

Volume 1-2 Technical Data Report Apalachee Region

Chapter VI Regional Transportation Evacuation Analysis

Prepared by

**APALACHEE REGIONAL PLANNING COUNCIL
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CHAPTER SIX

REGIONAL TRANSPORTATION EVACUATION 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, 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 nine county Apalachee Regional Planning Council (ARPC) 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 Apalachee region. While the impact of other regions is included in the Apalachee analysis, it is important to note that the results of the transportation analysis presented in this document are only reported for the nine counties included in the ARPC. Transportation analysis results for other regions and counties are reported in the corresponding Volume 4 report for those regions.

C. Input and Coordination

The SRESP transportation methodology and framework was developed during 2008 and 2009 in coordination with all eleven regional planning councils in Florida, along with the Division of Emergency Management, Department of Transportation, Department of Economic Opportunity (formerly the Department of Community Affairs), and local county emergency management teams with CDM Smith serving as the transportation consultant.

During the updates to SRESP in 2015, two meetings were held at the local and regional level to receive updated input from local county emergency management and the regional planning council. The two meetings held in the region included the following:

Regional Meeting No. 1 – Scenario Development Update Meeting

The first regional meeting for the Apalachee region was held on February 24, 2015. The purpose of the scenario development update meeting was to discuss the base scenarios for the region for growth management purposes and discuss and receive input on the operational scenarios to be evaluated for emergency management purposes.

Regional Meeting No. 2 – Transportation Analysis Update Meeting

The second and final regional meeting for the Apalachee region was held on August 25, 2015. The purpose of the transportation analysis meeting was to review the draft results of the transportation analysis and receive feedback on the draft final report.

D. Study Comparisons

It is important to note that this study contains updates and revisions in comparison to the 2010 SRESP study for the Apalachee region. These revisions include updates to population projections based on the 2010 census, new evacuation zones based on updated storm surge maps, modifications to the roadway network due to recently completed and planned construction projects and changes to the location and size of available shelters.

E. Evacuation Modeling Methodology and Framework

The overall evacuation modeling methodology and framework was developed during 2008 and 2009 in coordination with all eleven RPCs and DEM. The methodology used in the ARPC Analysis was updated to accommodate new versions of Cube Voyager and Cube Avenue software and is summarized in the following sections:

- **Behavioral Assumptions** – In 2008, a behavioral survey was commissioned in support of the SRESP. 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 8,829 zones. This number provides sufficient detail to accurately accommodate the assignment of evacuation trips onto an evacuation network.

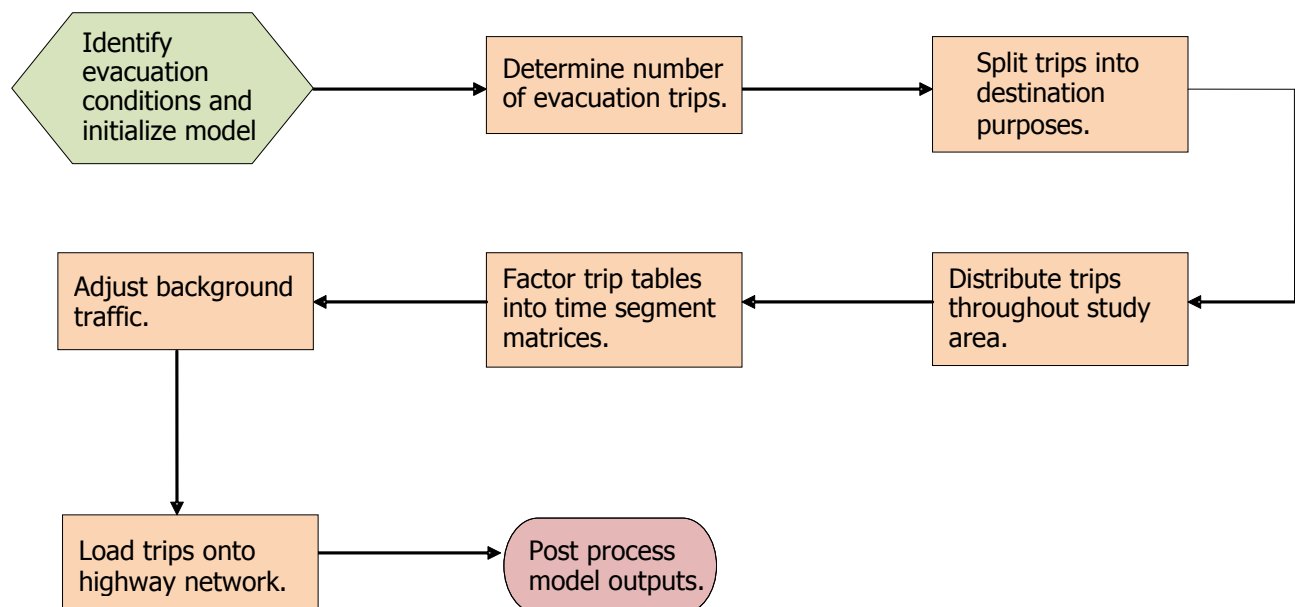
- **Background Traffic** - The traffic that consumes the roadway capacity of a transportation system during an evacuation can be divided into two groups. The first group is the evacuation traffic itself. Once the evacuation demand is determined, this information is converted into a number of vehicles 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** - CDM Smith developed the prototype model 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, survey rates, 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.

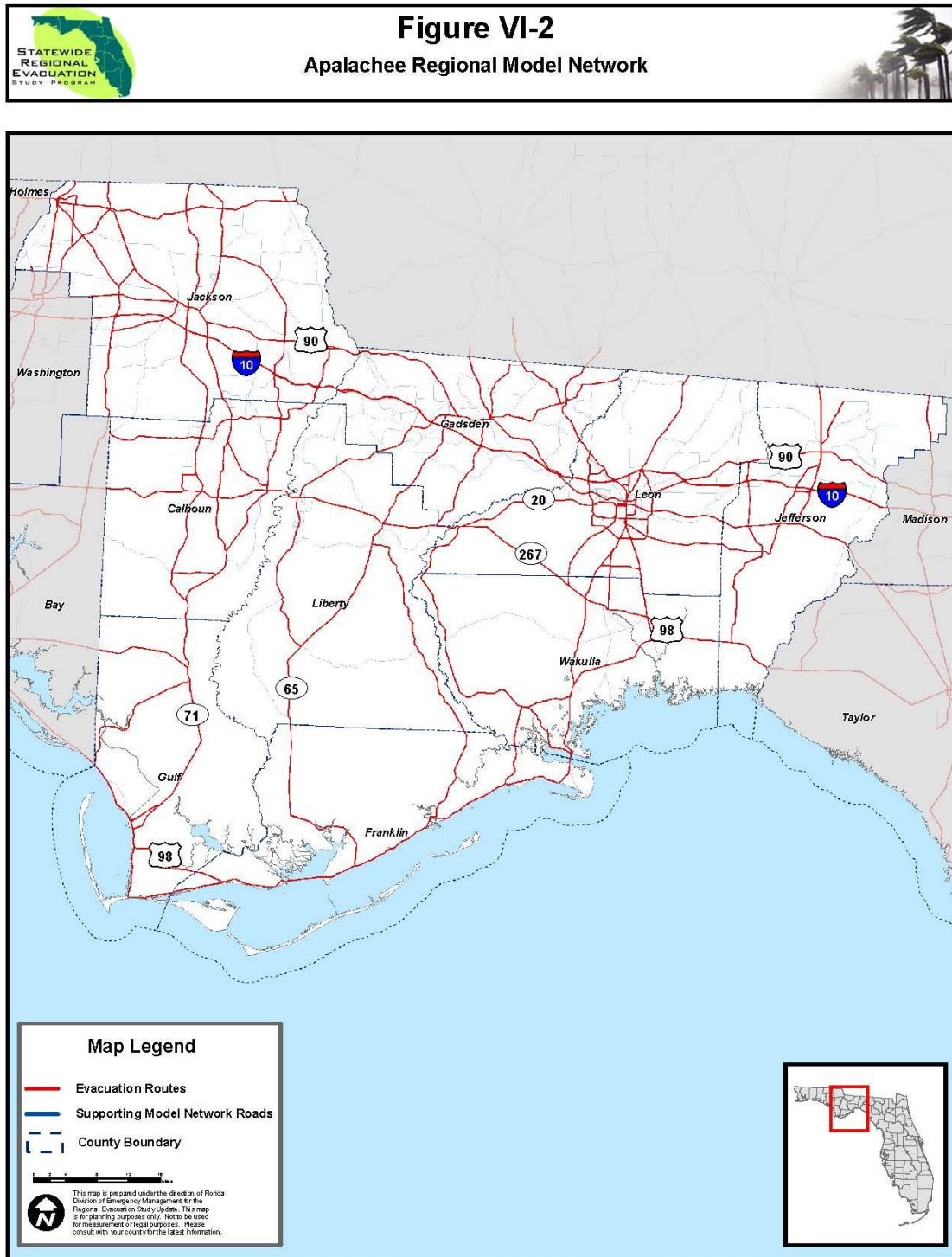
F. Regional Model Implementation

The regional model developed for the Apalachee region used a series of input data provided by the ARPC, including the following:

