



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



2015



STATEWIDE
REGIONAL
EVACUATION
STUDY PROGRAM



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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). Transportation analysis is probably one of the most important components required for the development of the SRESP. Due to the complex calculations involved to look at various factors including the transportation network and evacuation population as well as the 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

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. Over the years, different planning agencies have used different modeling approaches including differing data requirements and approaches with varying degrees of complexity and mixed success. 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 SRESP transportation methodology and framework was developed during 2008 and 2009 in coordination with all eleven regional planning councils in Florida, along with the Division of Emergency Management, Department of Transportation, Department of Economic Opportunity (formerly the Department of Community Affairs), and local county emergency management teams with CDM Smith serving as the transportation consultant.

During the development of this study completed in 2012 and 2013, two meetings were held at the local and regional level to receive updated input from local county emergency management and the regional planning council.

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
- Zone System and Highway Network
- Background Traffic
- Evacuation Traffic
- Dynamic Traffic Assignment
- Prototype Model Development

Additional information regarding these components can be found in Chapter II of this volume.

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. **Figure ES-1** 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.
- **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-2**.
- **Regional Demographic Characteristics** - Demographic data were developed for the following years: 2010, 2015, and 2020. A snapshot of the key demographic data for each county in the West Florida RPC for 2010, 2015, and 2020 is summarized in **Table ES-1**.



Figure ES-1

West Florida Regional Model Network





Figure ES-2

West Florida Regional Model Transportation Evacuation Zone (TEZ) System

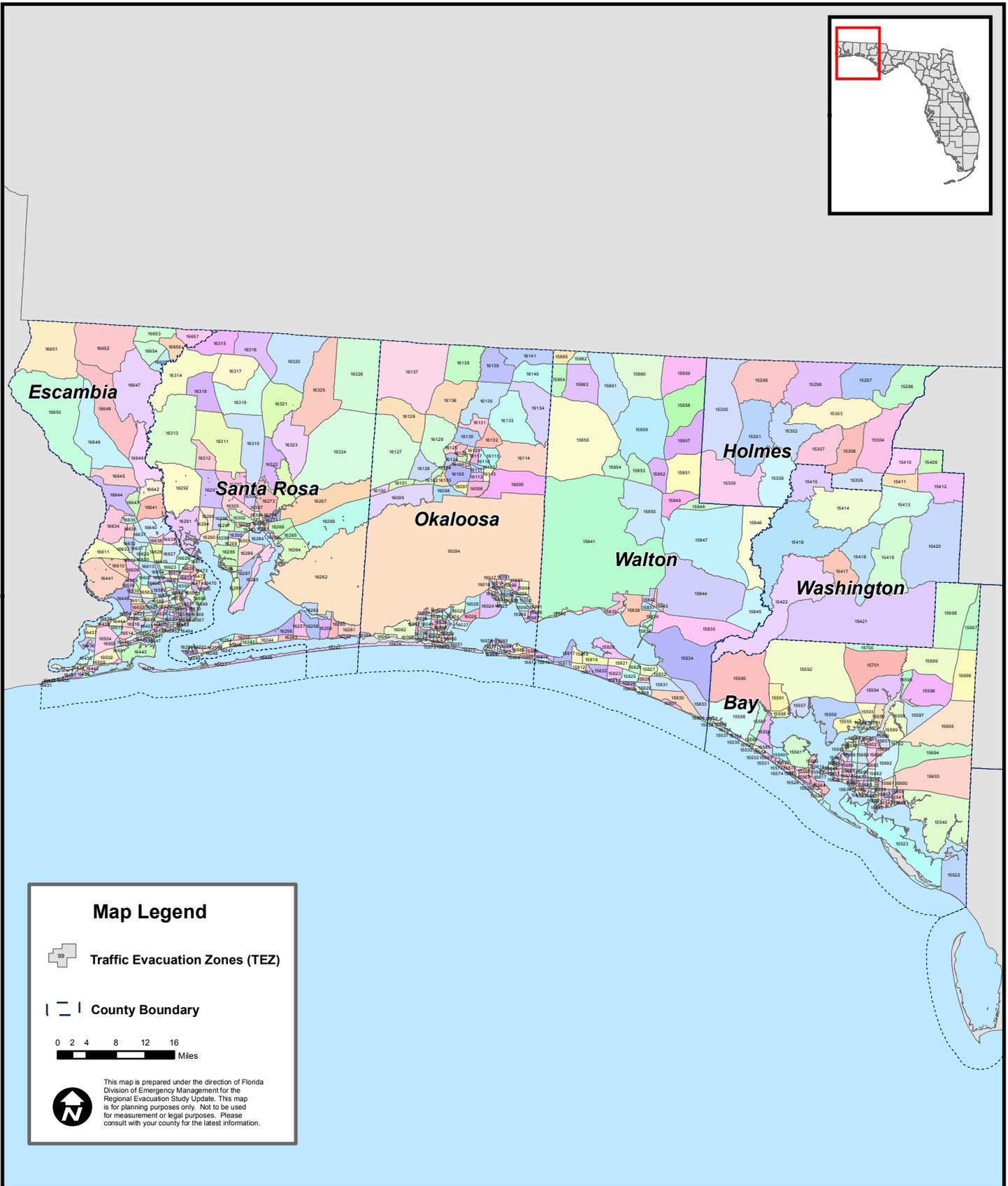


Table ES-1 – West Florida Demographic Characteristic Summary

County	Characteristic	Year		
		2010	2015	2020
Bay	Occupied site-built homes	58,107	59,913	63,484
	Population in site-built homes	140,509	144,870	153,505
	Occupied mobile homes	10,331	10,647	11,284
	Population in mobile home	24,526	25,285	26,796
	Hotel/motel units	7,887	7,690	7,690
Escambia	Occupied site-built homes	107,550	109,067	110,969
	Population in site-built homes	259,199	262,877	267,438
	Occupied mobile homes	8,688	8,810	8,963
	Population in mobile home	20,461	20,738	21,105
	Hotel/motel units	6,736	7,214	7,214
Holmes	Occupied site-built homes	5,152	5,214	5,340
	Population in site-built homes	12,835	12,986	13,306
	Occupied mobile homes	2,202	2,225	2,282
	Population in mobile home	5,360	5,418	5,553
	Hotel/motel units	200	257	257
Okaloosa	Occupied site-built homes	67,913	71,644	74,254
	Population in site-built homes	165,775	174,811	181,139
	Occupied mobile homes	4,466	4,709	4,880
	Population in mobile home	10,164	10,790	11,224
	Hotel/motel units	5,066	4,931	4,931
Santa Rosa	Occupied site-built homes	49,547	53,320	58,608
	Population in site-built homes	128,778	138,589	152,323
	Occupied mobile homes	7,363	7,925	8,709
	Population in mobile home	18,350	19,750	21,707
	Hotel/motel units	709	791	791
Walton	Occupied site-built homes	17,104	18,845	21,230
	Population in site-built homes	40,760	44,904	50,580
	Occupied mobile homes	5,197	5,725	6,448
	Population in mobile home	12,218	13,463	15,165
	Hotel/motel units	7,012	7,395	8,101
Washington	Occupied site-built homes	5,958	6,102	6,409
	Population in site-built homes	15,096	15,467	16,239
	Occupied mobile homes	2,906	2,976	3,124
	Population in mobile home	7,106	7,274	7,640
	Hotel/motel units	261	261	261

Source: West Florida Regional Planning Council

- **Planned Roadway Improvements** - The base 2010 network and two future year networks to correspond to the 2015 demographic data and the 2020 demographic data was developed. The 2010 base model network was updated to reflect roadway capacity improvement projects completed between 2011 and 2015 to create the 2015 network. The 2015 network was then updated to reflect planned roadway capacity improvement projects expected to be implemented between 2016 and 2020 to create the 2020 network.

