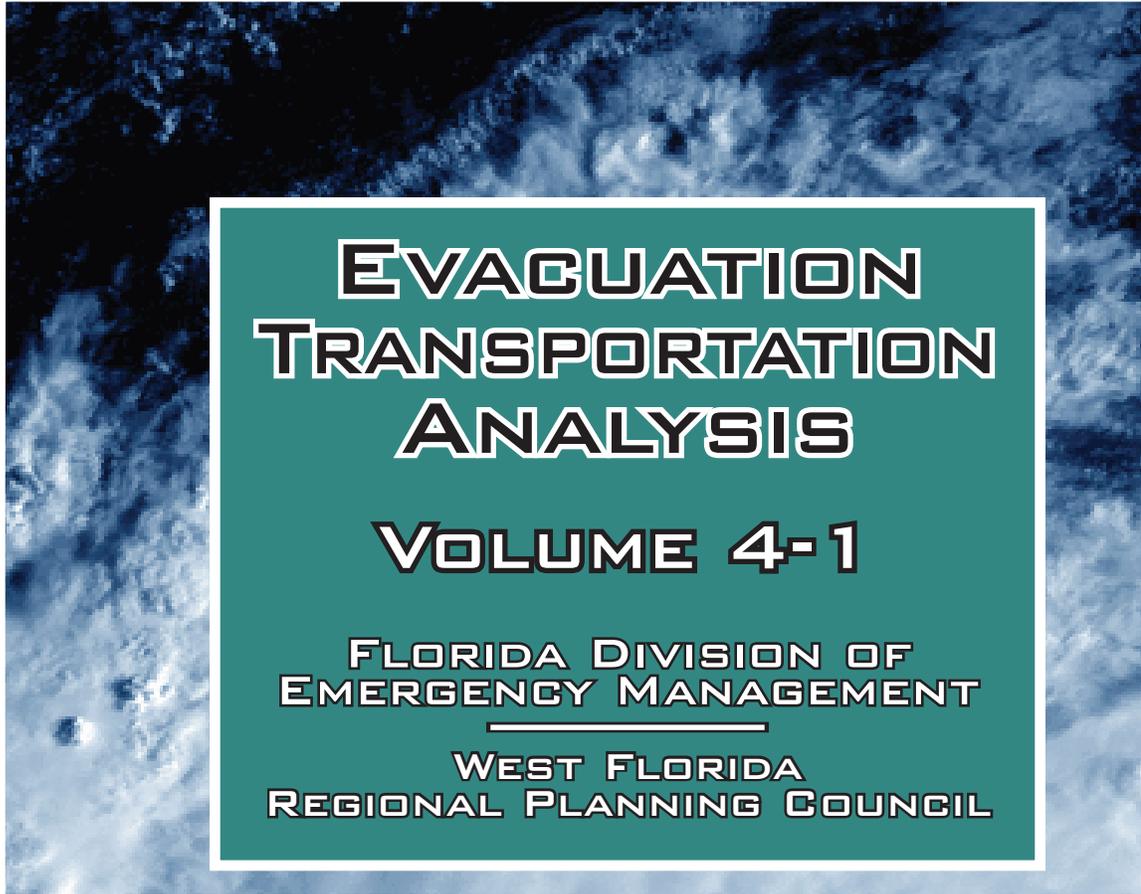




# FLORIDA STATEWIDE REGIONAL EVACUATION STUDY PROGRAM



## EVACUATION TRANSPORTATION ANALYSIS

### VOLUME 4-1

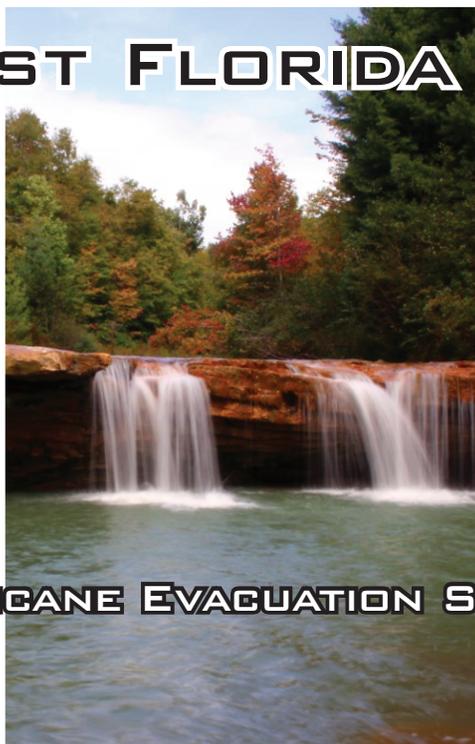
FLORIDA DIVISION OF  
EMERGENCY MANAGEMENT  

---

WEST FLORIDA  
REGIONAL PLANNING COUNCIL



## WEST FLORIDA REGION



INCLUDES HURRICANE EVACUATION STUDY



STATEWIDE  
REGIONAL  
EVACUATION  
STUDY PROGRAM

*This page intentionally left blank.*



## Volume 4-1

# West Florida Region Evacuation Transportation Analysis



**This page intentionally left blank.**



### CREDITS & ACKNOWLEDGEMENTS

Funding was authorized by the Florida Legislature through House Bill 7121, as a result of the 2004 and 2005 hurricane seasons. Provisions of this bill require the Division of Emergency Management to update all Regional Evacuation Studies in the State and inexorably tied the Evacuation Studies and Growth Management. As a result, this study addresses both Emergency Management and Growth Management data needs. Funds were also provided by the Federal Emergency Management Agency (FEMA) with all money administered through the Florida Division of Emergency Management (FDEM), 2555 Shumard

Oak Blvd., Tallahassee, 32399. Web site: [www.floridadisaster.org](http://www.floridadisaster.org). Local match was provided by the counties of Bay, Escambia, Holmes, Okaloosa, Santa Rosa, Walton and Washington

The Council acknowledges and extends its appreciation to the following agencies and people for their cooperation and assistance in the development of this document:

**Wilbur Smith Associates** for the methodology and framework of the evacuation transportation model; in association with BCC Engineering, Inc. A special thanks to **the Florida Department of Transportation** for their input and coordination.

**Florida Division of Emergency Management**  
 David Halstead, Director  
 Sandy Meyer, Hurricane Program Manager  
 Richard Butgereit, GIS Manager

**County Emergency Management Agencies**  
 Mark Bowen, Bay County  
 John Dosh, Escambia County  
 Wanda Stafford, Holmes County  
 Randy McDaniel, Okaloosa County  
 Sheryl Bracewell, Santa Rosa County  
 Joe Preston, Walton County  
 Roger Hagan, Washington County

**Northeast Florida Regional Council**  
 Jeffrey Alexander, Statewide Program Manager

**Florida Department of Transportation**  
 Ed Ward, D2 Emergency Coordination Officer

**Florida Emergency Preparedness Association**  
 For their support in this statewide effort



**This page intentionally left blank.**



---

# **EVACUATION TRANSPORTATION ANALYSIS**

## **VOLUME 4-1**

### **WEST FLORIDA REGION**

Prepared for:

West Florida Regional Planning Council  
Florida Division of Emergency Management

Prepared by:

**WilburSmith**  
ASSOCIATES

July 2010

---

*This page intentionally left blank.*

# TABLE OF CONTENTS

	<b><u>Page</u></b>
<b>Executive Summary .....</b>	<b>ES-1</b>
A. Background and Purpose.....	ES-1
B. Study Area .....	ES-1
C. Input and Coordination .....	ES-2
D. Evacuation Modeling Methodology and Framework .....	ES-2
E. Regional Model Implementation .....	ES-5
F. TIME User Interface.....	ES-16
G. Vulnerable Population .....	ES-16
H. Evacuation Model Scenarios.....	ES-22
I. Clearance Time Results .....	ES-22
J. Maximum Evacuating Population Clearances.....	ES-31
K. Sensitivity Analysis.....	ES-31
L. Summary and Conclusions.....	ES-34
 <b>Chapter I – Introduction .....</b>	 <b>I-1</b>
A. Background and Purpose.....	I-1
B. Study Area .....	I-1
C. Input and Coordination .....	I-3
 <b>Chapter II – Evacuation Modeling Methodology and Framework .....</b>	 <b>II-1</b>
A. Behavioral Assumptions.....	II-1
B. Zone System and Highway Network.....	II-3
C. Background Traffic.....	II-6
D. Evacuation Traffic .....	II-8
E. Dynamic Traffic Assignment .....	II-12
F. Prototype Model Development.....	II-13
 <b>Chapter III – Regional Model Implementation .....</b>	 <b>III-1</b>
A. Regional Model Network.....	III-1
B. Regional Zone System.....	III-1
C. Regional Demographic Characteristics.....	III-4
D. Planned Roadway Improvements .....	III-7
E. Behavioral Assumptions.....	III-10
F. Shelters.....	III-16
G. Evacuation Zones.....	III-16
H. TIME User Interface.....	III-16
 <b>Chapter IV – Transportation Analysis .....</b>	 <b>IV-1</b>
A. Vulnerable Population .....	IV-1
B. Clearance Time Definitions .....	IV-7
C. Evacuation Model Scenarios.....	IV-8
D. Base Scenarios .....	IV-8

	<b><u>Page</u></b>
E. Base Scenario Results .....	IV-11
F. Operational Scenarios .....	IV-40
G. Operational Scenario Results .....	IV-42
H. Maximum Evacuating Population Clearances.....	IV-70
I. Sensitivity Analysis.....	IV-70
J. Summary and Conclusions.....	IV-73

# LIST OF FIGURES

	<b>Page</b>
Figure ES-1 – General Model Flow .....	ES-4
Figure ES-2 – West Florida Regional Model Network.....	ES-6
Figure ES-3 – West Florida Regional Model Transportation Evacuation Zone (TEZ) System ..	ES-7
Figure ES-4 – Evacuating Participation Rates: Bay County – Site-Built Homes .....	ES-11
Figure ES-5 – Evacuating Participation Rates: Bay County – Mobile Homes .....	ES-11
Figure ES-6 – Evacuating Participation Rates: Escambia County – Site-Built Homes .....	ES-12
Figure ES-7 – Evacuating Participation Rates: Escambia County – Mobile Homes.....	ES-12
Figure ES-8 – Evacuating Participation Rates: Okaloosa County – Site-Built Homes .....	ES-13
Figure ES-9 – Evacuating Participation Rates: Okaloosa County – Mobile Homes .....	ES-13
Figure ES-10 – Evacuating Participation Rates: Santa Rosa County – Site-Built Homes .....	ES-14
Figure ES-11 – Evacuating Participation Rates: Santa Rosa County – Mobile Homes .....	ES-14
Figure ES-12 – Evacuating Participation Rates: Walton County – Site-Built Homes.....	ES-15
Figure ES-13 – Evacuating Participation Rates: Walton County – Mobile Homes .....	ES-15
Figure I-1 – West Florida Regional Planning Council .....	I-2
Figure II-1 – Nine Hour Response Curve.....	II-2
Figure II-2 – Percent of Available Capacity for Coastal Counties .....	II-7
Figure II-3 – Percent of Available Capacity for Other Counties .....	II-8
Figure II-4 – General Model Flow .....	II-9
Figure III-1 – West Florida Regional Model Area .....	III-2
Figure III-2 – West Florida Regional Model Network.....	III-3
Figure III-3 – West Florida Regional Model Transportation Evacuation Zone (TEZ) System ..	III-5
Figure III-4 – Evacuating Participation Rates: Bay County – Site-Built Homes .....	III-11
Figure III-5 – Evacuating Participation Rates: Bay County – Mobile Homes .....	III-11
Figure III-6 – Evacuating Participation Rates: Escambia County – Site-Built Homes .....	III-12
Figure III-7 – Evacuating Participation Rates: Escambia County – Mobile Homes.....	III-12
Figure III-8 – Evacuating Participation Rates: Okaloosa County – Site-Built Homes .....	III-13
Figure III-9 – Evacuating Participation Rates: Okaloosa County – Mobile Homes .....	III-13
Figure III-10 – Evacuating Participation Rates: Santa Rosa County – Site-Built Homes .....	III-14
Figure III-11 – Evacuating Participation Rates: Santa Rosa County – Mobile Homes .....	III-14
Figure III-12 – Evacuating Participation Rates: Walton County – Site-Built Homes.....	III-15
Figure III-13 – Evacuating Participation Rates: Walton County – Mobile Homes .....	III-15
Figure III-14 - West Florida Regional Evacuation Zones.....	III-17
Figure IV-1 – Critical Roadway Segments with Excessive Vehicle Queues for 2010 Base Scenario Evacuation Level A .....	IV-18
Figure IV-2 – Critical Roadway Segments with Excessive Vehicle Queues for 2010 Base Scenario Evacuation Level B .....	IV-19
Figure IV-3 – Critical Roadway Segments with Excessive Vehicle Queues for 2010 Base Scenario Evacuation Level C .....	IV-20
Figure IV-4 – Critical Roadway Segments with Excessive Vehicle Queues for 2010 Base Scenario Evacuation Level D .....	IV-21

	<b>Page</b>
Figure IV-5 – Critical Roadway Segments with Excessive Vehicle Queues for 2010 Base Scenario Evacuation Level E .....	IV-22
Figure IV-6 – Critical Roadway Segments with Excessive Vehicle Queues for 2015 Base Scenario Evacuation Level A .....	IV-23
Figure IV-7 – Critical Roadway Segments with Excessive Vehicle Queues for 2015 Base Scenario Evacuation Level B .....	IV-24
Figure IV- 8 – Critical Roadway Segments with Excessive Vehicle Queues for 2015 Base Scenario Evacuation Level C .....	IV-25
Figure IV-9 – Critical Roadway Segments with Excessive Vehicle Queues for 2015 Base Scenario Evacuation Level D .....	IV-28
Figure IV-10 – Critical Roadway Segments with Excessive Vehicle Queues for 2015 Base Scenario Evacuation Level E .....	IV-27
Figure IV-11 – Clearance Time to Shelter Base Scenarios .....	IV-38
Figure IV-12 – In-County Clearance Times Base Scenarios.....	IV-38
Figure IV-13 – Out of County Clearance Times Base Scenarios .....	IV-39
Figure IV-14 – Critical Roadway Segments with Excessive Vehicle Queues for 2010 Operational Scenario Evacuation Level A .....	IV-49
Figure IV-15 – Critical Roadway Segments with Excessive Vehicle Queues for 2010 Operational Scenario Evacuation Level B .....	IV-50
Figure IV-16 – Critical Roadway Segments with Excessive Vehicle Queues for 2010 Operational Scenario Evacuation Level C .....	IV-51
Figure IV-17 – Critical Roadway Segments with Excessive Vehicle Queues for 2010 Operational Scenario Evacuation Level D .....	IV-52
Figure IV-18 – Critical Roadway Segments with Excessive Vehicle Queues for 2010 Operational Scenario Evacuation Level E .....	IV-53
Figure IV-19 – Critical Roadway Segments with Excessive Vehicle Queues for 2015 Operational Scenario Evacuation Level A .....	IV-54
Figure IV-20 – Critical Roadway Segments with Excessive Vehicle Queues for 2015 Operational Scenario Evacuation Level B .....	IV-55
Figure IV-21 – Critical Roadway Segments with Excessive Vehicle Queues for 2015 Operational Scenario Evacuation Level C .....	IV-56
Figure IV-22 – Critical Roadway Segments with Excessive Vehicle Queues for 2015 Operational Scenario Evacuation Level D .....	IV-57
Figure IV-23 – Critical Roadway Segments with Excessive Vehicle Queues for 2015 Operational Scenario Evacuation Level E .....	IV-58
Figure IV-24 – Clearance Time to Shelter Operational Scenarios .....	IV-68
Figure IV-25 – In-County Clearance Times Operational Scenarios.....	IV-68
Figure IV-26 – Out of County Clearance Times Operational Scenarios .....	IV-69

# LIST OF TABLES

	<b>Page</b>
Table ES-1 – West Florida Demographic Characteristic Summary .....	ES-8
Table ES-2 – West Florida Region Roadway Improvements, 2006 – 2010 .....	ES-10
Table ES-3 – West Florida Region Roadway Improvements, 2011 – 2015 .....	ES-10
Table ES-4 – Vulnerable Population in the West Florida Region for 2010.....	ES-17
Table ES-5 – Vulnerable Population in the West Florida Region for 2015.....	ES-18
Table ES-6 – Vulnerable Population by Destination for 2010 .....	ES-19
Table ES-7 – Vulnerable Population by Destination for 2015 .....	ES-20
Table ES-8 – Vulnerable Shadow Evacuation Population .....	ES-21
Table ES-9 – Base Scenarios.....	ES-23
Table ES-10 – Operational Scenarios .....	ES-24
Table ES-11 – 2010 Clearance Times for Base Scenario.....	ES-27
Table ES-12 – 2015 Clearance Times for Base Scenario.....	ES-28
Table ES-13 – 2010 Clearance Times for Operational Scenarios .....	ES-29
Table ES-14 – 2015 Clearance Times for Operational Scenarios .....	ES-30
Table ES-15 – Maximum Evacuating Population by Time Interval for 2010.....	ES-32
Table ES-16 – Maximum Evacuating Population by Time Interval for 2015.....	ES-33
Table II-1 – Out of County Trip Destinations by Region .....	II-11
Table III-1 – West Florida Demographic Characteristics Summary.....	III-6
Table III-2 – West Florida Region Roadway Improvements, 2006 - 2010.....	III-8
Table III-3 – West Florida Region Roadway Improvements, 2011 - 2015.....	III-9
Table IV-1 – Vulnerable Population in the West Florida Region for 2010 .....	IV-2
Table IV-2 – Vulnerable Population in the West Florida Region for 2015 .....	IV-3
Table IV-3 – Vulnerable Population by Destination for 2010.....	IV-4
Table IV-4 – Vulnerable Population by Destination for 2015.....	IV-5
Table IV-5 – Vulnerable Shadow Evacuation Population.....	IV-6
Table IV-6 – Base Scenarios .....	IV-10
Table IV-7 – Evacuating Population by Base Scenario for 2010 .....	IV-12
Table IV-8 – Evacuating Population by Base Scenario for 2015 .....	IV-13
Table IV-9 – Evacuating Vehicles by Base Scenario for 2010.....	IV-14
Table IV-10 – Evacuating Vehicles by Base Scenario for 2015 .....	IV-15
Table IV-11 – Shelter Demand by Base Scenario.....	IV-16
Table IV-12 – Total Evacuating Vehicles for Base Scenarios .....	IV-17
Table IV-13 – Evacuating Vehicles Leaving Each County by Evacuation Route for the 2010 Base Scenario.....	IV-29
Table IV-14 – Evacuating Vehicles Leaving Each County by Evacuation Route for the 2015 Base Scenario.....	IV-31
Table IV-15 – Evacuating Vehicles Entering Each County by Evacuation Route for the 2010 Base Scenario.....	IV-33
Table IV-16 –Evacuating Vehicles Entering Each County by Evacuation Route for the 2015 Base Scenario .....	IV-34

	<b>Page</b>
Table IV-17 – 2010 Clearance Times for Base Scenario .....	IV-36
Table IV-18 – 2015 Clearance Times for Base Scenario .....	IV-37
Table IV-19 – Operational Scenarios .....	IV-41
Table IV-20 – Evacuating Population by Operational Scenario for 2010.....	IV-43
Table IV-21 – Evacuating Population by Operational Scenario for 2015.....	IV-44
Table IV-22 – Evacuating Vehicles by Operational Scenario for 2010 .....	IV-45
Table IV-23 – Evacuating Vehicles by Operational Scenario for 2015 .....	IV-46
Table IV-24 – Shelter Demand by Operational Scenario.....	IV-47
Table IV-25 – Total Evacuating Vehicles for Operational Scenarios .....	IV-48
Table IV-26 – Evacuating Vehicles Leaving Each County by Evacuation Route for the 2010 Operational Scenarios .....	IV-59
Table IV-27 – Evacuating Vehicles Leaving Each County by Evacuation Route for the 2015 Operational Scenarios .....	IV-61
Table IV-28 – Evacuating Vehicles Entering Each County by Evacuation Route for the 2010 Operational Scenarios .....	IV-63
Table IV-29 – Evacuating Vehicles Entering Each County by Evacuation Route for the 2015 Operational Scenarios .....	IV-64
Table IV-30 – 2010 Clearance Times for Operational Scenarios.....	IV-66
Table IV-31 – 2015 Clearance Times for Operational Scenarios.....	IV-67
Table IV-32 – Maximum Evacuating Population by Time Interval for 2010 .....	IV-71
Table IV-33 – Maximum Evacuating Population by Time Interval for 2015 .....	IV-72

# EXECUTIVE SUMMARY

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 seven county West 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 West Florida region. While the impact of other regions is included in the West Florida analysis, it is important to note that the results of the transportation analysis presented in this document are only reported for the seven counties included in the West 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 West Florida RPC Evacuation Transportation Analysis is identical to the methodology used for all eleven Regional Planning Councils and includes the following components:

- **Behavioral Assumptions** – In 2008, the Statewide Regional Evacuation Study Program (SRESP) commissioned a survey of Florida residents. The purpose of this survey was to develop an understanding of the behavior of individuals when faced with the prospect of an impending evacuation. These data were used to develop a set of “planning assumptions” that describe the way people respond to an order to evacuate and are an important input to the SRESP Evacuation Model. The behavioral data provides insights into how people respond to the changing conditions leading up to and during an evacuation. The primary application of the survey data was to help anticipate how people would respond with respect to five behaviors:
  - How many people would evacuate?
  - When they would leave?
  - What type of refuge they would seek?
  - Where they would travel for refuge?
  - How many vehicles would they use?

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

- Type of dwelling unit (site-built home versus mobile home);
  - The evacuation zone in which the evacuee reside; and,
  - The intensity of the evacuation that has been ordered.
- **Zone System and Highway Network** - The SRESP evacuation model relies upon data that covers the entire State of Florida as well as areas covering the States of Georgia, Alabama, Mississippi, South Carolina, North Carolina, and Tennessee. While the primary

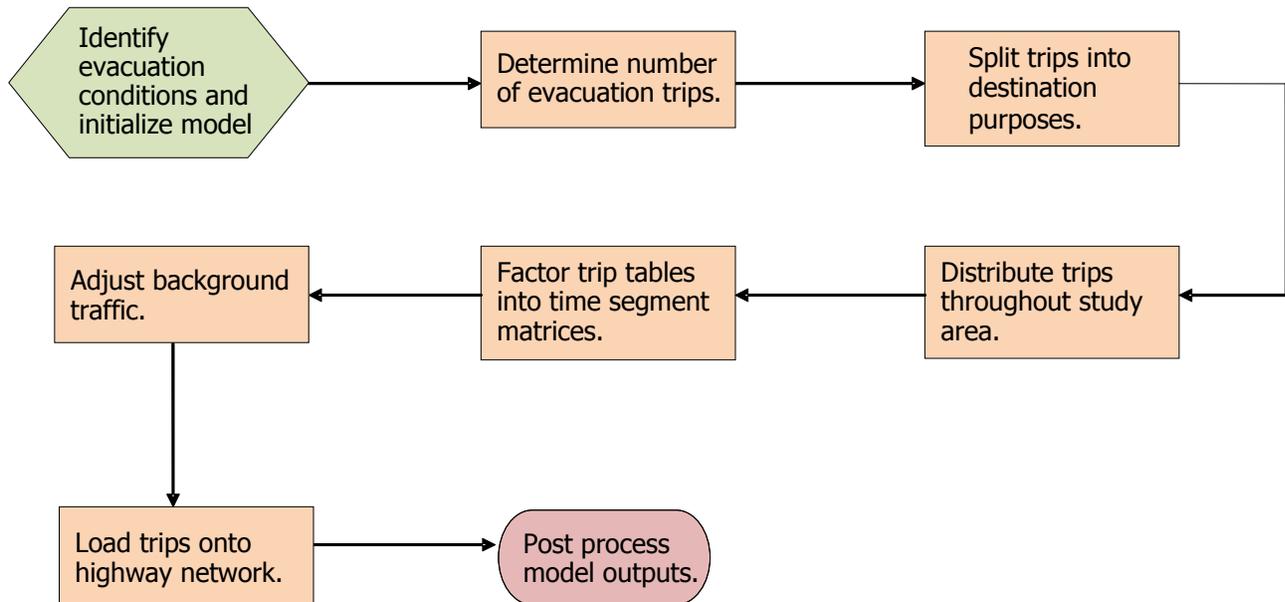
focus of the model is with evacuation behavior within Florida, areas outside of the state had to be considered in order to allow a more precise routing of evacuation traffic. This allows the model to measure the flow of traffic across the state line if needed.

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

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

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

- **Evacuation Traffic** - The model flow for the evacuation model is divided into a total of eight modeling steps. The following eight steps are represented graphically in the flowchart in Figure ES-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 ES-1 - General Model Flow**

- **Dynamic Traffic Assignment** - Dynamic traffic assignment (DTA) was utilized in the evacuation methodology because it is sensitive to individual time increments. DTA works by assigning a certain number of vehicles to the highway network in a given interval of time. The model then tracks the progress of these trips through the network over the interval. Another set of vehicles is assigned during the following time interval. The model then tracks the progress of these trips through the network along with the progress of the trips loaded in the previous time interval. As vehicles begin to arrive at the same segments of roadway, they interact with one another to create congestion. When vehicles that were loaded to the network in subsequent intervals of time arrive at the congested links, they contribute to the congestion as well. This results in a slowing down of the traffic and eventually spill-backs and queuing delays. It is this time dependent feature of DTA that makes it well suited to evacuation modeling. By dynamically adjusting the travel times and speeds of the vehicles moving through the network as they respond to congestion the model is able to do the following:
  - The evacuation model is able to estimate the critical clearance time statistics needed for this study;
  - The model takes into account the impact of compounded congestion from multiple congestion points;
  - The model is able to adjust the routing of traffic throughout the network as a function of congestion as it occurs throughout the evacuation; and,
  - The model is capable of adjusting its capacities from time segment to time segment, making it possible to represent such phenomena as reverse lane operations and background traffic.

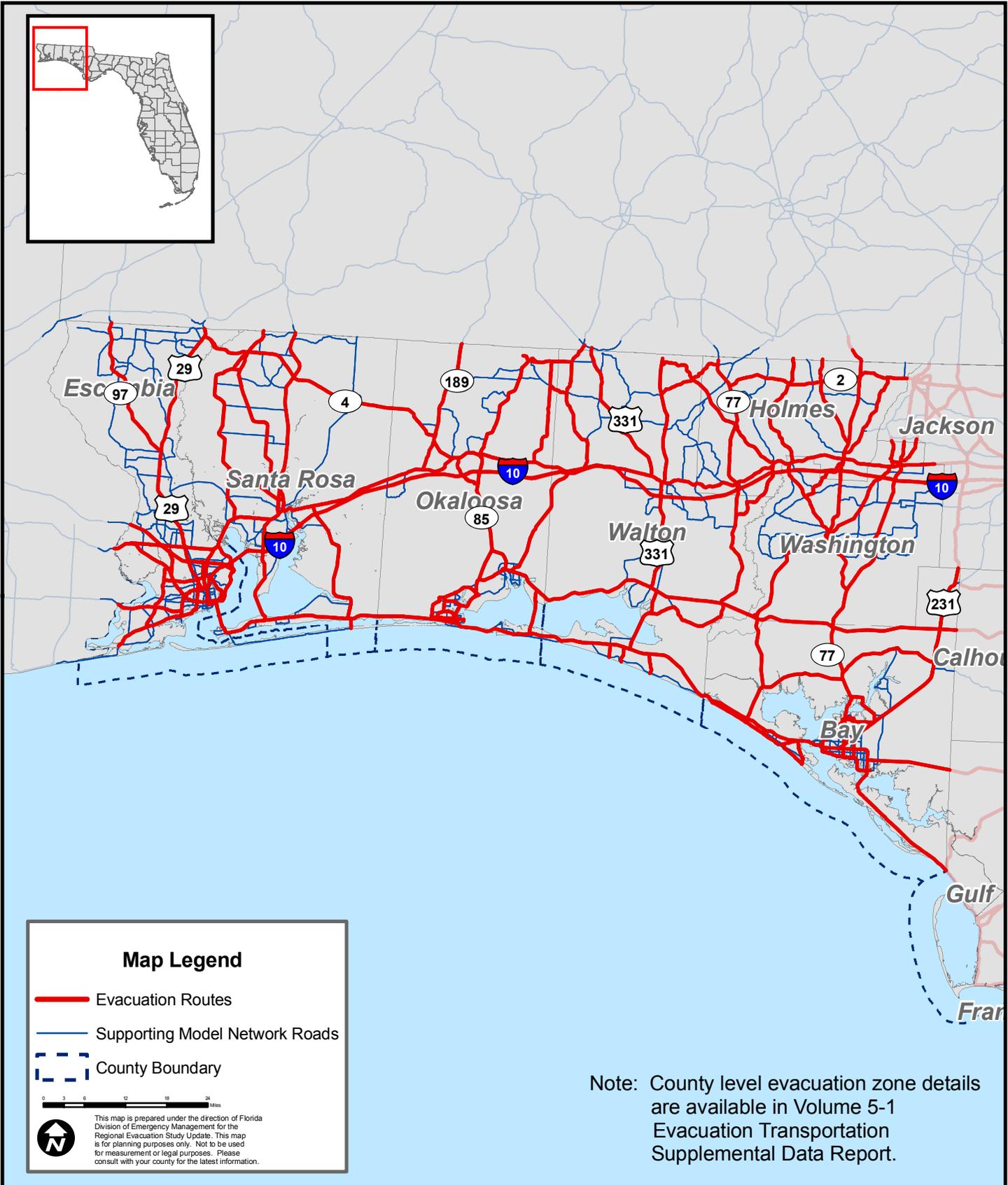
- **Prototype Model Development** - Wilbur Smith Associates developed a prototype model to test the modeling methodology used to calculate evacuation clearance times. The prototype model demonstrated the viability of the methodology developed for this study. This included the use of dynamic traffic assignment,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

## E. Regional Model Implementation

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

- **Regional Model Network** - The regional model network consists of the RPC designated evacuation routes as well as a supporting roadway network that facilitates movement of evacuation traffic. The 2005 Florida Department of Transportation (FDOT) Statewide Model Network was used as a basis for developing the regional model network, while the evacuation routes were obtained from the West 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 ES-2** identifies the model network and evacuation routes for the WFRPC. County level details of the regional model network are provided in the Volume 5-1 report. The regional model network for the West Florida region includes key roadways within the seven county region, including I-10, US 231, US 331, US 98, US 90, US 29, SR 77, SR 79, SR 20, SR 4, SR 87, and SR 85.
- **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 768 zones located within the seven county West Florida region, as illustrated in **Figure ES-3**. In the West Florida region, Escambia County has the largest number of TEZs with 184, and Bay County follows with 184 TEZs. Holmes and Washington Counties each contain 14 zones and have the lowest number of TEZs within the RPC. The larger number of TEZs generally reflects counties with denser urban form and higher population densities.
- **Regional Demographic Characteristics** - Demographic data were developed for the following years: 2006, 2010, and 2015. A snapshot of the key demographic data for each county in the West Florida RPC for 2006, 2010 and 2015 is summarized in **Table ES-1**. The tables list the number of occupied dwelling units for site built homes, the permanent population in site-built homes, as well as the number of occupied dwelling units for mobile homes and the permanent population in mobile homes. The mobile home category includes RVs and boats and the permanent population in those housing options. The demographic characteristics summary also includes hotels and motels because many of these units are in vulnerable areas, and the proportion of seasonal units and hotel/motel units that are occupied at any point in time will have an important impact on the total population that may participate in an evacuation.

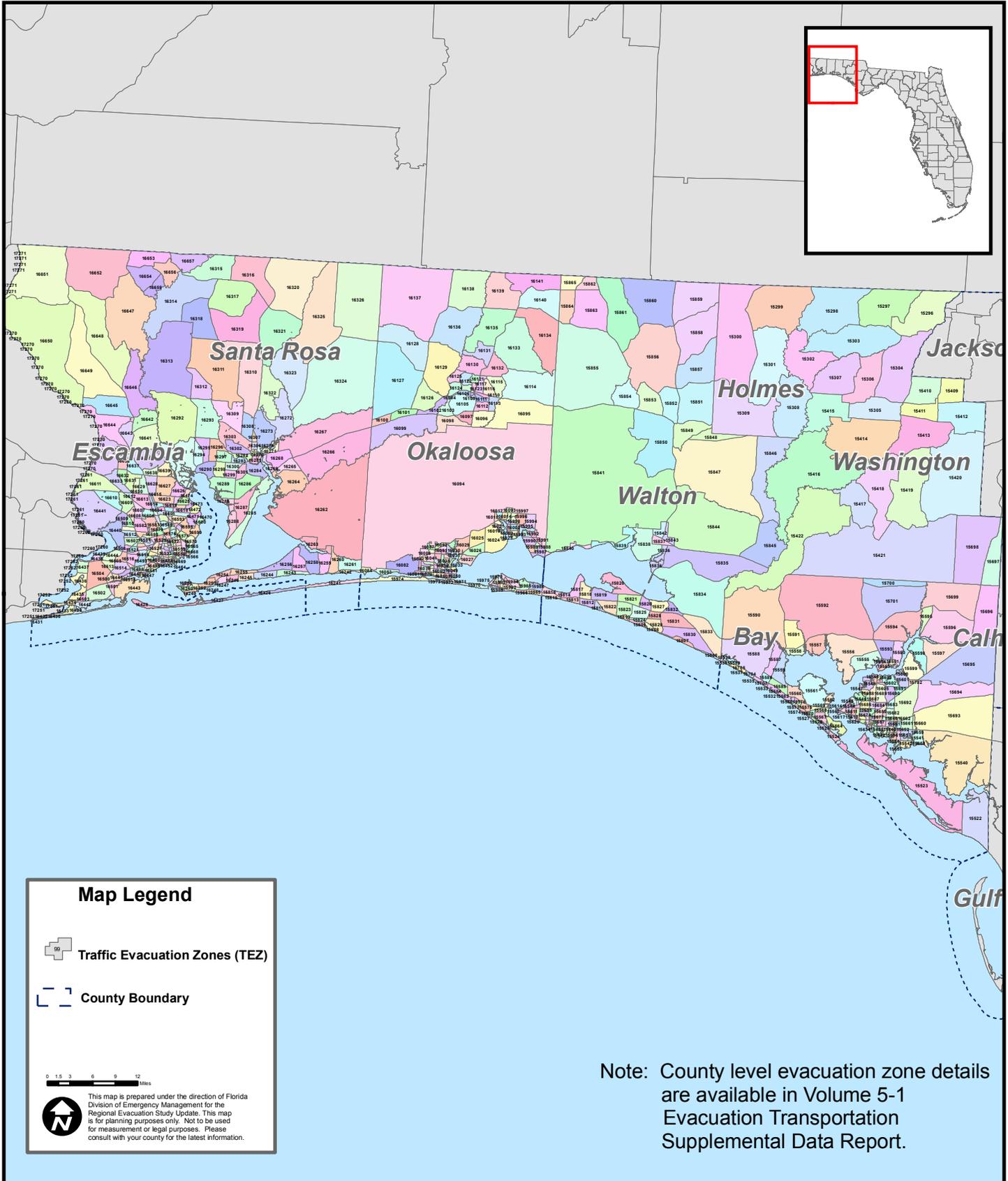
# Figure ES-2 West Florida Regional Model Network





# Figure ES-3

## West Florida Regional Model Transportation Evacuation Zone (TEZ) System



**Table ES-1 – West Florida Demographic Characteristic Summary**

County	Characteristic	Year		
		2006	2010	2015
Bay	Occupied site-built homes	61,176	63,605	67,412
	Population in site-built homes	144,342	151,030	160,110
	Occupied mobile homes	9,463	9,652	10,444
	Population in mobile home	24,485	24,988	27,032
	Hotel/motel units	10,766	10,904	11,598
Escambia	Occupied site-built homes	113,171	117,616	123,301
	Population in site-built homes	278,245	289,267	303,328
	Occupied mobile homes	7,218	7,525	7,921
	Population in mobile home	17,949	18,711	19,697
	Hotel/motel units	6,620	6,893	7,247
Holmes	Occupied site-built homes	4,752	4,895	5,033
	Population in site-built homes	11,360	11,710	12,045
	Occupied mobile homes	2,384	2,441	2,512
	Population in mobile home	6,007	6,150	6,328
	Hotel/motel units	181	181	181
Okaloosa	Occupied site-built homes	72,569	79,192	86,923
	Population in site-built homes	179,502	196,087	215,525
	Occupied mobile homes	3,154	3,325	3,796
	Population in mobile home	8,042	8,478	9,678
	Hotel/motel units	5,130	5,580	6,152
Santa Rosa	Occupied site-built homes	49,384	55,294	62,418
	Population in site-built homes	128,811	144,283	162,871
	Occupied mobile homes	5,853	6,807	8,030
	Population in mobile home	15,094	17,557	20,722
	Hotel/motel units	1,075	1,210	1,386
Walton	Occupied site-built homes	17,286	19,865	26,194
	Population in site-built homes	39,382	45,294	59,840
	Occupied mobile homes	3,310	3,735	4,929
	Population in mobile home	8,276	9,333	12,317
	Hotel/motel units	1,556	1,763	2,406
Washington	Occupied site-built homes	5,415	5,599	5,834
	Population in site-built homes	12,828	13,271	13,839
	Occupied mobile homes	2,930	3,046	3,188
	Population in mobile home	7,799	8,103	8,480
	Hotel/motel units	247	247	247

Source: West Florida Regional Planning Council

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

The planned roadway improvements that were added to the network generally include only capacity improvement projects such as additional through lanes. **Table ES-2** identifies capacity improvement projects completed between 2006 and 2010 that were included in the 2010 network. Likewise, **Table ES-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 2010 in Bay County, Baldwin Rd from St Andrews Blvd to State Ave will be widened to 4 lanes.

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

- **Behavioral Assumptions** - For the West Florida Region, five counties within the region have evacuation zones corresponding to five categories of storm surge. Evacuation rates for site-built homes and mobile/manufactured homes are provided by county and summarized in Figure ES-4 through Figure ES-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 5-1.

A review of the evacuation rates for the West Florida region illustrates that evacuation participation rates increase as the evacuation level increases, and participation rates for persons living in mobile/manufactured homes are generally higher than for persons living in site-built homes. It should be noted that a certain percentage of the population evacuates, even when they are not living in an area that is ordered to evacuate. These people are commonly referred to as shadow evacuees. Shadow evacuation rates are also included in Figure ES-4 through Figure ES-13.

- **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 seven county region there is a total of 46 shelters, including 4 in Bay County, 13 in Escambia County, 8 in Holmes County, 5 in Okaloosa County, 5 in Santa Rosa County, 6 in Walton County, and 5 in Washington County. All together, the 46 shelters located within the seven county region can host more than 48,000 persons during an evacuation event.

**Table ES-2 – West Florida Roadway Improvements, 2006 – 2010**

County	Roadway	From	To	Number of Lanes
Bay	Baldwin Rd	St Andrews Blvd	State Ave	4
	Baldwin Rd	State Ave	Harrison Ave	4
	CR 3031	Over Grand Lagoon Bridge (No. 460055)		4
Escambia	I-10	US 29	US 291	6
	I-10	US 90	End of Escambia Bay Bridge	6
	I-110	Maxwell St	I-10	6
	Brent Lane	Davis Hwy	Rawson Ln	6
Okaloosa	John Sims Pkwy	Government Ave/ SR 85	SR 85 N	6
Okaloosa/ Walton	SR 30/US 98	SR 293	Scenic Gulf Dr	6
Santa Rosa	SR 87	US 90	S of Hickory Hammock Rd	4
Walton	SR 83 (US 331)	SR 30/US 98	S End of Choctaw Bay Bridge	4
Washington	SR 79	S of Holmes Creek Bridge	Strickland Rd	4

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

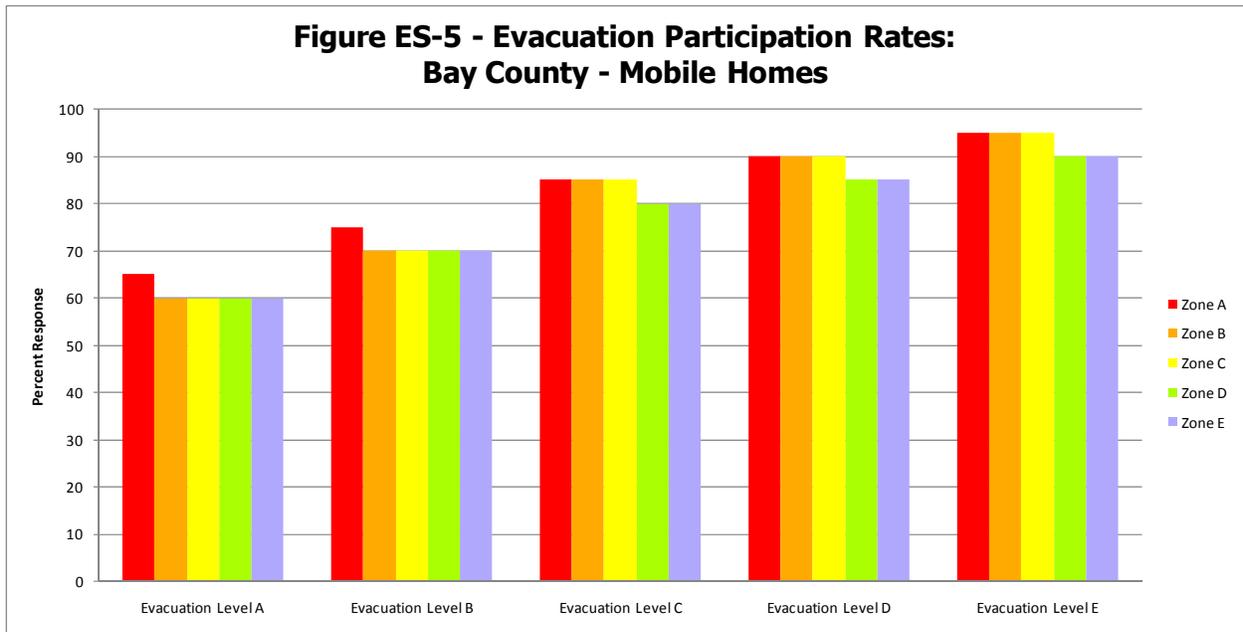
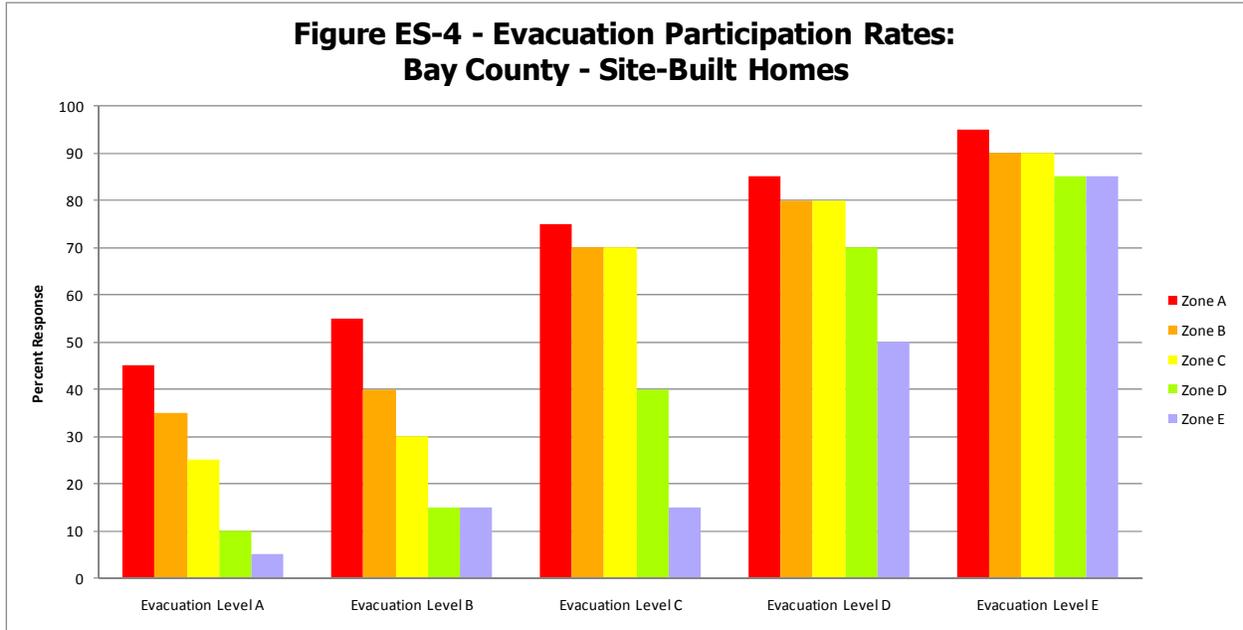
Note: Projects included in this table are roadway improvement projects completed between 2006 and 2010 on roadways that are included in the regional transportation model network. Only projects which added roadway capacity, such as additional through lanes, were included. The list is not intended to be 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.

