Florida Statewide Regional Evacuation Study Program

Regional Transportation Analysis Summary

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Volume 1-9
Southwest Florida Region
Technical Data Report

CHAPTER VI

REGIONAL TRANSPORTATION ANALYSIS

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Regional 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 six county Southwest Florida 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 Southwest Florida region. While the impact of other regions is included in the Southwest Florida analysis, it is important to note that the results of the transportation analysis presented in this document are only reported for the six counties included in the Southwest Florida 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 Southwest Florida RPC 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 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.

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 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.

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.

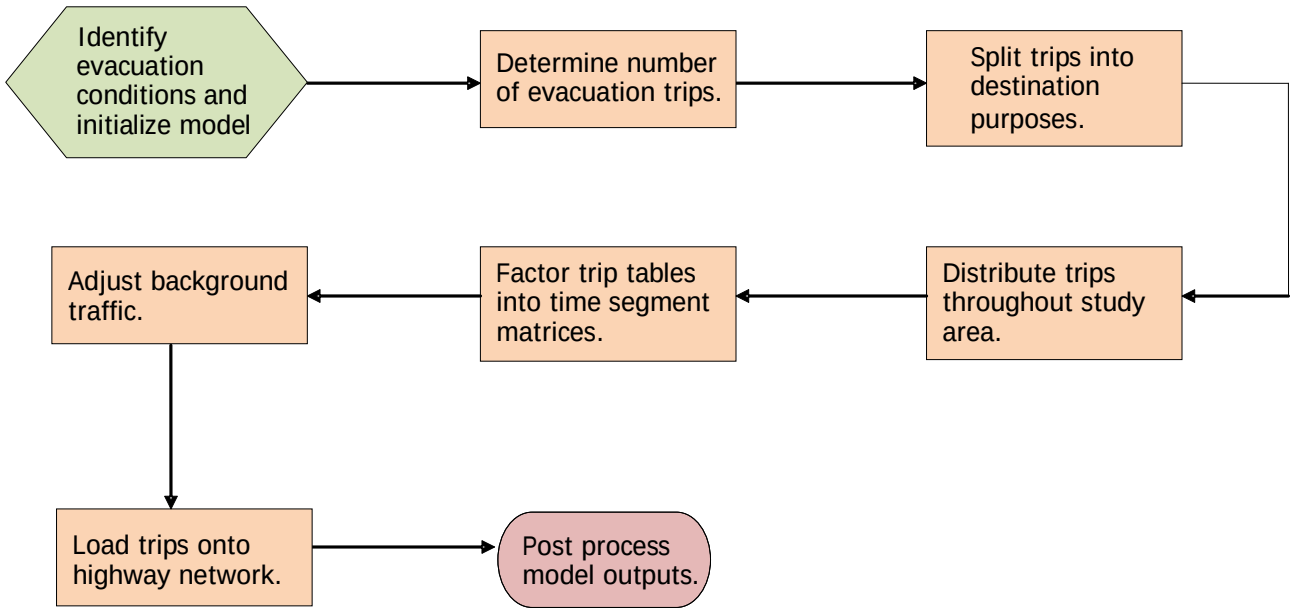
The second group of traffic is known as background traffic. Background traffic, as its name implies, is not the primary focus of an evacuation transportation analysis and is accounted for primarily to impede the movement of evacuation trips through the network. These trips represent individuals going about their daily business 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.

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, 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 Southwest Florida 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 Southwest Florida 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 SWFRPC. County level details of the regional model network are provided in the Volume 5-9 report. The regional model network for the Southwest Florida region includes key roadways within the six county region, including I-75, US 41, US 27, US 17, SR 29, SR 78, SR 72, SR 45, SR 31, SR 82 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 972 zones located within the six county Southwest Florida region, as illustrated in **Figure VI-3**. In the Southwest Florida region, Lee County has the largest number of TEZs with 337, and Sarasota County follows with 275 TEZs. Charlotte County contains 175 TEZs; Collier County, 156 TEZs. Hendry and Glades Counties have the lowest number of TEZs in the RPC with 21 and 8 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 Southwest Florida 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 or near 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: Southwest Florida Regional Model Network

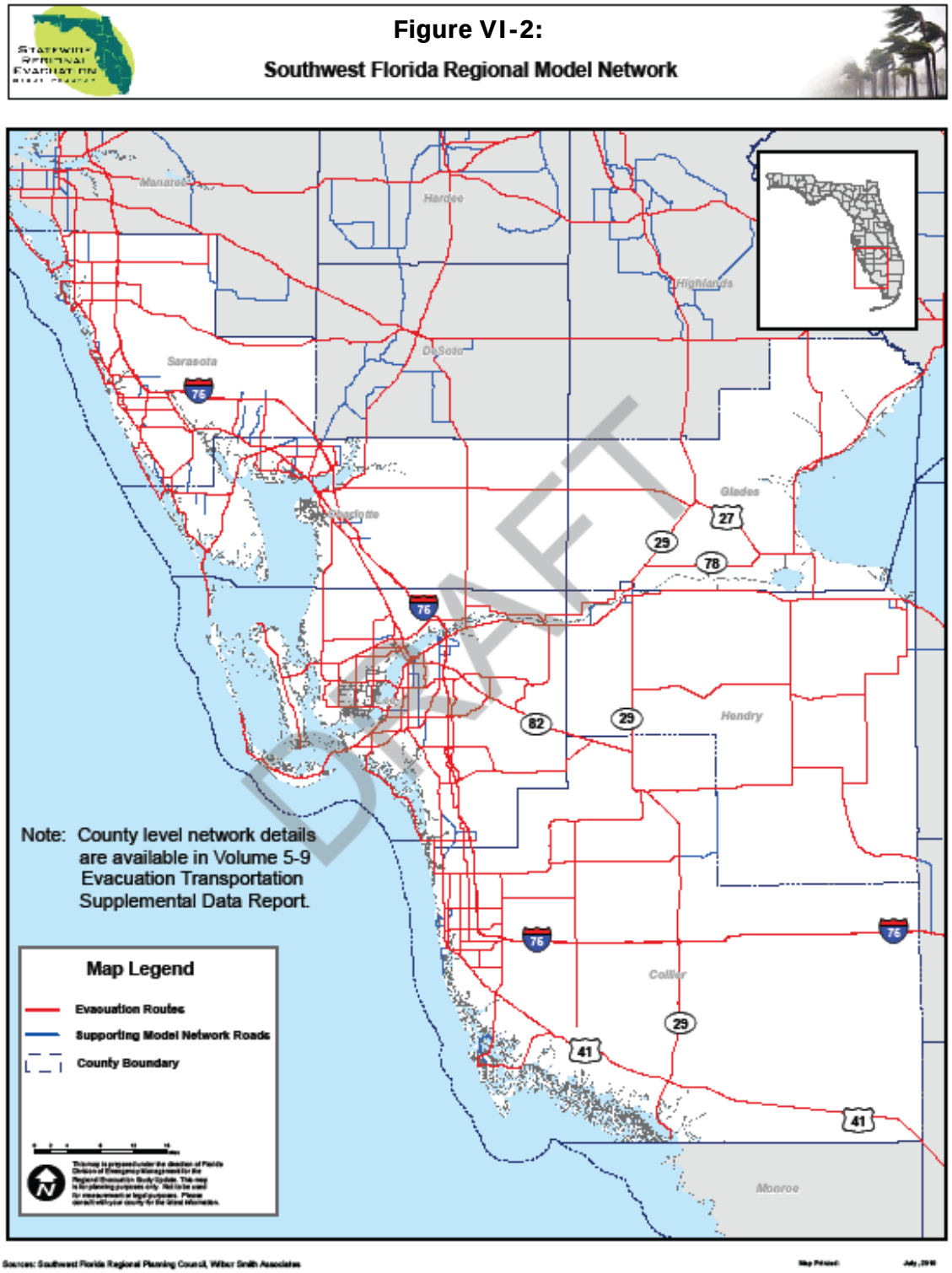
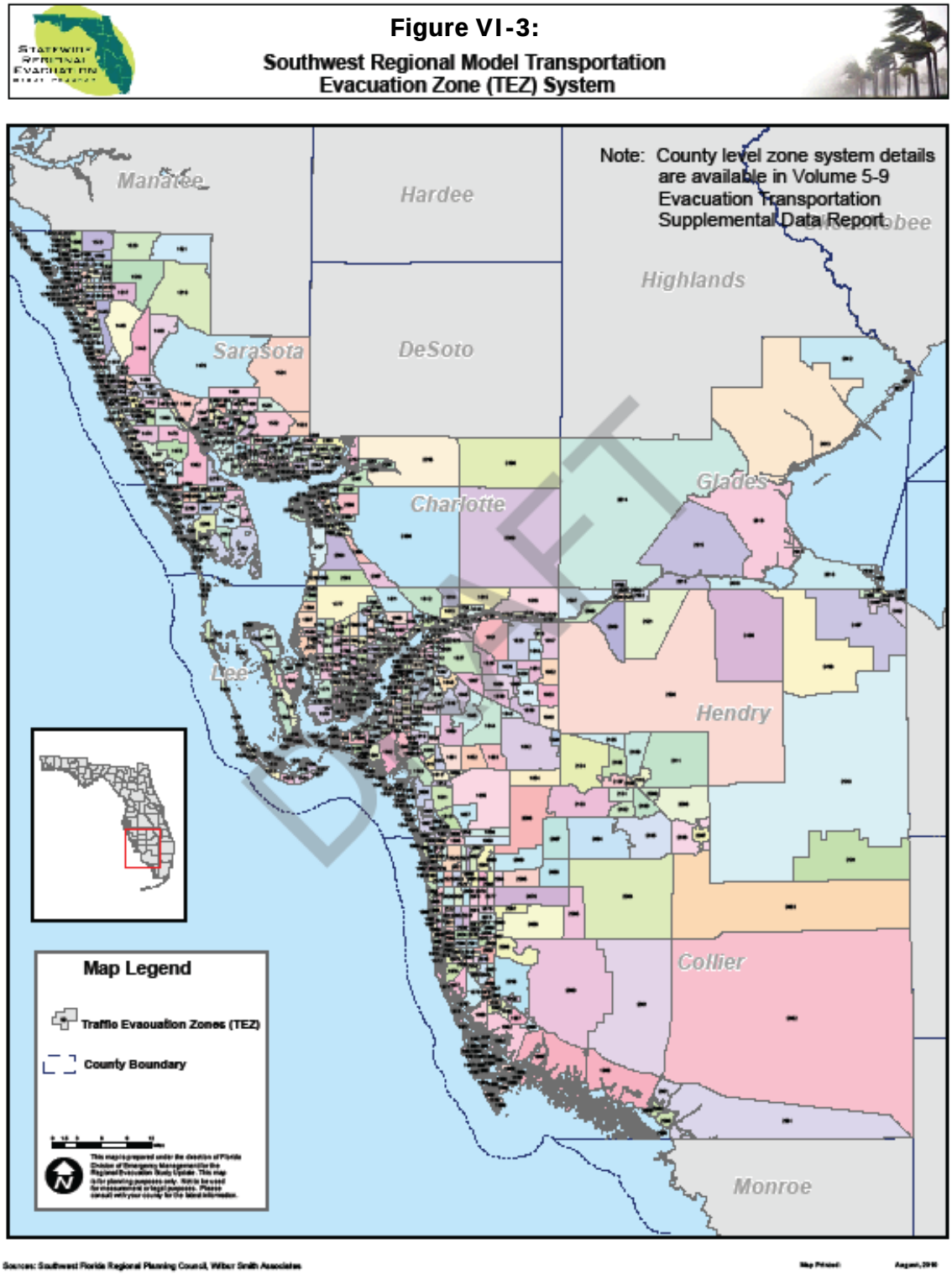