Table ES-2 identifies capacity improvement projects completed between 2011 and 2015 that were included in the 2015 network. Likewise, **Table ES-3** identifies capacity improvement projects planned for implementation between 2016 and 2020. The tables identify each roadway that will be improved as well as the extent of the improvement.

It is important to note that **Tables 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.

Table ES-2 – West Florida Roadway Improvements, 2011 – 2015

County	Roadway	From	To	Number of Lanes
Bay	SR 77 (Cove/MLK Blvd)	US 98 BUS (SR 30)	SR 75 (US 231)	6
	Grand Lagoon Bridge/Thomas Dr	End of 4 lane	End of 4 lane	4
	South Thomas Dr	SR 30/Front Beach Rd	N Thomas Dr	4
Escambia	I-110 (SR 8A)	Maxwell St	Airport Blvd	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
	Mid-Bay Bridge Rd	N End of Bridge	Range Road	4
	Mid-Bay Bridge Rd	Range Rd	SR 85	2
	SR 85	General Bond Rd	SR 123	6
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
	SR 87	Eglin AFB Boundary	2 Miles S of Yellow River	4
Walton	SR 83 (US 331)	N End of Choctaw Bay Bridge	S of SR 20	4
Washington	SR 79	Strickland Rd	I-10 (SR 8)	4
	SR 79 Holmes Creek Bridge (No. 610008)			4

Sources: *FDOT, West Florida Regional Planning Council*

Note: *Projects included in this table are roadway improvement projects completed between 2011 and 2015 on roadways that are included in the regional transportation model network. Only projects which added roadway capacity, such as additional through lanes, were included. The list is not intended to be all inclusive of every transportation improvement project completed within the region. A list of historical projects completed during the last five years was included in this report because the base regional network developed for the study, along with the base demographic data, is for the year 2010.*

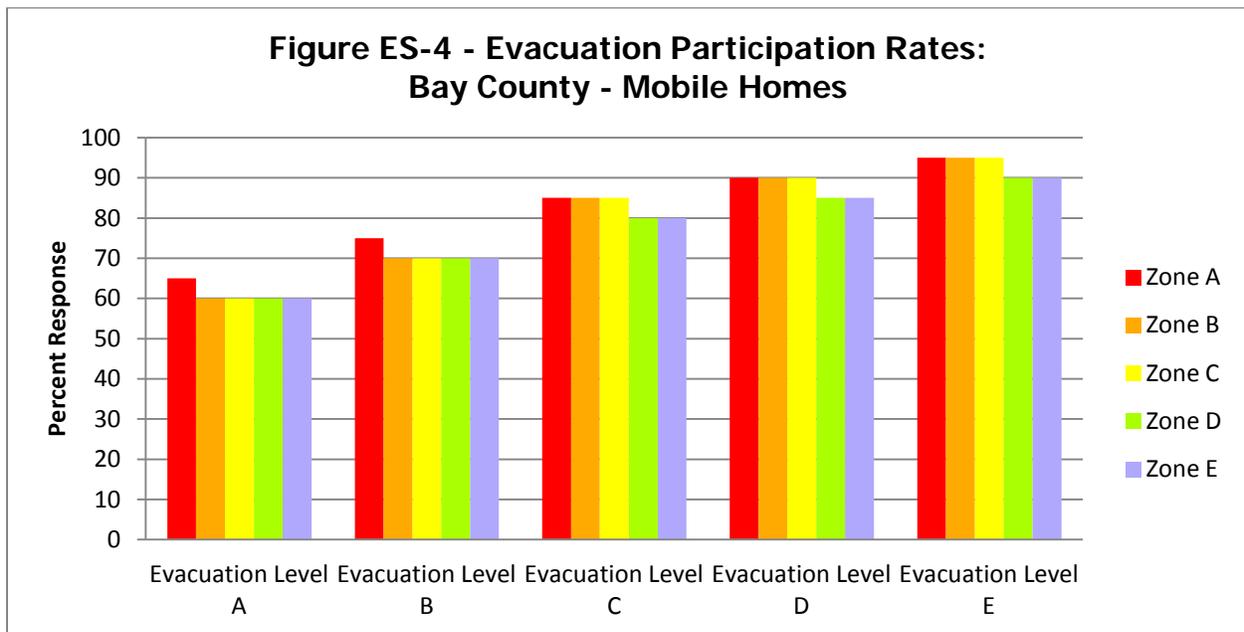
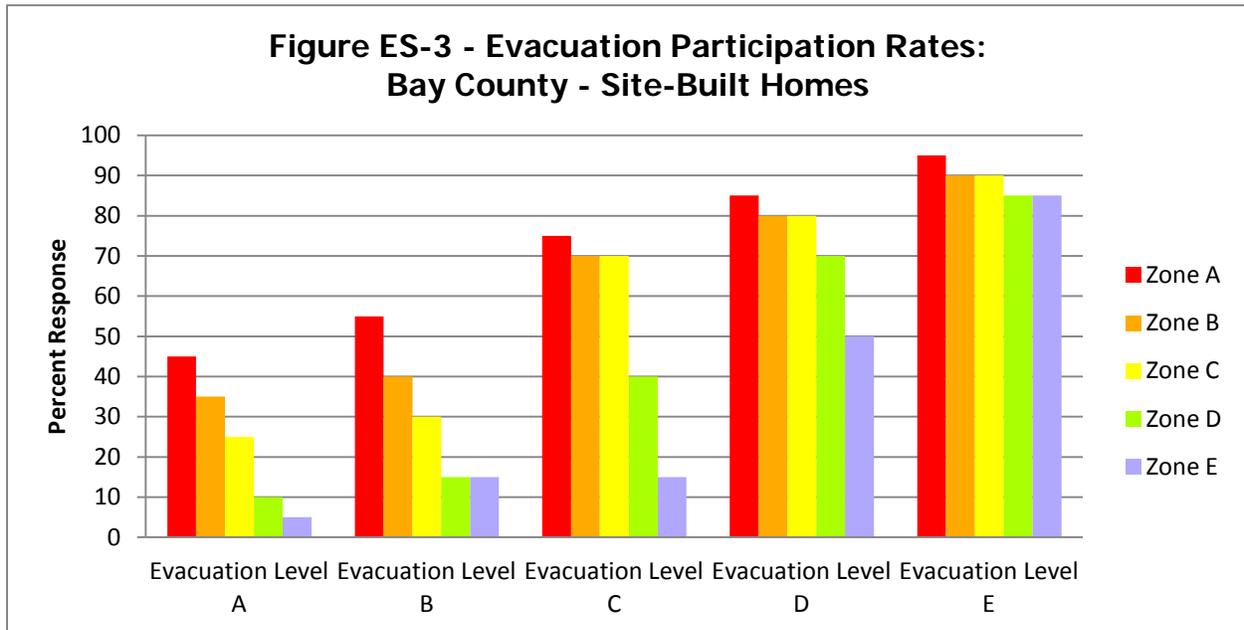
Table ES-3 - West Florida Planned Roadway Improvements, 2016–2020