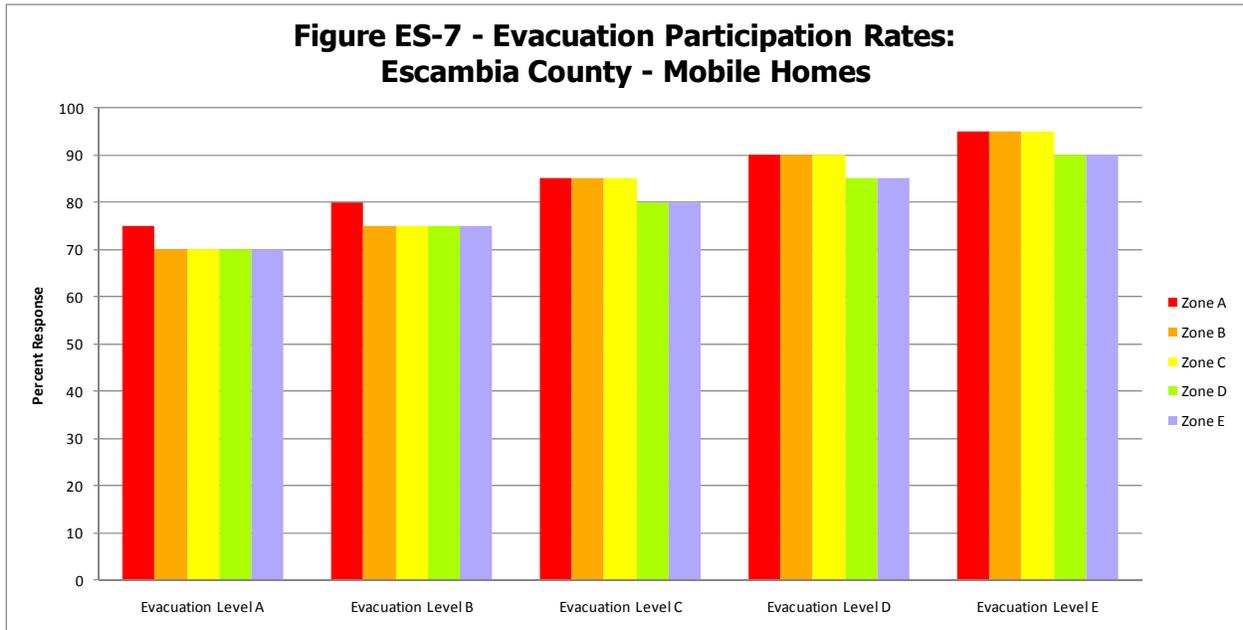
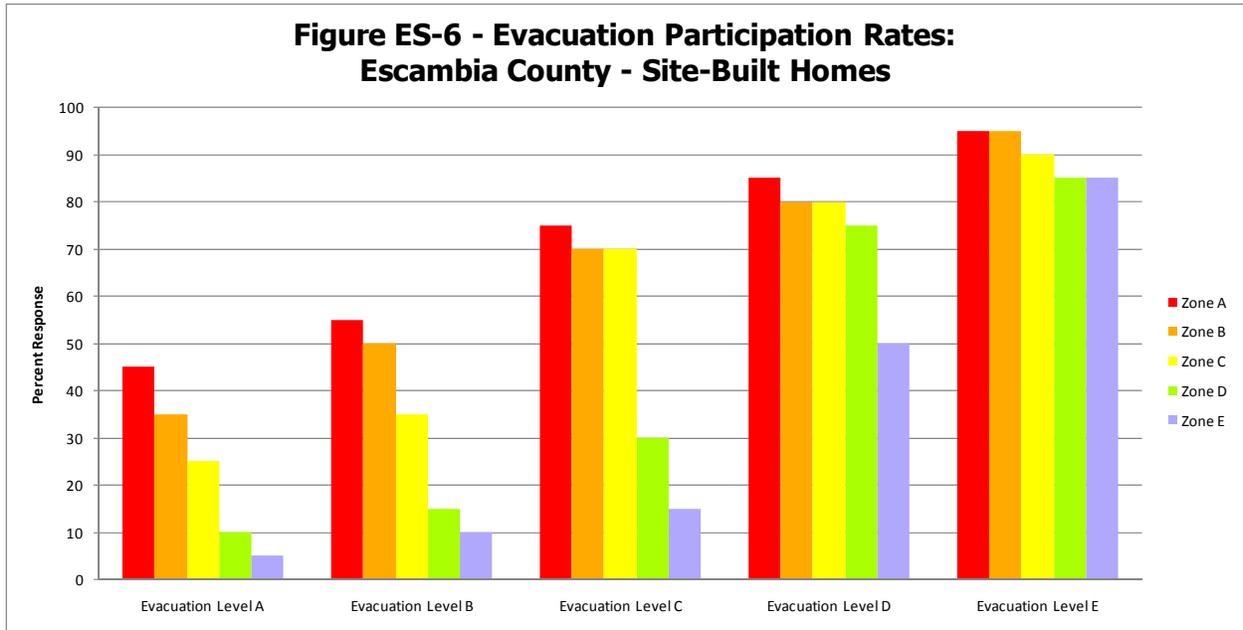
**Table ES-3 - West Florida Planned Roadway Improvements, 2011–2015**

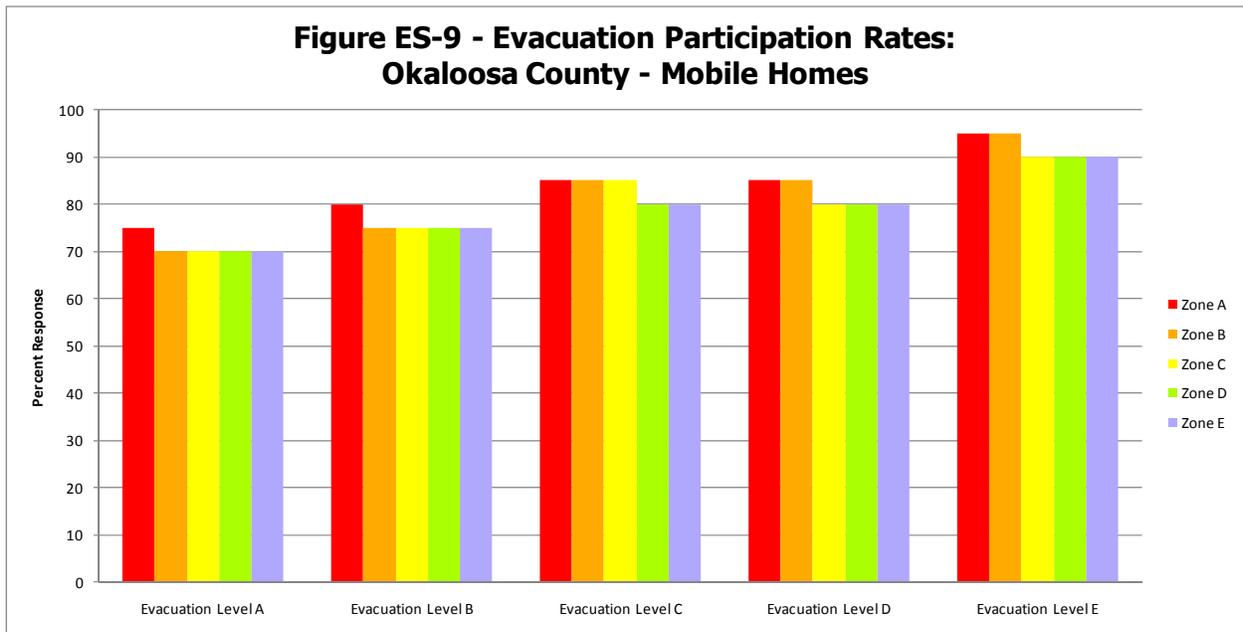
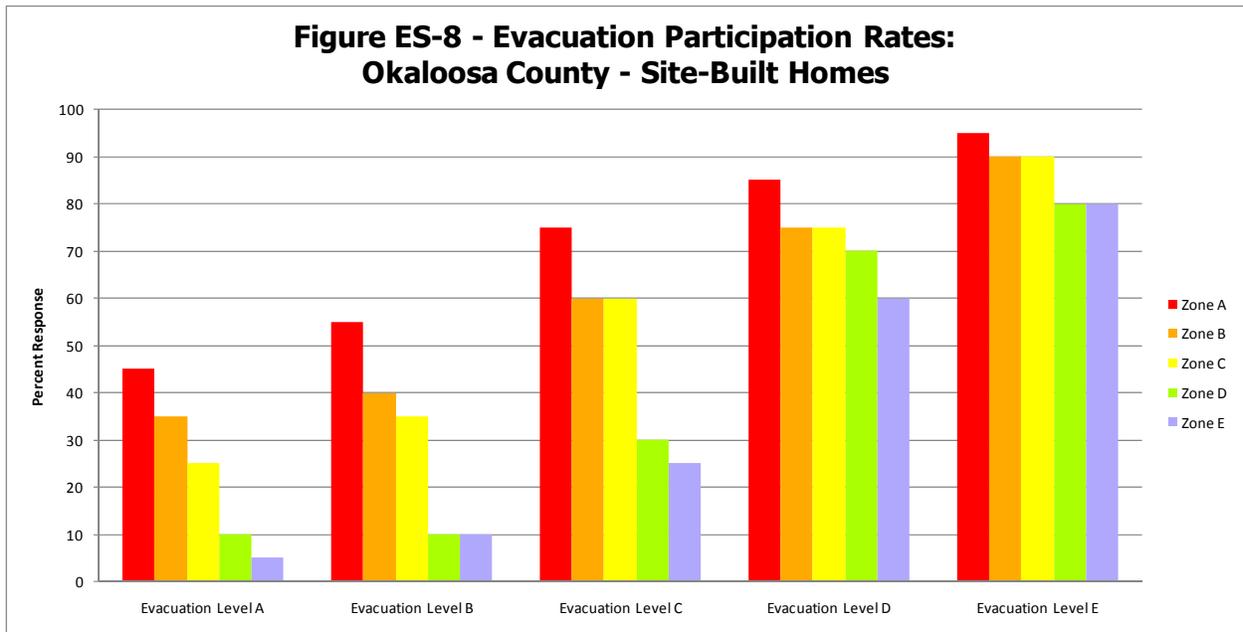
County	Roadway	From	To	Number of Lanes
Bay	Baldwin Rd	Harrison Ave	Minnesota Ave	4
Escambia	I-10	SR 291	US 90	6
Okaloosa	SR 85 @ SR 123	S of Gen Bond Blvd	N of Okaloosa Reg Arprt	6
	SR 20/John Sims Pkwy	SR 293/White Point Rd	Mid-Bay Bridge Connector	4
Santa Rosa	SR 281 Avalon Blvd	N of CSX R/R bridge	S of Commerce Rd	4
	SR 281 Avalon Blvd	S of Moors Lodge	N of CSX R/R Bridge	4
	SR 281 Avalon Blvd	Commerce Rd	US 90 (SR 10)	4
	SR 281 Avalon Blvd	I-10	S of Moors Lodge	4
	SR 87	N of Five Forks Rd	Eglin AFB Boundary	4
Walton	SR 83 (US 331)	N end Choctaw Bay Bridge	S of SR 20	4
	SR 83 (US 331)	New alignment of Owl's Head	Edgewood Circle	4
Washington	SR 79	Strickland Rd	N of Mills Branch Rd	4

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

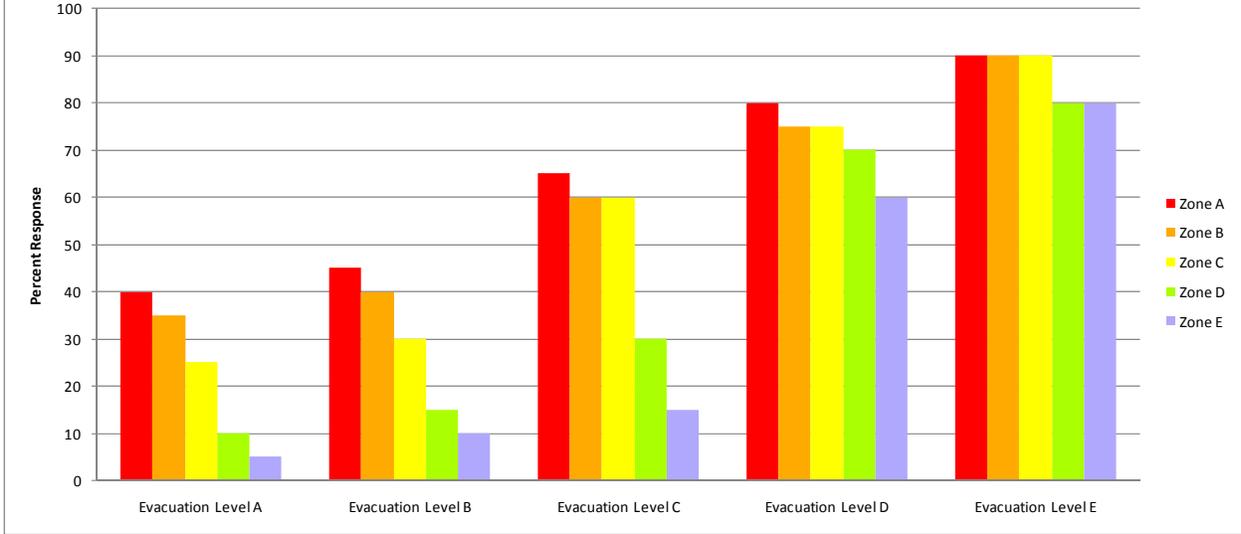
Note: Projects included in this table are roadway improvement projects planned for completion between 2011 and 2015 on roadways that are included in the regional transportation model network. Only projects which are planned to add roadway capacity, such as additional through lanes, were included. The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



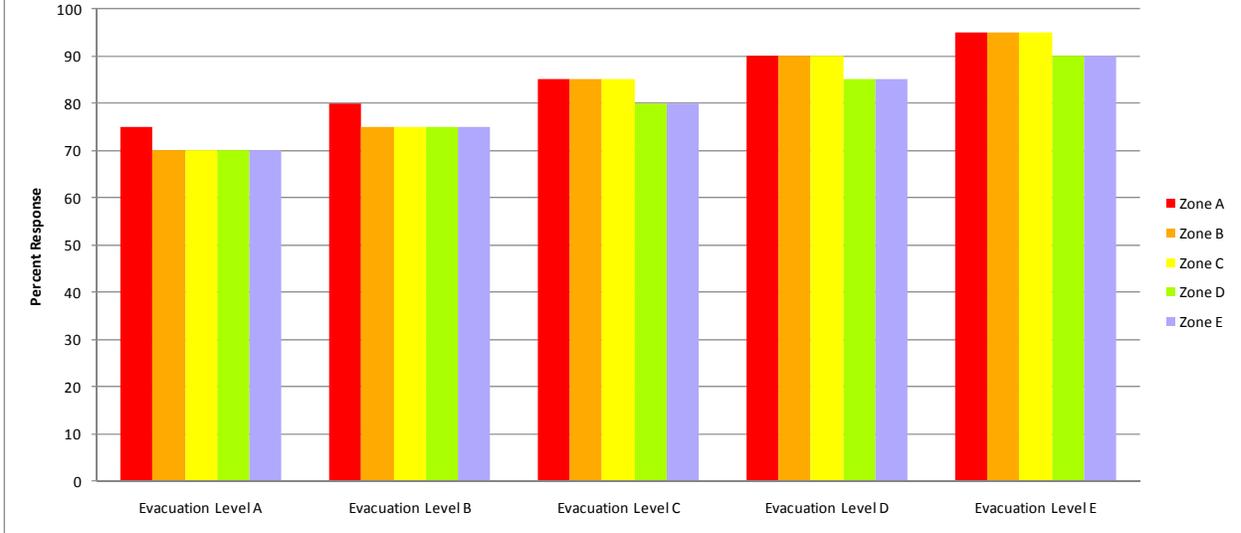




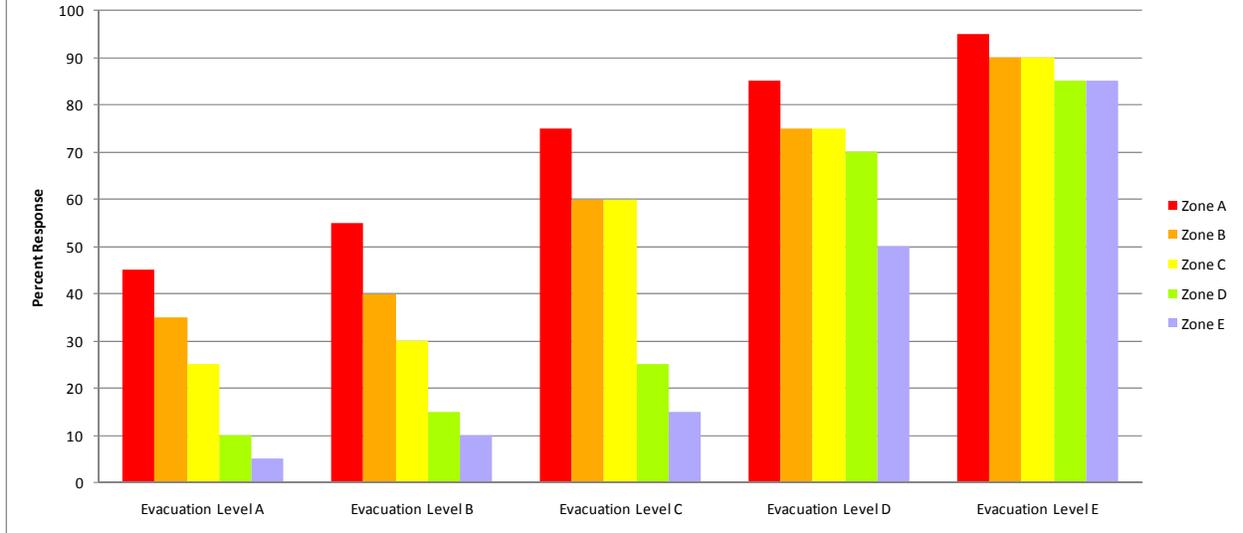
**Figure ES-10 - Evacuation Participation Rates:  
Santa Rosa County - Site-Built Homes**



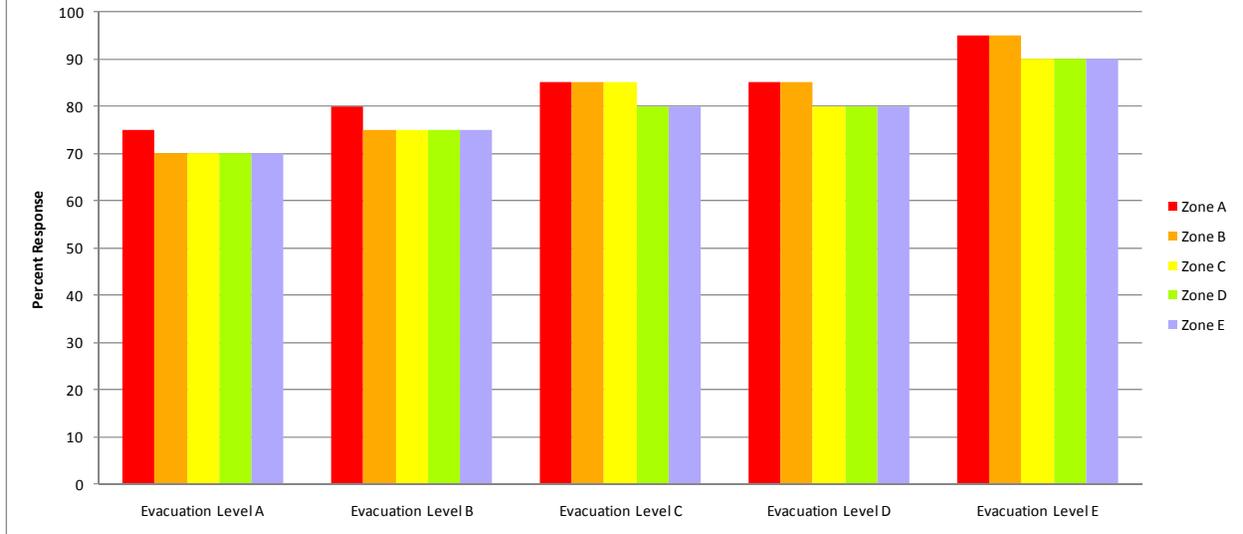
**Figure ES-11 - Evacuation Participation Rates:  
Santa Rosa County - Mobile Homes**



**Figure ES-12 - Evacuation Participation Rates:  
Walton County - Site-Built Homes**



**Figure ES-13 - Evacuation Participation Rates:  
Walton County - Mobile Homes**

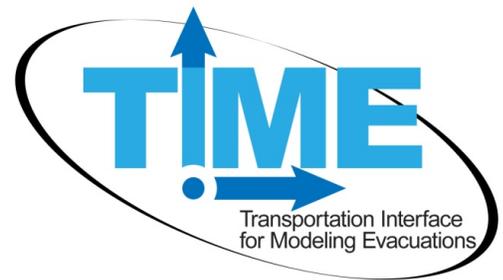


- **Evacuation Zones** - The final input variable that is needed to complete the transportation evacuation model is the delineation of evacuation zones for all coastal counties. Local county emergency managers have the responsibility of identifying and defining evacuation zones for their county. Within the West Florida region, five counties, Bay, Escambia, Okaloosa, Santa Rosa, and Walton, 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 5-1.

## F. TIME User Interface

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

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



- Analysis time period;
- Highway network;
- Behavioral response;
- One-way evacuation operations;
- University population;
- Tourist occupancy rates;
- Shelters;
- Counties evacuating;
- Evacuation level;
- Response curve hours; and,
- Evacuation Phasing.

## G. Vulnerable Population

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

**Table ES-4 – Vulnerable Population in the West Florida Region for 2010**

	<b>Evacuation Zone A</b>	<b>Evacuation Zone B</b>	<b>Evacuation Zone C</b>	<b>Evacuation Zone D</b>	<b>Evacuation Zone E</b>
<b>Bay County</b>					
Site-built Homes	24,529	9,056	9,734	8,390	13,613
Mobile/Manuf. Homes	3,142	769	1,063	1,236	1,561
TOTAL	27,672	9,826	10,797	9,626	15,174
<b>Escambia County</b>					
Site-built Homes	13,570	5,387	8,730	8,137	11,055
Mobile/Manuf. Homes	213	243	340	439	544
TOTAL	13,783	5,629	9,070	8,576	11,600
<b>Okaloosa County</b>					
Site-built Homes	1,141	8,345	18,101	18,951	31,106
Mobile/Manuf. Homes	18	108	245	626	391
TOTAL	1,159	8,453	18,346	19,577	31,497
<b>Santa Rosa County</b>					
Site-built Homes	8,682	6,989	13,968	4,681	14,272
Mobile/Manuf. Homes	627	490	1,107	313	667
TOTAL	9,309	7,479	15,074	4,993	14,938
<b>Walton County</b>					
Site-built Homes	7,852	8,394	7,277	1,399	3,690
Mobile/Manuf. Homes	1,453	892	931	142	278
TOTAL	9,305	9,286	8,208	1,540	3,968

*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 ES-5 – Vulnerable Population in the West Florida Region for 2015**

	<b>Evacuation Zone A</b>	<b>Evacuation Zone B</b>	<b>Evacuation Zone C</b>	<b>Evacuation Zone D</b>	<b>Evacuation Zone E</b>
<b>Bay County</b>					
Site-built Homes	26,065	9,440	10,122	8,762	14,438
Mobile/Manuf. Homes	3,551	829	1,141	1,380	1,942
TOTAL	29,615	10,269	11,263	10,142	16,380
<b>Escambia County</b>					
Site-built Homes	14,310	5,631	9,086	8,604	12,082
Mobile/Manuf. Homes	215	245	345	446	551
TOTAL	14,525	5,876	9,431	9,050	12,633
<b>Okaloosa County</b>					
Site-built Homes	1,177	8,546	18,451	19,518	31,987
Mobile/Manuf. Homes	19	109	307	628	421
TOTAL	1,197	8,655	18,758	20,146	32,407
<b>Santa Rosa County</b>					
Site-built Homes	9,932	8,120	16,000	5,176	16,066
Mobile/Manuf. Homes	757	592	1,343	374	783
TOTAL	10,689	8,712	17,343	5,550	16,849
<b>Walton County</b>					
Site-built Homes	8,101	10,187	7,659	3,251	8,732
Mobile/Manuf. Homes	1,853	1,464	1,208	286	915
TOTAL	9,954	11,650	8,867	3,536	9,647

*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 West Florida Region are identified in **Table ES-6** for 2010 and in **Table ES-7** for 2015.

The vulnerable shadow population is provided in **Table ES-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 ES-6 – Vulnerable Population by Destination for 2010**

	Evacuation Zone A	Evacuation Zone B	Evacuation Zone C	Evacuation Zone D	Evacuation Zone E
<b>Bay County</b>					
To Friends and Family	16,917	5,972	6,585	5,899	9,260
To Hotel/ Motel	6,447	2,341	2,540	2,221	3,559
To Public Shelter	1,541	530	593	291	428
To Other Destination	2,767	983	1,080	1,214	1,926
<b>Escambia County</b>					
To Friends and Family	9,637	3,928	6,332	5,981	8,092
To Hotel/ Motel	2,746	1,114	1,797	1,693	2,293
To Public Shelter	700	294	470	451	607
To Other Destination	700	294	470	451	607
<b>Okaloosa County</b>					
To Friends and Family	697	5,077	11,020	11,777	18,917
To Hotel/ Motel	288	2,103	4,562	4,832	7,835
To Public Shelter	24	172	374	979	1,575
To Other Destination	151	1,101	2,390	1,989	3,169
<b>Santa Rosa County</b>					
To Friends and Family	5,214	4,187	8,457	2,793	8,316
To Hotel/ Motel	2,667	2,146	4,301	1,435	4,348
To Public Shelter	236	398	809	265	780
To Other Destination	1,191	748	1,507	499	1,494
<b>Walton County</b>					
To Friends and Family	5,263	5,197	4,608	861	2,210
To Hotel/ Motel	2,181	2,232	1,959	371	964
To Public Shelter	230	296	265	77	198
To Other Destination	1,631	1,561	1,377	231	595

*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 ES-7 – Vulnerable Population by Destination for 2015**

	<b>Evacuation Zone A</b>	<b>Evacuation Zone B</b>	<b>Evacuation Zone C</b>	<b>Evacuation Zone D</b>	<b>Evacuation Zone E</b>
<b>Bay County</b>					
To Friends and Family	18,124	6,244	6,872	6,224	10,022
To Hotel/ Motel	6,871	2,443	2,645	2,329	3,804
To Public Shelter	1,658	555	620	313	483
To Other Destination	2,962	1,027	1,126	1,277	2,071
<b>Escambia County</b>					
To Friends and Family	10,156	4,101	6,584	6,313	8,816
To Hotel/ Motel	2,894	1,163	1,869	1,788	2,499
To Public Shelter	737	306	489	475	659
To Other Destination	737	306	489	475	659
<b>Okaloosa County</b>					
To Friends and Family	719	5,199	11,270	12,119	19,465
To Hotel/ Motel	297	2,153	4,659	4,974	8,060
To Public Shelter	25	176	384	1,007	1,620
To Other Destination	156	1,127	2,445	2,046	3,262
<b>Santa Rosa County</b>					
To Friends and Family	5,993	4,880	9,740	3,109	9,384
To Hotel/ Motel	3,055	2,495	4,934	1,590	4,898
To Public Shelter	274	465	934	296	882
To Other Destination	1,367	871	1,734	555	1,685
<b>Walton County</b>					
To Friends and Family	5,660	6,554	4,998	1,973	5,397
To Hotel/ Motel	2,303	2,766	2,096	855	2,320
To Public Shelter	255	379	290	177	482
To Other Destination	1,736	1,951	1,483	530	1,447

*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 ES-8 – Vulnerable Shadow Evacuation Population**

	<b>Evacuation Level A</b>	<b>Evacuation Level B</b>	<b>Evacuation Level C</b>	<b>Evacuation Level D</b>	<b>Evacuation Level E</b>
<b>2010</b>					
Bay County	37,934	50,162	50,745	60,609	61,619
Escambia County	38,420	50,288	60,825	86,053	104,412
Holmes County	6,738	7,323	7,908	8,493	9,078
Okaloosa County	25,271	31,735	44,833	62,865	59,008
Santa Rosa County	29,353	28,193	33,919	48,521	48,851
Walton County	14,108	13,629	11,011	13,473	12,214
Washington County	8,759	9,422	10,748	11,411	12,074
<b>2015</b>					
Bay County	40,395	53,276	53,893	64,454	65,531
Escambia County	40,297	52,751	63,851	90,424	109,387
Holmes County	6,925	7,527	8,129	8,731	9,333
Okaloosa County	27,583	34,949	49,135	69,114	66,972
Santa Rosa County	34,020	32,608	38,938	55,335	55,664
Walton County	18,378	17,339	14,785	18,924	14,833
Washington County	9,179	9,870	11,252	11,943	12,634

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

## H. Evacuation Model Scenarios

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

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

	<b>Scenario 1 Level A 2010</b>	<b>Scenario 2 Level B 2010</b>	<b>Scenario 3 Level C 2010</b>	<b>Scenario 4 Level D 2010</b>	<b>Scenario 5 Level E 2010</b>
<b>Demographic Data</b>	2010	2010	2010	2010	2010
<b>Highway Network</b>	2010	2010	2010	2010	2010
<b>One-Way Operations</b>	None	None	None	None	None
<b>University Population</b>	Fall/Spring	Fall/Spring	Fall/Spring	Fall/Spring	Fall/Spring
<b>Tourist Rate</b>	Default	Default	Default	Default	Default
<b>Shelters Open</b>	Primary	Primary	Primary	Primary	Primary
<b>Response Curve</b>	12-hour	12-hour	12-hour	12-hour	12-hour
<b>Evacuation Phasing</b>	None	None	None	None	None
<b>Behavioral Response</b>	100%	100%	100%	100%	100%
<b>Evacuation Zone</b>	A	B	C	D	E
<b>Counties Evacuating</b>	Bay Escambia Holmes Okaloosa Santa Rosa Walton Washington Baldwin (AL) Gulf				
	<b>Scenario 6 Level A 2015</b>	<b>Scenario 7 Level B 2015</b>	<b>Scenario 8 Level C 2015</b>	<b>Scenario 9 Level D 2015</b>	<b>Scenario 10 Level E 2015</b>
<b>Demographic Data</b>	2015	2015	2015	2015	2015
<b>Highway Network</b>	2015	2015	2015	2015	2015
<b>One-Way Operations</b>	None	None	None	None	None
<b>University Population</b>	Fall/Spring	Fall/Spring	Fall/Spring	Fall/Spring	Fall/Spring
<b>Tourist Rate</b>	Default	Default	Default	Default	Default
<b>Shelters Open</b>	Primary	Primary	Primary	Primary	Primary
<b>Response Curve</b>	12-hour	12-hour	12-hour	12-hour	12-hour
<b>Evacuation Phasing</b>	None	None	None	None	None
<b>Behavioral Response</b>	100%	100%	100%	100%	100%
<b>Evacuation Zone</b>	A	B	C	D	E
<b>Counties Evacuating</b>	Bay Escambia Holmes Okaloosa Santa Rosa Walton Washington Baldwin (AL) Gulf				

**Table ES-10 – Operational Scenarios**

	<b>Scenario 1 Level A 2010</b>	<b>Scenario 2 Level B 2010</b>	<b>Scenario 3 Level C 2010</b>	<b>Scenario 4 Level D 2010</b>	<b>Scenario 5 Level E 2010</b>
<b>Demographic Data</b>	2010	2010	2010	2010	2010
<b>Highway Network</b>	2010	2010	2010	2010	2010
<b>One-Way Operations</b>	None	None	None	None	None
<b>University Population</b>	Fall/Spring	Fall/Spring	Fall/Spring	Fall/Spring	Fall/Spring
<b>Tourist Rate</b>	Default	Default	Default	Default	Default
<b>Shelters Open</b>	Primary	Primary	Primary	Primary	Primary
<b>Response Curve</b>	12-hour	12-hour	12-hour	12-hour	12-hour
<b>Evacuation Phasing</b>	None	None	None	None	None
<b>Behavioral Response</b>	Planning	Planning	Planning	Planning	Planning
<b>Evacuation Zone</b>	A	B	C	D	E
<b>Counties Evacuating</b>	Bay Escambia Holmes Okaloosa Santa Rosa Walton Washington Baldwin (AL) Gulf				
	<b>Scenario 6 Level A 2015</b>	<b>Scenario 7 Level B 2015</b>	<b>Scenario 8 Level C 2015</b>	<b>Scenario 9 Level D 2015</b>	<b>Scenario 10 Level E 2015</b>
<b>Demographic Data</b>	2015	2015	2015	2015	2015
<b>Highway Network</b>	2015	2015	2015	2015	2015
<b>One-Way Operations</b>	None	None	None	None	None
<b>University Population</b>	Fall/Spring	Fall/Spring	Fall/Spring	Fall/Spring	Fall/Spring
<b>Tourist Rate</b>	Default	Default	Default	Default	Default
<b>Shelters Open</b>	Primary	Primary	Primary	Primary	Primary
<b>Response Curve</b>	12-hour	12-hour	12-hour	12-hour	12-hour
<b>Evacuation Phasing</b>	None	None	None	None	None
<b>Behavioral Response</b>	Planning	Planning	Planning	Planning	Planning
<b>Evacuation Zone</b>	A	B	C	D	E
<b>Counties Evacuating</b>	Bay Escambia Holmes Okaloosa Santa Rosa Walton Washington Baldwin (AL) Gulf				

- **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 ES-11** and **ES-12**, while clearance times for each of the operational scenarios are summarized in **Table ES-13** and **Table ES-14**. Clearance time includes several components, including the mobilization time for the evacuating population to prepare for an evacuation (pack supplies and personal belongs, load their vehicle, etc.), the actual time spent traveling on the roadway network, and the delay time caused by traffic congestion.

### **Base Scenarios**

In-county clearance times for the base scenarios range from 11.5 hours for the evacuation level A scenarios to 24 hours for Walton 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 9 hours for the evacuation level A scenarios to 20.5 hours for Okaloosa County for evacuation level E scenario in 2010.

In 2015, in-county clearance times for the base scenarios increase slightly to between 12 hours for the evacuation level A scenarios and 28 hours for Walton County for the evacuation level E scenario. Clearance Time to Shelter shows a similar pattern, with clearance times for the base scenarios ranging from 10 hours for the evacuation level A scenarios to 22.5 hours for Okaloosa 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 24.5 hours in Bay County for the evacuation level E scenario. Out of county clearance times increase for several counties in 2015, which increase up to 28.5 hours.

Regional clearance time for the seven county WFRPC region ranges from 15 hours to 24.5 hours in 2010. This time increases to between 15 and 28.5 hours in 2015.

### **Operational Scenarios**

In-county clearance times for the 2010 operational scenarios range from 10 hours to 20 hours depending upon the scenario. Clearance Time to Shelter shows a similar pattern, with clearance times for the operational scenarios ranging from 6 hours to 17 hours depending upon the county and the scenario.

In 2015, in-county clearance times for the operational scenarios vary from 10.5 hours to 26 hours for the level E evacuation in Walton County. Clearance Time to Shelter shows a similar pattern to the 2010 scenarios, with clearance times for the base scenarios ranging from 7 hours to 20.5 hours depending upon the scenario.

Out of county clearance times for the 2010 operational scenarios range from 14 hours to 21.5 hours for the evacuation level E scenario. Out of county clearance times generally increase for all counties in 2015 to between 13 and 26.5 hours depending upon the scenario. Regional clearance time for the seven county WFRPC region ranges from 15 hours to 21.5 hours in 2010. This time increases to between 15 and 26.5 hours in 2015.

**Table ES-11 – 2010 Clearance Times for Base Scenario**

	<b>Evacuation Level A Base Scenario</b>	<b>Evacuation Level B Base Scenario</b>	<b>Evacuation Level C Base Scenario</b>	<b>Evacuation Level D Base Scenario</b>	<b>Evacuation Level E Base Scenario</b>
<b>Clearance Time to Shelter</b>					
Bay County	12.5	12.5	12.5	12.5	13.0
Escambia County	12.5	12.5	12.5	13.0	13.0
Holmes County	9.0	10.5	10.5	11.5	13.0
Okaloosa County	12.0	12.5	13.0	14.5	20.5
Santa Rosa County	13.0	12.5	13.0	13.0	13.5
Walton County	12.0	13.0	13.0	13.5	14.5
Washington County	10.5	11.0	11.5	11.5	13.0
<b>In-County Clearance Time</b>					
Bay County	14.5	15.0	14.5	16.0	22.0
Escambia County	13.5	14.5	15.0	21.0	22.0
Holmes County	11.5	12.5	12.5	13.5	15.0
Okaloosa County	12.0	13.5	13.5	15.0	23.0
Santa Rosa County	14.5	14.5	14.5	21.5	22.5
Walton County	14.0	14.5	14.5	15.5	24.0
Washington County	12.5	12.5	13.0	13.0	14.5
<b>Out of County Clearance Time</b>					
Bay County	14.5	15.0	14.5	16.5	24.5
Escambia County	15.0	15.0	15.0	21.0	22.0
Holmes County	14.0	14.0	14.5	22.5	23.0
Okaloosa County	14.0	14.0	14.5	22.0	23.0
Santa Rosa County	14.5	14.5	14.5	21.5	22.5
Walton County	14.0	14.5	14.5	22.5	24.0
Washington County	14.5	14.5	15.0	23.0	24.0
<b>Regional Clearance Time</b>					
West Florida	15.0	15.0	15.0	23.0	24.5

Table ES-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
<b>Clearance Time to Shelter</b>					
Bay County	12.5	12.5	12.5	12.5	14.5
Escambia County	12.5	12.5	12.5	14.0	14.0
Holmes County	10.0	10.5	10.5	11.0	13.5
Okaloosa County	12.0	13.0	13.0	15.5	22.5
Santa Rosa County	12.5	12.5	13.0	13.0	14.5
Walton County	13.0	13.0	13.0	13.5	17.5
Washington County	10.5	11.0	11.0	11.5	13.5
<b>In-County Clearance Time</b>					
Bay County	14.0	15.0	15.0	25.0	27.5
Escambia County	13.5	14.5	15.0	26.0	26.0
Holmes County	12.5	12.5	12.5	13.5	15.5
Okaloosa County	12.0	13.5	14.0	25.0	27.5
Santa Rosa County	14.5	14.5	14.5	26.0	27.0
Walton County	14.0	14.5	14.5	25.5	28.0
Washington County	12.5	13.0	13.0	13.0	15.0
<b>Out of County Clearance Time</b>					
Bay County	14.0	15.0	15.0	25.0	28.0
Escambia County	15.0	15.0	15.0	26.0	27.0
Holmes County	14.0	14.0	14.5	27.0	28.0
Okaloosa County	14.0	14.0	14.5	27.0	27.5
Santa Rosa County	14.5	14.5	14.5	26.5	27.0
Walton County	14.0	14.5	14.5	27.5	28.5
Washington County	14.5	15.0	15.0	28.0	28.5
<b>Regional Clearance Time</b>					
West Florida	15.0	15.0	15.0	28.0	28.5

**Table ES-13 – 2010 Clearance Times for Operational Scenarios**

	<b>Evacuation Level A Operational Scenario</b>	<b>Evacuation Level B Operational Scenario</b>	<b>Evacuation Level C Operational Scenario</b>	<b>Evacuation Level D Operational Scenario</b>	<b>Evacuation Level E Operational Scenario</b>
<b>Clearance Time to Shelter</b>					
Bay County	12.5	12.5	12.5	12.5	13.0
Escambia County	12.0	12.5	12.5	13.0	13.0
Holmes County	6.0	9.5	10.0	10.0	12.0
Okaloosa County	12.0	12.0	13.0	13.0	17.0
Santa Rosa County	12.5	12.5	13.0	13.0	13.0
Walton County	12.5	13.0	13.0	13.0	14.0
Washington County	6.5	8.5	10.5	11.0	12.0
<b>In-County Clearance Time</b>					
Bay County	13.0	14.0	15.0	15.0	18.5
Escambia County	13.5	14.5	15.0	16.5	19.5
Holmes County	10.0	12.5	12.5	12.0	14.0
Okaloosa County	13.0	13.5	14.0	14.5	18.5
Santa Rosa County	14.5	14.5	14.5	16.5	20.0
Walton County	13.0	14.0	14.5	15.0	20.0
Washington County	11.0	11.0	12.0	13.0	13.5
<b>Out of County Clearance Time</b>					
Bay County	14.0	14.0	15.0	16.0	20.5
Escambia County	15.0	15.0	15.0	16.5	19.5
Holmes County	14.0	14.0	14.5	17.5	21.0
Okaloosa County	14.0	14.0	14.0	17.0	20.5
Santa Rosa County	14.5	14.5	14.5	16.5	20.0
Walton County	14.0	14.0	14.5	17.5	21.0
Washington County	14.0	14.5	15.0	18.0	21.5
<b>Regional Clearance Time</b>					
West Florida	15.0	15.0	15.0	18.0	21.5

**Table ES-14 – 2015 Clearance Times for Operational Scenarios**

	<b>Evacuation Level A Operational Scenario</b>	<b>Evacuation Level B Operational Scenario</b>	<b>Evacuation Level C Operational Scenario</b>	<b>Evacuation Level D Operational Scenario</b>	<b>Evacuation Level E Operational Scenario</b>
<b>Clearance Time to Shelter</b>					
Bay County	12.5	12.5	12.5	12.5	13.5
Escambia County	12.5	12.5	12.5	13.0	14.5
Holmes County	7.0	7.0	9.5	11.0	12.5
Okaloosa County	12.0	13.0	13.0	13.0	20.5
Santa Rosa County	12.0	12.5	13.0	13.0	14.0
Walton County	12.5	13.0	13.0	13.5	15.0
Washington County	7.0	8.0	11.0	11.0	13.0
<b>In-County Clearance Time</b>					
Bay County	13.0	14.0	15.0	18.5	24.5
Escambia County	13.5	14.5	15.0	17.5	24.5
Holmes County	10.5	11.5	12.0	13.0	14.5
Okaloosa County	12.0	13.5	14.0	17.5	25.0
Santa Rosa County	14.5	14.5	14.5	18.0	24.5
Walton County	12.5	14.0	14.5	18.0	26.0
Washington County	10.5	11.0	12.5	13.0	14.5
<b>Out of County Clearance Time</b>					
Bay County	13.0	14.0	15.0	18.5	26.0
Escambia County	15.0	15.0	15.0	18.5	24.5
Holmes County	14.0	14.0	14.5	17.5	26.0
Okaloosa County	14.0	14.0	14.0	19.0	25.0
Santa Rosa County	14.5	14.5	14.5	18.0	24.5
Walton County	14.0	14.0	14.5	18.0	26.0
Washington County	14.0	15.0	15.0	18.0	26.5
<b>Regional Clearance Time</b>					
West Florida	15.0	15.0	15.0	19.0	26.5

## 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 ES-15** and for 2015 in **Table ES-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 ES-15 – Maximum Evacuating Population by Time Interval for 2010**

	Evacuation Level A	Evacuation Level B	Evacuation Level C	Evacuation Level D	Evacuation Level E
<b>Estimated Evacuating Population Clearing Bay County</b>					
12-Hour	54,295	70,128	81,964	86,204	65,982
18-Hour	65,606	87,660	99,040	118,530	98,974
24-Hour					131,965
36-Hour					134,714
<b>Estimated Evacuating Population Clearing Escambia County</b>					
12-Hour	41,762	55,760	71,446	70,349	83,493
18-Hour	52,203	69,700	89,307	105,524	125,239
24-Hour				123,111	153,070
36-Hour					
<b>Estimated Evacuating Population Clearing Holmes County</b>					
12-Hour	5,775	6,277	6,545	4,530	4,736
18-Hour	6,738	7,323	7,908	6,794	7,105
24-Hour				8,493	9,078
36-Hour					
<b>Estimated Evacuating Population Clearing Okaloosa County</b>					
12-Hour	22,654	35,440	60,241	60,218	72,021
18-Hour	26,430	41,347	72,791	90,327	108,031
24-Hour				110,400	138,040
36-Hour					
<b>Estimated Evacuating Population Clearing Santa Rosa County</b>					
12-Hour	31,996	37,226	54,439	47,652	53,677
18-Hour	38,662	44,981	65,781	71,478	80,515
24-Hour				85,376	100,644
36-Hour					
<b>Estimated Evacuating Population Clearing Walton County</b>					
12-Hour	20,068	26,665	31,291	22,300	22,261
18-Hour	23,413	32,220	37,810	33,450	33,391
24-Hour				41,812	44,521
36-Hour					
<b>Estimated Evacuating Population Clearing Washington County</b>					
12-Hour	7,249	7,798	8,598	5,954	6,037
18-Hour	8,759	9,422	10,748	8,930	9,056
24-Hour				11,411	12,074
36-Hour					

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

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

	Evacuation Level A	Evacuation Level B	Evacuation Level C	Evacuation Level D	Evacuation Level E
<b>Estimated Evacuating Population Clearing Bay County</b>					
12-Hour	60,009	74,528	84,032	60,357	61,371
18-Hour	70,010	93,160	105,040	90,535	92,057
24-Hour				120,713	122,743
36-Hour				125,743	143,200
<b>Estimated Evacuating Population Clearing Escambia County</b>					
12-Hour	43,858	58,522	74,946	59,680	71,512
18-Hour	54,822	73,152	93,683	89,520	107,268
24-Hour				119,359	143,024
36-Hour				129,306	160,902
<b>Estimated Evacuating Population Clearing Holmes County</b>					
12-Hour	5,936	6,452	6,727	3,880	4,000
18-Hour	6,925	7,527	8,129	5,821	6,000
24-Hour				7,761	8,000
36-Hour				8,731	9,333
<b>Estimated Evacuating Population Clearing Okaloosa County</b>					
12-Hour	24,669	38,401	64,341	52,387	64,641
18-Hour	28,780	44,801	77,745	78,580	96,961
24-Hour				104,773	129,281
36-Hour				117,870	148,135
<b>Estimated Evacuating Population Clearing Santa Rosa County</b>					
12-Hour	37,001	43,042	62,633	44,209	51,025
18-Hour	44,709	52,009	75,682	66,314	76,538
24-Hour				88,419	102,051
36-Hour				97,629	114,807
<b>Estimated Evacuating Population Clearing Walton County</b>					
12-Hour	24,285	32,229	37,453	23,097	24,626
18-Hour	28,332	38,943	45,256	34,646	36,939
24-Hour				46,194	49,252
36-Hour				52,931	58,487
<b>Estimated Evacuating Population Clearing Washington County</b>					
12-Hour	7,596	7,896	9,002	5,118	5,320
18-Hour	9,179	9,870	11,252	7,678	7,979
24-Hour				10,237	10,639
36-Hour				11,943	12,634

*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 West 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 WFRPC region include SR 85, US 331, SR 285, I-10, US 231, US 29, SR 77, SR 79, SR 87, US 90, US 98 and SR 281. Outside the region, I-65, US 29, US 331, and US 231 are also critical facilities in Alabama. For large storm events, such as level D and E evacuations, other State facilities also play an important role in evacuations, such as SR 20;
- 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 military installations located with the WFRPC region have an impact on regional evacuations in terms of both personnel and equipment movements. Based on current information, the equipment and on-base personnel movements were assumed in this analysis to occur prior to evacuation orders being given by local county emergency managers. Off-base military personnel and civilian personnel were included in the analysis as part of the evacuating population after the evacuation order was given. WFRPC counties should continue their coordination efforts with the military installations to ensure evacuations are conducted as efficiently as possible;

- 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;
- Local counties and State agencies should continue development of north-south evacuation routes away from the coastal areas to help in reducing evacuation clearance times. All of the major north-south routes, such as US 231, US 331, US 29, SR 87, and SR 285, are critical in the evacuation process;
- The State can use the data and information provided in this report (specifically the evacuating vehicle maps in Volume 5-1) 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 northbound direction; and,
- The counties within the West 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.

*This page intentionally left blank.*

# CHAPTER I

## INTRODUCTION

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.

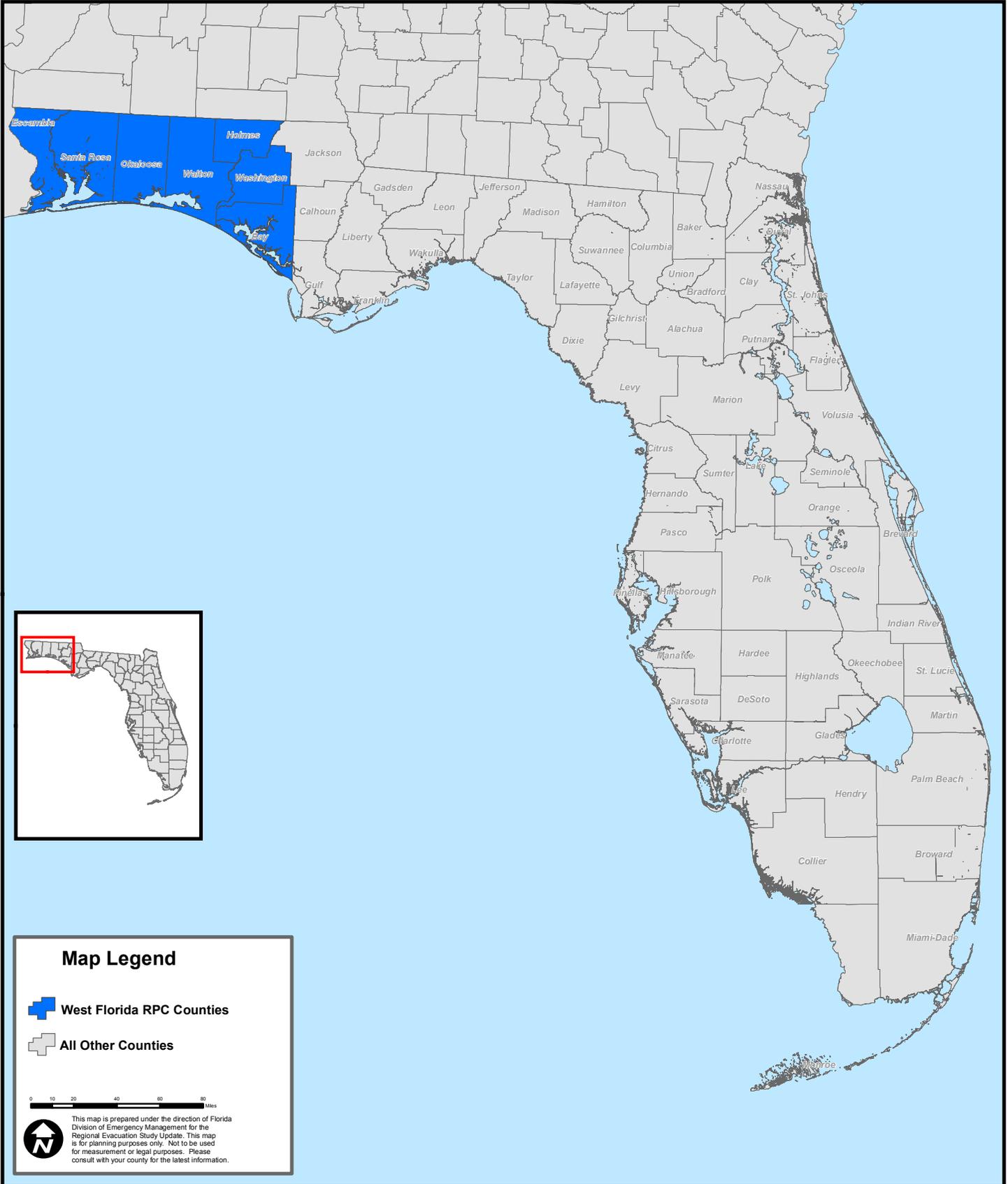
### B. Study Area

The study area for this analysis includes the seven county West Florida Regional Planning Council area, as illustrated in **Figure I-1**. 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 West Florida region. While the impact of other regions is included in the West Florida analysis, it is important to note that the results of the transportation analysis presented in this document are only reported for the seven counties included in the West Florida RPC. Transportation analysis results for other regions and counties are reported in the corresponding Volume 4 report for those regions.