Figure VI-3: Southwest Florida Model Transportation Evacuation Zone System



Lee County has the largest population in the region during all three time periods. The county is expected to reach over 670,000 people by 2015. Sarasota County has the second largest population in the region and is forecasted to have more than 440,000 people by 2015. Glades County has the smallest population in the region; the county is expected to have just more than 11,000 people by 2015.

Table VI-1: Southwest Florida Demographic Characteristic Summary

County	Characteristic	Year		
		2006	2010	2015
Charlotte	Occupied site-built homes	67,738	75,962	87,992
	Population in site-built homes	151,896	166,676	182,451
	Occupied mobile homes	6,134	5,991	6,223
	Population in mobile home	10,450	10,162	10,476
	Hotel/motel units	2,805	3,132	3,893
Collier	Occupied site-built homes	115,997	123,529	107,795
	Population in site-built homes	279,001	307,337	338,168
	Occupied mobile homes	6,099	5,671	5,558
	Population in mobile home	15,056	13,838	13,625
	Hotel/motel units	10,834	11,029	11,269
Glades	Occupied site-built homes	1,697	1,898	2,140
	Population in site-built homes	4,220	4,677	5,056
	Occupied mobile homes	2,160	2,252	2,394
	Population in mobile home	5,419	5,704	6,134
	Hotel/motel units	244	244	244
Hendry	Occupied site-built homes	6,802	7,383	7,777
	Population in site-built homes	20,023	21,834	23,061
	Occupied mobile homes	4,999	5,343	6,017
	Population in mobile home	16,438	17,528	19,512
	Hotel/motel units	726	726	726
Lee	Occupied site-built homes	214,412	225,915	216,990
	Population in site-built homes	517,285	563,420	598,350
	Occupied mobile homes	25,672	30,648	47,650
	Population in mobile home	46,224	54,076	78,846
	Hotel/motel units	15,208	16,766	19,319
Sarasota	Occupied site-built homes	152,151	165,633	178,988
	Population in site-built homes	342,336	374,391	405,919
	Occupied mobile homes	15,542	17,064	20,901
	Population in mobile home	25,740	28,281	34,847
	Hotel/motel units	12,991	13,152	13,257

Source: Southwest Florida Regional Planning Council

4. 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 Charlotte County, Toledo Blade Blvd from US 41 to Hillsborough Blvd. will be widened to four 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 Southwest Florida Region, all six counties within the region have evacuation zones corresponding to different 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-15**. 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 5-9.

Please note that the original behavioral response rates provided by SRESP in Volume 2-9 were modified to fit the evacuation zones created for Glades and Hendry Counties. The original rates for Glades and Hendry were based on the assumption that those counties were inland areas with no evacuation zones; however, for the purpose of the transportation analysis, both counties utilize five zones.

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 six county region there are a total of 175 shelters, including 18 in Charlotte County, 56 in Collier County, 12 in Glades County, 17 in Hendry County, and 50 in Lee

County, and 22 in Sarasota County. The total number of shelters for Southwest Florida includes other shelters as well as those shelters compliant with ARC standards/risk shelters. All together, the 175 shelters located within the six county region can host more than 100,000 persons during an evacuation event. Detailed lists of the primary and other shelters used in the transportation analysis are included in Volume 5-9. It is important to note that the shelter list used in the transportation analysis was developed early in the study process and may not match the latest available list of primary and other shelters from each county.

Table VI-2: Southwest Florida Roadway Improvements, 2006 – 2010

County	Roadway	From	To	Number of Lanes
Charlotte	Kings Highway	I-75	Desoto County line	4
	Veterans Blvd	Toledo Blade Rd	Kings Highway	4
Collier	CR 951 (Collier Blvd)	Green Blvd	Golden Gate Blvd	4
	CR 858 (Oil Well Rd)	CR 846 (Immokalee Rd)	Everglades Blvd	4
	Golden Gate Pkwy	Livingston Rd	Santa Barbara Blvd	6
	Immokalee Rd	US 41	Oil Well Rd	6
	SR 84 (Davis Blvd)	Santa Barbara Blvd	Radio Rd	6
Collier/Lee	I-75	Golden Gate Pkwy	Colonial Blvd (SR 884)	6
Hendry	SR 80 (Palm Beach Blvd)	Clark Street	Birchwood Pkwy	4
Lee	Ortiz Ave	SR 884	SR 82	4
	SR 78	Chiquita Blvd	Del Prado Blvd	4
	SR 739 (Metro Pkwy)	Six Mile Cypress Pkwy	Daniels Pkwy	6
	SR 739 (Metro Parkway)	US 41	Six Mile Cypress Pkwy	6
	SR 739	Six Mile Cypress Pkwy	Daniels Pkwy	6
	SR 82 (MLK Blvd)	Ortiz Ave	Lee Blvd	6
	US 41	Bonita Beach Rd	Old US 41	6
Sarasota	US 301	Wood St	University Pkwy	6
	US 301	29th St	Northgate Blvd	6
	I-75	River Rd	SR 681	6
	US 41	US 41 Business	Laurel Rd	6

