



Volume 1-5

Withlacoochee Region Technical Data Report

CHAPTER VI

EVACUATION TRANSPORTATION ANALYSIS



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CHAPTER VI EVACUATION TRANSPORTATION ANALYSIS



The evacuation transportation analysis discussed in this volume 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 best way 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, to facilitate knowledge sharing between state, regional, county, and local partners. To achieve this objective, it is important for all 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 the Regional Planning Councils.

B. Study Area

The study area for this analysis includes the five county Withlacoochee Regional Planning Council area. 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 Withlacoochee region. While the impact of other regions is included in the Withlacoochee analysis, it is important to note that the results of the transportation analysis presented in this document are only reported for the five counties included in the Withlacoochee RPC. 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, Department of Transportation, Department of Community Affairs, and local county emergency management teams. At the statewide level, the transportation consultant, Wilbur Smith Associates, participated in SRESP Work Group Meetings which were typically held on a monthly basis to discuss the development of the transportation methodology and receive feedback and input from the State 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 Regional Planning Councils and the Division of Emergency Management. The methodology used in the Withlacoochee RPC Evacuation Transportation Analysis is identical to the methodology used for all eleven Regional Planning Councils and includes the following components:

- **Behavioral Assumptions** – In 2008, the Statewide Regional Evacuation Study Program (SRESP) commissioned a survey of Florida residents. 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.
- **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 contain 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.

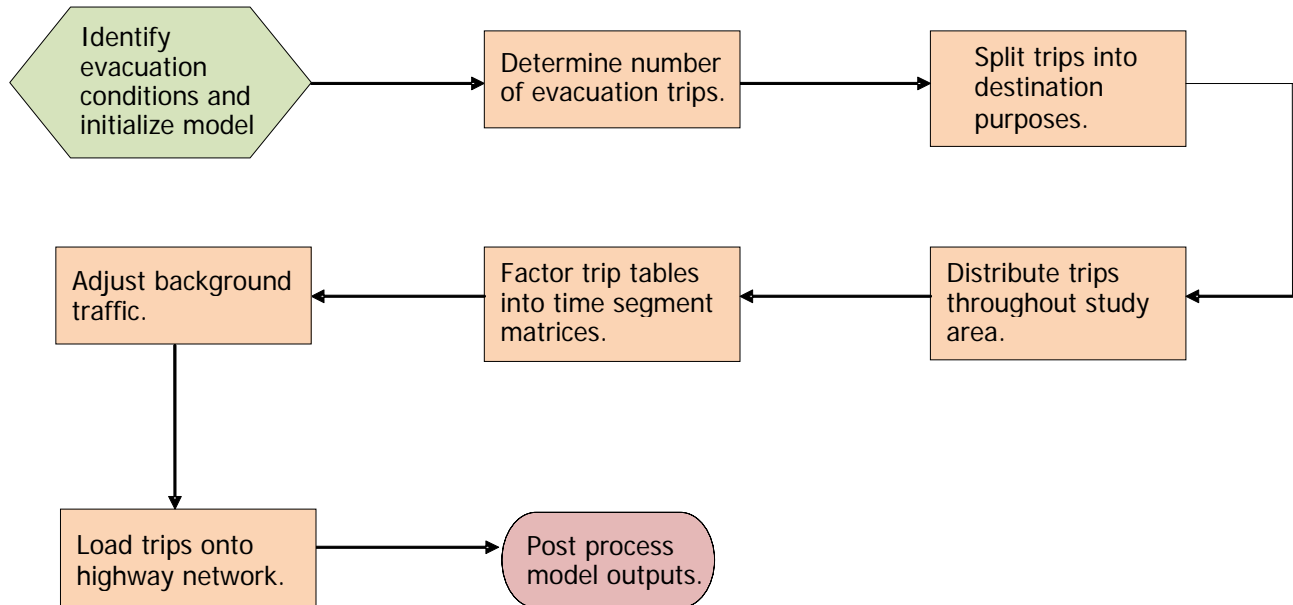
- **Background Traffic** - The traffic that consumes the roadway capacity of a transportation system during an evacuation can be divided into two groups. The first group is the evacuation traffic itself. Once the evacuation demand is determined, this information is converted into a number of vehicles 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 mostly unconcerned with 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.

- **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



- **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.
- **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, the use of survey rates, the 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.