- **Regional Model Network** - The regional model network consists of the Apalachee region designated evacuation routes as well as a supporting roadway network that facilitates movement of evacuation traffic. The 2015 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 ARPC. The ARPC coordinated with emergency managers to provide the information on which roads were to be included as evacuation routes. The resulting model network was updated to 2010 conditions and is referred to as the base model network. Figure VI-2 identifies the model network and evacuation routes for the ARPC. County level details of the regional model network are provided in the Volume 5-2 report. The regional model network for the Apalachee Bay Region includes key roadways within the nine county region, including I-10, US 231, US 27, US 98, US 90, US 19, US 319, SR 71, SR 20, SR 65, SR 61, SR 363 and SR 59.
- **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 224 zones located within the nine county Apalachee Bay Region, as illustrated in Figure VI-3. In the Apalachee Bay Region, Leon County has the largest number of TEZs with 97; Jackson follows with 35 TEZs. Liberty, Franklin and Jefferson Counties have the lowest number of TEZs within the RPC; Liberty has 6 and Franklin and Jefferson have 10 zones

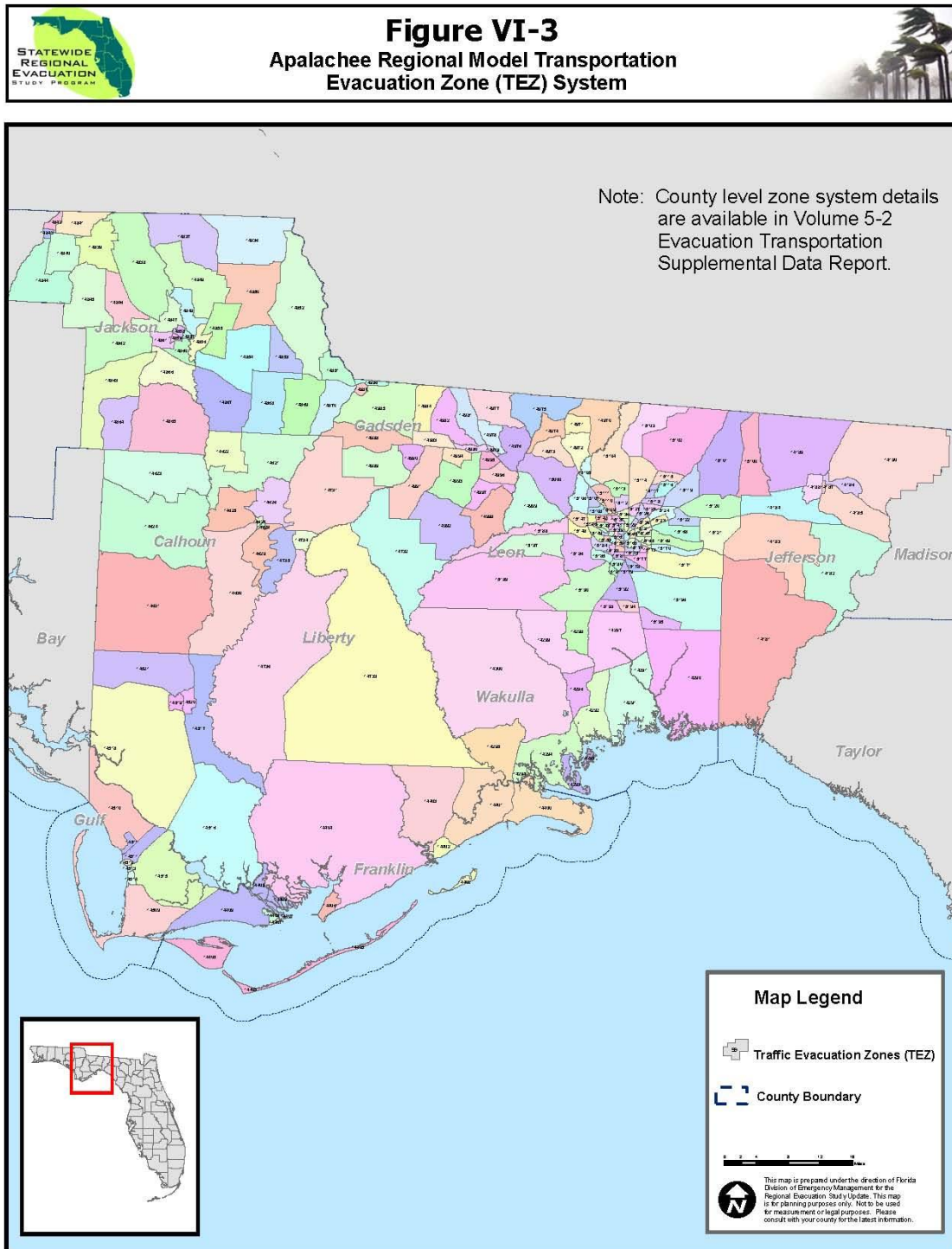
each. The larger number of TEZs generally reflects counties with dense urban structure and higher population densities.

- **Regional Demographic Characteristics** - Demographic data were developed for 2015 and 2020. A snapshot of the key demographic data for each county in the Apalachee region for 2010, 2015 and 2020 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.



Sources: Apalachee Regional Planning Council, CDM Smith

Map Printed: July, 2015



Sources: Apalachee Regional Planning Council, Wilbur Smith Associates

Map Printed: July, 2010

Table VI-1 - Apalachee Demographic Characteristics

County	Characteristic	Year		
		2010	2015	2020
Calhoun	Occupied site-built homes	3,419	3,491	3,634
	Population in site-built homes	8,345	8,515	8,869
	Occupied mobile homes	1,642	1,677	1,746
	Population in mobile home	4,389	4,483	4,665
	Hotel/motel units	24	24	24
Franklin	Occupied site-built homes	3,191	3,306	3,306
	Population in site-built homes	7,418	7,686	7,689
	Occupied mobile homes	1,063	1,102	1,102
	Population in mobile home	2,303	2,386	2,386
	Hotel/motel units	457	457	457
Gadsden	Occupied site-built homes	12,250	12,579	12,804
	Population in site-built homes	30,602	31,420	31,975
	Occupied mobile homes	4,702	4,826	4,913
	Population in mobile home	13,626	13,990	14,242
	Hotel/motel units	456	456	456
Gulf	Occupied site-built homes	4,224	4,251	4,286
	Population in site-built homes	9,075	9,134	9,208
	Occupied mobile homes	1,111	1,116	1,125
	Population in mobile home	3,338	3,353	3,380
	Hotel/motel units	160	160	160
Jackson	Occupied site-built homes	12,755	12,810	12,858
	Population in site-built homes	30,679	30,809	30,930
	Occupied mobile homes	4,662	4,684	4,700
	Population in mobile home	11,073	11,124	11,162
	Hotel/motel units	829	829	829
Jefferson	Occupied site-built homes	3,716	3,701	3,826
	Population in site-built homes	7,878	7,846	8,113
	Occupied mobile homes	1,930	1,919	1,983
	Population in mobile home	5,544	5,513	5,697
	Hotel/motel units	197	197	197
Leon	Occupied site-built homes	101,411	104,813	109,845
	Population in site-built homes	237,554	245,528	257,296
	Occupied mobile homes	9,534	9,859	10,332
	Population in mobile home	22,939	23,727	24,865
	Hotel/motel units	5,990	5,990	6,000
Liberty	Occupied site-built homes	1,590	1,760	1,866
	Population in site-built homes	3,428	3,794	4,024
	Occupied mobile homes	935	1,034	1,096
	Population in mobile home	3,055	3,381	3,584
	Hotel/motel units	12	12	12
Wakulla	Occupied site-built homes	6,769	7,057	7,663
	Population in site-built homes	17,997	18,763	20,375
	Occupied mobile homes	3,721	3,879	4,212
	Population in mobile home	9,351	9,747	10,584
	Hotel/motel units	205	205	205

Source: Apalachee Regional Planning Council

Leon County has the largest population in the region during all three time periods. The county is expected to reach more than 300,000 people by 2020. Gadsden and Jackson Counties have the second and third largest populations in the region; the projected growth did not occur in Wakulla County. Liberty County has the least population in the region and is projected to have less than 10,000 people in 2020. Leon County has the highest population numbers for mobile home residents for all three time periods; however this only represents approximately 8% of the population. In contrast, almost 47% of Liberty County residents reside in mobile homes while 37% of Wakulla County residents do as well.