Sources: FDOT SIS First Five Year Plan, FDOT SIS Second Five Year Plan, Southwest Florida 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: Southwest Florida Planned Roadway Improvements, 2011–2015

County	Roadway	From	To	Number of Lanes
Charlotte	Toledo Blade Blvd	US 41	Hillsborough Blvd	4
	US 41	Enterprise Dr	Flamingo Blvd	4
	Burntstore Rd	Notre Dame Rd	US 41	4
Lee	I-75	S of Colonial Blvd	S of SR 82	6
	I-75	S of SR 82	S of Luckett Rd	6
	US 41	Corkscrew Rd	San Carlos Blvd	6
	Del Prado Pkwy	NE 7th St	S of Diplomat Pkwy	6

Sources: FDOT SIS First Five Year Plan, FDOT SIS Second Five Year Plan, Southwest Florida 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: Charlotte County Site-Built Homes

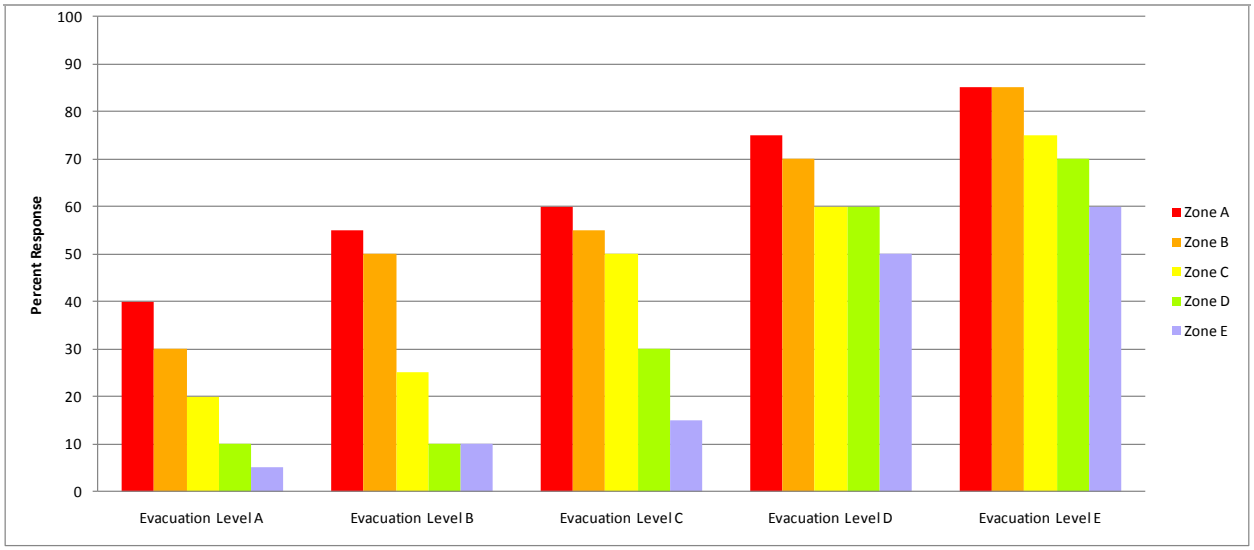


Figure VI-5: Evacuation Participation Rates: Charlotte County Mobile Homes

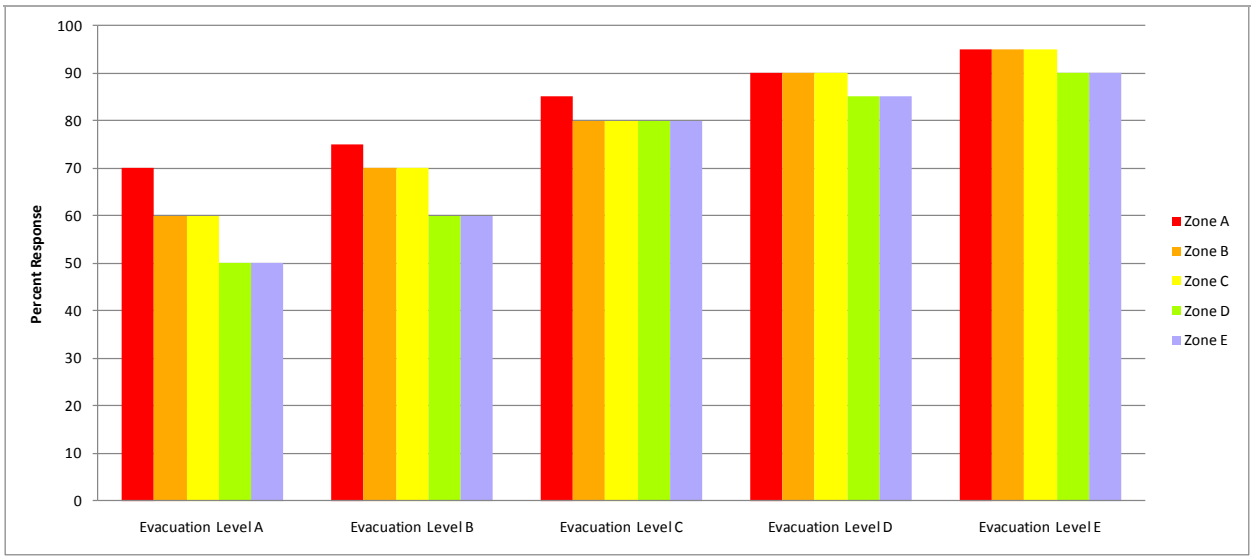


Figure VI-6: Evacuation Participation Rates: Collier County Site-Built Homes

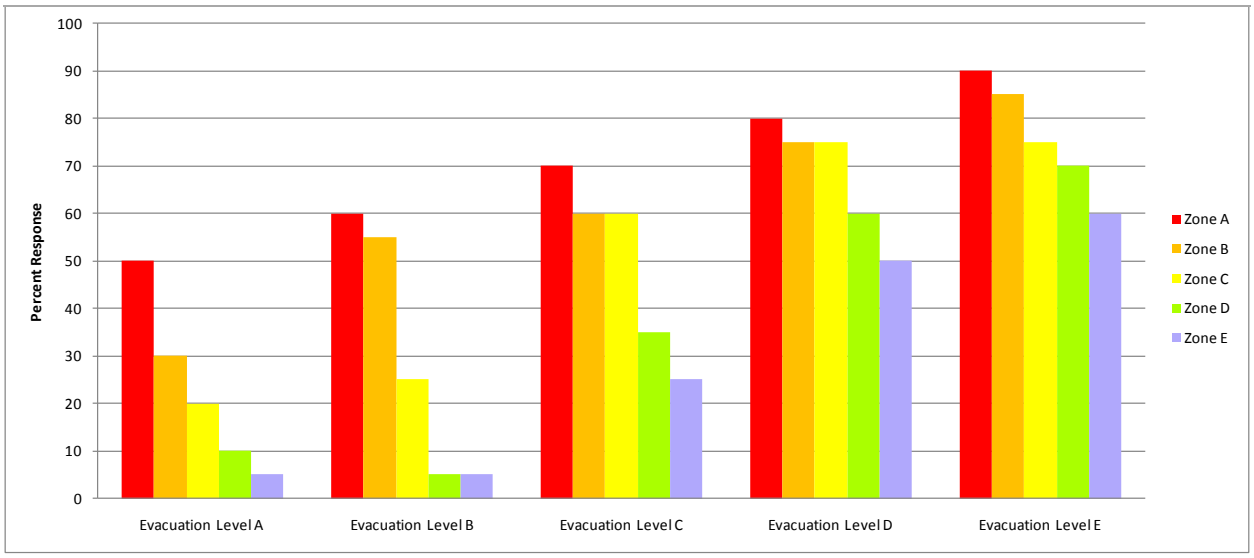


Figure VI-7: Evacuation Participation Rates: Collier County Mobile Homes

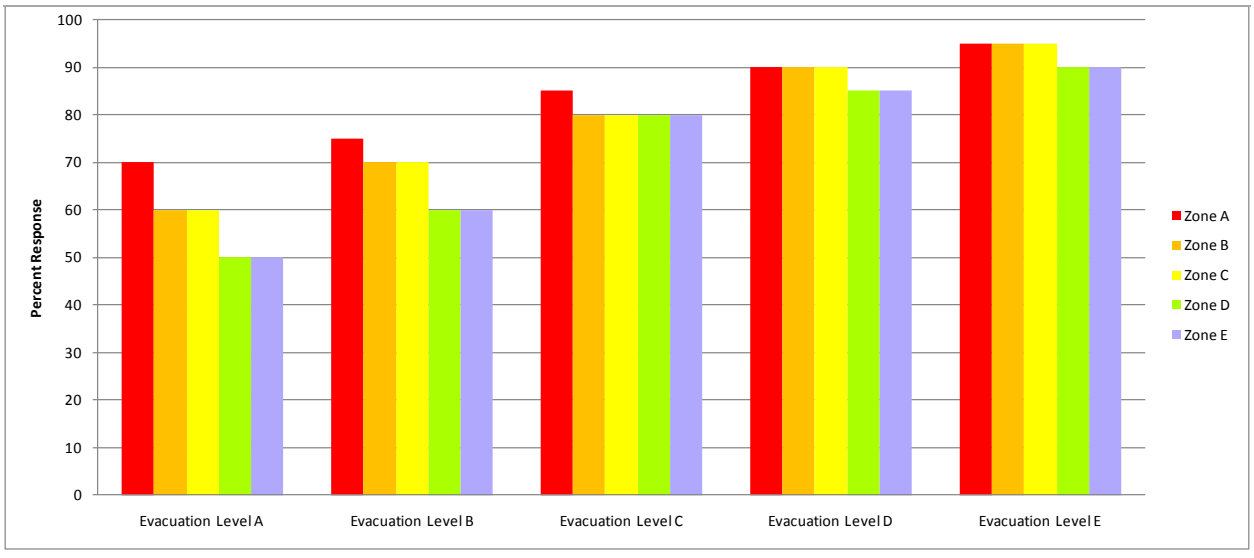


Figure VI-8: Evacuation Participation Rates: Glades County Site-Built Homes

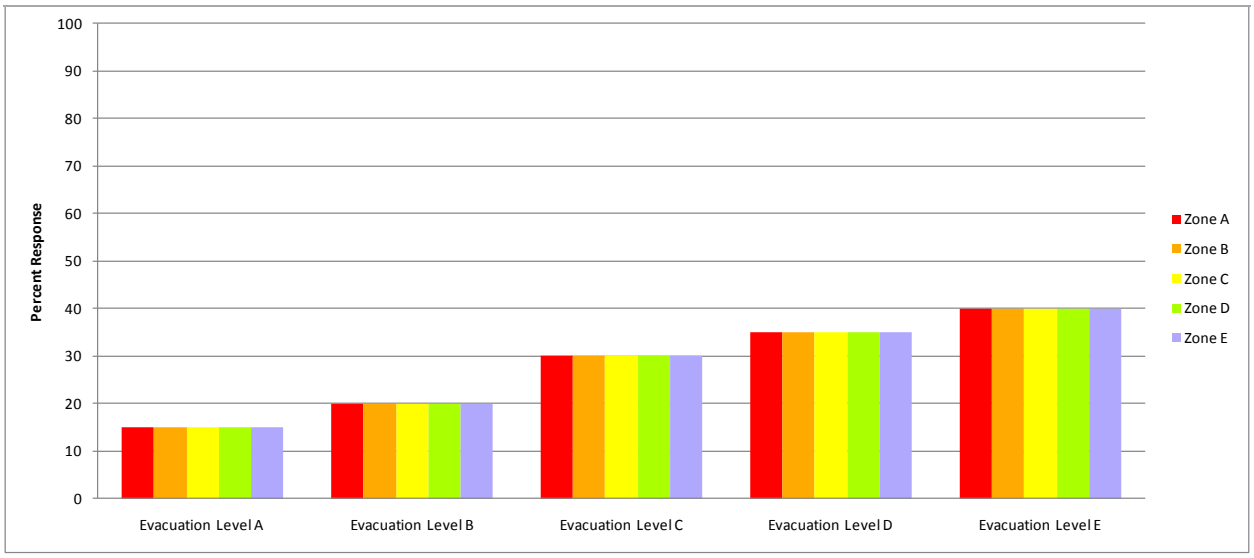


Figure VI-9: Evacuation Participation Rates: Glades County Mobile Homes

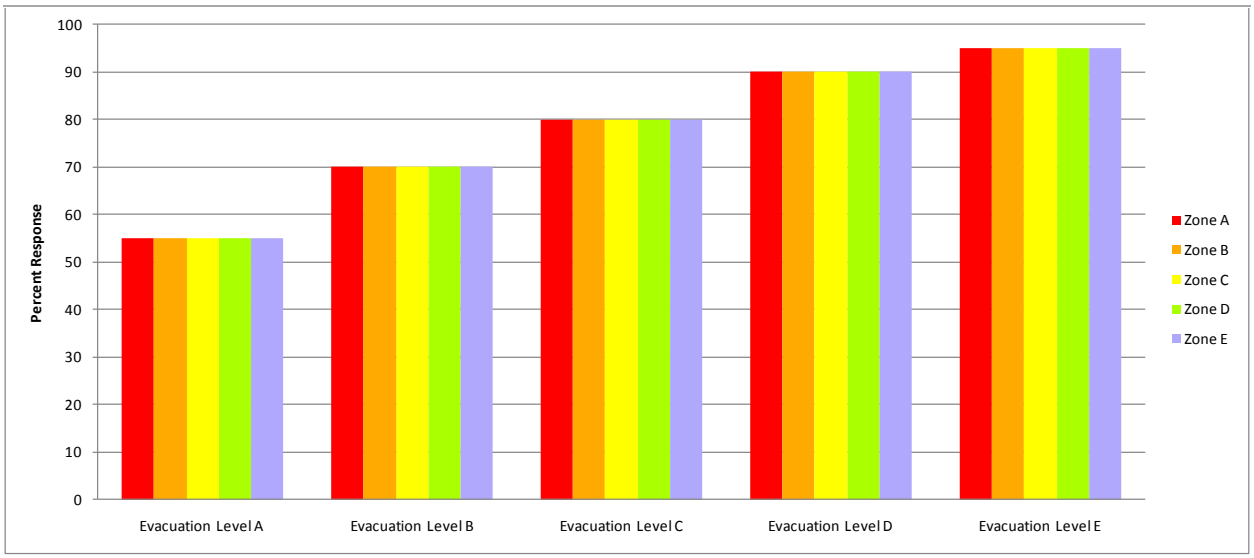


Figure VI-10: Evacuation Participation Rates: Hendry County Site-Built Homes

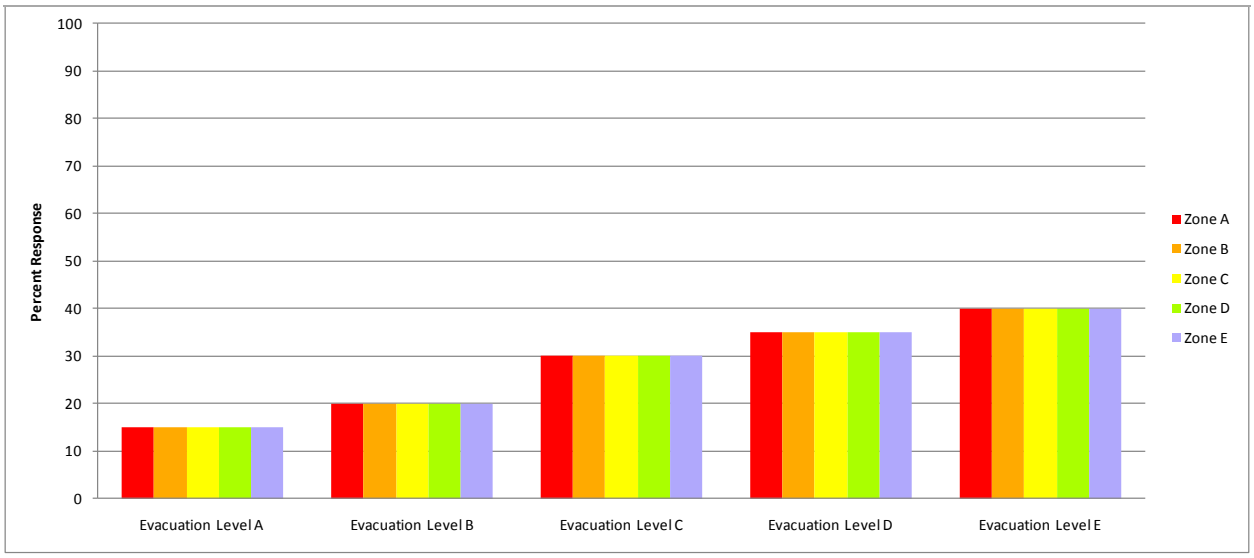


Figure VI-11: Evacuation Participation Rates: Hendry County Mobile Homes

