Volume 1-10
Treasure Coast Region
Technical Data Report

CHAPTER VI

Regional Transportation Analysis

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Chapter VI
Regional Transportation Analysis

The evacuation transportation analysis discussed in this Chapter and in Volume IV documents the methodology, analysis, and results of the transportation component of the Statewide Regional Evacuation Study Program (SRESP). Among the many analyses required for the SRESP study, transportation analysis is probably one of the most important components in the process. By bringing together storm intensity, transportation network, shelters, and evacuation population, transportation analysis explicitly links people's behavioral responses to the regional evacuation infrastructure and helps formulate effective and responsive evacuation policy options. Due to the complex calculations involved and numerous evacuation scenarios that need to be evaluated, the most effective and efficient manner to conduct the transportation analysis is through the use of computerized transportation simulation programs, or transportation models.

A. Background and Purpose

Over the years, different planning agencies have used different modeling approaches with varying degrees of complexity and mixed success. Some have used full-blown conventional transportation models such as the standard Florida model FSUTMS; others have used a combination of a simplified conventional model and a spreadsheet program, such as the Abbreviated Transportation Model (ATM). These models have different data requirements, use different behavioral assumptions, employ different traffic assignment algorithms, and produce traffic analysis results with different levels of detail and accuracy. These differences make it difficult for planning agencies to share information and data with each other. They also may produce undesirable conditions for staff training and knowledge sharing.

One of the objectives of the SRESP is to create consistent and integrated regional evacuation data and mapping, and by doing so, facilitate knowledge sharing between state, regional, county, and local partners. To achieve this objective, it is important for Florida's eleven Regional Planning Councils to adopt the same data format and to use the same modeling methodologies for their transportation analyses. The primary purpose of the transportation component of the SRESP is to develop a unified evacuation transportation modeling framework that can be implemented with the data collected by Regional Planning Councils.

B. Study Area

The study area for this analysis includes the four counties of the Treasure Coast Regional Planning Council (TCRPC) area (Indian River, Martin, Palm Beach, and St. Lucie counties). The transportation modeling methodology includes some processes that are performed at the statewide level in order to determine the impacts of evacuations from other regions impacting the evacuation clearance times in the Treasure Coast region. While the impact of other regions is included in the Treasure Coast analysis, it is important to note that the results of the transportation analysis presented in this document are only reported for the four counties

included in the TCRPC Region. Transportation analysis results for other regions and counties are reported in the corresponding Volume 4 report for those regions.

C. Input and Coordination

The development of the transportation methodology and framework required coordination and input from all eleven regional planning councils in Florida, along with the Division of Emergency Management (FDEM), Department of Transportation, Department of Community Affairs, and local county emergency management officials. At the statewide level, the transportation consultant, Wilbur Smith Associates, participated in SRESP Work Group meetings that were held on a monthly basis. Discussions focused on the development of the transportation methodology and incorporated feedback and input from the State agencies, planning agencies and RPCs.

At the local and regional level, Wilbur Smith Associates conducted a series of four regional meetings to coordinate with and receive input from local county emergency management, the regional planning council, local transportation planning agencies and groups, as well as other interested agencies.

D. Evacuation Modeling Methodology and Framework

The evacuation modeling methodology and framework was developed during 2008 and 2009 in coordination with all eleven RPCs and the FDEM. The methodology used in the TCRPC Evacuation Transportation Analysis is identical to the methodology used for all eleven Regional Planning Councils and includes the following components:

1. Behavioral Assumptions

In 2008, the SRESP commissioned a survey of Florida residents in each county. The purpose of this survey was to develop an understanding of the behavior of individuals when faced with the prospect of an impending evacuation. These data were used to develop a set of "planning assumptions" that describe the way people respond to an order to evacuate and are an important input to the SRESP Evacuation Model. The behavioral data provides insights into how people respond to the changing conditions leading up to and during an evacuation. The primary application of the survey data was to help anticipate how people would respond with respect to five behaviors:

- How many people would evacuate?
- When they would leave?
- What type of refuge they would seek?
- Where they would travel for refuge?
- How many vehicles would they use?

These evacuation behaviors are distinguished based on several descriptive variables as listed below:

- Type of dwelling unit (site-built home versus mobile home);
- The evacuation zone in which the evacuee reside; and,

- The intensity of the evacuation that has been ordered.

2. Zone System and Highway Network

The SRESP evacuation model relies upon data that covers the entire State of Florida as well as areas covering the States of Georgia, Alabama, Mississippi, South Carolina, North Carolina, and Tennessee. While the primary focus of the model is with evacuation behavior within Florida, areas outside of the state had to be considered in order to allow a more precise routing of evacuation traffic. This allows the model to measure the flow of traffic across the state line if needed.

The data included in this system contains the demographic information crucial to modeling evacuation traffic. The demographic information is labeled as "small area data". These data provide population and dwelling unit information that will identify where the individuals in the region reside. The planning assumptions developed from the behavioral analysis conducted for this study were applied to these demographic data. The result is a set of evacuation trips generated by the evacuation model. The number of these trips will vary depending on the hazard conditions that prompt the evacuation. Small area data geographies were aggregated into larger units known as Traffic Evacuation Zones (TEZ). These TEZ form the basic unit of analysis in the evacuation model. The final TEZ system for the State of Florida has 17,328 zones. This number provides sufficient detail to accurately accommodate the assignment of evacuation trips onto an evacuation network.

3. Background Traffic

The traffic that consumes the roadway capacity of a transportation system during an evacuation can be divided into two groups. The first group is the evacuation traffic itself. Once the evacuation demand is determined, this information is converted into a number of vehicles evacuating over time. These evacuation trips are then placed on a representation of the highway network by a model. The model determines the speed at which these trips can move and proceeds to move the evacuation trips accordingly. The result is a set of clearance times.

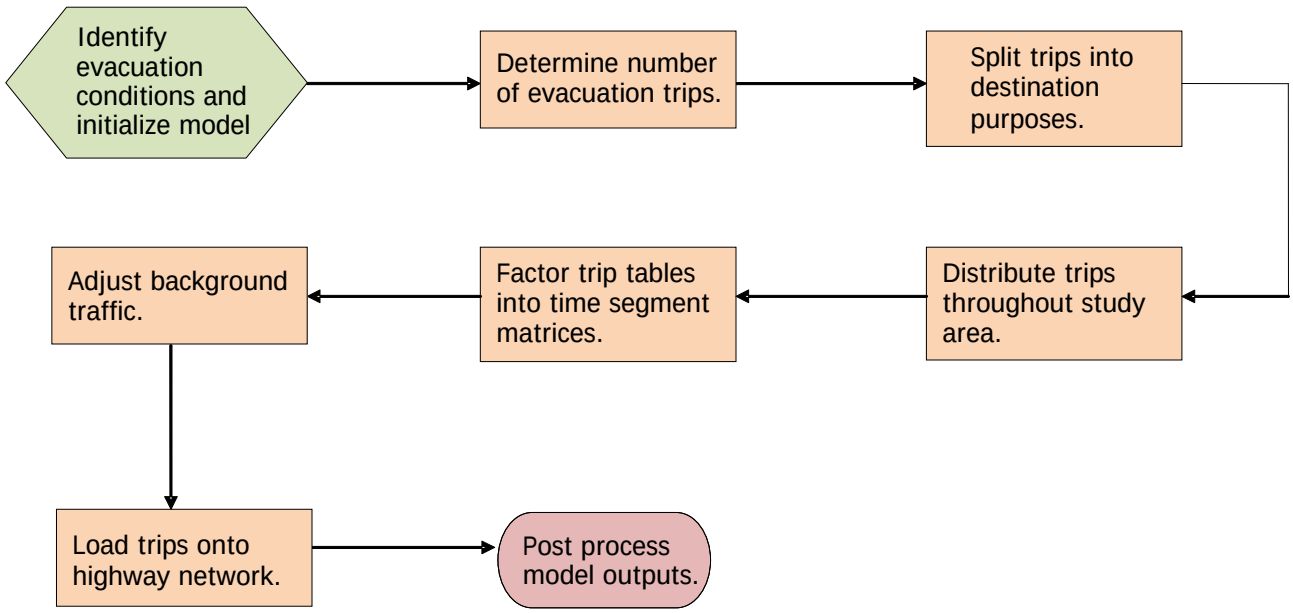
The second group of traffic is known as background traffic. Background traffic, as its name implies, is not the primary focus of an evacuation transportation analysis and is accounted for primarily to impede the movement of evacuation trips through the network. These trips represent individuals going about their daily business not engaged in the evacuation event. For the most part, background traffic represents trips that are relatively insensitive to an order to evacuate and are thus said to be occurring in the "background." Even though background traffic is relatively insensitive to evacuation orders, it is important to account for background traffic since it can have a dramatic impact on available roadway capacity. This in turn can severely affect evacuation clearance times.

4. Evacuation Traffic

The model flow for the evacuation model is divided into a total of eight modeling steps. The following eight steps are represented graphically in the flowchart in Figure VI-1:

1. Identify evacuation conditions and initialize model;
2. Determine number of evacuation trips;
3. Split trips into destination purposes;
4. Distribute trips throughout study area;
5. Factor trip tables into time segment matrices;
6. Adjust background traffic;
7. Load trips onto highway network; and,
8. Post process model outputs.

Figure VI-1 - General Model Flow



5. Dynamic Traffic Assignment

Dynamic Traffic Assignment (DTA) was utilized in the evacuation methodology because it is sensitive to individual time increments. DTA works by assigning a certain number of vehicles to the highway network in a given interval of time. The model then tracks the progress of these trips through the network over the interval. Another set of vehicles is assigned during the following time interval. The model then tracks the progress of these trips through the network along with the progress of the trips loaded in the previous time interval. As vehicles begin to arrive at the same segments of roadway, they interact with one another to create congestion. When vehicles that were loaded to the network in subsequent intervals of time arrive at the congested links, they contribute to the congestion as well. This results in a slowing down of the traffic and eventually spill-backs and queuing delays. It is this time dependent feature of DTA that makes it well suited to evacuation modeling. By dynamically adjusting the travel times and speeds of the vehicles moving through the network as they respond to congestion the model is able to do the following:

- The evacuation model is able to estimate the critical clearance time statistics needed for this study;
- The model takes into account the impact of compounded congestion from multiple congestion points;
- The model is able to adjust the routing of traffic throughout the network as a function of congestion as it occurs throughout the evacuation; and,
- The model is capable of adjusting its capacities from time segment to time segment, making it possible to represent such phenomena as reverse lane operations and background traffic.