- **Planned Roadway Improvements** - To correspond to the three different sets of demographic data, three model networks were ultimately developed. The base 2010 network and two future year networks to correspond to the 2015 and the 2020 demographic data. The 2010 base model network was updated to reflect roadway capacity improvement projects completed between 2011 and 2015 to create the 2015 network. The 2015 network was then updated to reflect planned roadway capacity improvement projects expected to be implemented between 2016 and 2020 to create the 2020 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 2011 and 2015 that were included in the 2015 network. Likewise, Table VI-3 identifies capacity improvement projects planned for implementation between 2016 and 2020. The tables identify each roadway that will be improved as well as the extent of the improvement.

It is important to note that Tables VI-2 and VI-3 are not intended to be 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** - Five of the counties within the Apalachee Bay Region have evacuation zones A – D. Evacuation rates for site-built homes and mobile/manufactured homes are provided by county and summarized in Figure VI-4 through Figure VI-13. 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 5-2.

Please note that the original behavioral response rates provided by SRESP in Volume 2-2 were modified to fit the evacuation zones created by each of the counties. The original rates were based on a five zone system; however, the evacuation zones for the Apalachee RPC range from two to four zones depending upon the county. The evacuation zone systems for the Apalachee Bay Region are listed below:

- Gulf – 4 zones: Zone A, Zone B, Zone C, Zone D;
- Franklin – 2 zones: Zone A, Zone B;
- Jefferson – 4 zones: Zone A, Zone B, Zone C, Zone D;
- Leon – 2 zones: Zone C, Zone D; and,
- Wakulla – 3 zones: Zone A, Zone B, Zone C.

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 Apalachee region there are a total of 26 shelters in six counties. The number of shelters in each of the counties includes one in Calhoun, two in Gadsden, two in Gulf, two in Jackson, one in Jefferson, 15 in Leon, one in Liberty and two in Wakulla. All together, the 26 shelters located within the region are capable of sheltering more than 32,000 persons during an evacuation event. Detailed lists of the available public shelters by county are included in Volume 1-2 Chapter V.

Table VI-2 - Apalachee Region Roadway Improvements, 2015

County	Roadway	From	To	Number of Lanes
Leon	Gaines St	Monroe St	Bradford Rd	2
	Franklin Blvd	Lafayette St	Tennessee St	2
	Capital Circle NW	I-10	Blountstown Hwy	6
	Mahan Dr/US Hwy 90	Dempsey Mayo Rd	I-10	4

Sources: FDOT SIS First Five Year Plan, FDOT SIS Second Five Year Plan, Apalachee Regional Planning Council

Note: Projects included in this table are roadway improvement projects completed between 2011 and 2015 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 2010.

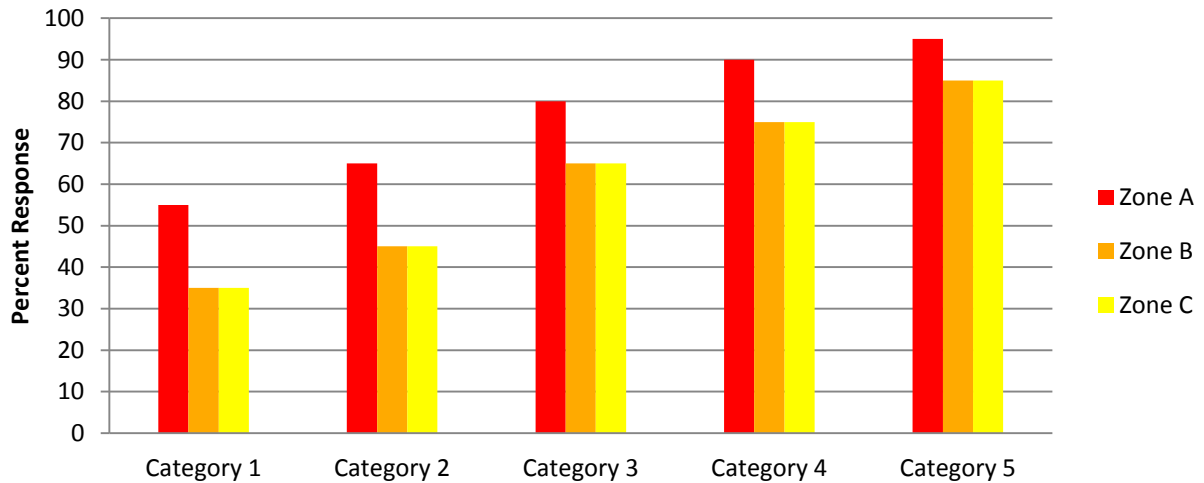
Table VI-3 – Apalachee Region Planned Roadway Improvements, 2020

County	Roadway	From	To	Number of Lanes
Leon	Capital Circle SW	Crawfordville Rd	Blountstown Hwy	6
	Woodville Hwy	Capital Circle	Gaile Ave	4
	FAMU Way	Wahnish Way	Lake Bradford Rd	2
Wakulla	Crawfordville Hwy	East Ivan Rd	Leon County Line	4

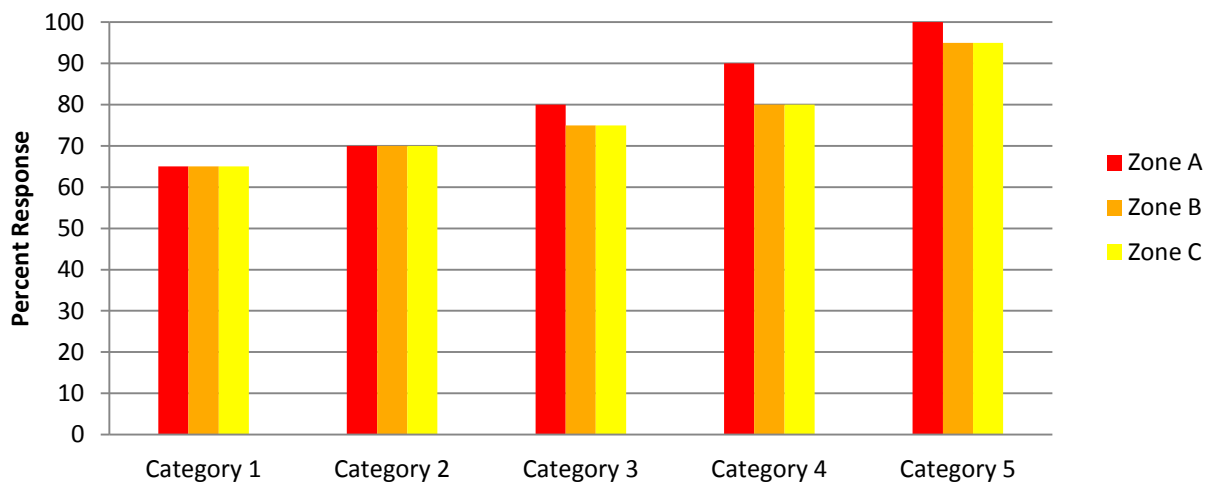
Sources: FDOT SIS First Five Year Plan, FDOT SIS Second Five Year Plan, Apalachee Regional Planning Council

Note: Projects included in this table are roadway improvement projects planned for completion between 2016 and 2020 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.

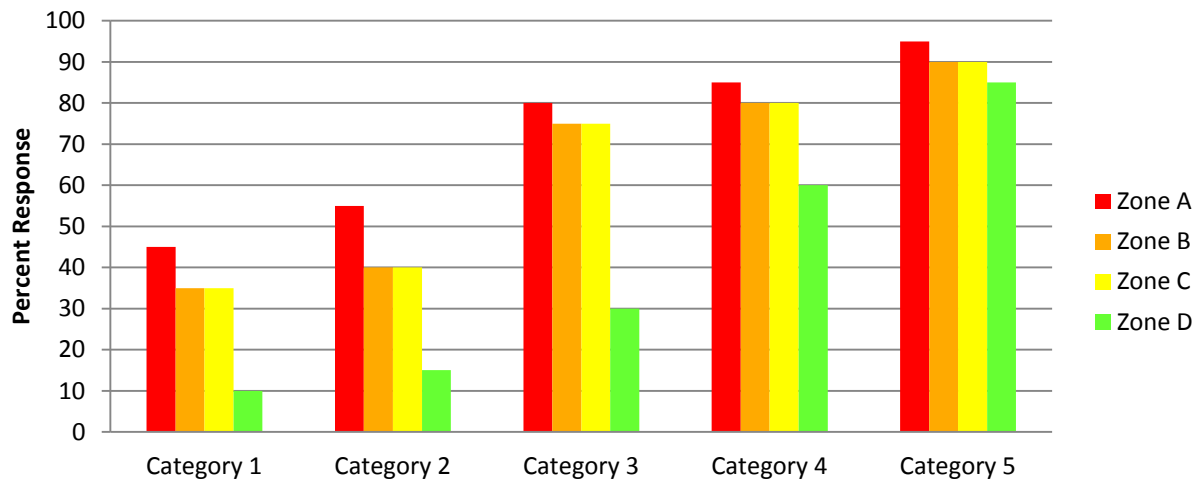
**Figure VI-4 - Evacuation Participation Rates
Franklin County - Site-Built Homes**