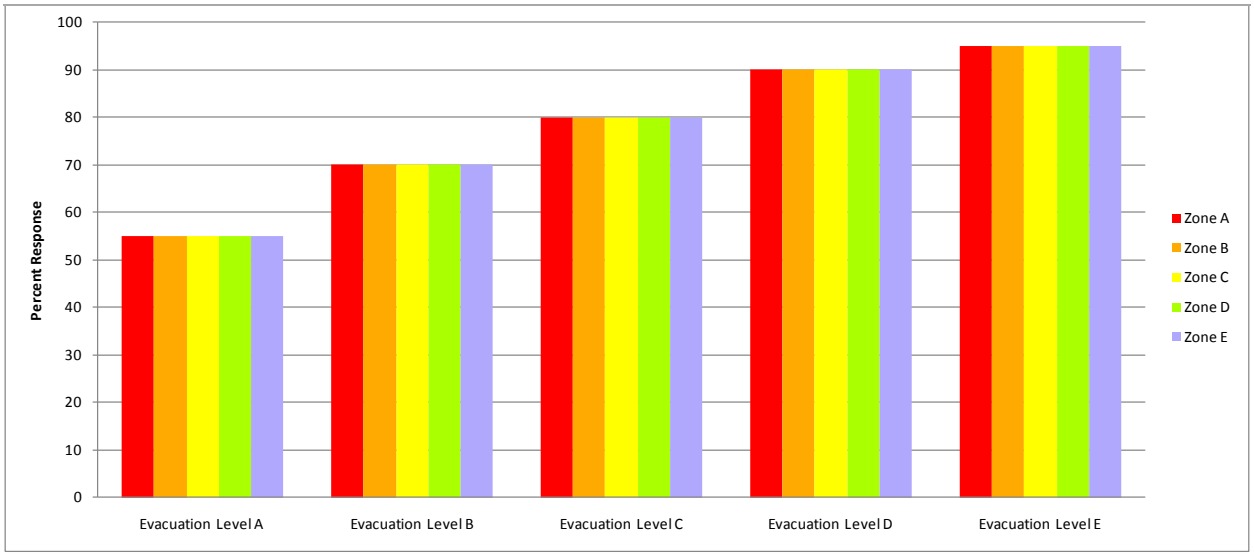


Figure VI-12: Evacuation Participation Rates: Lee County Site-Built Homes

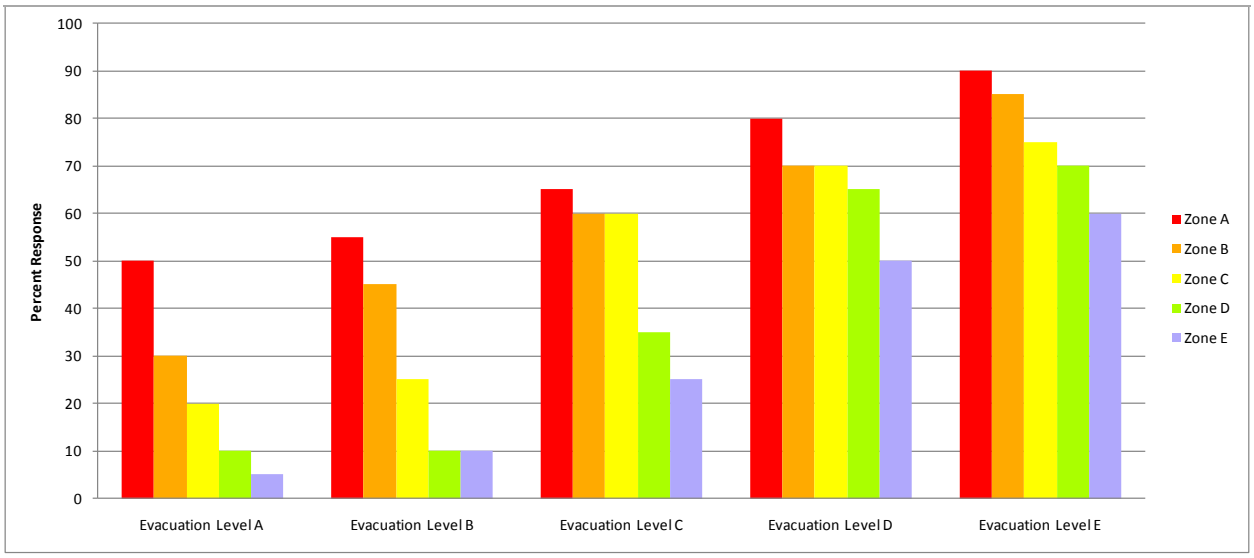


Figure VI-13: Evacuation Participation Rates: Lee County Mobile Homes

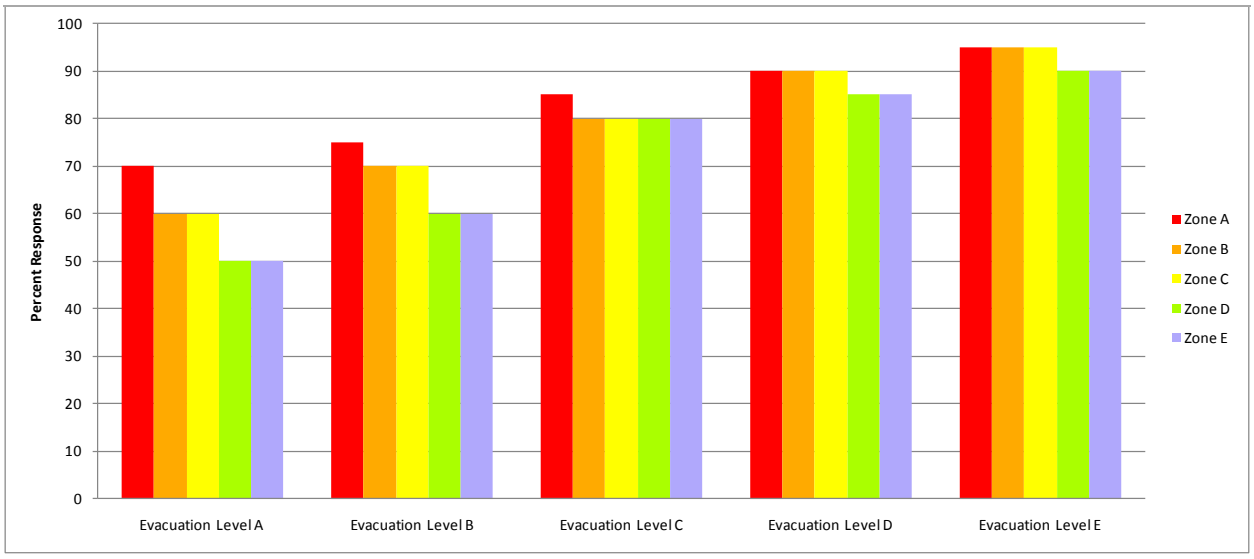


Figure VI-14: Evacuation Participation Rates: Sarasota County Site-Built Homes

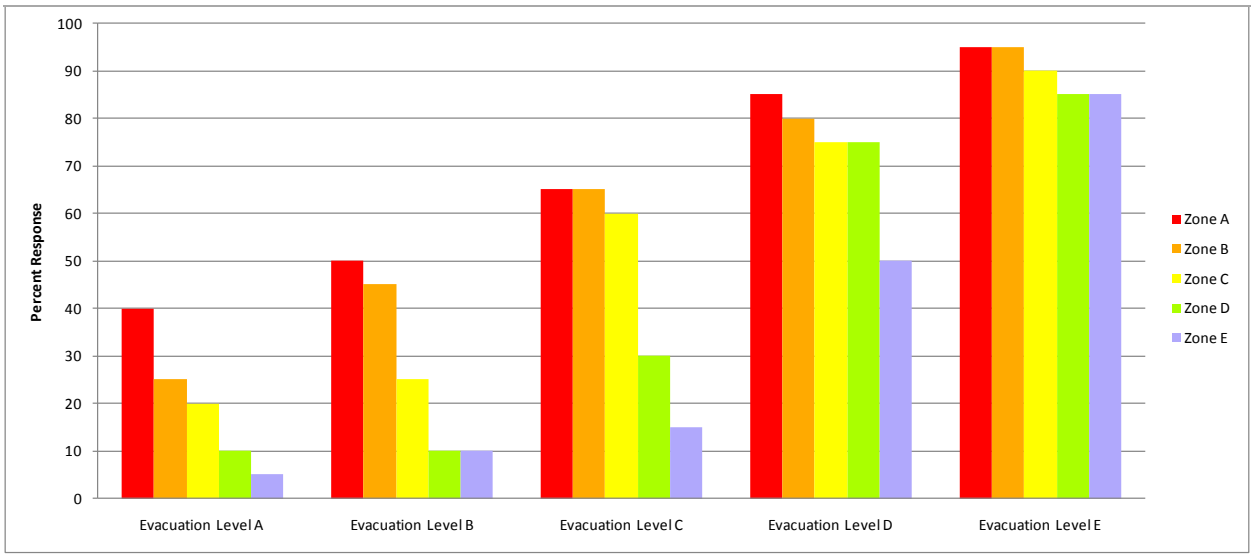
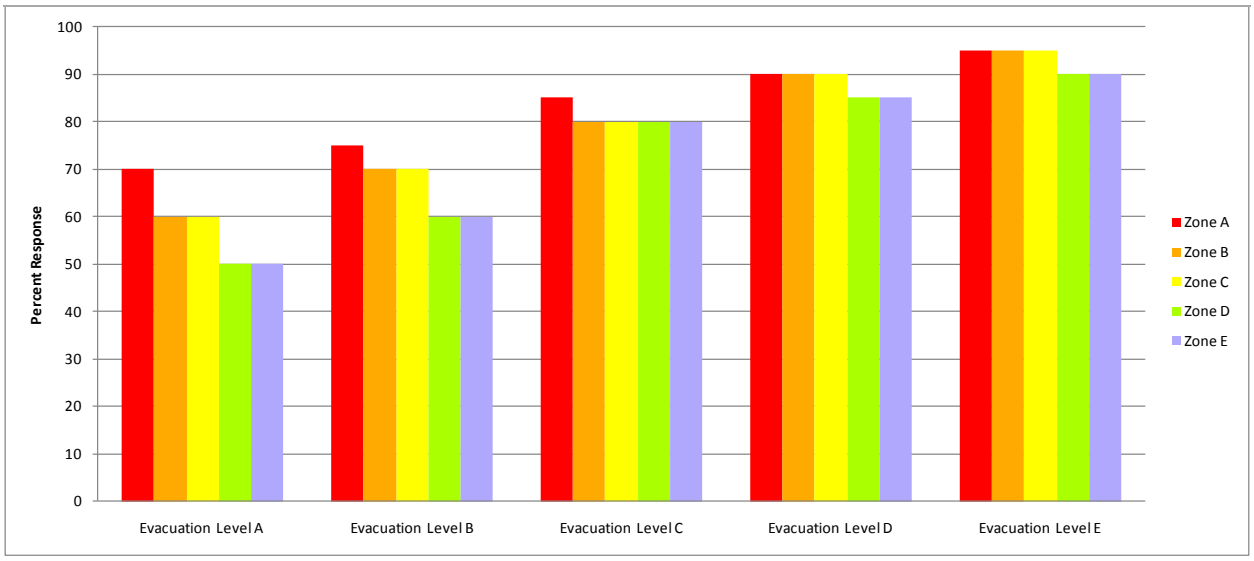


Figure VI-15: Evacuation Participation Rates: Sarasota County Mobile Homes



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. Within the Southwest Florida region, Charlotte, Collier, Glades, Hendry, Lee and Sarasota Counties 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 5-9.

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:

8. Analysis time period;
9. Highway network;
10. Behavioral response;
11. One-way evacuation operations;
12. University population;
13. Tourist occupancy rates;
14. Shelters;
15. Counties evacuating;
16. Evacuation level;
17. Response curve hours; and,
18. 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 Southwest Florida 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 Southwest Florida Region for 2010

	Evacuation Zone A	Evacuation Zone B	Evacuation Zone C	Evacuation Zone D	Evacuation Zone E
Charlotte County					
Site-built Homes	45,862	88,357	28,011	3,326	230
Mobile/Manuf. Homes	2,460	4,637	1,107	1,869	19
TOTAL	48,322	92,994	29,118	5,195	249
Collier County					
Site-built Homes	85,217	127,260	75,144	8,786	2,552