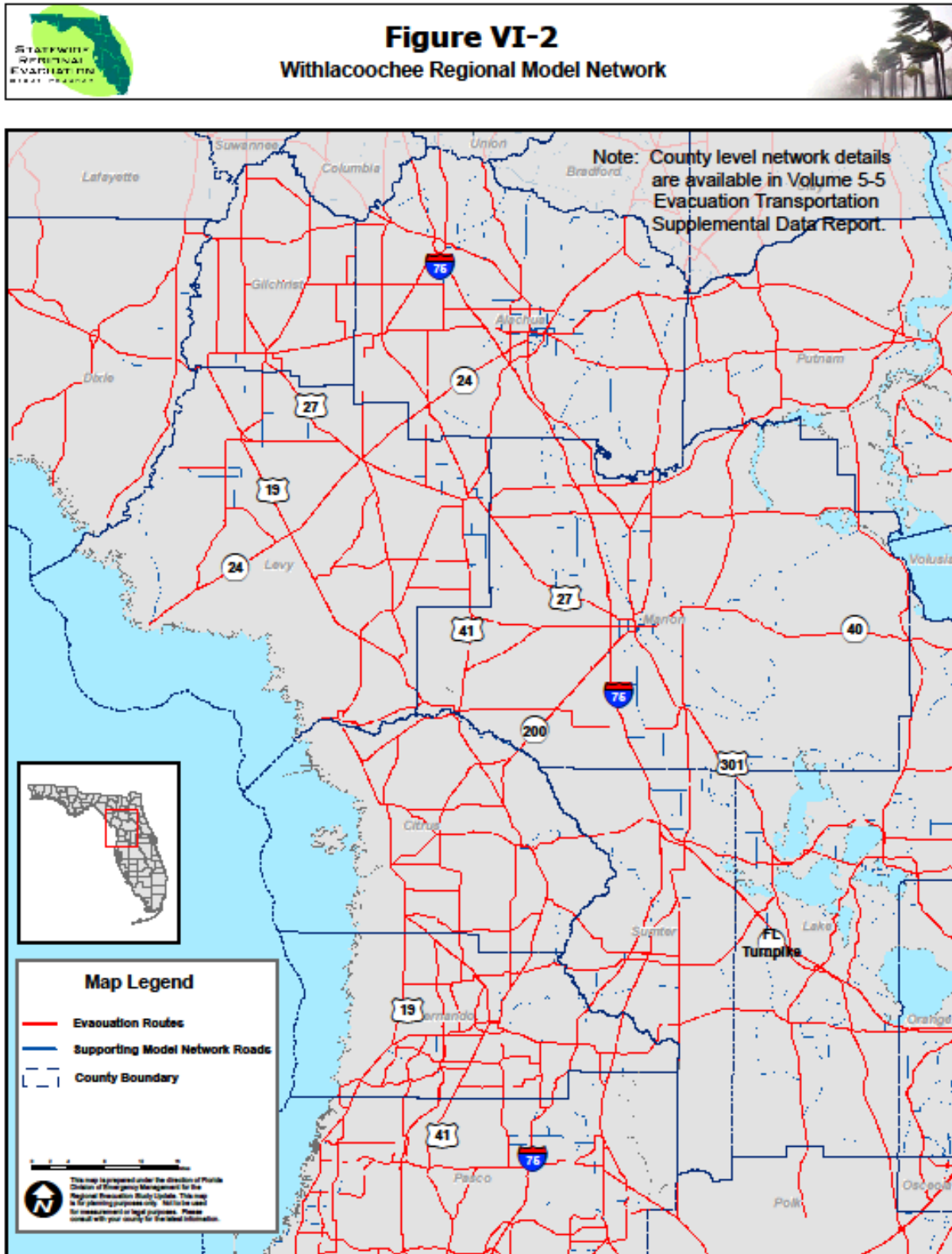
E. Regional Model Implementation

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

- **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 Withlacoochee RPC. The RPC 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 WRPC. County level details of the regional model network are provided in the Volume 5-5 report. The regional model network for the Withlacoochee region includes key roadways within the five county region, including I-75, Florida's Turnpike, Suncoast Parkway, US 19, US 98, US 27, US 301, US 19, US 41, SR 24, SR 40, SR 44, and SR 50.
- **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 363 TEZs located within the five county Withlacoochee region, as illustrated in **Figure VI-3**. In the Withlacoochee region, Marion County has the largest number of TEZs with 151, and Hernando follows with 71 TEZs. Sumter County has 60 TEZs, while Citrus and Levy Counties have the lowest number of TEZs within the RPC with 55 and 26 zones, respectively. The larger number of TEZs generally reflect counties with denser urban structure and higher population densities.
- **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 Withlacoochee RPC 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.

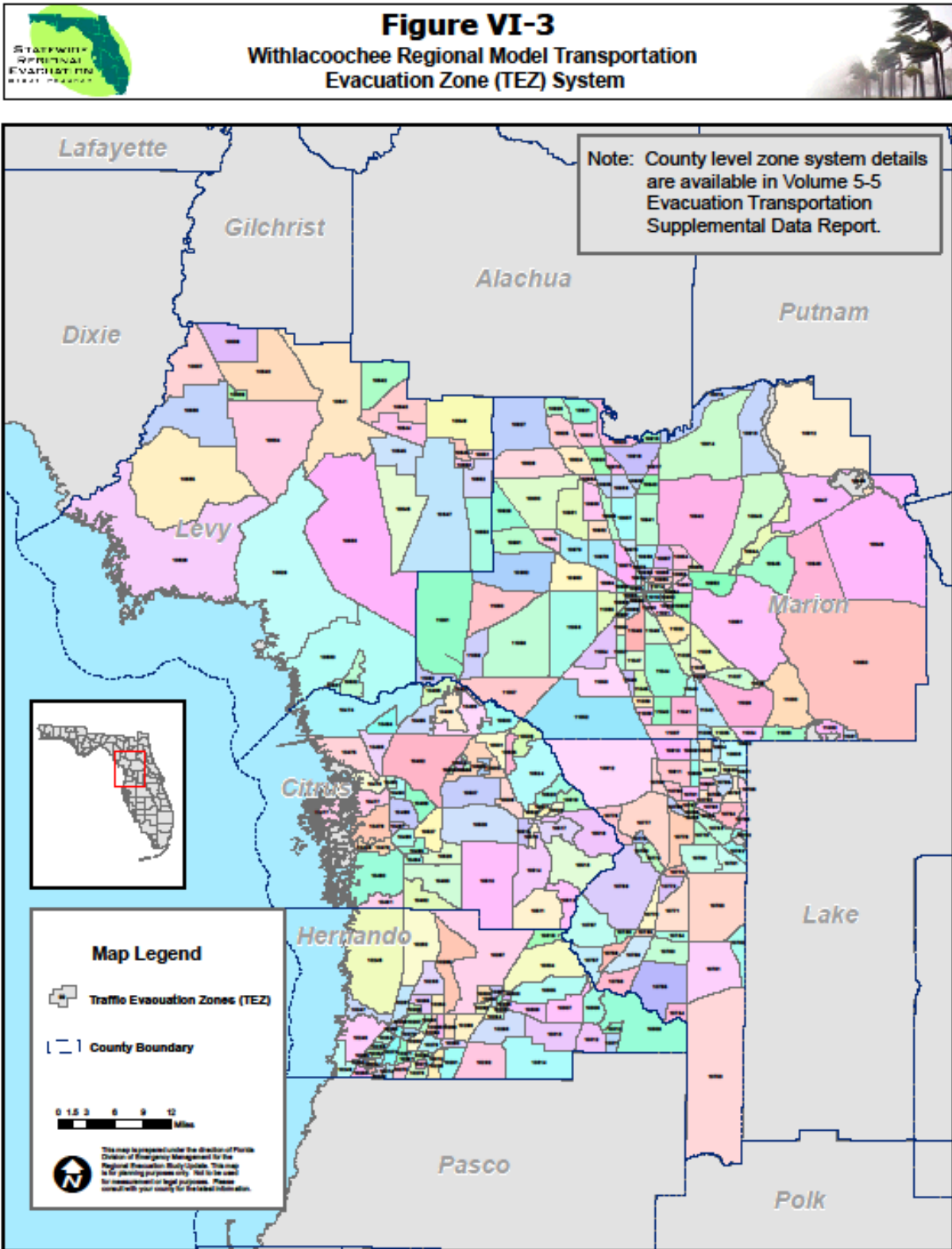
Figure VI-2 Withlacoochee Regional Model Network



Sources: Withlacoochee Regional Planning Council, Wilbur Smith Associates

Map Project: June, 2010

Figure VI-3 Withlacoochee Regional Model Traffic Evacuation Zone Map



Sources: Withlacoochee Regional Planning Council, Wilbur Smith Associates

Map Printed: June, 2010

Marion County has the largest population in the region during all three time periods. The county is expected to reach over 400,000 people by 2015. Hernando County has the second largest population in the region is forecasted to have almost 190,000 people by 2015. Citrus is projected to have the third largest population in the region, hitting the 150,000 by 2015. Sumter County falls just below Citrus at just over 130,000; however, it is significant to note that Sumter County is expected to grow by almost 50% between 2006 and 2105. Of all the counties, Levy County has the smallest population for all three time periods and may reach more than 45,000 people by 2015.

