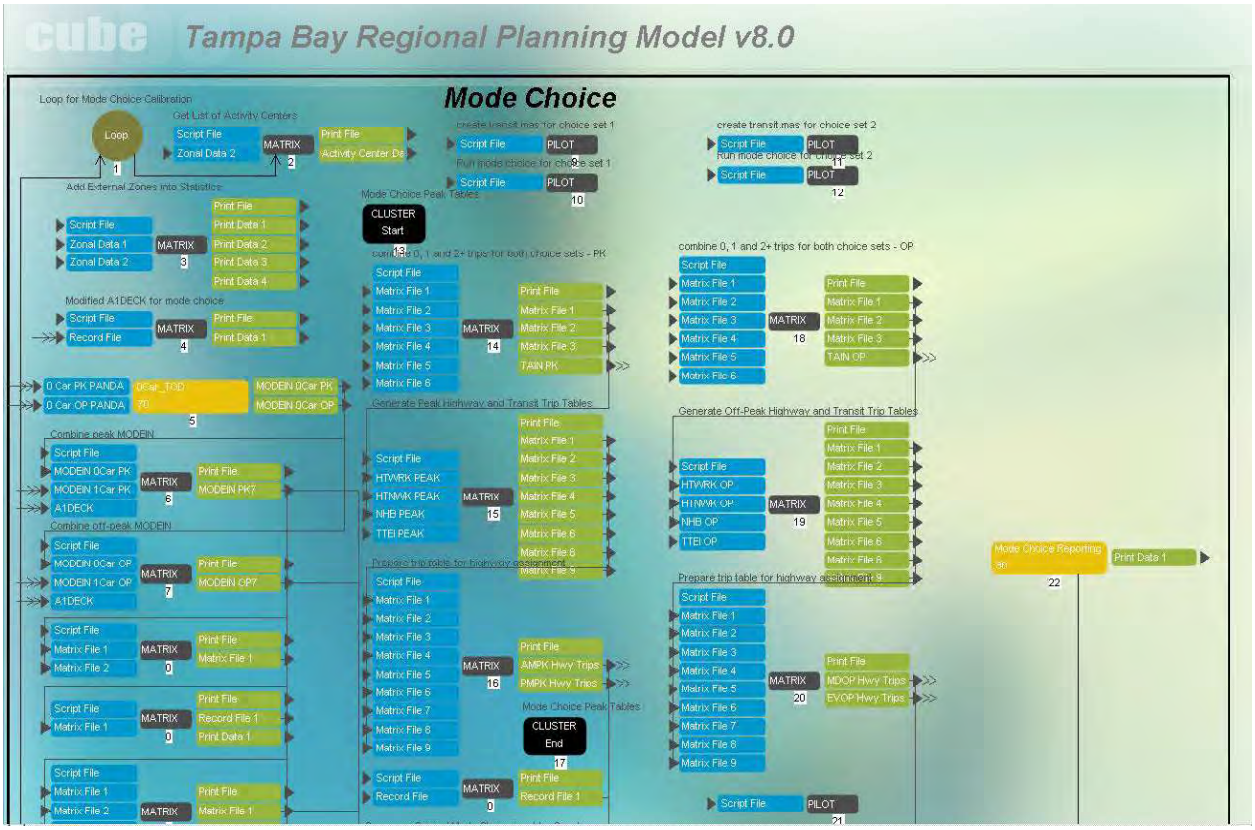


Figure 9.1 Mode Choice Flowchart Part 1

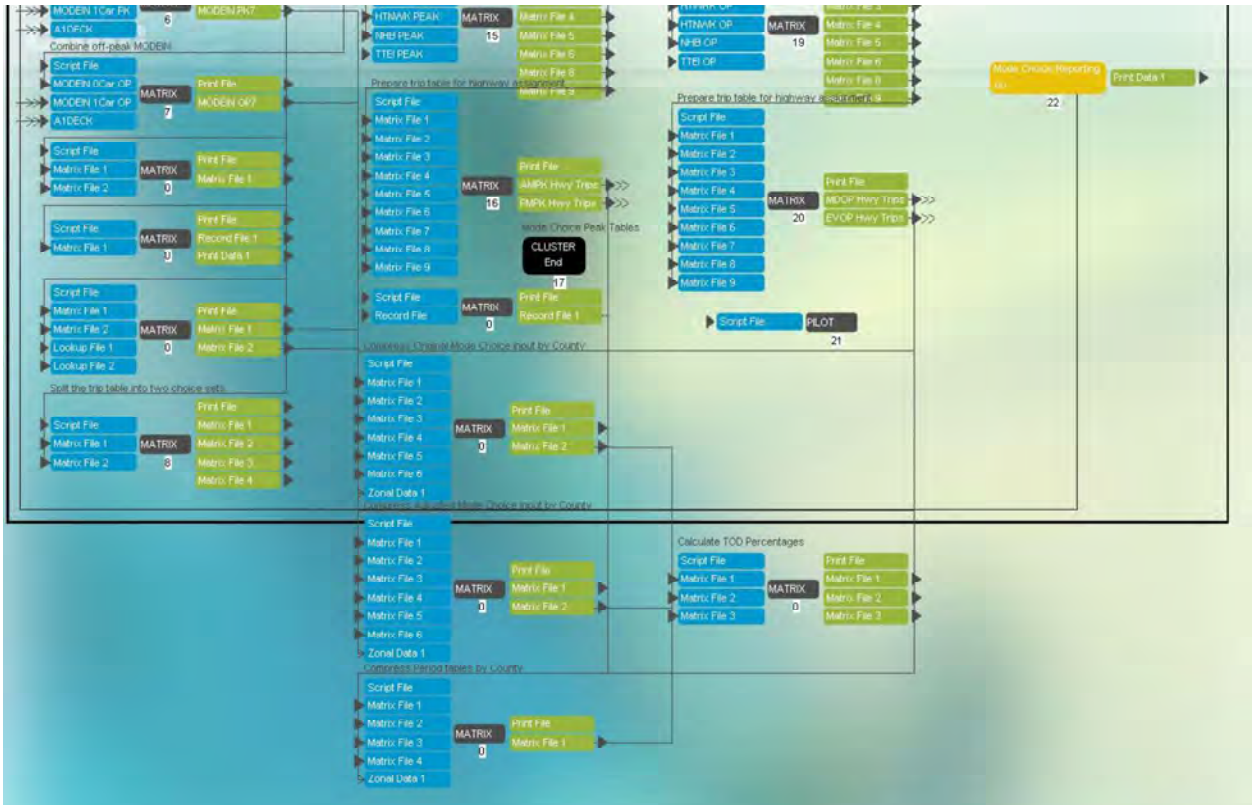


Figure 9.2 Mode Choice Model Flowchart Part 2

Generate List of Activity Centers, County, Urban Service Area, EJ Area

Steps 2 generates list of activity center locations. Step 3 generates files that list the County code, Urban Service Area code, and EJ flag for each TAZ.

Modify A1DECK

Step 4 reads in the ***A1DECK*** file and modifies the activity center codes for TAZs that are designated as USF, Moffitt Center, MacDill Air Force Base, and Tampa Downtown in catalog keys.

Step 5 in the **Mode Choice** module is the **0Car_TOD** module. This module performs 0-Car Household trip distribution. **Figure 9.3** shows the **0Car_TOD** flowchart with its description following.