Mobile/Manuf. Homes	4,537	3,664	1,056	369	1,322
TOTAL	89,754	130,924	76,200	9,155	3,874
Glades County					
Site-built Homes	336	287	296	525	193
Mobile/Manuf. Homes	268	356	378	660	215
TOTAL	604	643	674	1,185	408
Hendry County					
Site-built Homes	739	137	229	60	0
Mobile/Manuf. Homes	1,529	170	45	10	0
TOTAL	2,268	307	274	70	0
Lee County					
Site-built Homes	95,163	245,594	118,236	40,296	47,096
Mobile/Manuf. Homes	17,500	16,638	19,304	411	0
TOTAL	112,663	262,232	137,540	40,707	47,096
Sarasota County					
Site-built Homes	26,182	48,068	107,295	66,128	37,745
Mobile/Manuf. Homes	3,501	7,172	7,423	2,659	1,506
TOTAL	29,683	55,240	114,718	68,787	39,251

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 Southwest Florida Region for 2015

	Evacuation Zone A	Evacuation Zone B	Evacuation Zone C	Evacuation Zone D	Evacuation Zone E
Charlotte County					
Site-built Homes	75,303	81,803	22,207	2,319	151
Mobile/Manuf. Homes	2,201	4,799	1,123	2,241	28
TOTAL	77,504	86,602	23,330	4,560	179
Collier County					
Site-built Homes	145,306	99,170	72,740	12,586	1,908
Mobile/Manuf. Homes	4,171	3,491	1,059	411	1,436
TOTAL	149,477	102,661	73,799	12,997	3,344
Glades County					
Site-built Homes	507	286	357	474	165
Mobile/Manuf. Homes	270	378	391	668	215
TOTAL	777	664	748	1,142	380
Hendry County					
Site-built Homes	767	140	191	56	0
Mobile/Manuf. Homes	1,550	172	46	10	0
TOTAL	2,317	312	237	66	0
Lee County					
Site-built Homes	72,531	202,454	156,318	70,136	77,885
Mobile/Manuf. Homes	32,351	21,691	24,037	492	0