Marion County has the highest number of mobile homes followed by Citrus and Hernando. Levy County has the smallest number of mobile homes in the Withlacoochee region, but these homes, in fact, make up 50% of the total homes in the county.

Table VI-1 Withlacoochee Demographic Characteristic Summary

County	Characteristic	Year		
		2006	2010	2015
Citrus	Occupied site-built homes	41,970	45,819	50,178
	Population in site-built homes	92,584	101,065	110,690
	Occupied mobile homes	11,568	15,172	16,619
	Population in mobile home	27,937	36,641	40,134
	Hotel/motel units	1,713	1,713	1,713
Hernando	Occupied site-built homes	52,510	58,191	64,819
	Population in site-built homes	123,980	137,383	153,045
	Occupied mobile homes	10,649	13,940	15,530
	Population in mobile home	25,039	32,781	36,527
	Hotel/motel units	1,661	1,661	1,661
Levy	Occupied site-built homes	7,722	8,428	9,238
	Population in site-built homes	19,188	20,942	22,952
	Occupied mobile homes	6,654	8,728	9,565
	Population in mobile home	15,993	20,974	22,987
	Hotel/motel units	952	952	952
Marion	Occupied site-built homes	104,389	117,261	131,514
	Population in site-built homes	247,821	279,465	314,997
	Occupied mobile homes	31,261	35,933	39,095
	Population in mobile home	80,082	92,194	100,501
	Hotel/motel units	6,447	6,647	6,647
Sumter	Occupied site-built homes	32,014	38,913	47,404
	Population in site-built homes	64,623	81,063	101,868
	Occupied mobile homes	8,869	9,583	10,543
	Population in mobile home	24,809	26,673	29,479
	Hotel/motel units	612	612	862

Source: Withlacoochee Regional Planning Council

- **Planned Roadway Improvements** - 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 Citrus County, CR 486 from SR 44 to Ottawa Ave will be widened to 4 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.

- **Behavioral Assumptions** - For the Withlacoochee Region, three of the counties within the region have evacuation zones corresponding to five 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-9**. 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 5-5.

A review of the evacuation rates for the Withlacoochee region illustrates that evacuation participation rates increase as the evacuation level increases, and participation rates for persons living in mobile/manufactured homes are generally higher than for persons living in site-built homes. It should be noted that a certain percentage of the population evacuates, even when they are not living in an area that is ordered to evacuate. These people are commonly referred to as shadow evacuees. Shadow evacuation rates are also included in Figure VI-4 through Figure VI-9.

- **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 five county region there are a total of 153 shelters, including 42 in Citrus County, 41 in Marion County, 34 in Hernando County, 22 in Sumter County, and 14 in Levy County. All together, the 153 shelters located within the five county region can host nearly 40,000 persons during an evacuation event. Detailed lists of the available public shelters by county are included in Volume 5-5.

Table VI-2 Withlacoochee Region Roadway Improvements, 2006-2010

County	Roadway	From	To	Number of Lanes
Citrus	CR 486	Ottawa Ave	US 41	4
	SR 44	US 41	Sumter County line	4
Hernando	CR 578 (County Line Rd)	US 19	E of East Rd	4
	Barclay Ave	Spring Hill Rd	Powell Rd	4
	Barclay Ave	Powell Rd	SR 50	4
Marion	SR 40	SW 80th Ave (CR 225A)	52nd Ave	4
	CR 484	I-75	US 27	4
	NW 60th Ave	SR 200	US 27	4
	SR 35 (US 301)	Sumter County line	CR 42	4
Sumter	SR 44	Citrus County line	I-75	4
	SR 35 (US 301)	CR 214	Marion County line	4
	CR 466	US 301	Lake County line	4

Sources: FDOT SIS First Five Year Plan, FDOT SIS Second Five Year Plan, Withlacoochee 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 Withlacoochee Planned Roadway Improvements, 2011-2015

County	Roadway	From	To	Number of Lanes
Citrus	CR 486	SR 44	Ottawa Ave	4
Hernando	SR 50 (Cortez Blvd)	US 19 (SR 55)	W of Mariner Blvd	6
Marion	SW 42nd St	Overpass from SR 200	SW 27th Ave	2
	SR 40	CR 328	SW 80th Ave (CR 225A)	4
	SR 35 (Baseline Rd)	S CR 464 (Maricamp Rd)	SR 40	4
Sumter	SR 35 (US 301)	N of CR 466A	CR 214	4
	CR 468	CR 466A	CR 466	4
	Turnpike	@CR 468		New interchange

Sources: FDOT SIS First Five Year Plan, FDOT SIS Second Five Year Plan, Withlacoochee 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: Citrus County - Site-Built Homes