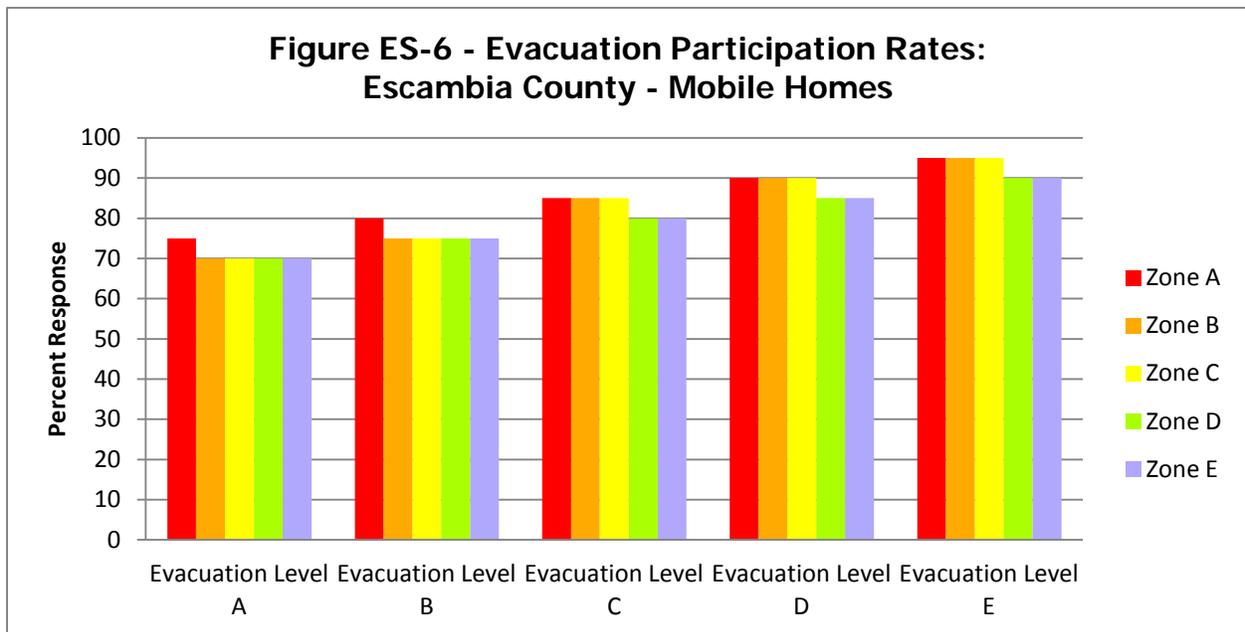
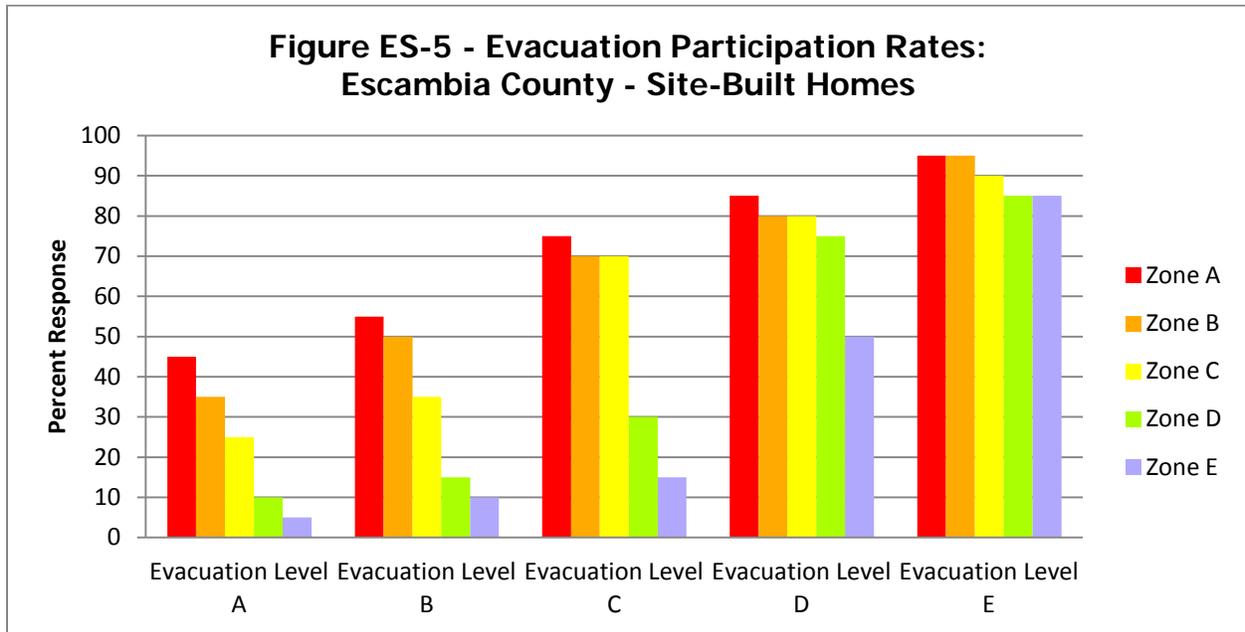
County	Roadway	From	To	Number of Lanes
Bay	Baldwin Rd/CR 2312	SR 390/St Andrews Blvd	Minnesota Ave	4
	SR 390 (St. Andrews)	23rd St (SR 368)	Jenks Ave	6
	SR 390 (St. Andrews)	Jenks Ave	Ohio Ave (SR 77)	6
	US 98 at 23rd St (SR 368)			N/A
	Jenks Ave	23rd St	Baldwin Rd	4
Escambia	I-10	SR 291	US 90	6
	US 29 (SR 95)	I-10 (SR 8)	9 and 1/2 Mile Rd	6
	Longleaf Dr	SR 297/Pine Forest Rd	Wymart Rd	4
	SR 10 (US 90A)/9 Mile Rd	SR 297/Pine Forest Rd	SR 95 (US 29)	4
	SR 10 (US 90A)/9 Mile Rd	CR 99/Beulah Rd	SR 8 (I-10)	4
	SR 10 (US 90A)/9 Mile Rd	SR 8 (I-10)	SR 297/Pine Forest Rd	4
Okaloosa	SR 123	N of Turkey Creek	SR 85 N	4
	PJ Adams Pkwy	SR 85 (S Ferdon Blvd)	Key Lime Place	4
	PJ Adams Pkwy	Key Lime Place	Ashley Drive	4
	SR 123	North of SR 85 S	North of Toms Creek	4
	SR 123	North of Toms Creek	North of Turkey Creek	4
Santa Rosa	SR 87	2 Miles S of Yellow River	CR 184	4
	I-10 (SR 8)	East end of Escambia Bay Bridge	SR 281/Avalon Blvd	6
Walton	SR 83 (US 331)	N of SR 20	I-10 (SR 8)	4
	SR 83 (US 331)	S end of Choctawhatchee Bay Bridge	N end of Choctawhatchee Bay Bridge	4
	SR 30 (US 98)	Emerald Bay Dr	Tang-O-Mar Dr	8
	SR 83 (US 331)	N of W Indian Creek Ranch	N of CR 278	4
Washington	SR 77	Bay County Line	CR 276 (Clayton Rd)	4