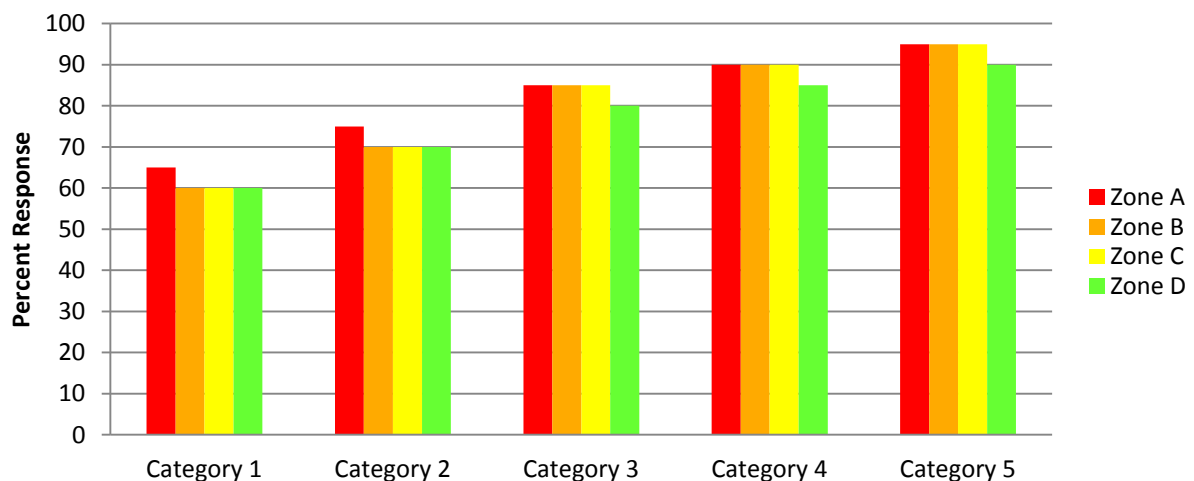
**Figure VI-5 - Evacuation Participation Rates
Franklin County - Mobile Homes**



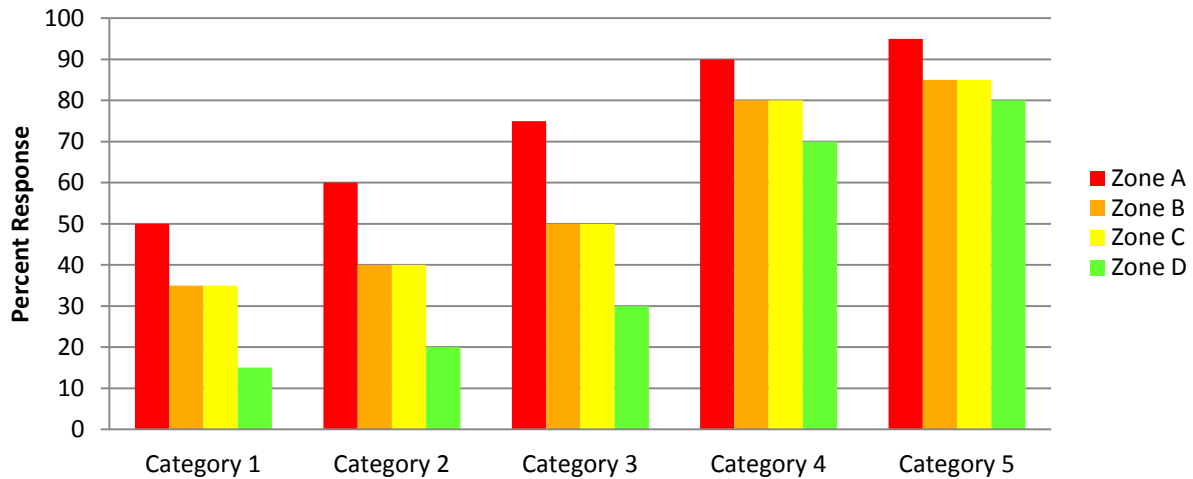
**Figure VI-6 - Evacuation Participation Rates
Gulf County - Site-Built Homes**



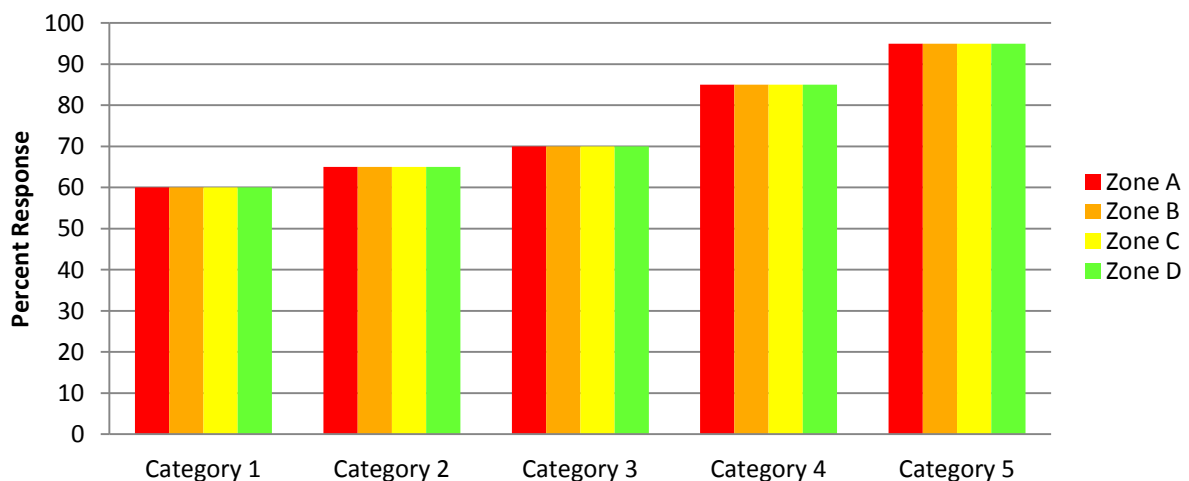
**Figure VI-7 - Evacuation Participation Rates
Gulf County - Mobile Homes**