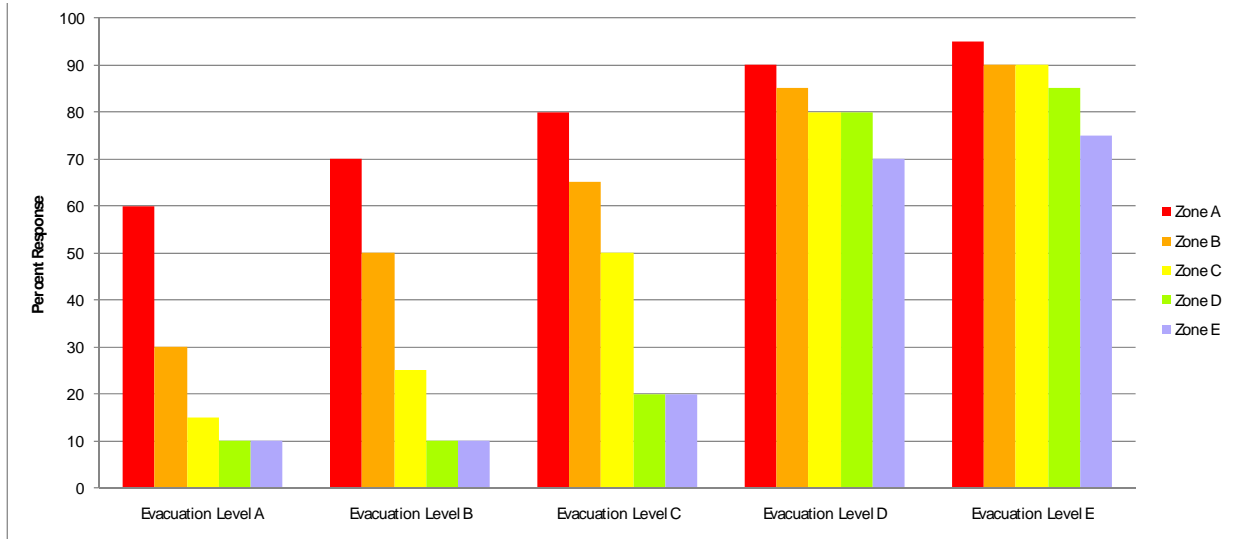


Figure VI-5 Evacuation Participation Rates: Citrus County - Mobile Homes

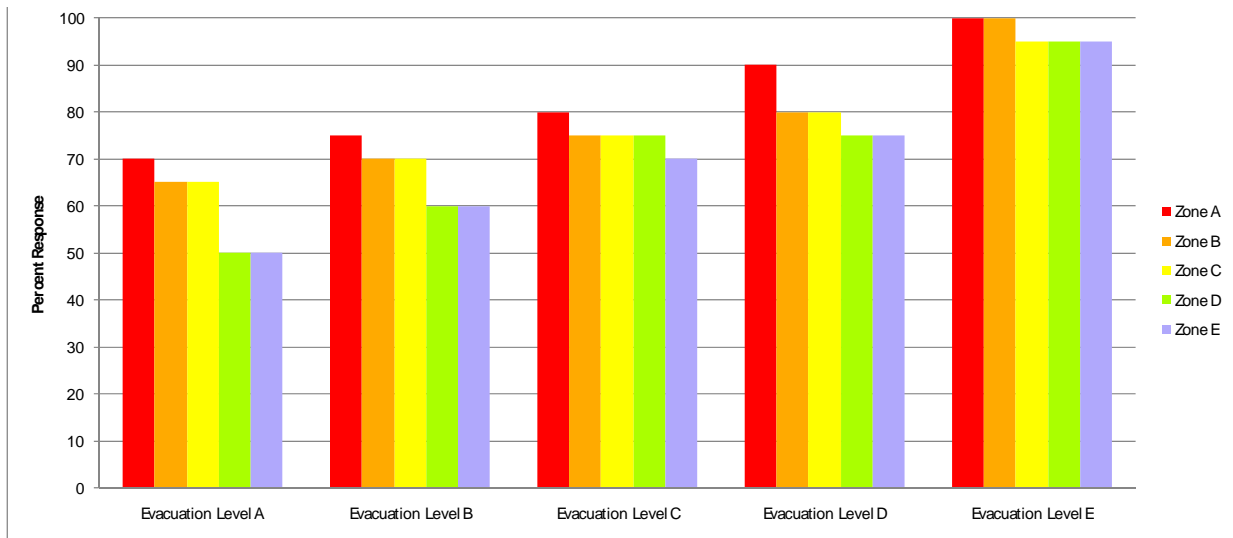


Figure VI-6 Evacuation Participation Rates: Hernando County - Site Built Homes

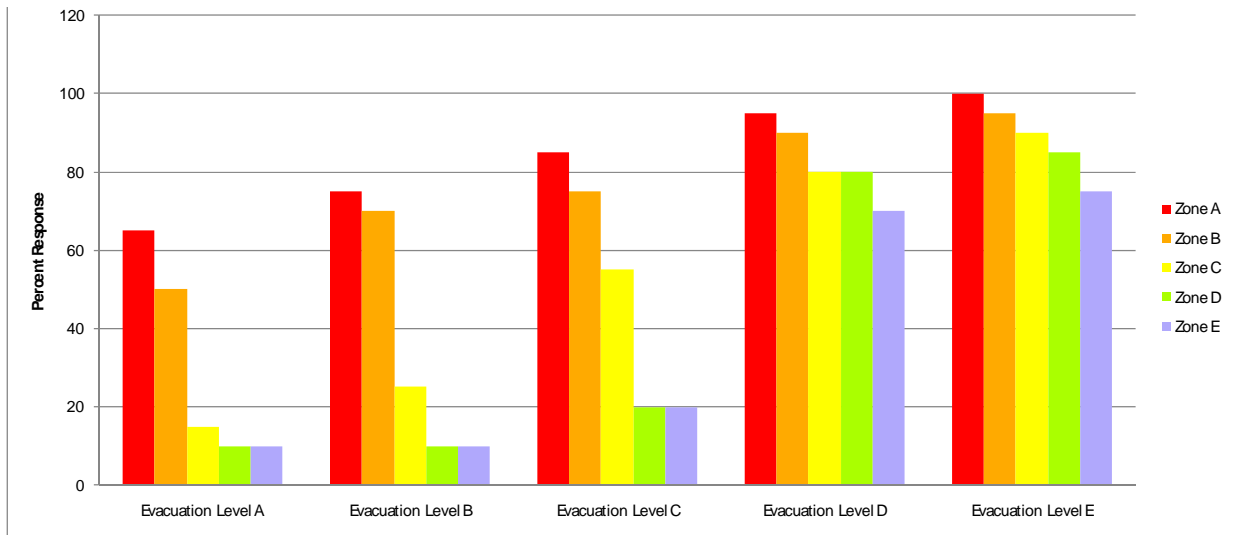