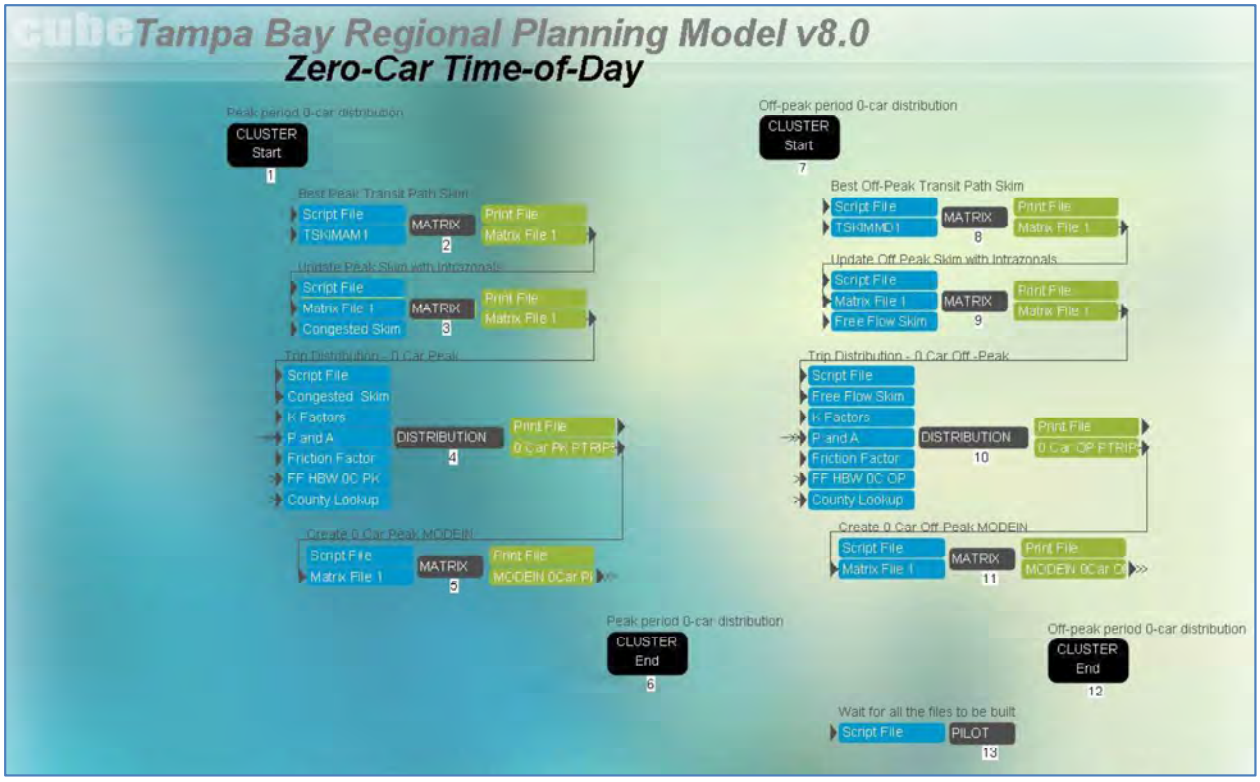


Figure 9.3 0-Car TOD Module Flowchart

Prepare Peak Period Travel Time Skims for Use in Trip Distribution

Steps 2 and 3 provide a provision for using "Walk to Bus" path skims in conjunction with highway skims to produce a final skim for use in trip distribution of 0-Car Household trips. In TBRPM v8.0, only highway skims are currently being used for 0-Car Household trip distribution.

Peak Period 0-Car Trip Distribution

In step 4, the trip distribution for Home Based Work (HBW), Home Based Shopping (HBSH), Home Based Social Recreational (HBSR), Home Based School (HBSC), and Home Based Other (HBO) trips for 0-Car Households are performed. The inputs are production/attractions by purpose, travel time skims, and friction factors. The trip distribution is performed using a gravity model.

Peak Period 0-Car Trip Table for Mode Choice (MODEIN)

The Mode Choice model requires a person trip table for three trip purposes; Home Based Work, Home Based Other (HBO), also labeled Home Based Non-Work (HBNW), and Non-Home Based (NHB). In step 5, the person trip tables out of step 4 are converted into the final format required by the mode choice program. The HBO or HBNW trips (Home Based Shopping (HBSH), Home Based Social

Recreational (HBSR), Home Based School (HBSC), and Home Based Other (HBO)) are combined into one purpose for use in the mode choice model.

Prepare Off-Peak Period Travel Time Skims for Use in Trip Distribution

Steps 8 and 9 perform the same function for the Off-Peak period as steps 2 and 3 do for the Peak period.

Off-Peak Period 0-Car Trip Distribution

Step 10 performs the same function for the Off-Peak period as step 4 does for the Peak period.

Peak Period 0-Car Trip Table for Mode Choice (MODEIN)

Step 11 performs the same function for the Off-Peak period as step 5 does for the Peak period.

Once the 0-Car Household trip distribution is complete control is sent back to the **Mode Choice** module and continues as follows.

Generate Peak Period Trip Table for Use in Mode Choice Program

Step 6 of the **Mode Choice** module reads in the person trip tables for 0-Car and 1-Plus Car Households. The trip tables for 1-Plus Car Households are split into 1-Car Household and 2-Plus Car Households using the factors from A1DECK file. The output is a matrix file for the Peak period that has trip tables for the HBW and HBO trip purposes of Mode Choice by 3 auto ownership levels and one trip table for the NHB trip purpose for Mode Choice.

Generate Off-Peak Period Trip Table for Use in Mode Choice Program

Step 7 performs the same function for the Off-Peak period as step 6 does for the Peak period.

Split Trip Tables into Choice Set

The TBRPM v8.0 Mode Choice can be run using one of either "Traditional" or "Choice Set" methods. If "Traditional" method is used, then step 8 assigns all the trips to "Choice Set 1". If "Choice Set" method is used, step 8 assigns one portion of the trips to "Choice Set 1" and the remaining portion of the trips to "Choice Set 2". The split into the two choice sets is done based on predetermined factors from the Charlotte Rail Study in NC. At the end of this step, there are four trip matrices; Peak period "Choice Set 1" and "Choice Set 2", and Off-Peak period "Choice Set 1" and "Choice Set 2". These matrices form the final input to the Mode Choice model.

Run Mode Choice for Choice Set 1

Step 9 creates the ***TRANSIT.MAS*** file that includes information on the model parameters, location of the constant/coefficient files, location of skim files and trip tables, and location of the output files. The ***TRANSIT.MAS*** is used as an input to the Mode Choice model. Step 10, runs the Mode Choice model for both the Peak and the Off-Peak periods for "Choice Set 1".

Run Mode Choice for Choice Set 2

Step 11 and 12 perform the same function for "Choice Set 2" as steps 9 and 10 do for "Choice Set 1".

Combine Trips Across all Auto Ownership Levels for Peak Period

The trips tables out of the mode choice program are disaggregated by auto ownership levels (0-Car, 1-Car, and 2-Plus Cars), "Choice set 1" and "Choice set 2" (if the mode choice program is run using "Choice Set" method). In Step 14, mode choice outputs are aggregated by auto ownership levels and choice sets to produce trip tables by purpose (HBW, HBO, and NHB) and mode. A separate trip table is produce to report trips for transit only modes aggregated across all purposes and auto ownership levels.

Generate Peak Period Highway Trip Tables

The Peak period person trip tables out of step 14 are now converted into highway vehicle trip tables. In step 15, the Peak period person trips are converted to vehicle trips by applying the auto occupancy factors by trip purpose by highway mode chosen. The Peak period vehicle trips are split into AM-Peak and PM-Peak by applying pre-determined factors by trip purpose by direction. The AM-Peak and PM-Peak trips are converted from Production/Attraction format to Origin/Destination format by applying P-to-A and A-to-P factors. The peak period truck, taxi, and EI trips (that are not processed by the mode choice program) are also split in this step to produce trips for AM-Peak and PM-Peak periods. The outputs of step 15 include vehicle trips matrices by two time periods (AM-Peak and PM-Peak), three trip purposes, and one additional matrix for trucks.

Prepare Peak Period Trip Table for Highway Assignment

In step 16, the separate matrices by purpose from step 15 are combined to produce two matrices one for AM-Peak and other for PM-Peak. These matrices are used in AM and PM highway assignments. Each of these matrices include trip tables by three levels of auto occupancy (drive alone, shared-ride 2, and shared-ride 3+), external-external trips, and truck trips.

Combine Trips Across all Auto Ownership Levels for Off-Peak Period

Step 18 performs the same function for Off-Peak period as step 14 does for Peak period.

Generate Off-Peak Period Highway Trip Tables

Step 19 performs the same function for Off-Peak period as step 15 does for Peak period.

Prepare Off-Peak Period Trip Table for Highway Assignment

Step 20 performs the same function for Off-Peak period as step 16 does for Peak period. The outputs of this step are vehicle trip matrices for use in MD Off-Peak and EV Off-Peak highway assignments.

Mode Choice Reporting

Step 22 performs the reporting functionality for the Mode Choice results and prepares the HTML web-based report page. **Figure 9.4**, below, shows the **Mode Choice Reporting** module flowchart.