6. Prototype Model Development

Wilbur Smith Associates developed a prototype model to test the modeling methodology used to calculate evacuation clearance times. The prototype model demonstrated the viability of the methodology developed for this study. This included the use of dynamic traffic assignment, background traffic curves, regional sub-area trip balancing, use of survey rates, use of 100% participation rates, response curves, and county-by-county phasing of evacuations. The prototype model served as the backbone for all regional evacuation models that have been developed for this study. The models implemented for each RPC use a structure similar to the prototype with identical methodology.

E. Regional Model Implementation

The regional model developed for the Treasure Coast Region used a series of input data provided by the RPC, including the following:

1. Regional Model Network

The regional model network consists of the RPC designated evacuation routes as well as a supporting roadway network that facilitates movement of evacuation traffic. The 2005 Florida Department of Transportation (FDOT) Statewide Model Network was used as a basis for developing the regional model network, while the evacuation routes were obtained from the TCRPC. The TCRPC relied on the emergency managers of its constituent counties to provide it with information on which roads were to be included as evacuation routes. The resulting model network was updated to 2006 conditions and is referred to as the base model network. **Figure VI-2** identifies the model network and evacuation routes for the TCRPC. County level details of the regional model network are provided in the Volume 5-10, Transportation Supplemental Data Support report. The regional model network for the Treasure Coast region includes key roadways within the four county region, including I-95, Florida's Turnpike, US 1, US 441, US 27, US 98, SR 60, SR 70, SR A1A, SR 76, SR 710, and SR 80.

2. Regional Zone System

The regional zone system is based on Traffic Evacuation Zones (TEZ) and contains the regional demographic information, which includes housing and population data that is essential to modeling evacuation traffic. There are 752 zones located within the four

county Treasure Coast region, as illustrated in **Figure VI-3**. In the Treasure Coast region, Palm Beach County has the largest number of TEZs with 382, and St. Lucie County follows with 157 TEZs. Indian River and Martin Counties have the lowest number of TEZs in the RPC with 117 and 96 zones, respectively. The larger number of TEZs generally reflects counties with denser urban structure and/or higher population densities.

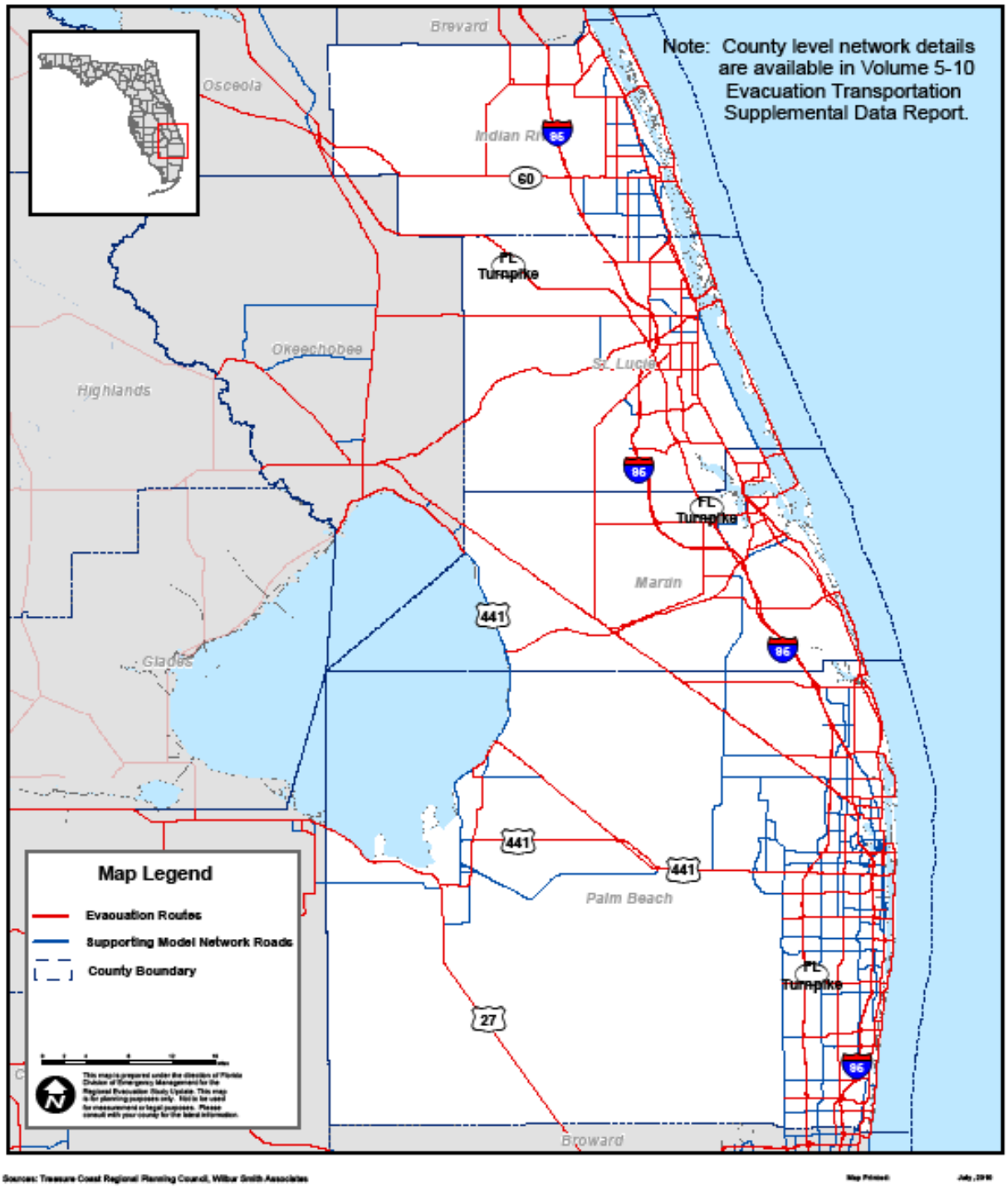
3. Regional Demographic Characteristics

Demographic data were developed for the following years: 2006, 2010, and 2015. A snapshot of the key demographic data for each county in the TCRPC region for 2006, 2010 and 2015 is summarized in **Table VI-1**. The tables list the number of occupied dwelling units for site built homes, the permanent population in site-built homes, as well as the number of occupied dwelling units for mobile homes and the permanent population in mobile homes. The mobile home category includes RVs and boats and the permanent population in those housing options. The demographic characteristics summary also includes hotels and motels because many of these units are in vulnerable areas, and the proportion of seasonal units and hotel/motel units that are occupied at any point in time will have an important impact on the total population that may participate in an evacuation.

Figure VI-2

FIGURE VI-2

Treasure Coast Regional Model Network



Sources: Treasure Coast Regional Planning Council, Wilbur Smith Associates

Figure VI-3

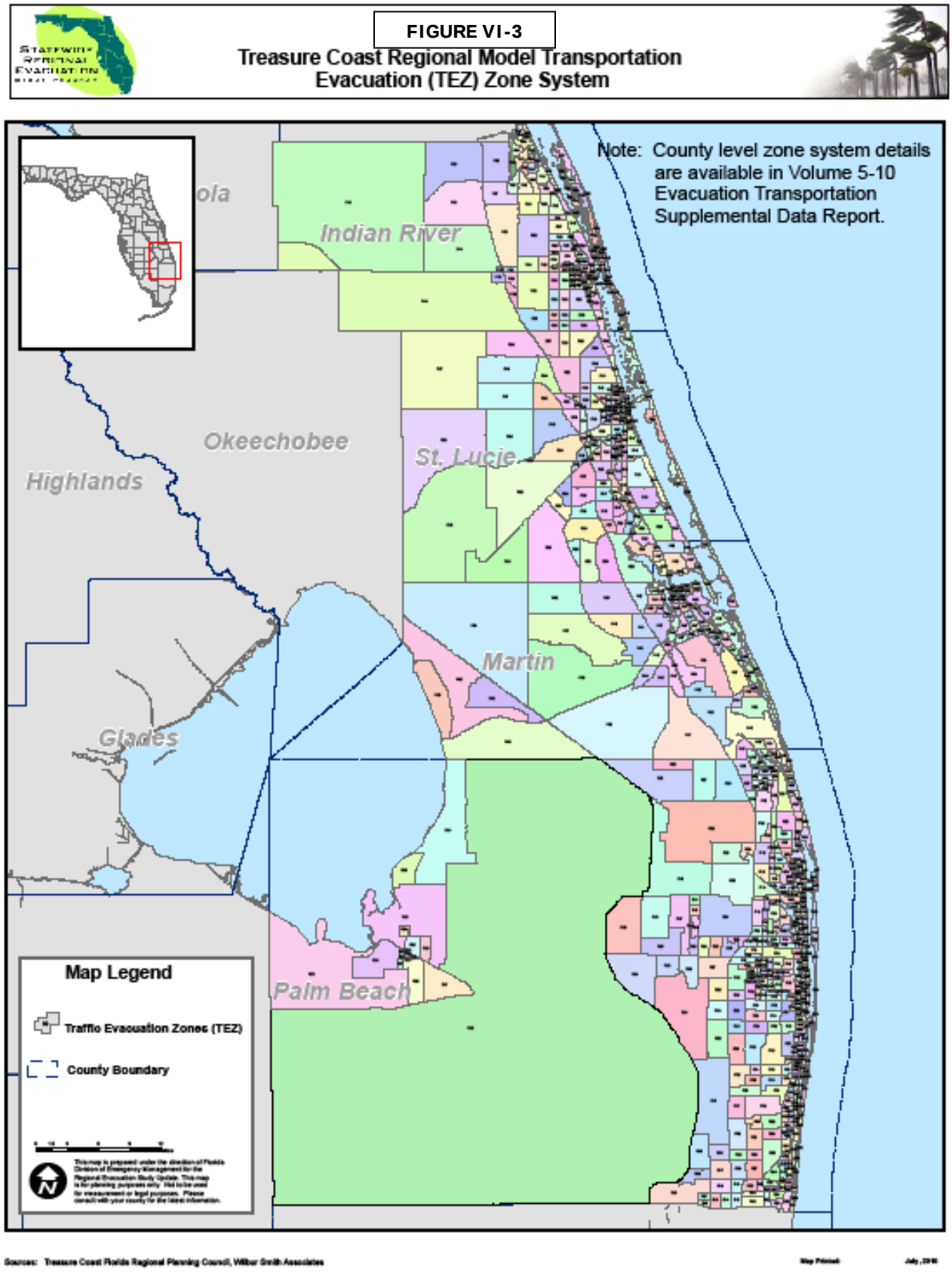


FIGURE VI-3
Treasure Coast Regional Model Transportation
Evacuation (TEZ) Zone System
Note: County level zone system details are available in Volume 5-10 Evacuation Transportation Supplemental Data Report.
Indian River
Okeechobee
St. Lucie
Highlands
Martin
Glades
Palm Beach
Map Legend
Traffic Evacuation Zones (TEZ)
County Boundary

Palm Beach County has the largest population in the region during all three time periods. The county is expected to reach over 1.3 million people by 2015. St. Lucie County has the second largest population in the region and is forecasted to have more that 300,000 people by 2015. Indian River and Martin Counties have the smallest populations in the region; however, both are expected to reach more than 150,000 in 2015. Although Palm Beach County shows the largest absolute growth between 2006 and 2015, the county will experience the smallest percentage of change in population. St. Lucie County is predicted to experience the largest percentage of change at 33%.