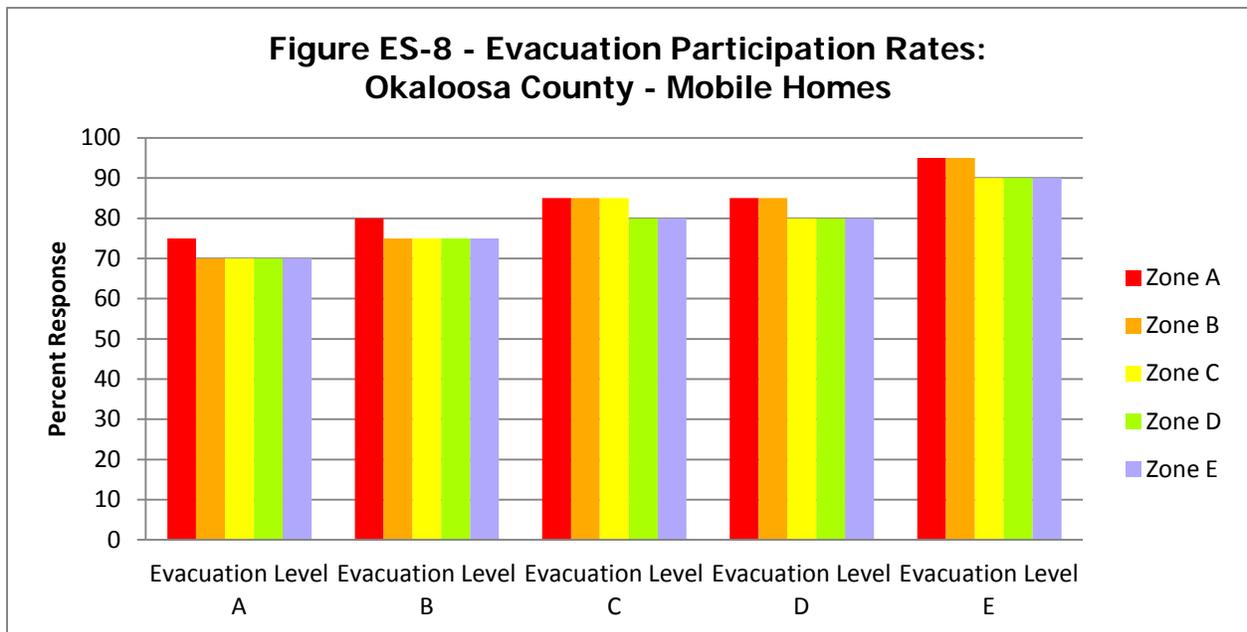
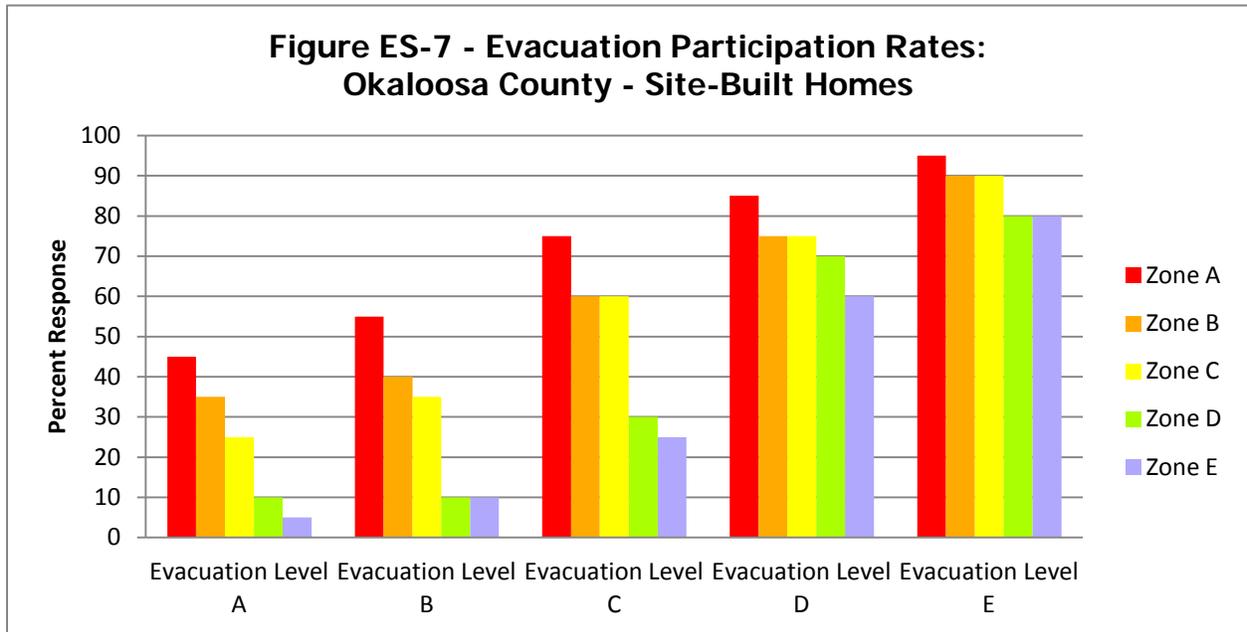
Sources: FDOT, West Florida Regional Planning Council