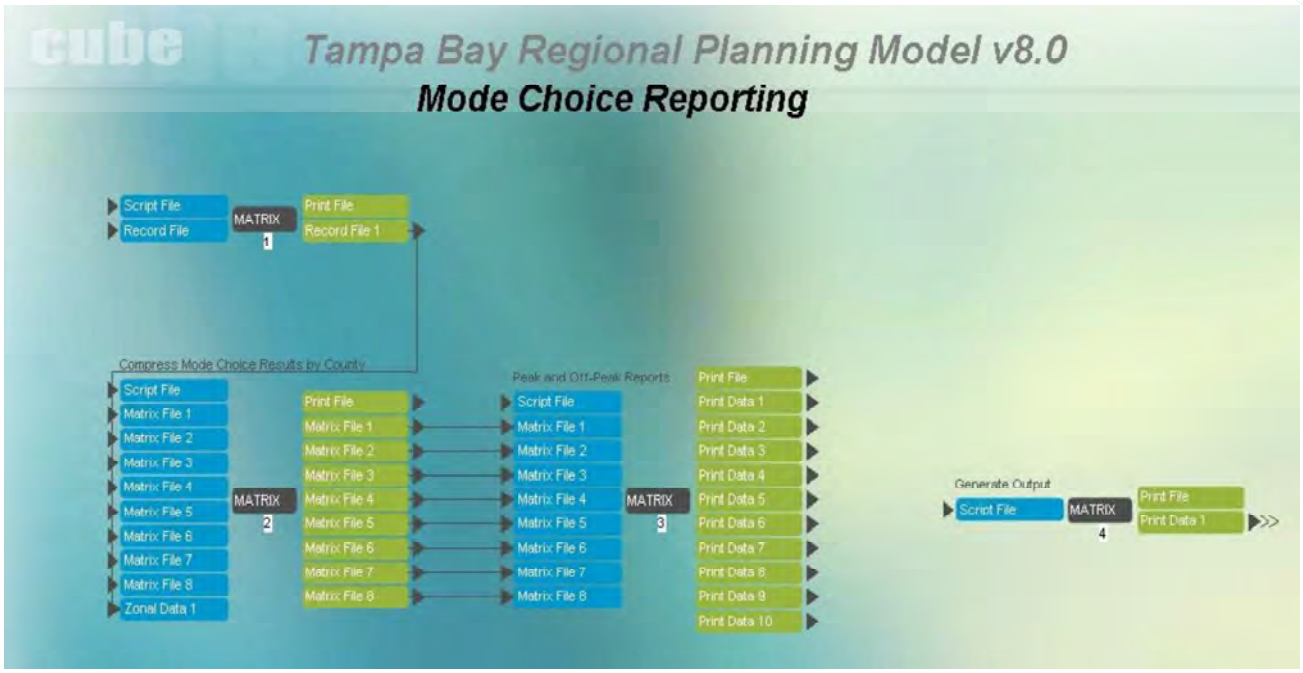


Figure 9.4 Mode Choice Reporting Flowchart

9.4 Model Outputs

The **Mode Choice** module web-based reports include the following reports:

- ***Daily Mode Choice Summary***
- ***Peak Period Mode Choice Summary***
- ***Off-Peak Period Mode Choice Summary***

Chapter 10 - **Transit Assignment**

10.1 General Description

Transit assignment is the process of allocating the transit trips estimated in the **Mode Choice** module to the transit network. These assigned transit trips are identified by transit modes that are used in traveling to a destination. Transit trips are measured by route and represent unlinked trips by mode. Transit trips are assigned independently of highway trips.

A Period transit assignment by trip purpose is used for the TBRPM v8.0. Peak trips for all three trip purposes from Mode Choice are assigned to the Peak period, or AM network. This network contains all the transit service routes and associated characteristics for transit services provided during the Peak commuting periods. The trips by purpose have been calibrated in the Mode Choice / Transit Assignment to reflect the latest Household and On-Board survey information. The rest of the daily trips are assigned to the Off-Peak period, or midday (MD) network. This network describes the average Off-Peak period transit service characteristics typically associated with late morning and early afternoon schedules. Transit unlinked trips are then summarized by the TASSIGN module.

10.2 Model Inputs and Outputs

Table 10.1 shows the transit assignment inputs and outputs.

Table 10.1 Model Inputs and Outputs

Input	Process	Output
HRLDXY_TLink1.NET **UNLOADED_TLink1.NET** **TAIN_PK_AYY.MTX** **TAIN_OP_ AYY.MTX**	**TASSIGN**	**TLINKAM_AYY.DBF, TLINKMD_AYY.DBF** **TLINK_AYY.DBF** **TASREPORT_AYY.PRN, TASUM_AYY.PRN** **TASSIGN.HTM, TNET.HTML**

INPUTS:

HRLDXY_TLink1.NET Network used for Peak period transit assignment

UNLOADED_ TLink1.NET Network used for Off-Peak period transit assignment

TAIN_PK_AYY.MTX Peak period transit assignment trip table

TAIN_OP_ AYY.MTX Off-Peak period transit assignment trip table

OUTPUTS:

TLINKAM_AYY.DBF	Peak period transit assignment results by route and link
TLINKMD_AYY.DBF	Off-Peak period transit assignment results by route and link
TLINK_AYY.DBF	Daily transit assignment results by route and link
TASREPORT_AYY.PRN	Daily Transit assignment report by route and link in text file format
TASUM_AYY.PRN	Daily Transit assignment report by operator in text file format
TASSIGN.HTM	Transit assignment reports in HTML file format
TNET.HTML	Transit Service Summary report in HTML file format

10.3 Model Procedure

Figure 10.1, below, shows the processes of the Transit Assignment module as described below.

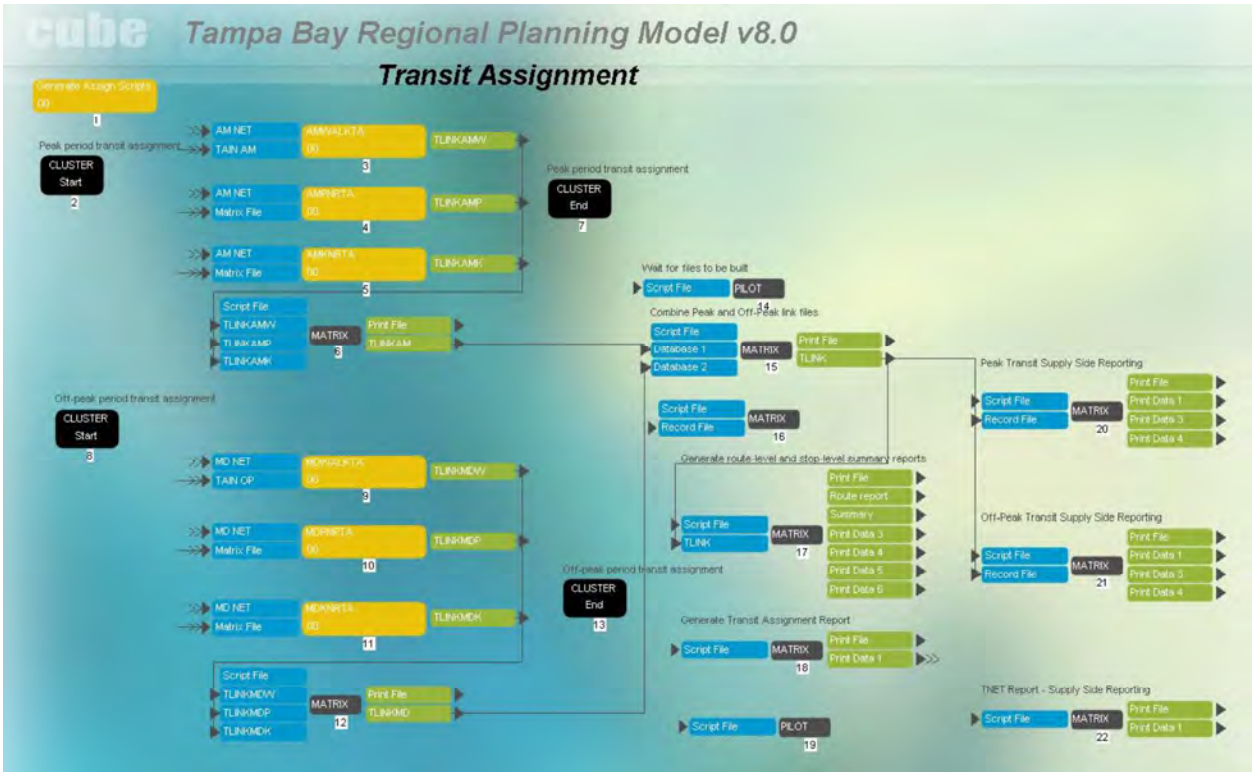


Figure 10.1 Transit Assignment Flowchart

Generate Assign Scripts

The first step of the **Transit Assignment** module is to generate the transit assignment scripts that will be read and used to perform the assignment processes. **Figure 10.2**, below, shows the **Generate Transit Assignment Scripts** module flowchart. Three loops on Period, Access, and Mode are used setup the parameters needed for each of the assignment scripts using combinations of the three loops; Period – Peak and Off-Peak, Access – Walk, Park-and-Ride, and Kiss-and-Ride, Mode – Bus, New Mode, Premium Bus, Fixed Guideway, Premium Bus C2, and Fixed Guideway C2. Step 4, Matrix, holds the various parameters of each assignment process in one simple location for script adjustments.