TOTAL	104,882	224,145	180,355	70,628	77,885
Sarasota County					
Site-built Homes	17,781	44,214	133,880	94,657	29,181
Mobile/Manuf. Homes	4,995	9,114	9,152	3,613	1,816
TOTAL	22,776	53,328	143,032	98,270	30,997

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 Southwest Florida 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
Charlotte County					
To Friends and Family	26,823	51,610	16,125	3,045	139
To Hotel/ Motel	11,957	23,017	7,224	1,206	61
To Public Shelter	3,792	7,300	2,352	586	31
To Other Destination	5,749	11,067	3,417	360	19
Collier County					
To Friends and Family	53,625	78,371	45,614	5,456	2,192
To Hotel/ Motel	22,665	32,914	19,103	2,307	969
To Public Shelter	7,044	12,909	7,620	1,091	505
To Other Destination	8,975	9,275	5,366	476	260
Glades County					
To Friends and Family	349	368	386	678	234
To Hotel/ Motel	74	82	86	151	52
To Public Shelter	91	96	101	178	61
To Other Destination	91	96	101	178	61
Hendry County					
To Friends and Family	1,513	202	169	43	0
To Hotel/ Motel	150	22	25	6	0
To Public Shelter	454	62	55	14	0
To Other Destination	150	22	25	6	0
Lee County					
To Friends and Family	66,723	156,508	80,594	24,383	28,258
To Hotel/ Motel	28,166	65,558	34,385	8,162	9,419
To Public Shelter	5,633	13,112	7,842	4,877	5,652
To Other Destination	12,141	27,055	14,719	3,285	3,768
Sarasota County					
To Friends and Family	18,769	32,427	68,088	41,006	23,400
To Hotel/ Motel	7,246	11,048	22,944	13,757	7,850
To Public Shelter	1,834	5,280	10,068	8,467	4,831
To Other Destination	1,834	6,485	13,618	5,556	3,170