Figure VI-7 Evacuation Participation Rates: Hernando County - Mobile Homes

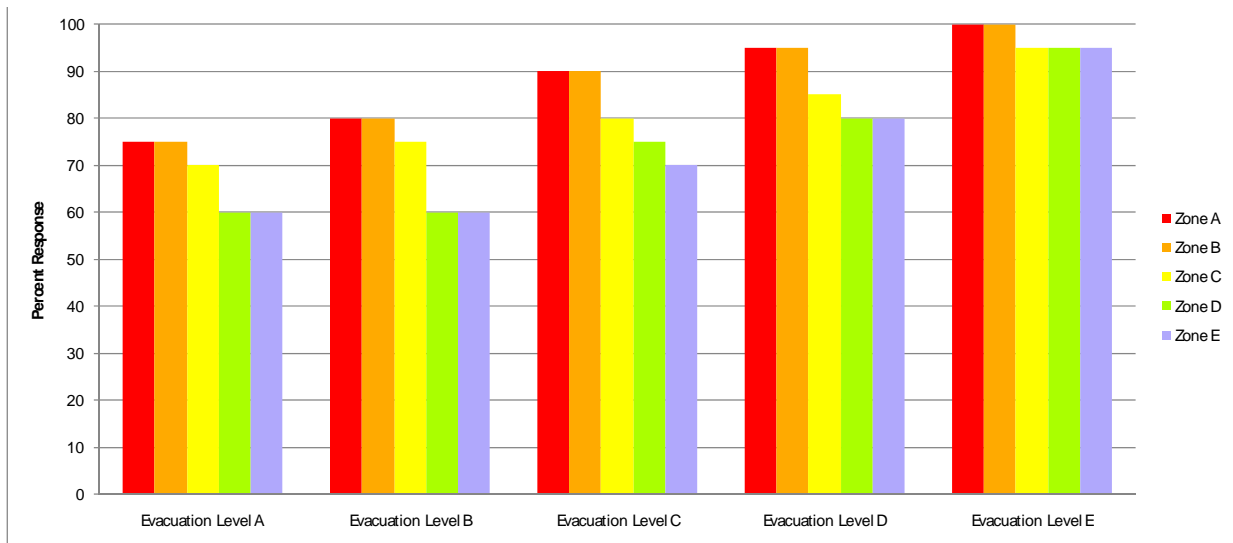


Figure VI-8 Evacuation Participation Rates: Levy County - Site Built Homes

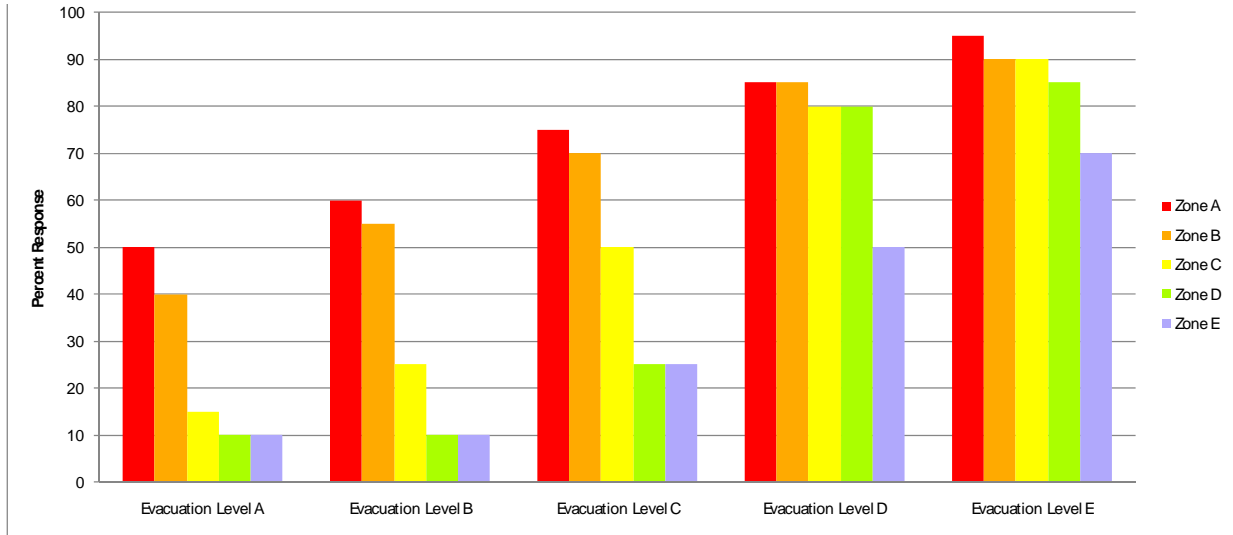
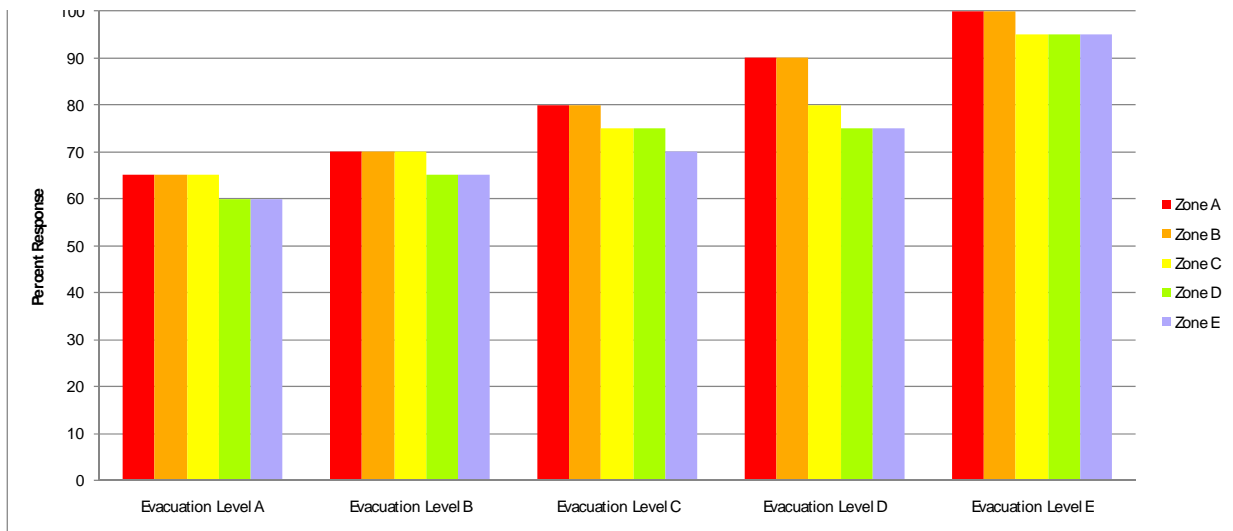