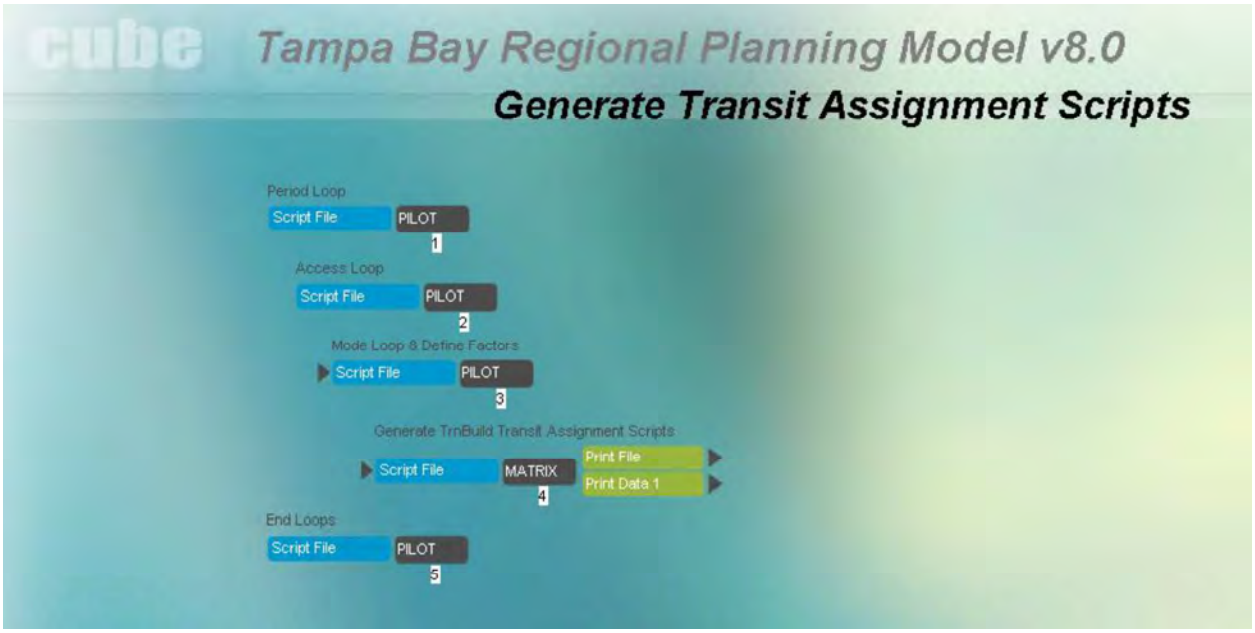


Figure 10.2 Generate Transit Assignment Scripts Flowchart

The transit assignment scripts generated are then executed within the next modules found in the Transit Assignment module show above in **Figure 10.1**.

Peak Period Transit Assignment

Perform Peak period transit assignment, following the same transit paths in TPATH. There are up to 18 paths/assignments (3 transit access modes by 6 mode paths) in the Peak period, if there is premium transit flagged in the transit network. The modules **AMWALKTA**, **AMPNRTA**, and **AMKNRTA** are executed in order representing the three access modes; Walk, Park-and-Ride, and Kiss-and-Ride. **Figure 10.3**, below, shows the **AMWALKTA** module flowchart which is processing the Peak (AM) Walk access transit assignments for the 6 mode paths described above.

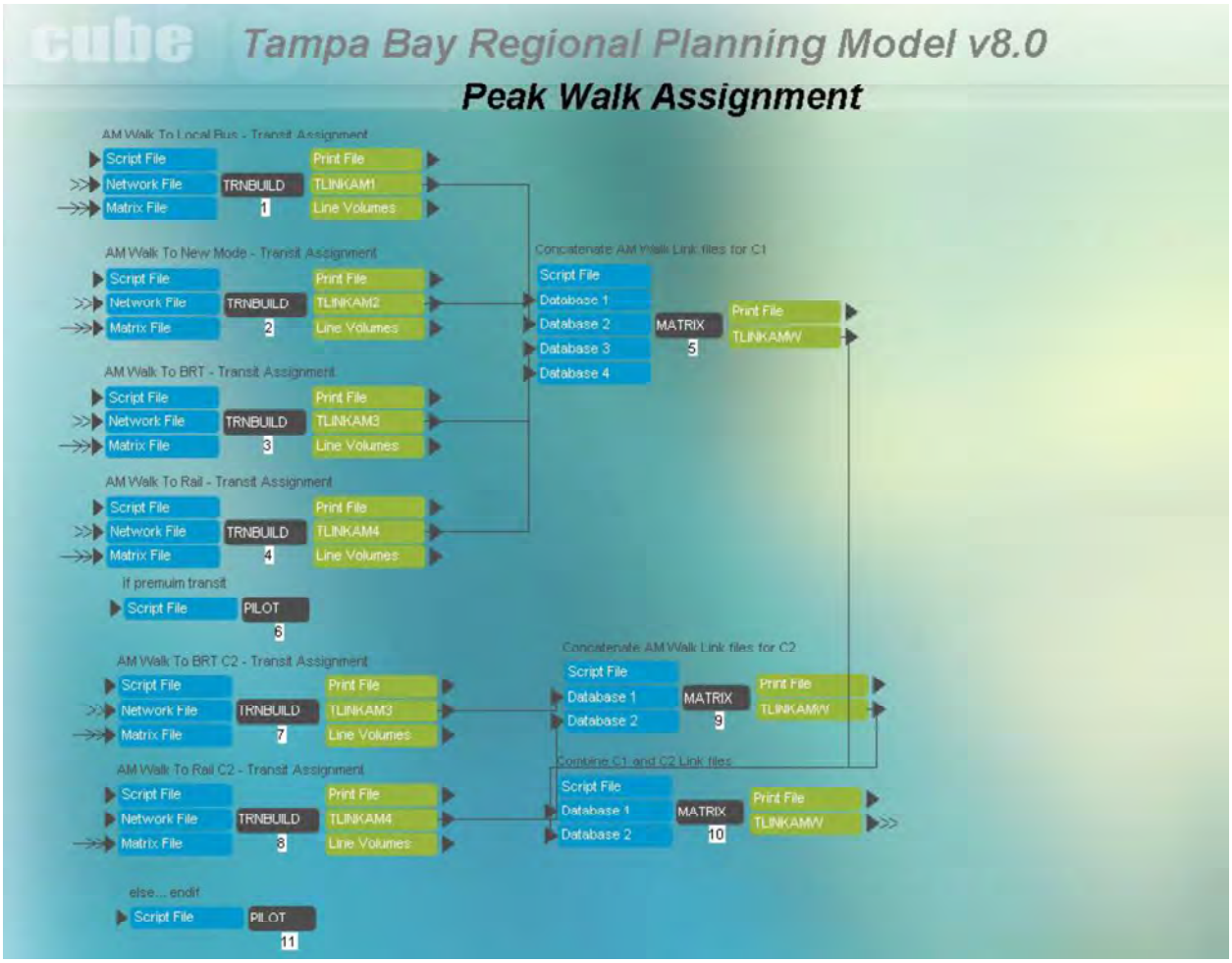


Figure 10.3 Peak (AM) Walk Transit Assignment Module Flowchart

After the assignments by mode path, the results are summed into a single results file, e.g. TLINKAMW.DBF, to be summed with the other access modes and eventually the total period assignment.