Table VI-1 – Treasure Coast Demographic Characteristic Summary

County	Characteristic	Year		
		2006	2010	2015
Indian River	Occupied site-built homes	54,270	57,972	62,586
	Population in site-built homes	121,023	129,279	139,564
	Occupied mobile homes	6,500	6,500	6,500
	Population in mobile home	13,546	13,546	13,546
	Hotel/motel units	2,235	2,235	2,310
Martin	Occupied site-built homes	57,028	60,400	65,402
	Population in site-built homes	126,031	133,488	144,539
	Occupied mobile homes	7,009	7,009	7,009
	Population in mobile home	12,879	12,879	12,879
	Hotel/motel units	1,335	1,335	1,335
Palm Beach	Occupied site-built homes	521,288	540,518	584,453
	Population in site-built homes	1,224,572	1,269,753	1,372,899
	Occupied mobile homes	18,609	19,294	20,854
	Population in mobile home	41,375	42,908	46,390
	Hotel/motel units	23,023	23,023	23,023
St. Lucie	Occupied site-built homes	80,965	93,492	107,037
	Population in site-built homes	231,995	269,736	313,422
	Occupied mobile homes	10,115	10,115	10,115
	Population in mobile home	17,312	17,312	17,312
	Hotel/motel units	3,726	3,726	3,726

Source: Treasure Coast Regional Planning Council (Indian River, Martin, and St. Lucie Counties) and Wilbur Smith Associates (Palm Beach County). Demographic data for Palm Beach County used in the transportation analysis was derived independently to conform to model TEZ boundaries and may vary from demographic data presented in other sections of the Treasure Coast Statewide Regional Evacuation Study.

4. Zone System and Highway Network

To correspond to the three different sets of demographic data, three model networks were ultimately developed. The base 2006 network and two future year networks to correspond to the 2010 demographic data and the 2015 demographic data. The 2006 base model network was updated to reflect roadway capacity improvement projects completed between 2006 and 2010 to create the 2010 network. The 2010 network was then updated to reflect planned roadway capacity improvement projects expected to be implemented between 2011 and 2015 to create the 2015 network.

The planned roadway improvements that were added to the network generally include only capacity improvement projects such as additional through lanes. **Table VI-2** identifies capacity improvement projects completed between 2006 and 2010 that were included in the 2010 network. Likewise, **Table VI-3** identifies capacity improvement projects planned for implementation between 2011 and 2015. The tables identify each roadway that will be improved as well as the extent of the improvement. For example, by the end of 2015 in Indian River County, US 1 from the Oslo Rd to Highlands Drive will be widened to 6 lanes.

It is important to note that Tables VI-2 and VI-3 are not intended to be all inclusive of every transportation improvement project completed within the region. The tables only identify key capacity improvement projects that impact the evacuation model network and are anticipated to have an impact on evacuation clearance times.

5. Behavioral Assumptions

For the Treasure Coast Region, all four of the counties within the region have evacuation zones corresponding to categories of storm surge. Evacuation rates for site-built homes and mobile/manufactured homes are provided by county and summarized in **Figure VI-4** through **Figure VI-11**. Other rates, such as out of county trip rates, vehicle use rates, public shelter use rates, friend/relative refuge use rates, hotel/motel refuge use rates, and other refuge use rates, are detailed by county, storm threat, and evacuation zone in Volume 5-10.

Please note that the original behavioral response rates provided by SRESP in Volume 2-10, Regional Behavioral Analysis were modified to fit the evacuation zones created by Indian River and Martin Counties. The original rates were based on a five zone system, such as in Palm Beach and St. Lucie Counties; however, Indian River utilizes four zones, and Martin, three zones. The evacuation zone systems for those counties are listed below:

- Indian River – 4 zones: Zone A, Zone B, Zone C, Zone D/E;
- Martin – 3 zones: Zone A, Zone B/C, Zone /D/E.
- Palm Beach – 2 zones: Zone A, Zone B-E

6. Shelters

In order for the transportation model to accurately assign public shelter trips to the correct location, a complete list of available public shelters needs to be available. The shelters were categorized as either primary or other, with primary indicating that the shelter is compliant with American Red Cross standards for a shelter and other indicating all other shelters. In the four county region there are a total of 78 shelters, including 14 in Indian River County, 14 in Martin County, 30 in Palm Beach County, and 20 in St. Lucie County, all of which are classified as primary shelters. All together, the 78 shelters located within the four county region can host more than 73,000 persons during an evacuation event. Detailed lists of the available public shelters by county are included in Volume 5-10.

Table VI-2 – Treasure Coast Roadway Improvements, 2006 – 2010

County	Roadway	From	To	Number of Lanes
Indian River	SR 60	Osceola County line	I-95	4
	CR 512	I-95	Roseland Road	4
	Oslo Road	US 1	27th Avenue	4
Martin	SR-714	CR-A1A	SR-A1A	4
	CR A1A (Dixie Hwy)	Indian St	Monterey Rd	4
Palm Beach	Seminole Pratt Whitney Rd	SR 80	Sycamore Dr	4
	SR 710	Military Trail	Congress Ave	4
	SR 809	SR 704	SR 702	6
	SR 80	US 441	SR 807	8
	Turnpike	Lantana Toll Plaza	Lake Worth Rd	8
	I-95	N of SR 80	N of Congress Ave	10
	SR 811	Broward County line	SW 18th St	4
	Atlantic Ave	Lyons Rd.	Starkey Rd.	6
	Beeline Hwy	Martin County Line	Seminole Pratt Whitney	4
	Jog Rd.	Roebuck Rd.	45th Street	4
	Jog Rd.	Beeline Hwy	Turnpike	4
St Lucie	SR 70	McCarty Rd	Header Canal Rd	4
	US 41	NE Riomar Dr	W Midway Rd	6

Sources: FDOT SIS First Five Year Plan, FDOT SIS Second Five Year Plan, Treasure Coast Regional Planning Council
Note: Projects included in this table are roadway improvement projects completed between 2006 and 2010 on roadways that are included in the regional transportation model network. Only projects which added roadway capacity, such as additional through lanes, were included. The list is not intended to be all inclusive of every transportation improvement project completed within the region. A list of historical projects completed during the last five years was included in this report because the base regional network developed for the study, along with the base demographic data, is for the year 2006.

Table VI-3 - Treasure Coast Planned Roadway Improvements, 2011–2015

County	Roadway	From	To	Number of Lanes
Indian River	58th Ave	53rd St	49th St	4
	43rd Ave	26th St	16th St	4
	17th St	Old Dixie Hwy	6th Ave	4
	Aviation Blvd	26th St	16th St	4
	Oslo Road	58th Ave	29th Ave	4
	US 1	Oslo Rd	Indian River Blvd	6
	SR 60	I-95	66th Ave	6
	US 1	Oslo Rd	Highlands Drive	6
Martin	SR-710	SR-76	SW Citrus Blvd	4
	SR-76	SW Jack James Drive	SW Lost River Road	6
Palm Beach	Seminole Pratt Whitney Rd	Sycamore Dr.	Beeline Hwy	4
	SR 710	Congress Ave	Old Dixie Hwy	4
	Palmetto Park Rd	W of Military Trail	I-95	8
	Turnpike	SR 802	SR 704	8
	I-95	Broward County line	Linton Blvd	10
	Atlantic Ave	Turnpike	Jog Rd.	6
	Beeline Hwy	PGA Blvd.	Congress Ave	6
	Northlake Blvd.	Seminole Pratt Whitney	Coconut Blvd.	4
	Okeechobee Blvd.	Australian Blvd.	Tamarind Ave	8
	Palmetto Park Rd	Lyons Rd.	W of Military Trail	8
St Lucie	SR 70	Okeechobee County line	MP 10.216	4
	SR 70	Kings Hwy	Jenkins Rd	6
	I-95	SR 70	Indian River County line	8

Sources: FDOT SIS First Five Year Plan, FDOT SIS Second Five Year Plan, Treasure Coast Regional Planning Council
Note: Projects included in this table are roadway improvement projects planned for completion between 2011 and 2015 on roadways that are included in the regional transportation model network. Only projects which are planned to add roadway capacity, such as additional through lanes, were included. The list is not intended to be all inclusive of every transportation improvement project planned for completion within the region.