# Figure I-1

## West Florida Regional Planning Council



## 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. The four meetings held in the West Florida region included the following:

### **Regional Meeting No. 1 – Model Development Meeting**

The first regional meeting for the West Florida region was held on September 17, 2008 at 11:00 AM. The purpose of the model development meeting was to introduce the transportation model development process. Feedback received through this process was used and incorporated into the development of the evacuation transportation methodology and framework.

### **Regional Meeting No. 2 – Model Implementation Meeting**

The second regional meeting for the West Florida region was held on April 13, 2009 at 9:30 AM. The purpose of the model implementation meeting was to discuss the evacuation modeling methodology, present the evacuation networks and small area data summaries, and obtain input from local county emergency management staff regarding county level traffic management plans, model input assumptions, and the geographic extents of the regional model. Feedback received through this process was used and incorporated into the development of the West Florida regional model.

### **Regional Meeting No. 3 – Scenario Development Meeting**

The third regional meeting for the West Florida region was held on two different dates due to the impacts of Tropical Storm Ida which impacted the region on the originally scheduled meeting date. Thus, follow-up meetings were held in different parts of the region as schedules permitted on November 16, 2009 at 9:00 AM and January 28, 2010 at 1:00 PM. The purpose of the scenario development meetings was to discuss the final evacuation methodology and framework, review the West Florida regional model network, 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. 4 – Transportation Analysis Meeting**

The fourth and final regional meeting for the West Florida region was held on August 30, 2010 at 10:00 AM. 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.

*This page intentionally left blank.*

# CHAPTER II

## 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 West Florida RPC Evacuation Transportation Analysis is identical to the methodology used for all eleven Regional Planning Councils and is summarized in the following sections.

### A. 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.

#### **How many people?**

The evacuation rate indicates the percent of residents who will leave their homes to go some place safer in each storm threat scenario. The evacuation rates are based on the following assumptions: that the storm track passes very close to the area being evacuated; and officials order evacuation for surge evacuation zones corresponding to storm category. Under the 100 percent response scenario, this rate will default to 100 percent.

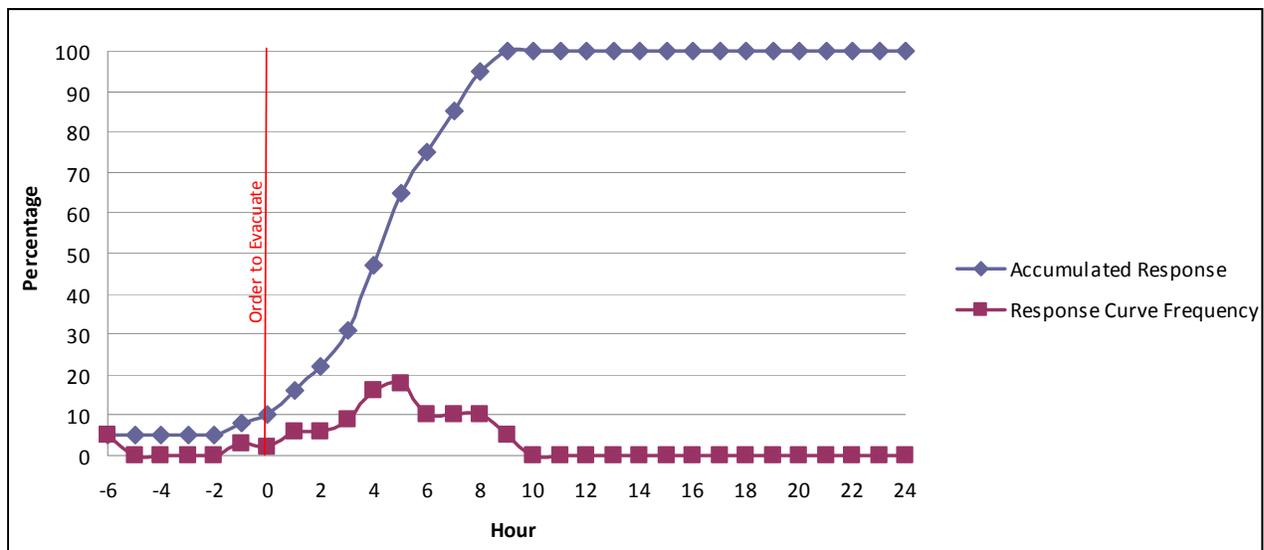
#### **When will they leave?**

Consistent with behavior observed in past evacuations, evacuees do not begin their journey toward safety all at the same time. Rather, evacuees each begin their trips at different times

based on their unique characteristics and constraints. Some individuals will prefer to evacuate soon after an order is given. Others may need to spend time securing personal property or seeing to the welfare of their relatives before they feel comfortable evacuating. Yet others will underestimate the threat posed to them by an oncoming storm and may not evacuate until very late. A set of evacuation response curves show the proportion of evacuation by increment of time for evacuation orders that were issued.

Each curve represents a different assumption on the amount of time it will take for an evacuating population to fully mobilize. The curves reflect the sense of urgency with which the population perceives the impending evacuation. Faster curves represent more urgent circumstances and slower curves represent less urgent circumstances. These curves are used by the model to divide the total number of evacuating trips into segments representing each hour that evacuating trips begin their journey. For example, a nine hour curve will place a certain number of evacuating trips in the first segment. These trips will represent those evacuees leaving in the first hour of an evacuation. The curve will then place another number of trips in the second segment representing the number of people leaving in the second hour of an evacuation. This process continues until all evacuees have begun their journey, which in a nine hour curve occurs during the ninth segment. All of the curves developed for the SRESP assume that some portion of the evacuating population leave before an order to evacuate is given. Typically, this is ten percent of the evacuating population. The nine hour response curve used in the model is depicted in **Figure II-1**. Response curves are available in the model to evaluate six, nine, twelve, eighteen, twenty-four, and thirty-six hour responses.

**Figure II-1 – Nine Hour Response Curve**



**What type of refuge would be sought?**

The survey data identified four types of refuge sought by evacuees. Specific rates were developed that identified the number of evacuees seeking shelter at each of these following different types of refuge:

- Friends and family;
- Hotel or motel;
- Public shelter; and,
- Other types of refuge not covered elsewhere in the list including, but not limited to, office space, churches, civic organization halls, and club houses.

**Where will they travel?**

The behavior survey distinguishes between trips that leave the county where an evacuation journey begins and trips that stay within the county. The out-of-county trip rate indicates the percent of evacuees who will seek refuge outside their county of residence. The in-county trip rate will determine how many of the evacuating trips are destined to remain within the county.

**How many vehicles are used?**

The vehicle use rate indicates the percentage of vehicles available to the evacuating household(s) that will be used in evacuation in each storm threat scenario. This rate ultimately determines the number of vehicles on the highways during an evacuation.

**B. 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.

**Zone System**

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.

The RPC developed their small area data by consulting either MPO or FDOT model Traffic Analysis Zone (TAZ) data or Census 2000 geography. In some cases, demographic data were developed at the parcel level. Data were developed for the following years: 2006, 2010, and 2015.

**Traffic Evacuation Zones (TEZ)**

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 similar to how traffic analysis zones form the basic unit of analysis in a standard travel demand model. The

TEZ system was developed so that the small area geographies will nest completely within one TEZ or another. This eliminates any potential for split data and will ensure that data in the TEZ system can always be updated with relative ease.

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. Furthermore, additional roadway segments have been included in the model's highway network to facilitate the movement of evacuation trips onto and off of the evacuation network. Each TEZ has a unique identification number that will be used by the model to connect evacuation trip generation to the evacuation highway network.

### **Highway Network**

A highway network is used to represent the roads that evacuees travel along as they journey toward safety. Various datasets were used to develop the highway network database as follows:

- Florida Statewide Model Network – The 2005 base year statewide model was used as a basis for developing the evacuation model. The statewide model was obtained from the Florida Department of Transportation (FDOT) Systems Planning Office;
- Evacuation Routes – Evacuation routes in each Regional Planning Council (RPC) area were obtained from the RPCs themselves. The RPCs relied on their constituent counties to provide them with information on which roads were to be included as evacuation routes;
- Florida Highway Data Software (FHD) – The 2006 Florida Highway Data software was obtained from FDOT. This software was used to view and query data extracted from the Roadway Characteristics Inventory (RCI) which includes number of lanes, facility types, speed limits, etc.;
- FDOT Quality/Level of Service Handbook – The 2002 FDOT Quality/Level of Service Handbook (QLOS) and the 2007 LOS Issue Papers (2002 FDOT QLOS addendum) were obtained from the FDOT Systems Planning Office website. The QLOS handbook and the LOS tables were used to establish roadway capacities for evacuation purposes; and,
- Microsoft and Google aeriels and maps – These aerial maps were used to identify and clarify roadway alignments. Whenever questions concerning the existence of particular facilities, their characteristics, or their alignments arose, aeriels were referenced.

### **Changes to the Florida Statewide Model Network**

Some modifications to the Florida Statewide Model network were necessary in order to make the data usable for evacuation modeling purposes:

- The original database, which was coded for a 2005 base year, was updated to 2006 conditions to correspond to the SRESP base year;
- Additional facilities had to be added to the network to accommodate evacuation traffic behavior;
- Many attributes from the original data set were removed and new ones were added

- specifically tailored for trip activity for evacuation modeling purposes;
- Based on RPC input, any missing facilities instrumental for evacuations were coded into the highway network database;
  - The highway network database was extensively reviewed for the correct coding of one-way links;
  - The 2006 FHD software was used to verify the highway network database number of lanes for the state roads, US highways, and major county roads. For other roads Microsoft and Google aerial maps were used;
  - The area type and facility type attributes for each roadway segment were verified for their consistency with existing conditions; and,
  - The network attributes were modified to the specific needs of evacuation modeling and reporting purposes. The evacuation routes designated by the RPC were flagged for reporting purposes. The County name attribute and the RPC number attributes were checked and modified accordingly.

### Capacities

Network capacities for the evacuation model are based on facility type and area type. The network facility type classification and the area type classification were retained from the existing Florida Statewide Model highway network database.

FDOT's 2002 Quality/Level of Service (QLOS) generalized level of service volume tables were used for estimating the link capacity for each combination of functional class and area type. The generalized level of service volume tables were generated from conceptual planning software which is based on the 2000 edition of the Highway Capacity Manual (HCM). Using statewide default values for each of these roadway characteristics, the generalized LOS volume tables were developed from the conceptual planning software.

The peak hour volume represents the most critical period for traffic operations and has the highest capacity requirements. Many urban routes are filled to capacity during each peak hour, and variation is therefore severely constrained. The peak hour directional volumes at LOS E, closely represent the maximum volume (capacity) that can be accommodated through a given roadway. In some cases the Peak Hour Two-Way LOS tables do not show the maximum services volumes at the LOS E. For example, the four-lane Class I arterial service volumes are only shown from LOS A to LOS D, This indicates that the maximum volume thresholds (capacity) are reached at LOS D and these volumes represent the capacity of the roadway.

A lookup table was created with facility type, area type, number of lanes, and capacities by comparing model network characteristics to the roadway characteristics in the QLOS manual. The lookup table is shown in **the Transportation Supplemental Data Report**. The capacity attribute in the network was automatically assigned for any given link with a specific facility type, area type and number of lanes during the network preparation process.

### Speeds

The existing highway network database link speeds were verified for their reasonableness and their suitability for evacuation modeling purpose. The speed values of the existing statewide model database were reasonable and therefore retained in for evacuation modeling.

### **Roadway Attributes**

The roadway attributes contain the highway characteristics for each link in the highway network. Some of the attributes like DISTANCE, FTYPE, ATYPE, etc., were retained from the highway network database and other attributes like DENSITY and EVAC\_RTE are specific to the evacuation modeling and were included in the network.

### **Reverse Lane Operations**

Additional changes were also made in order to accommodate reverse lane operations in an evacuation scenario. Most of the facilities that would be subject to a reverse lane operations scenario were coded as a pair of one-way links. Additional attributes were added to the network in order to allow for the correct calculation of capacity in the reverse lane direction. The configurations of reverse lane facilities reflect the reverse lane operations plans established by the State.

## **C. 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.

### **Methodology used to Account for Background Traffic**

There are two dynamics at work when evacuation traffic and background traffic interact with one another. The first is the effect of background traffic displacing evacuation traffic as background traffic attempts to use the same roads as the evacuation traffic. The second is the effect of evacuation traffic displacing background traffic. As vehicles move along the network and try to get onto certain roads they leave less room for other vehicles to use those same roads. As background traffic builds up there is less room for evacuation traffic to move, and vice versa. While the effect that evacuation traffic has on background traffic may be of some interest to those who are concerned with disruptions in daily trip making behavior during an evacuation event, for the purposes of this study we are much more interested in the effect that background traffic has on evacuation clearance times.

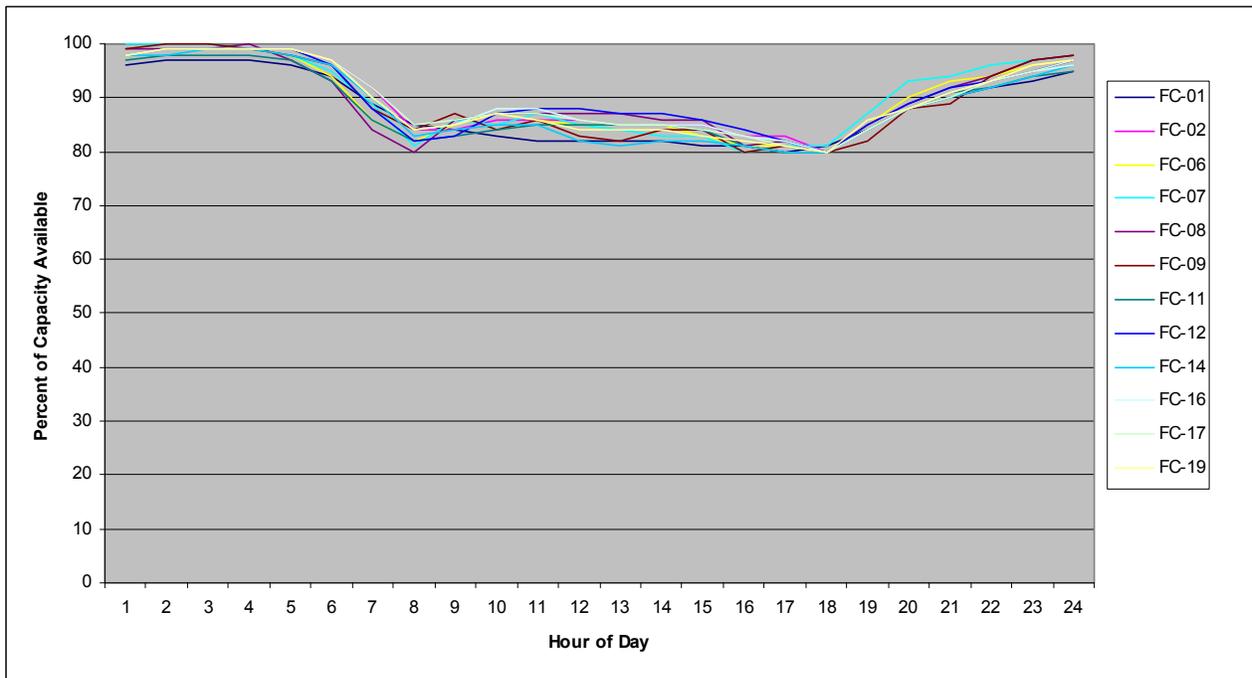
The effect that background traffic has on evacuation traffic can be stated in terms of available capacity. The more background traffic there is on a segment of road, the less capacity is available for evacuation traffic to use. Following this logic, it becomes apparent that by causing the available capacity to fluctuate throughout the evacuation event, one is able to sufficiently

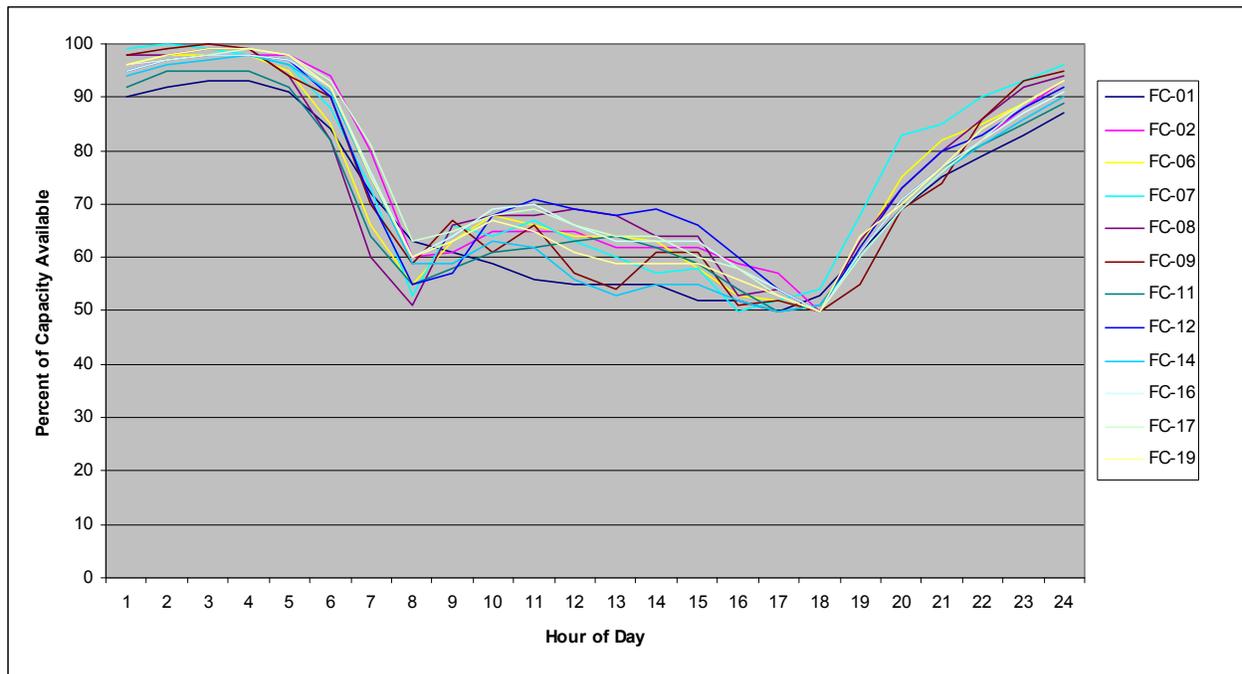
account for the impact of background traffic. FDOT’s Florida Traffic Information DVD was used to develop average peaking characteristics for various functional classes of roadways throughout the state. These characteristics were analyzed to determine how much capacity is available throughout a given day during an evacuation.

Two sets of curves were developed, one for coastal evacuating counties that represent lower background traffic and one for all other counties representing greater background traffic. The model then adjusts capacities up and down consistent with these curves as it simulates the evacuation.

**Figure II-2** illustrates the set of curves showing the percentage of available capacity throughout a 24 hour period for a coastal evacuating county after the model accounts for background traffic. **Figure II-3** illustrates the set of curves showing the percentage of available capacity throughout a 24 hour period for all other counties after the model accounts for background traffic.

**Figure II-2 – Percent of Available Capacity for Coastal Counties**

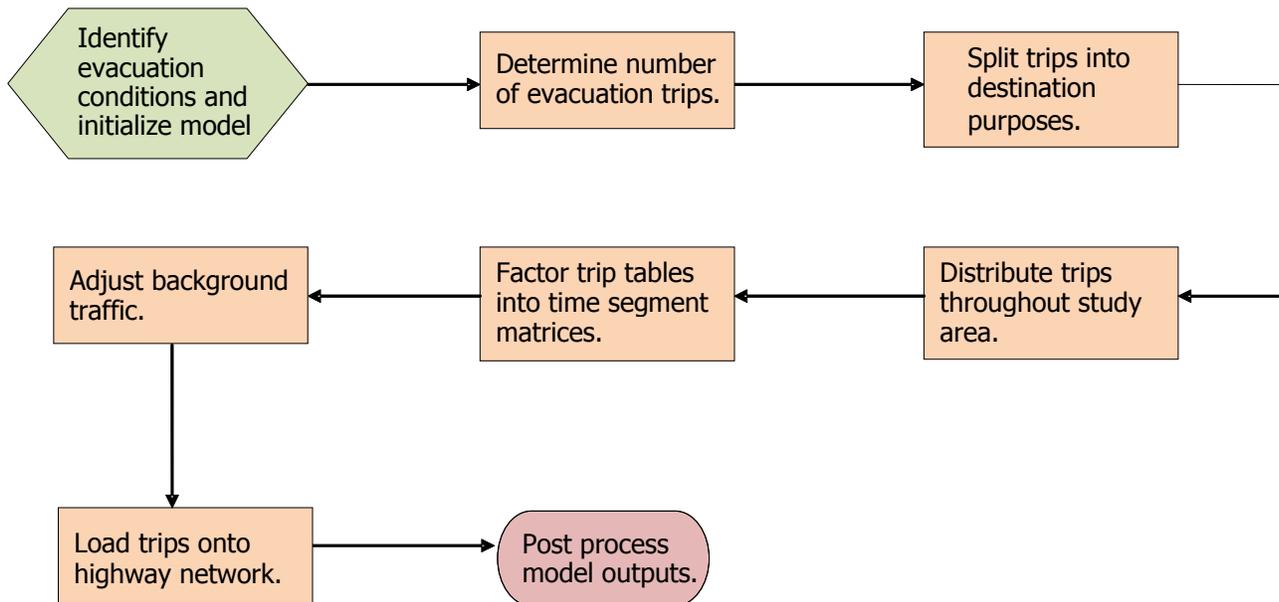


**Figure II-3 – Percent of Available Capacity for Other Counties**

## D. 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 II-4**:

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 II-4 - General Model Flow**

### Initializing the Model

At the beginning of the model flow, the model will need to determine the hazard conditions representing the particular scenario that will be analyzed. This will allow the model to accurately identify the areas that will be subject to evacuation and to determine the intensity of the evacuation event. This process will then establish the appropriate rates that will be used to determine the number of evacuation trips that will be generated.

### Number of Evacuating Trips

After the model has finished initializing it will begin to calculate the number of evacuation trips that are generated. Estimating an appropriate number of trips is essential to ensuring that the behavior expressed on the highway network during trip assignment is reflective of likely conditions during a real world evacuation event.

The planning assumptions developed by the behavioral analysis were translated into a master rates file that can be referenced by the model in order to determine the number of evacuation trips that a particular scenario can be expected to generate.

#### *Production Ends*

Every trip has two ends. One end represents where a trip begins its journey and is typically referred to as the production end. The other end represents where a trip finishes its journey and is typically referred to as the attraction end. The calculation of the production end of each evacuation trip in the model is driven by the master rates file mentioned above.

#### *Attraction Ends*

The other end of an evacuation trip, the attraction end, is calculated using a much more simplified methodology. Public shelters have clearly defined capacities. For hotels and motels,

each room will be designated as an attraction. Trips destined to shelter with friends and family or in other unspecified destinations will have an attraction generated at each non-evacuating household in the model. This will ensure that these trips are evenly distributed around the area with some clumping occurring in highly residential areas.

### **Splitting Trips into Destination Purposes**

Once the number of evacuation trips has been determined it will be necessary to divide the trips into various trip purposes. These purposes are based on the type of destination that an evacuee is headed to and the relative location of that destination. There are four types of destinations and two relative locations for a total of eight trip purposes, as identified below:

- Friends & Family – In County;
- Public Shelter – In County;
- Hotel/Motel – In County;
- Other – In County;
- Friends & Family – Out of County;
- Public Shelter – Out of County;
- Hotel/Motel – Out of County; and,
- Other – Out of County.

The same behavioral analysis that establishes the evacuation and vehicle use rates used to determine the number of evacuation trips that are being generated by the model is also a source of data for determining the various destinations where these evacuation trips are heading.

#### *Trip End Balancing*

Once the model has finished splitting the trip ends into their respective purposes, it will commence the process of balancing trip ends. The balancing of trip ends is critical so that the trip distribution process which is to follow this step will be able to tie every trip production to every trip attraction. A surplus or deficit of one trip end or the other may cause complications in the evacuation model that can lead to overestimating the model, underestimating the model, or aborting the model process.

In County Balancing - The trip balancing procedure begins by considering each purpose individually. If the trip purpose under consideration is an In County purpose the model compares the number of productions to the number of attractions. If the number of attractions is greater than the number of productions, the model will simply apply a universal adjustment of all attraction trip ends in the county down to the number of productions. The end result should be an equal number of In County productions and attractions.

If, on the other hand, the productions should exceed attractions the excess productions are shifted over to the corresponding Out of County purposes. For example, if the model estimates using the behavioral planning assumptions that there will be 3,000 evacuees destined In County to Hotel/Motel destinations, but there are only 2,500 Hotel/Motel attraction ends available in the county, the excess 500 trips will become Out of County Hotel/Motel trips.

Out of County Balancing - If the purpose under consideration is an Out of County purpose the model will balance the attractions regionally. Using data derived from the behavioral study, a

certain percentage of each out of county trip will be destined to a particular region. If a particular region is prohibited by the model from receiving evacuation trips, the model will reallocate the portion of evacuation trips originally destined for that regional equally among all other regions. **Table II-1** identifies the percentages of out of county trips destined from each region and to each region. When the model has finished balancing the evacuation productions and attractions, the model will then proceed with trip distribution.

**Table II-1 – Out of County Trip Destinations by Region**

<b>To</b> <b>From</b>	Apalachee	Central	East Central	North Central	Northeast	South	Southwest	Tampa Bay	Treasure Coast	West	Withla-coochie	Out-of-State
Apalachee	31.2%	0.1%	1.1%	2.3%	2.1%	0.0%	0.1%	0.7%	0.3%	3.5%	0.8%	57.8%
Central	5.9%	9.8%	13.0%	4.4%	4.7%	0.0%	4.2%	5.9%	5.4%	0.7%	1.7%	44.2%
East Central	2.5%	1.7%	27.1%	5.4%	5.9%	1.5%	2.6%	6.7%	0.8%	1.4%	3.1%	41.2%
North Central	5.2%	0.7%	3.6%	15.2%	6.3%	0.3%	0.3%	3.1%	0.2%	1.3%	2.0%	61.8%
Northeast	3.7%	0.7%	4.2%	6.6%	10.3%	0.6%	0.6%	1.8%	0.2%	1.9%	2.0%	67.4%
South	2.0%	3.4%	20.9%	2.1%	3.4%	24.5%	5.7%	2.1%	9.0%	0.5%	3.1%	23.4%
Southwest	1.4%	5.2%	15.9%	3.9%	3.3%	4.6%	11.0%	8.4%	3.2%	0.8%	5.4%	37.0%
Tampa Bay	3.2%	3.7%	14.1%	2.8%	4.5%	2.2%	1.3%	15.7%	2.0%	0.5%	7.3%	42.6%
Treasure Coast	2.8%	1.5%	22.8%	3.0%	4.4%	4.5%	4.0%	9.4%	11.5%	0.2%	2.0%	34.0%
West	6.3%	0.2%	2.1%	0.9%	3.5%	0.4%	0.1%	0.3%	0.3%	8.7%	0.8%	76.4%
Withla-coochie	2.4%	1.7%	12.4%	7.4%	3.3%	1.0%	0.7%	6.5%	0.5%	1.2%	15.0%	48.0%

*Source: Derived from SRESP Behavioral Data and Planning Assumptions*

### Trip Distribution

After the model has determined how many evacuation trips there will be in a given scenario, split those trips into purposes, and balanced the trip ends for those purposes, it will be necessary for the model to perform a trip distribution. The trip distribution step in the model connects each production end to a unique attraction end. The end result is a trip table containing origins and destinations for each trip in the model. Typically, origin zones are referred to by the letter I and destination zones are referred to by the letter J. An Origin-Destination matrix, also known as an OD matrix, is one of the principal inputs into trip assignment. This matrix tells the model where each trip is coming from and where it is going to.

The trip distribution process begins by looping through each trip purpose and determining whether the purpose is In County or Out of County. In County trips are restricted to destination TEZs within the same county as the trip origin. Out of County trips are restricted to TEZs not in the same county as the trip origin. The trip distribution is conducted using a gravity model that relies on distances as the chief measure of impedance.

### **Time Segmentation**

The final step of the model prior to initiating the trip assignment sequence is to segment the trip table into discreet time periods. This segmentation determines at what point in time each trip begins its evacuation. The model is set up to process a set of evacuation response curves with a period resolution of one-half hour. The model uses a set of factors developed from the behavioral response curves to divide the evacuation trip tables into the different segments.

The model makes the following assumptions. Due to limitations in the model, these assumptions cannot be adjusted. The analyst should keep these assumptions in mind when using results developed by the model:

- All evacuations begin when an order to evacuate has been issued;
- All evacuations begin during the first hour of daylight, approximately 7:00 AM;
- All evacuations begin during an average weekday;
- Some portion of evacuation trips, typically ten percent, leaves prior to the beginning of an evacuation; and,
- Those evacuation trips that leave prior to the beginning of an evacuation leave no later than the previous evening and have already cleared the network by the time an evacuation order is given.

### **E. Dynamic Traffic Assignment**

Dynamic traffic assignment (DTA) was utilized 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.

### Parameters of the Evacuation Assignment

The DTA for the evacuation model makes use of certain parameters which dictate how the assignment will function. The parameters that were established are:

- **Capacity** - The SRESP evacuation model uses hourly lane capacities derived from the Florida Department of Transportation Quality/Level-of-Service Handbook. These capacities are initially set to represent Level-of-Service E conditions. These capacities are then further increased by an additional 20 percent for freeway links and 10 percent for non-freeway links. These increases in capacity are meant to reflect high volume usage typically found during an evacuation, optimal green timing of traffic signals and traffic control typically controlled during an evacuation by law enforcement personnel, and the use of shoulder and emergency lanes;
- **Storage** - Storage determines how many vehicles can remain standing on a length of roadway at any moment in time. The evacuation model assumes that storage is set to 250 vehicles per lane per mile. This assumes approximately 21 feet of space are "occupied" by any given vehicle. Given the mix of vehicles on a roadway network (including compacts, SUVs, trailers, and trucks) this spacing appears to be reasonable for stand-still traffic;
- **Time Intervals** - In order to properly implement a DTA model, the assignment process needs to be segmented according to a set of time intervals. Half-hour intervals provide sufficient detail to satisfy the planning needs of both emergency management and growth management concerns. The model calculates vehicle assignments over 192 such intervals for a 96 hour model period. This is sufficient to capture all evacuation activity during an event and allows sufficient time for the evacuation traffic to clear at both the county and regional level; and,
- **One-Way Evacuation Operation** - The State of Florida has recently published a series of one-way evacuation operation plans for major corridors throughout the state. The intention of these plans is to fully maximize the available capacity on a freeway by using all lanes to move evacuees away from danger. The model will emulate one-way operations by simultaneously increasing the capacity of links headed away from the threatened area and eliminating the capacity of links headed toward the threatened area. The capacity of links headed away from the threatened area will increase by 66 percent, which is consistent with capacity increases used by Florida's Turnpike Enterprise. Past experience of reverse lane operations have shown that capacities do not double, as is commonly assumed, but increase by a lower percentage of about two thirds.

## F. Prototype Model Development

Wilbur Smith Associates developed the 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.

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.

## CHAPTER III

# REGIONAL MODEL IMPLEMENTATION

The evacuation transportation model discussed in Chapter II includes several components that are completed using a statewide dataset (determine number of evacuation trips, split trips into destination purposes, and distribute trips throughout state) and several components that can only be completed at the regional level (factor trip tables into time segment matrices, adjust background traffic, and load trips onto the highway network) due to computer run time limitations with the model software. Thus, for the regional level steps, each RPC throughout the State needed to decide on a regional model network to complete the analysis in their region. For the West Florida Region, the regional model network includes the seven counties within the RPC plus 26 other counties surrounding the region, as illustrated in **Figure III-1**.

This chapter discusses the input data used in evaluating evacuation transportation conditions for the West Florida Region. It is important to note that the input data discussed in this chapter is included only for the counties within the West Florida RPC, as these are the counties that the West Florida RPC has direct responsibility for the data. Data for the adjacent counties included in the West Florida Regional model were provided by the corresponding RPC in which the counties belong. The model data for these counties is discussed in the corresponding Volume 4 report for those respective RPCs.

### A. Regional Model Network

The road network is a key component of the evacuation model. The roadway variables in the network include area type, functional class, number of through lanes, capacity, speed, and several others. 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 West 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 III-2** identifies the model network and evacuation routes for the WFRPC. County level details of the regional model network are provided in the Volume 5 report. The regional model network for the West Florida region includes key roadways within the seven county region, including I-10, US 231, US 331, US 98, US 90, US 29, SR 281, SR 77, SR 79, SR 20, SR 4, SR 87, and SR 85.

### B. Regional Zone System

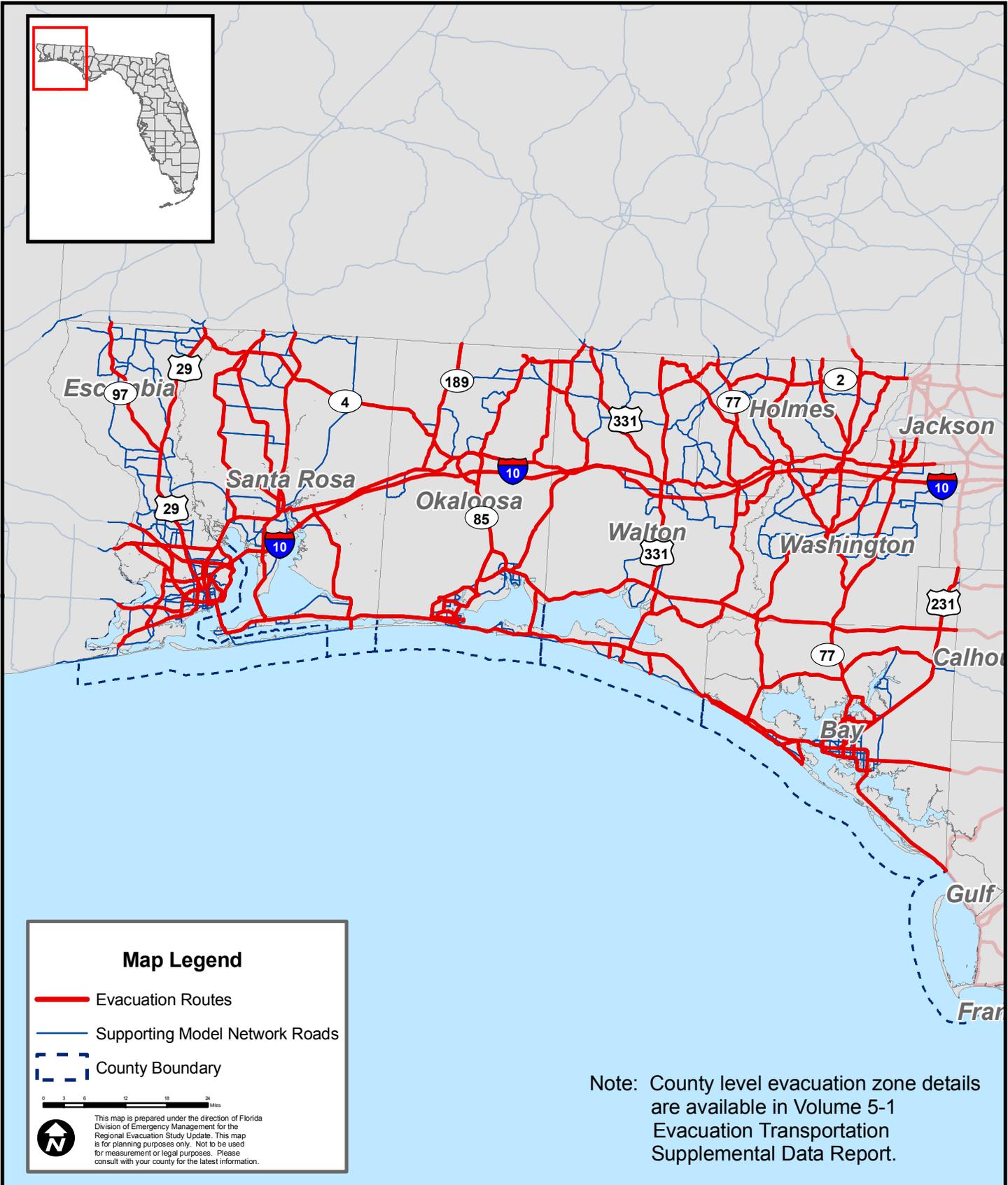
The regional zone system is based on Traffic Evacuation Zones (TEZ) and contains the regional demographic information, which includes housing and population data that is essential to modeling evacuation traffic, as discussed in Chapter II. The regional demographic characteristics identify where the individuals in the region reside, as well as where the vulnerable populations are located. The TEZs are aggregations of the smaller small area data geographies provided by the RPC. Each traffic evacuation zone has a unique identification



# Figure III-1 West Florida Regional Model Area



# Figure III-2 West Florida Regional Model Network



number that is used by the model to connect evacuation trip generation to the evacuation highway network. There is a buffer in zone numbering between counties to allow for future growth in each county.

The final TEZ system for the State of Florida has 17,328 zones. Of the total number of zones in Florida, 768 of the zones are located within the seven county West Florida region, as illustrated in **Figure III-3**. In the West Florida region, Escambia County has the largest number of TEZs with 184, and Bay County follows with 184 TEZs. Holmes and Washington Counties each contain 14 zones and have the lowest number of TEZs within the RPC. The larger number of TEZs generally reflects counties with denser urban form and higher population densities. The number of TEZs for each county in the region is listed below:

- Bay – 184
- Escambia – 232
- Holmes – 14
- Okaloosa – 178
- Santa Rosa – 86
- Walton – 60
- Washington – 14

### C. Regional Demographic Characteristics

As discussed in Chapter II, the evacuation model uses the demographic information as input for generating a set of evacuation trips. The demographic data were developed for the following years: 2006, 2010, and 2015.

A snapshot of the key demographic data for each county in the West Florida RPC for 2006, 2010 and 2015 is summarized in **Table III-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. Detailed demographic data for each individual TEZ within the region is included in Volume 5.

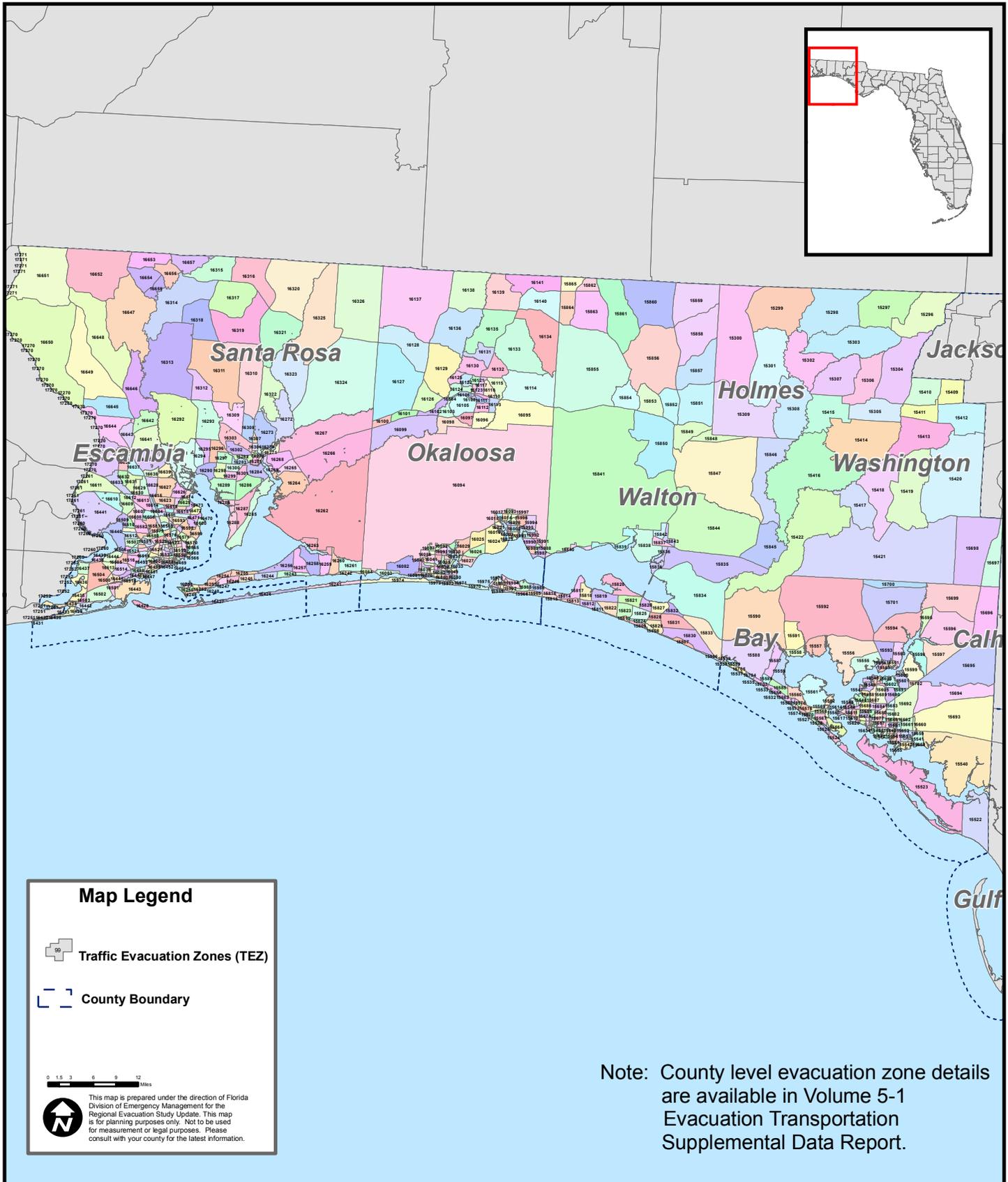
Escambia County has the largest population in the region during all three time periods. The county is expected to reach over 320,000 people by 2015. Okaloosa County has the second largest population for all years and is expected to exceed 225,000 people by 2015. The counties with the lowest populations in the region are Holmes and Washington Counties; both counties have fewer than 25,000 in each time period. Between 2006 and 2015, Holmes and Washington are also projected to experience the smallest rates of growth, about 6% and 8%, respectively. In contrast, Walton County is expected to grow by more than 50% between 2006 and 2015.

Bay County has the highest number of mobile homes for all three time periods; although Bay County has the most mobile homes, the homes only represent a little more than 13% of the total occupied homes. Washington and Holmes Counties have the lowest number of mobile homes; however, mobile homes comprise more than a third of the total occupied homes in those counties.



# Figure III-3

## West Florida Regional Model Transportation Evacuation Zone (TEZ) System



**Table III-1 - West Florida Demographic Characteristic Summary**

County	Characteristic	Year		
		2006	2010	2015
Bay	Occupied site-built homes	61,176	63,605	67,412
	Population in site-built homes	144,342	151,030	160,110
	Occupied mobile homes	9,463	9,652	10,444
	Population in mobile home	24,485	24,988	27,032
	Hotel/motel units	10,766	10,904	11,598
Escambia	Occupied site-built homes	113,171	117,616	123,301
	Population in site-built homes	278,245	289,267	303,328
	Occupied mobile homes	7,218	7,525	7,921
	Population in mobile home	17,949	18,711	19,697
	Hotel/motel units	6,620	6,893	7,247
Holmes	Occupied site-built homes	4,752	4,895	5,033
	Population in site-built homes	11,360	11,710	12,045
	Occupied mobile homes	2,384	2,441	2,512
	Population in mobile home	6,007	6,150	6,328
	Hotel/motel units	181	181	181
Okaloosa	Occupied site-built homes	72,569	79,192	86,923
	Population in site-built homes	179,502	196,087	215,525
	Occupied mobile homes	3,154	3,325	3,796
	Population in mobile home	8,042	8,478	9,678
	Hotel/motel units	5,130	5,580	6,152
Santa Rosa	Occupied site-built homes	49,384	55,294	62,418
	Population in site-built homes	128,811	144,283	162,871
	Occupied mobile homes	5,853	6,807	8,030
	Population in mobile home	15,094	17,557	20,722
	Hotel/motel units	1,075	1,210	1,386
Walton	Occupied site-built homes	17,286	19,865	26,194
	Population in site-built homes	39,382	45,294	59,840
	Occupied mobile homes	3,310	3,735	4,929
	Population in mobile home	8,276	9,333	12,317
	Hotel/motel units	1,556	1,763	2,406
Washington	Occupied site-built homes	5,415	5,599	5,834
	Population in site-built homes	12,828	13,271	13,839
	Occupied mobile homes	2,930	3,046	3,188
	Population in mobile home	7,799	8,103	8,480
	Hotel/motel units	247	247	247

Source: West Florida Regional Planning Council

## D. Planned Roadway Improvements

To correspond to the three different sets of demographic data, three model networks were ultimately developed. The base 2006 network, discussed in section A, 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 III-2** identifies capacity improvement projects completed between 2006 and 2010 that were included in the 2010 network. Likewise, **Table III-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 2010 in Bay County, Baldwin Rd from St Andrews Blvd to State Ave will be widened to 4 lanes.

It is important to note that Tables III-2 and III-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.