Off-Peak Period Transit Assignment

Perform Off-Peak period transit assignment, following the same transit path in TPATH. There are up to 18 paths/assignments in the Off-Peak period, if there is premium transit flagged in the transit network. The modules **MDWALKTA**, **MDPNRTA**, and **MDKNRTA** are executed in much the same way as the modules for Peak transit assignment representing the same three access modes; Walk, Park-and-Ride, and Kiss-and-Ride.

Once both period transit assignments are complete, the results are summed to a daily level and the generation of the TASSIGN and TNET standard output reports is completed.

In the end, a time stamp is recorded for determining the total runtime of the **Transit Assignment** module.

10.4 Model Outputs

The TASSIGN web-based reports include the following reports:

- ***Transit Summary by Mode***
- ***Transit Summary by Operator***
- ***Transit Route Summary***
- ***Transit Route Loadings***

Chapter 11 - **Highway Assignment**

11.1 General Description

The **Highway Assignment** (**HAASIGN_TOD**) module simulates the daily volume of vehicle trips for all trip purposes on each highway network link. A summary report similar to the TranPlan HEVAL report was developed for validation purposes. The biggest differences for the TBRPM v8.0 is that four (4) different TOD assignments are processed for the four (4) highway trip tables that are prepared in the **Mode Choice** module. A loop is used to cycle through each of the four (4) assignments with a fifth loop that sums the previous four assignment results into a single daily volume for each link. This means that there is 5 times the information, or more, on the loaded network than the previous daily assignment models.

The **Highway Assignment** (**HAASIGN_TOD**) module uses the trip table files, ***HWYTRIPS_AMPK_AYY.MAT***, ***HWYTRIPS_PMPK_AYY.MAT***, ***HWYTRIPS_MDOP_AYY.MAT***, and ***HWYTRIPS_EVOP_AYY.MAT***, generated in the **Mode Choice** module as input. In addition to the trip tables, the assignment model requires the transportation network attribute files, ***UNLOADED_PK_AYY.NET*** and ***UNLOADED_OP_AYY.NET***, which are generated by the **Highway Network** module. The **Highway Assignment** (**HAASIGN_TOD**) module uses highway network attributes, such as distance, speed, and capacity, in assigning the vehicle trips to the highway network using an equilibrium assignment procedure. A detailed description of the traffic assignment model is presented in a later section.

11.2 Model Inputs and Outputs

Table 11.1 Model Inputs and Outputs**Table 11.1**, below, lists the inputs and outputs of the **HAASIGN_TOD** module.

Table 11.1 Model Inputs and Outputs

Input	Process	Output
HWYTRIPS_AMPK_AYY.MAT HWYTRIPS_PMPK_AYY.MAT HWYTRIPS_MDOP_AYY.MAT HWYTRIPS_EVOP_AYY.MAT UNLOADED_PK_AYY.NET UNLOADED_OP_AYY.NET TURN_PK_YYA.PEN TURN_OP_YYA.PEN VFACTORS_TOD.DBF Final_2010_TOD_Factors.DBF	**HAASIGN_TOD**	HWYLOAD_AMPK_AYY.NET, HWYLOAD_PMPK_AYY.NET HWYLOAD_MDOP_AYY.NET, HWYLOAD_EVOP_AYY.NET HWYLOAD_DAILY_AYY.NET HASSIGN_AMPK.HTML, HASSIGN_PMPK.HTML HASSIGN_MDOP.HTML, HASSIGN_EVOP.HTML HASSIGN_DAILY_.HTML HASSIGN_Val_AMPK.HTML, HASSIGN_Val_PMPK.HTML HASSIGN_Val_MDOP.HTML, HASSIGN_Val_EVOP.HTML HASSIGN_Val_DAILY_.HTML

INPUTS:

HWYTRIPS_AMPK_AYY.MAT AM Peak Period vehicle trips for highway assignment

HWYTRIPS_PMPK_AYY.MAT PM Peak Period vehicle trips for highway assignment

HWYTRIPS_MDOP_AYY.MAT MD Off-Peak Period vehicle trips for highway assignment

HWYTRIPS_EVOP_AYY.MAT EV Off-Peak Period vehicle trips for highway assignment

UNLOADED_OP_YYA.NET Updated highway network with free-flow speeds and travel times setup for the Off-Peak period where the RELs of the Lee Roy Selmon Crosstown are in the outbound configuration

UNLOADED_PK_YYA.NET Updated highway network with free-flow speeds and travel times setup for the Peak period where the RELs of the Lee Roy Selmon Crosstown are in the inbound configuration

TURN_PK_YYA.PEN Peak period / network turn prohibitor and time penalty records

TURN_OP_YYA.PEN Off-Peak period / network turn prohibitor and time penalty records

VFACTORS_TOD.DBF Factors file used to specify TOD period capacity factors and BPR curve parameters by Facility Type

FINAL_2010_TOD_Factors.DBF File contains the records of the traffic counts for network Validation purposes by period and AADT. Three types of available

traffic counts comprise the database records; 1) Class counts by TOD, 2) TOD counts, and 3) AADT. For Class and TOD counts there are generally 8 records for each count location; one record for each period and direction, unless the facility is one way. AADT counts generally only have 2 records for each count location, one for each direction unless the facility is one way. Where possible counts by TOD were used for comparison within the TOD periods, and all counts were used for a daily comparison.

OUTPUTS:

HWYLOAD_AMPK_AYY.NET AM-Peak period highway assignment loaded network. This network is combined with the other three period networks into the ***HWYLOAD_DAILY_AYY.NET.***

HWYLOAD_PMPK_AYY.NET PM-Peak period highway assignment loaded network.

HWYLOAD_MDOP_AYY.NET Midday (MD) Off-Peak period highway assignment loaded network.

HWYLOAD_EVOP_AYY.NET Evening (EV) Off-Peak period highway assignment loaded network.

HWYLOAD_DAILY_AYY.NET Daily summed highway assignment loaded network.

The following table, **Table 11.2,** shows the attributes of the ***HWYLOAD_DAILY_AYY.NET*** network file.

Table 11.2 HWYLOAD_DAILY_AYY.NET Attributes

Attribute	Description
A	A-Node of highway link
B	B-Node of highway link
OBJECTID	ID of link in ArcGIS "True Shape" shapefile
…	All attributes from OBJECTID to TWOWAY are the same as the ***BASE_YYA.NET***; Time_ is renamed to TIME and updated with Free-Flow speed, following attributes listed have been added first to the period networks
COUNTY	County name of traffic count location
YEAR	Year of traffic count
PERIOD	Used in the period networks to identify the period of the traffic count; 1-AM, 2-MD, 3-PM, 4-EV, in the "Daily" network default is 1
AUTO_PCT	Percent directional auto split of traffic count by period
LT_PCT	Percent directional medium truck split of traffic count by period (class counts only)
HT_PCT	Percent directional heavy truck split of traffic count by period (class counts only)

Attribute	Description
TRK_PCT	Percent directional truck split of traffic count by period
PD_VOL_PCT	Percent directional split of traffic count by period
AUTO	Directional Auto count by period
LT_TRK	Directional medium truck count by period
HT_TRK	Directional heavy truck count by period
PDDIR_CNT	Directional count by period
PDDIR_SPL	Period directional split of count
DLDIR_SPL	Daily directional split of count
DLTRK_PCT	Daily truck percent of count
DLTRK_SPL	Daily truck directional split of count
TRK_AADT	Truck AADT from count
TRK_PSWADT	Truck PSWADT from count
DLTRK_DIR	PSWADT directional truck count
TOLLTYPE PLAZADESC PLZALNSMIN PLZALNSMAX CARTOLL SVCMINUTES SVCSECONDS DECELCODDE ACCELCODE EXTCHGLNS AVILANES PCTTRUCKS	From Toll Link file
SPEED	Free-flow speed from highway network lookup table
UROADFACTOR CONFAC BPRCOEFFICIENT BPREXPONENT CONFACAMP CONFACPMP CONFACMDP CONFACEVP	From ***VFACTORS*** file
TOLLCOST	Toll cost converted to time using CTOLL
LINKCOST	Time for traversing link in free-flow speed
TOTALCOST	Total time associated to traversing a link used for path choice
DELAY	Time delay associated with accel/decel links of a toll facility
TRKCOST	Special time cost for truck routing
TOLL_ACC	Flag for toll acceleration links
TOLL_DEC	Flag for toll deceleration links