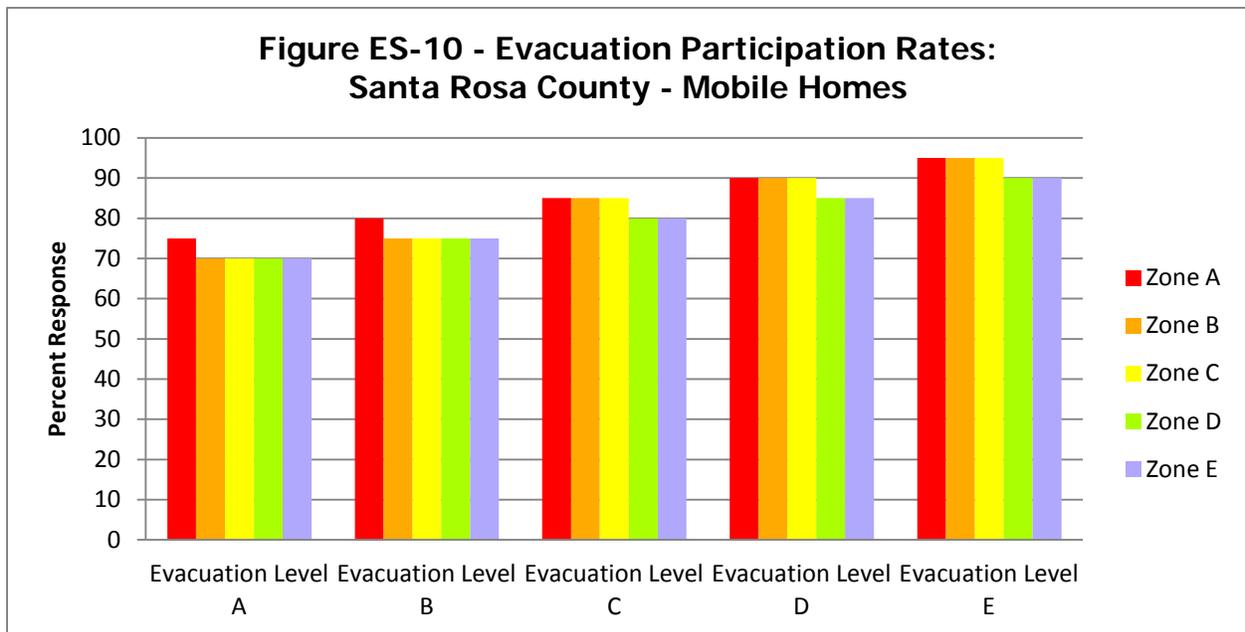
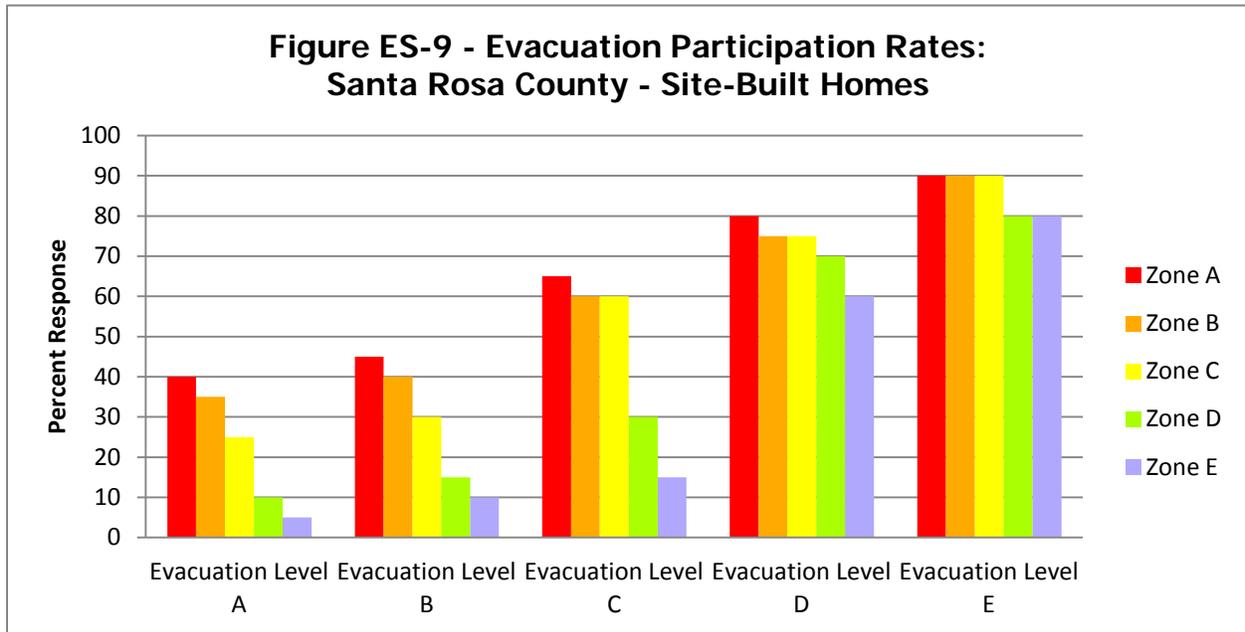
Note: Projects included in this table are roadway improvement projects planned for completion between 2016 and 2020 on roadways that are included in the regional transportation model network. Only projects which are planned to add roadway capacity, such as additional through lanes, were included. The list is not intended to be all inclusive of every transportation improvement project planned for completion within the region.