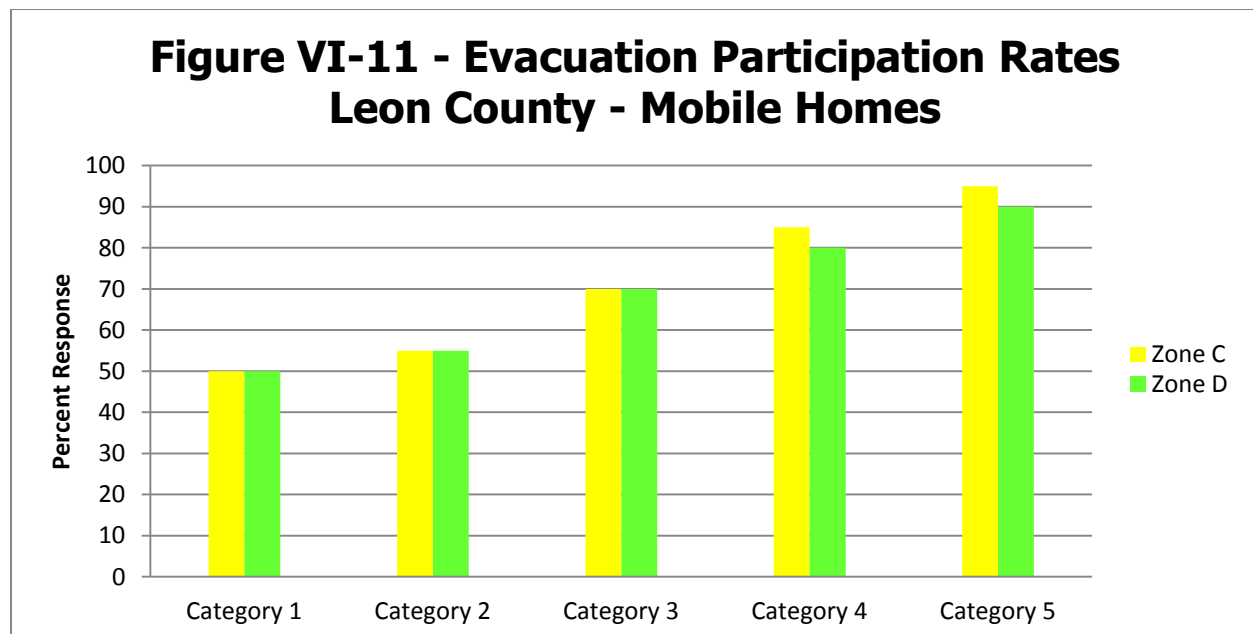
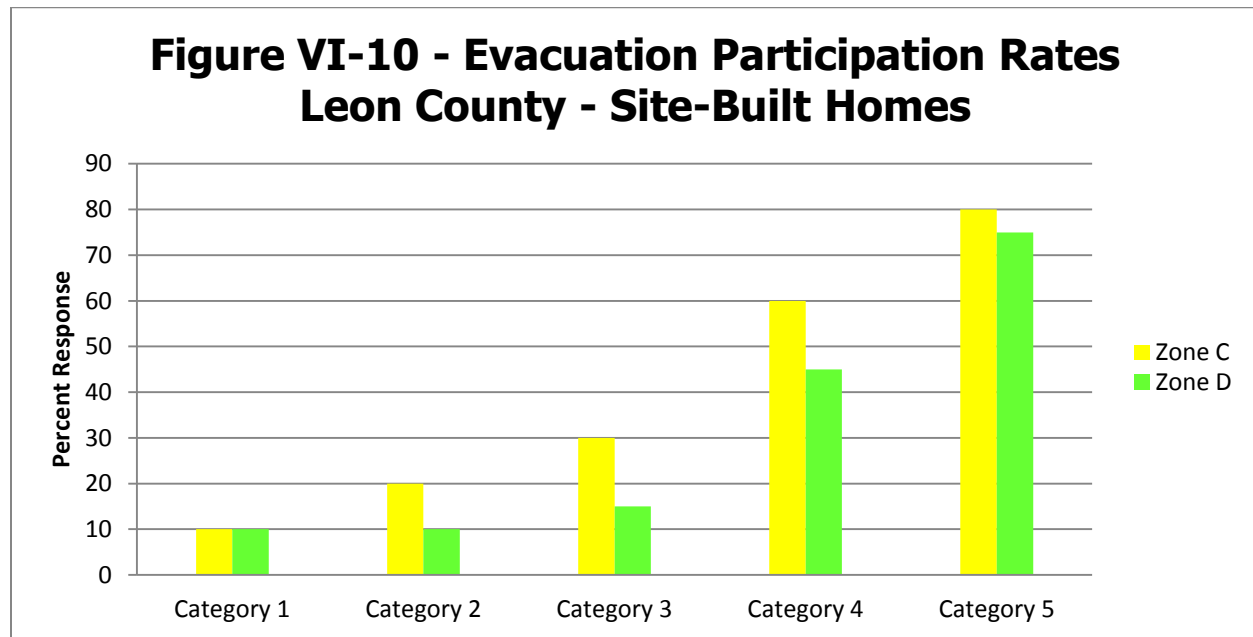


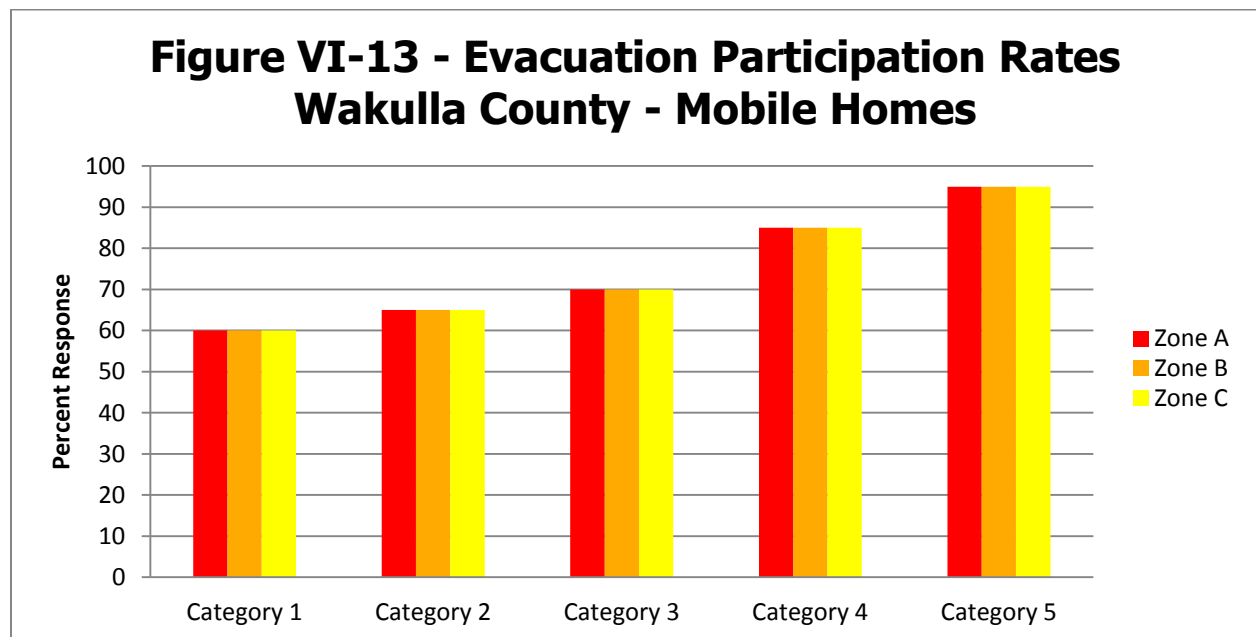
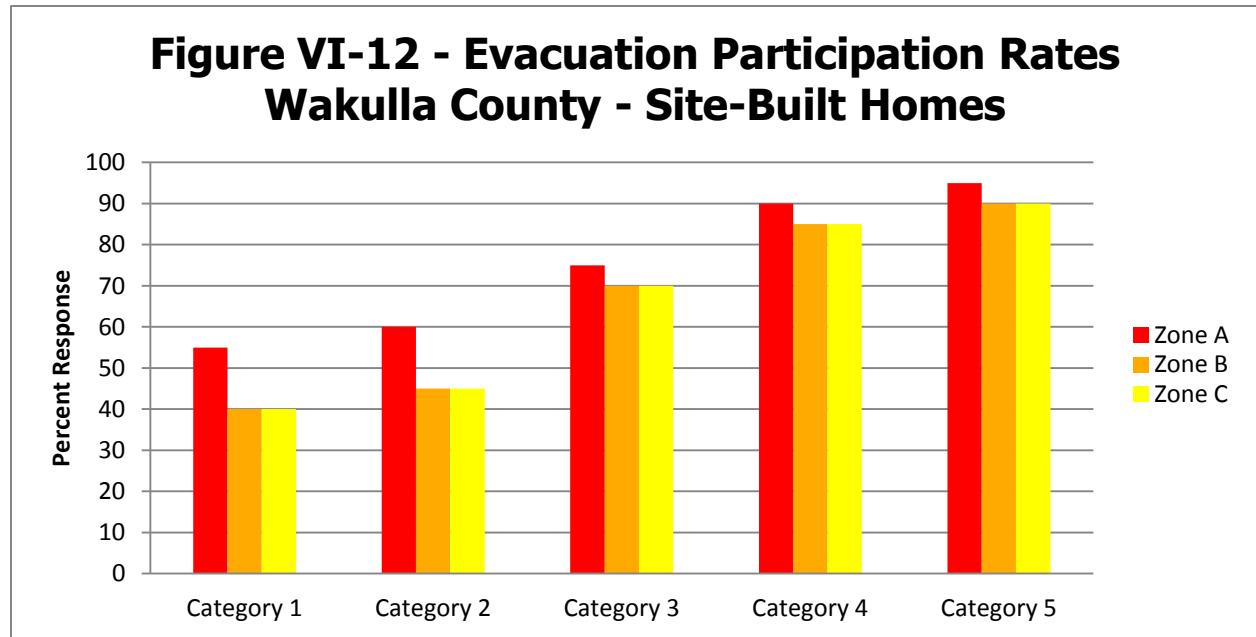
**Figure VI-8 - Evacuation Participation Rates
Jefferson County - Site-Built Homes**



**Figure VI-9 - Evacuation Participation Rates
Jefferson County - Mobile Homes**



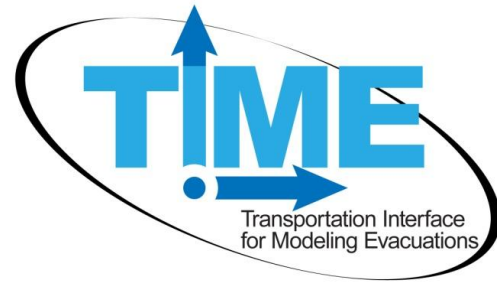




- **Evacuation Zones** - The final input variable that is needed to complete the transportation evacuation model is the delineation of evacuation zones for all coastal counties. Local county emergency managers have the responsibility of identifying and defining evacuation zones for their county. Franklin, Gulf, Jefferson, Leon and Wakulla Counties within the Apalachee Bay Region have updated and established their evacuation zones as stated earlier.