Attribute	Description
…	The following attributes are renamed and summed / calculated from the period networks to form the "Daily" network using "AL" for all-day; each period set of attributes are the same but designated with "AM", "MD", "PM", and "EV"
AL_CONGTIME	Weighted congested time of the highway link, sum of (period vol * period CGTime) / sum of period volumes; otherwise it's the congested time generated in the period assignment
AL_CONGSPD	Weighted congested speed of the highway link, sum of (period vol * period CGSpeed) / sum of period volumes; otherwise it's the congested speed based on the congested time generated in the period assignment
AL_VOL	Sum of the Directional Period Volumes; Directional Period Volume
AL_TRK_V	Sum of the Directional Period Truck Volumes; Directional Period Truck Volume
AL_SOV_V	Sum of the Directional Period SOV Volumes; Directional Period SOV Volume
AL_HOV_V	Sum of the Directional Period HOV (2+) Volumes; Directional Period HOV (2+) Volume
AL_VOL_T	Sum of the Total Link Period Volumes; Total Link Period Volume
AL_TRK_VT	Sum of the Total Link Period Truck Volumes; Total Link Period Truck Volume
AL_SOV_VT	Sum of the Total Link Period SOV Volumes; Total Link Period SOV Volume
AL_HOV_VT	Sum of the Total Link Period HOV (2+) Volumes; Total Link Period HOV (2+) Volume
AL_SELVOL	Sum of the Directional Selected Link / Zone Period Volumes; Directional Selected Link / Zone Period Volume
AL_TRK_SELV	Sum of the Directional Selected Link / Zone Period Truck Volumes; Directional Selected Link / Zone Period Truck Volume
AL_SOV_SELV	Sum of the Directional Selected Link / Zone Period SOV Volumes; Directional Selected Link / Zone Period SOV Volume
AL_HOV_SELV	Sum of the Directional Selected Link / Zone Period HOV (2+) Volumes; Directional Selected Link / Zone Period HOV (2+) Volume
AL_VOL_SELT	Sum of the Total Link, Selected Link / Zone, Period Volumes; Total Link, Selected Link / Zone, Period Volume
AL_TRK_SELVT	Sum of the Total Link, Selected Link / Zone, Period Truck Volumes; Total Link, Selected Link / Zone, Period Truck Volume
AL_SOV_SELVT	Sum of the Total Link, Selected Link / Zone, Period SOV Volumes; Total Link, Selected Link / Zone, Period SOV Volume
AL_HOV_SELVT	Sum of the Total Link, Selected Link / Zone, Period HOV (2+) Volumes; Total Link, Selected Link / Zone, Period HOV (2+) Volume
AL_CAPLOSE	Sum of the Period LOS "E" capacities; Period LOS "E" capacity which is Hourly lane capacity * number of lanes / period confactor
AL_VCLOSE	Weighted Volume over LOS "E" Capacity (sum of the period volumes / sum of the period capacities); Period Volume over Period LOS "E" capacity
AL_VCNT	Directional "Daily" volume / Directional PSWADT (DIR_COUNT); Directional Period volume / Directional Period PSWADT (PDDIR_CNT)

Attribute	Description
AL_CNT	Same as Directional PSWADT (DIR_COUNT); Same as Directional Period PSWADT (PDDIR_CNT)
AL_TKCNT	Directional "Daily" truck volume / Directional truck PSWADT (TRK_PSWADT); Directional Period truck volume / Directional Period truck PSWADT (DLTRK_DIR)
AL_TCNT	Same as Directional truck PSWADT (TRK_PSWADT); Same as Directional Period truck PSWADT (DLTRK_DIR)
…	Repeat "AL" attributes for each period

HASSIGN_AMPK.HTML, HASSIGN_PMPK.HTML
HASSIGN_MDOP.HTML, HASSIGN_EVOP.HTML
HASSIGN_DAILY_.HTML HTML Report files for Highway Assignment Analysis statistics, one for each period network and the "Daily" total network

HASSIGN_Val_AMPK.HTML, HASSIGN_Val_PMPK.HTML
HASSIGN_Val_MDOP.HTML, HASSIGN_Val_EVOP.HTML
HASSIGN_Val_DAILY_.HTML HTML Report files for Highway Assignment Validation statistics, one for each period network and the "Daily" total network; only run for the 2010 Base Year network.

Corridor_Segments.DBF Database file used to label and identify segments of the major roadway corridors for reporting purposes.

The following table, **Table 11.3**, shows the attributes of the ***Corridor_Segments.DBF*** file.

Table 11.3 Corridor_Segments.DBF Attributes

Attribute	Description
COUNTY	County code for corridor segment
CORRIDOR	Corridor code of major corridor, segment belongs to
C_SEGMENT	Seven digit code merging the County, Corridor, and a three digit number for each segment
C_Lable	Label used for Corridor name
SEG_FROM	Beginning bounds of corridor segment
SEG_TO	Ending bounds of corridor segment

Major_Corridors.DBF Database file used to label and identify major roadway corridors for reporting purposes.

The following table, **Table 11.4,** shows the attributes of the ***Major_Corridors.DBF*** file.

Table 11.4 Major_Corridors.DBF Attributes

Attribute	Description
COUNTY	County code of major corridor
CORRIDOR	Corridor identifier number
COR_LABEL	Label used for Corridor name in reporting
FROM	Beginning bounds identifier of the major corridor
TO	Ending bounds identifier of the major corridor

11.3 Model Procedure

Figure 11.1 shows the new TOD **Highway Assignment** module flowchart.