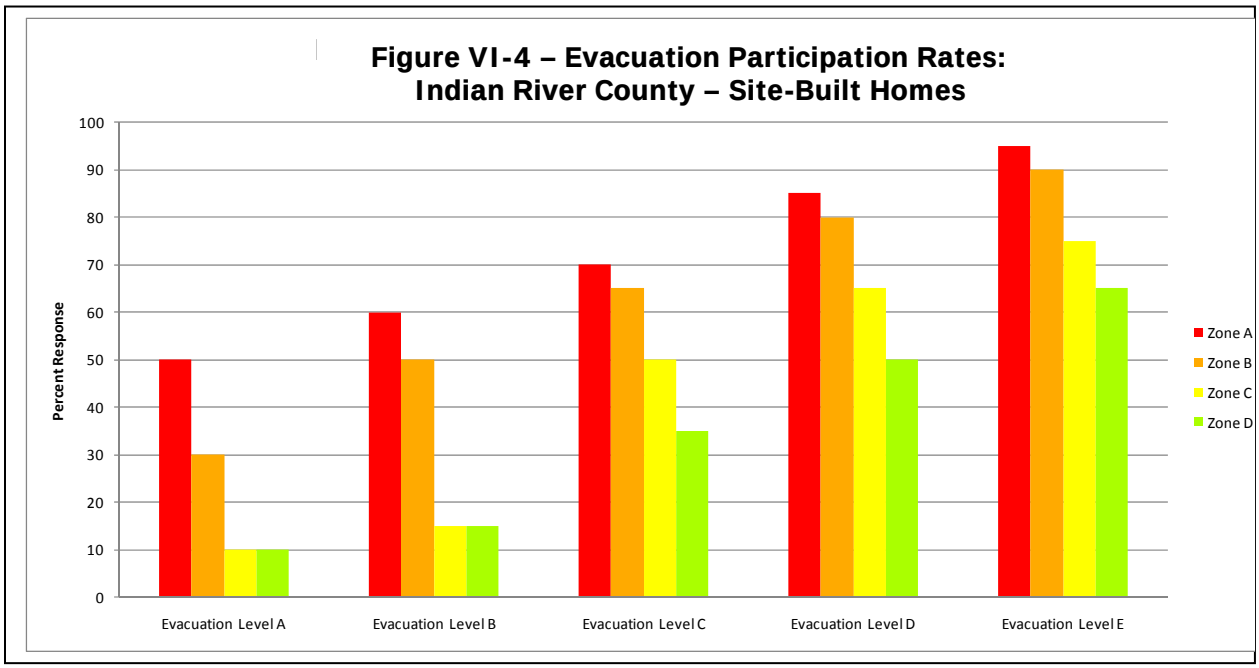


Figure VI-4 – Evacuation Participation Rates:
Indian River County – Site-Built Homes
Percent Response
100
90
80
70
60
50
40
30
20
10
0
Evacuation Level A
Evacuation Level B
Evacuation Level C
Evacuation Level D
Evacuation Level E
Zone A
Zone B
Zone C
Zone D

Figure VI-5 – Evacuation Participation Rates: Indian River County – Mobile Homes

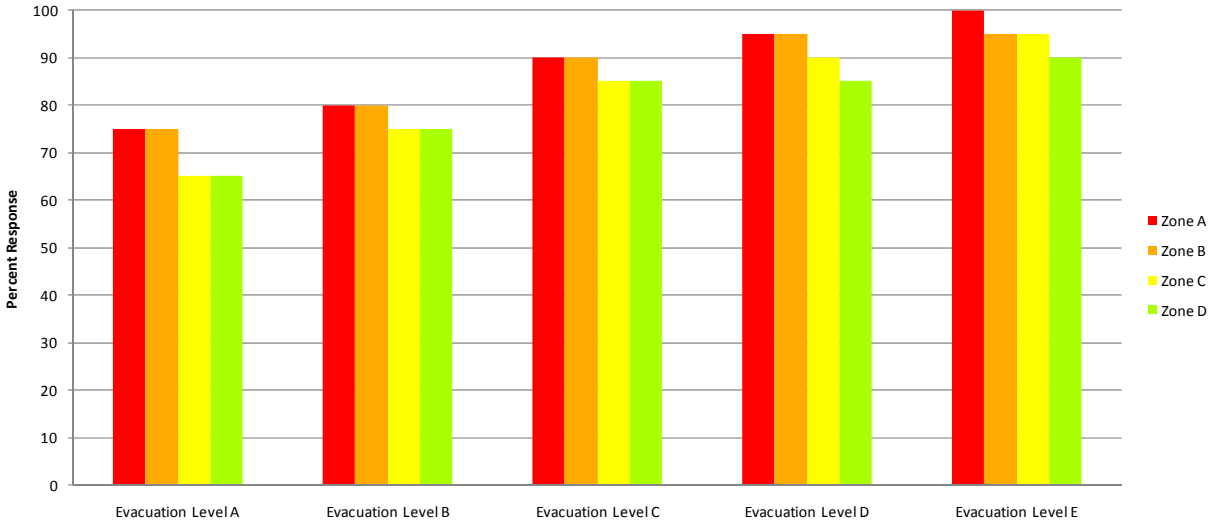


Figure VI-6 – Evacuation Participation Rates: Martin County – Site-Built Homes

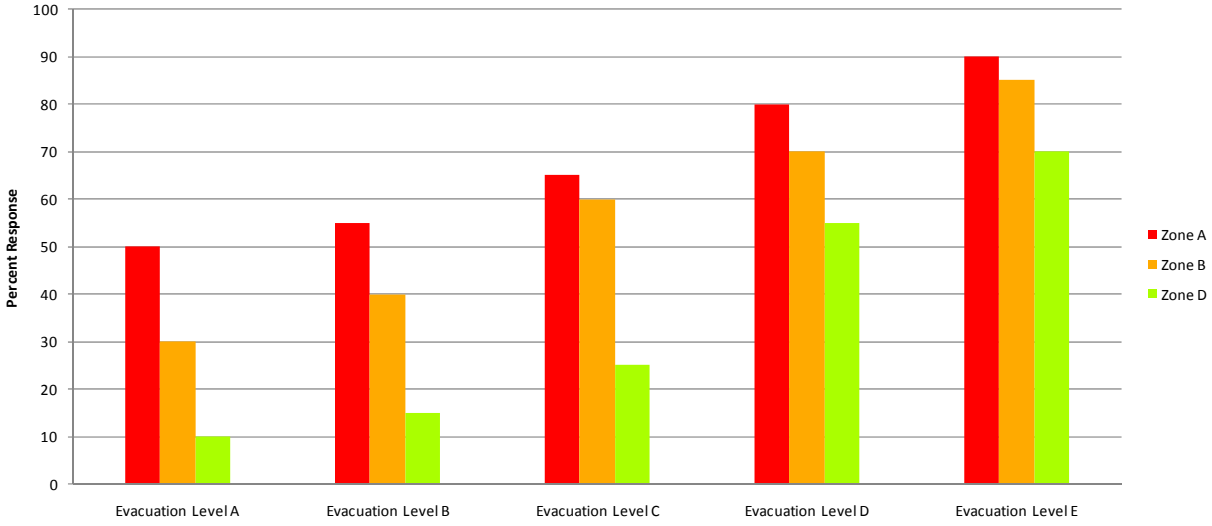


Figure VI-7 – Evacuation Participation Rates: Martin County – Mobile Homes

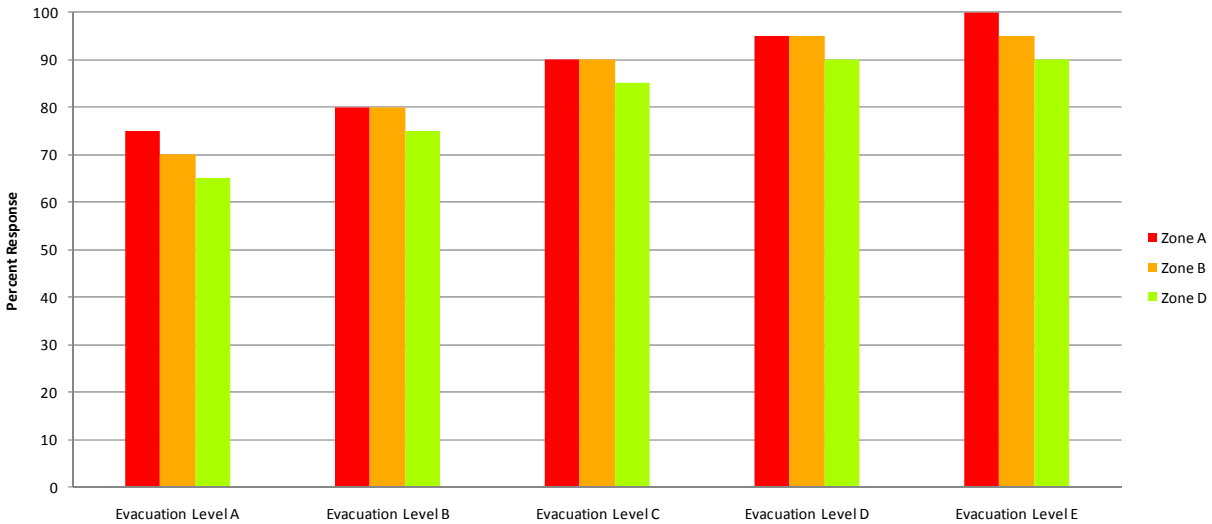


Figure VI-8 – Evacuation Participation Rates: Palm Beach County – Site-Built Homes