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
Charlotte County					
To Friends and Family	42,848	48,111	12,944	2,732	101
To Hotel/ Motel	19,266	21,411	5,777	1,028	42
To Public Shelter	6,134	6,784	1,889	502	22
To Other Destination	9,257	10,296	2,721	298	14
Collier County					
To Friends and Family	89,478	61,422	44,173	7,757	1,863
To Hotel/ Motel	37,578	25,840	18,503	3,270	836
To Public Shelter	11,833	10,092	7,380	1,551	444
To Other Destination	14,948	7,291	5,198	670	239
Glades County					
To Friends and Family	453	380	429	652	217
To Hotel/ Motel	91	85	94	148	49
To Public Shelter	117	100	112	171	57
To Other Destination	117	100	112	171	57
Hendry County					
To Friends and Family	1,545	205	147	41	0
To Hotel/ Motel	154	23	21	6	0
To Public Shelter	463	63	47	13	0
To Other Destination	154	23	21	6	0
Lee County					
To Friends and Family	61,311	133,402	105,809	42,328	46,731
To Hotel/ Motel	26,220	56,036	45,089	14,150	15,577
To Public Shelter	5,244	11,207	10,220	8,466	9,346
To Other Destination	12,106	23,499	19,237	5,685	6,231
Sarasota County					
To Friends and Family	14,055	31,085	84,904	58,601	18,417
To Hotel/ Motel	5,444	10,666	28,606	19,654	6,200
To Public Shelter	1,638	5,360	12,541	12,082	3,865
To Other Destination	1,638	6,217	16,981	7,934	2,516

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					
Charlotte County	41,409	13,877	7,170	4,486	4,397
Collier County	70,131	39,209	24,137	22,172	19,572
Glades County	6,064	5,867	5,844	5,229	5,130
Hendry County	19,261	20,177	22,159	23,164	24,197
Lee County	154,098	76,609	49,073	47,813	25,840
Sarasota County	78,833	69,455	62,663	54,971	41,846
2015					
Charlotte County	38,874	13,165	8,186	5,392	5,322
Collier County	62,127	39,586	26,502	22,815	20,424
Glades County	6,533	6,326	6,294	5,697	5,619
Hendry County	21,398	22,369	24,478	25,545	26,638
Lee County	166,187	100,455	70,751	66,733	29,398
Sarasota County	90,633	81,248	71,007	50,749	41,475

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 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 Southwest Florida 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 Southwest Florida 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 Southwest Florida 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 Southwest Florida 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	Charlotte Collier Glades Hendry Lee Sarasota Manatee Monroe (ML)	Charlotte Collier Glades Hendry Lee Sarasota Manatee Monroe (ML)	Charlotte Collier Glades Hendry Lee Sarasota Manatee Monroe (ML)	Charlotte Collier Glades Hendry Lee Sarasota Manatee Monroe (ML)	Charlotte Collier Glades Hendry Lee Sarasota Manatee Monroe (ML)
	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	Charlotte Collier Glades Hendry Lee Sarasota Manatee Monroe (ML)	Charlotte Collier Glades Hendry Lee Sarasota Manatee Monroe (ML)	Charlotte Collier Glades Hendry Lee Sarasota Manatee Monroe (ML)	Charlotte Collier Glades Hendry Lee Sarasota Manatee Monroe (ML)	Charlotte Collier Glades Hendry Lee Sarasota Manatee Monroe (ML)

ML – includes mainland portion of Monroe County only.

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	9-hour	12-hour	12-hour	18-hour	18-hour
Evacuation Phasing	None	None	None	None	None
Behavioral Response	Planning	Planning	Planning	Planning	Planning
Evacuation Level	A	B except as noted below	C except as noted below	D except as noted below	E except as noted below
Counties Evacuating	Collier Lee Monroe (ML) Hendry Glades Okeechobee Highlands	Sarasota Charlotte Lee DeSoto Glades (A) Hendry (A) Collier (A) Highlands (A)	Collier Lee Charlotte Sarasota (B) Monroe (ML-B) Glades (B) Hendry (B) Highlands (B) DeSoto (B)	Collier Lee Charlotte Sarasota (C) Monroe (ML-C) Glades (C) Hendry (C) Highlands (C) DeSoto (C) Okeechobee (B)	Collier Lee Charlotte Sarasota Monroe Manatee (D) Glades (D) Hendry (D) Highlands (C) DeSoto (C) Okeechobee (C) Hardee (C) Polk (C)
	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	9-hour	12-hour	12-hour	18-hour	18-hour
Evacuation Phasing	None	None	None	None	None
Behavioral Response	Planning	Planning	Planning	Planning	Planning
Evacuation Level	A	B except as noted below	C except as noted below	D except as noted below	E except as noted below
Counties Evacuating	Sarasota Lee Charlotte Manatee DeSoto Highlands Glades	Collier Charlotte Lee DeSoto Glades (A) Hendry (A) Sarasota (A) Highlands (A)	Sarasota Lee Charlotte Collier (B) Manatee (B) Glades (B) Hardee (B) Highlands (B) DeSoto (B) Hendry (B)	Sarasota Lee Charlotte Collier (C) Manatee (C) Glades (C) Hendry (C) Highlands (C) DeSoto (C) Hardee (C)	Broward Palm Beach Martin Highlands (D) Glades (D) Hendry (D) Okeechobee (D) Lee (C) Sarasota (C) Charlotte (C) DeSoto (C) Hardee (C) Collier (B)

(ML) – includes the mainland portion of Monroe County only.

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 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 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 base scenarios range from 13 hours for the evacuation level A scenarios to 70.5 hours for Charlotte 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 11.5 hours for the evacuation level A scenarios to 66.5 hours for Collier 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 78 hours for Sarasota County for the evacuation level E scenario. Clearance Time to Shelter shows a similar pattern, with clearance times for the base scenarios ranging from 11.5 hours for the evacuation level A scenarios to 74.5 hours for Lee County for evacuation level E scenario in 2015.

Out-of-county clearance times for the base scenarios range from 14 hours for the base evacuation level A scenario to 89.5 hours in Glades County for the evacuation level E scenario. Out-of-county clearance times remain relatively constant in 2015, with Glades County at 89 hours for evacuation level E.

Regional clearance time for the six county SWFRPC region ranges from 15.5 hours to 89.5 hours in 2010 and from 15.5 to 89 hours in 2015.

6. Operational Scenarios

In-county clearance times for the 2010 operational scenarios range from 0 hours to 51 hours depending upon the scenario. Counties that were not included in the evacuation scenario will have an in-county clearance time of 0 since no one within the county is evacuating. Clearance Time to Shelter shows a similar pattern, with clearance times for the operational scenarios ranging from 0 hours to 35.5 hours depending upon the county and the scenario.

In 2015, in-county clearance times for the operational scenarios vary from 0 hours to 34.5 hours for the level D evacuation in Sarasota County. The 2015 level E evacuation includes vehicle trips evacuating from the Treasure Coast region, which is why clearance times within the Southwest region are lower for the operational level E scenario than the operational level D scenario. Clearance Time to Shelter shows a similar pattern to the 2010 scenarios, with clearance times for the base scenarios ranging from 0 hours to 32 hours depending upon the scenario.