**Table III-2 - West Florida Region Roadway Improvements, 2006 – 2010**

County	Roadway	From	To	Number of Lanes
Bay	Baldwin Rd	St Andrews Blvd	State Ave	4
	Baldwin Rd	State Ave	Harrison Ave	4
	CR 3031	Over Grand Lagoon Bridge (No. 460055)		4
Escambia	I-10	US 29	US 291	6
	I-10	US 90	End of Escambia Bay Bridge	6
	I-110	Maxwell St	I-10	6
	Brent Lane	Davis Hwy	Rawson Ln	6
Okaloosa	John Sims Pkwy	Government Ave/ SR 85	SR 85 N	6
Okaloosa/ Walton	SR 30/US 98	SR 293	Scenic Gulf Dr	6
Santa Rosa	SR 87	US 90	S of Hickory Hammock Rd	4
Walton	SR 83 (US 331)	SR 30/US 98	S End of Choctaw Bay Bridge	4
Washington	SR 79	S of Holmes Creek Bridge	Strickland Rd	4

Sources: FDOT SIS First Five Year Plan, FDOT SIS Second Five Year Plan, West 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 III-3 - West Florida Planned Roadway Improvements, 2011–2015**

County	Roadway	From	To	Number of Lanes
Bay	Baldwin Rd	Harrison Ave	Minnesota Ave	4
Escambia	I-10	SR 291	US 90	6
Okaloosa	SR 85 @ SR 123	S of Gen Bond Blvd	N of Okaloosa Reg Airport	6
	SR 20/John Sims Pkwy	SR 293/White Point Rd	Mid-Bay Bridge Connector	4
Santa Rosa	SR 281 Avalon Blvd	N of CSX R/R bridge	S of Commerce Rd	4
	SR 281 Avalon Blvd	S of Moors Lodge	N of CSX R/R Bridge	4
	SR 281 Avalon Blvd	Commerce Rd	US 90 (SR 10)	4
	SR 281 Avalon Blvd	I-10	S of Moors Lodge	4
	SR 87	N of Five Forks Rd	Eglin AFB Boundary	4
Walton	SR 83 (US 331)	N end Choctaw Bay Bridge	S of SR 20	4
	SR 83 (US 331)	New alignment of Owl's Head	Edgewood Circle	4
Washington	SR 79	Strickland Rd	N of Mills Branch Rd	4

Sources: FDOT SIS First Five Year Plan, FDOT SIS Second Five Year Plan, West 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.

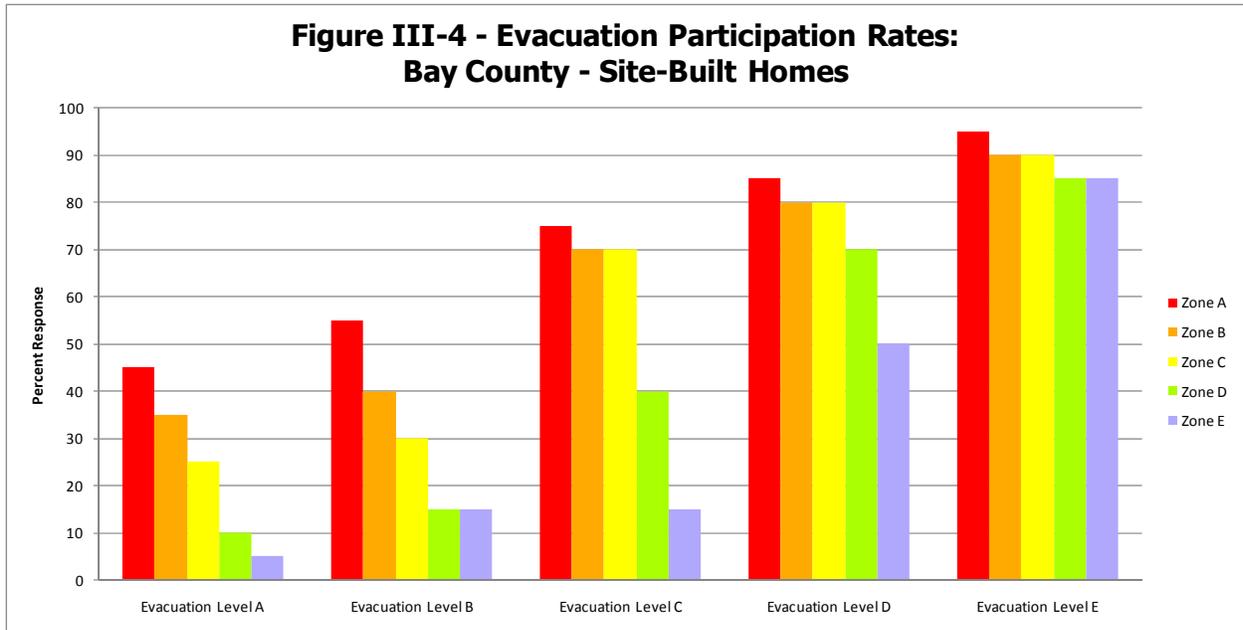
## E. Behavioral Assumptions

The behavioral assumptions provide important information on the way people respond to an evacuation order and are an important input to the SRESP transportation evacuation model. For the West Florida Region, five counties within the region have evacuation zones corresponding to five categories of storm surge. Evacuation rates for site-built homes and mobile/manufactured homes are provided by county and summarized in **Figure III-4** through **Figure III-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 5-1.

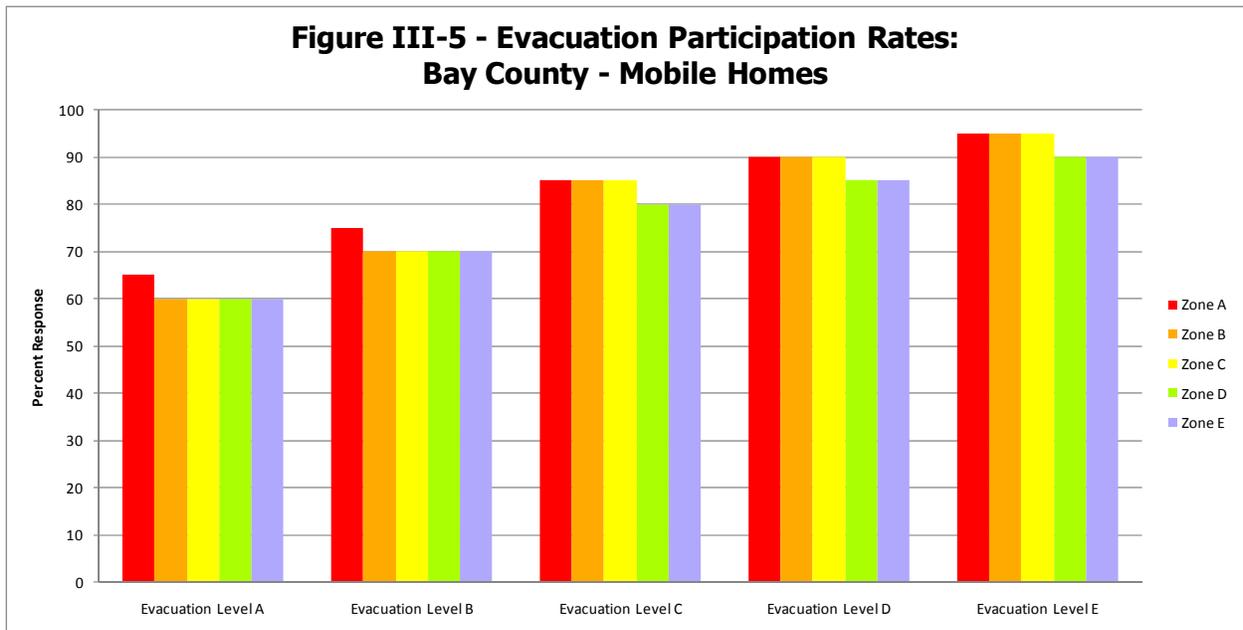
A review of the evacuation rates for the West Florida region illustrates that evacuation participation rates increase as the evacuation level increases, and participation rates for persons living in mobile/manufactured homes are generally higher than for persons living in site-built homes. It should be noted that a certain percentage of the population evacuates, even when they are not living in an area that is ordered to evacuate. These people are commonly referred to as shadow evacuees. Shadow evacuation rates are also included in Figure III-4 through Figure III-11.

For example, if an evacuation order was issued for Bay County for persons living in evacuation zone A, the county could expect a 45 percent participation rate from persons living in site-built homes in evacuation zone A (Figure III-4) and an 65 percent participation rate from persons living in mobile/manufactured homes in evacuation zone A (Figure III-5). In addition, Bay County can expect shadow evacuations to occur for persons living in site-built homes at a rate of 35 percent from evacuation zone B, 25 percent from zone C, 10 percent from zone D, and 5 percent from zone E (Figure III-4). Likewise, for persons living in mobile/manufactured homes, Bay County can expect shadow evacuations to occur at a rate of 60 percent from evacuation zones B, C, D and E (Figure III-5).

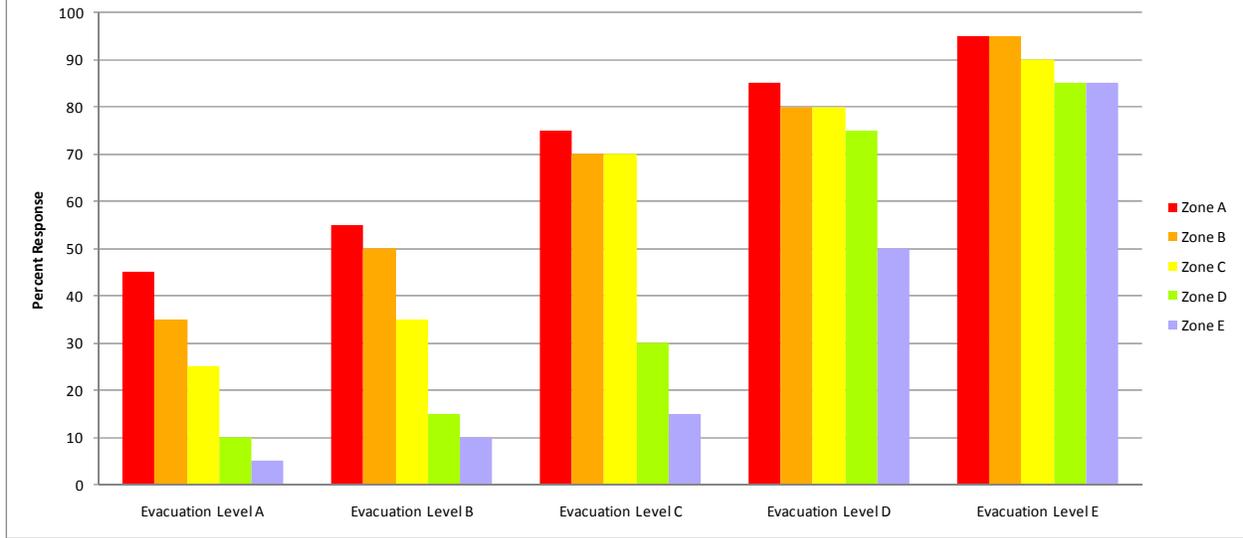
**Figure III-4 - Evacuation Participation Rates:  
Bay County - Site-Built Homes**



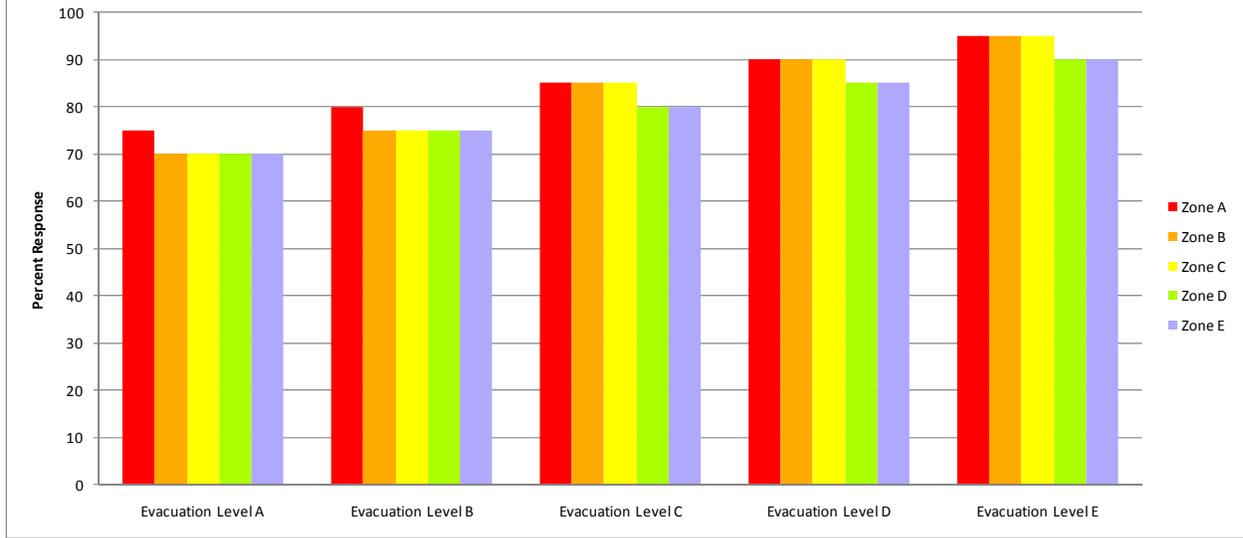
**Figure III-5 - Evacuation Participation Rates:  
Bay County - Mobile Homes**



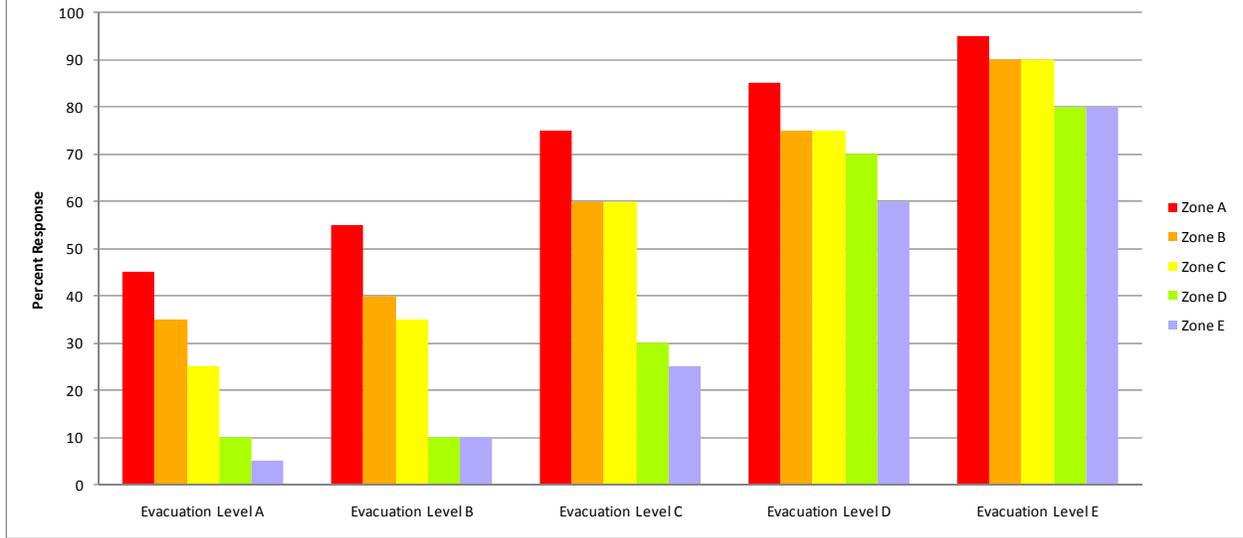
**Figure III-6 - Evacuation Participation Rates:  
Escambia County - Site-Built Homes**



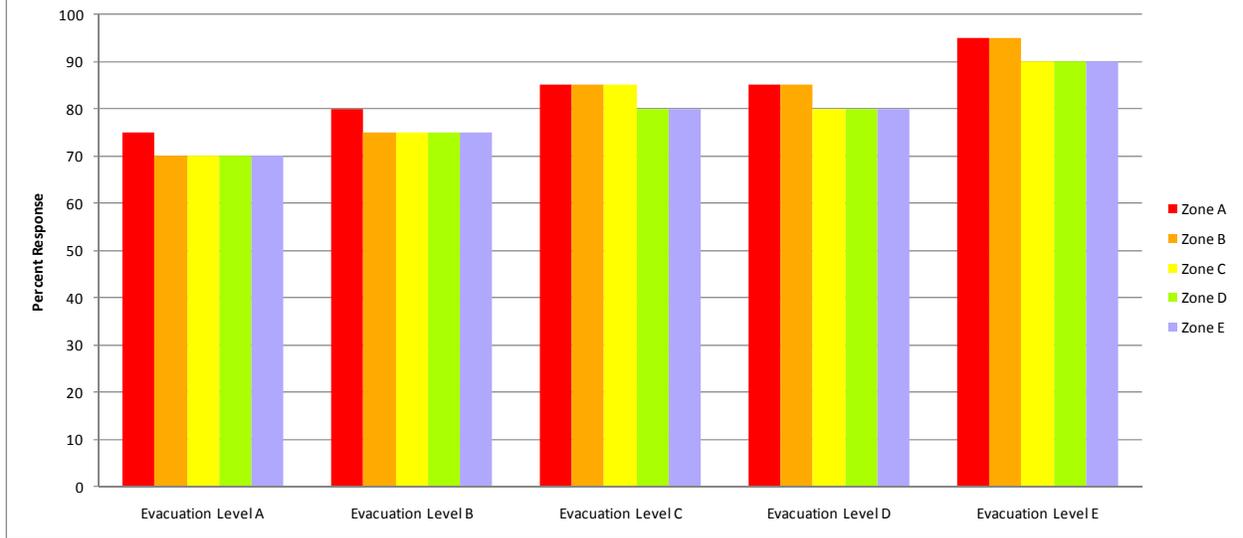
**Figure III-7 - Evacuation Participation Rates:  
Escambia County - Mobile Homes**



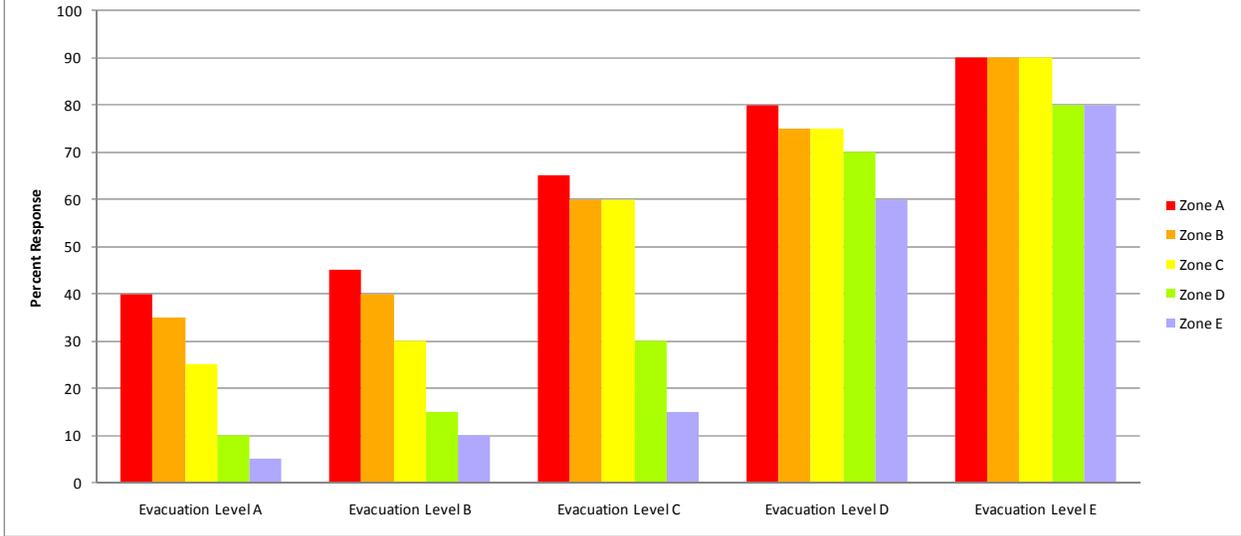
**Figure III-8 - Evacuation Participation Rates:  
Okaloosa County - Site-Built Homes**



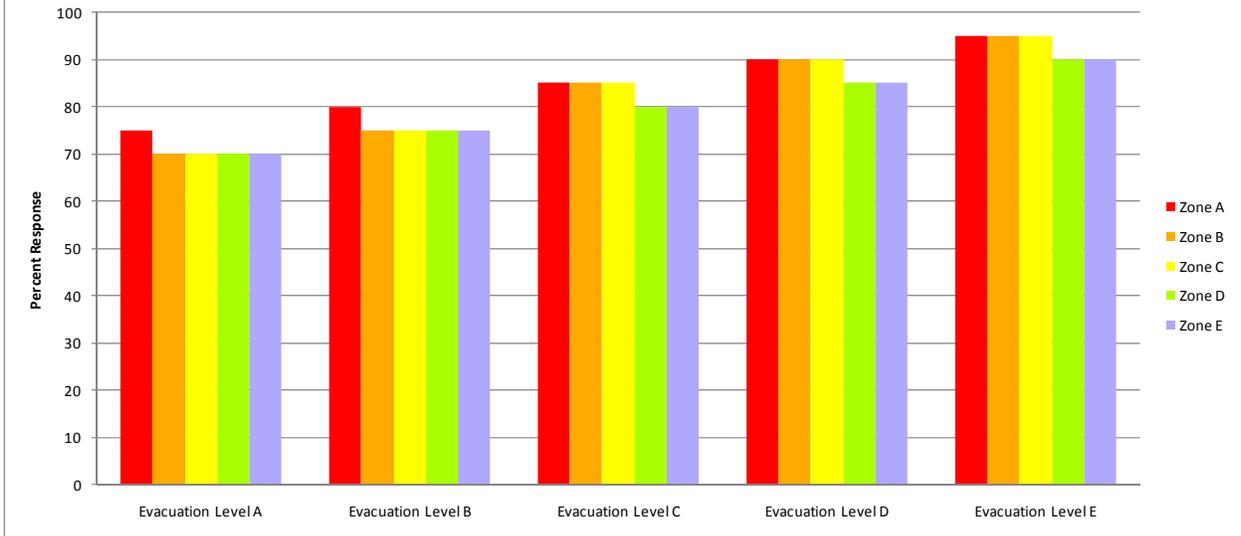
**Figure III-9 - Evacuation Participation Rates:  
Okaloosa County - Mobile Homes**



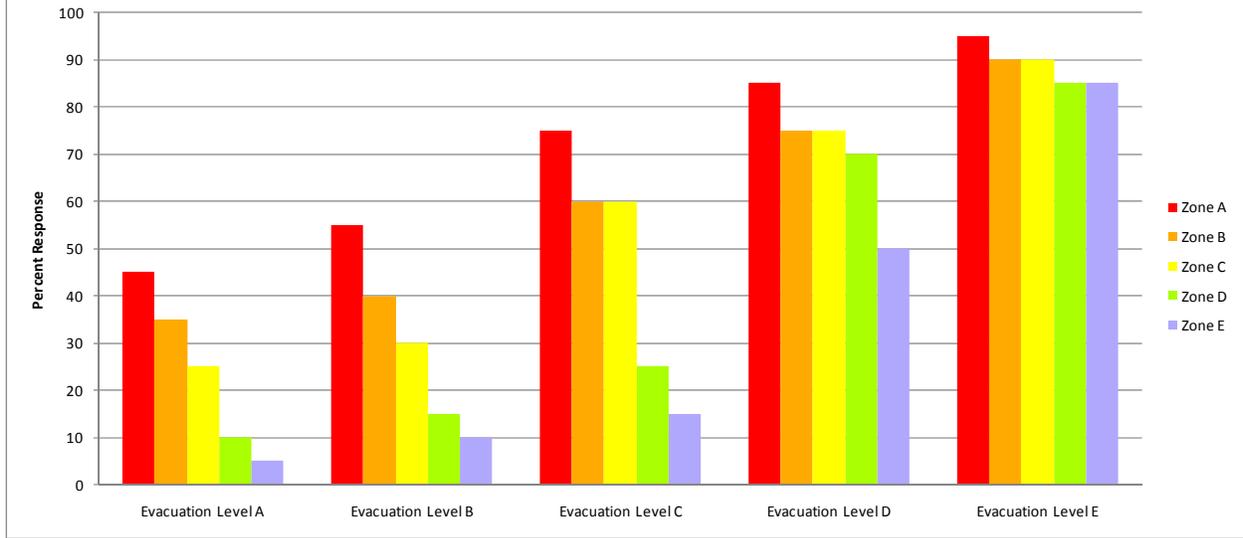
**Figure III-10 - Evacuation Participation Rates:  
Santa Rosa County - Site-Built Homes**



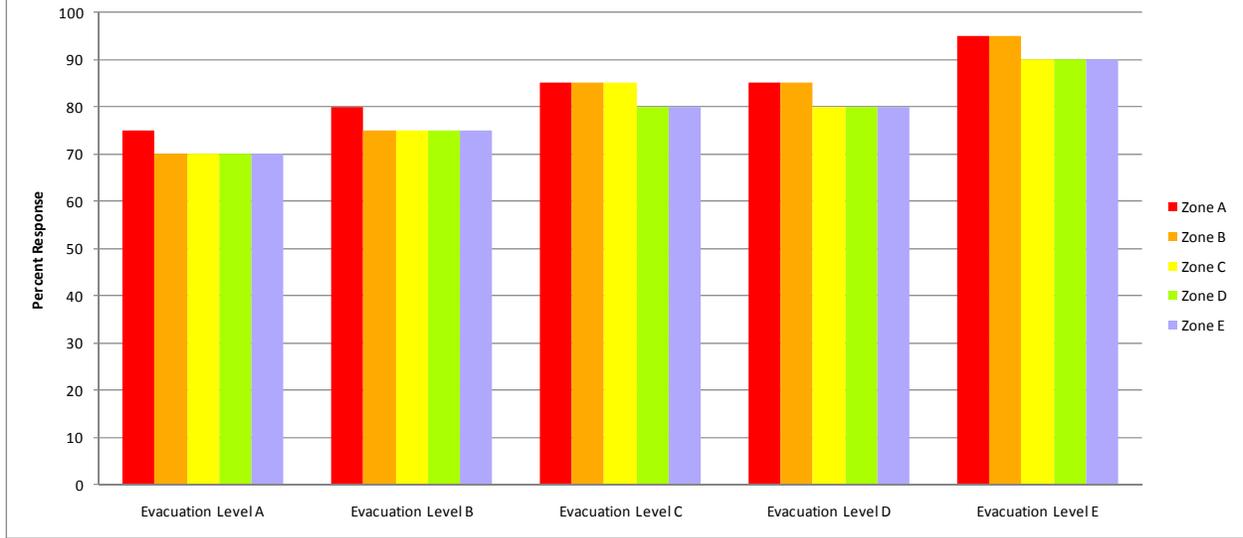
**Figure III-11 - Evacuation Participation Rates:  
Santa Rosa County - Mobile Homes**



**Figure III-12 - Evacuation Participation Rates:  
Walton County - Site-Built Homes**



**Figure III-13 - Evacuation Participation Rates:  
Walton County - Mobile Homes**



## F. 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 West Florida RPC compiled the list of available public shelters using information provided by the local county emergency managers. 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 seven county region there are a total of 46 shelters. The number of shelters in each county in the region is listed below:

- Bay – 4
- Escambia – 13
- Holmes – 8
- Okaloosa – 5
- Santa Rosa – 5
- Walton – 6
- Washington – 5

All together, the 46 shelters located within the seven county region can host more than 48,000 persons during an evacuation event. Detailed lists of the available public shelters by county are included in Volume 5-1.

## G. Evacuation Zones

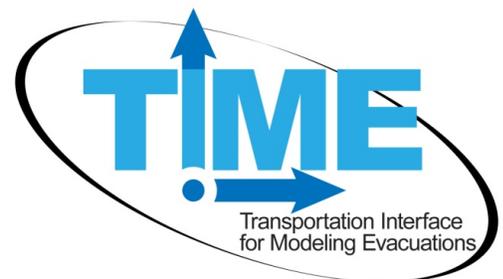
The final input variable that is needed to complete the transportation evacuation model is the delineation of evacuation zones for all coastal counties. Local county emergency managers have the responsibility of identifying and defining evacuation zones for their county. Within the West Florida region, five counties, Bay, Escambia, Okaloosa, Santa Rosa, and Walton, have updated and established their evacuation zones based on the results of the new data and information collected as part of the SRESP. Evacuation zones for the West Florida Region are illustrated in **Figure III-14**. County level evacuation zones are included in Volume 5-1.

## H. TIME User Interface

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

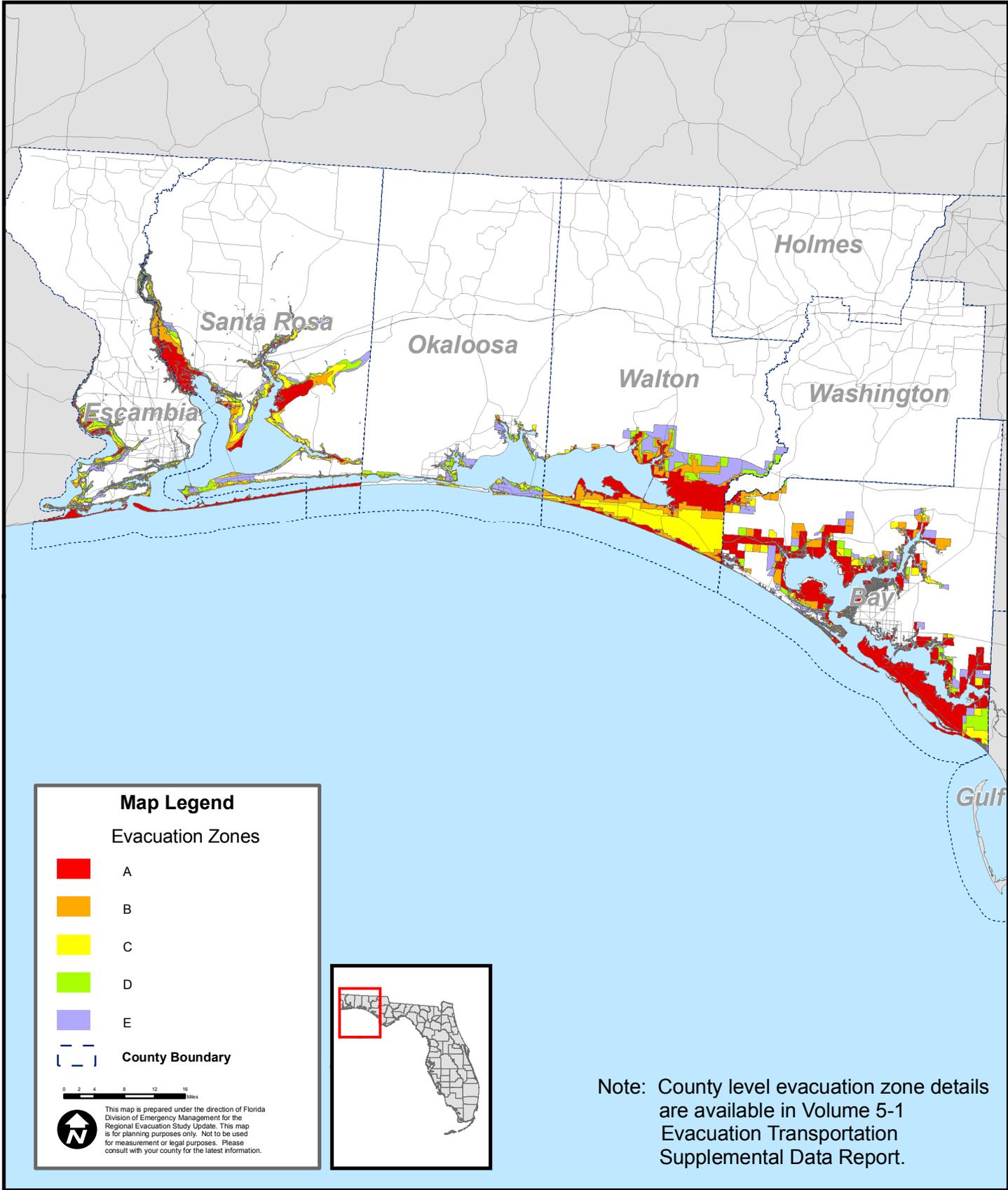
The evacuation model variables include a set of distinguishing characteristics that could apply to evacuation scenarios as selection criteria. These following variables may be selected using the TIME interface and allow the user to retrieve the best results from various evacuation alternatives:

- **Analysis time period** - The first input variable is the evacuation analysis time period. The time period selections include 2006, 2010 and 2015. The time period determines which set of demographic data and which version of the model network will be used.





# Figure III-14 West Florida Regional Evacuation Zones



- **Highway network** - Once the time period is selected, the user must pick either the default highway network or a modified network. The default includes the network corresponding to the selected time period and also incorporates planned highway improvement projects from the Florida Department of Transportation Work Program. In the case that there are any new projects or changes need to be taken into account, the modified network would be chosen. These changes could include possible road or bridge closures because of storm conditions or any managed traffic diversions or traffic control measures.
- **Behavioral response** - The next variable is behavioral response, which is 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. A user may choose 100% or the survey response. The 100% response indicates that 100% of people in evacuation zones will evacuate, while the survey response uses the percentage of people from the behavioral planning assumptions corresponding to the evacuation level for each county.
- **One-way evacuation operations** - Another variable for consideration is whether to allow one-way evacuation operations or not. One-way evacuation operations allow take into account the FDOT one-way evacuation operations plans for major facilities.
- **University population** - The model permits the user to incorporate the population in university housing since this data is not included in the regular population numbers. The default assumption is that the region's universities are at the maximum housing capacity housing during the Fall/Spring semester. The other options available are the summer university population, which is generally much less than the fall or spring, and an option for no school in session.
- **Tourist occupancy rates** - The RPC has the option to choose the default rates or to modify those rates based on any special circumstance they may have for tourist rates since there are different tourist seasons, sectors and special events. If modified rates are desired, then the user may select no tourist occupancy or modify the rates on a county by county basis.
- **Shelters** - When choosing which shelters are open to the public during an evacuation event, the user may select either primary shelters or other shelters, both primary and other shelters, and/or modified. In many situations, the shelters category may need to be modified because of availability or capacity changes.
- **Counties evacuating** - The evacuating counties are the counties within the geographic extent of West Florida's model network and include both coastal and inland counties. The coastal counties in Florida include Escambia, Santa Rosa, Okaloosa, Walton, Bay, Gulf, Franklin, Wakulla, and Jefferson; Alabama coastal counties include Mobile and Baldwin. The inland counties in Florida are Washington, Holmes, Jackson, Calhoun, Gadsden, Liberty, and Leon Counties. The inland counties in Alabama are Washington, Clarke, Monroe, Escambia, Conecuh, Covington, Butler, Crenshaw, Lowndes, Montgomery, Pike, Coffee, Dale, Geneva and Houston Counties. The user has the opportunity to pick which of the counties in the network actually evacuate.

- **Evacuation level** - Once the evacuating counties are chosen, the evacuation level is designated. The evacuation levels range from A to E and represent the evacuation zones that are ordered to evacuate. The user may also select "none", which assumes that no evacuations are made within the selected county; only regular background traffic will occur.
- **Response curve hours** – The user must define which evacuation response curve will be applied to each evacuating county in the area. The evacuation response curves show the proportion of evacuation by increment of time for evacuation orders that were issued. There are six different curves to from which to choose: a 6-hour curve, 9-hour curve, 12-hour curve, 18-hour curve, 24-hour curve, and a 36-hour curve. The faster curves represent more urgent circumstances and slower curves represent less urgent circumstances.
- **Evacuation Phasing** – The phase selection indicates when an evacuation would begin in a given county. There are ten different options beginning in hour 1 and extending to hour 27. After hour 3, the other phasing options follow in 3 hour increments.

*This page intentionally left blank.*

## CHAPTER IV

# TRANSPORTATION ANALYSIS

The transportation analysis brings together key factors such as evacuation level, transportation network, shelters, and evacuation population, and explicitly links people's behavioral responses to the regional evacuation infrastructure. The results of this analysis help to formulate effective and responsive evacuation policy options. 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 results of this analysis are discussed in this chapter.

### A. 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 West Florida Region for 2010 is identified in **Table IV-1**, summarized by evacuation zone and split between site-built homes and mobile/manufactured homes. Vulnerable population for 2015 is summarized in **Table IV-2**.

The vulnerable population in the West Florida Region includes only the five coastal counties in the region and varies by evacuation zone. Bay County, for example, has more than 27,000 vulnerable residents in evacuation zone A and only slightly more than 9,800 vulnerable residents in evacuation zone B in 2010. In the coastal counties in the region, the vulnerable population living in site-built homes far exceeds the vulnerable population living in mobile/manufactured homes.

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 West Florida Region are identified in **Table IV-3** for 2010 and in **Table IV-4** for 2015.

In all cases in the West Florida Region, the vulnerable population is far more likely to stay with friends and family during an evacuation. This is followed by hotel/motel as the second choice and other locations as the third. In all cases, public shelter destinations are identified as the least likely destination of the vulnerable population during an evacuation event.

The vulnerable shadow population is provided in **Table IV-5** 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. Vulnerable shadow population for the seven county region ranges from 160,500 to nearly 307,300 persons for 2010, depending upon the evacuation level. For 2015, the range increases to between 176,700 and 334,300 persons.

**Table IV-1 – Vulnerable Population in the West Florida Region for 2010**

	<b>Evacuation Zone A</b>	<b>Evacuation Zone B</b>	<b>Evacuation Zone C</b>	<b>Evacuation Zone D</b>	<b>Evacuation Zone E</b>
<b>Bay County</b>					
Site-built Homes	24,529	9,056	9,734	8,390	13,613
Mobile/Manuf. Homes	3,142	769	1,063	1,236	1,561
<b>TOTAL</b>	<b>27,672</b>	<b>9,826</b>	<b>10,797</b>	<b>9,626</b>	<b>15,174</b>
<b>Escambia County</b>					
Site-built Homes	13,570	5,387	8,730	8,137	11,055
Mobile/Manuf. Homes	213	243	340	439	544
<b>TOTAL</b>	<b>13,783</b>	<b>5,629</b>	<b>9,070</b>	<b>8,576</b>	<b>11,600</b>
<b>Okaloosa County</b>					
Site-built Homes	1,141	8,345	18,101	18,951	31,106
Mobile/Manuf. Homes	18	108	245	626	391
<b>TOTAL</b>	<b>1,159</b>	<b>8,453</b>	<b>18,346</b>	<b>19,577</b>	<b>31,497</b>
<b>Santa Rosa County</b>					
Site-built Homes	8,682	6,989	13,968	4,681	14,272
Mobile/Manuf. Homes	627	490	1,107	313	667
<b>TOTAL</b>	<b>9,309</b>	<b>7,479</b>	<b>15,074</b>	<b>4,993</b>	<b>14,938</b>
<b>Walton County</b>					
Site-built Homes	7,852	8,394	7,277	1,399	3,690
Mobile/Manuf. Homes	1,453	892	931	142	278
<b>TOTAL</b>	<b>9,305</b>	<b>9,286</b>	<b>8,208</b>	<b>1,540</b>	<b>3,968</b>

*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 IV-2 – Vulnerable Population in the West Florida Region for 2015**

	<b>Evacuation Zone A</b>	<b>Evacuation Zone B</b>	<b>Evacuation Zone C</b>	<b>Evacuation Zone D</b>	<b>Evacuation Zone E</b>
<b>Bay County</b>					
Site-built Homes	26,065	9,440	10,122	8,762	14,438
Mobile/Manuf. Homes	3,551	829	1,141	1,380	1,942
TOTAL	29,615	10,269	11,263	10,142	16,380
<b>Escambia County</b>					
Site-built Homes	14,310	5,631	9,086	8,604	12,082
Mobile/Manuf. Homes	215	245	345	446	551
TOTAL	14,525	5,876	9,431	9,050	12,633
<b>Okaloosa County</b>					
Site-built Homes	1,177	8,546	18,451	19,518	31,987
Mobile/Manuf. Homes	19	109	307	628	421
TOTAL	1,197	8,655	18,758	20,146	32,407
<b>Santa Rosa County</b>					
Site-built Homes	9,932	8,120	16,000	5,176	16,066
Mobile/Manuf. Homes	757	592	1,343	374	783
TOTAL	10,689	8,712	17,343	5,550	16,849
<b>Walton County</b>					
Site-built Homes	8,101	10,187	7,659	3,251	8,732
Mobile/Manuf. Homes	1,853	1,464	1,208	286	915
TOTAL	9,954	11,650	8,867	3,536	9,647

*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 IV-3 – Vulnerable Population by Destination for 2010**

	<b>Evacuation Zone A</b>	<b>Evacuation Zone B</b>	<b>Evacuation Zone C</b>	<b>Evacuation Zone D</b>	<b>Evacuation Zone E</b>
<b>Bay County</b>					
To Friends and Family	16,917	5,972	6,585	5,899	9,260
To Hotel/ Motel	6,447	2,341	2,540	2,221	3,559
To Public Shelter	1,541	530	593	291	428
To Other Destination	2,767	983	1,080	1,214	1,926
<b>Escambia County</b>					
To Friends and Family	9,637	3,928	6,332	5,981	8,092
To Hotel/ Motel	2,746	1,114	1,797	1,693	2,293
To Public Shelter	700	294	470	451	607
To Other Destination	700	294	470	451	607
<b>Okaloosa County</b>					
To Friends and Family	697	5,077	11,020	11,777	18,917
To Hotel/ Motel	288	2,103	4,562	4,832	7,835
To Public Shelter	24	172	374	979	1,575
To Other Destination	151	1,101	2,390	1,989	3,169
<b>Santa Rosa County</b>					
To Friends and Family	5,214	4,187	8,457	2,793	8,316
To Hotel/ Motel	2,667	2,146	4,301	1,435	4,348
To Public Shelter	236	398	809	265	780
To Other Destination	1,191	748	1,507	499	1,494
<b>Walton County</b>					
To Friends and Family	5,263	5,197	4,608	861	2,210
To Hotel/ Motel	2,181	2,232	1,959	371	964
To Public Shelter	230	296	265	77	198
To Other Destination	1,631	1,561	1,377	231	595

*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 IV-4 – Vulnerable Population by Destination for 2015**

	<b>Evacuation Zone A</b>	<b>Evacuation Zone B</b>	<b>Evacuation Zone C</b>	<b>Evacuation Zone D</b>	<b>Evacuation Zone E</b>
<b>Bay County</b>					
To Friends and Family	18,124	6,244	6,872	6,224	10,022
To Hotel/ Motel	6,871	2,443	2,645	2,329	3,804
To Public Shelter	1,658	555	620	313	483
To Other Destination	2,962	1,027	1,126	1,277	2,071
<b>Escambia County</b>					
To Friends and Family	10,156	4,101	6,584	6,313	8,816
To Hotel/ Motel	2,894	1,163	1,869	1,788	2,499
To Public Shelter	737	306	489	475	659
To Other Destination	737	306	489	475	659
<b>Okaloosa County</b>					
To Friends and Family	719	5,199	11,270	12,119	19,465
To Hotel/ Motel	297	2,153	4,659	4,974	8,060
To Public Shelter	25	176	384	1,007	1,620
To Other Destination	156	1,127	2,445	2,046	3,262
<b>Santa Rosa County</b>					
To Friends and Family	5,993	4,880	9,740	3,109	9,384
To Hotel/ Motel	3,055	2,495	4,934	1,590	4,898
To Public Shelter	274	465	934	296	882
To Other Destination	1,367	871	1,734	555	1,685
<b>Walton County</b>					
To Friends and Family	5,660	6,554	4,998	1,973	5,397
To Hotel/ Motel	2,303	2,766	2,096	855	2,320
To Public Shelter	255	379	290	177	482
To Other Destination	1,736	1,951	1,483	530	1,447

*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 IV-5 – Vulnerable Shadow Evacuation Population**

	<b>Evacuation Level A</b>	<b>Evacuation Level B</b>	<b>Evacuation Level C</b>	<b>Evacuation Level D</b>	<b>Evacuation Level E</b>
<b>2010</b>					
Bay County	37,934	50,162	50,745	60,609	61,619
Escambia County	38,420	50,288	60,825	86,053	104,412
Holmes County	6,738	7,323	7,908	8,493	9,078
Okaloosa County	25,271	31,735	44,833	62,865	59,008
Santa Rosa County	29,353	28,193	33,919	48,521	48,851
Walton County	14,108	13,629	11,011	13,473	12,214
Washington County	8,759	9,422	10,748	11,411	12,074
<b>2015</b>					
Bay County	40,395	53,276	53,893	64,454	65,531
Escambia County	40,297	52,751	63,851	90,424	109,387
Holmes County	6,925	7,527	8,129	8,731	9,333
Okaloosa County	27,583	34,949	49,135	69,114	66,972
Santa Rosa County	34,020	32,608	38,938	55,335	55,664
Walton County	18,378	17,339	14,785	18,924	14,833
Washington County	9,179	9,870	11,252	11,943	12,634

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

## B. Clearance Time Definitions

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:

- **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.

## C. 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; 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.

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 West Florida RPC to continue testing combinations of options and provide additional information to emergency managers.

## D. Base Scenarios

A total of ten base scenarios were developed through discussions with the SRESP Statewide Work Group and are identical for all eleven RPCs. The SRESP requires a consistent set of base scenarios that will be used by all regions across the State to provide a consistent background between regions. The base scenarios also allow the results to be used consistently from region to region for other purposes, such as growth management. The ten base scenarios were developed to include the following assumptions:

- **Analysis Time Period** – Five scenarios for the 2010 time period and five scenarios for the 2015 time period. The five scenarios for each time period include one for each of the five evacuation levels, A, B, C, D, and E;
- **Highway Network** – The five 2010 scenarios use the 2010 network and the five 2015 scenarios use the 2015 network, which includes planned roadway capacity improvement

projects expected to be implemented by 2015;

- **One-Way Evacuation Operations** – The base scenarios do not include implementation of any one-way evacuation operations;
- **University Population** – The base scenarios use the fall/spring semester data to estimate evacuation trips by the student population. This data was provided by each RPC as part of the demographic small area data;
- **Tourist Occupancy Rates** – The base scenarios use the default hotel/motel occupancy rates to estimate tourist evacuation trips. This data was provided by each RPC as part of the demographic small area data;
- **Shelters** – The base scenarios assume all designated primary shelters within each county in the model network are open. The base scenarios do not include shelters that are designated as other shelters, only primary shelters;
- **Response Curve** – The 12-hour response curve is used for all ten base scenarios;
- **Evacuation Phasing** - All counties that are evacuating begin at same time, within 1 hour of the evacuation order being given;
- **Behavioral Response** - For all five evacuation levels (A, B, C, D, or E) in both the 2010 and 2015 time periods, the behavioral response for the base scenarios includes the following:
  - 100% response in evacuation zones for both mobile homes and site built homes for the counties in the RPC, plus one coastal county on either side of the region (includes Bay, Escambia, Okaloosa, Santa Rosa, Walton, Baldwin (AL), and Gulf Counties);
  - 100% response for mobile homes in inland areas for the counties in the RPC, plus one coastal county on either side of the region (includes Bay, Escambia, Holmes, Okaloosa, Santa Rosa, Walton, Washington, Baldwin (AL), and Gulf Counties);
  - Planning Assumption response (shadow evacuation) for site built homes in inland areas for the counties in the RPC plus one coastal county on either side of the region (includes Bay, Escambia, Holmes, Okaloosa, Santa Rosa, Walton, Washington, Baldwin (AL), and Gulf Counties); and,
  - For the remaining counties in the West Florida model network, no evacuations are assumed, including shadow evacuations.

The ten base scenarios are summarized in **Table IV-6**.