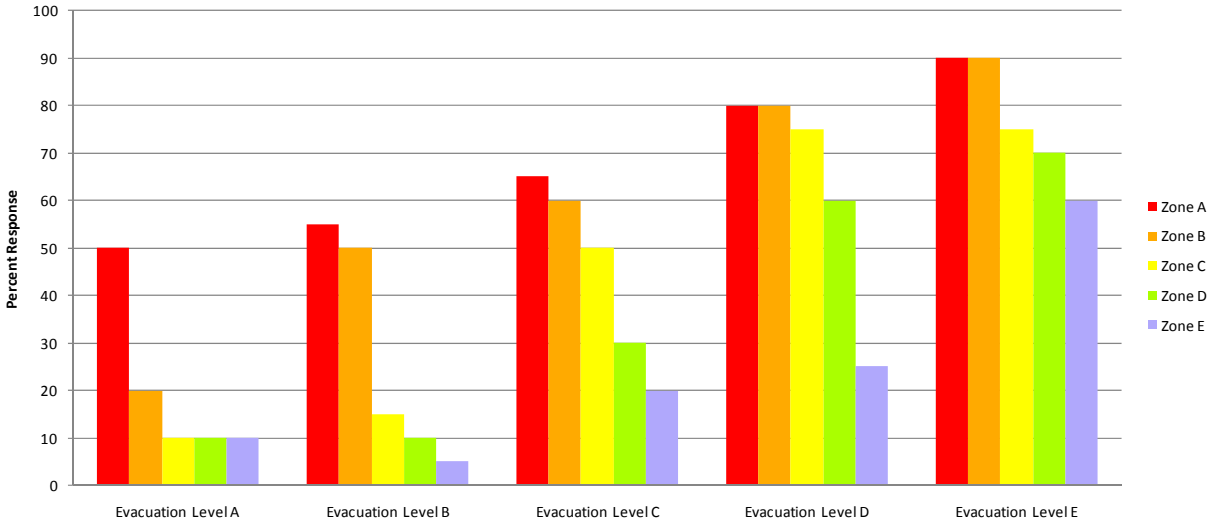


Figure VI-9 – Evacuation Participation Rates: Palm Beach County – Mobile Homes

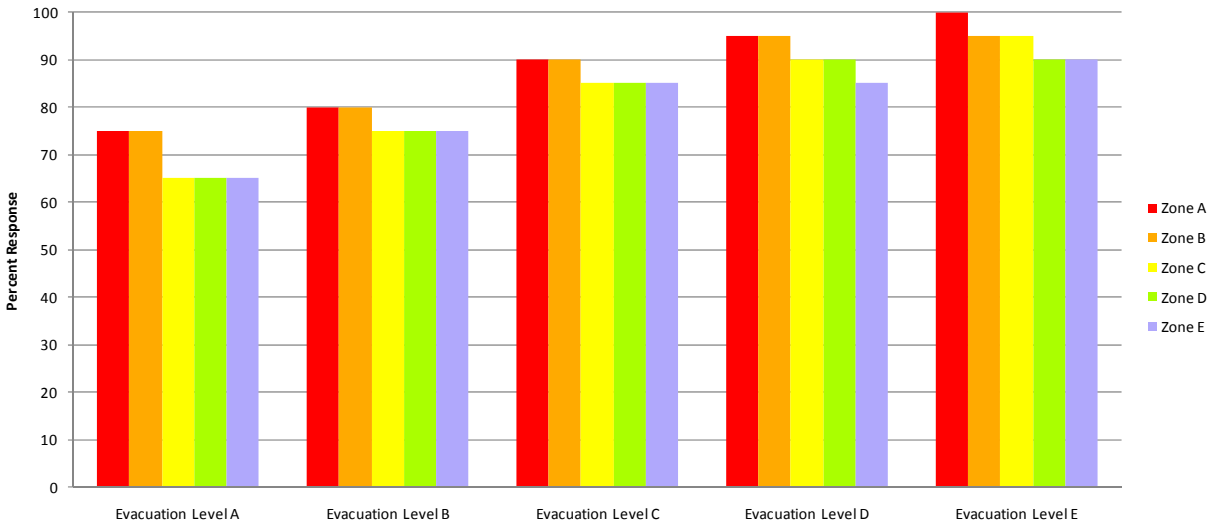


Figure VI-10 – Evacuation Participation Rates: St. Lucie County – Site-Built Homes

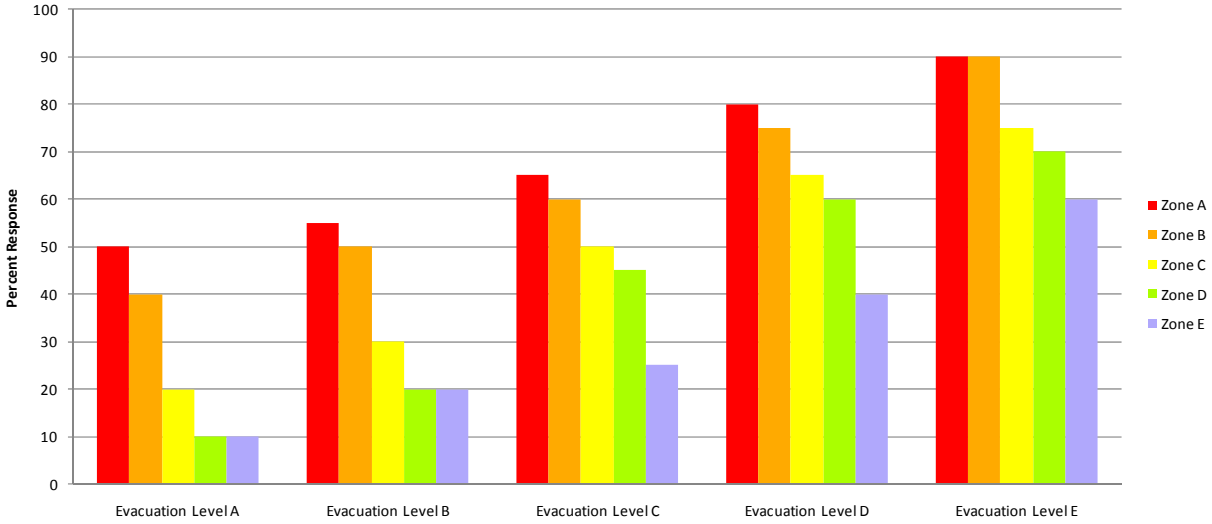
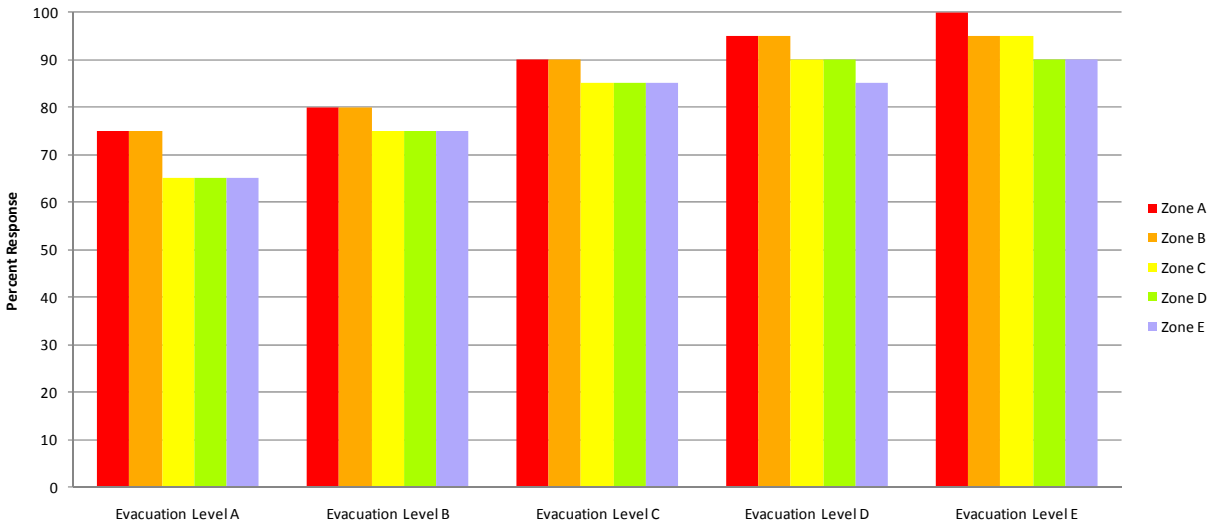


Figure VI-11 – Evacuation Participation Rates: Indian River County – Site-Built Homes



7. Evacuation Zones

The final input variable that is needed to complete the transportation evacuation model is the delineation of evacuation zones for all coastal counties. Local county emergency managers have the responsibility of identifying and defining evacuation zones for their county. All four counties within the Treasure Coast region have updated and established their evacuation zones based on the results of the new data and information collected as part of the SRESP. County level evacuation zones are included in Volume 5-10, Evacuation Transportation Supplemental Data Report.

F. TIME User Interface

Wilbur Smith Associates developed the Transportation Interface for Modeling Evacuations (TIME) to make it easier for TCRPC staff and transportation planners to use the model and implement the evacuation methodology. The TIME interface is based on an ArcGIS platform and is essentially a condensed transportation model, which provides a user friendly means of modifying input variables that would change the clearance times for various evacuation scenarios.

The evacuation model variables include a set of distinguishing characteristics that could apply to evacuation scenarios as selection criteria. These following variables may be selected using the TIME interface and allow the user to retrieve the best results from various evacuation alternatives:

- Analysis time period;
- Highway network;
- Behavioral response;
- One-way evacuation operations;

- University population;
- Tourist occupancy rates;
- Shelters;
- Counties evacuating;
- Evacuation level;
- Response curve hours; and,
- Evacuation Phasing.

G. Vulnerable Population

Using a combination of the demographic data, behavioral assumptions, and evacuation zones, the vulnerable population in each county could be determined by evacuation level. For the purposes of the transportation analysis, the vulnerable population, or population-at-risk, is defined as the total population living within the county designated evacuation zones for each evacuation level. This population is living in an area that is at risk for severe flooding during a storm event. The vulnerable population for the Treasure Coast Region for 2010 is identified in **Table VI-4**, summarized by evacuation zone and split between site-built homes and mobile/manufactured homes. Vulnerable population for 2015 is summarized in **Table VI-5**.

Table VI-4 – Vulnerable Population in the Treasure Coast Region for 2010

	Evacuation Zone A	Evacuation Zone B	Evacuation Zone C	Evacuation Zone D	Evacuation Zone E
Indian River County*					
Site-built Homes	18,125	19,208	907	2,547	
Mobile/Manuf. Homes	10	1,550	0	533	
TOTAL	18,135	20,758	907	3,081	
Martin County					
Site-built Homes	6,632	2,182	6,186	8,153	23,438
Mobile/Manuf. Homes	335	60	184	154	1,422
TOTAL	6,966	2,242	6,370	8,308	24,861
Palm Beach County					
Site-built Homes	73,968	9,039	22,530	26,358	41,615
Mobile/Manuf. Homes	2,112	195	540	468	723
TOTAL	76,080	9,234	23,070	26,826	42,338
St. Lucie County					
Site-built Homes	6,942	2,241	2,710	1,447	1,775
Mobile/Manuf. Homes	1,759	307	286	75	104
TOTAL	8,701	2,548	2,996	1,522	1,879

Note: Vulnerable population determined using SRESP behavioral data and county provided evacuation zones. Vulnerable population numbers are not inclusive, meaning population numbers listed for a higher zone are not included in the lower zone. For example, vulnerable population listed for Evacuation Zone B does not include vulnerable population listed for Evacuation Zone A.