G. TIME User Interface

CDM 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.

H. 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 Apalachee Bay Region for 2015 is identified in Table VI-4, summarized by evacuation zone and split between site-built homes and mobile/manufactured homes. Vulnerable population for 2020 is summarized in Table VI-5.

Table VI-4
Vulnerable Population in the Apalachee Bay Region for 2015

	Evacuation Zone A	Evacuation Zone B	Evacuation Zone C	Evacuation Zone D	Total
Franklin County					
Site-built Homes	3,699	3,857	N/A		
Mobile/Manuf. Homes	929	1,431	N/A		
TOTAL	4,628	5,288	N/A		9,916
Gulf County					
Site-built Homes	1,818	3,228	2,240	189	
Mobile/Manuf. Homes	201	263	1,224	84	
TOTAL	2,019	3,491	3,464	274	9,248
Jefferson County					
Site-built Homes	104	65	150	265	
Mobile/Manuf. Homes	116	72	166	278	
TOTAL	220	137	316	543	1,216
Leon County					
Site-built Homes	N/A		2,772	2,408	
Mobile/Manuf. Homes	N/A		2,981	1,831	
TOTAL	N/A		5,753	4,241	9,994
Wakulla County					
Site-built Homes	5,934	2,653	6,835	N/A	
Mobile/Manuf. Homes	1,645	834	5,306	N/A	
TOTAL	7,578	3,486	12,141	N/A	23,205

Note: Vulnerable population was determined using small area data and county 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 Apalachee Region for 2020**

	Evacuation Zone A	Evacuation Zone B	Evacuation Zone C	Evacuation Zone D	Total
Franklin County					
Site-built Homes	3,700	3,859	N/A		
Mobile/Manuf. Homes	929	1,431	N/A		
TOTAL	4,629	5,290	N/A		9,919
Gulf County					
Site-built Homes	1,833	3,254	2,261	191	
Mobile/Manuf. Homes	202	264	1,232	84	
TOTAL	2,035	3,518	3,493	275	9,321
Jefferson County					
Site-built Homes	108	67	155	274	
Mobile/Manuf. Homes	120	75	172	288	
TOTAL	228	142	327	562	1,259
Leon County					
Site-built Homes	N/A		2,907	2,524	
Mobile/Manuf. Homes	N/A		3,122	1,921	
TOTAL	N/A		6,029	4,445	10,474
Wakulla County					
Site-built Homes	6,444	2,880	7,420	N/A	
Mobile/Manuf. Homes	1,785	905	5,765	N/A	
TOTAL	8,229	3,785	13,185	N/A	25,199

Note: Vulnerable population determined using small area data and county 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 Apalachee Bay Region are identified in Table VI-6 for 2015 and in Table VI-7 for 2020.

The vulnerable shadow population is provided in Table VI-8 for both 2015 and 2020. The vulnerable shadow population was determined using the behavioral assumptions for evacuating shadow population and is based on storm category, not evacuation zone.

**Table VI-6
Vulnerable Population by Destination for 2015**

	Evacuation Zone A	Evacuation Zone B	Evacuation Zone C	Evacuation Zone D	Total
Franklin County					
To Friends and Family	2,407	2,787	N/A		
To Hotel/Motel	1,110	1,251	N/A		
To Public Shelter	148	308	N/A		
To Other Destinations	962	943	N/A		
Total	4,627	5,279			9,906
Gulf County					
To Friends and Family	1,151	1,972	2,150	167	
To Hotel/Motel	475	833	682	56	
To Public Shelter	107	182	210	22	
To Other Destinations	287	503	422	29	
Total	2,022	3,490	3,464	274	9,250
Jefferson County					
To Friends and Family	143	89	206	353	
To Hotel/Motel	22	14	32	54	
To Public Shelter	28	17	40	68	
To Other Destinations	27	17	39	68	
Total	220	137	317	543	1,217
Leon County					
To Friends and Family	N/A		3,601	2,636	
To Hotel/Motel	N/A		853	665	
To Public Shelter	N/A		437	304	
To Other Destinations	N/A		863	636	
Total			5,754	4,241	9,995
Wakulla County					
To Friends and Family	4,926	2,266	7,892	N/A	
To Hotel/Motel	1,055	481	1,556	N/A	
To Public Shelter	379	174	607	N/A	
To Other Destinations	1,219	565	2,086	N/A	
Total	7,579	3,486	12,141		23,206

Note: Vulnerable population destinations determined using small area data and county 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 2020**

	Evacuation Zone A	Evacuation Zone B	Evacuation Zone C	Evacuation Zone D	Total
Franklin County					
To Friends and Family	2,407	2,788	N/A		
To Hotel/Motel	1,111	1,251	N/A		
To Public Shelter	148	308	N/A		
To Other Destinations	962	943	N/A		
Total	4,628	5,290			9,918
Gulf County					
To Friends and Family	1,160	1,988	2,167	169	
To Hotel/Motel	478	840	688	56	
To Public Shelter	107	182	210	22	
To Other Destinations	289	507	425	29	
Total	2,034	3,517	3,490	276	9,317
Jefferson County					
To Friends and Family	147	92	213	365	
To Hotel/Motel	23	14	33	56	
To Public Shelter	28	17	40	68	
To Other Destinations	28	18	40	70	
Total	226	141	326	559	1,252
Leon County					
To Friends and Family	N/A		3,773	2,763	
To Hotel/Motel	N/A		894	697	
To Public Shelter	N/A		458	318	
To Other Destinations	N/A		904	667	
Total			6,029	4,445	10,474
Wakulla County					
To Friends and Family	5,349	2,460	8,570	N/A	
To Hotel/Motel	1,145	523	1,689	N/A	
To Public Shelter	379	174	607	N/A	
To Other Destinations	1,324	613	2,266	N/A	
Total	8,197	3,770	13,132		25,099

Note: Vulnerable population destinations determined using small area data and county 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**

	Category 1 Hurricane	Category 2 Hurricane	Category 3 Hurricane	Category 4 Hurricane	Category 5 Hurricane
2015					
Calhoun County	4,901	5,327	6,178	6,603	7,029
Franklin County	3,138	808	797	804	810
Gadsden County	17,127	18,696	20,265	21,834	23,403
Gulf County	5,190	4,075	2,208	2,235	2,318
Jackson County	12,682	14,223	17,303	18,844	20,384
Jefferson County	5,864	6,153	6,316	6,375	6,738
Leon County	36,166	48,561	75,881	85,484	97,637
Liberty County	3,574	3,779	4,163	4,363	4,576
Wakulla County	12,173	10,625	2,616	2,783	2,951
Total	100,815	112,247	135,727	150,325	165,846
2020					
Calhoun County	5,109	5,553	6,441	6,886	7,330
Franklin County	3,136	806	795	802	808
Gadsden County	17,440	19,038	20,636	22,235	23,833
Gulf County	5,230	4,104	2,222	2,246	2,329
Jackson County	12,725	14,271	17,364	18,910	20,456
Jefferson County	6,076	6,374	6,542	6,599	6,974
Leon County	37,870	50,847	79,457	89,508	102,234
Liberty County	3,798	4,016	4,424	4,637	4,863
Wakulla County	13,211	11,531	2,814	2,996	3,177
Total	104,595	116,540	140,695	154,819	172,004

Note: Vulnerable shadow population determined using small area data and county evacuation zones.

I. 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 planning scenarios for the Apalachee 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 Apalachee 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 ARPC to continue testing combinations of options and provide additional information to emergency managers.