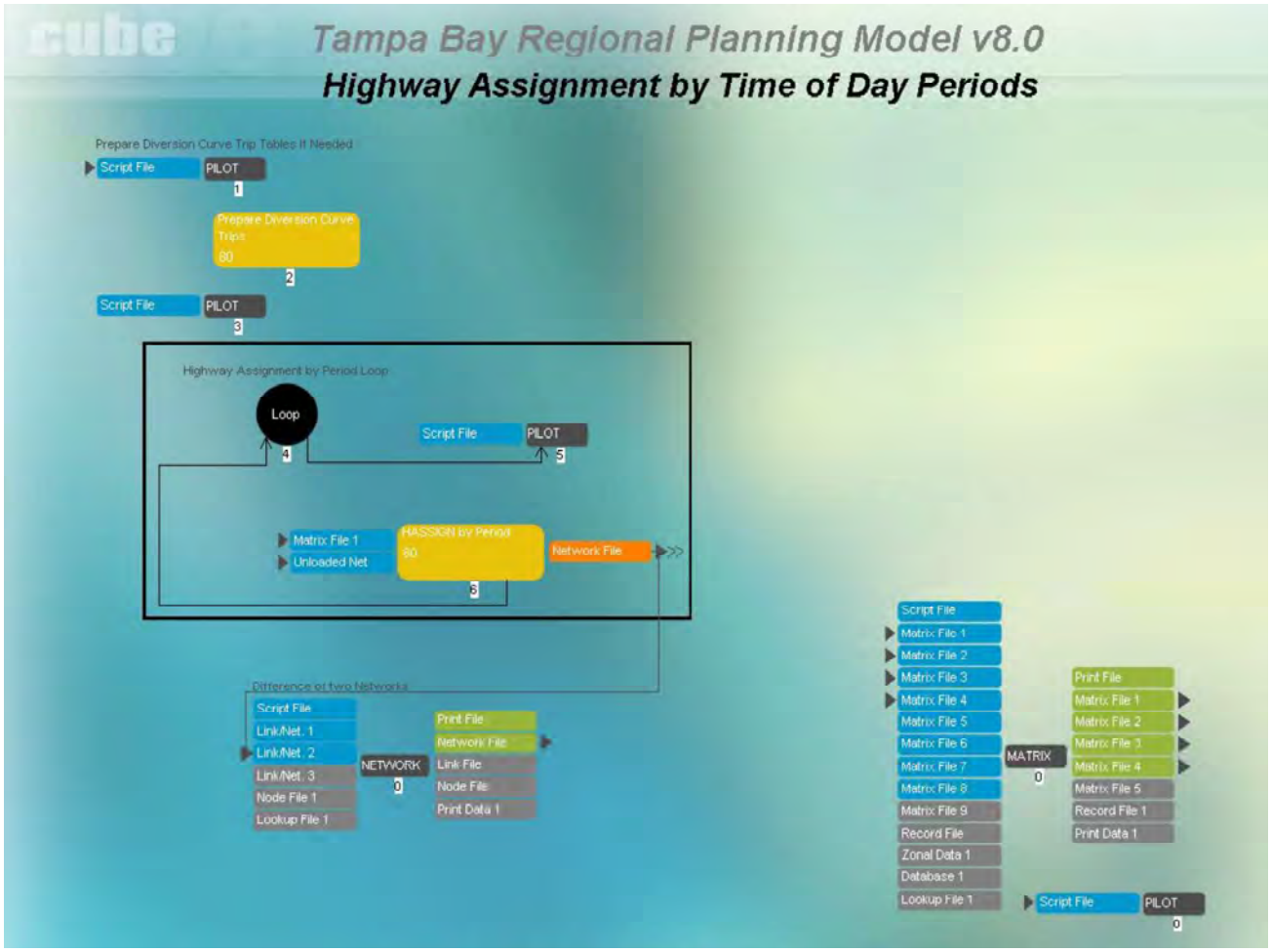


Figure 11.1 Highway Assignment Flowchart

Prepare Diversion Curve Trips

The new TBRPM v8.0 has two versions of highway assignment that can be used as necessary. The default method is the User Equilibrium method that has been used previously with the CTOLL base toll facilities model. This is the same method that is used for the pre-assignment processing of the Peak congested skims and distribution. The second method is the Toll Diversion Curve method which has been used in conjunction with Express Lanes studies. Instead of CTOLL, a different process of determining time savings over toll costs is used to assign traffic volumes to the toll lanes. This method is much slower than the straight User Equilibrium method used by default. Also, a special treatment of the highway trip tables is needed for the Diversion Curve method which is the first step of the **Highway Assignment** module if this method is chosen.

Highway Assignment by Period

The TBRPM v8.0, as stated before, uses a loop to process each period's highway assignment and a final loop to summarize and process the "Daily" network. Inside the loop, the **HASSIGN by Period** module is looped through 5 times, each time a change in system variables is used to distinguish the files generated by each period process. Figure, below, shows the **HASSIGN by Period** module flowchart.

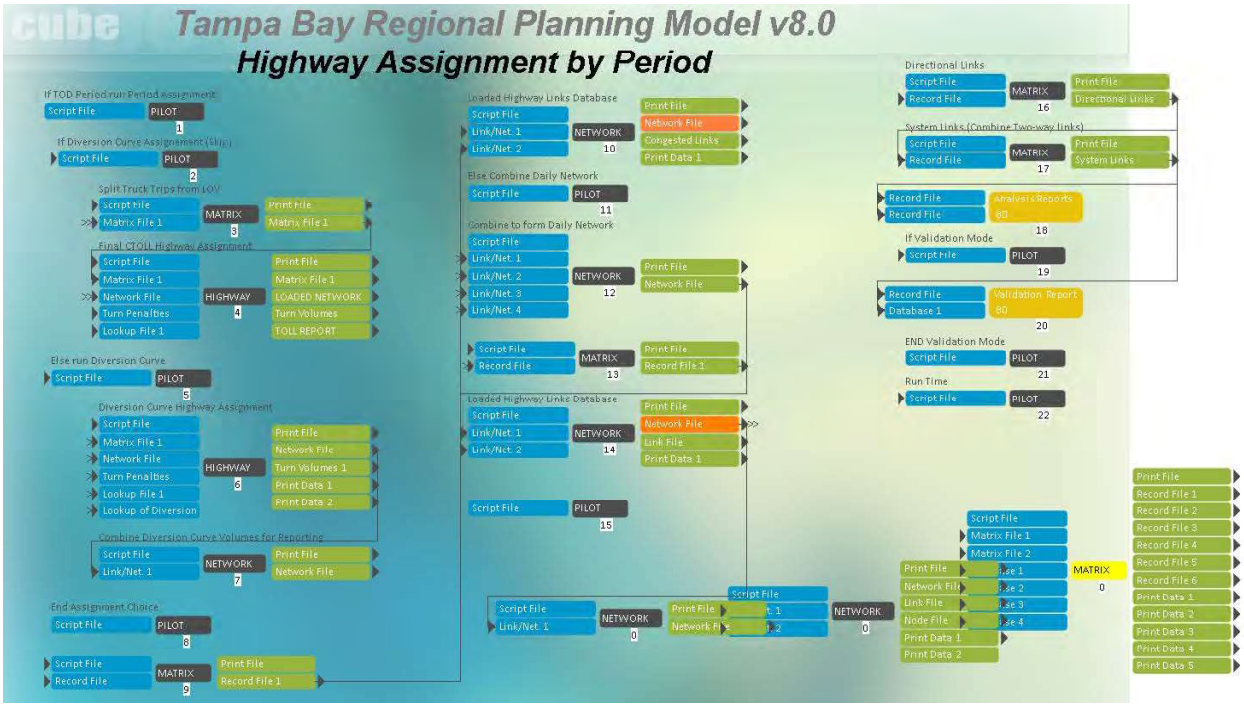


Figure 11.2 Highway Assignment by Period Module Flow Chart

Highway Assignment

The period highway assignment is processed at either step 4, default assignment, or step 6, Diversion Curve assignment, based on the method chosen. Also, it is possible to run one of the Select Link or

Select Zone assignment processes at this point, but only for the default assignment method. To run the Select Link and Zone process, the {RUNSELZONE} or {RUNSELLINK} parameter needs to be turned on before the highway assignment is run by making one or the other equal to 1, or by using the checkbox on the Scenario parameters form when the scenario is double-clicked on the scenario list. (See the introduction chapter if needed). The {SelectZone} and {SelectLink} parameters would also need to be adjusted based on the desired run.

Based on the loop that is processing, the model next either prepares for the next period loop, or if it is the last loop, joins the four period network results into the "Daily" network.

The last steps in the loop prepare the loaded network and the assignment results to run the **Analysis Reports** module, and the **Validation Reports** module for the Base Year scenario. Here the Highway Assignment reports are formed into the web-base HTML format for the user.

11.4 Model Outputs

The HASSIGN web-based reports included in the **Validation** mode are listed in **Table 11.5**. A separate web page is prepared for each period and the daily network for the Base Year scenario when the {ANALYSIS} parameter key is set to 0, the default value should be 1 for all other scenarios to be turned off. These reports are not typically necessary for any of the other scenarios.

Table 11.5 HASSIGN Web Based Validation Reports

Table	Table Name
1	Overall Statistics
2	Highway Network Summary Statistics (by County)
3	Total Number of Links (by AT and FT)
4	Total Number of Links with Counts (by AT and FT)
5	Percentage of Links with Counts (by AT and FT)
6	Original Highway Speeds (MPH) (by AT and FT)
7	Congested Highway Speeds (MPH) (by AT and FT)
8	Total Volume on Links with Counts (by AT and FT)
9	Total Counts on Links with Counts (by AT and FT)
10	Volume to Count Ratios for Links with Counts (by AT and FT)
11	Total VMT (by AT and FT)
12	Total VHT (by AT and FT)
13	Total Capacity on Links with Counts (by AT and FT)
14	Count to Capacity Ratios for Links with Counts (by AT and FT)
15	RMSE Directional Link Group Counts
16	RMSE Directional Link Error Percentage
17	Total Number of Links (by AT, FT, and NL)
18	Link Percentages (by AT, FT, and NL)