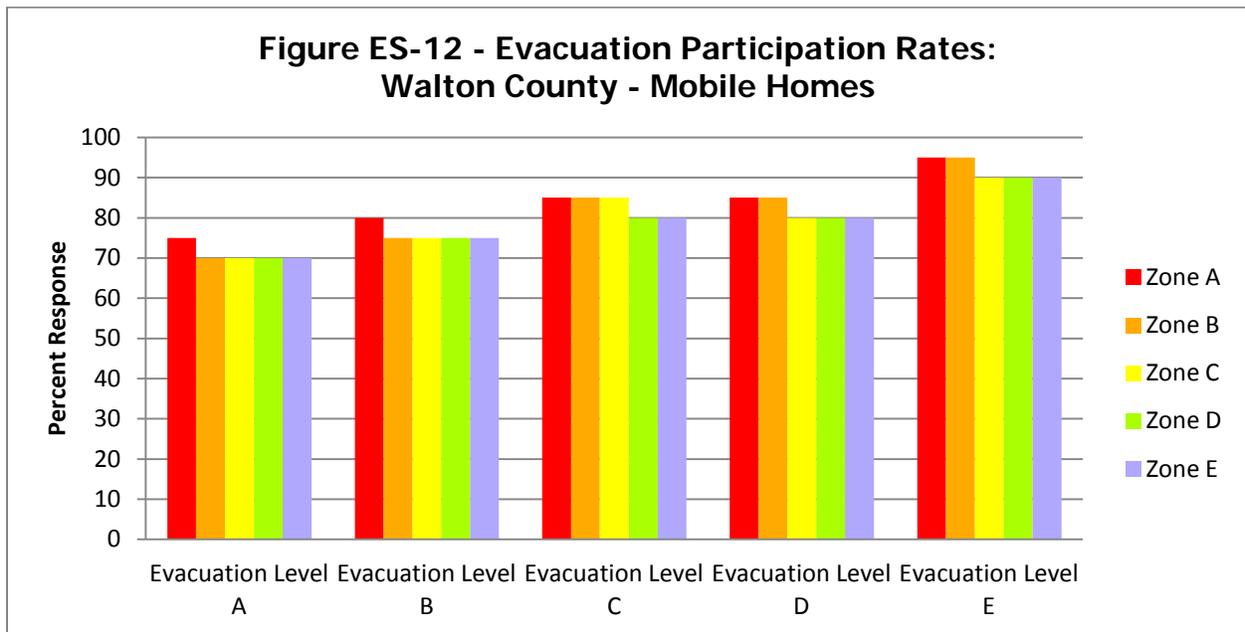
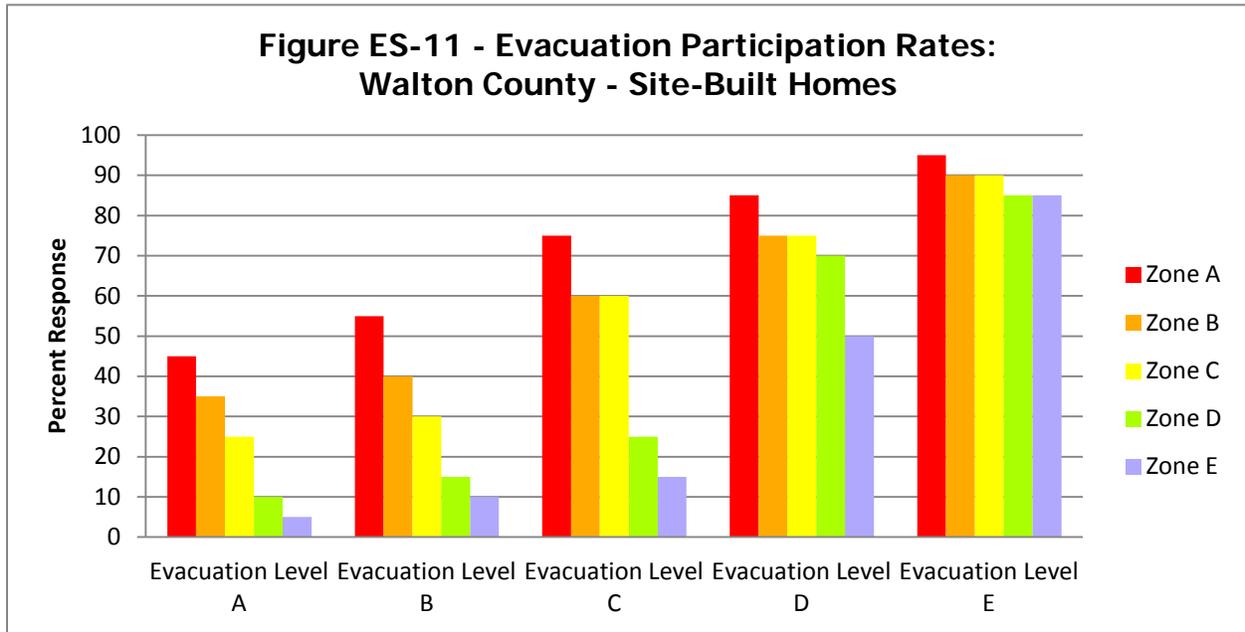
- Behavioral Assumptions** - For the West Florida Region, evacuation rates for site-built homes and mobile/manufactured homes are provided by county and summarized in **Figure ES-3** through **Figure ES-12**. Shadow evacuation rates are also included. Other rates, such as out of county trip rates, vehicle 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.









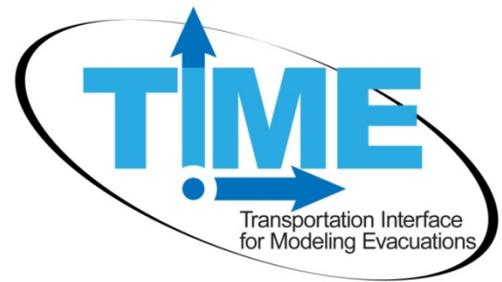


- **Shelters** - In order for the transportation model to accurately assign public shelter trips to the correct location, a complete list of available public shelters needs to be available. The shelters were categorized as either primary or other, with primary indicating that the shelter is compliant with American Red Cross standards for a shelter and other indicating all other shelters. In the seven county region there is a total of 77 shelters which can host more than 79,000 persons during an evacuation event.
- **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. County level evacuation zones are included in Volume 5-1.

F. TIME User Interface

CDM Smith 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 2015 is identified in **Table ES-4**, summarized by evacuation zone and split between site-built homes and mobile/manufactured homes. Vulnerable population for 2020 is summarized in **Table ES-5**.

Table ES-4 – Vulnerable Population in the West Florida Region for 2015

	Evacuation Zone A	Evacuation Zone B	Evacuation Zone C	Evacuation Zone D	Evacuation Zone E
Bay County					
Site-built Homes	25,150	5,289	6,934	7,732	11,808
Mobile/Manuf. Homes	2,863	810	784	776	1,074
TOTAL	28,013	6,099	7,718	8,508	12,882
Escambia County					
Site-built Homes	5,799	5,038	7,892	7,148	9,308
Mobile/Manuf. Homes	240	373	503	520	655
TOTAL	6,038	5,411	8,395	7,667	9,963
Okaloosa County					
Site-built Homes	919	4,109	12,435	17,205	27,350
Mobile/Manuf. Homes	16	52	271	408	351
TOTAL	935	4,161	12,706	17,613	27,702
Santa Rosa County					
Site-built Homes	6,849	6,011	12,683	4,747	13,263
Mobile/Manuf. Homes	977	576	1,161	549	766
TOTAL	7,826	6,587	13,844	5,295	14,028
Walton County					
Site-built Homes	6,619	7,879	6,674	441	807
Mobile/Manuf. Homes	1,146	1,050	726	311	612
TOTAL	7,765	8,929	7,400	752	1,419

Note: Vulnerable population determined using SRESP small area 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 2020

	Evacuation Zone A	Evacuation Zone B	Evacuation Zone C	Evacuation Zone D	Evacuation Zone E
Bay County					
Site-built Homes	26,647	5,605	7,347	8,192	12,511
Mobile/Manuf. Homes	3,034	858	831	824	1,139
TOTAL	29,682	6,463	8,178	9,015	13,650
Escambia County					
Site-built Homes	5,898	5,126	8,030	7,273	9,470
Mobile/Manuf. Homes	243	378	511	528	666
TOTAL	6,141	5,505	8,541	7,801	10,136
Okaloosa County					
Site-built Homes	952	4,259	12,888	17,832	28,343
Mobile/Manuf. Homes	17	53	282	422	366
TOTAL	969	4,313	13,170	18,254	28,710
Santa Rosa County					
Site-built Homes	7,528	6,606	13,940	5,218	14,579
Mobile/Manuf. Homes	1,073	633	1,276	602	840
TOTAL	8,601	7,239	15,216	5,820	15,419
Walton County					
Site-built Homes	7,456	8,873	7,517	497	910
Mobile/Manuf. Homes	1,290	1,184	817	350	689
TOTAL	8,746	10,057	8,334	847	1,599

Note: Vulnerable population determined using SRESP small area 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 2015 and in **Table ES-7** for 2020.