**Table IV-6 – Base Scenarios**

	<b>Scenario 1 Level A 2010</b>	<b>Scenario 2 Level B 2010</b>	<b>Scenario 3 Level C 2010</b>	<b>Scenario 4 Level D 2010</b>	<b>Scenario 5 Level E 2010</b>
<b>Demographic Data</b>	2010	2010	2010	2010	2010
<b>Highway Network</b>	2010	2010	2010	2010	2010
<b>One-Way Operations</b>	None	None	None	None	None
<b>University Population</b>	Fall/Spring	Fall/Spring	Fall/Spring	Fall/Spring	Fall/Spring
<b>Tourist Rate</b>	Default	Default	Default	Default	Default
<b>Shelters Open</b>	Primary	Primary	Primary	Primary	Primary
<b>Response Curve</b>	12-hour	12-hour	12-hour	12-hour	12-hour
<b>Evacuation Phasing</b>	None	None	None	None	None
<b>Behavioral Response</b>	100%	100%	100%	100%	100%
<b>Evacuation Zone</b>	A	B	C	D	E
<b>Counties Evacuating</b>	Bay Escambia Holmes Okaloosa Santa Rosa Walton Washington Baldwin (AL) Gulf				
	<b>Scenario 6 Level A 2015</b>	<b>Scenario 7 Level B 2015</b>	<b>Scenario 8 Level C 2015</b>	<b>Scenario 9 Level D 2015</b>	<b>Scenario 10 Level E 2015</b>
<b>Demographic Data</b>	2015	2015	2015	2015	2015
<b>Highway Network</b>	2015	2015	2015	2015	2015
<b>One-Way Operations</b>	None	None	None	None	None
<b>University Population</b>	Fall/Spring	Fall/Spring	Fall/Spring	Fall/Spring	Fall/Spring
<b>Tourist Rate</b>	Default	Default	Default	Default	Default
<b>Shelters Open</b>	Primary	Primary	Primary	Primary	Primary
<b>Response Curve</b>	12-hour	12-hour	12-hour	12-hour	12-hour
<b>Evacuation Phasing</b>	None	None	None	None	None
<b>Behavioral Response</b>	100%	100%	100%	100%	100%
<b>Evacuation Zone</b>	A	B	C	D	E
<b>Counties Evacuating</b>	Bay Escambia Holmes Okaloosa Santa Rosa Walton Washington Baldwin (AL) Gulf				

## E. Base Scenario Results

Each of the ten base scenarios were modeled for the West 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. Each of these results are discussed in the following sections.

### Evacuating Population

It is important to determine the evacuating population for each of the base scenarios in order to understand the magnitude of the evacuation effort, including estimated population that is evacuating and the county level shelter demand. Evacuating population for the base scenarios is summarized by county for 2010 in **Table IV-7** and for 2015 in **Table IV-8**.

Within the seven county region, total evacuating population ranges from more than 221,800 persons for a base scenario level A evacuation to more than 592,100 persons for a base scenario level E evacuation in 2010. By 2015, this range increases within the seven counties to more than 242,700 persons for a base scenario level A evacuation and nearly 647,500 persons for a base scenario level E evacuation.

### Evacuating Vehicles

From a transportation standpoint, the number of evacuating vehicles is more important than the evacuating population. Evacuating vehicles for the base scenarios is summarized by county for 2010 in **Table IV-9** and for 2015 in **Table IV-10**.

The total number of evacuating vehicles within the seven county region for the base scenarios also varies by evacuation level. A total of more than 112,900 vehicles evacuate from the seven county RPC for a base scenario level A evacuation in 2010, and this number increases to more than 305,300 evacuating vehicles from the seven county region for a base scenario level E evacuation in 2010. By 2015, the number of evacuating vehicles is expected to increase to more than 124,600 vehicles for a base scenario level A evacuation and 338,700 evacuating vehicles for a base scenario level E evacuation.

### Shelter Demand

Shelter demand is another critical piece of the evacuating population, and shelter demand estimates by county are summarized for each of the base scenarios in **Table IV-11**. Shelter demand is the population in each county who will seek public shelter during their evacuation, either at an in-county shelter or an out of county shelter.

Public shelter demand in the seven county region ranges from more than 14,400 persons for the base scenario level A evacuation in 2010 to more than 36,700 persons for the base scenario level E evacuation. By 2015, the public shelter demand is expected to increase to more than 15,900 persons for the level A evacuation and nearly 40,700 persons for the level E evacuation.

**Table IV-7 – Evacuating Population by Base Scenario for 2010**

	<b>Evacuation Level A Base Scenario</b>	<b>Evacuation Level B Base Scenario</b>	<b>Evacuation Level C Base Scenario</b>	<b>Evacuation Level D Base Scenario</b>	<b>Evacuation Level E Base Scenario</b>
<b>Bay County</b>					
Site-built Homes	35,926	52,649	61,561	79,944	95,335
Mobile/Manuf. Homes	24,944	24,944	24,944	24,944	24,944
Tourists	4,736	10,067	12,535	13,642	14,435
TOTAL	65,606	87,660	99,040	118,530	134,714
<b>Escambia County</b>					
Site-built Homes	31,205	48,674	68,243	102,047	131,813
Mobile/Manuf. Homes	18,711	18,711	18,711	18,711	18,711
Tourists	2,287	2,315	2,353	2,353	2,546
TOTAL	52,203	69,700	89,307	123,111	153,070
<b>Holmes County</b>					
Site-built Homes	585	1,170	1,755	2,340	2,925
Mobile/Manuf. Homes	6,153	6,153	6,153	6,153	6,153
Tourists	0	0	0	0	0
TOTAL	6,738	7,323	7,908	8,493	9,078
<b>Okaloosa County</b>					
Site-built Homes	17,957	32,664	58,813	94,816	119,110
Mobile/Manuf. Homes	8,473	8,473	8,473	8,473	8,473
Tourists	0	210	5,505	7,111	10,457
TOTAL	26,430	41,347	72,791	110,400	138,040
<b>Santa Rosa County</b>					
Site-built Homes	20,574	26,764	47,509	66,768	82,036
Mobile/Manuf. Homes	17,564	17,564	17,564	17,564	17,564
Tourists	524	653	708	1,044	1,044
TOTAL	38,662	44,981	65,781	85,376	100,644
<b>Walton County</b>					
Site-built Homes	13,794	20,716	26,152	30,154	32,829
Mobile/Manuf. Homes	9,309	9,309	9,309	9,309	9,309
Tourists	310	2,195	2,349	2,349	2,383
TOTAL	23,413	32,220	37,810	41,812	44,521
<b>Washington County</b>					
Site-built Homes	663	1,326	2,652	3,315	3,978
Mobile/Manuf. Homes	8,096	8,096	8,096	8,096	8,096
Tourists	0	0	0	0	0
TOTAL	8,759	9,422	10,748	11,411	12,074

**Table IV-8 – Evacuating Population by Base Scenario for 2015**

	<b>Evacuation Level A Base Scenario</b>	<b>Evacuation Level B Base Scenario</b>	<b>Evacuation Level C Base Scenario</b>	<b>Evacuation Level D Base Scenario</b>	<b>Evacuation Level E Base Scenario</b>
<b>Bay County</b>					
Site-built Homes	38,049	55,696	64,960	84,406	100,764
Mobile/Manuf. Homes	26,994	26,994	26,994	26,994	26,994
Tourists	4,967	10,470	13,086	14,343	15,442
TOTAL	70,010	93,160	105,040	125,743	143,200
<b>Escambia County</b>					
Site-built Homes	32,768	51,070	71,558	107,181	138,589
Mobile/Manuf. Homes	19,689	19,689	19,689	19,689	19,689
Tourists	2,365	2,393	2,436	2,436	2,624
TOTAL	54,822	73,152	93,683	129,306	160,902
<b>Holmes County</b>					
Site-built Homes	602	1,204	1,806	2,408	3,010
Mobile/Manuf. Homes	6,323	6,323	6,323	6,323	6,323
Tourists	0	0	0	0	0
TOTAL	6,925	7,527	8,129	8,731	9,333
<b>Okaloosa County</b>					
Site-built Homes	19,113	34,896	62,369	100,796	127,171
Mobile/Manuf. Homes	9,667	9,667	9,667	9,667	9,667
Tourists	0	238	5,709	7,407	11,297
TOTAL	28,780	44,801	77,745	117,870	148,135
<b>Santa Rosa County</b>					
Site-built Homes	23,473	30,604	54,138	75,742	92,920
Mobile/Manuf. Homes	20,729	20,729	20,729	20,729	20,729
Tourists	507	676	815	1,158	1,158
TOTAL	44,709	52,009	75,682	97,629	114,807
<b>Walton County</b>					
Site-built Homes	15,426	24,114	30,240	37,915	43,367
Mobile/Manuf. Homes	12,289	12,289	12,289	12,289	12,289
Tourists	617	2,540	2,727	2,727	2,831
TOTAL	28,332	38,943	45,256	52,931	58,487
<b>Washington County</b>					
Site-built Homes	691	1,382	2,764	3,455	4,146
Mobile/Manuf. Homes	8,488	8,488	8,488	8,488	8,488
Tourists	0	0	0	0	0
TOTAL	9,179	9,870	11,252	11,943	12,634

**Table IV-9 – Evacuating Vehicles by Base Scenario for 2010**

	<b>Evacuation Level A Base Scenario</b>	<b>Evacuation Level B Base Scenario</b>	<b>Evacuation Level C Base Scenario</b>	<b>Evacuation Level D Base Scenario</b>	<b>Evacuation Level E Base Scenario</b>
<b>Bay County</b>					
Site-built Homes	18,821	27,368	32,071	41,629	49,569
Mobile/Manuf. Homes	12,574	12,574	12,574	12,574	12,574
Tourists	1,796	4,115	5,076	5,548	5,853
TOTAL	33,191	44,057	49,721	59,751	67,996
<b>Escambia County</b>					
Site-built Homes	15,698	24,370	34,188	50,902	65,416
Mobile/Manuf. Homes	8,793	8,793	8,793	8,793	8,793
Tourists	1,053	1,066	1,084	1,084	1,173
TOTAL	25,544	34,229	44,065	60,779	75,382
<b>Holmes County</b>					
Site-built Homes	320	640	959	1,279	1,599
Mobile/Manuf. Homes	2,858	2,858	2,858	2,858	2,858
Tourists	0	0	0	0	0
TOTAL	3,178	3,498	3,817	4,137	4,457
<b>Okaloosa County</b>					
Site-built Homes	9,934	17,941	32,663	52,833	66,114
Mobile/Manuf. Homes	4,207	4,207	4,207	4,470	4,470
Tourists	0	70	2,164	2,709	3,900
TOTAL	14,141	22,218	39,034	60,012	74,484
<b>Santa Rosa County</b>					
Site-built Homes	10,860	14,255	24,920	34,767	42,431
Mobile/Manuf. Homes	8,426	8,426	8,426	8,426	8,426
Tourists	241	289	305	460	460
TOTAL	19,527	22,970	33,651	43,653	51,317
<b>Walton County</b>					
Site-built Homes	8,221	12,393	15,599	18,181	19,875
Mobile/Manuf. Homes	5,098	5,098	5,098	5,098	5,098
Tourists	155	974	1,055	1,055	1,077
TOTAL	13,474	18,465	21,752	24,334	26,050
<b>Washington County</b>					
Site-built Homes	353	705	1,411	1,764	2,116
Mobile/Manuf. Homes	3,558	3,558	3,558	3,558	3,558
Tourists	0	0	0	0	0
TOTAL	3,911	4,263	4,969	5,322	5,674

**Table IV-10 – Evacuating Vehicles by Base Scenario for 2015**

	<b>Evacuation Level A Base Scenario</b>	<b>Evacuation Level B Base Scenario</b>	<b>Evacuation Level C Base Scenario</b>	<b>Evacuation Level D Base Scenario</b>	<b>Evacuation Level E Base Scenario</b>
<b>Bay County</b>					
Site-built Homes	19,917	28,938	33,825	43,928	52,362
Mobile/Manuf. Homes	13,556	13,556	13,556	13,556	13,556
Tourists	1,880	4,261	5,272	5,797	6,203
TOTAL	35,353	46,755	52,653	63,281	72,121
<b>Escambia County</b>					
Site-built Homes	17,391	27,045	37,972	56,708	73,000
Mobile/Manuf. Homes	9,260	9,260	9,260	9,260	9,260
Tourists	1,106	1,119	1,140	1,140	1,229
TOTAL	27,757	37,424	48,372	67,108	83,489
<b>Holmes County</b>					
Site-built Homes	329	658	987	1,316	1,645
Mobile/Manuf. Homes	2,936	2,936	2,936	2,936	2,936
Tourists	0	0	0	0	0
TOTAL	3,265	3,594	3,923	4,252	4,581
<b>Okaloosa County</b>					
Site-built Homes	10,545	19,114	34,547	56,002	70,365
Mobile/Manuf. Homes	4,797	4,797	4,797	5,096	5,096
Tourists	0	80	2,256	2,834	4,257
TOTAL	15,342	23,991	41,600	63,932	79,718
<b>Santa Rosa County</b>					
Site-built Homes	12,410	16,326	28,434	39,480	48,104
Mobile/Manuf. Homes	9,941	9,941	9,941	9,941	9,941
Tourists	241	297	320	475	475
TOTAL	22,592	26,564	38,695	49,896	58,520
<b>Walton County</b>					
Site-built Homes	9,208	14,455	18,064	22,900	26,283
Mobile/Manuf. Homes	6,725	6,725	6,725	6,725	6,725
Tourists	309	1,152	1,254	1,254	1,322
TOTAL	16,242	22,332	26,043	30,879	34,330
<b>Washington County</b>					
Site-built Homes	368	737	1,473	1,841	2,210
Mobile/Manuf. Homes	3,731	3,731	3,731	3,731	3,731
Tourists	0	0	0	0	0
TOTAL	4,099	4,468	5,204	5,572	5,941

**Table IV-11 – Shelter Demand by Base Scenario**

	<b>Evacuation Level A</b>	<b>Evacuation Level B</b>	<b>Evacuation Level C</b>	<b>Evacuation Level D</b>	<b>Evacuation Level E</b>
<b>2010</b>					
Bay County	4,318	5,519	5,987	6,862	7,665
Escambia County	3,715	5,049	6,492	9,102	11,516
Holmes County	851	912	971	1,029	1,088
Okaloosa County	1,036	1,558	2,749	4,692	6,037
Santa Rosa County	2,536	2,855	4,262	5,607	6,736
Walton County	940	1,334	1,528	1,878	2,091
Washington County	1,084	1,184	1,378	1,476	1,576
<b>2015</b>					
Bay County	4,614	5,879	6,364	7,298	8,160
Escambia County	4,020	5,506	7,110	10,027	12,724
Holmes County	877	938	999	1,058	1,119
Okaloosa County	1,141	1,711	2,967	5,038	6,505
Santa Rosa County	2,949	3,315	4,910	6,418	7,689
Walton County	1,193	1,680	1,909	2,501	2,892
Washington County	1,138	1,240	1,445	1,547	1,650

*Note: Shelter demand is the population in each county who will seek public shelter during their evacuation, either at an in-county shelter or an out of county shelter.*

### Congested Roadways

Another important component of the transportation analysis is the identification of critical roadway segments for evacuation traffic. This analysis includes a review of vehicle flows during the evacuation period, along with excessive vehicle queues. A summary of the total number of evacuating vehicles for each of the base scenarios is presented in **Table IV-12**. It is important to note that the total number of evacuating vehicles in the table below includes vehicles evacuating from the two coastal counties on either side of the RPC, in addition to the seven counties within the RPC, for a total of nine evacuating counties.

**Table IV-12 – Total Evacuating Vehicles for Base Scenarios**

	<b>Evacuation Level A Base Scenario</b>	<b>Evacuation Level B Base Scenario</b>	<b>Evacuation Level C Base Scenario</b>	<b>Evacuation Level D Base Scenario</b>	<b>Evacuation Level E Base Scenario</b>
2010	158,307	216,864	272,223	363,591	419,222
2015	175,217	239,956	300,315	402,657	465,614

The identification of critical roadways in the evacuation network is also important to assist emergency managers with identifying roadways that have the greatest impact on clearance times. Critical roadways were identified by reviewing roadways in the model network that have the highest vehicle queues for extended periods of time during an evacuation. Due to the nature of a major evacuation in general, nearly all roadway facilities will have extended vehicle queues at some point during the evacuation process. The point of this analysis is to identify those roadway facilities that have vehicle queues for the longest time periods during each of the evacuation scenarios. Critical roadway segments for the West Florida Region are identified in **Figures IV-1** through **IV-10** for each of the base scenarios for 2010 and 2015.

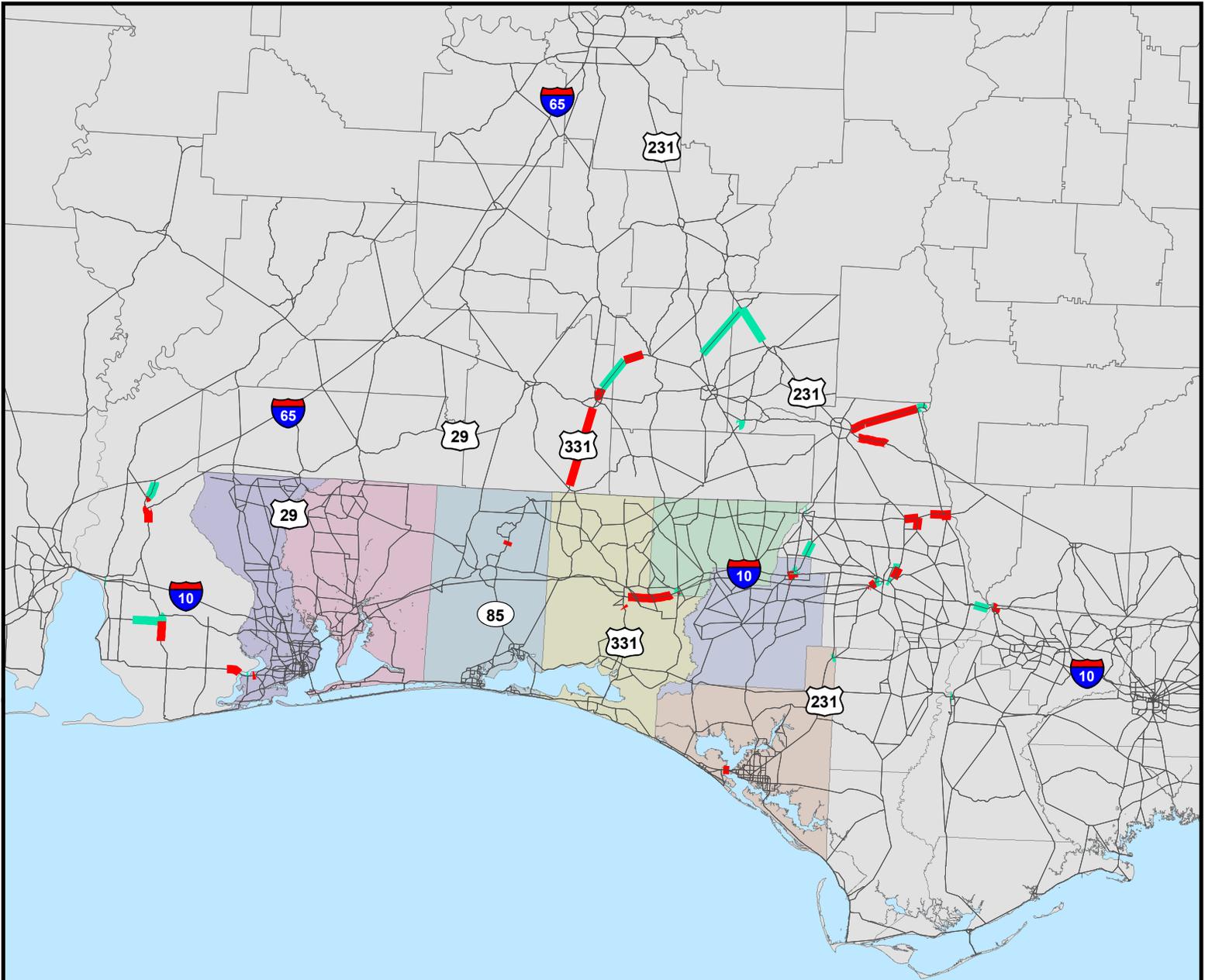
Through a review of the critical roadway segment figures and vehicle flows, it is clear that SR 85, US 331, SR 285, I-10, US 231, US 29, SR 77, SR 79, SR 87, US 90, US 98 and SR 281 are critical facilities for all evacuation scenarios. During the level A evacuation scenarios, the roadway segments with the highest vehicle queues are primarily concentrated along the major Interstate and State Highway system. In contrast, for the level E evacuation scenarios, the roadway segments with the highest vehicle queues include other roadways, such as SR 20. Outside the region, I-65, US 29, US 331, and US 231 are also critical facilities in Alabama. Critical facilities in each county include, but are not limited to, the following:

- **Bay County** - SR 20, US 231, CR 388, SR 77, CR 167, US 98, US 98 Alt, SR 79, Wisteria Lane, CR 2315, and 23<sup>rd</sup> Street;
- **Escambia County** - US 29, SR 4, W Quintette Rd, Muscogee Rd, CR 297A, CR 97, E Kingsfield Rd, US 90, Pine Forest Rd, Gulf Beach Hwy, Beulah Rd, I-10, Blue Angel Pkwy, Lillian Hwy, New Warrington Rd, US 98, and SR 292;
- **Holmes County** - I-10, US 90, SR 79, SR 2, SR 81, CR 185, and CR 181;
- **Okaloosa County** - SR 85, CR 393, SR 189, CR C4A, SR 4, Galiver Cutoff, US 90, I-10, SR 285, Log Lake Rd, Antioch Rd, P J Adams Pkwy, US 98, SR 20, SR 293, SR 123, College Blvd, Palm Blvd, Gen Bond Blvd, Airport Rd, and Anderson Dr;



# Figure IV-1

## Critical Roadway Segments with Excessive Vehicle Queues for 2010 Base Scenario Evacuation Level A



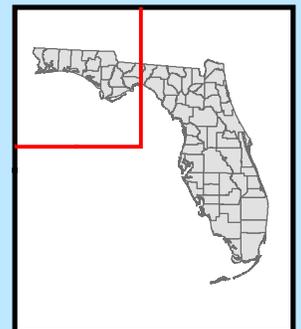
### Map Legend

-  Critical Segments with Highest Vehicle Queues
-  Other Critical Segments
-  Other Network Roadways

0 3 6 12 18 24 Miles



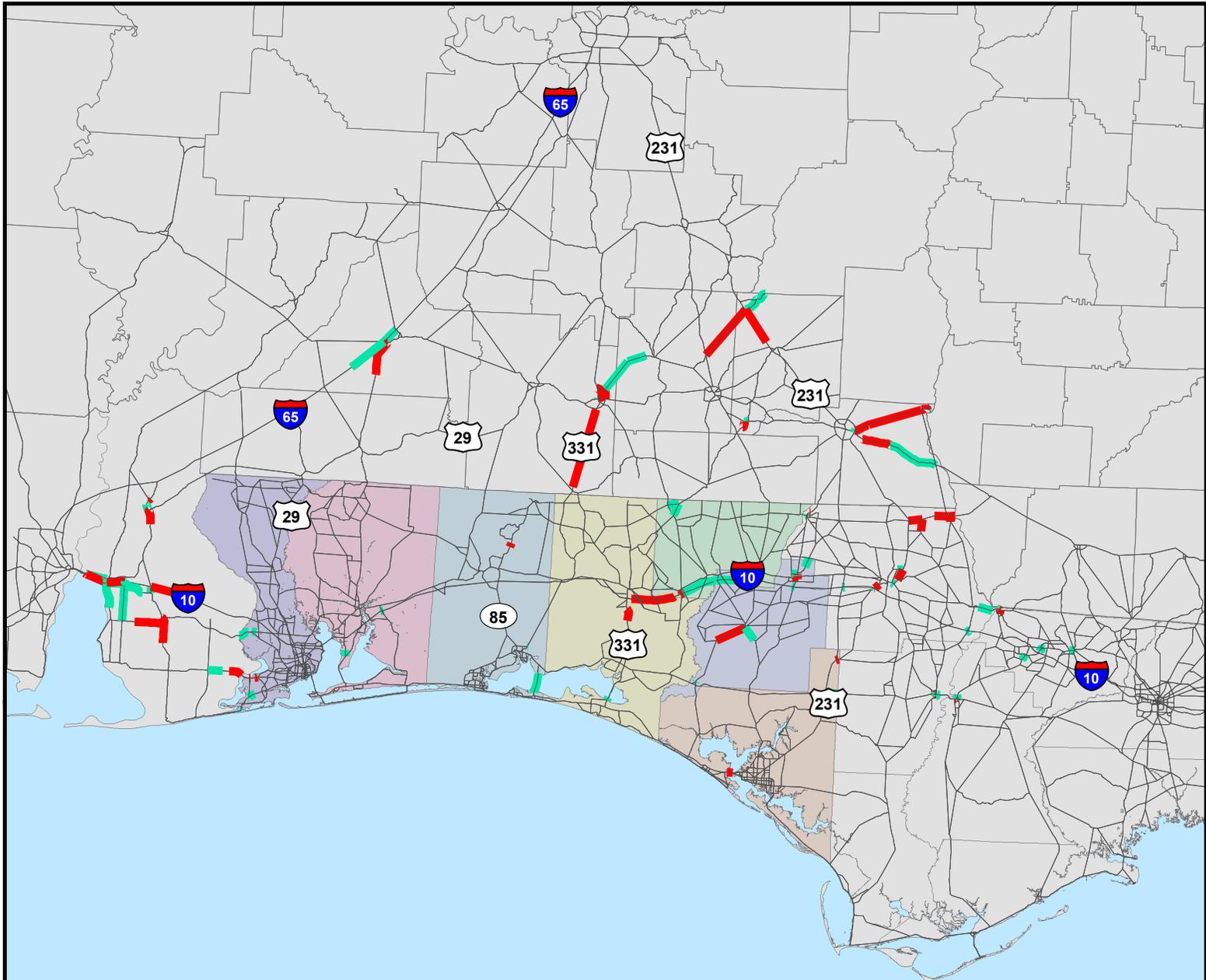
This map is prepared under the direction of Florida Division of Emergency Management for the Regional Evacuation Study Update. This map is for planning purposes only. Not to be used for measurement or legal purposes. Please consult with your county for the latest information.





# Figure IV-2

## Critical Roadway Segments with Excessive Vehicle Queues for 2010 Base Scenario Evacuation Level B

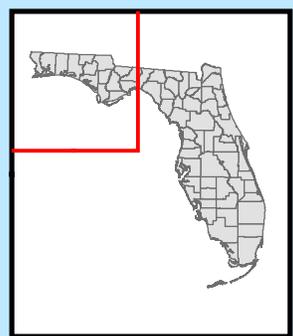


**Map Legend**

-  Critical Segments with Highest Vehicle Queues
-  Other Critical Segments
-  Other Network Roadways

0 3 6 12 18 24 Miles

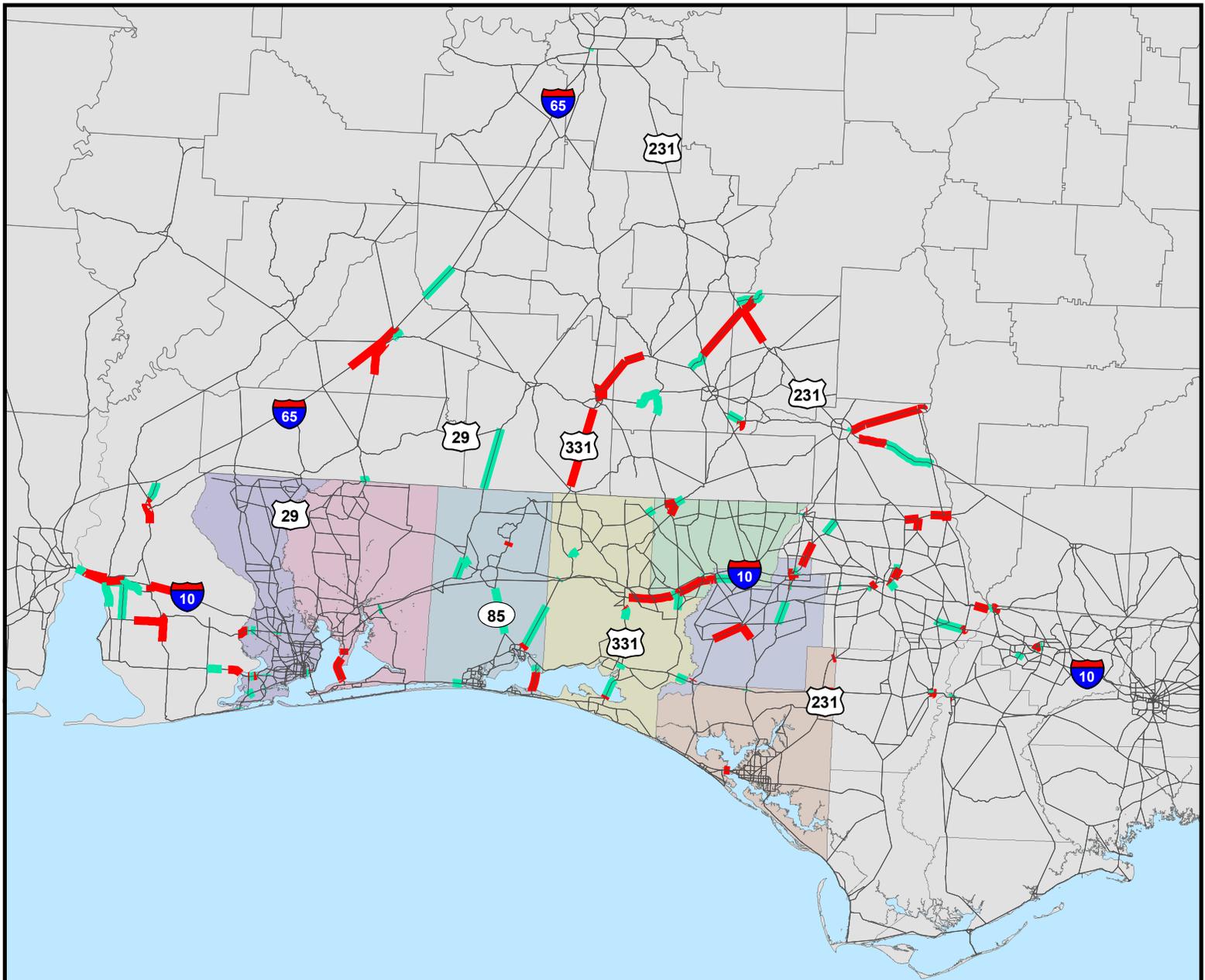
This map is prepared under the direction of Florida Division of Emergency Management for the Regional Evacuation Study Update. This map is for planning purposes only. Not to be used for measurement or legal purposes. Please consult with your county for the latest information.





# Figure IV-3

## Critical Roadway Segments with Excessive Vehicle Queues for 2010 Base Scenario Evacuation Level C



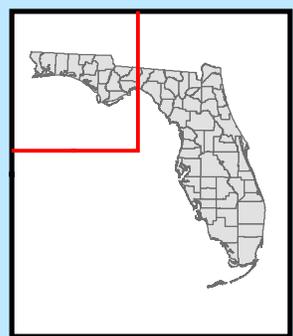
### Map Legend

-  Critical Segments with Highest Vehicle Queues
-  Other Critical Segments
-  Other Network Roadways

0 3 6 12 18 24 Miles



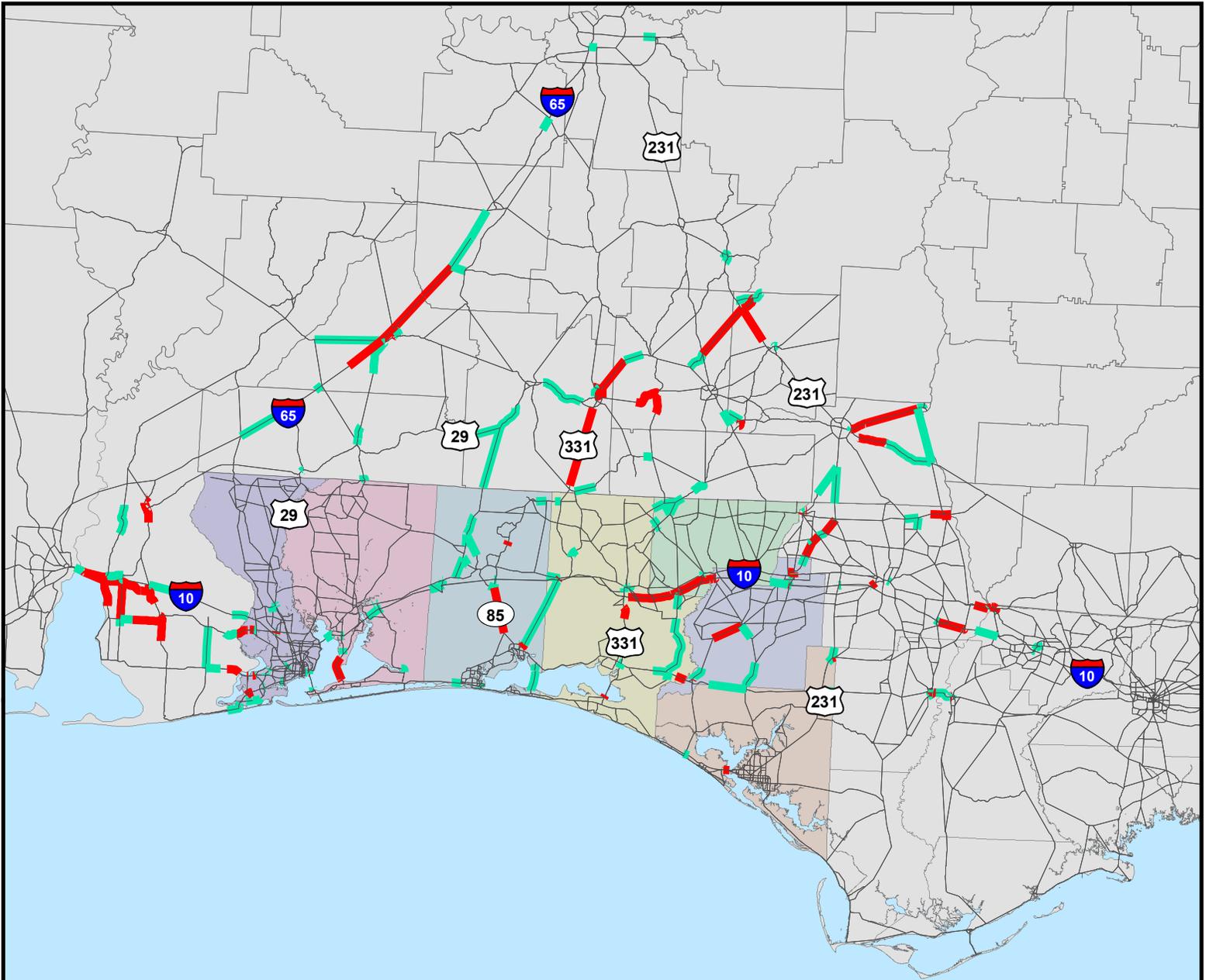
This map is prepared under the direction of Florida Division of Emergency Management for the Regional Evacuation Study Update. This map is for planning purposes only. Not to be used for measurement or legal purposes. Please consult with your county for the latest information.





# Figure IV-4

## Critical Roadway Segments with Excessive Vehicle Queues for 2010 Base Scenario Evacuation Level D



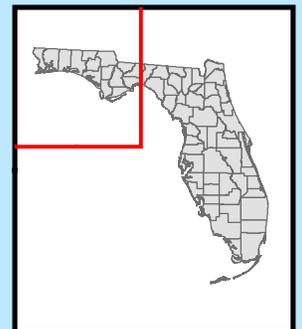
### Map Legend

-  Critical Segments with Highest Vehicle Queues
-  Other Critical Segments
-  Other Network Roadways

0 3 6 12 18 24 Miles



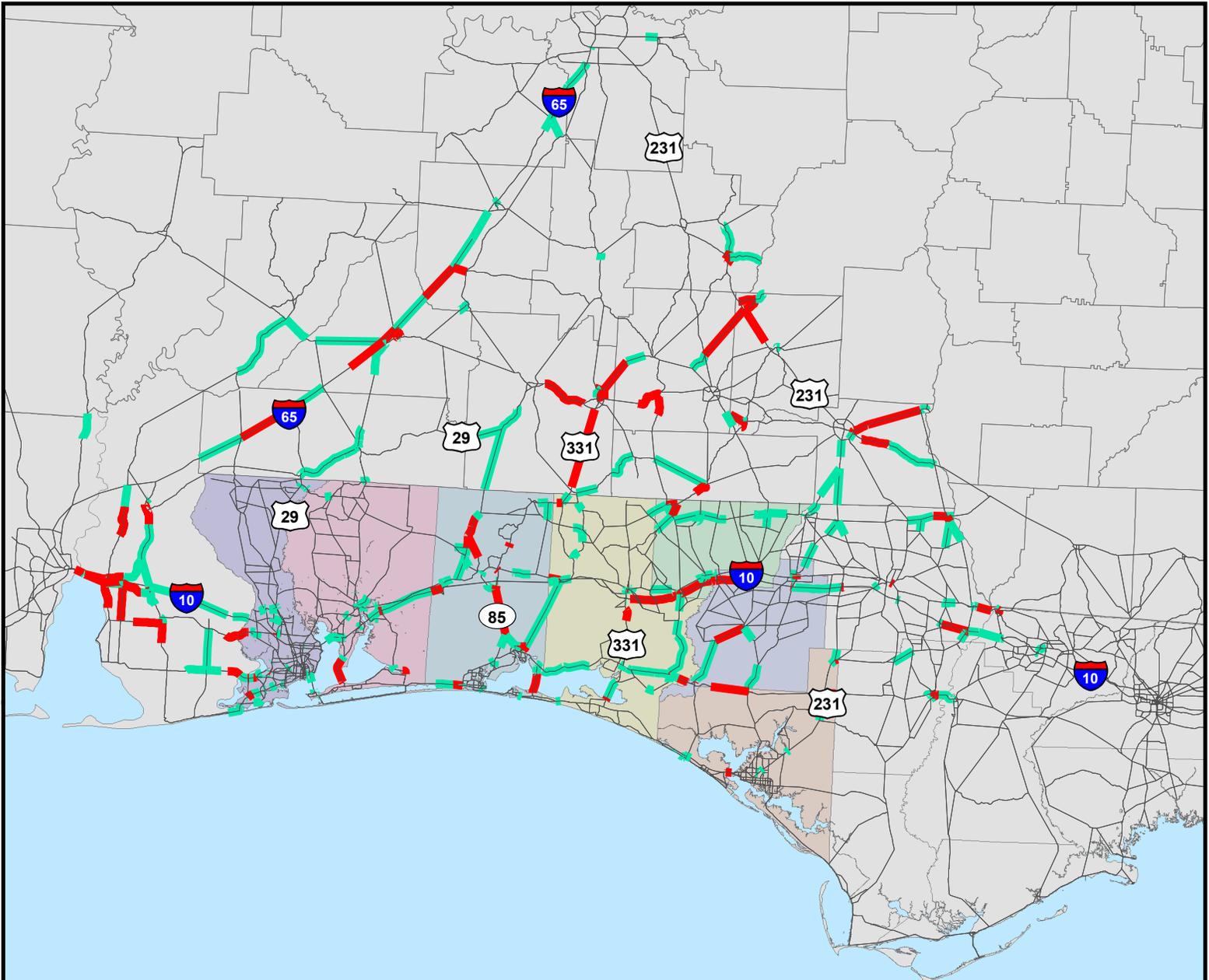
This map is prepared under the direction of Florida Division of Emergency Management for the Regional Evacuation Study Update. This map is for planning purposes only. Not to be used for measurement or legal purposes. Please consult with your county for the latest information.





# Figure IV-5

## Critical Roadway Segments with Excessive Vehicle Queues for 2010 Base Scenario Evacuation Level E

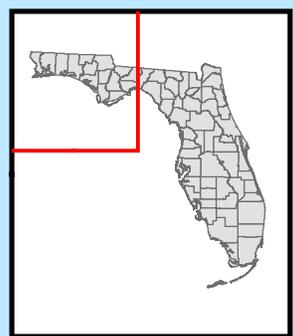


**Map Legend**

-  Critical Segments with Highest Vehicle Queues
-  Other Critical Segments
-  Other Network Roadways

0 3 6 12 18 24 Miles

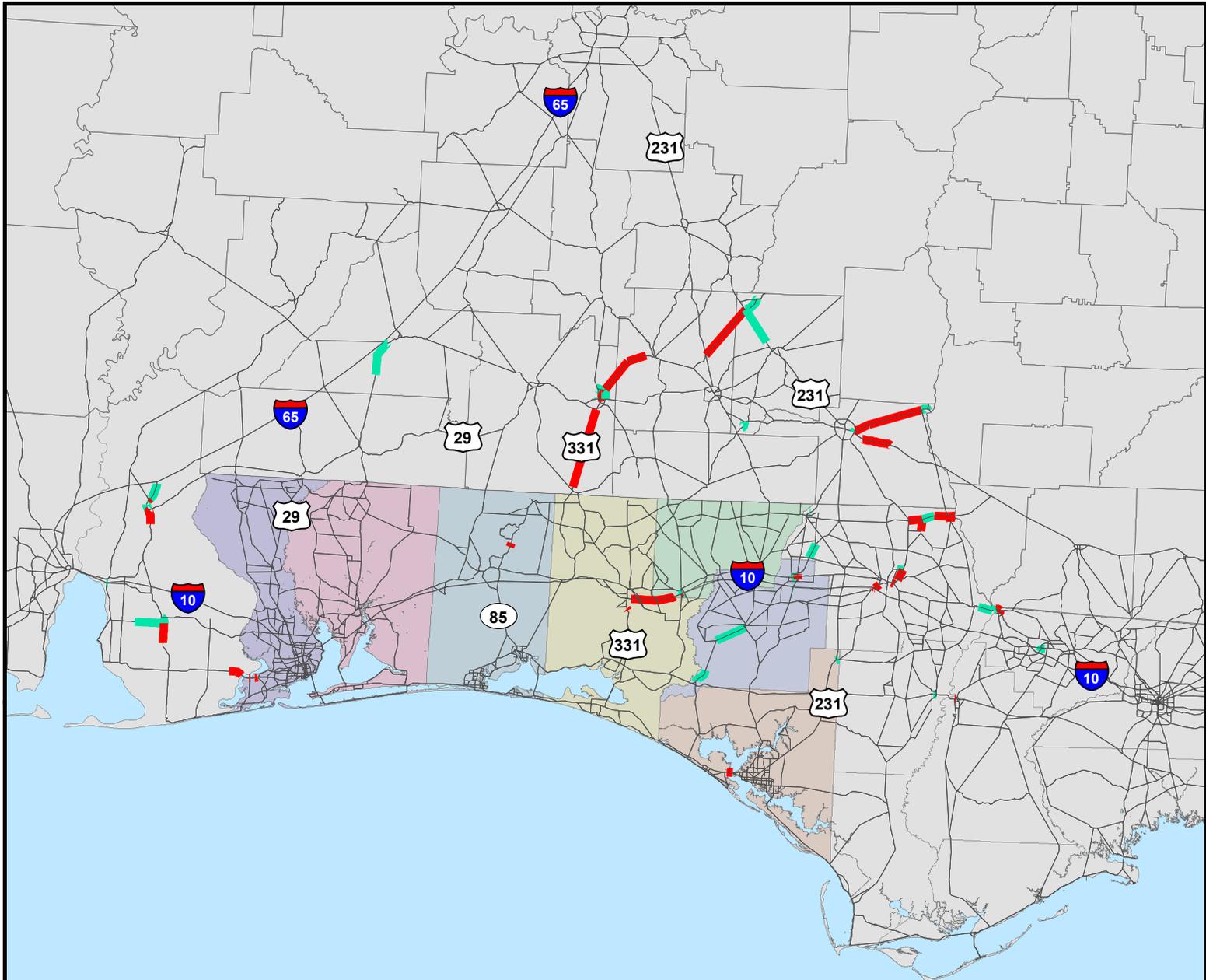
 This map is prepared under the direction of Florida Division of Emergency Management for the Regional Evacuation Study Update. This map is for planning purposes only. Not to be used for measurement or legal purposes. Please consult with your county for the latest information.





# Figure IV-6

## Critical Roadway Segments with Excessive Vehicle Queues for 2015 Base Scenario Evacuation Level A

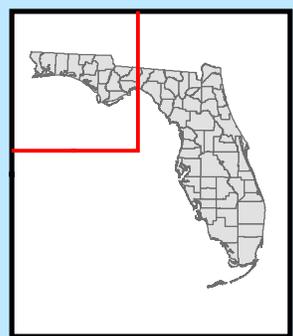


**Map Legend**

-  Critical Segments with Highest Vehicle Queues
-  Other Critical Segments
-  Other Network Roadways

0 3 6 12 18 24 Miles

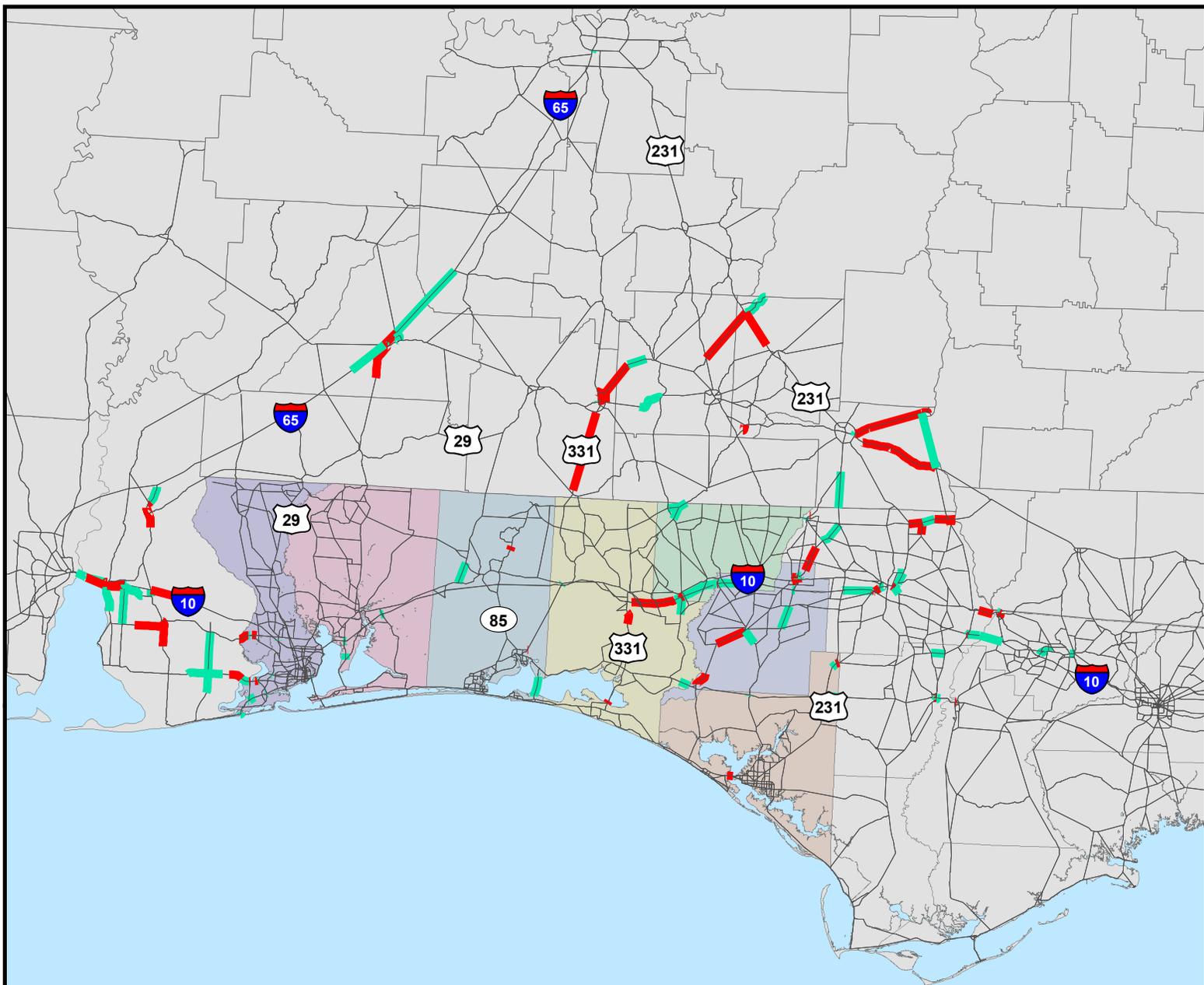
This map is prepared under the direction of Florida Division of Emergency Management for the Regional Evacuation Study Update. This map is for planning purposes only. Not to be used for measurement or legal purposes. Please consult with your county for the latest information.