Table VI-5 – Vulnerable Population in the Treasure Coast Region for 2015

	Evacuation Zone A	Evacuation Zone B	Evacuation Zone C	Evacuation Zone D	Evacuation Zone E
Indian River County*					
Site-built Homes	19,566	20,736	979	2,749	
Mobile/Manuf. Homes	10	1,550	0	533	
TOTAL	19,576	22,286	979	3,283	
Martin County					
Site-built Homes	6,935	2,277	6,412	8,439	24,427
Mobile/Manuf. Homes	335	60	184	154	1,422
TOTAL	7,270	2,337	6,596	8,593	25,850
Palm Beach County					
Site-built Homes	79,978	9,773	24,360	28,499	44,996
Mobile/Manuf. Homes	2,282	210	583	506	781
TOTAL	82,261	9,983	24,943	29,005	45,777
St. Lucie County					
Site-built Homes	7,244	2,329	2,862	1,521	1,874
Mobile/Manuf. Homes	1,759	307	286	75	104
TOTAL	9,003	2,635	3,148	1,596	1,978

Note: Vulnerable population determined using SRESP behavioral data and county provided evacuation zones. Vulnerable population numbers are not inclusive, meaning population numbers listed for a higher zone are not included in the lower zone. For example, vulnerable population listed for Evacuation Zone B does not include vulnerable population listed for Evacuation Zone A.

In addition, based again on the demographic data, behavioral assumptions, and evacuation zones, the planned destinations of vulnerable population in each county could be determined by evacuation level. Destinations include friends and family, hotel/motel, public shelter, and other locations. Vulnerable population destinations for the Treasure Coast Region are identified in **Table VI-6** for 2010 and in **Table VI-7** for 2015.

The vulnerable shadow population is provided in **Table VI-8** for both 2010 and 2015. The vulnerable shadow population was determined using the behavioral assumptions for evacuating shadow population and is based on evacuation level (storm category), not evacuation zone.

Table VI-6 – Vulnerable Population by Destination for 2010

	Evacuation Zone A	Evacuation Zone B	Evacuation Zone C	Evacuation Zone D	Evacuation Zone E
Indian River County*					
To Friends and Family	9,975	11,495	499	1,721	
To Hotel/ Motel	4,533	5,035	227	717	
To Public Shelter	907	1,146	73	268	
To Other Destination	2,720	3,083	109	375	
Martin County					
To Friends and Family	4,528	1,457	4,140	5,400	16,159
To Hotel/ Motel	1,028	333	946	1,238	3,658
To Public Shelter	239	73	208	426	1,343
To Other Destination	1,171	379	1,076	1,243	3,701
Palm Beach County					
To Friends and Family	45,648	5,540	13,842	16,095	25,403
To Hotel/ Motel	18,809	2,289	5,714	6,660	10,512
To Public Shelter	3,952	475	1,191	1,374	2,167
To Other Destination	7,671	929	2,323	2,697	4,255
St. Lucie County					
To Friends and Family	5,133	1,513	1,783	910	1,122
To Hotel/ Motel	1,569	428	492	240	297
To Public Shelter	696	204	348	180	221
To Other Destination	1,303	402	372	193	238

Note: Vulnerable population destinations determined using SRESP behavioral data and county provided evacuation zones. Vulnerable population numbers are not inclusive, meaning population numbers listed for a higher zone are not included in the lower zone. For example, vulnerable population listed for Evacuation Zone B does not include vulnerable population listed for Evacuation Zone A.

Table VI-7 – Vulnerable Population by Destination for 2015

	Evacuation Zone A	Evacuation Zone B	Evacuation Zone C	Evacuation Zone D	Evacuation Zone E
Indian River County*					
To Friends and Family	10,767	12,335	539	1,832	
To Hotel/ Motel	4,893	5,417	245	767	
To Public Shelter	980	1,223	78	284	
To Other Destination	2,936	3,312	118	399	
Martin County					
To Friends and Family	4,725	1,519	4,287	5,586	16,802
To Hotel/ Motel	1,074	348	980	1,281	3,806
To Public Shelter	248	76	214	440	1,392
To Other Destination	1,223	395	1,114	1,286	3,849
Palm Beach County					
To Friends and Family	49,356	5,990	14,966	17,403	27,466
To Hotel/ Motel	20,337	2,475	6,177	7,201	11,366
To Public Shelter	4,273	514	1,288	1,486	2,344
To Other Destination	8,295	1,005	2,512	2,916	4,601
St. Lucie County					
To Friends and Family	5,314	1,566	1,874	954	1,182
To Hotel/ Motel	1,614	441	515	251	312
To Public Shelter	720	211	366	188	233
To Other Destination	1,355	417	392	203	251

Note: Vulnerable population destinations determined using SRESP behavioral data and county provided evacuation zones. Vulnerable population numbers are not inclusive, meaning population numbers listed for a higher zone are not included in the lower zone. For example, vulnerable population listed for Evacuation Zone B does not include vulnerable population listed for Evacuation Zone A.

Table VI-8 – Vulnerable Shadow Evacuation Population

	Evacuation Level A	Evacuation Level B	Evacuation Level C	Evacuation Level D	Evacuation Level E
2010					
Indian River County	24,990	22,875	23,296	30,839	35,268
Martin County	22,950	29,028	29,697	39,600	36,918
Palm Beach County	110,854	108,368	172,042	221,435	267,138
St. Lucie County	30,029	42,643	41,996	67,001	79,289
2015					
Indian River County	25,807	23,585	24,037	32,214	36,995
Martin County	23,694	30,345	31,056	42,037	39,598
Palm Beach County	119,508	116,779	185,530	238,869	288,141
St. Lucie County	32,256	47,013	46,343	75,618	90,010

Note: Vulnerable shadow population determined using SRESP behavioral data and county provided evacuation zones.

H. Evacuation Model Scenarios

There are literally thousands of possible combinations of variables that can be applied using the evacuation transportation model, which will result in thousands of possible outcomes. For the purposes of this analysis, two distinct sets of analyses were conducted using the SRESP evacuation transportation model, including one set of analysis for growth management purposes and one set of analysis for emergency management purposes. The two sets of analysis include the following:

1. Base Scenarios

The base scenarios were developed to estimate a series of worst case scenarios and are identical for all eleven RPCs across the State. These scenarios assume 100 percent of the vulnerable population evacuates and includes impacts from counties outside of the TCRPC area. These scenarios are generally designed for growth management purposes, in order to ensure that all residents that choose to evacuate during an event are able to do so. The base scenarios for the Treasure Coast region are identified in **Table VI-9**; and,

2. Operational Scenarios

The operational scenarios were developed by the RPCs in coordination with local county emergency managers and are designed to provide important information to emergency management personnel to plan for different storm events. These scenarios are different from region to region and vary for each evacuation level. The operational scenarios for the Treasure Coast region are identified in **Table VI-10**.

Because of the numerous possible combinations of variables that can be applied in the model, the evacuation transportation model is available for use through the TCRPC to continue testing combinations of options and provide additional information to emergency managers.

I. Clearance Time Results

Each of the ten base scenarios and ten operational scenarios were modeled for the Treasure Coast Region using the regional evacuation model. Results were derived from the model to summarize the evacuating population, evacuating vehicles, clearance times, and critical congested roadways. Detailed results are discussed in Chapter IV, Regional Population and Vulnerability Analysis. Clearance times are presented in this executive summary since the determination of clearance time is one of the most important outcomes from the evacuation transportation analysis.

Calculated clearance times are used by county emergency managers as one input to determine when to recommend an evacuation order. This calculation can include the population-at-risk, shadow evacuees, as well as evacuees from other counties anticipated to pass through the county. Clearance time is developed to include the time required for evacuees to secure their homes and prepare to leave, the time spent by all vehicles traveling along the evacuation route network, and the additional time spent on the road caused by traffic and road congestion. Clearance time does not relate to the time any one vehicle spends traveling along the evacuation route network, nor does it guarantee vehicles will safely reach their destination once outside the County. The four clearance times that are calculated as part of the evacuation transportation analysis include the following:

Table VI-9 – Base Scenarios

	Scenario 1 Level A 2010	Scenario 2 Level B 2010	Scenario 3 Level C 2010	Scenario 4 Level D 2010	Scenario 5 Level E 2010
Demographic Data	2010	2010	2010	2010	2010
Highway Network	2010	2010	2010	2010	2010
One-Way Operations	None	None	None	None	None
University Population	Fall/Spring	Fall/Spring	Fall/Spring	Fall/Spring	Fall/Spring
Tourist Rate	Default	Default	Default	Default	Default
Shelters Open	Primary	Primary	Primary	Primary	Primary
Response Curve	12-hour	12-hour	12-hour	12-hour	12-hour
Evacuation Phasing	None	None	None	None	None
Behavioral Response	100%	100%	100%	100%	100%
Evacuation Zone	A	B	C	D	E
Counties Evacuating	Indian River Martin Palm Beach St. Lucie Broward Brevard	Indian River Martin Palm Beach St. Lucie Broward Brevard	Indian River Martin Palm Beach St. Lucie Broward Brevard	Indian River Martin Palm Beach St. Lucie Broward Brevard	Indian River Martin Palm Beach St. Lucie Broward Brevard
	Scenario 6 Level A 2015	**Scenario 7 Level B 2015**	**Scenario 8 Level C 2015**	**Scenario 9 Level D 2015**	**Scenario 10 Level E 2015**
Demographic Data	2015	2015	2015	2015	2015
Highway Network	2015	2015	2015	2015	2015
One-Way Operations	None	None	None	None	None
University Population	Fall/Spring	Fall/Spring	Fall/Spring	Fall/Spring	Fall/Spring
Tourist Rate	Default	Default	Default	Default	Default
Shelters Open	Primary	Primary	Primary	Primary	Primary
Response Curve	12-hour	12-hour	12-hour	12-hour	12-hour
Evacuation Phasing	None	None	None	None	None
Behavioral Response	100%	100%	100%	100%	100%
Evacuation Zone	A	B	C	D	E
Counties Evacuating	Indian River Martin Palm Beach St. Lucie Broward Brevard	Indian River Martin Palm Beach St. Lucie Broward Brevard	Indian River Martin Palm Beach St. Lucie Broward Brevard	Indian River Martin Palm Beach St. Lucie Broward Brevard	Indian River Martin Palm Beach St. Lucie Broward Brevard