J. Clearance Time Results

Each of the ten base scenarios and ten operational scenarios were modeled for the Apalachee Bay 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 Planning Scenarios for 2015 and 2020**

	Category 1 Scenario 1 2015	Category 2 Scenario 2 2015	Category 3 Scenario 3 2015	Category 4 Scenario 4 2015	Category 5 Scenario 5 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%
Counties Evacuating	Bay Calhoun Franklin Gadsden Gulf Jackson Jefferson Leon Liberty Taylor Wakulla	Bay Calhoun Franklin Gadsden Gulf Jackson Jefferson Leon Liberty Taylor Wakulla	Bay Calhoun Franklin Gadsden Gulf Jackson Jefferson Leon Liberty Taylor Wakulla	Bay Calhoun Franklin Gadsden Gulf Jackson Jefferson Leon Liberty Taylor Wakulla	Bay Calhoun Franklin Gadsden Gulf Jackson Jefferson Leon Liberty Taylor Wakulla
	Category 1 Scenario 6 2020	Category 2 Scenario 7 2020	Category 3 Scenario 8 2020	Category 4 Scenario 9 2020	Category 5 Scenario 10 2020
Demographic Data	2020	2020	2020	2020	2020
Highway Network	2020	2020	2020	2020	2020
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%
Counties Evacuating	Bay Calhoun Franklin Gadsden Gulf Jackson Jefferson Leon Liberty Taylor Wakulla	Bay Calhoun Franklin Gadsden Gulf Jackson Jefferson Leon Liberty Taylor Wakulla	Bay Calhoun Franklin Gadsden Gulf Jackson Jefferson Leon Liberty Taylor Wakulla	Bay Calhoun Franklin Gadsden Gulf Jackson Jefferson Leon Liberty Taylor Wakulla	Bay Calhoun Franklin Gadsden Gulf Jackson Jefferson Leon Liberty Taylor Wakulla

Table VI-10
Operational Scenarios for 2015 and 2020

	Scenario 1 2015	Scenario 2 2015	Scenario 3 2015	Scenario 4 2015	Scenario 5 2015
Demographic Data	2015	2015	2015	2015	2015
Highway Network	2015	2015	2015	2015	2015
One-Way Operations	None	None	I-10	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	18-hour	18-hour	12-hour	12-hour	12-hour
Evacuation Phasing	None	None	None	None	None
Behavioral Response	Planning	Planning	Planning	Planning	Planning
Evacuation Zone	A	B	B and C	B - D	D
Counties Evacuating	Bay Franklin Gulf Taylor Wakulla Shadow – Calhoun Leon Liberty	Bay Franklin Gulf Jefferson Taylor Wakulla Shadow – Calhoun Gadsden Jackson Leon Liberty	Bay Franklin Gulf Jefferson Taylor Wakulla Shadow – Calhoun Gadsden Jackson Leon Liberty	Bay Franklin Gulf Jefferson Taylor Wakulla Shadow – Calhoun Gadsden Jackson Leon Liberty	Bay Franklin Gulf Jefferson Taylor Wakulla Shadow – Calhoun Gadsden Jackson Leon Liberty
	Scenario 6 2020	Scenario 7 2020	Scenario 8 2020	Scenario 9 2020	Scenario 10 2020
Demographic Data	2020	2020	2020	2020	2020
Highway Network	2020	2020	2020	2020	2020
One-Way Operations	None	None	None	None	I-10
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	18-hour	18-hour	12-hour	12-hour	12-hour
Evacuation Phasing	None	None	None	None	None
Behavioral Response	Planning	Planning	Planning	Planning	Planning
Evacuation Zone	A	B	B and C	B - D	D
Counties Evacuating	Bay Franklin Gulf Taylor Wakulla	Bay Franklin Gulf Jefferson Taylor Wakulla Shadow – Calhoun Gadsden Jackson Leon Liberty	Bay Franklin Gulf Jefferson Taylor Wakulla Shadow – Calhoun Gadsden Jackson Leon Liberty	Bay Franklin Gulf Jefferson Taylor Wakulla Shadow – Calhoun Gadsden Jackson Leon Liberty	Bay Franklin Gulf Jefferson Taylor Wakulla Shadow – Calhoun Gadsden Jackson Leon Liberty

- **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 Planning Scenarios

The 2015 In-County clearance times for the base scenarios range from 13 hours to 15.5 hours depending upon the scenario. Clearance Time to Shelter varies a little more, with clearance times for the base scenarios ranging from 8 hours to 14 hours. In 2020, in-county clearance times for the base scenarios remain fairly constant, with clearance times ranging from 13 hours to 17 hours. 2020 Clearance Time to Shelter shows a similar pattern to 2015, with clearance times for the base scenarios ranging from 8.5 hours to 14 hours depending upon the scenario.

The Out of County clearance times for the base planning scenarios range from 13 hours to 16 hours, depending on the scenario. Out of County clearance times remain fairly constant in 2020, with clearance times ranging from 13 to 17 hours.

Regional clearance time for the Apalachee region remains constant at 15 - 17 hours for all base scenarios for both 2015 and 2020.

Operational Scenarios

The county emergency management offices intentionally chose longer response curves for the operational scenarios. This increased the evacuation clearance times from the previous ones published in 2010. There are minimal differences in clearance times between 2015 and 2020.

In-County clearance times for both the 2015 and 2020 operational scenarios range from 18 hours to 21 hours depending upon the scenario. Clearance Time to Shelter for both 2015 and 2020, has a greater range with 4.5 hours for Franklin County which does not have a shelter to 18.5 hours for the rest of the region. The Out of County clearance times for range 19 to 21 hours depending upon the scenario.

Regional clearance times for the Apalachee region ranges from 20.5 hours to 21 hours in both 2015 and 2020.

Table VI-11
Clearance Times for Base Planning Scenarios for 2015

	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5
Clearance Time to Shelter					
Calhoun County	12.5	12.5	12.5	12.5	13.0
Franklin County	8.5	8.5	8.5	8.5	8.5
Gadsden County	13.0	13.0	13.5	13.5	14.0
Gulf County	12.5	12.5	12.5	12.5	12.5
Jackson County	12.5	12.5	12.5	12.5	12.5
Jefferson County	12.5	12.5	12.5	12.5	12.5
Leon County	12.5	12.5	13.5	13.5	13.5
Liberty County	12.5	12.5	12.5	12.5	13.0
Wakulla County	13.0	13.0	13.0	13.0	13.0
In-County Clearance Time					
Calhoun County	13.0	13.0	13.0	13.0	13.5
Franklin County	13.0	13.0	13.0	13.5	13.5
Gadsden County	13.5	13.5	14.0	14.0	14.5
Gulf County	13.0	13.0	13.0	13.0	13.0
Jackson County	13.0	13.0	13.0	13.0	13.0
Jefferson County	14.0	14.0	14.0	15.5	16.5
Leon County	13.0	13.0	14.0	14.0	16.0
Liberty County	13.0	12.5	12.5	12.5	13.0
Wakulla County	13.5	14.0	14.0	15.0	15.5
Out of County Clearance Time					
Calhoun County	14.0	14.0	14.0	14.0	14.0
Franklin County	13.0	13.0	13.0	13.5	13.5
Gadsden County	14.5	14.5	14.5	15.5	16.0
Gulf County	13.0	13.0	13.0	13.0	13.5
Jackson County	15.0	15.0	15.0	15.0	15.0
Jefferson County	15.0	15.0	15.0	16.0	16.5
Leon County	14.5	14.5	15.0	15.5	16.5
Liberty County	14.0	14.0	14.0	14.5	15.0
Wakulla County	14.0	14.0	14.0	15.0	15.5
Regional Clearance Time					
Apalachee	15.0	15.0	15.0	16.0	16.5

Table VI-12
Clearance Times for Base Planning Scenarios for 2020

	Scenario 6	Scenario 7	Scenario 8	Scenario 9	Scenario 10
Clearance Time to Shelter					
Calhoun County	12.5	12.5	12.5	13.0	13.5
Franklin County	8.5	8.5	8.5	8.5	8.5
Gadsden County	12.5	13.0	13.0	13.5	14.0
Gulf County	12.5	12.5	12.5	12.5	12.5
Jackson County	12.5	12.5	12.5	12.5	12.5
Jefferson County	12.5	12.5	12.5	12.5	12.5
Leon County	12.5	13.0	13.0	13.5	13.5
Liberty County	12.5	12.5	13.0	13.0	13.0
Wakulla County	13.0	13.0	13.0	13.0	13.0
In-County Clearance Time					
Calhoun County	13.0	13.0	13.0	13.5	14.0
Franklin County	13.0	13.0	13.0	13.5	13.5
Gadsden County	13.0	13.5	13.5	14.0	14.5
Gulf County	13.0	13.0	13.0	13.0	13.0
Jackson County	13.0	13.0	13.0	13.0	13.0
Jefferson County	14.0	14.0	14.0	15.0	17.0
Leon County	13.0	13.5	14.0	14.0	16.5
Liberty County	13.0	13.0	13.0	13.0	13.0
Wakulla County	14.0	14.0	14.0	15.0	16.0
Out of County Clearance Time					
Calhoun County	14.0	14.0	14.0	14.5	14.0
Franklin County	13.0	13.0	13.0	13.5	13.5
Gadsden County	14.5	14.5	15.0	15.5	16.5
Gulf County	13.0	13.5	13.5	13.5	13.5
Jackson County	14.5	14.5	14.5	14.5	14.5
Jefferson County	15.0	15.0	15.5	16.0	17.0
Leon County	14.5	14.5	15.0	16.0	16.5
Liberty County	14.0	14.0	14.0	14.5	15.5
Wakulla County	14.0	14.0	14.0	15.0	16.0
Regional Clearance Time					
Apalachee	15.0	15.0	15.5	16.0	17.0