Figure VI-9 Evacuation Participation Rates: Levy County - Mobile Homes

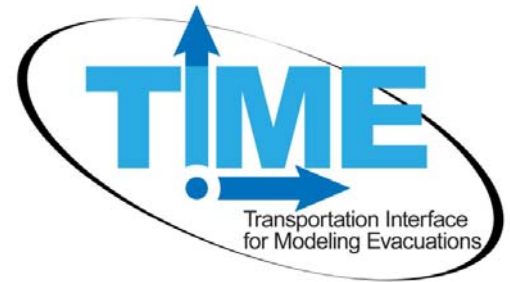


- Evacuation Zones** - The final input variable that is needed to complete the transportation evacuation model is the delineation of evacuation zones for all coastal counties. Local county emergency managers have the responsibility of identifying and defining evacuation zones for their county. Citrus, Hernando, and Levy Counties within the Withlacoochee 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 5-5.

F. TIME User Interface

Wilbur Smith Associates developed the Transportation Interface for Modeling Evacuations (TIME) to make it easier for RPC 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 Withlacoochee 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 Withlacoochee Region for 2010

	Evacuation Zone A	Evacuation Zone B	Evacuation Zone C	Evacuation Zone D	Evacuation Zone E
Citrus County					
Site-built Homes	14,702	7,549	1,319	3,241	1,958
Mobile/Manuf. Homes	6,338	4,384	891	1,130	723
TOTAL	21,040	11,933	2,211	4,371	2,681
Hernando County					
Site-built Homes	3,998	1,886	3,200	7,549	34,296
Mobile/Manuf. Homes	1,064	213	415	1,073	1,836
TOTAL	5,061	2,099	3,614	8,622	36,132
Levy County					
Site-built Homes	1,778	1,568	620	314	1,688
Mobile/Manuf. Homes	1,087	1,249	683	364	1,471
TOTAL	2,865	2,817	1,304	678	3,158

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 Withlacoochee Region for 2015

	Evacuation Zone A	Evacuation Zone B	Evacuation Zone C	Evacuation Zone D	Evacuation Zone E
Citrus County					
Site-built Homes	16,100	8,268	1,445	3,549	2,144
Mobile/Manuf. Homes	6,942	4,802	976	1,238	792
TOTAL	23,042	13,070	2,421	4,787	2,936
Hernando County					
Site-built Homes	4,453	2,101	3,564	8,410	38,206
Mobile/Manuf. Homes	1,185	237	462	1,196	2,047
TOTAL	5,637	2,338	4,026	9,606	40,253
Levy County					
Site-built Homes	1,948	1,719	680	344	1,849
Mobile/Manuf. Homes	1,191	1,369	749	399	1,611
TOTAL	3,140	3,088	1,429	743	3,461

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 Withlacoochee 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
Citrus County					
To Friends and Family	13,359	7,537	1,392	2,785	1,706
To Hotel/ Motel	2,839	1,571	287	656	402
To Public Shelter	1,369	816	195	316	193
To Other Destination	13,359	7,537	1,280	2,721	1,660
Hernando County					
To Friends and Family	3,290	1,364	2,349	5,604	23,486
To Hotel/ Motel	759	315	542	1,293	5,420
To Public Shelter	359	126	297	711	2,927
To Other Destination	2,224	934	2,086	4,204	17,882
Levy County					
To Friends and Family	1,521	1,487	683	355	1,664
To Hotel/ Motel	484	485	230	120	547
To Public Shelter	198	203	165	86	389
To Other Destination	1,877	1,801	745	386	1,832

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
Citrus County					
To Friends and Family	14,630	8,255	1,525	3,050	1,869
To Hotel/ Motel	3,109	1,720	314	718	440
To Public Shelter	1,499	894	213	346	211
To Other Destination	14,630	8,255	1,402	2,980	1,817
Hernando County					
To Friends and Family	3,664	1,520	2,617	6,244	26,165
To Hotel/ Motel	846	351	604	1,441	6,038
To Public Shelter	400	141	331	792	3,261
To Other Destination	2,478	1,040	2,323	4,684	19,922
Levy County					
To Friends and Family	1,667	1,630	748	389	1,823
To Hotel/ Motel	531	532	252	131	600
To Public Shelter	217	223	180	94	427
To Other Destination	2,057	1,974	816	423	2,008

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					
Citrus County	41,601	35,084	37,994	44,677	49,837
Hernando County	46,014	45,192	52,490	75,910	58,871
Levy County	22,739	21,070	21,280	22,763	22,738
Marion County	134,181	148,168	162,155	176,142	176,142
Sumter County	38,842	42,893	46,943	50,994	55,045
2015					
Citrus County	45,458	38,319	41,509	48,809	54,462
Hernando County	51,239	50,322	58,448	84,496	65,486
Levy County	24,894	23,055	23,285	24,910	24,879
Marion County	147,808	163,583	179,357	195,131	195,131
Sumter County	44,777	49,874	54,970	60,066	65,162

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:

- **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 RPC 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 Withlacoochee region are identified in **Table VI-9**; and,
- **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 Withlacoochee 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 Withlacoochee RPC 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 Withlacoochee 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. 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	Citrus Hernando Levy Marion Sumter Dixie Pasco	Citrus Hernando Levy Marion Sumter Dixie Pasco	Citrus Hernando Levy Marion Sumter Dixie Pasco	Citrus Hernando Levy Marion Sumter Dixie Pasco	Citrus Hernando Levy Marion Sumter Dixie Pasco
	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	Citrus Hernando Levy Marion Sumter Dixie Pasco	Citrus Hernando Levy Marion Sumter Dixie Pasco	Citrus Hernando Levy Marion Sumter Dixie Pasco	Citrus Hernando Levy Marion Sumter Dixie Pasco	Citrus Hernando Levy Marion Sumter Dixie Pasco