# Figure IV-7

## Critical Roadway Segments with Excessive Vehicle Queues for 2015 Base Scenario Evacuation Level B



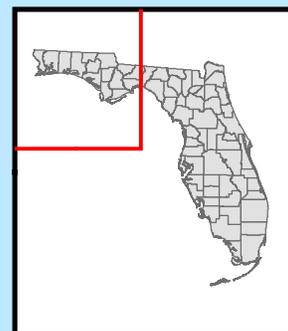
### Map Legend

-  Critical Segments with Highest Vehicle Queues
-  Other Critical Segments
-  Other Network Roadways

0 3 6 12 18 24 Miles



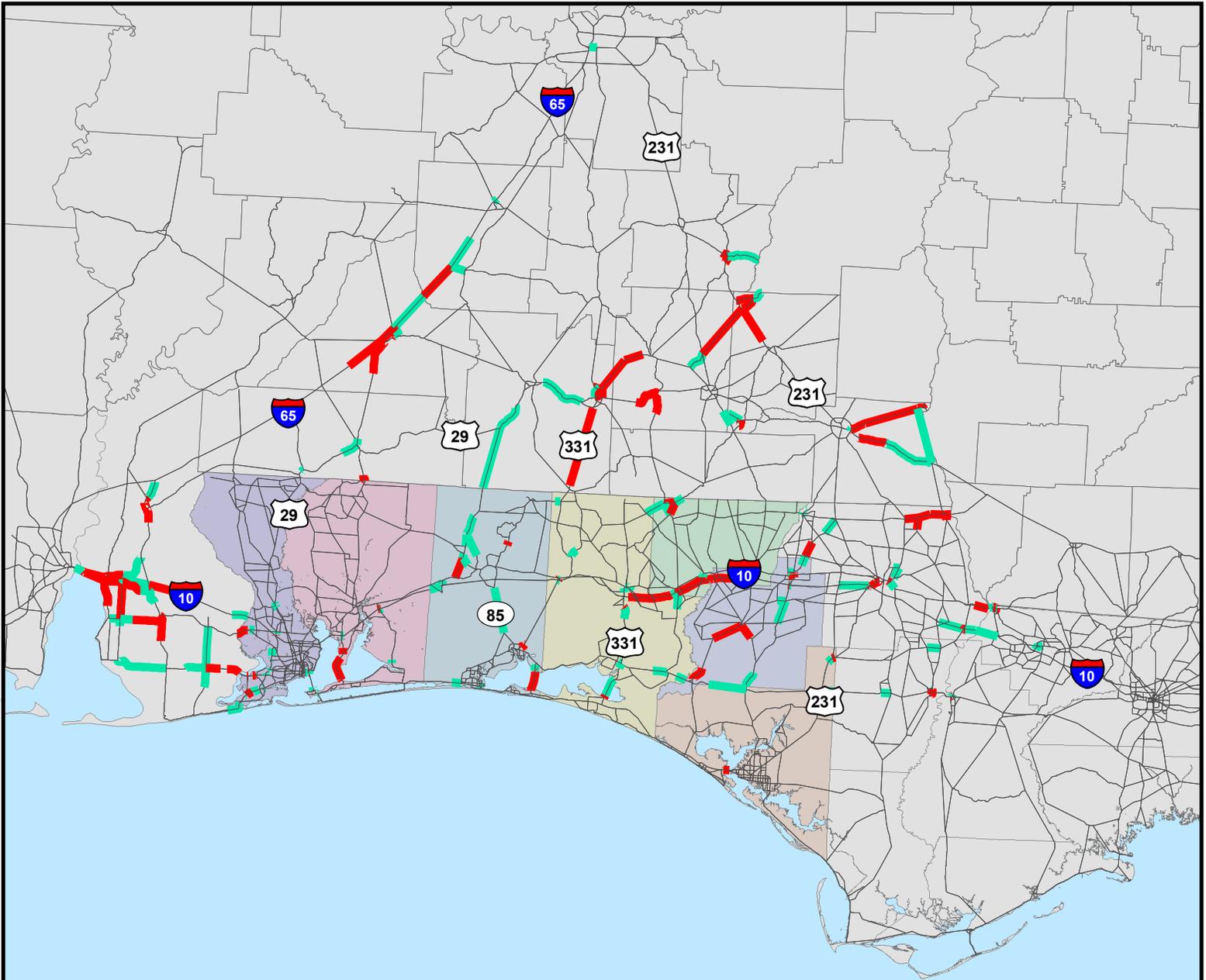
This map is prepared under the direction of Florida Division of Emergency Management for the Regional Evacuation Study Update. This map is for planning purposes only. Not to be used for measurement or legal purposes. Please consult with your county for the latest information.





# Figure IV-8

## Critical Roadway Segments with Excessive Vehicle Queues for 2015 Base Scenario Evacuation Level C



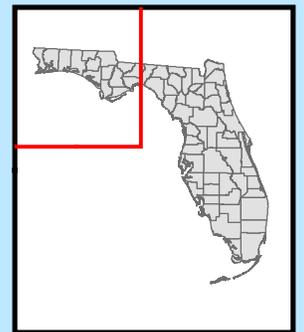
### Map Legend

-  Critical Segments with Highest Vehicle Queues
-  Other Critical Segments
-  Other Network Roadways

0 3 6 12 18 24 Miles



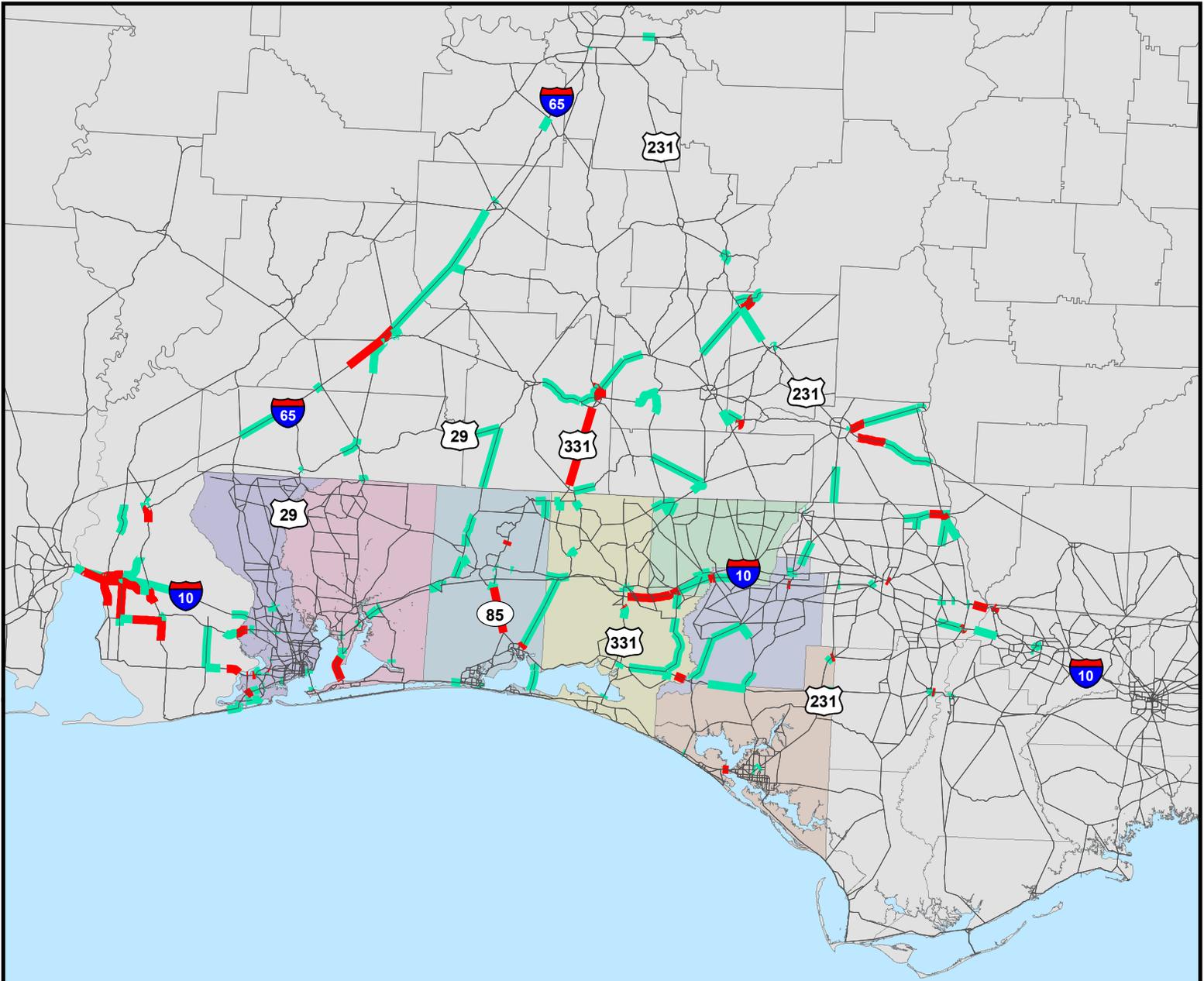
This map is prepared under the direction of Florida Division of Emergency Management for the Regional Evacuation Study Update. This map is for planning purposes only. Not to be used for measurement or legal purposes. Please consult with your county for the latest information.





# Figure IV-9

## Critical Roadway Segments with Excessive Vehicle Queues for 2015 Base Scenario Evacuation Level D



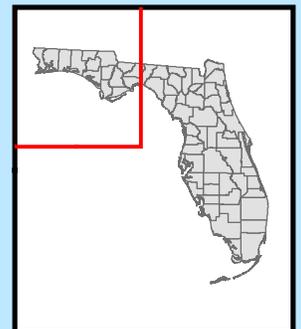
### Map Legend

-  Critical Segments with Highest Vehicle Queues
-  Other Critical Segments
-  Other Network Roadways

0 3 6 12 18 24 Miles



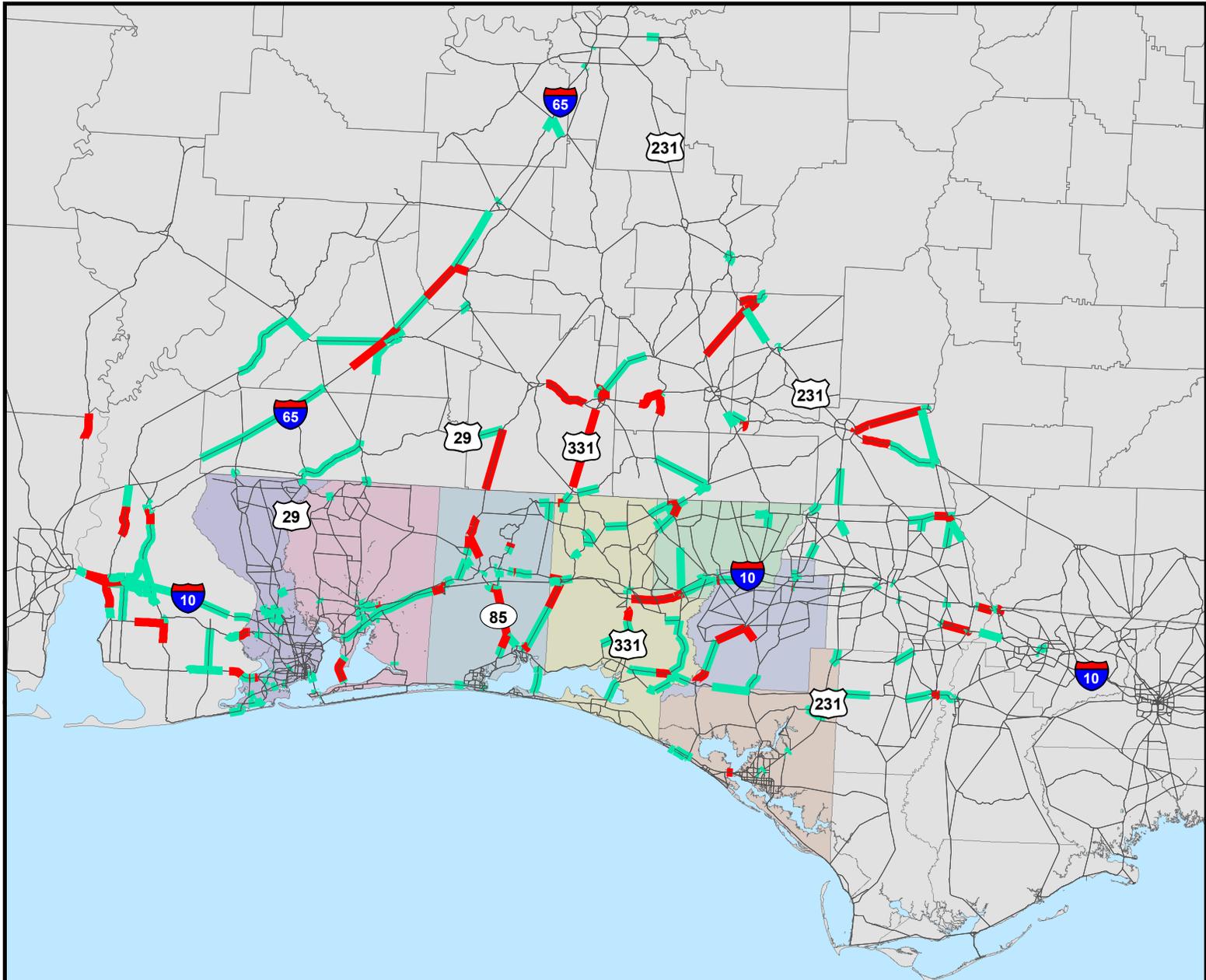
This map is prepared under the direction of Florida Division of Emergency Management for the Regional Evacuation Study Update. This map is for planning purposes only. Not to be used for measurement or legal purposes. Please consult with your county for the latest information.





# Figure IV-10

## Critical Roadway Segments with Excessive Vehicle Queues for 2015 Base Scenario Evacuation Level E



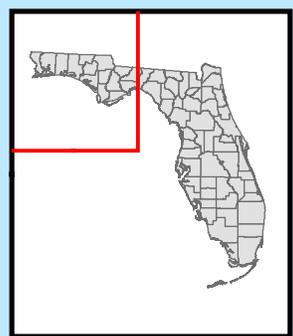
### Map Legend

-  Critical Segments with Highest Vehicle Queues
-  Other Critical Segments
-  Other Network Roadways

0 3 6 12 18 24 Miles



This map is prepared under the direction of Florida Division of Emergency Management for the Regional Evacuation Study Update. This map is for planning purposes only. Not to be used for measurement or legal purposes. Please consult with your county for the latest information.



- **Santa Rosa County** - SR 4, SR 87, CR 197, SR 281, US 90, I-10, Old Bagdad Hwy, Garcon , Point Rd, Munson Hwy, Ward Basin Rd, Hickory Hammock Rd, and US 98;
- **Walton County** - SR 85, US 331, CR 2, CR 2A ,CR 147, CR 1087, SR 285, SR 83, SR 81, CR 183, CR 282, SR 20, CR 3280, and US 98; and,
- **Washington County** - SR 77, SR 79, CR 276, I-10, US 90, CR 279, SR 273, and CR 166.

In addition to the identification of critical roadway segments, the total number of evacuating vehicles entering and exiting each county by evacuation scenario was also determined. Evacuating vehicles exiting each county by major evacuation route are identified in **Table IV-13** for 2010 and **Table IV-14** for 2015. In addition, evacuating vehicles entering each county by major evacuation route are identified in **Table IV-15** for 2010 and **Table IV-16** for 2015. Detailed volume figures for all evacuation routes in the West Florida Region for each base scenario are included in Volume 5-1.

The number of vehicles entering and exiting each county during an evacuation varies widely depending upon the scenario, roadway, and county. As expected, major interstates and state highways generally carry larger volumes of evacuating traffic. The vehicle flows into and out of each county also generally follow the same pattern as the critical segment figures, as locations with higher queues and congestion generally have higher traffic volumes.

**Table IV-13 – Evacuating Vehicles Leaving Each County by Evacuation Route for the 2010 Base Scenario**

	Evacuation Level A Scenario	Evacuation Level B Scenario	Evacuation Level C Scenario	Evacuation Level D Scenario	Evacuation Level E Scenario
<b>Bay County</b>					
US 98 Southbound	400	400	800	2,100	2,900
SR 22 Eastbound	100	100	200	600	1,100
SR 20 Eastbound	2,100	3,700	4,700	5,700	7,700
US 231 Northbound	6,800	8,300	9,700	13,700	15,700
SR 77 Northbound	1,000	1,800	3,000	4,900	5,700
SR 20 Westbound	400	500	500	300	200
SR79 Northbound	2,400	4,000	4,900	6,500	8,200
US 98 Westbound	2,500	3,400	3,200	2,800	2,500
<b>Escambia County</b>					
US 98 Eastbound	900	1,300	1,500	2,900	4,600
I-10 Eastbound	13,800	19,800	22,700	34,300	38,400
US 90 Eastbound	200	200	400	2,800	6,900
US 29 Northbound	2,500	5,700	9,600	19,100	22,600
US 97 Northbound	100	200	300	2,900	4,700
I-10 Westbound	8,000	11,100	14,500	16,700	18,900
US 90 Westbound	-	-	200	500	600
US 98 Westbound	400	300	700	400	900
<b>Holmes County</b>					
I-10 Eastbound	15,100	18,200	22,100	26,500	27,800
US 90 Eastbound	400	900	1,200	2,300	3,000
SR 2 Eastbound	700	1,200	1,800	3,300	4,300
SR 81 Northbound	500	1,500	2,900	5,200	5,700
I-10 Westbound	500	900	1,300	2,300	3,300
<b>Okaloosa County</b>					
US 98 Eastbound	1,000	1,300	1,800	6,400	9,400
SR 20 Eastbound	800	1,000	2,300	5,600	7,200
SR 285 Northbound	3,900	5,900	8,300	9,300	11,600
I-10 Eastbound	11,300	16,300	22,600	30,500	31,500
US 85 Eastbound	6,100	6,900	7,300	9,100	11,800
US 189 Northbound	500	2,200	4,400	6,700	9,500
US 4 Westbound	400	900	1,700	3,200	4,300
I-10 Westbound	4,800	6,400	6,600	5,200	6,500
US 98 Westbound	1,300	2,200	4,600	8,300	9,100
<b>Santa Rosa County</b>					
US 98 Eastbound	2,100	2,700	3,700	7,200	10,200
I-10 Eastbound	16,600	23,200	27,600	35,600	38,000
US 90 Eastbound	100	200	700	4,100	6,000
US 4 Westbound	100	100	200	2,300	5,400
US 87 Northbound	2,500	3,400	5,700	7,500	7,700
I-10 Westbound	5,700	7,400	8,200	7,300	9,500
US 98 Westbound	5,400	6,700	10,200	14,400	15,900

**Table IV-13 – Evacuating Vehicles Leaving Each County by Evacuation Route for the 2010 Base Scenario**

	<b>Evacuation Level A Scenario</b>	<b>Evacuation Level B Scenario</b>	<b>Evacuation Level C Scenario</b>	<b>Evacuation Level D Scenario</b>	<b>Evacuation Level E Scenario</b>
<b>Walton County</b>					
US 98 Eastbound	1,200	1,700	3,200	7,200	10,500
SR 20 Eastbound	600	1,700	3,600	6,300	7,400
SR 81 Northbound	700	2,400	3,600	5,200	5,300
I-10 Eastbound	17,200	21,600	24,700	28,100	29,500
US 90 Eastbound	200	600	1,900	3,800	5,700
SR 2 Eastbound	800	2,000	3,400	4,300	7,200
US 331 Northbound	1,200	2,000	2,900	6,000	8,800
US 98 Westbound	3,600	5,100	5,600	5,000	4,600
<b>Washington County</b>					
I-10 Eastbound	12,000	16,600	21,100	27,300	30,300
US 90 Eastbound	200	700	900	1,300	3,200
SR 273 Northbound	6,400	6,800	7,200	7,400	7,400
I-10 Westbound	500	800	900	1,400	2,300
SR 20 Westbound	900	1,700	2,500	2,900	2,900
SR 20 Eastbound	300	700	1,800	3,800	5,400

**Table IV-14 – Evacuating Vehicles Leaving Each County by Evacuation Route for the 2015 Base Scenario**

	Evacuation Level A Scenario	Evacuation Level B Scenario	Evacuation Level C Scenario	Evacuation Level D Scenario	Evacuation Level E Scenario
<b>Bay County</b>					
US 98 Southbound	500	500	1,100	2,400	3,000
SR 22 Eastbound	100	200	400	600	1,100
SR 20 Eastbound	2,500	3,900	4,500	7,000	8,400
US 231 Northbound	7,000	8,600	10,200	14,700	16,900
SR 77 Northbound	1,100	2,600	3,400	5,100	6,000
SR 20 Westbound	400	500	500	200	200
SR79 Northbound	2,700	4,200	5,500	6,600	8,700
US 98 Westbound	2,600	3,400	3,300	3,100	2,500
<b>Escambia County</b>					
US 98 Eastbound	1,000	1,500	1,700	4,100	4,900
I-10 Eastbound	15,200	22,000	25,200	37,700	39,000
US 90 Eastbound	300	400	700	4,000	10,400
US 29 Northbound	2,900	6,800	11,600	21,200	22,200
US 97 Northbound	100	200	500	4,000	5,800
I-10 Westbound	8,800	11,700	15,300	18,200	18,300
US 90 Westbound	100	100	300	400	800
US 98 Westbound	400	400	600	500	900
<b>Holmes County</b>					
I-10 Eastbound	16,400	19,800	22,700	28,300	32,300
US 90 Eastbound	300	1,000	1,500	2,500	4,100
SR 2 Eastbound	900	1,400	2,200	3,200	4,400
SR 81 Northbound	500	2,000	3,600	5,300	6,300
I-10 Westbound	700	1,000	1,300	2,300	3,600
<b>Okaloosa County</b>					
US 98 Eastbound	1,100	1,500	2,300	7,900	9,800
SR 20 Eastbound	700	1,000	2,600	5,100	5,800
SR 285 Northbound	4,200	6,400	8,600	10,300	11,900
I-10 Eastbound	12,900	18,300	24,000	32,800	33,800
US 85 Eastbound	6,500	7,000	7,500	9,600	13,400
US 189 Northbound	900	3,300	5,300	7,100	12,100
US 4 Westbound	500	1,000	1,900	3,400	4,900
I-10 Westbound	5,200	6,700	6,600	5,600	6,400
US 98 Westbound	1,400	2,300	5,000	8,800	9,100
<b>Santa Rosa County</b>					
US 98 Eastbound	2,400	3,200	4,400	9,100	11,000
I-10 Eastbound	18,700	26,000	30,100	38,600	39,200
US 90 Eastbound	200	400	1,400	4,600	7,600
US 4 Westbound	-	100	400	4,000	7,200
US 87 Northbound	2,800	3,900	6,300	7,800	8,400
I-10 Westbound	6,200	7,900	8,400	8,500	8,800
US 98 Westbound	5,700	6,900	11,100	15,000	16,600

**Table IV-14 – Evacuating Vehicles Leaving Each County by Evacuation Route for the 2015 Base Scenario**

	<b>Evacuation Level A Scenario</b>	<b>Evacuation Level B Scenario</b>	<b>Evacuation Level C Scenario</b>	<b>Evacuation Level D Scenario</b>	<b>Evacuation Level E Scenario</b>
<b>Walton County</b>					
US 98 Eastbound	1,400	2,100	4,000	9,700	10,600
SR 20 Eastbound	1,000	2,600	4,300	7,100	8,200
SR 81 Northbound	1,100	3,100	4,100	6,000	6,600
I-10 Eastbound	18,600	21,900	24,400	28,000	32,200
US 90 Eastbound	200	1,300	2,900	5,400	4,900
SR 2 Eastbound	1,200	2,500	4,100	5,500	7,500
US 331 Northbound	1,400	2,400	3,800	7,500	7,400
US 98 Westbound	3,700	5,300	5,700	5,400	5,100
<b>Washington County</b>					
I-10 Eastbound	13,600	18,500	22,500	30,300	34,000
US 90 Eastbound	300	800	1,600	1,800	2,900
SR 273 Northbound	6,500	7,000	6,900	6,700	8,600
I-10 Westbound	600	800	900	1,700	2,600
SR 20 Westbound	900	1,900	2,700	2,600	2,500
SR 20 Eastbound	400	1,200	2,000	4,600	6,100

**Table IV-15 – Evacuating Vehicles Entering Each County by Evacuation Route for the 2010 Base Scenario**

	Evacuation Level A Scenario	Evacuation Level B Scenario	Evacuation Level C Scenario	Evacuation Level D Scenario	Evacuation Level E Scenario
<b>Bay County</b>					
US 98 Eastbound	1,200	1,700	3,200	7,200	10,500
SR 20 Eastbound	300	700	1,800	3,800	5,400
<b>Escambia County</b>					
US 4 Westbound	100	100	200	2,300	5,400
I-10 Westbound	5,700	7,400	8,200	7,300	9,500
US 98 Westbound	5,400	6,700	10,200	14,400	15,900
I-10 Eastbound	3,200	5,500	6,700	17,000	21,500
US 90 Eastbound	900	3,100	3,800	6,300	6,900
US 98 Eastbound	4,200	5,300	5,200	6,700	6,700
<b>Holmes County</b>					
SR 81 Northbound	700	2,400	3,600	5,200	5,300
US 90 Eastbound	200	600	1,900	3,800	5,700
SR 2 Eastbound	800	2,000	3,400	4,300	7,200
I-10 Westbound	500	800	900	1,400	2,300
<b>Okaloosa County</b>					
US 98 Eastbound	2,100	2,700	3,700	7,200	10,200
I-10 Eastbound	16,600	23,200	27,600	35,600	38,000
US 90 Eastbound	100	200	700	4,100	6,000
US 98 Westbound	3,600	5,100	5,600	5,000	4,600
<b>Santa Rosa County</b>					
US 98 Eastbound	900	1,300	1,500	2,900	4,600
I-10 Eastbound	13,800	19,800	22,700	34,300	38,400
US 90 Eastbound	200	200	400	2,800	6,900
US 4 Westbound	400	900	1,700	3,200	4,300
I-10 Westbound	4,800	6,400	6,600	5,200	6,500
US 98 Westbound	1,300	2,200	4,600	8,300	9,100
<b>Walton County</b>					
US 98 Westbound	2,500	3,400	3,200	2,800	2,500
US 98 Eastbound	1,000	1,300	1,800	6,400	9,400
SR 20 Eastbound	800	1,000	2,300	5,600	7,200
I-10 Eastbound	11,300	16,300	22,600	30,500	31,500
US 85 Eastbound	6,100	6,900	7,300	9,100	11,800
I-10 Westbound	500	900	1,300	2,300	3,300
SR 20 Westbound	900	1,700	2,500	2,900	2,900
<b>Washington County</b>					
SR 77 Northbound	1,000	1,800	3,000	4,900	5,700
SR 20 Westbound	400	500	500	300	200
SR79 Northbound	2,400	4,000	4,900	6,500	8,200
I-10 Eastbound	15,100	18,200	22,100	26,500	27,800
US 90 Eastbound	400	900	1,200	2,300	3,000
SR 20 Eastbound	600	1,700	3,600	6,300	7,400
I-10 Westbound	100	100	200	300	700

**Table IV-16 – Evacuating Vehicles Entering Each County by Evacuation Route for the 2015 Base Scenario**

	Evacuation Level A Scenario	Evacuation Level B Scenario	Evacuation Level C Scenario	Evacuation Level D Scenario	Evacuation Level E Scenario
<b>Bay County</b>					
US 98 Eastbound	1,400	2,100	4,000	9,700	10,600
SR 20 Eastbound	400	1,200	2,000	4,600	6,100
<b>Escambia County</b>					
US 4 Westbound	-	100	400	4,000	7,200
I-10 Westbound	6,200	7,900	8,400	8,500	8,800
US 98 Westbound	5,700	6,900	11,100	15,000	16,600
I-10 Eastbound	3,600	6,100	7,900	20,400	23,800
US 90 Eastbound	1,200	3,800	4,400	7,100	7,400
US 98 Eastbound	4,500	5,700	5,700	6,800	7,100
<b>Holmes County</b>					
SR 81 Northbound	1,100	3,100	4,100	6,000	6,600
US 90 Eastbound	200	1,300	2,900	5,400	4,900
SR 2 Eastbound	1,200	2,500	4,100	5,500	7,500
I-10 Westbound	600	800	900	1,700	2,600
<b>Okaloosa County</b>					
US 98 Eastbound	2,400	3,200	4,400	9,100	11,000
I-10 Eastbound	18,700	26,000	30,100	38,600	39,200
US 90 Eastbound	200	400	1,400	4,600	7,600
US 98 Westbound	3,700	5,300	5,700	5,400	5,100
<b>Santa Rosa County</b>					
US 98 Eastbound	1,000	1,500	1,700	4,100	4,900
I-10 Eastbound	15,200	22,000	25,200	37,700	39,000
US 90 Eastbound	300	400	700	4,000	10,400
US 4 Westbound	500	1,000	1,900	3,400	4,900
I-10 Westbound	5,200	6,700	6,600	5,600	6,400
US 98 Westbound	1,400	2,300	5,000	8,800	9,100
<b>Walton County</b>					
US 98 Westbound	2,600	3,400	3,300	3,100	2,500
US 98 Eastbound	1,100	1,500	2,300	7,900	9,800
SR 20 Eastbound	700	1,000	2,600	5,100	5,800
I-10 Eastbound	12,900	18,300	24,000	32,800	33,800
US 85 Eastbound	6,500	7,000	7,500	9,600	13,400
I-10 Westbound	700	1,000	1,300	2,300	3,600
SR 20 Westbound	900	1,900	2,700	2,600	2,500
<b>Washington County</b>					
SR 77 Northbound	1,100	2,600	3,400	5,100	6,000
SR 20 Westbound	400	500	500	200	200
SR79 Northbound	2,700	4,200	5,500	6,600	8,700
I-10 Eastbound	16,400	19,800	22,700	28,300	32,300
US 90 Eastbound	300	1,000	1,500	2,500	4,100
SR 20 Eastbound	1,000	2,600	4,300	7,100	8,200
I-10 Westbound	100	100	100	500	900

### Clearance Times

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 IV-17** and **IV-18**, as well as **Figures IV-11, IV-12, and IV-13**. 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.

In-county clearance times for the base scenarios range from 11.5 hours for the evacuation level A scenarios to 24 hours for Walton 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 9 hours for the evacuation level A scenarios to 20.5 hours for Okaloosa County for evacuation level E scenario in 2010.

In 2015, in-county clearance times for the base scenarios increase slightly to between 12 hours for the evacuation level A scenarios and 28 hours for Walton County for the evacuation level E scenario. Clearance Time to Shelter shows a similar pattern, with clearance times for the base scenarios ranging from 10 hours for the evacuation level A scenarios to 22.5 hours for Okaloosa 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 24.5 hours in Bay County for the evacuation level E scenario. Out of county clearance times increase for several counties in 2015, which increase up to 28.5 hours.

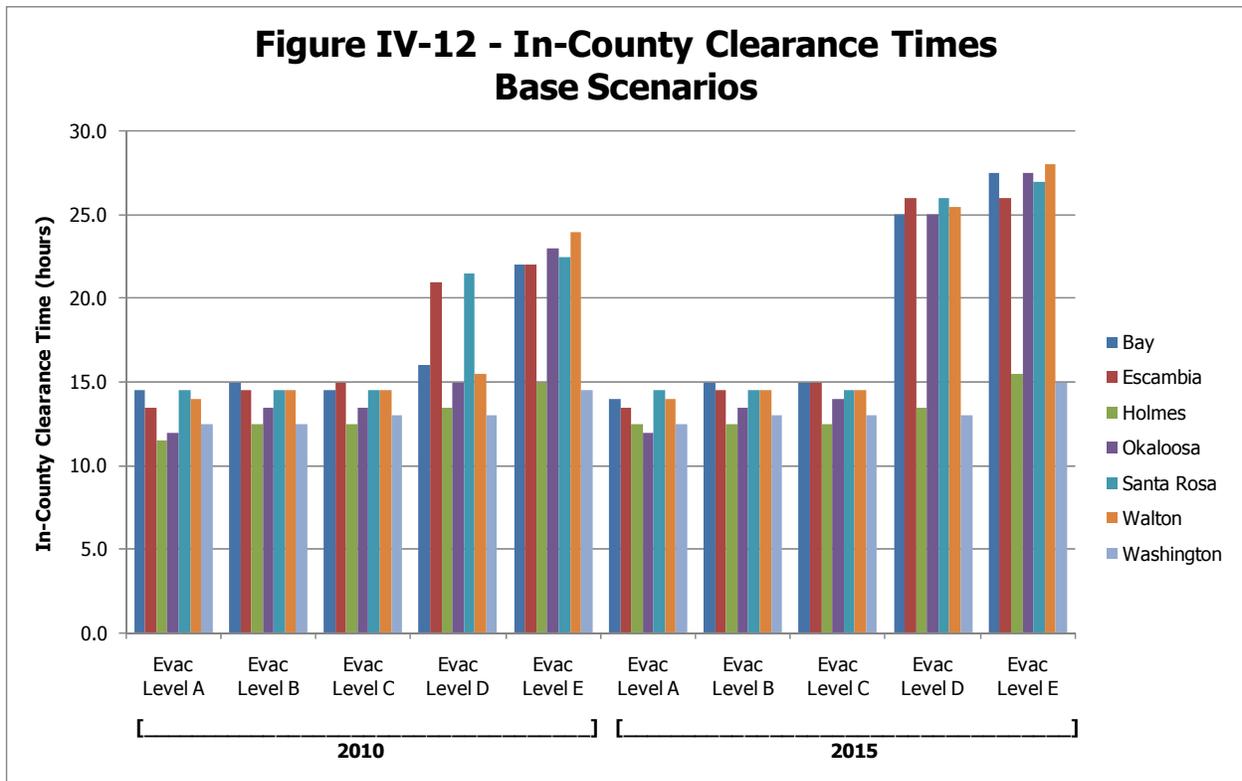
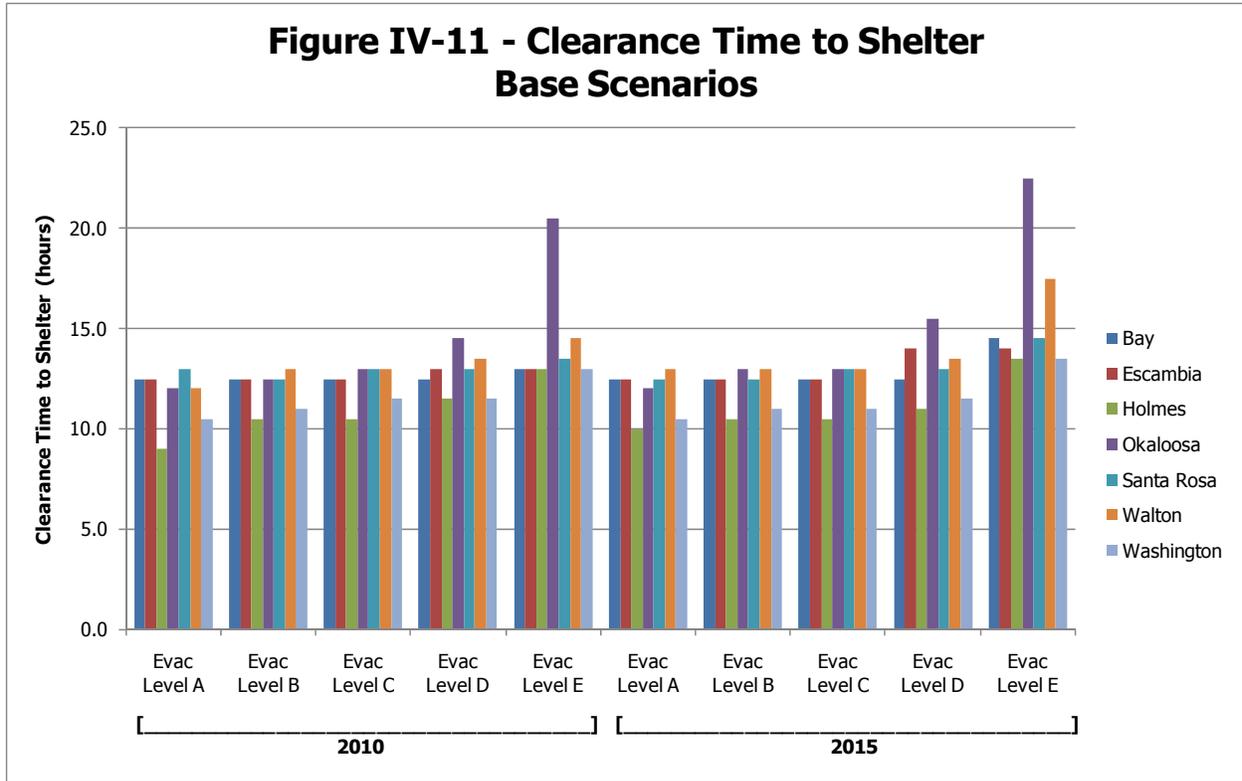
Regional clearance time for the seven county WFRPC region ranges from 15 hours to 24.5 hours in 2010. This time increases to between 15 and 28.5 hours in 2015.

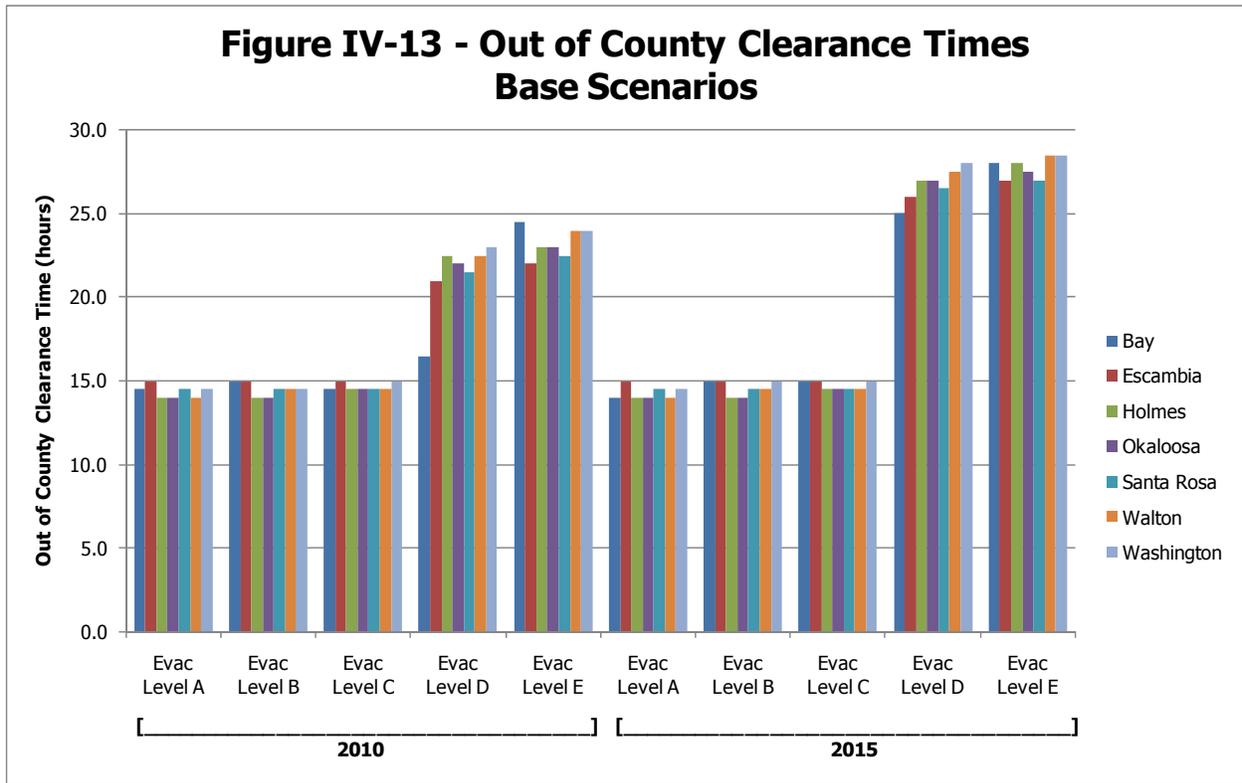
**Table IV-17 – 2010 Clearance Times for Base Scenario**

	<b>Evacuation Level A Base Scenario</b>	<b>Evacuation Level B Base Scenario</b>	<b>Evacuation Level C Base Scenario</b>	<b>Evacuation Level D Base Scenario</b>	<b>Evacuation Level E Base Scenario</b>
<b>Clearance Time to Shelter</b>					
Bay County	12.5	12.5	12.5	12.5	13.0
Escambia County	12.5	12.5	12.5	13.0	13.0
Holmes County	9.0	10.5	10.5	11.5	13.0
Okaloosa County	12.0	12.5	13.0	14.5	20.5
Santa Rosa County	13.0	12.5	13.0	13.0	13.5
Walton County	12.0	13.0	13.0	13.5	14.5
Washington County	10.5	11.0	11.5	11.5	13.0
<b>In-County Clearance Time</b>					
Bay County	14.5	15.0	14.5	16.0	22.0
Escambia County	13.5	14.5	15.0	21.0	22.0
Holmes County	11.5	12.5	12.5	13.5	15.0
Okaloosa County	12.0	13.5	13.5	15.0	23.0
Santa Rosa County	14.5	14.5	14.5	21.5	22.5
Walton County	14.0	14.5	14.5	15.5	24.0
Washington County	12.5	12.5	13.0	13.0	14.5
<b>Out of County Clearance Time</b>					
Bay County	14.5	15.0	14.5	16.5	24.5
Escambia County	15.0	15.0	15.0	21.0	22.0
Holmes County	14.0	14.0	14.5	22.5	23.0
Okaloosa County	14.0	14.0	14.5	22.0	23.0
Santa Rosa County	14.5	14.5	14.5	21.5	22.5
Walton County	14.0	14.5	14.5	22.5	24.0
Washington County	14.5	14.5	15.0	23.0	24.0
<b>Regional Clearance Time</b>					
West Florida	15.0	15.0	15.0	23.0	24.5

**Table IV-18 – 2015 Clearance Times for Base Scenario**

	<b>Evacuation Level A Base Scenario</b>	<b>Evacuation Level B Base Scenario</b>	<b>Evacuation Level C Base Scenario</b>	<b>Evacuation Level D Base Scenario</b>	<b>Evacuation Level E Base Scenario</b>
<b>Clearance Time to Shelter</b>					
Bay County	12.5	12.5	12.5	12.5	14.5
Escambia County	12.5	12.5	12.5	14.0	14.0
Holmes County	10.0	10.5	10.5	11.0	13.5
Okaloosa County	12.0	13.0	13.0	15.5	22.5
Santa Rosa County	12.5	12.5	13.0	13.0	14.5
Walton County	13.0	13.0	13.0	13.5	17.5
Washington County	10.5	11.0	11.0	11.5	13.5
<b>In-County Clearance Time</b>					
Bay County	14.0	15.0	15.0	25.0	27.5
Escambia County	13.5	14.5	15.0	26.0	26.0
Holmes County	12.5	12.5	12.5	13.5	15.5
Okaloosa County	12.0	13.5	14.0	25.0	27.5
Santa Rosa County	14.5	14.5	14.5	26.0	27.0
Walton County	14.0	14.5	14.5	25.5	28.0
Washington County	12.5	13.0	13.0	13.0	15.0
<b>Out of County Clearance Time</b>					
Bay County	14.0	15.0	15.0	25.0	28.0
Escambia County	15.0	15.0	15.0	26.0	27.0
Holmes County	14.0	14.0	14.5	27.0	28.0
Okaloosa County	14.0	14.0	14.5	27.0	27.5
Santa Rosa County	14.5	14.5	14.5	26.5	27.0
Walton County	14.0	14.5	14.5	27.5	28.5
Washington County	14.5	15.0	15.0	28.0	28.5
<b>Regional Clearance Time</b>					
West Florida	15.0	15.0	15.0	28.0	28.5





## F. Operational Scenarios

The transportation analysis also included ten region wide operational scenarios selected by the county emergency managers and RPC staff for the West Florida Region. While the base scenarios required that the basic assumptions were consistent between scenarios except for the year and the evacuation level, this is not the case for the operational scenarios. The only requirement for each region is that two operational scenarios are developed for each evacuation level (two for Level A, two for Level B, etc.). Otherwise, the assumptions and characteristics between the ten operational scenarios can be different for each scenario.

The ten operational scenarios selected for analysis in the West Florida Region are illustrated in **Table IV-19**. Due to its geographic location, the West Florida region is not greatly impacted by evacuations in other parts of the State, with the exception of some minor impacts from the Apalachee region and impacts from the Mobile, AL area. For these reasons, the WFRPC and local county emergency managers selected operational scenarios nearly identical to the base scenarios, with the only exception being the use of the behavioral planning assumptions instead of the 100 percent behavioral assumptions. All ten operational scenarios used the default tourist and university population rates, along with the 12-hour response curve. Counties evacuating also were identical to the base scenarios and included the seven counties within the RPC plus one coastal county on either side of the RPC (Gulf County and Baldwin County, AL).

**Table IV-19 – Operational Scenarios**

	<b>Scenario 1 Level A 2010</b>	<b>Scenario 2 Level B 2010</b>	<b>Scenario 3 Level C 2010</b>	<b>Scenario 4 Level D 2010</b>	<b>Scenario 5 Level E 2010</b>
<b>Demographic Data</b>	2010	2010	2010	2010	2010
<b>Highway Network</b>	2010	2010	2010	2010	2010
<b>One-Way Operations</b>	None	None	None	None	None
<b>University Population</b>	Fall/Spring	Fall/Spring	Fall/Spring	Fall/Spring	Fall/Spring
<b>Tourist Rate</b>	Default	Default	Default	Default	Default
<b>Shelters Open</b>	Primary	Primary	Primary	Primary	Primary
<b>Response Curve</b>	12-hour	12-hour	12-hour	12-hour	12-hour
<b>Evacuation Phasing</b>	None	None	None	None	None
<b>Behavioral Response</b>	Planning	Planning	Planning	Planning	Planning
<b>Evacuation Zone</b>	A	B	C	D	E
<b>Counties Evacuating</b>	Bay Escambia Holmes Okaloosa Santa Rosa Walton Washington Baldwin (AL) Gulf				
	<b>Scenario 6 Level A 2015</b>	<b>Scenario 7 Level B 2015</b>	<b>Scenario 8 Level C 2015</b>	<b>Scenario 9 Level D 2015</b>	<b>Scenario 10 Level E 2015</b>
<b>Demographic Data</b>	2015	2015	2015	2015	2015
<b>Highway Network</b>	2015	2015	2015	2015	2015
<b>One-Way Operations</b>	None	None	None	None	None
<b>University Population</b>	Fall/Spring	Fall/Spring	Fall/Spring	Fall/Spring	Fall/Spring
<b>Tourist Rate</b>	Default	Default	Default	Default	Default
<b>Shelters Open</b>	Primary	Primary	Primary	Primary	Primary
<b>Response Curve</b>	12-hour	12-hour	12-hour	12-hour	12-hour
<b>Evacuation Phasing</b>	None	None	None	None	None
<b>Behavioral Response</b>	Planning	Planning	Planning	Planning	Planning
<b>Evacuation Zone</b>	A	B	C	D	E
<b>Counties Evacuating</b>	Bay Escambia Holmes Okaloosa Santa Rosa Walton Washington Baldwin (AL) Gulf				

## G. Operational Scenario Results

Each of the ten operational scenarios were modeled for the West 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. The results are discussed in the following sections.