Table VI-13
Clearance Times for Operational Scenarios for 2015

	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5
Clearance Time to Shelter					
Calhoun County	18.5	18.5	18.5	18.5	18.5
Franklin County	4.5	4.5	4.5	4.5	4.5
Gadsden County	0.0	18.5	18.5	18.5	18.5
Gulf County	18.5	18.5	18.5	18.5	18.5
Jackson County	0.0	18.5	18.5	18.5	18.5
Jefferson County	18.5	18.5	18.5	18.5	18.5
Leon County	18.5	18.5	18.5	18.5	18.5
Liberty County	18.5	18.5	18.5	18.5	18.5
Wakulla County	18.5	18.5	18.5	18.5	18.5
In-County Clearance Time					
Calhoun County	19.0	19.0	19.0	19.0	19.0
Franklin County	19.0	19.0	19.0	19.0	19.0
Gadsden County	0.0	19.0	19.0	19.0	19.0
Gulf County	19.0	18.5	18.5	19.0	19.0
Jackson County	0.0	19.0	19.0	19.0	19.0
Jefferson County	20.0	20.0	20.0	21.0	21.0
Leon County	19.0	20.0	20.0	20.5	20.5
Liberty County	19.0	18.5	18.5	18.5	18.5
Wakulla County	20.0	20.0	20.0	20.0	20.0
Out of County Clearance Time					
Calhoun County	20.0	19.5	19.5	20.0	20.0
Franklin County	19.0	19.0	19.0	19.0	19.0
Gadsden County	20.5	20.5	20.5	20.5	20.5
Gulf County	19.0	19.0	19.0	19.5	19.5
Jackson County	20.5	20.5	20.5	21.0	21.0
Jefferson County	20.5	21.0	21.0	21.0	21.0
Leon County	20.5	20.5	20.5	20.5	20.5
Liberty County	19.5	20.0	20.0	20.0	20.0
Wakulla County	20.0	20.0	20.0	20.0	20.0
Regional Clearance Time					
Apalachee	20.5	21.0	21.0	21.0	21.0

Table VI-14
Clearance Times for Operational Scenarios for 2020

	Scenario 6	Scenario 7	Scenario 8	Scenario 9	Scenario 10
Clearance Time to Shelter					
Calhoun County	18.5	18.5	18.5	18.5	18.5
Franklin County	4.5	4.5	4.5	4.5	4.5
Gadsden County	0.0	18.5	18.5	18.5	18.5
Gulf County	18.5	18.5	18.5	18.5	18.5
Jackson County	0.0	18.5	18.5	18.5	18.5
Jefferson County	18.5	18.5	18.5	18.5	18.5
Leon County	18.5	18.5	18.5	18.5	18.5
Liberty County	18.5	18.5	18.5	18.5	18.5
Wakulla County	18.5	18.5	18.5	18.5	18.5
In-County Clearance Time					
Calhoun County	19.0	19.0	19.0	19.0	19.0
Franklin County	19.0	19.0	19.0	19.0	19.0
Gadsden County	0.0	19.0	19.0	19.0	19.0
Gulf County	19.0	18.5	18.5	19.0	19.0
Jackson County	0.0	19.0	19.0	19.0	19.0
Jefferson County	20.0	20.0	20.0	21.0	21.0
Leon County	19.0	20.0	20.0	20.5	20.5
Liberty County	19.0	18.5	18.5	18.5	18.5
Wakulla County	20.0	20.0	20.0	20.0	19.5
Out of County Clearance Time					
Calhoun County	20.0	21.5	19.5	20.0	20.0
Franklin County	19.0	19.0	19.0	19.0	19.0
Gadsden County	20.5	20.0	20.5	20.5	20.5
Gulf County	19.0	19.0	19.0	19.0	19.0
Jackson County	20.5	20.5	20.5	20.5	21.0
Jefferson County	20.5	21.0	21.0	21.0	21.0
Leon County	20.5	20.5	20.5	20.5	20.5
Liberty County	20.0	21.0	20.0	20.0	20.0
Wakulla County	20.0	20.0	20.0	20.0	19.5
Regional Clearance Time					
Apalachee	20.5	21.5	21.0	21.0	21.0

K. 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 2015 is identified in Table VI-15 and for 2020 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.

L. 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 as in scenarios 1 and 2, clearance time will vary by as much as 40 percent depending on the response curve. Low evacuation levels for these scenarios 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 2015

	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5
Estimated Evacuating Population Clearing Calhou County					
12-Hour	4,201	4,566	5,295	5,660	6,025
18-Hour	4,901	5,327	6,178	6,603	7,029
Estimated Evacuating Population Clearing Franklin County					
12-Hour	7,168	9,870	9,889	9,529	9,534
18-Hour	7,765	10,692	10,713	10,720	10,726
Estimated Evacuating Population Clearing Gadsden County					
12-Hour	14,174	15,473	16,771	16,904	17,552
18-Hour	17,127	18,696	20,265	21,834	23,403
Estimated Evacuating Population Clearing Gulf County					
12-Hour	6,654	8,848	10,322	10,599	10,280
18-Hour	7,209	9,585	11,182	11,482	11,565
Estimated Evacuating Population Clearing Jackson County					
12-Hour	10,146	11,378	13,842	15,075	16,307
18-Hour	12,682	14,223	17,303	18,844	20,384
Estimated Evacuating Population Clearing Jefferson County					
12-Hour	4,867	5,208	5,592	5,694	5,785
18-Hour	6,084	6,510	6,990	7,592	7,955
Estimated Evacuating Population Clearing Leon County					
12-Hour	29,930	40,188	60,705	69,465	74,093
18-Hour	36,166	48,561	75,881	89,725	101,878
Estimated Evacuating Population Clearing Liberty County					
12-Hour	3,063	3,239	3,568	3,611	3,661
18-Hour	3,574	3,779	4,163	4,363	4,576
Estimated Evacuating Population Clearing Wakulla County					
12-Hour	16,929	18,591	22,133	20,791	20,251
18-Hour	19,751	21,690	25,822	25,989	26,157

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 IV-33 – Maximum Evacuating Population by Time Interval for 2020

	Scenario 6	Scenario 7	Scenario 8	Scenario 9	Scenario 10
Estimated Evacuating Population Clearing Calhou County					
12-Hour	4,379	4,760	5,521	5,699	6,283
18-Hour	5,109	5,553	6,441	6,886	7,330
Estimated Evacuating Population Clearing Franklin County					
12-Hour	7,168	9,870	9,889	9,529	9,534
18-Hour	7,765	10,692	10,713	10,720	10,726
Estimated Evacuating Population Clearing Gadsden County					
12-Hour	14,433	15,756	16,509	17,214	17,333
18-Hour	17,440	19,038	20,636	22,235	23,833
Estimated Evacuating Population Clearing Gulf County					
12-Hour	6,706	8,584	10,015	10,282	10,356
18-Hour	7,265	9,657	11,267	11,567	11,650
Estimated Evacuating Population Clearing Jackson County					
12-Hour	10,531	11,810	14,370	15,650	16,929
18-Hour	12,725	14,271	17,364	18,910	20,456
Estimated Evacuating Population Clearing Jefferson County					
12-Hour	5,043	5,395	5,604	5,894	5,812
18-Hour	6,304	6,744	7,239	7,858	8,233
Estimated Evacuating Population Clearing Leon County					
12-Hour	31,341	42,080	63,566	70,465	77,585
18-Hour	37,870	50,847	79,457	93,953	106,679
Estimated Evacuating Population Clearing Liberty County					
12-Hour	3,255	3,442	3,792	3,838	3,765
18-Hour	3,798	4,016	4,424	4,637	4,863
Estimated Evacuating Population Clearing Wakulla County					
12-Hour	18,377	20,181	24,011	22,556	21,282
18-Hour	21,440	23,545	28,013	28,195	28,376

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 scenarios 3 and sometimes 4, clearance times varied by as much as 25 percent during the sensitivity analysis. The number of evacuating vehicles is considerably higher than for levels scenarios 1 and 2, 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 in scenario 4 and 5 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 Apalachee 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.

M. 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 ARPC region include US 319, SR 79, US 98, and I-10. For large storm events, such as category 4 and 5 hurricanes, other state facilities also play an important role in evacuations, such as SR 20;
- Given the rural nature of many of the counties within the ARPC, many two-lane state and US highways play a major role during the evacuation process. State and County officials should coordinate personnel resources to provide sufficient traffic control at major intersections along these routes;
- 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 5-2) 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 directions. This is especially important in Leon County along US 319 (Capital Circle); and,
- The counties within the Apalachee 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.