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	Default	Default	Default	Default	Default
Tourist Rate	Default	Default	Default	Default	Default
Shelters Open	Primary	Primary	All	All	All
Response Curve	6-hour, except Marion and Sumter with 12-hour	12-hour	12-hour, except Dixie, Hernando, Citrus, at 6-hour and Levy, Manatee, Pasco, Pinellas at 9-hour	12-hour	6-hour
Evacuation Phasing	None	None	None	None	None
Behavioral Response	Planning	Planning	Planning	Planning	Planning
Evacuation Zone	A	B except as noted below	C except as noted below	D except as noted below	E except as noted below
Counties Evacuating	Citrus Hernando Levy Marion Sumter Hillsborough Manatee Pasco Pinellas	Citrus Hernando Levy Marion Sumter Hillsborough (C) Manatee (C) Pasco (C) Pinellas (C) Lake Orange Osceola Polk	Citrus Hernando Levy Marion Sumter Manatee (A) Pasco (B) Pinellas (B) Dixie (B) Lake (B) Alachua (B) Gilchrist (B)	Citrus Hernando Levy Marion Sumter Hillsborough Manatee Pasco Pinellas Alachua (B) Lake (B) Polk (B)	Citrus Hernando Levy Marion Sumter Dixie (D) Hillsborough (D) Manatee (B) Pasco (D) Pinellas (D) Alachua (D) Gilchrist (D) Lake (C) Orange (B)
	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	Default	Default	Default	Default	Default
Tourist Rate	Default	Default	Default	Default	Default
Shelters Open	Primary	Primary	All	All	All
Response Curve	6-hour, except Lake, Marion, Orange, Polk, and Sumter at 9-hour	6-hour, except Marion and Sumter at 12-hour	6-hour, except Alachua, Lake, Marion, Polk, and Sumter at 12-hour	12-hour, except Lake, Marion, Orange, Osceola, Polk, and Sumter at 18-hour	12-hour, except Alachua, Gilchrist, Lake, Marion, Polk, and Sumter at 18-hour
Evacuation Phasing	None	None	None	None	None
Behavioral Response	Planning	Planning	Planning	Planning	Planning
Evacuation Zone	A	B	C except as noted below	D except as noted below	E except as noted below
Counties Evacuating	Citrus Hernando Levy Marion Sumter	Citrus Hernando Levy Marion Sumter	Citrus Hernando Levy Marion Sumter	Citrus Hernando Levy Marion Sumter	Citrus Hernando Levy Marion Sumter

	Hillsborough Manatee Pasco Pinellas Lake Orange Polk	Hillsborough Manatee Pasco Pinellas	Hillsborough Manatee Pasco Pinellas Lake (A) Alachua (A) Polk (A)	Hillsborough (E) Manatee (E) Pasco (E) Pinellas (E) Lake (C) Orange (B) Osceola (B) Polk (C)	Dixie Hillsborough Manatee Pasco Pinellas Alachua (D) Gilchrist (D) Lake (C) Polk (C)
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- **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.

- **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.

- **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.

- **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 RPC is clear;
 - All out of county trips exit the RPC, 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 RPC, 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 belongs, load their vehicle, etc.), the actual time spent traveling on the roadway network, and the delay time caused by traffic congestion.

Base Scenarios

In-county clearance times for the base scenarios range from 13 hours for the evacuation level A scenarios to 17.5 hours for the Levy County for evacuation level E scenario in 2010. Clearance Time to Shelter shows a similar pattern, with clearance times for the base scenarios ranging from 12 hours for the evacuation level A scenarios to 16.5 hours for Hernando County for evacuation level E scenario in 2010.

In 2015, in-county clearance times for the base scenarios increase slightly to between 13 hours for the evacuation level A scenarios and 19.5 hours for Levy County for the evacuation level E scenario. Clearance Time to Shelter shows a similar pattern, with clearance times for the base scenarios ranging from 12.5 hours for the evacuation level A scenarios to 17.5 hours for Hernando County for evacuation level E scenario in 2015.

Out of county clearance times for the base scenarios range from 13.5 hours for the base evacuation level A scenario to 19 hours in Marion County for the evacuation level E scenario. Out of county clearance times increase for several counties in 2015, especially in Marion and Levy Counties which increase to 20 hours.

Regional clearance time for the five county WRPC region ranges from 14.5 hours to 19 hours in 2010. This time increases to between 14.5 and 20 hours in 2015.

Operational Scenarios

In-county clearance times for the 2010 operational scenarios range from 7 hours to 37.5 hours depending upon the scenario. Clearance Time to Shelter shows a similar pattern, with clearance times for the operational scenarios ranging from 6 hours to 22 hours depending upon the county and the scenario.

In 2015, in-county clearance times for the operational scenarios vary from 7 hours to 47.5 hours for the level D evacuation in Levy County. The 2015 level D and E scenarios include vehicle trips evacuating from Tampa for a large storm event (approximately 1.4 million evacuating vehicles in the model network), which cause a large increase in clearance times. Clearance Time to Shelter shows a similar pattern to the 2010 scenarios, with clearance times for the base scenarios ranging from 6.5 hours to 43 hours depending upon the scenario.

Out of county clearance times for the 2010 operational scenarios range from 13 hours to 48.5

hours for the evacuation level E scenario. Out of county clearance times show a similar pattern in 2015 to between 10.5 and 51.5 hours depending upon the scenario. Regional clearance time for the five county Withlacoochee region ranges from 15.5 hours to 48.5 hours in 2010. This time increases to between 19 and 51.5 hours in 2015.

Table VI-11 2010 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					
Citrus County	12.5	12.5	14.0	13.5	14.5
Hernando County	12.5	12.5	13.0	14.5	16.5
Levy County	12.0	12.5	12.5	13.0	12.5
Marion County	13.0	12.5	13.0	13.5	13.0
Sumter County	12.5	12.5	12.5	13.0	14.0
In-County Clearance Time					
Citrus County	13.5	13.5	15.0	17.0	17.0
Hernando County	13.0	13.0	13.0	14.5	16.5
Levy County	14.0	14.0	15.0	17.5	17.5
Marion County	13.5	13.0	13.5	14.0	17.0
Sumter County	13.0	13.0	13.0	13.5	14.5
Out of County Clearance Time					
Citrus County	13.5	14.0	15.0	17.0	18.0
Hernando County	13.5	13.5	14.5	16.5	17.5
Levy County	14.5	14.5	15.5	18.0	18.0
Marion County	14.5	14.5	16.0	18.0	19.0
Sumter County	13.5	14.0	15.0	17.0	18.0
Regional Clearance Time					
Withlacoochee	14.5	14.5	16.0	18.0	19.0