### Evacuating Population

Similar to the base scenarios, the evacuating population was estimated for the seven county region. Evacuating population for the operational scenarios is summarized by county for 2010 in **Table IV-20** and for 2015 in **Table IV-21**.

Within the seven county region, total evacuating population ranges from 153,800 persons for the operational scenario level A evacuation to nearly 546,600 persons for the operational scenario level E evacuation in 2010. By 2015, this range increases within the seven counties to more than 168,500 persons for the operational scenario level A evacuation and more than 597,400 persons for the operational scenario level E evacuation.

### Evacuating Vehicles

From a transportation standpoint, the number of evacuating vehicles is more important than the evacuating population. Evacuating vehicles for the operational scenarios are summarized by county for 2010 in **Table IV-22** and for 2015 in **Table IV-23**.

The total number of evacuating vehicles within the seven county region for the operational scenarios also varies by evacuation level. A total of more than 78,300 vehicles evacuate from the seven county RPC for the operational scenario level A evacuation in 2010, and this number increases to slightly more than 280,600 evacuating vehicles from the seven county region for the operational scenario level E evacuation in 2010. By 2015, the number of evacuating vehicles is expected to increase to nearly 86,700 vehicles for the operational scenario level A evacuation and more than 311,400 evacuating vehicles for the operational scenario level E evacuation.

### Shelter Demand

Shelter demand estimates by county are summarized for each of the operational scenarios in **Table IV-24**. Shelter demand is the population in each county who will seek public shelter during their evacuation, either at an in-county shelter or an out of county shelter.

Public shelter demand in the seven county region ranges from only 9,900 persons for the operational scenario level A evacuation in 2010 to more than 34,100 persons for the operational scenario level E evacuation. By 2015, the public shelter demand is expected to increase to more than 11,000 persons for the level A evacuation and more than 37,900 persons for the level E evacuation.

**Table IV-20 – Evacuating Population by Operational Scenario for 2010**

	<b>Evacuation Level A Operational Scenario</b>	<b>Evacuation Level B Operational Scenario</b>	<b>Evacuation Level C Operational Scenario</b>	<b>Evacuation Level D Operational Scenario</b>	<b>Evacuation Level E Operational Scenario</b>
<b>Bay County</b>					
Site-built Homes	22,441	36,190	49,798	69,993	88,928
Mobile/Manuf. Homes	15,124	16,759	19,345	20,592	21,840
Tourists	4,736	10,067	12,535	13,642	14,435
TOTAL	42,301	63,016	81,678	104,227	125,203
<b>Escambia County</b>					
Site-built Homes	23,702	39,831	60,590	95,139	127,109
Mobile/Manuf. Homes	11,416	12,351	14,163	15,098	16,034
Tourists	2,287	2,315	2,353	2,353	2,546
TOTAL	37,405	54,497	77,106	112,590	145,689
<b>Holmes County</b>					
Site-built Homes	585	1,170	1,755	2,340	2,925
Mobile/Manuf. Homes	3,692	3,999	4,615	4,922	5,537
Tourists	0	0	0	0	0
TOTAL	4,277	5,169	6,370	7,262	8,462
<b>Okaloosa County</b>					
Site-built Homes	17,329	27,144	47,948	82,347	106,386
Mobile/Manuf. Homes	5,224	5,647	6,443	6,784	7,278
Tourists	0	210	5,505	7,111	10,457
TOTAL	22,553	33,001	59,896	96,242	124,121
<b>Santa Rosa County</b>					
Site-built Homes	15,368	17,797	36,092	58,390	75,281
Mobile/Manuf. Homes	10,890	11,769	13,445	14,323	15,201
Tourists	524	653	708	1,044	1,044
TOTAL	26,782	30,219	50,245	73,757	91,526
<b>Walton County</b>					
Site-built Homes	9,468	12,127	17,898	24,625	30,101
Mobile/Manuf. Homes	6,027	6,492	7,330	7,564	8,214
Tourists	310	2,195	2,349	2,349	2,383
TOTAL	15,805	20,814	27,577	34,538	40,698
<b>Washington County</b>					
Site-built Homes	663	1,326	2,652	3,315	3,978
Mobile/Manuf. Homes	4,048	4,453	5,262	6,072	6,882
Tourists	0	0	0	0	0
TOTAL	4,711	5,779	7,914	9,387	10,860

**Table IV-21 – Evacuating Population by Operational Scenario for 2015**

	<b>Evacuation Level A Operational Scenario</b>	<b>Evacuation Level B Operational Scenario</b>	<b>Evacuation Level C Operational Scenario</b>	<b>Evacuation Level D Operational Scenario</b>	<b>Evacuation Level E Operational Scenario</b>
<b>Bay County</b>					
Site-built Homes	23,717	38,316	52,587	73,964	94,027
Mobile/Manuf. Homes	16,374	18,165	20,963	22,313	23,663
Tourists	4,967	10,470	13,086	14,343	15,442
<b>TOTAL</b>	<b>45,058</b>	<b>66,951</b>	<b>86,636</b>	<b>110,620</b>	<b>133,132</b>
<b>Escambia County</b>					
Site-built Homes	24,866	41,778	63,543	99,925	133,575
Mobile/Manuf. Homes	12,004	12,989	14,897	15,881	16,866
Tourists	2,365	2,393	2,436	2,436	2,624
<b>TOTAL</b>	<b>39,235</b>	<b>57,160</b>	<b>80,876</b>	<b>118,242</b>	<b>153,065</b>
<b>Holmes County</b>					
Site-built Homes	602	1,204	1,806	2,408	3,010
Mobile/Manuf. Homes	3,794	4,110	4,742	5,058	5,690
Tourists	0	0	0	0	0
<b>TOTAL</b>	<b>4,396</b>	<b>5,314</b>	<b>6,548</b>	<b>7,466</b>	<b>8,700</b>
<b>Okaloosa County</b>					
Site-built Homes	18,466	29,242	51,283	88,024	114,113
Mobile/Manuf. Homes	5,950	6,433	7,347	7,740	8,298
Tourists	0	238	5,709	7,407	11,297
<b>TOTAL</b>	<b>24,416</b>	<b>35,913</b>	<b>64,339</b>	<b>103,171</b>	<b>133,708</b>
<b>Santa Rosa County</b>					
Site-built Homes	17,511	20,274	41,020	66,176	85,272
Mobile/Manuf. Homes	12,860	13,897	15,874	16,910	17,947
Tourists	507	676	815	1,158	1,158
<b>TOTAL</b>	<b>30,878</b>	<b>34,847</b>	<b>57,709</b>	<b>84,244</b>	<b>104,377</b>
<b>Walton County</b>					
Site-built Homes	10,974	14,370	21,082	31,269	39,385
Mobile/Manuf. Homes	8,038	8,652	9,729	9,997	10,897
Tourists	617	2,540	2,727	2,727	2,831
<b>TOTAL</b>	<b>19,629</b>	<b>25,562</b>	<b>33,538</b>	<b>43,993</b>	<b>53,113</b>
<b>Washington County</b>					
Site-built Homes	691	1,382	2,764	3,455	4,146
Mobile/Manuf. Homes	4,244	4,669	5,517	6,366	7,215
Tourists	0	0	0	0	0
<b>TOTAL</b>	<b>4,935</b>	<b>6,051</b>	<b>8,281</b>	<b>9,821</b>	<b>11,361</b>

**Table IV-22 – Evacuating Vehicles by Operational Scenario for 2010**

	<b>Evacuation Level A Operational Scenario</b>	<b>Evacuation Level B Operational Scenario</b>	<b>Evacuation Level C Operational Scenario</b>	<b>Evacuation Level D Operational Scenario</b>	<b>Evacuation Level E Operational Scenario</b>
<b>Bay County</b>					
Site-built Homes	11,702	18,747	25,905	36,380	46,179
Mobile/Manuf. Homes	7,610	8,403	9,699	10,327	10,956
Tourists	1,796	4,115	5,076	5,548	5,853
TOTAL	21,108	31,265	40,680	52,255	62,988
<b>Escambia County</b>					
Site-built Homes	11,862	19,754	30,127	47,203	62,874
Mobile/Manuf. Homes	5,350	5,790	6,645	7,085	7,525
Tourists	1,053	1,066	1,084	1,084	1,173
TOTAL	18,265	26,610	37,856	55,372	71,572
<b>Holmes County</b>					
Site-built Homes	320	640	959	1,279	1,599
Mobile/Manuf. Homes	1,715	1,858	2,143	2,286	2,572
Tourists	0	0	0	0	0
TOTAL	2,035	2,498	3,102	3,565	4,171
<b>Okaloosa County</b>					
Site-built Homes	9,574	14,844	26,472	45,629	58,737
Mobile/Manuf. Homes	2,594	2,804	3,199	3,579	3,839
Tourists	0	70	2,164	2,709	3,900
TOTAL	12,168	17,718	31,835	51,917	66,476
<b>Santa Rosa County</b>					
Site-built Homes	8,045	9,374	18,682	30,189	38,735
Mobile/Manuf. Homes	5,225	5,646	6,450	6,871	7,293
Tourists	241	289	305	460	460
TOTAL	13,511	15,309	25,437	37,520	46,488
<b>Walton County</b>					
Site-built Homes	5,675	7,345	10,744	14,925	18,263
Mobile/Manuf. Homes	3,300	3,555	4,014	4,142	4,498
Tourists	155	974	1,055	1,055	1,077
TOTAL	9,130	11,874	15,813	20,122	23,838
<b>Washington County</b>					
Site-built Homes	353	705	1,411	1,764	2,116
Mobile/Manuf. Homes	1,779	1,957	2,312	2,668	3,024
Tourists	0	0	0	0	0
TOTAL	2,132	2,662	3,723	4,432	5,140

**Table IV-23 – Evacuating Vehicles by Operational Scenario for 2015**

	<b>Evacuation Level A Operational Scenario</b>	<b>Evacuation Level B Operational Scenario</b>	<b>Evacuation Level C Operational Scenario</b>	<b>Evacuation Level D Operational Scenario</b>	<b>Evacuation Level E Operational Scenario</b>
<b>Bay County</b>					
Site-built Homes	12,360	19,839	27,342	38,424	48,802
Mobile/Manuf. Homes	8,208	9,072	10,469	11,147	11,825
Tourists	1,880	4,261	5,272	5,797	6,203
<b>TOTAL</b>	<b>22,448</b>	<b>33,172</b>	<b>43,083</b>	<b>55,368</b>	<b>66,830</b>
<b>Escambia County</b>					
Site-built Homes	13,168	21,949	33,482	52,594	70,122
Mobile/Manuf. Homes	5,631	6,094	6,996	7,459	7,922
Tourists	1,106	1,119	1,140	1,140	1,229
<b>TOTAL</b>	<b>19,905</b>	<b>29,162</b>	<b>41,618</b>	<b>61,193</b>	<b>79,273</b>
<b>Holmes County</b>					
Site-built Homes	329	658	987	1,316	1,645
Mobile/Manuf. Homes	1,762	1,909	2,202	2,349	2,643
Tourists	0	0	0	0	0
<b>TOTAL</b>	<b>2,091</b>	<b>2,567</b>	<b>3,189</b>	<b>3,665</b>	<b>4,288</b>
<b>Okaloosa County</b>					
Site-built Homes	10,174	15,943	28,229	48,621	62,799
Mobile/Manuf. Homes	2,952	3,192	3,645	4,081	4,375
Tourists	0	80	2,256	2,834	4,257
<b>TOTAL</b>	<b>13,126</b>	<b>19,215</b>	<b>34,130</b>	<b>55,536</b>	<b>71,431</b>
<b>Santa Rosa County</b>					
Site-built Homes	9,180	10,692	21,258	34,247	43,914
Mobile/Manuf. Homes	6,167	6,665	7,613	8,110	8,607
Tourists	241	297	320	475	475
<b>TOTAL</b>	<b>15,588</b>	<b>17,654</b>	<b>29,191</b>	<b>42,832</b>	<b>52,996</b>
<b>Walton County</b>					
Site-built Homes	6,593	8,730	12,682	18,985	23,926
Mobile/Manuf. Homes	4,398	4,734	5,324	5,471	5,963
Tourists	309	1,152	1,254	1,254	1,322
<b>TOTAL</b>	<b>11,300</b>	<b>14,616</b>	<b>19,260</b>	<b>25,710</b>	<b>31,211</b>
<b>Washington County</b>					
Site-built Homes	368	737	1,473	1,841	2,210
Mobile/Manuf. Homes	1,866	2,052	2,425	2,798	3,171
Tourists	0	0	0	0	0
<b>TOTAL</b>	<b>2,234</b>	<b>2,789</b>	<b>3,898</b>	<b>4,639</b>	<b>5,381</b>

**Table IV-24 – Shelter Demand by Operational Scenario**

	<b>Evacuation Level A</b>	<b>Evacuation Level B</b>	<b>Evacuation Level C</b>	<b>Evacuation Level D</b>	<b>Evacuation Level E</b>
<b>2010</b>					
Bay County	2,740	3,950	4,882	6,037	7,150
Escambia County	2,721	4,066	5,718	8,443	11,046
Holmes County	535	633	773	871	1,010
Okaloosa County	875	1,315	2,425	4,157	5,380
Santa Rosa County	1,841	2,033	3,410	4,949	6,210
Walton County	681	951	1,180	1,611	1,931
Washington County	592	738	1,034	1,230	1,426
<b>2015</b>					
Bay County	2,925	4,209	5,193	6,423	7,615
Escambia County	2,960	4,449	6,275	9,311	12,210
Holmes County	549	651	794	895	1,038
Okaloosa County	958	1,445	2,629	4,479	5,824
Santa Rosa County	2,131	2,353	3,920	5,655	7,084
Walton County	881	1,219	1,502	2,157	2,655
Washington County	620	773	1,082	1,288	1,493

*Note: Shelter demand is the population in each county who will seek public shelter during their evacuation, either at an in-county shelter or an out of county shelter.*

### Congested Roadways

A summary of the total number of evacuating vehicles for each of the operational scenarios is presented in **Table IV-25**. It is important to note that the total number of evacuating vehicles in the table below includes vehicles evacuating from all of the counties included in the operational scenario, as identified in Table IV-19.

**Table IV-25 – Total Evacuating Vehicles for Operational Scenarios**

	<b>Evacuation Level A Operational Scenario</b>	<b>Evacuation Level B Operational Scenario</b>	<b>Evacuation Level C Operational Scenario</b>	<b>Evacuation Level D Operational Scenario</b>	<b>Evacuation Level E Operational Scenario</b>
2010	112,452	151,512	218,970	312,238	383,565
2015	124,727	167,704	241,796	345,964	426,075

Similar to the base scenarios, critical roadways were identified by reviewing roadways in the model network that have the highest vehicle queues for extended periods of time during an evacuation. Due to the nature of a major evacuation in general, nearly all roadway facilities will have extended vehicle queues at some point during the evacuation process. The point of this analysis is to identify those roadway facilities that have vehicle queues for the longest time periods during each of the evacuation scenarios. Critical roadway segments for the West Florida region are identified in **Figures IV-14** through **IV-23** for each of the operational scenarios for 2010 and 2015.

SR 85, US 331, SR 285, I-10, US 231, US 29, SR 77, SR 79, SR 87, US 90, US 98 and SR 281 are critical facilities for all operational scenarios. During the level A evacuation scenarios, the roadway segments with the highest vehicle queues are primarily concentrated along the major Interstate and State Highway system. In contrast, for the level E evacuation scenarios, the roadway segments with the highest vehicle queues include other roadways within the region, such as SR 20. Outside the region, I-65, US 29, US 331, and US 231 are also critical facilities in Alabama.

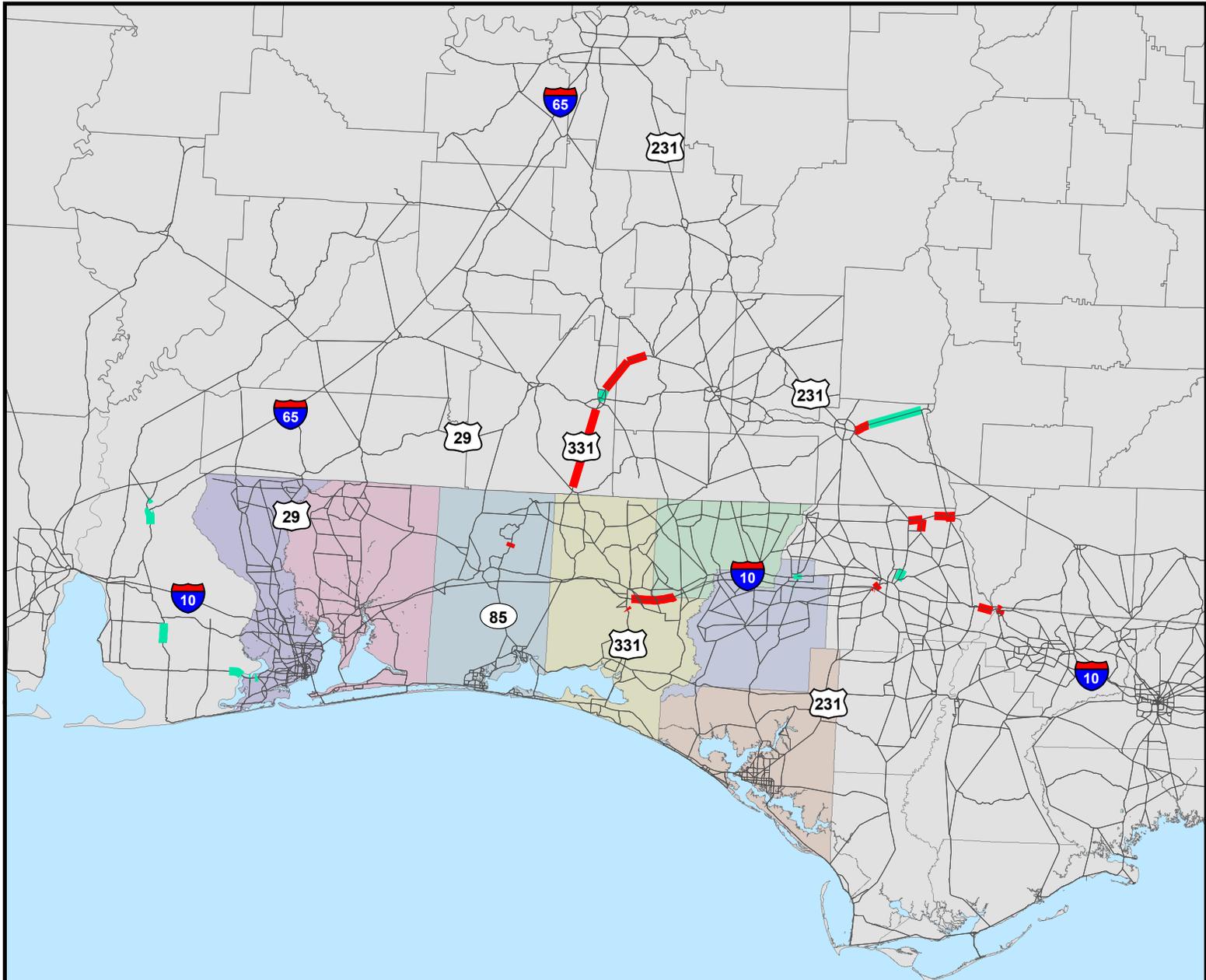
In addition to the identification of critical roadway segments, the total number of evacuating vehicles entering and exiting each county by evacuation scenario was also determined. Evacuating vehicles exiting each county by major evacuation route are identified in **Table IV-26** for 2010 and **Table IV-27** for 2015. In addition, evacuating vehicles entering each county by major evacuation route are identified in **Table IV-28** for 2010 and **Table IV-29** for 2015. Detailed volume figures for all evacuation routes in the West Florida Region for each operational scenario are included in Volume 5-1.

The number of vehicles entering and exiting each county during an evacuation varies widely depending upon the scenario, roadway, and county. As expected, major interstates and state highways generally carry larger volumes of evacuating traffic. The vehicle flows into and out of each county also generally follow the same pattern as the critical segment figures, as locations with higher queues and congestion generally have higher traffic volumes.



# Figure IV-14

## Critical Roadway Segments with Excessive Vehicle Queues for 2010 Operational Scenario Evacuation Level A

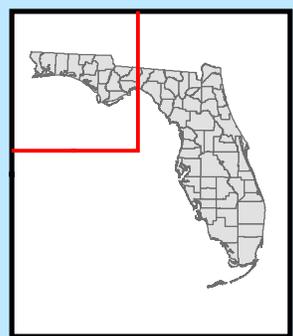


**Map Legend**

-  Critical Segments with Highest Vehicle Queues
-  Other Critical Segments
-  Other Network Roadways

0 3 6 12 18 24 Miles

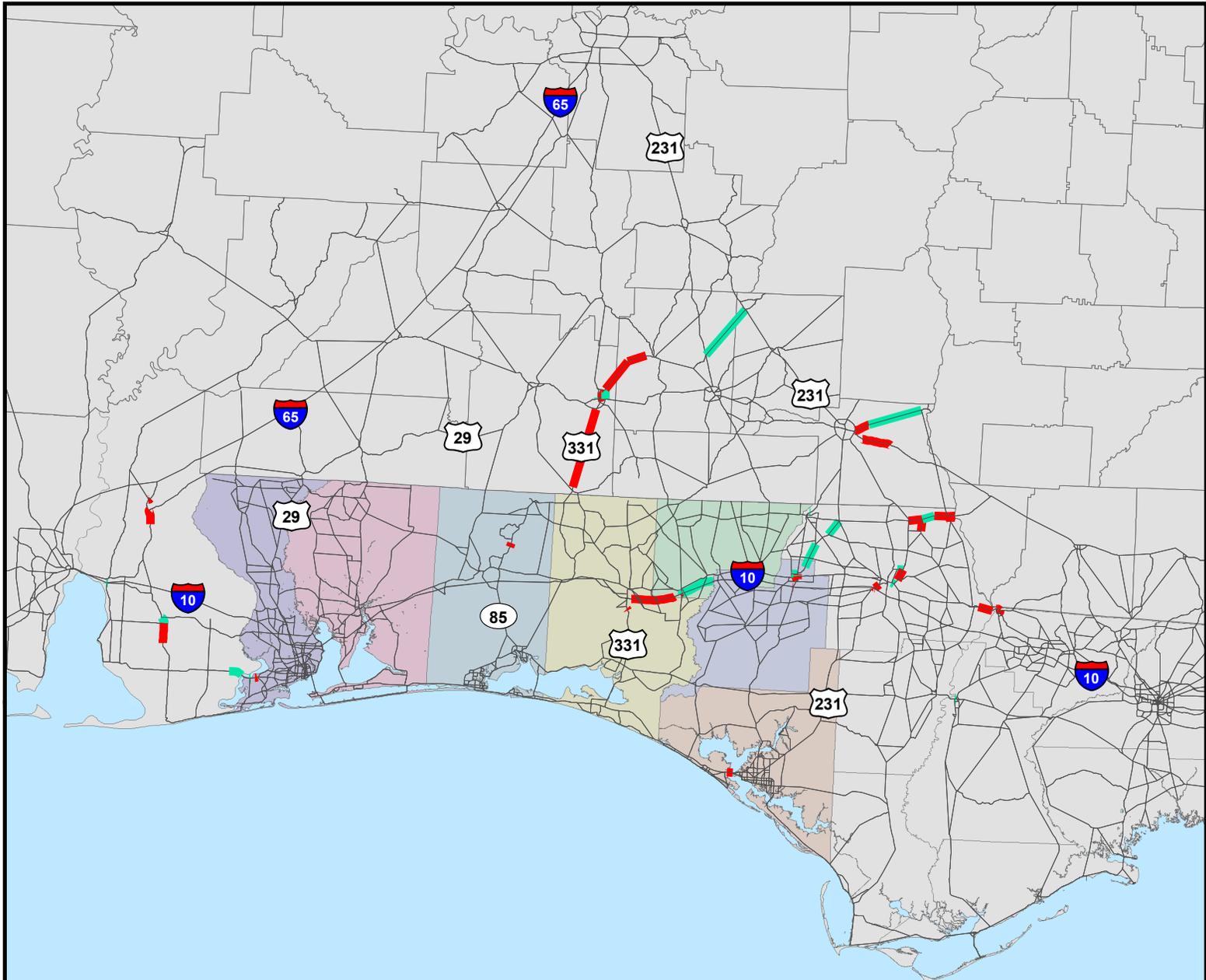
 This map is prepared under the direction of Florida Division of Emergency Management for the Regional Evacuation Study Update. This map is for planning purposes only. Not to be used for measurement or legal purposes. Please consult with your county for the latest information.





# Figure IV-15

## Critical Roadway Segments with Excessive Vehicle Queues for 2010 Operational Scenario Evacuation Level B

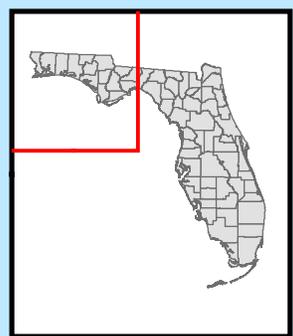


**Map Legend**

-  Critical Segments with Highest Vehicle Queues
-  Other Critical Segments
-  Other Network Roadways

0 3 6 12 18 24 Miles

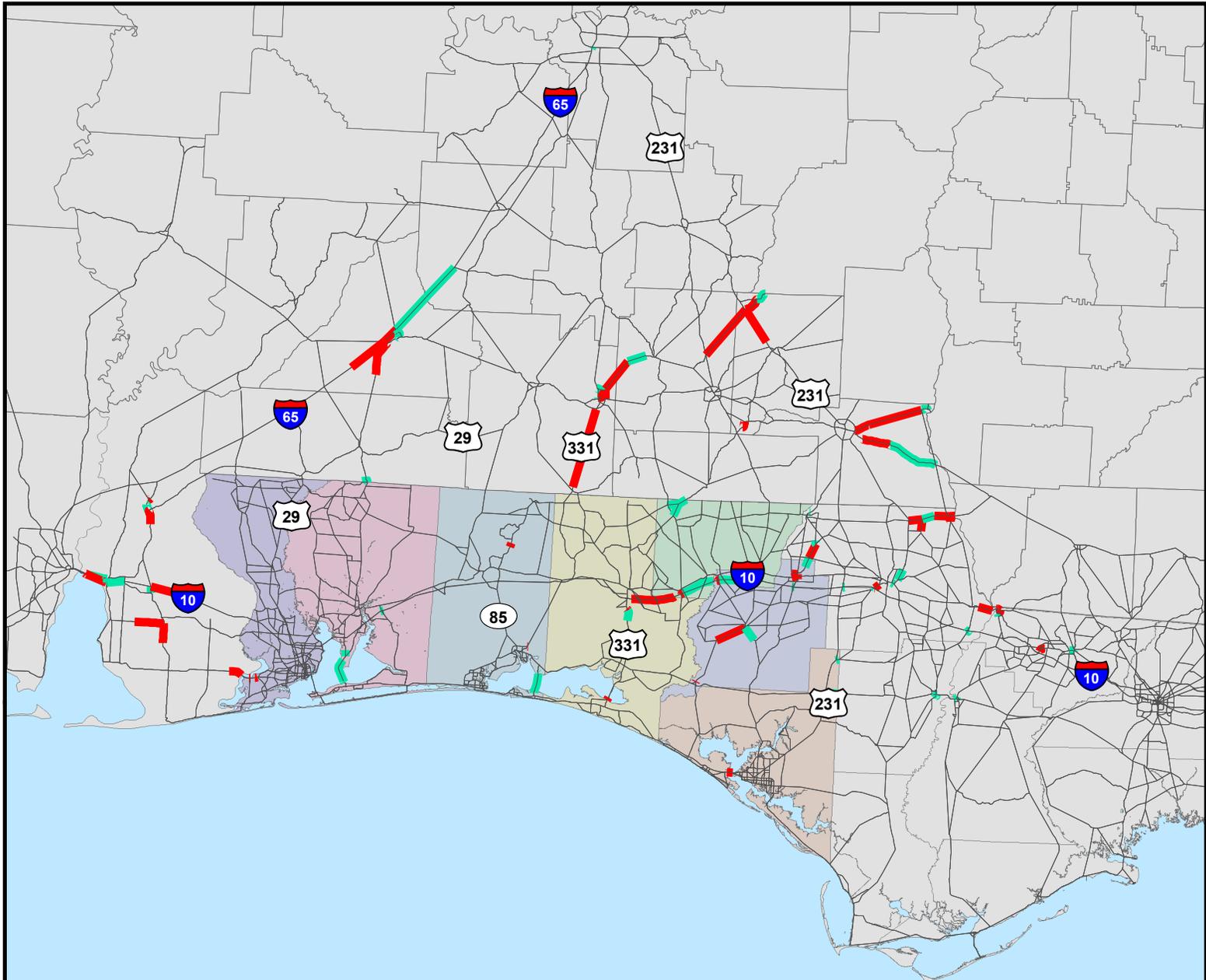
 This map is prepared under the direction of Florida Division of Emergency Management for the Regional Evacuation Study Update. This map is for planning purposes only. Not to be used for measurement or legal purposes. Please consult with your county for the latest information.





# Figure IV-16

## Critical Roadway Segments with Excessive Vehicle Queues for 2010 Operational Scenario Evacuation Level C

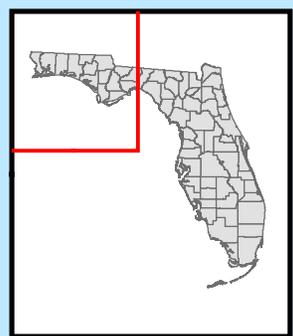


**Map Legend**

-  Critical Segments with Highest Vehicle Queues
-  Other Critical Segments
-  Other Network Roadways

0 3 6 12 18 24 Miles

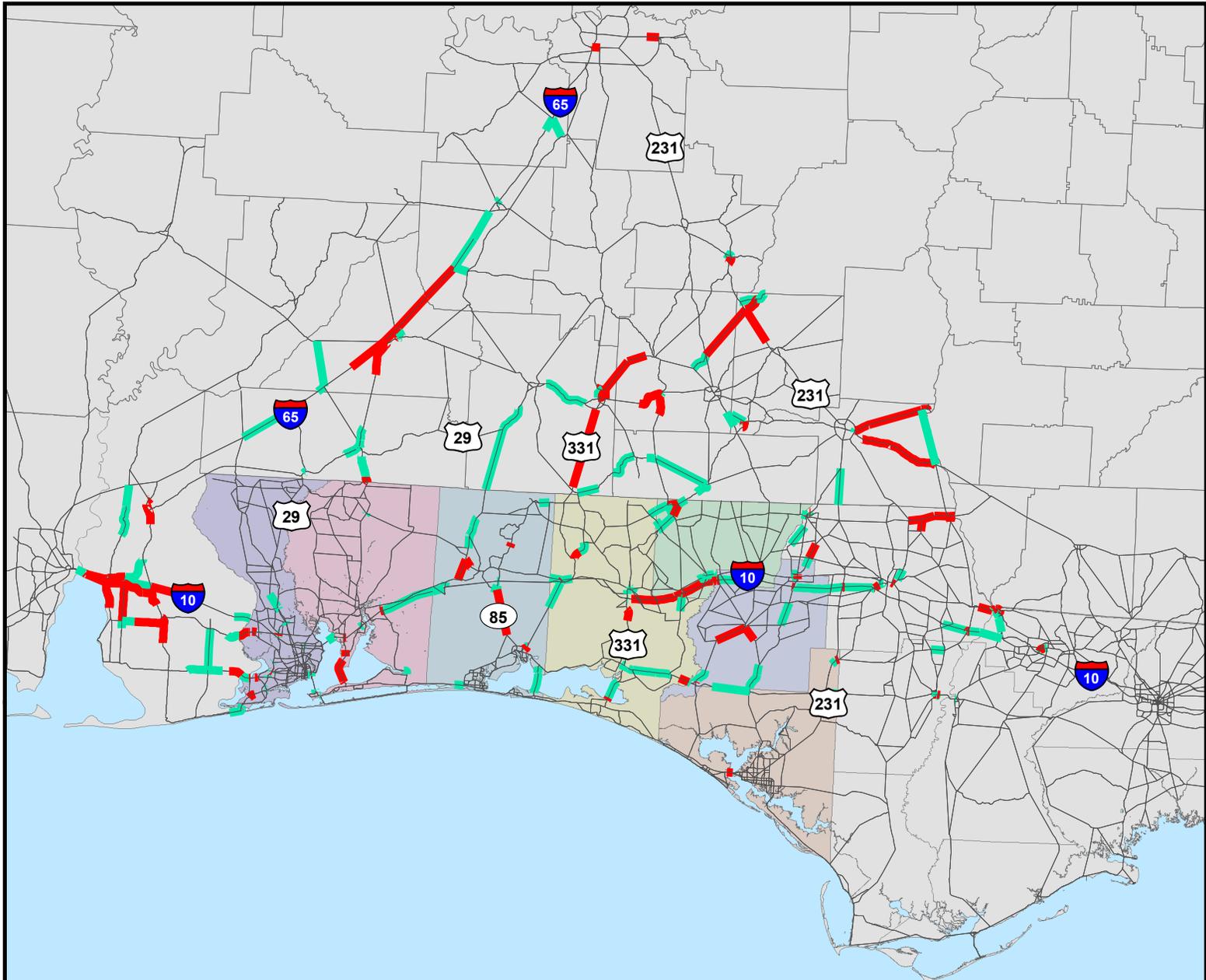
This map is prepared under the direction of Florida Division of Emergency Management for the Regional Evacuation Study Update. This map is for planning purposes only. Not to be used for measurement or legal purposes. Please consult with your county for the latest information.





# Figure IV-17

## Critical Roadway Segments with Excessive Vehicle Queues for 2010 Operational Scenario Evacuation Level D

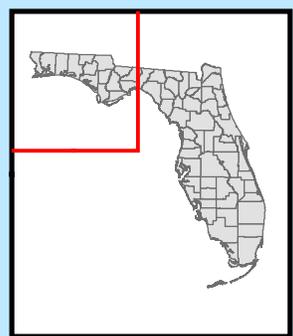


**Map Legend**

-  Critical Segments with Highest Vehicle Queues
-  Other Critical Segments
-  Other Network Roadways

0 3 6 12 18 24 Miles

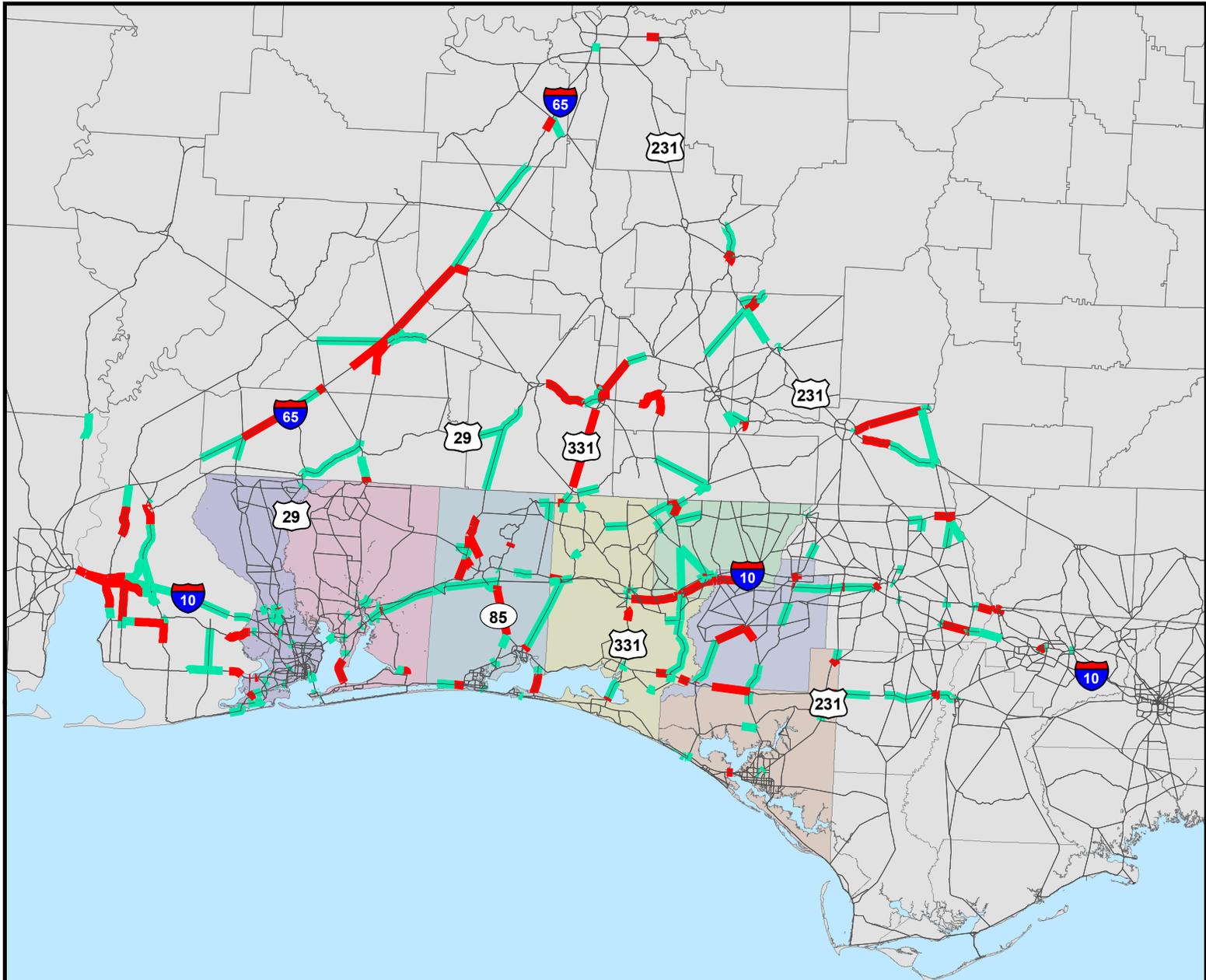
 This map is prepared under the direction of Florida Division of Emergency Management for the Regional Evacuation Study Update. This map is for planning purposes only. Not to be used for measurement or legal purposes. Please consult with your county for the latest information.





# Figure IV-18

## Critical Roadway Segments with Excessive Vehicle Queues for 2010 Operational Scenario Evacuation Level E

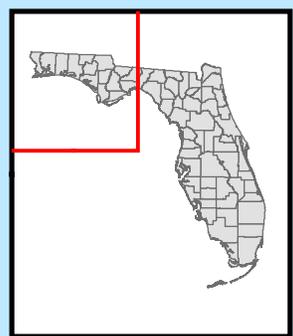


**Map Legend**

-  Critical Segments with Highest Vehicle Queues
-  Other Critical Segments
-  Other Network Roadways

0 3 6 12 18 24 Miles

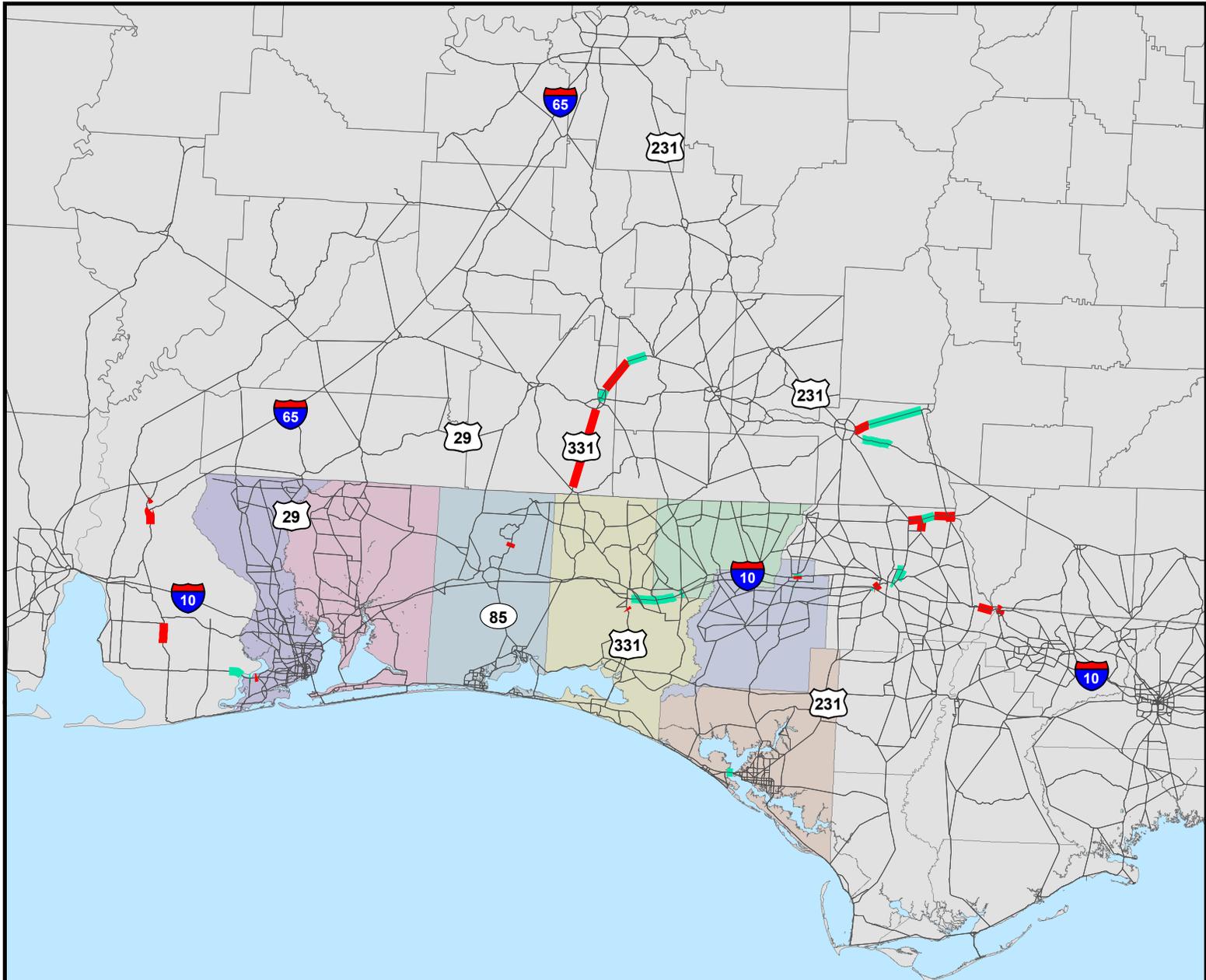
This map is prepared under the direction of Florida Division of Emergency Management for the Regional Evacuation Study Update. This map is for planning purposes only. Not to be used for measurement or legal purposes. Please consult with your county for the latest information.





# Figure IV-19

## Critical Roadway Segments with Excessive Vehicle Queues for 2015 Operational Scenario Evacuation Level A

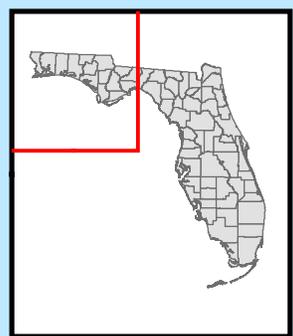


**Map Legend**

-  Critical Segments with Highest Vehicle Queues
-  Other Critical Segments
-  Other Network Roadways

0 3 6 12 18 24 Miles

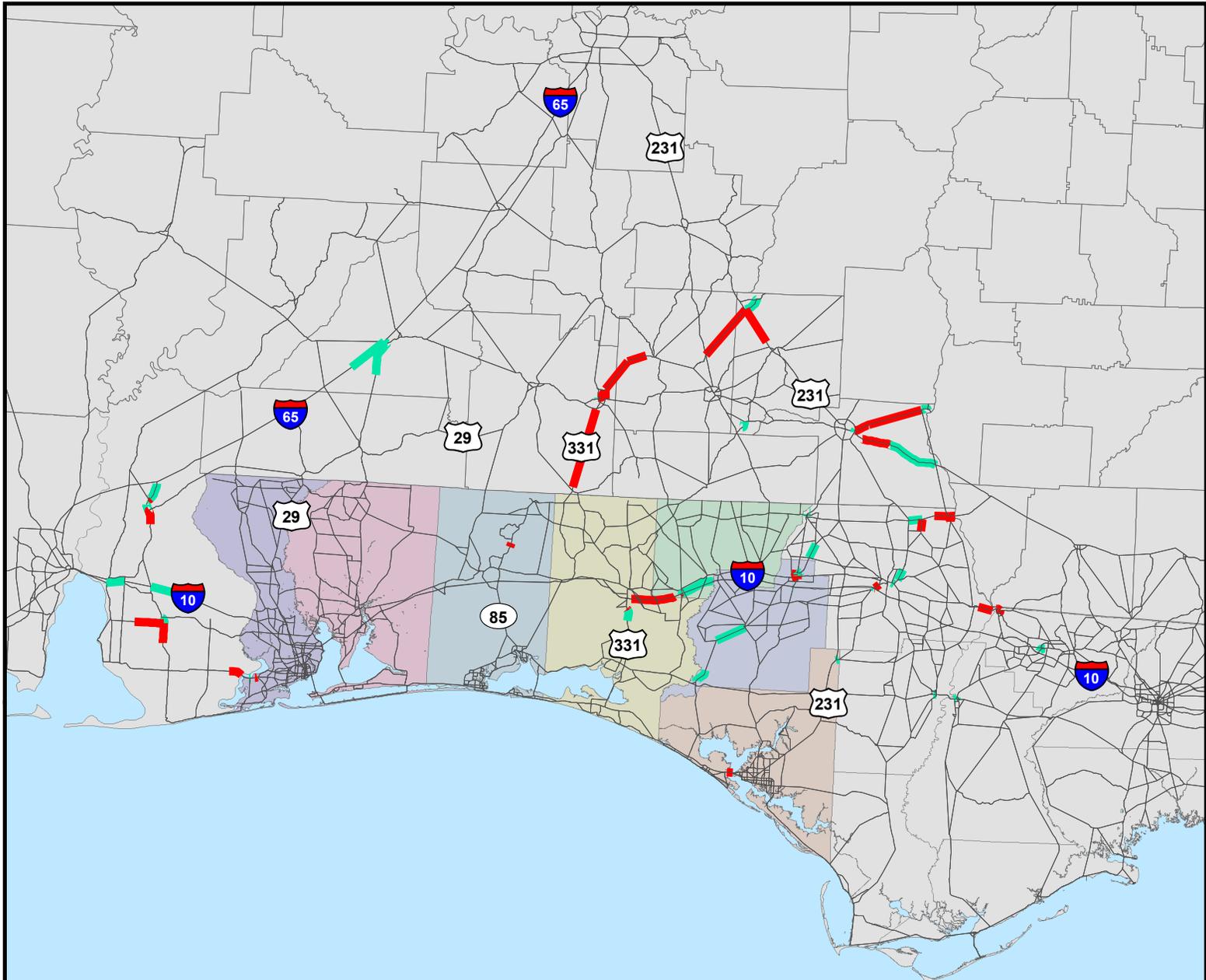
 This map is prepared under the direction of Florida Division of Emergency Management for the Regional Evacuation Study Update. This map is for planning purposes only. Not to be used for measurement or legal purposes. Please consult with your county for the latest information.