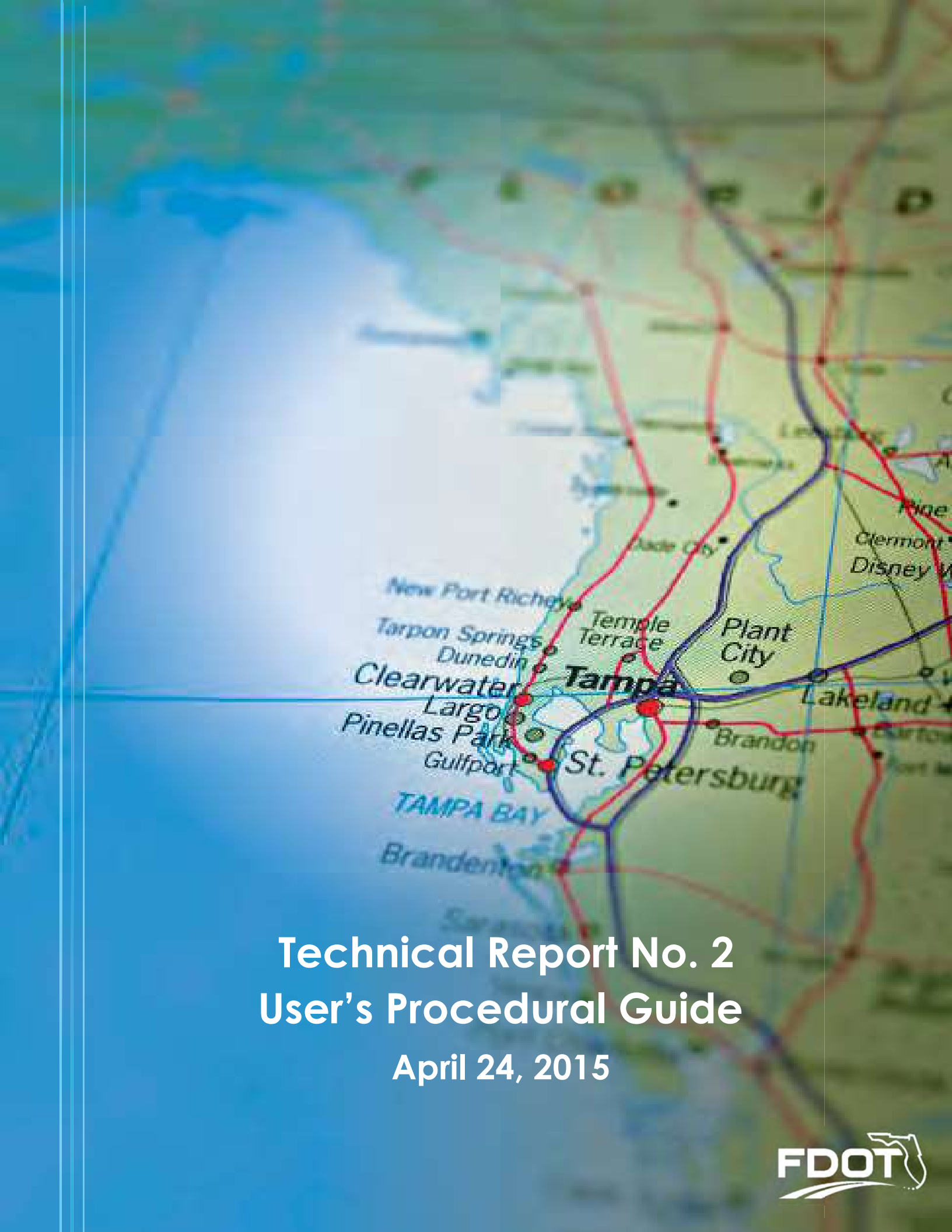
Table	Table Name
19	Percentage of Links with Counts (by AT, FT, and NL)
20	Total System Miles (by AT, FT, and NL)
21	Total Lane Miles by (by AT, FT, and NL)
22	Total Directional System Miles (by AT, FT, and NL)
23	Average Link Length Using System Miles (by AT, FT, and NL)
24	Total VMT Using Volumes on Links with Counts (by AT, FT, and NL)
25	Total VMT Using Counts on Links with Counts (by AT, FT, and NL)
26	Ratio of Volume Over Counts VMT (by AT, FT, and NL)
27	Total VHT Using Volumes on Links with Counts (by AT, FT, and NL)
28	Total VHT Using Counts on Links with Counts (by AT, FT, and NL)
29	Ratio of Volume Over Count VHT (by AT, FT, and NL)
30	Total Volume on Links with Counts (by AT, FT, and NL)
31	Total of Counts on Links with Counts (by AT, FT, and NL)
32	Ratio of Volume over Counts (by AT, FT, and NL)
33	Total Volume on All Links (by AT, FT, and NL)
34	Volume Percentages on All Links (by AT, FT, and NL)
35	Average Total Volumes on All Links (by AT, FT, and NL)
36	Total VMT for All Links Using Volumes (by AT, FT, and NL)
37	Total VHT for All Links Using Volumes (by AT, FT, and NL)
38	Total Truck Volume on All Links with Truck Counts (by AT, FT, and NL)
39	Total Truck Counts (by AT, FT, and NL)
40	Ratio of Truck Volume Over Truck Counts (by AT, FT, and NL)
41	Percent of Truck Volume Over Total Volume (by AT, FT, and NL)
42	Total Capacity on Links with Counts (by AT, FT, and NL)
43	Total of Counts on Links with Counts (by AT, FT, and NL)
44	Ratio of Counts Over Capacity (by AT, FT, and NL)
45	Original Average Speeds (MPH) (by AT, FT, and NL)
46	Congested Average Speeds (MPH) (by AT, FT, and NL)
47	Percent Change in Speeds (by AT, FT, and NL)
48	Screenline Detail Summaries (by Screenline and Link)
49	Screenline Validation Summary (by Screenline)
50	Corridor Link Details (by Corridor, Segment, and Link)
51	Corridor Segment Validation Summary (by Corridor and Segment)
52	Corridor Validation Summary (by Corridor)

The HASSIGN web-based reports included in the **Analysis** mode are found in **Table 11.6.**

Table 11.6 HASSIGN Web Based Analysis Reports

Table	Table Name
1	Overall Statistics
2	Total Number of Links (by AT and FT)
3	Total System Miles (by AT and FT)
4	Total Lane Miles (by AT and FT)
5	Total Directional System Miles (by AT and FT)
6	Average Link Length Using System Miles (by AT and FT)
7	Total VMT Using Volumes (by AT and FT)
8	Total VMT Using Capacity (by AT and FT)
9	Ratio of Volume Over Capacities VMT (by AT and FT)
10	Total VHT Using Volumes (by AT and FT)
11	Total VHT Using Capacities (by AT and FT)
12	Ratio of Volume Over Capacity VHT (by AT and FT)
13	Total Volumes on All Links (by AT and FT)
14	Total Capacities on All Links (by AT and FT)
15	Ratio of Volume Over Capacities (by AT and FT)
16	Total Volume on All Links (by AT and FT)
17	Volume Percentages on All Links (by AT and FT)
18	Average Total Volumes on All Links (by AT and FT)
19	Original Speeds (MPH) (by AT and FT)
20	Congested Speeds (MPH) (by AT and FT)
21	Percent Change in Speed (by AT and FT)
22	Number of Links (by County and FT)
23	Total System Miles (by County and FT)
24	Total Lane Miles (by County and FT)
25	Total VMT (by County and FT)
26	Total VHT (Free-Flow Speeds) (by County and FT)
27	Total VHT (Congested Speeds) (by County and FT)
28	Number of Links (by County and AT)
29	Total System Miles (by County and AT)
30	Total Lane Miles (by County and AT)
31	Total VMT (by County and AT)
32	Total VHT (Free-Flow Speeds) (by County and AT)
33	Total VHT (Congested Speeds) (by County and AT)
34	Screenline summaries (by Screenline and Link)
35	Total Accident Occurrences (by AT and FT) (Old rates)
36	Total Injury Occurrences (by AT and FT) (Old rates)
37	Total Fatality Occurrences (by AT and FT) (Old rates)
38	Total Emissions of Carbon Monoxide (kilograms) (by AT and FT) (Old rates)

Table	Table Name
39	Total Emissions of Hydrocarbons (kilograms) (by AT and FT) (Old rates)
40	Total Emissions of Oxides of Nitrogen (kilograms) (by AT and FT) (Old rates)
41	Total Fuel Use (Gals) (by AT and FT) (Old rates)
42	Total Delay Due to Congestion (Veh-Hrs) (by AT and FT)
43	Corridor Analysis Details (by Corridor, Segment, and Link)
44	Corridor Segment Analysis Details (by Corridor and Segment)
45	Corridor Analysis Summary (by Corridor)



Technical Report No. 2
User's Procedural Guide

April 24, 2015

FDOT