Table VI-10 – Operational Scenarios

	Scenario 1 Level A 2010	Scenario 2 Level B 2010	Scenario 3 Level C 2010	Scenario 4 Level D 2010	Scenario 5 Level E 2010
Demographic Data	2010	2010	2010	2010	2010
Highway Network	2010	2010	2010	2010	2010
One-Way Operations	None	None	None	None	None
University Population	Fall/Spring	Fall/Spring	Fall/Spring	Fall/Spring	Fall/Spring
Tourist Rate	Default	Default	Default	Default	Default
Shelters Open	Primary	Primary	Primary	Primary	Primary
Response Curve	6-hour	6-hour	6-hour	9-hour	9-hour
Evacuation Phasing	None	None	None	None	None
Behavioral Response	Planning	Planning	Planning	Planning	Planning
Evacuation Level	A	B	C	D	E
Counties Evacuating	Indian River Martin Palm Beach St. Lucie Broward Brevard	Indian River Martin Palm Beach St. Lucie Broward Brevard	Indian River Martin Palm Beach St. Lucie Broward Brevard	Indian River Martin Palm Beach St. Lucie Broward Brevard	Indian River Martin Palm Beach St. Lucie Broward Brevard
	Scenario 6 Level A 2015	**Scenario 7 Level B 2015**	**Scenario 8 Level C 2015**	**Scenario 9 Level D 2015**	**Scenario 10 Level E 2015**
Demographic Data	2015	2015	2015	2015	2015
Highway Network	2015	2015	2015	2015	2015
One-Way Operations	None	None	None	None	None
University Population	Fall/Spring	Fall/Spring	Fall/Spring	Fall/Spring	Fall/Spring
Tourist Rate	Default	Default	Default	Default	Default
Shelters Open	Primary	Primary	Primary	Primary	Primary
Response Curve	6-hour	6-hour	6-hour	9-hour	9-hour
Evacuation Phasing	None	None	None	None	None
Behavioral Response	Planning	Planning	Planning	Planning	Planning
Evacuation Level	A	B	C	D	E
Counties Evacuating	Indian River Martin Palm Beach St. Lucie Broward Brevard	Indian River Martin Palm Beach St. Lucie Broward Brevard	Indian River Martin Palm Beach St. Lucie Broward Brevard	Indian River Martin Palm Beach St. Lucie Broward Brevard	Indian River Martin Palm Beach St. Lucie Broward Brevard

1. Clearance Time to Shelter

The time necessary to safely evacuate vulnerable residents and visitors to a "point of safety" within the county based on a specific hazard, behavioral assumptions and evacuation scenario. Calculated from the point in time when the evacuation order is given to the point in time when the last vehicle reaches a point of safety within the county. Key points to remember for clearance time to shelter include:

- All in-county trips reach their destination within the county; and,
- This definition does not include any out of county trips.

2. In-County Clearance Time

The time required from the point an evacuation order is given until the last evacuee can either leave the evacuation zone or arrive at safe shelter within the county. This does not include those evacuees leaving the county on their own. Key points to remember for in-county clearance time include:

- All in-county trips reach their destination within the county;
- All out of county trips exit the evacuation zone, but may still be located in the county; and,
- This definition does not include out-of-county pass-through trips from adjacent counties, unless they evacuate through an evacuation zone.

3. Out of County Clearance Time

The time necessary to safely evacuate vulnerable residents and visitors to a "point of safety" within the county based on a specific hazard, behavioral assumptions and evacuation scenario. Calculated from the point an evacuation order is given to the point in time when the last vehicle assigned an external destination exits the county. Key points to remember for out of county clearance time include:

- The roadway network within the county is clear;
- All out of county trips exit the county, including out of county pass-through trips from adjacent counties; and,
- All in-county trips reach their destination.

4. Regional Clearance Time

The time necessary to safely evacuate vulnerable residents and visitors to a "point of safety" within the (RPC) region based on a specific hazard, behavioral assumptions and evacuation scenario. Calculated from last vehicle assigned an external destination exits the region. Key points to remember for regional clearance time include:

- The roadway network within the TCRPC is clear;
- All out of county trips exit the TCRPC region, including out of county pass-through trips from adjacent counties;
- All in-county trips reach their destination; and,
- Regional clearance time is equal to the largest out of county clearance time for a given scenario for any of the counties within the TCRPC region, since the out of county clearance time includes out of county pass through trips from adjacent counties.

Calculated clearance times are used by county emergency managers as one input to determine when to recommend an evacuation order. Clearance times for each of the base scenarios are summarized in **Table VI-11** and **VI-12**, while clearance times for

each of the operational scenarios are summarized in **Table VI-13** and **Table VI-14.** Clearance time includes several components, including the mobilization time for the evacuating population to prepare for an evacuation (pack supplies and personal belongings, load their vehicle, etc.), the actual time spent traveling on the roadway network, and the delay time caused by traffic congestion.

5. Base Scenarios

In-county clearance times for the 2010 base scenarios range from 12.5 hours to 35.5 hours, depending upon the evacuation level. Palm Beach County has the highest in-county clearance time of 35.5 hours for the level E scenario. Clearance time to shelter shows a similar pattern, with clearance times ranging from 11 to 35.5 hours.

In 2015, in-county clearance times for the base scenarios vary between 12 hours for the evacuation level A scenarios and 30.5 hours for Indian River County for the evacuation level E scenario. This shows a slight reduction in clearance time from 2010 due to the completion of several roadway improvement projects throughout the region. Clearance Time to Shelter shows a similar pattern, with clearance times for the base scenarios ranging from 11 hours for the evacuation level A scenarios to 25.5 hours for Palm Beach County for evacuation level E scenario in 2015.

Out of county clearance times for the 2010 base scenarios range from 14 to 35.5 hours, while in 2015 they range from 14 hours for the base evacuation level A scenario to 31.5 hours in Indian River County for the evacuation level E scenario in 2015. Regional clearance time for the four county TCRPC region ranges from 14.5 hours to 35.5 hours.

6. Operational Scenarios

In-county clearance times for the 2010 operational scenarios range from 5.5 hours to 40.5 hours depending upon the scenario. Clearance Time to Shelter are significantly lower, with clearance times for the operational scenarios ranging from 0 hours to 19.5 hours depending upon the county and the scenario.

In 2015, in-county clearance times for the operational scenarios vary from 0 hours to 38.5 hours for the level B evacuation in Palm Beach County. The 2010 level B evacuation includes vehicle trips evacuating from as far south as Monroe County and the Florida Keys, which causes a large northbound evacuation through Palm Beach County. Clearance Time to Shelter is significantly lower, with clearance times for the base scenarios ranging from 0 hours to 19.0 hours depending upon the scenario.

Out of county clearance times for the 2010 operational scenarios range from 7 hours to 41.5 hours for the evacuation level C scenario, which includes Monroe County evacuations. Out of county clearance times are similar for all counties in 2015 to between 10.5 and 40 hours depending upon the scenario. Regional clearance time for the four county TCRPC region ranges from 8 hours to 41.5 hours in 2010. This time increases to between 11 and 40 hours in 2015.

Table VI-11 – 2010 Clearance Times for Base Scenarios

	Evacuation Level A Base Scenario	Evacuation Level B Base Scenario	Evacuation Level C Base Scenario	Evacuation Level D Base Scenario	Evacuation Level E Base Scenario
Clearance Time to Shelter					
Indian River	12.5	12.5	14.0	13.0	18.0
Martin	12.5	12.5	12.5	13.5	15.5
Palm Beach	13.5	13.0	13.5	16.0	25.5
St. Lucie	12.5	12.5	13.0	16.0	18.0
In-County Clearance Time					
Indian River	12.5	13.0	15.0	18.5	27.0
Martin	13.5	14.0	14.0	15.5	23.0
Palm Beach	14.5	14.5	14.5	17.5	26.5
St. Lucie	13.0	13.5	14.0	17.5	25.0
Out of County Clearance Time					
Indian River	14.5	14.5	16.0	19.5	28.0
Martin	14.0	14.0	14.0	16.0	23.0
Palm Beach	14.5	14.5	14.5	17.5	26.5
St. Lucie	14.0	14.5	14.5	18.5	25.0
Regional Clearance Time					
Treasure Coast	14.5	14.5	16.0	19.5	28.0

Table VI-12 – 2015 Clearance Times for Base Scenario

	Evacuation Level A Base Scenario	Evacuation Level B Base Scenario	Evacuation Level C Base Scenario	Evacuation Level D Base Scenario	Evacuation Level E Base Scenario
Clearance Time to Shelter					
Indian River	12.5	12.5	13.0	15.5	19.0
Martin	12.5	12.5	12.5	14.0	17.0
Palm Beach	13.5	13.5	13.5	16.0	23.5
St. Lucie	12.5	12.5	13.5	14.0	16.5
In-County Clearance Time					
Indian River	12.5	14.0	15.0	17.5	37.5
Martin	13.5	13.5	14.0	16.0	23.0
Palm Beach	14.0	14.0	14.0	17.0	26.5
St. Lucie	13.0	14.0	14.0	16.0	31.0
Out of County Clearance Time					
Indian River	14.5	15.0	16.0	19.5	41.0
Martin	14.0	14.0	14.0	16.0	23.0
Palm Beach	14.5	14.0	14.5	17.0	26.5
St. Lucie	14.5	14.5	14.5	16.5	34.0
Regional Clearance Time					
Treasure Coast	14.5	15.0	16.0	19.5	41.0

Table VI-13 – 2010 Clearance Times for Operational Scenarios

	Evacuation Level A Operational Scenario	Evacuation Level B Operational Scenario	Evacuation Level C Operational Scenario	Evacuation Level D Operational Scenario	Evacuation Level E Operational Scenario
Clearance Time to Shelter					
Indian River	6.5	6.5	7.0	10.5	13.0
Martin	6.5	6.5	7.5	11.0	14.5
Palm Beach	7.0	7.0	8.5	13.0	28.5
St. Lucie	6.5	6.5	6.5	12.0	12.0
In-County Clearance Time					
Indian River	7.5	9.5	12.5	16.5	26.5
Martin	7.5	7.5	8.0	12.5	26.5
Palm Beach	8.0	8.0	10.0	16.0	31.5
St. Lucie	7.0	8.0	10.5	15.5	25.0
Out of County Clearance Time					
Indian River	9.0	9.5	13.5	20.0	26.5
Martin	8.0	8.0	8.0	12.5	26.5
Palm Beach	8.0	8.0	10.0	16.0	32.0
St. Lucie	8.5	8.5	11.5	17.0	25.0
Regional Clearance Time					
Treasure Coast	9.0	9.5	13.5	20.0	32.0