Out-of-county clearance times for the 2010 operational scenarios range from 10.5 hours to 51.5 hours for the evacuation level E scenario. Out-of-county clearance times for all

counties in 2015 range from 10.5 to 35 hours depending upon the scenario. Regional clearance time for the six-county SWFRPC region ranges from 13 hours to 51.5 hours in 2010 and between 12 and 35 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					
Charlotte County	13.5	18.5	25.5	50.0	62.0
Collier County	13.0	19.0	38.5	45.5	66.5
Glades County	11.5	11.5	11.5	11.5	12.0
Hendry County	13.5	16.0	31.5	39.5	55.5
Lee County	13.0	19.0	42.0	48.0	63.0
Sarasota County	13.0	19.5	30.5	40.5	65.5
In-County Clearance Time					
Charlotte County	15.0	26.5	45.0	52.0	70.5
Collier County	14.0	19.0	39.0	46.0	68.5
Glades County	13.0	13.0	13.0	13.0	13.5
Hendry County	14.0	16.5	43.5	52.0	66.0
Lee County	13.5	23.0	43.5	52.5	66.0
Sarasota County	15.5	27.0	45.0	52.5	69.5
Out-of-County Clearance Time					
Charlotte County	15.0	26.5	45.0	52.0	70.5
Collier County	14.5	19.5	44.5	46.0	69.0
Glades County	15.5	24.0	45.0	62.5	89.5
Hendry County	14.5	24.0	44.5	53.5	71.0
Lee County	14.0	23.0	43.5	52.5	66.0
Sarasota County	15.5	27.0	45.0	52.5	69.5
Regional Clearance Time					
Southwest	15.5	27.0	45.0	62.5	89.5

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					
Charlotte County	13.5	17.0	28.5	39.5	52.5
Collier County	13.0	18.0	37.0	45.5	55.0
Glades County	11.5	11.5	11.5	11.5	11.5
Hendry County	13.0	13.5	36.5	45.5	47.5
Lee County	13.0	17.0	36.5	45.5	74.5
Sarasota County	13.0	18.0	35.0	49.5	60.0
In-County Clearance Time					
Charlotte County	14.5	19.0	41.0	49.0	77.5
Collier County	14.0	18.0	37.0	46.5	68.0
Glades County	13.0	13.0	13.0	13.0	13.0
Hendry County	13.5	14.0	40.0	45.5	77.0
Lee County	14.0	18.5	40.5	49.5	77.0
Sarasota County	15.0	20.0	43.5	50.0	78.0
Out-of-County Clearance Time					
Charlotte County	15.0	19.5	41.0	49.0	77.5
Collier County	14.5	20.0	40.5	47.0	70.0
Glades County	15.0	23.5	41.5	62.5	89.0
Hendry County	14.5	21.5	41.0	53.0	77.5
Lee County	14.5	18.5	40.5	49.5	77.0
Sarasota County	15.5	20.5	43.5	50.5	79.0
Regional Clearance Time					
Southwest	15.5	23.5	43.5	62.5	89.0

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					
Charlotte County	0.0	13.5	19.0	19.5	27.0
Collier County	10.0	13.0	17.0	28.5	35.5
Glades County	7.0	9.0	10.5	14.0	15.0
Hendry County	10.5	12.0	17.0	19.5	35.0
Lee County	10.0	13.0	19.5	27.5	35.5
Sarasota County	0.0	13.0	14.5	19.0	30.0
In-County Clearance Time					
Charlotte County	0.0	14.0	25.0	33.0	51.0
Collier County	10.0	14.0	17.5	28.5	37.0
Glades County	9.0	12.5	12.5	16.5	17.0
Hendry County	11.0	13.5	17.5	29.5	37.5
Lee County	10.5	14.0	20.0	32.5	40.5
Sarasota County	0.0	14.5	25.5	33.5	51.0
Out-of-County Clearance Time					
Charlotte County	12.5	14.5	25.0	33.0	51.0
Collier County	10.5	14.0	19.0	31.5	38.0
Glades County	12.5	16.0	27.0	33.0	42.5
Hendry County	11.5	14.5	23.0	32.5	42.5
Lee County	10.5	14.0	20.0	32.5	40.5
Sarasota County	12.5	15.0	26.0	34.0	51.5
Regional Clearance Time					
Southwest	13.0	16.0	27.0	34.0	51.5

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					
Charlotte County	10.0	13.0	20.0	30.0	20.0
Collier County	0.0	13.0	14.5	23.5	19.0
Glades County	8.0	10.5	11.0	15.5	14.5
Hendry County	0.0	13.5	14.0	24.0	20.5
Lee County	10.0	13.0	20.5	24.0	20.0
Sarasota County	10.0	13.0	19.0	32.0	20.5
In-County Clearance Time					
Charlotte County	10.5	14.0	25.5	34.0	23.5
Collier County	0.0	14.0	17.0	24.5	20.5
Glades County	9.5	12.5	12.5	17.0	17.0
Hendry County	0.0	14.5	14.5	24.5	21.5
Lee County	10.5	13.5	20.5	31.5	22.5
Sarasota County	11.0	15.0	26.0	34.5	31.0
Out-of-County Clearance Time					
Charlotte County	10.5	14.0	25.5	34.0	23.5
Collier County	11.0	14.5	17.0	27.0	20.5
Glades County	12.0	16.5	22.0	31.0	23.0
Hendry County	11.5	15.5	21.5	31.0	22.5
Lee County	10.5	13.5	20.5	31.5	22.5
Sarasota County	11.0	15.0	26.0	35.0	31.5
Regional Clearance Time					
Southwest	12.0	16.5	26.0	35.0	31.5

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 Charlotte County					
12-Hour	71,785	70,276	47,361	41,565	30,685
18-Hour	89,731	105,414	71,042	62,348	46,028
24-Hour		140,552	94,722	83,130	61,370
36-Hour		155,193	142,083	124,695	92,055
Estimated Evacuating Population Clearing Collier County					
12-Hour	132,319	159,930	86,566	85,619	57,301
18-Hour	159,885	239,896	129,849	128,428	85,951
24-Hour		259,887	173,132	171,237	114,601
36-Hour			259,698	256,856	171,902
Estimated Evacuating Population Clearing Glades County					
12-Hour	5,162	3,557	2,071	1,600	1,159
18-Hour	6,668	5,336	3,106	2,400	1,738
24-Hour		7,114	4,141	3,201	2,318
36-Hour			6,212	4,801	3,477
Estimated Evacuating Population Clearing Hendry County					
12-Hour	17,817	11,376	6,744	5,850	4,583
18-Hour	21,529	17,064	10,116	8,776	6,874
24-Hour		22,752	13,487	11,701	9,166
36-Hour			20,231	17,551	13,749
Estimated Evacuating Population Clearing Lee County					
12-Hour	228,652	235,567	154,899	137,361	113,832
18-Hour	266,761	353,351	232,348	206,042	170,749
24-Hour		451,504	309,798	274,722	227,665
36-Hour			464,696	412,083	341,497
Estimated Evacuating Population Clearing Sarasota County					
12-Hour	84,012	68,612	69,948	73,920	60,350
18-Hour	108,516	102,919	104,922	110,880	90,524
24-Hour		137,225	139,895	147,840	120,699
36-Hour		154,378	209,843	221,759	181,049

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 Charlotte County					
12-Hour	93,102	109,090	57,255	48,340	30,580
18-Hour	116,378	163,635	85,883	72,510	45,870
24-Hour		177,271	114,510	96,680	61,160
36-Hour			171,766	145,020	91,741
Estimated Evacuating Population Clearing Collier County					
12-Hour	175,121	175,034	104,426	92,361	62,177
18-Hour	211,604	262,552	156,640	138,542	93,266
24-Hour		291,724	208,853	184,723	124,355
36-Hour			313,279	277,084	186,532
Estimated Evacuating Population Clearing Glades County					
12-Hour	5,848	3,966	2,453	1,733	1,258
18-Hour	7,310	5,949	3,679	2,600	1,887
24-Hour		7,767	4,906	3,467	2,516
36-Hour			7,359	5,200	3,774
Estimated Evacuating Population Clearing Hendry County					
12-Hour	19,626	13,952	8,003	6,448	4,579
18-Hour	23,715	20,929	12,005	9,671	6,868
24-Hour		24,998	16,006	12,895	9,157
36-Hour			24,009	19,343	13,736
Estimated Evacuating Population Clearing Lee County					
12-Hour	224,333	278,583	171,891	156,786	107,111
18-Hour	271,069	417,874	257,837	235,179	160,666
24-Hour		429,482	343,783	313,572	214,221
36-Hour			515,674	470,359	321,332
Estimated Evacuating Population Clearing Sarasota County					
12-Hour	87,801	92,108	80,039	87,482	59,222
18-Hour	113,409	138,163	120,059	131,224	88,833
24-Hour		157,352	160,079	174,965	118,444
36-Hour			240,118	262,447	177,666

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 Southwest Florida 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 SWFRPC region include I-75, US 41, SR 82, SR 29, SR 78, SR 31, and US 17. 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 SWFRPC counties, in coordination with the State, should continue public information campaigns to clearly define those that are vulnerable and should evacuate versus those who choose to evacuate on their own. Shadow evacuations in inland areas of the counties impact the ability of the vulnerable population to evacuate;

- 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 5-9) 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 east directions; and,

- The counties within the Southwest Florida 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.

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