Table ES-6 – Vulnerable Population by Destination for 2015

	Evacuation Zone A	Evacuation Zone B	Evacuation Zone C	Evacuation Zone D	Evacuation Zone E
Bay County					
To Friends and Family	17,094	3,741	4,709	5,183	7,836
To Hotel/ Motel	6,574	1,403	1,812	2,011	3,059
To Public Shelter	1,544	345	425	232	344
To Other Destination	2,801	610	772	1,083	1,642
Escambia County					
To Friends and Family	4,215	3,769	5,852	5,341	6,941
To Hotel/ Motel	1,196	1,064	1,654	1,507	1,960
To Public Shelter	314	289	445	409	531
To Other Destination	314	289	445	409	531
Okaloosa County					
To Friends and Family	562	2,499	7,637	10,588	16,639
To Hotel/ Motel	232	1,035	3,149	4,362	6,890
To Public Shelter	19	85	262	881	1,385
To Other Destination	122	542	1,657	1,782	2,788
Santa Rosa County					
To Friends and Family	4,451	3,709	7,788	2,995	7,830
To Hotel/ Motel	2,152	1,861	3,921	1,479	4,055
To Public Shelter	235	358	750	292	740
To Other Destination	988	659	1,384	530	1,403
Walton County					
To Friends and Family	4,385	5,016	4,143	444	842
To Hotel/ Motel	1,827	2,127	1,777	157	294
To Public Shelter	190	289	237	38	71
To Other Destination	1,363	1,497	1,243	113	213

Note: Vulnerable population destinations determined using SRESP small area 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 2020

	Evacuation Zone A	Evacuation Zone B	Evacuation Zone C	Evacuation Zone D	Evacuation Zone E
Bay County					
To Friends and Family	18,112	3,963	4,990	5,491	8,304
To Hotel/ Motel	6,965	1,487	1,920	2,130	3,242
To Public Shelter	1,636	366	450	246	364
To Other Destination	2,968	646	818	1,147	1,740
Escambia County					
To Friends and Family	4,287	3,834	5,953	5,434	7,062
To Hotel/ Motel	1,216	1,082	1,683	1,534	1,994
To Public Shelter	319	294	453	416	540
To Other Destination	319	294	453	416	540
Okaloosa County					
To Friends and Family	582	2,590	7,916	10,974	17,244
To Hotel/ Motel	241	1,073	3,264	4,521	7,141
To Public Shelter	20	88	272	913	1,435
To Other Destination	126	562	1,718	1,847	2,889
Santa Rosa County					
To Friends and Family	4,891	4,076	8,560	3,291	8,606
To Hotel/ Motel	2,366	2,045	4,310	1,626	4,458
To Public Shelter	258	394	825	321	813
To Other Destination	1,086	724	1,522	582	1,542
Walton County					
To Friends and Family	4,939	5,650	4,666	501	948
To Hotel/ Motel	2,058	2,396	2,002	177	331
To Public Shelter	214	325	266	42	80
To Other Destination	1,536	1,686	1,400	127	240

Note: Vulnerable population destinations determined using SRESP small area 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.

The vulnerable shadow population is provided in **Table ES-8** for both 2015 and 2020. 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-8 – Vulnerable Shadow Evacuation Population

	Evacuation Level A	Evacuation Level B	Evacuation Level C	Evacuation Level D	Evacuation Level E
2015					
Bay County	32,196	43,511	45,460	54,939	59,054
Escambia County	39,402	50,326	60,086	83,488	100,989
Holmes County	6,065	6,714	7,364	8,014	8,664
Okaloosa County	24,063	31,399	42,950	59,632	57,827
Santa Rosa County	29,965	28,868	34,773	48,270	49,579
Walton County	22,572	35,610	35,848	37,955	38,061
Washington County	8,027	8,799	10,343	11,115	11,887
2020					
Bay County	34,115	45,909	47,805	57,823	62,045
Escambia County	40,051	51,164	61,091	84,901	102,706
Holmes County	6,222	6,887	7,551	8,216	8,881
Okaloosa County	24,977	32,560	44,421	61,658	59,650
Santa Rosa County	32,920	31,648	38,129	53,392	54,445
Walton County	25,309	39,573	39,791	42,164	42,283
Washington County	8,440	9,250	10,871	11,682	12,492

Note: Vulnerable shadow population determined using SRESP behavioral data and county provided evacuation zones. As opposed to Tables ES-4 through ES-7, vulnerable population numbers used for this table are inclusive, meaning population numbers listed for a higher zone are included in the lower zone. For example, vulnerable population listed for Evacuation Zone B does include vulnerable population listed for Evacuation Zone A. The resulting numbers are then subtracted from the evacuating population as reported in the modeling results to provide the vulnerable shadow evacuation population amount by county, per evacuation level.

H. Evacuation Model Scenarios

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 RC area. The base scenarios for the West Florida 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. The operational scenarios for the West Florida 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 fourteen 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: 1) Clearance Time to Shelter, 2) In-County Clearance Time, 3) Out of County Clearance Time, and 4) Regional Clearance Time. Definitions for these clearance times are found in Chapter IV of this volume.

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**.

Table ES-9 – Base Scenarios

	Scenario 1 Level A 2015	Scenario 2 Level B 2015	Scenario 3 Level C 2015	Scenario 4 Level D 2015	Scenario 5 Level E 2015
Demographic Data	2015	2015	2015	2015	2015
Highway Network	2015	2015	2015	2015	2015
One-Way Operations	None	None	None	None	None
University Population	Fall/Spring	Fall/Spring	Fall/Spring	Fall/Spring	Fall/Spring
Tourist Rate	Default	Default	Default	Default	Default
Shelters Open	Primary	Primary	Primary	Primary	Primary
Response Curve	12-hour	12-hour	12-hour	12-hour	12-hour
Evacuation Phasing	None	None	None	None	None
Behavioral Response	100%	100%	100%	100%	100%
Evacuation Zone	A	B	C	D	E
Counties Evacuating	Bay Escambia Holmes Okaloosa Santa Rosa Walton Washington Baldwin (AL) Gulf				
	Scenario 6 Level A 2020	Scenario 7 Level B 2020	Scenario 8 Level C 2020	Scenario 9 Level D 2020	Scenario 10 Level E 2020
Demographic Data	2020	2020	2020	2020	2020
Highway Network	2020	2020	2020	2020	2020
One-Way Operations	None	None	None	None	None
University Population	Fall/Spring	Fall/Spring	Fall/Spring	Fall/Spring	Fall/Spring
Tourist Rate	Default	Default	Default	Default	Default
Shelters Open	Primary	Primary	Primary	Primary	Primary
Response Curve	12-hour	12-hour	12-hour	12-hour	12-hour
Evacuation Phasing	None	None	None	None	None
Behavioral Response	100%	100%	100%	100%	100%
Evacuation Zone	A	B	C	D	E
Counties Evacuating	Bay Escambia Holmes Okaloosa Santa Rosa Walton Washington Baldwin (AL) Gulf				