Table VI-14 – 2015 Clearance Times for Operational Scenarios

	Evacuation Level A Operational Scenario	Evacuation Level B Operational Scenario	Evacuation Level C Operational Scenario	Evacuation Level D Operational Scenario	Evacuation Level E Operational Scenario
Clearance Time to Shelter					
Indian River	6.5	6.5	7.0	11.0	12.0
Martin	6.5	7.0	7.5	11.5	14.5
Palm Beach	7.5	7.5	10.5	21.0	20.5
St. Lucie	6.0	6.5	6.5	12.0	16.0
In-County Clearance Time					
Indian River	8.0	9.5	12.5	19.5	27.5
Martin	7.5	7.5	8.5	13.0	20.5
Palm Beach	8.0	8.0	11.0	21.5	31.0
St. Lucie	7.0	8.0	11.5	16.5	26.0
Out of County Clearance Time					
Indian River	9.0	10.5	13.0	19.5	27.5
Martin	8.0	7.5	8.5	13.0	21.0
Palm Beach	8.5	8.5	11.0	21.5	31.0
St. Lucie	8.0	8.5	12.0	17.5	26.0
Regional Clearance Time					
Treasure Coast	9.0	10.5	13.0	21.5	31.0

J. Maximum Evacuating Population Clearances

From an emergency management standpoint, it is important to get an understanding of the maximum proportion of the evacuating population that can be expected to evacuate at various time intervals during an evacuation. Should storm conditions change during an evacuation, emergency managers will need to be able to estimate what portion of the evacuating population is estimated to still remain within the county trying to evacuate.

Using the base scenarios, which assume 100% of the vulnerable population is evacuating, along with shadow evacuations and evacuations from adjacent counties, an estimate was made of the evacuating population actually able to evacuate out of each county by the time intervals of 12, 18, 24, and 36 hours. The estimated maximum evacuating population by time interval for 2010 is identified in **Table VI-15** and for 2015 in **Table VI-16**.

It is important to note that these estimates take into account many variables, including roadway capacity, in-county evacuating trips, out of county evacuating trips, evacuating trips from other counties, and background traffic that is impeding the evacuation trips. For this reason, the maximum evacuation population by time interval will vary slightly between evacuation level and either increase or decrease from one evacuation level to the next.

K. Sensitivity Analysis

As discussed previously, there are literally thousands of possible combinations of variables that can be applied using the evacuation transportation model, which will result in thousands of possible outcomes. As part of the analysis process, a sensitivity analysis was conducted using the prototype model to evaluate the effect of different response curves on the calculated evacuation clearance times. Calculated clearance times will never be lower than the designated response time, since some evacuating residents will wait to evacuate until near the end of the response time window. For example, using a 12-hour response curve in the analysis means that all residents will begin their evacuation process within 12-hours, and some residents will choose to wait and begin evacuating more than 11.5 hours from when the evacuation was ordered. This will generate a clearance time of more than 12 hours.

The sensitivity analysis identified that clearance times will vary by scenario and by any of the numerous parameters that can be chosen in a particular scenario model run (demographics, student population, tourist population, different counties that are evacuating, response curve, phasing, shadow evacuations, etc.). A few general rules of thumb did emerge from the sensitivity analysis that can provide some guidance to the region regarding the sensitivity of the response curve to the calculated clearance times:

- For low evacuation levels A and B, clearance time will vary by as much as 40 percent depending on the response curve. Low evacuation levels A and B have fewer evacuating vehicles that can be accommodated more easily on the transportation network. In most cases, clearance times typically exceed the response curve by one to two hours. Thus, a 12 hour response curve may yield a clearance time of 13 or 14 hours while an 18 hour response curve may yield a clearance time of 19 or 20 hours. This leads to a higher level of variability than larger evacuations;

Table VI-15 – Maximum Evacuating Population by Time Interval for 2010

	Evacuation Level A	Evacuation Level B	Evacuation Level C	Evacuation Level D	Evacuation Level E
Estimated Evacuating Population Clearing Indian River County					
12-Hour	35,690	51,118	47,322	45,366	33,492
18-Hour	43,125	61,768	63,096	68,049	50,239
24-Hour				73,720	66,985
36-Hour					78,149
Estimated Evacuating Population Clearing Martin County					
12-Hour	25,642	32,774	38,807	47,615	44,695
18-Hour	29,916	38,236	45,275	63,486	67,042
24-Hour					85,665
36-Hour					
Estimated Evacuating Population Clearing Palm Beach County					
12-Hour	154,704	160,289	232,077	244,557	201,367
18-Hour	186,934	193,682	280,426	356,645	302,051
24-Hour					402,734
36-Hour					444,686
Estimated Evacuating Population Clearing St. Lucie County					
12-Hour	33,197	44,600	46,544	53,687	46,529
18-Hour	38,730	53,892	56,241	80,531	69,793
24-Hour				82,768	93,058
36-Hour					96,935

Note: These estimates take into account many variables, including roadway capacity, in-county evacuating trips, out of county evacuating trips, evacuating trips from other counties, and background traffic that is impeding the evacuation trips. For this reason, the maximum evacuation population by time interval will vary between evacuation level and either increase or decrease from one evacuation level to the next.

Table VI-16 – Maximum Evacuating Population by Time Interval for 2015

	Evacuation Level A	Evacuation Level B	Evacuation Level C	Evacuation Level D	Evacuation Level E
Estimated Evacuating Population Clearing Indian River County					
12-Hour	37,558	52,358	50,159	48,208	24,328
18-Hour	45,383	65,447	66,878	72,312	36,491
24-Hour				78,338	48,655
36-Hour					72,983
Estimated Evacuating Population Clearing Martin County					
12-Hour	26,541	34,245	40,508	50,125	47,084
18-Hour	30,964	39,952	47,259	66,833	70,626
24-Hour					90,244
36-Hour					
Estimated Evacuating Population Clearing Palm Beach County					
12-Hour	166,981	179,163	250,524	271,808	217,408
18-Hour	201,769	209,023	302,717	385,061	326,112
24-Hour					434,817
36-Hour					480,110
Estimated Evacuating Population Clearing St. Lucie County					
12-Hour	34,145	48,539	50,590	66,909	38,248
18-Hour	41,259	58,651	61,129	92,000	57,372
24-Hour					76,496
36-Hour					108,370

Note: These estimates take into account many variables, including roadway capacity, in-county evacuating trips, out of county evacuating trips, evacuating trips from other counties, and background traffic that is impeding the evacuation trips. For this reason, the maximum evacuation population by time interval will vary between evacuation level and either increase or decrease from one evacuation level to the next.

- For mid-level evacuations such as C and sometimes D, clearance time varied by as much as 25 percent during the sensitivity analysis. The number of evacuating vehicles is considerably higher than for levels A and B, and lower response curves tend to load the transportation network faster than longer response curves. The variability in clearance times is less in these cases than for low evacuation levels; and,

- For high-level evacuations such as some level D evacuations and all E evacuations, clearance time variability is reduced to about 10 to 15 percent. Large evacuations involve large numbers of evacuating vehicles, and the sensitivity test identified that clearance times are not as dependent on the response curve as lower level evacuations since it takes a significant amount of time to evacuate a large number of vehicles.

The counties within the Treasure Coast Region are encouraged to test additional scenarios beyond what has been provided in this study. Each model run will provide additional information for the region to use in determining when to order an evacuation. Due to advancements in computer technology and the nature of the developed transportation evacuation methodology, this study includes a more detailed and time consuming analysis process than used in previous years studies. Counties interested in testing various response curves for each scenario can easily do so using the TIME interface to calculate clearance times for different response curves.

L. Summary and Conclusions

Through a review of the results of the 20 different scenarios (10 base and 10 operational), several conclusions could be reached regarding the transportation analysis, including the following:

- Critical transportation facilities within the TCRPC region include I-95, the Turnpike, SR 60, and portions of US 441 and SR 710 for all evacuation scenarios. For large storm events, such as level D and E evacuations, other State facilities also play an important role in evacuations, such as SR 76 in Martin County and SR 68 in St. Lucie County;

- During the level A and B evacuation scenarios, the roadway segments with the highest vehicle queues are primarily concentrated along the major Interstate and State Highway system. During these levels of evacuation, State and County officials should coordinate personnel resources to provide sufficient traffic control at interchanges and major intersections along these routes;

- In contrast, for the higher level C, D, and E evacuation scenarios, many other roadway facilities, both within and outside of the region, will require personnel resources for sufficient traffic control at interchanges and major intersections;

- TCRPC counties play a major role even when evacuations occur in other parts of the State, especially with South Florida and Monroe County storm events. For example, for the operational scenarios including evacuations of the Florida Keys, out of county clearance times for TCRPC counties were significantly higher due to a large influx of evacuees from other counties. TCRPC counties should continue their coordination efforts with the State on public information campaigns to clearly define those that are

vulnerable and should evacuate verses those who choose to evacuate on their own.

- The Florida Department of Transportation should continue to work with local counties on implementing intelligent transportation system (ITS) technology, which will provide enhanced monitoring and notification systems to provide evacuating traffic with up to date information regarding expected travel times and alternate routes;

- The State can use the data and information provided in this report (specifically the evacuating vehicle maps in Volume 5-10, Evacuation Transportation Supplemental Data Report) to estimate fuel and supply requirements along major evacuation routes to aid motorists during the evacuation process;

- For major evacuation routes that have signalized traffic control at major intersections, traffic signal timing patterns should be adjusted during the evacuation process to provide maximum green time for evacuating vehicles in the predominate north and west directions; and,

- The counties within the Treasure Coast Region are encouraged to test additional transportation scenarios beyond what has been provided in this study. Each model run will provide additional information for the region to use in planning for an evacuation. Counties interested in testing various response curves for each scenario can easily do so using the TIME interface to calculate clearance times for different evacuation conditions, such as different evacuation levels, different behavioral response assumptions, and different response curves.