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					
Citrus County	12.5	13.0	13.0	14.0	14.0
Hernando County	12.5	12.5	13.5	15.5	17.5
Levy County	12.5	12.5	12.5	12.5	13.0
Marion County	13.0	13.0	13.0	13.5	13.0
Sumter County	12.5	12.5	12.5	14.0	14.0
In-County Clearance Time					
Citrus County	13.5	13.5	14.5	16.5	19.0
Hernando County	13.0	13.0	13.5	15.5	17.5
Levy County	14.0	14.0	14.5	15.5	19.5
Marion County	13.5	13.5	13.5	14.0	19.0
Sumter County	13.0	13.0	13.0	14.5	14.5
Out of County Clearance Time					
Citrus County	13.5	14.0	14.5	17.5	19.0
Hernando County	13.5	13.5	14.0	17.0	18.0
Levy County	14.5	14.5	15.0	17.5	20.0
Marion County	14.5	14.5	15.5	18.5	20.0
Sumter County	13.5	14.0	14.5	18.0	19.0
Regional Clearance Time					
Withlacoochee	14.5	14.5	15.5	18.5	20.0

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					
Citrus County	12.5	17.5	10.0	18.0	20.0
Hernando County	12.5	14.0	10.0	22.5	22.0
Levy County	6.0	12.0	6.5	12.5	6.5
Marion County	12.5	14.5	13.0	16.5	11.5
Sumter County	13.5	14.5	15.5	15.5	10.5
In-County Clearance Time					
Citrus County	12.5	22.0	17.0	24.5	37.0
Hernando County	7.0	14.0	13.5	22.5	31.0
Levy County	13.0	22.0	18.0	25.0	37.5
Marion County	13.0	15.0	13.5	17.0	37.0
Sumter County	14.0	15.0	16.0	16.0	11.0
Out of County Clearance Time					
Citrus County	13.0	26.0	17.5	32.5	39.0
Hernando County	13.0	25.5	13.5	42.5	38.0
Levy County	13.5	25.5	18.5	29.0	38.0
Marion County	15.5	29.5	18.0	47.5	48.5
Sumter County	13.5	29.0	17.0	47.0	47.5
Regional Clearance Time					
Withlacoochee	15.5	29.5	18.5	47.5	48.5

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					
Citrus County	9.0	9.0	12.0	18.5	21.0
Hernando County	7.0	8.0	15.0	43.0	33.0
Levy County	6.5	6.5	6.5	12.5	12.5
Marion County	13.0	13.0	14.5	19.0	18.5
Sumter County	14.0	15.0	20.0	20.0	20.5
In-County Clearance Time					
Citrus County	13.5	15.5	26.5	45.0	45.5
Hernando County	7.0	11.5	16.5	44.5	41.5
Levy County	16.0	16.0	28.0	47.5	45.5
Marion County	13.5	13.5	15.0	19.5	45.5
Sumter County	14.5	15.5	16.0	20.5	21.0
Out of County Clearance Time					
Citrus County	16.5	15.5	27.5	50.5	46.5
Hernando County	10.5	13.5	22.0	50.0	45.0
Levy County	17.0	16.5	28.5	51.5	46.5
Marion County	19.0	22.0	34.0	51.5	47.5
Sumter County	15.5	22.0	33.5	50.5	46.5
Regional Clearance Time					
Withlacoochee	19.0	22.0	34.0	51.5	47.5

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 Citrus County					
12-Hour	55,681	58,335	58,542	59,458	61,382
18-Hour	62,641	68,057	73,178	84,232	92,073
24-Hour					
36-Hour					
Estimated Evacuating Population Clearing Hernando County					
12-Hour	45,400	46,535	52,356	69,313	78,445
18-Hour	51,075	52,352	63,264	95,306	114,399
24-Hour					
36-Hour					
Estimated Evacuating Population Clearing Levy County					
12-Hour	21,190	22,140	21,883	20,285	22,373
18-Hour	25,604	26,752	28,266	30,427	33,560
24-Hour					
36-Hour					
Estimated Evacuating Population Clearing Marion County					
12-Hour	111,046	122,622	121,616	117,428	111,248
18-Hour	134,181	148,168	162,155	176,142	166,871
24-Hour					176,142
36-Hour					
Estimated Evacuating Population Clearing Sumter County					
12-Hour	34,526	36,765	37,554	35,996	36,697
18-Hour	38,842	42,893	46,943	50,994	55,045
24-Hour					
36-Hour					

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 Citrus County					
12-Hour	60,889	63,798	66,242	63,174	63,611
18-Hour	68,500	74,431	80,042	92,129	100,718
24-Hour					100,718
36-Hour					
Estimated Evacuating Population Clearing Hernando County					
12-Hour	50,556	51,820	60,385	74,896	84,897
18-Hour	56,876	58,297	70,449	106,103	127,346
24-Hour					
36-Hour					
Estimated Evacuating Population Clearing Levy County					
12-Hour	23,201	24,234	24,754	22,841	22,044
18-Hour	28,034	29,283	30,942	33,310	33,066
24-Hour					36,740
36-Hour					
Estimated Evacuating Population Clearing Marion County					
12-Hour	122,324	135,379	138,857	126,571	117,079
18-Hour	147,808	163,583	179,357	189,857	175,618
24-Hour				195,131	195,131
36-Hour					
Estimated Evacuating Population Clearing Sumter County					
12-Hour	39,802	42,749	45,492	40,044	41,155
18-Hour	44,777	49,874	54,970	60,066	61,732
24-Hour					65,162
36-Hour					

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 Withlacoochee 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 WRPC region include I-75, US 19, US 301, and portions of SR 200 and US 41. For large storm events, such as level D and E evacuations, other State facilities also play an important role in evacuations;
- 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;
- The WRPC counties, in coordination with the State, should continue public information campaigns to clearly define those that are vulnerable and should evacuate verses those who choose to evacuate on their own. During large storm events, evacuations by the vulnerable population are impacted by shadow evacuations occurring in other parts of the region;
- WRPC counties play a major role even when evacuations occur in other parts of the State, especially with Tampa Bay area storm events. For example, for the 2015 operational scenarios for level D and level E which include a major Tampa Bay region evacuation, total evacuating vehicles along I-75 in Sumter County totaled to around 66,000 vehicles. WRPC counties should continue their coordination efforts with the State and provide assistance even when WRPC counties are not evacuating;
- 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 5-5) 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 Withlacoochee 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.