# Figure IV-20

## Critical Roadway Segments with Excessive Vehicle Queues for 2015 Operational Scenario Evacuation Level B

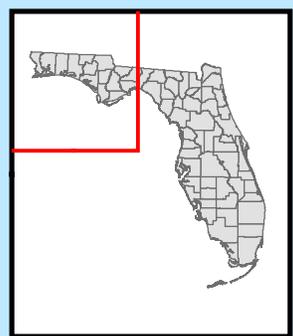


**Map Legend**

-  Critical Segments with Highest Vehicle Queues
-  Other Critical Segments
-  Other Network Roadways

0 3 6 12 18 24 Miles

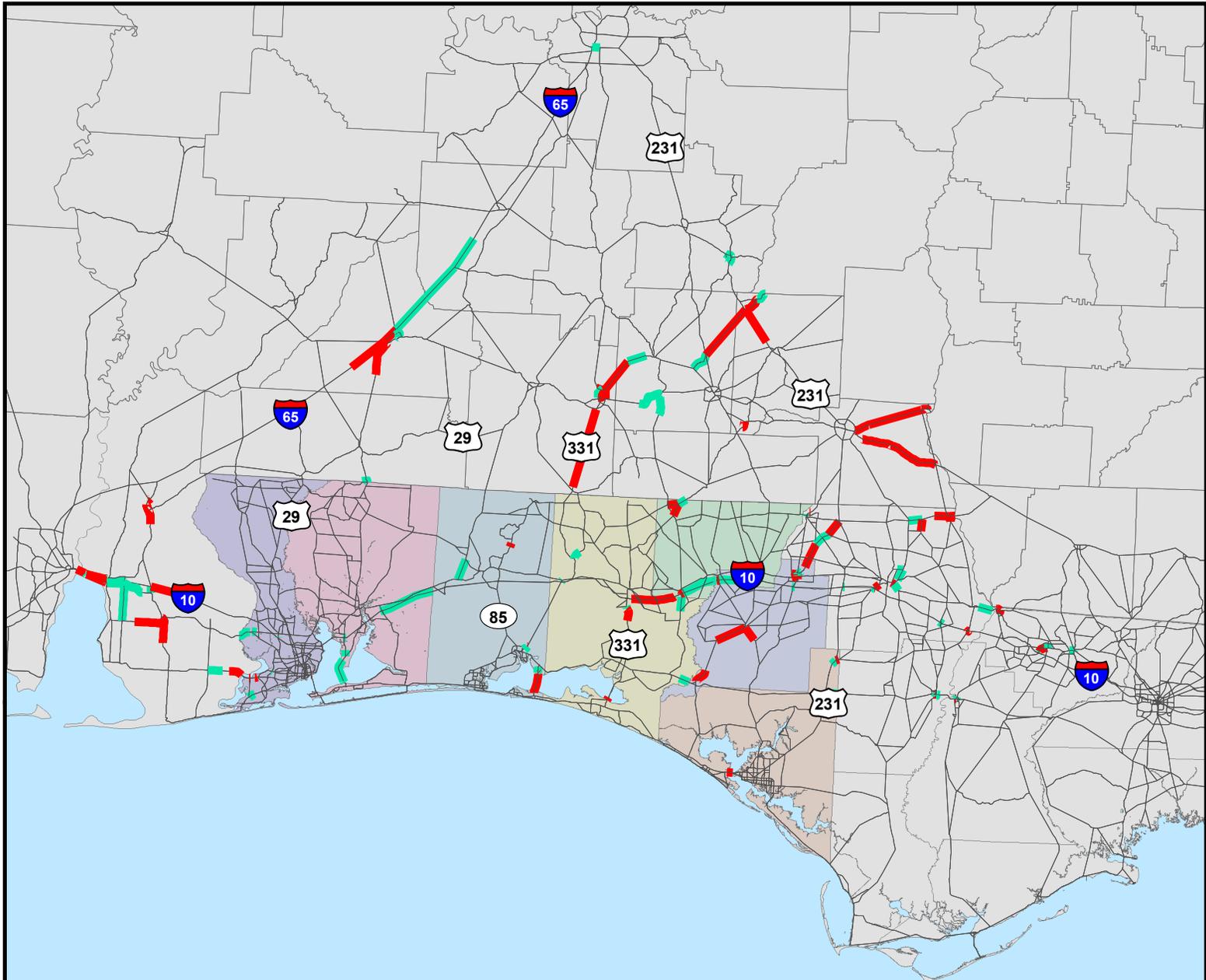
This map is prepared under the direction of Florida Division of Emergency Management for the Regional Evacuation Study Update. This map is for planning purposes only. Not to be used for measurement or legal purposes. Please consult with your county for the latest information.





# Figure IV-21

## Critical Roadway Segments with Excessive Vehicle Queues for 2015 Operational Scenario Evacuation Level C

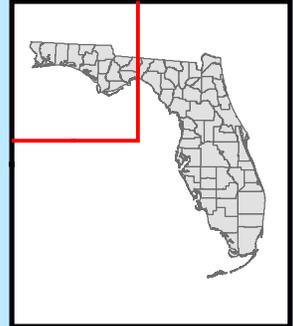


**Map Legend**

-  Critical Segments with Highest Vehicle Queues
-  Other Critical Segments
-  Other Network Roadways

0 3 6 12 18 24 Miles

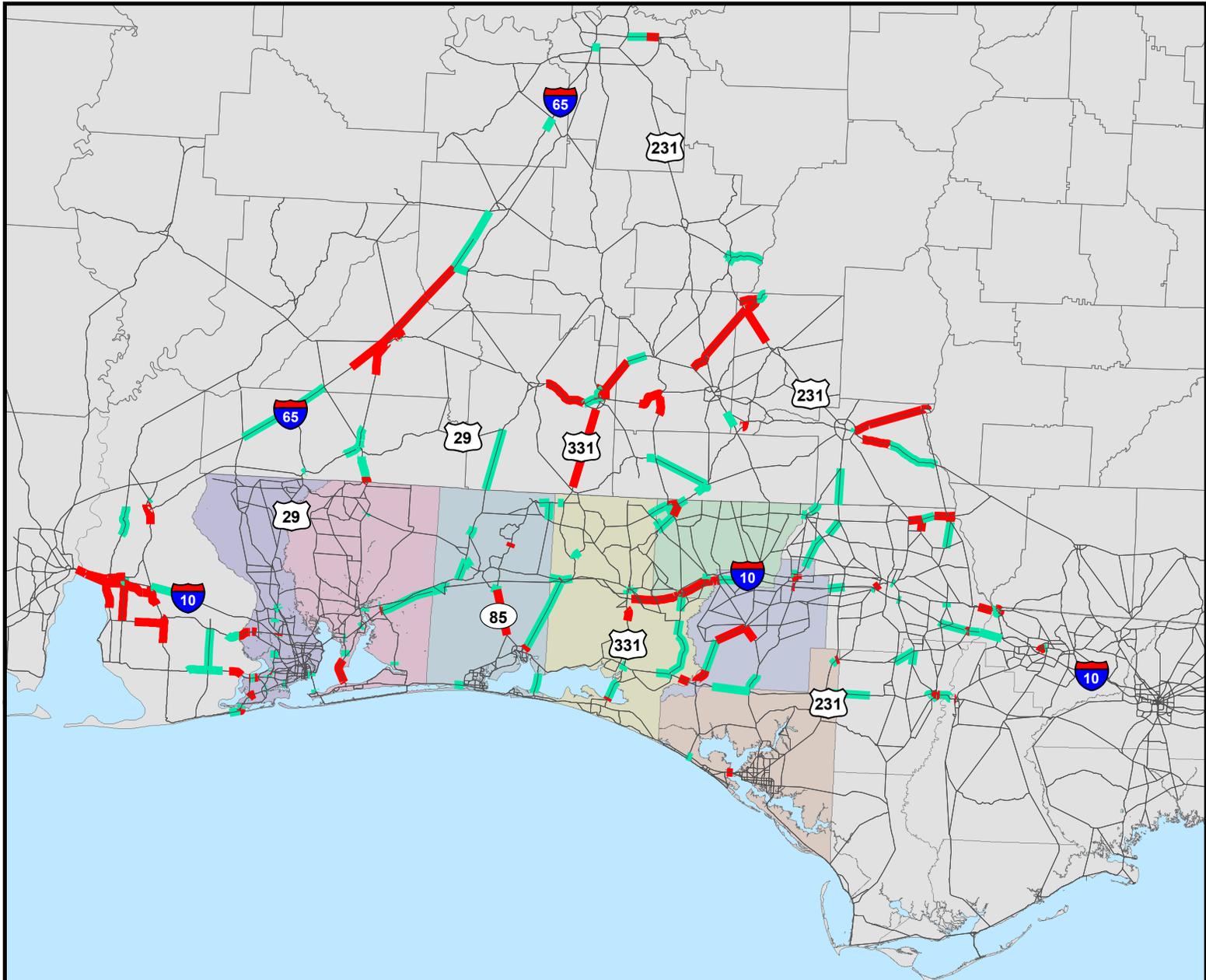
This map is prepared under the direction of Florida Division of Emergency Management for the Regional Evacuation Study Update. This map is for planning purposes only. Not to be used for measurement or legal purposes. Please consult with your county for the latest information.





# Figure IV-22

## Critical Roadway Segments with Excessive Vehicle Queues for 2015 Operational Scenario Evacuation Level D

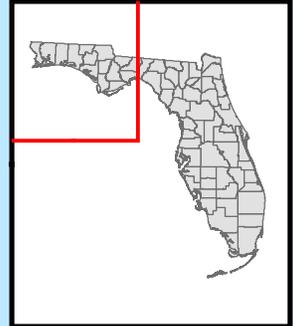


**Map Legend**

-  Critical Segments with Highest Vehicle Queues
-  Other Critical Segments
-  Other Network Roadways

0 3 6 12 18 24 Miles

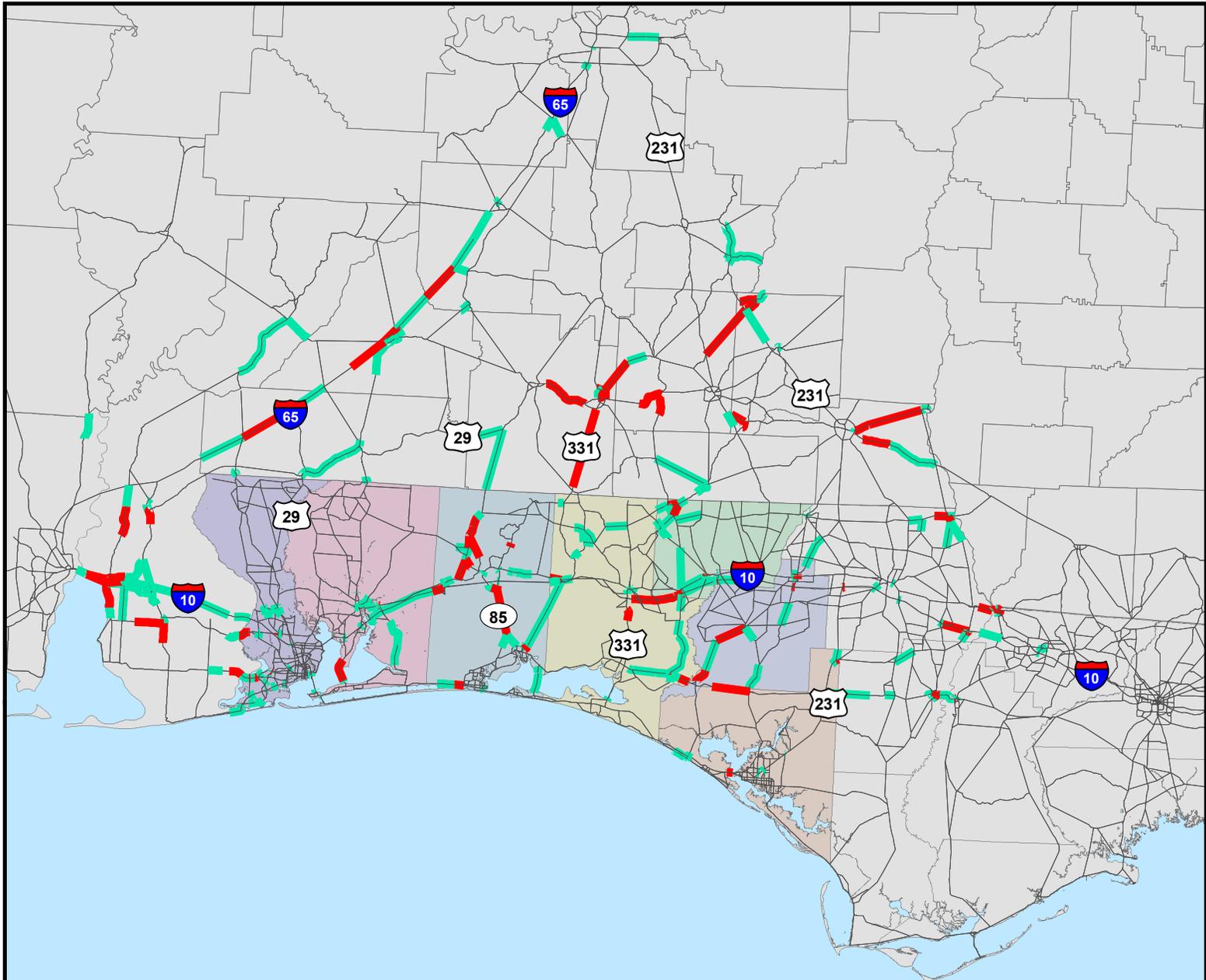
 This map is prepared under the direction of Florida Division of Emergency Management for the Regional Evacuation Study Update. This map is for planning purposes only. Not to be used for measurement or legal purposes. Please consult with your county for the latest information.





# Figure IV-23

## Critical Roadway Segments with Excessive Vehicle Queues for 2015 Operational Scenario Evacuation Level E

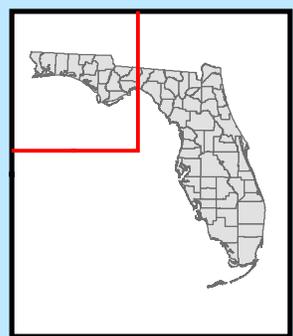


**Map Legend**

-  Critical Segments with Highest Vehicle Queues
-  Other Critical Segments
-  Other Network Roadways

0 3 6 12 18 24 Miles

This map is prepared under the direction of Florida Division of Emergency Management for the Regional Evacuation Study Update. This map is for planning purposes only. Not to be used for measurement or legal purposes. Please consult with your county for the latest information.



**Table IV-26 – Evacuating Vehicles Leaving Each County by Evacuation Route for the 2010 Operational Scenario**

	Evacuation Level A Scenario	Evacuation Level B Scenario	Evacuation Level C Scenario	Evacuation Level D Scenario	Evacuation Level E Scenario
<b>Bay County</b>					
US 98 Southbound	300	300	600	1,200	2,200
SR 22 Eastbound	100	100	200	400	800
SR 20 Eastbound	1,100	2,200	3,600	5,700	7,500
US 231 Northbound	4,700	6,100	7,400	10,700	13,400
SR 77 Northbound	500	700	1,600	3,700	5,600
SR 20 Westbound	300	400	400	300	200
SR79 Northbound	1,600	2,800	4,100	5,400	7,200
US 98 Westbound	1,600	2,700	3,200	2,800	3,000
<b>Escambia County</b>					
US 98 Eastbound	600	800	1,100	2,400	4,600
I-10 Eastbound	10,800	14,500	19,500	30,800	34,900
US 90 Eastbound	100	200	300	1,200	5,700
US 29 Northbound	1,600	2,800	6,500	14,700	22,300
US 97 Northbound	100	100	300	1,500	2,900
I-10 Westbound	5,800	8,500	12,500	15,200	17,500
US 90 Westbound	0	0	0	300	500
US 98 Westbound	400	400	600	500	900
<b>Holmes County</b>					
I-10 Eastbound	12,100	15,700	20,500	24,900	26,000
US 90 Eastbound	200	300	700	1,800	2,900
SR 2 Eastbound	500	900	1,200	2,900	3,700
SR 81 Northbound	200	500	1,600	4,000	5,500
I-10 Westbound	300	500	800	1,400	2,300
<b>Okaloosa County</b>					
US 98 Eastbound	700	800	1,500	4,900	9,200
SR 20 Eastbound	800	1,000	1,600	4,400	6,400
SR 285 Northbound	3,700	4,400	7,200	8,500	9,400
I-10 Eastbound	8,300	11,800	17,900	27,300	29,800
US 85 Eastbound	5,800	6,000	7,100	8,100	10,400
US 189 Northbound	200	600	2,400	6,100	7,200
US 4 Westbound	200	500	1,400	2,600	3,800
I-10 Westbound	3,200	5,100	6,400	5,100	5,500
US 98 Westbound	1,100	1,500	3,200	6,400	9,200
<b>Santa Rosa County</b>					
US 98 Eastbound	1,300	1,600	2,400	5,600	9,400
I-10 Eastbound	13,200	17,000	23,500	33,900	35,400
US 90 Eastbound	100	100	300	2,600	5,000
US 4 Westbound	100	100	200	1,500	4,900
US 87 Northbound	1,500	2,200	4,500	6,700	7,600
I-10 Westbound	3,900	5,600	7,500	6,800	7,800
US 98 Westbound	3,600	4,500	7,500	11,900	15,100

**Table IV-26 – Evacuating Vehicles Leaving Each County by Evacuation Route for the 2010 Operational Scenario**

	<b>Evacuation Level A Scenario</b>	<b>Evacuation Level B Scenario</b>	<b>Evacuation Level C Scenario</b>	<b>Evacuation Level D Scenario</b>	<b>Evacuation Level E Scenario</b>
<b>Walton County</b>					
US 98 Eastbound	700	1,000	1,800	5,000	9,700
SR 20 Eastbound	300	600	2,300	5,200	7,200
SR 81 Northbound	500	700	1,400	4,700	5,600
I-10 Eastbound	13,500	18,200	22,500	25,800	26,200
US 90 Eastbound	0	100	1,200	3,400	4,200
SR 2 Eastbound	200	800	2,500	4,500	6,300
US 331 Northbound	1,000	1,200	2,000	4,900	6,900
US 98 Westbound	2,200	3,700	4,600	4,300	4,800
<b>Washington County</b>					
I-10 Eastbound	8,500	12,300	18,400	25,800	28,600
US 90 Eastbound	100	100	500	800	2,300
SR 273 Northbound	5,700	6,500	7,000	6,500	6,600
I-10 Westbound	300	400	700	900	1,500
SR 20 Westbound	600	800	1,600	2,800	2,700
SR 20 Eastbound	300	300	900	2,500	4,700

**Table IV-27 – Evacuating Vehicles Leaving Each County by Evacuation Route for the 2015 Operational Scenario**

	Evacuation Level A Scenario	Evacuation Level B Scenario	Evacuation Level C Scenario	Evacuation Level D Scenario	Evacuation Level E Scenario
<b>Bay County</b>					
US 98 Southbound	300	300	700	1,600	2,800
SR 22 Eastbound	100	100	200	500	1,000
SR 20 Eastbound	1,200	2,500	4,000	5,700	7,200
US 231 Northbound	4,800	6,400	7,700	12,200	15,600
SR 77 Northbound	500	900	2,200	4,300	6,200
SR 20 Westbound	300	400	500	200	100
SR79 Northbound	1,700	2,900	4,300	5,800	7,800
US 98 Westbound	1,700	2,800	3,100	3,100	3,000
<b>Escambia County</b>					
US 98 Eastbound	600	900	1,300	3,400	6,000
I-10 Eastbound	11,800	15,800	21,700	32,500	35,300
US 90 Eastbound	100	200	300	1,900	8,900
US 29 Northbound	1,700	3,700	7,700	18,000	23,200
US 97 Northbound	100	100	300	1,800	4,600
I-10 Westbound	6,400	9,100	13,000	16,100	18,200
US 90 Westbound	0	0	100	300	700
US 98 Westbound	400	500	600	500	1,000
<b>Holmes County</b>					
I-10 Eastbound	13,500	16,600	20,900	25,900	30,400
US 90 Eastbound	400	400	700	1,300	3,100
SR 2 Eastbound	700	900	1,700	3,400	4,100
SR 81 Northbound	300	600	2,100	5,000	5,200
I-10 Westbound	300	600	900	1,700	3,000
<b>Okaloosa County</b>					
US 98 Eastbound	700	900	1,800	6,900	10,300
SR 20 Eastbound	700	900	1,600	4,700	5,700
SR 285 Northbound	3,300	4,800	7,600	9,000	11,200
I-10 Eastbound	9,600	13,200	20,000	28,700	30,400
US 85 Eastbound	6,200	6,200	7,400	8,900	10,800
US 189 Northbound	200	1,000	3,700	6,100	9,800
US 4 Westbound	200	600	1,400	2,400	4,200
I-10 Westbound	3,600	5,500	6,800	5,100	5,500
US 98 Westbound	1,100	1,600	3,100	7,500	9,500
<b>Santa Rosa County</b>					
US 98 Eastbound	1,500	1,900	3,000	7,300	11,600
I-10 Eastbound	14,600	18,600	26,400	34,400	36,800
US 90 Eastbound	100	100	400	3,600	6,400
US 4 Westbound	0	0	100	2,100	5,700
US 87 Northbound	1,800	2,600	4,900	7,500	8,100
I-10 Westbound	4,300	6,200	8,100	6,900	8,400
US 98 Westbound	3,700	4,700	7,600	12,900	15,400

**Table IV-27 – Evacuating Vehicles Leaving Each County by Evacuation Route for the 2015 Operational Scenario**

	<b>Evacuation Level A Scenario</b>	<b>Evacuation Level B Scenario</b>	<b>Evacuation Level C Scenario</b>	<b>Evacuation Level D Scenario</b>	<b>Evacuation Level E Scenario</b>
<b>Walton County</b>					
US 98 Eastbound	900	1,100	2,300	7,200	11,300
SR 20 Eastbound	500	1,100	3,300	6,400	8,100
SR 81 Northbound	700	1,100	2,800	5,400	6,400
I-10 Eastbound	15,300	19,100	23,000	25,600	28,900
US 90 Eastbound	0	200	1,500	4,000	5,000
SR 2 Eastbound	400	1,400	3,000	4,900	6,900
US 331 Northbound	1,000	1,400	2,800	5,800	7,100
US 98 Westbound	2,400	3,900	4,600	4,700	5,300
<b>Washington County</b>					
I-10 Eastbound	10,100	13,700	18,500	26,800	32,100
US 90 Eastbound	100	200	600	900	2,100
SR 273 Northbound	300	600	1,000	1,100	1,700
I-10 Westbound	1,100	1,400	1,700	2,300	3,200
SR 20 Westbound	600	900	1,900	2,500	2,400
SR 20 Eastbound	300	400	1,500	3,300	5,300

**Table IV-28 – Evacuating Vehicles Entering Each County by Evacuation Route for the 2010 Operational Scenario**

	Evacuation Level A Scenario	Evacuation Level B Scenario	Evacuation Level C Scenario	Evacuation Level D Scenario	Evacuation Level E Scenario
<b>Bay County</b>					
US 98 Eastbound	700	1,000	1,800	5,000	9,700
SR 20 Eastbound	300	300	900	2,500	4,700
<b>Escambia County</b>					
US 4 Westbound	100	100	200	1,500	4,900
I-10 Westbound	3,900	5,600	7,500	6,800	7,800
US 98 Westbound	3,600	4,500	7,500	11,900	15,100
I-10 Eastbound	2,700	3,700	5,600	12,500	19,400
US 90 Eastbound	600	800	2,400	5,400	6,800
US 98 Eastbound	3,500	3,900	4,300	6,000	6,600
<b>Holmes County</b>					
SR 81 Northbound	500	700	1,400	4,700	5,600
US 90 Eastbound	0	100	1,200	3,400	4,200
SR 2 Eastbound	200	800	2,500	4,500	6,300
I-10 Westbound	300	400	700	900	1,500
<b>Okaloosa County</b>					
US 98 Eastbound	1,300	1,600	2,400	5,600	9,400
I-10 Eastbound	13,200	17,000	23,500	33,900	35,400
US 90 Eastbound	100	100	300	2,600	5,000
US 98 Westbound	2,200	3,700	4,600	4,300	4,800
<b>Santa Rosa County</b>					
US 98 Eastbound	600	800	1,100	2,400	4,600
I-10 Eastbound	10,800	14,500	19,500	30,800	34,900
US 90 Eastbound	100	200	300	1,200	5,700
US 4 Westbound	200	500	1,400	2,600	3,800
I-10 Westbound	3,200	5,100	6,400	5,100	5,500
US 98 Westbound	1,100	1,500	3,200	6,400	9,200
<b>Walton County</b>					
US 98 Westbound	1,600	2,700	3,200	2,800	3,000
US 98 Eastbound	700	800	1,500	4,900	9,200
SR 20 Eastbound	800	1,000	1,600	4,400	6,400
I-10 Eastbound	8,300	11,800	17,900	27,300	29,800
US 85 Eastbound	5,800	6,000	7,100	8,100	10,400
I-10 Westbound	300	500	800	1,400	2,300
SR 20 Westbound	600	800	1,600	2,800	2,700
<b>Washington County</b>					
SR 77 Northbound	500	700	1,600	3,700	5,600
SR 20 Westbound	300	400	400	300	200
SR79 Northbound	1,600	2,800	4,100	5,400	7,200
I-10 Eastbound	12,100	15,700	20,500	24,900	26,000
US 90 Eastbound	200	300	700	1,800	2,900
SR 20 Eastbound	300	600	2,300	5,200	7,200
I-10 Westbound	100	100	100	100	500

**Table IV-29 – Evacuating Vehicles Entering Each County by Evacuation Route for the 2015 Operational Scenario**

	Evacuation Level A Scenario	Evacuation Level B Scenario	Evacuation Level C Scenario	Evacuation Level D Scenario	Evacuation Level E Scenario
<b>Bay County</b>					
US 98 Eastbound	900	1,100	2,300	7,200	11,300
SR 20 Eastbound	300	400	1,500	3,300	5,300
<b>Escambia County</b>					
US 4 Westbound	0	0	100	2,100	5,700
I-10 Westbound	4,300	6,200	8,100	6,900	8,400
US 98 Westbound	3,700	4,700	7,600	12,900	15,400
I-10 Eastbound	3,000	4,200	6,300	14,400	22,400
US 90 Eastbound	700	1,200	3,100	6,000	6,800
US 98 Eastbound	3,600	4,100	4,600	6,200	7,100
<b>Holmes County</b>					
SR 81 Northbound	700	1,100	2,800	5,400	6,400
US 90 Eastbound	0	200	1,500	4,000	5,000
SR 2 Eastbound	400	1,400	3,000	4,900	6,900
I-10 Westbound	1,100	1,400	1,700	2,300	3,200
<b>Okaloosa County</b>					
US 98 Eastbound	1,500	1,900	3,000	7,300	11,600
I-10 Eastbound	14,600	18,600	26,400	34,400	36,800
US 90 Eastbound	100	100	400	3,600	6,400
US 98 Westbound	2,400	3,900	4,600	4,700	5,300
<b>Santa Rosa County</b>					
US 98 Eastbound	600	900	1,300	3,400	6,000
I-10 Eastbound	11,800	15,800	21,700	32,500	35,300
US 90 Eastbound	100	200	300	1,900	8,900
US 4 Westbound	200	600	1,400	2,400	4,200
I-10 Westbound	3,600	5,500	6,800	5,100	5,500
US 98 Westbound	1,100	1,600	3,100	7,500	9,500
<b>Walton County</b>					
US 98 Westbound	1,700	2,800	3,100	3,100	3,000
US 98 Eastbound	700	900	1,800	6,900	10,300
SR 20 Eastbound	700	900	1,600	4,700	5,700
I-10 Eastbound	9,600	13,200	20,000	28,700	30,400
US 85 Eastbound	6,200	6,200	7,400	8,900	10,800
I-10 Westbound	300	600	900	1,700	3,000
SR 20 Westbound	600	900	1,900	2,500	2,400
<b>Washington County</b>					
SR 77 Northbound	500	900	2,200	4,300	6,200
SR 20 Westbound	300	400	500	200	100
SR79 Northbound	1,700	2,900	4,300	5,800	7,800
I-10 Eastbound	13,500	16,600	20,900	25,900	30,400
US 90 Eastbound	400	400	700	1,300	3,100
SR 20 Eastbound	500	1,100	3,300	6,400	8,100
I-10 Westbound	100	100	100	200	600

### Clearance Times

Clearance times for each of the operational scenarios are summarized in **Table IV-30** and **IV-31**, as well as **Figures IV-24, IV-25, and IV-26**. 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.

In-county clearance times for the 2010 operational scenarios range from 10 hours to 20 hours depending upon the scenario. Clearance Time to Shelter shows a similar pattern, with clearance times for the operational scenarios ranging from 6 hours to 17 hours depending upon the county and the scenario.

In 2015, in-county clearance times for the operational scenarios vary from 10.5 hours to 26 hours for the level E evacuation in Walton County. Clearance Time to Shelter shows a similar pattern to the 2010 scenarios, with clearance times for the base scenarios ranging from 7 hours to 20.5 hours depending upon the scenario.

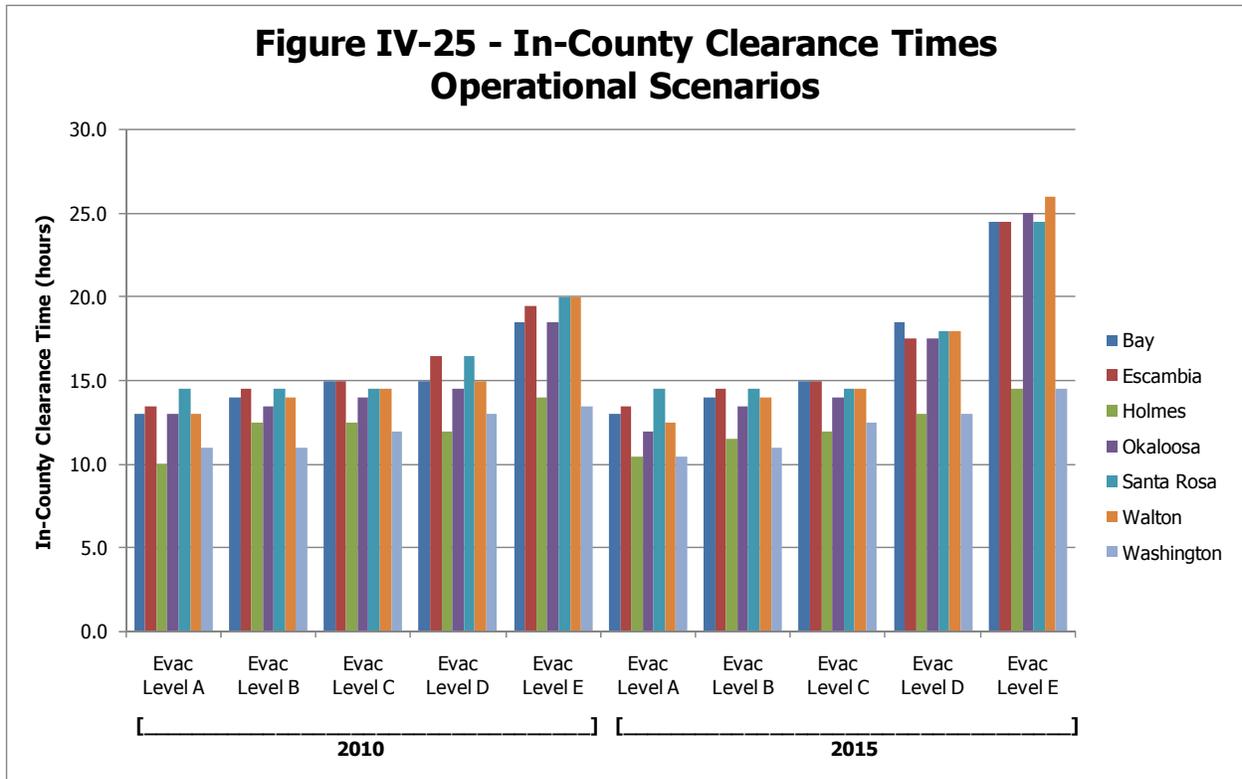
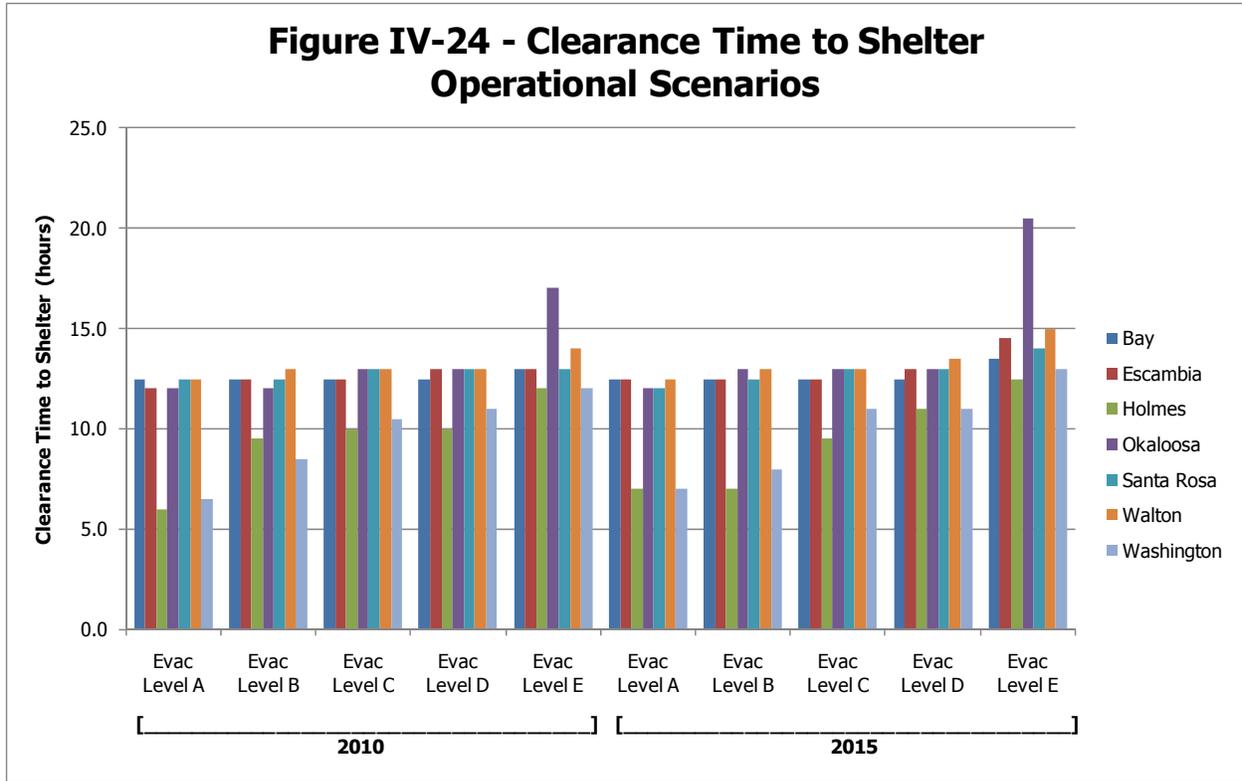
Out of county clearance times for the 2010 operational scenarios range from 14 hours to 21.5 hours for the evacuation level E scenario. Out of county clearance times generally increase for all counties in 2015 to between 13 and 26.5 hours depending upon the scenario. Regional clearance time for the seven county WFRPC region ranges from 15 hours to 21.5 hours in 2010. This time increases to between 15 and 26.5 hours in 2015.

**Table IV-30 – 2010 Clearance Times for Operational Scenarios**

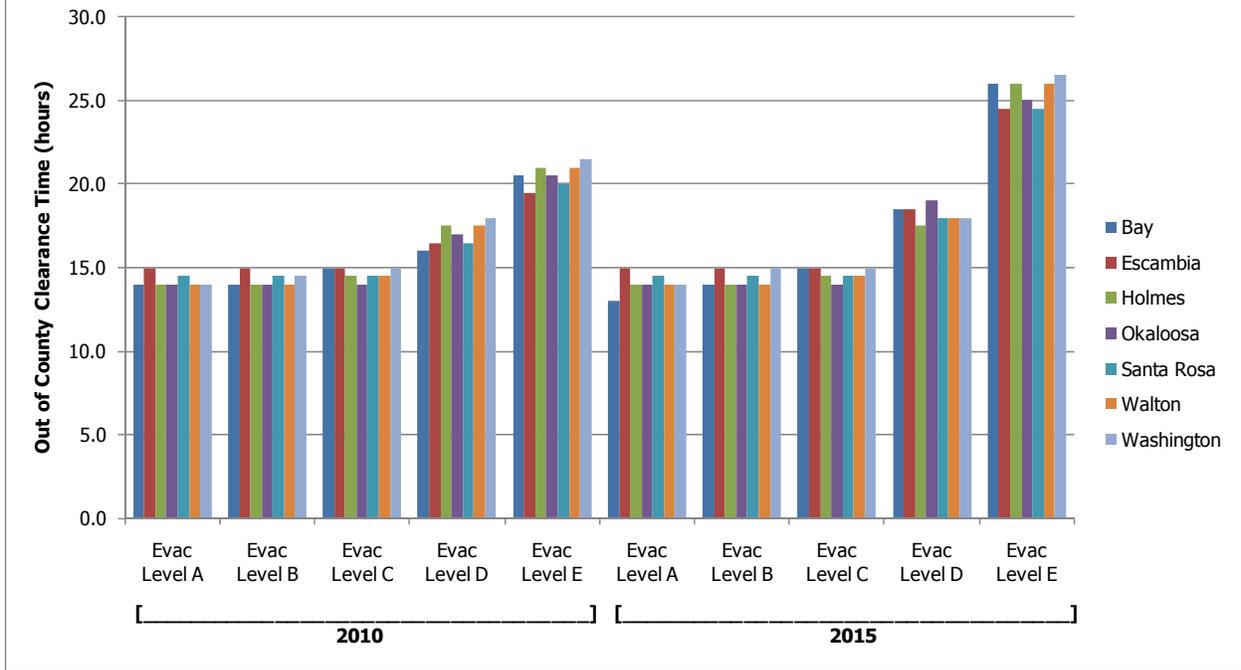
	<b>Evacuation Level A Operational Scenario</b>	<b>Evacuation Level B Operational Scenario</b>	<b>Evacuation Level C Operational Scenario</b>	<b>Evacuation Level D Operational Scenario</b>	<b>Evacuation Level E Operational Scenario</b>
<b>Clearance Time to Shelter</b>					
Bay County	12.5	12.5	12.5	12.5	13.0
Escambia County	12.0	12.5	12.5	13.0	13.0
Holmes County	6.0	9.5	10.0	10.0	12.0
Okaloosa County	12.0	12.0	13.0	13.0	17.0
Santa Rosa County	12.5	12.5	13.0	13.0	13.0
Walton County	12.5	13.0	13.0	13.0	14.0
Washington County	6.5	8.5	10.5	11.0	12.0
<b>In-County Clearance Time</b>					
Bay County	13.0	14.0	15.0	15.0	18.5
Escambia County	13.5	14.5	15.0	16.5	19.5
Holmes County	10.0	12.5	12.5	12.0	14.0
Okaloosa County	13.0	13.5	14.0	14.5	18.5
Santa Rosa County	14.5	14.5	14.5	16.5	20.0
Walton County	13.0	14.0	14.5	15.0	20.0
Washington County	11.0	11.0	12.0	13.0	13.5
<b>Out of County Clearance Time</b>					
Bay County	14.0	14.0	15.0	16.0	20.5
Escambia County	15.0	15.0	15.0	16.5	19.5
Holmes County	14.0	14.0	14.5	17.5	21.0
Okaloosa County	14.0	14.0	14.0	17.0	20.5
Santa Rosa County	14.5	14.5	14.5	16.5	20.0
Walton County	14.0	14.0	14.5	17.5	21.0
Washington County	14.0	14.5	15.0	18.0	21.5
<b>Regional Clearance Time</b>					
West Florida	15.0	15.0	15.0	18.0	21.5

**Table IV-31 – 2015 Clearance Times for Operational Scenarios**

	<b>Evacuation Level A Operational Scenario</b>	<b>Evacuation Level B Operational Scenario</b>	<b>Evacuation Level C Operational Scenario</b>	<b>Evacuation Level D Operational Scenario</b>	<b>Evacuation Level E Operational Scenario</b>
<b>Clearance Time to Shelter</b>					
Bay County	12.5	12.5	12.5	12.5	13.5
Escambia County	12.5	12.5	12.5	13.0	14.5
Holmes County	7.0	7.0	9.5	11.0	12.5
Okaloosa County	12.0	13.0	13.0	13.0	20.5
Santa Rosa County	12.0	12.5	13.0	13.0	14.0
Walton County	12.5	13.0	13.0	13.5	15.0
Washington County	7.0	8.0	11.0	11.0	13.0
<b>In-County Clearance Time</b>					
Bay County	13.0	14.0	15.0	18.5	24.5
Escambia County	13.5	14.5	15.0	17.5	24.5
Holmes County	10.5	11.5	12.0	13.0	14.5
Okaloosa County	12.0	13.5	14.0	17.5	25.0
Santa Rosa County	14.5	14.5	14.5	18.0	24.5
Walton County	12.5	14.0	14.5	18.0	26.0
Washington County	10.5	11.0	12.5	13.0	14.5
<b>Out of County Clearance Time</b>					
Bay County	13.0	14.0	15.0	18.5	26.0
Escambia County	15.0	15.0	15.0	18.5	24.5
Holmes County	14.0	14.0	14.5	17.5	26.0
Okaloosa County	14.0	14.0	14.0	19.0	25.0
Santa Rosa County	14.5	14.5	14.5	18.0	24.5
Walton County	14.0	14.0	14.5	18.0	26.0
Washington County	14.0	15.0	15.0	18.0	26.5
<b>Regional Clearance Time</b>					
West Florida	15.0	15.0	15.0	19.0	26.5



**Figure IV-26 - Out of County Clearance Times Operational Scenarios**



## H. 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 IV-32** and for 2015 in **Table IV-33**.

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.

## I. 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 IV-32 – Maximum Evacuating Population by Time Interval for 2010**

	Evacuation Level A	Evacuation Level B	Evacuation Level C	Evacuation Level D	Evacuation Level E
<b>Estimated Evacuating Population Clearing Bay County</b>					
12-Hour	54,295	70,128	81,964	86,204	65,982
18-Hour	65,606	87,660	99,040	118,530	98,974
24-Hour					131,965
36-Hour					134,714
<b>Estimated Evacuating Population Clearing Escambia County</b>					
12-Hour	41,762	55,760	71,446	70,349	83,493
18-Hour	52,203	69,700	89,307	105,524	125,239
24-Hour				123,111	153,070
36-Hour					
<b>Estimated Evacuating Population Clearing Holmes County</b>					
12-Hour	5,775	6,277	6,545	4,530	4,736
18-Hour	6,738	7,323	7,908	6,794	7,105
24-Hour				8,493	9,078
36-Hour					
<b>Estimated Evacuating Population Clearing Okaloosa County</b>					
12-Hour	22,654	35,440	60,241	60,218	72,021
18-Hour	26,430	41,347	72,791	90,327	108,031
24-Hour				110,400	138,040
36-Hour					
<b>Estimated Evacuating Population Clearing Santa Rosa County</b>					
12-Hour	31,996	37,226	54,439	47,652	53,677
18-Hour	38,662	44,981	65,781	71,478	80,515
24-Hour				85,376	100,644
36-Hour					
<b>Estimated Evacuating Population Clearing Walton County</b>					
12-Hour	20,068	26,665	31,291	22,300	22,261
18-Hour	23,413	32,220	37,810	33,450	33,391
24-Hour				41,812	44,521
36-Hour					
<b>Estimated Evacuating Population Clearing Washington County</b>					
12-Hour	7,249	7,798	8,598	5,954	6,037
18-Hour	8,759	9,422	10,748	8,930	9,056
24-Hour				11,411	12,074
36-Hour					

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

**Table IV-33 – Maximum Evacuating Population by Time Interval for 2015**

	Evacuation Level A	Evacuation Level B	Evacuation Level C	Evacuation Level D	Evacuation Level E
<b>Estimated Evacuating Population Clearing Bay County</b>					
12-Hour	60,009	74,528	84,032	60,357	61,371
18-Hour	70,010	93,160	105,040	90,535	92,057
24-Hour				120,713	122,743
36-Hour				125,743	143,200
<b>Estimated Evacuating Population Clearing Escambia County</b>					
12-Hour	43,858	58,522	74,946	59,680	71,512
18-Hour	54,822	73,152	93,683	89,520	107,268
24-Hour				119,359	143,024
36-Hour				129,306	160,902
<b>Estimated Evacuating Population Clearing Holmes County</b>					
12-Hour	5,936	6,452	6,727	3,880	4,000
18-Hour	6,925	7,527	8,129	5,821	6,000
24-Hour				7,761	8,000
36-Hour				8,731	9,333
<b>Estimated Evacuating Population Clearing Okaloosa County</b>					
12-Hour	24,669	38,401	64,341	52,387	64,641
18-Hour	28,780	44,801	77,745	78,580	96,961
24-Hour				104,773	129,281
36-Hour				117,870	148,135
<b>Estimated Evacuating Population Clearing Santa Rosa County</b>					
12-Hour	37,001	43,042	62,633	44,209	51,025
18-Hour	44,709	52,009	75,682	66,314	76,538
24-Hour				88,419	102,051
36-Hour				97,629	114,807
<b>Estimated Evacuating Population Clearing Walton County</b>					
12-Hour	24,285	32,229	37,453	23,097	24,626
18-Hour	28,332	38,943	45,256	34,646	36,939
24-Hour				46,194	49,252
36-Hour				52,931	58,487
<b>Estimated Evacuating Population Clearing Washington County</b>					
12-Hour	7,596	7,896	9,002	5,118	5,320
18-Hour	9,179	9,870	11,252	7,678	7,979
24-Hour				10,237	10,639
36-Hour				11,943	12,634

*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 West 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.

## **J. 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 WFRPC region include SR 85, US 331, SR 285, I-10, US 231, US 29, SR 77, SR 79, SR 87, US 90, US 98 and SR 281. Outside the region, I-65, US 29, US 331, and US 231 are also critical facilities in Alabama. For large storm events, such as level D and E evacuations, other State facilities also play an important role in evacuations, such as SR 20;
- 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 military installations located with the WFRPC region have an impact on regional evacuations in terms of both personnel and equipment movements. Based on current information, the equipment and on-base personnel movements were assumed in this analysis to occur prior to evacuation orders being given by local county emergency managers. Off-base military personnel and civilian personnel were included in the analysis as part of the evacuating population after the evacuation order was given. WFRPC counties should continue their coordination efforts with the military installations

to ensure evacuations are conducted as efficiently as possible;

- 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;
- Local counties and State agencies should continue development of north-south evacuation routes away from the coastal areas to help in reducing evacuation clearance times. All of the major north-south routes, such as US 231, US 331, US 29, SR 87, and SR 285, are critical in the evacuation process;
- The State can use the data and information provided in this report (specifically the evacuating vehicle maps in Volume 5-1) 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 northbound direction; and,
- The counties within the West 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.

*This page intentionally left blank.*



Funding was provided by the Florida Legislature with funding from the Federal Emergency Management Agency (FEMA) through the Florida Division of Emergency Management. Local match was provided by West Florida Regional Planning Council and the counties of Bay, Escambia, Holmes, Okaloosa, Santa Rosa, Walton and Washington.

**Florida Division of Emergency Management**  
**David Halstead, Director**  
2255 Shumard Oak Boulevard, Tallahassee, Florida 32399  
Web site: [www.floridadisaster.org](http://www.floridadisaster.org)



Prepared and published by  
West Florida Regional Council, 4081 E. Olive Rd., Ste A, Pensacola, Florida 32514  
Tel: (850) 332-7976, Fax: (850) 637-1923, E-mail: [jim.crumlish@wfrpc.org](mailto:jim.crumlish@wfrpc.org), Web site: [www.wfrpc.org](http://www.wfrpc.org)  
Study Manager: Jim Crumlish, Regional Planner  
Statewide Program Manager: Jeffery Alexander, Northeast Florida Regional Council