Table ES-10 – 2015 Clearance Times for Base Scenario

	Evacuation Level A Base Scenario	Evacuation Level B Base Scenario	Evacuation Level C Base Scenario	Evacuation Level D Base Scenario	Evacuation Level E Base Scenario
Clearance Time to Shelter					
Bay County	13.0	13.0	13.0	13.0	13.0
Escambia County	13.0	13.5	13.5	13.5	14.0
Holmes County	12.5	12.5	12.5	13.0	14.0
Okaloosa County	12.5	12.5	13.0	14.0	15.0
Santa Rosa County	13.0	13.0	13.0	14.5	15.0
Walton County	13.5	14.5	16.5	17.5	19.0
Washington County	13.0	13.0	13.0	15.5	15.5
In-County Clearance Time					
Bay County	16.0	16.5	17.0	28.5	32.0
Escambia County	14.5	15.5	17.5	26.0	30.0
Holmes County	13.0	13.0	13.0	13.5	14.5
Okaloosa County	12.5	15.0	16.0	27.0	31.0
Santa Rosa County	14.5	15.5	17.0	26.5	30.5
Walton County	14.5	16.0	16.5	28.0	31.5
Washington County	13.5	13.5	13.5	16.0	16.0
Out of County Clearance Time					
Bay County	16.0	17.0	17.5	28.5	32.5
Escambia County	15.0	16.0	17.5	26.5	30.0
Holmes County	15.0	16.0	16.5	28.0	32.0
Okaloosa County	14.5	15.5	17.0	27.0	31.0
Santa Rosa County	15.0	16.0	17.5	26.5	30.5
Walton County	15.0	16.0	16.5	28.0	31.5
Washington County	15.0	16.5	17.5	28.0	32.0
Regional Clearance Time					
West Florida	16.0	17.0	17.5	28.5	32.0

Table ES-11 – 2020 Clearance Times for Base Scenario

	Evacuation Level A Base Scenario	Evacuation Level B Base Scenario	Evacuation Level C Base Scenario	Evacuation Level D Base Scenario	Evacuation Level E Base Scenario
Clearance Time to Shelter					
Bay County	13.0	13.0	13.0	13.0	12.5
Escambia County	13.0	13.0	13.5	13.5	13.5
Holmes County	12.5	12.5	12.5	13.5	15.0
Okaloosa County	13.0	12.5	13.0	13.5	15.0
Santa Rosa County	13.0	13.0	13.0	13.5	14.0
Walton County	13.0	13.5	13.5	14.0	15.0
Washington County	13.0	13.0	15.0	15.0	14.0
In-County Clearance Time					
Bay County	16.0	17.0	18.5	29.0	31.5
Escambia County	14.5	15.0	15.5	26.5	29.5
Holmes County	13.0	13.0	13.0	14.0	15.5
Okaloosa County	13.0	15.0	17.0	27.5	30.0
Santa Rosa County	14.5	15.0	16.5	27.0	29.5
Walton County	15.0	16.0	17.5	28.5	31.0
Washington County	13.5	13.5	15.5	15.5	14.5
Out of County Clearance Time					
Bay County	16.0	17.0	18.5	29.0	31.5
Escambia County	15.0	15.5	16.0	26.5	29.5
Holmes County	15.0	16.5	17.5	28.5	31.0
Okaloosa County	14.5	15.5	17.0	27.5	30.5
Santa Rosa County	15.0	15.0	16.5	27.0	29.5
Walton County	15.0	16.0	17.5	28.5	31.0
Washington County	15.5	16.5	17.5	28.5	31.5
Regional Clearance Time					
West Florida	16.0	17.0	18.5	29.0	31.5

Table ES-12 – Operational Scenarios

	Scenario 1 Level A 2015	Scenario 2 Level B 2015	Scenario 3 Level C 2015	Scenario 4 Level D 2015	Scenario 5 Level E 2015
Demographic Data	2015	2015	2015	2015	2015
Highway Network	2015	2015	2015	2015	2015
One-Way Operations	None	None	None	None	None
University Population	Fall/Spring	Fall/Spring	Fall/Spring	Fall/Spring	Fall/Spring
Tourist Rate	Default	Default	Default	Default	Default
Shelters Open	Primary	Primary	Primary	Primary	Primary
Response Curve	12-hour	12-hour	12-hour	12-hour	12-hour
Evacuation Phasing	None	None	None	None	None
Behavioral Response	Planning	Planning	Planning	Planning	Planning
Evacuation Zone	A	B	C	D	E
Counties Evacuating	Bay Escambia Holmes Okaloosa Santa Rosa Walton Washington Baldwin (AL) Gulf				
	Scenario 6 Level A 2020	Scenario 7 Level B 2020	Scenario 8 Level C 2020	Scenario 9 Level D 2020	Scenario 10 Level E 2020
Demographic Data	2020	2020	2020	2020	2020
Highway Network	2020	2020	2020	2020	2020
One-Way Operations	None	None	None	None	None
University Population	Fall/Spring	Fall/Spring	Fall/Spring	Fall/Spring	Fall/Spring
Tourist Rate	Default	Default	Default	Default	Default
Shelters Open	Primary	Primary	Primary	Primary	Primary
Response Curve	12-hour	12-hour	12-hour	12-hour	12-hour
Evacuation Phasing	None	None	None	None	None
Behavioral Response	Planning	Planning	Planning	Planning	Planning
Evacuation Zone	A	B	C	D	E
Counties Evacuating	Bay Escambia Holmes Okaloosa Santa Rosa Walton Washington Baldwin (AL) Gulf				

Table ES-13 – 2015 Clearance Times for Operational Scenarios

	Evacuation Level A Operational Scenario	Evacuation Level B Operational Scenario	Evacuation Level C Operational Scenario	Evacuation Level D Operational Scenario	Evacuation Level E Operational Scenario
Clearance Time to Shelter					
Bay County	12.5	12.5	12.5	13.0	13.0
Escambia County	13.0	13.0	13.0	13.5	13.5
Holmes County	12.5	12.5	12.5	12.5	14.0
Okaloosa County	13.0	13.0	13.0	13.0	13.5
Santa Rosa County	13.0	13.0	13.0	13.0	15.0
Walton County	13.0	13.0	14.5	16.0	18.5
Washington County	12.5	13.0	13.0	13.5	13.5
In-County Clearance Time					
Bay County	15.5	15.5	15.5	22.5	26.5
Escambia County	14.5	15.5	15.5	19.5	23.5
Holmes County	13.0	13.0	13.0	13.0	14.5
Okaloosa County	13.0	13.5	14.5	21.0	25.0
Santa Rosa County	15.0	15.0	15.0	20.0	24.0
Walton County	14.5	14.5	15.0	21.5	25.5
Washington County	13.0	13.5	13.5	14.0	14.0
Out of County Clearance Time					
Bay County	15.5	15.5	16.0	22.5	26.5
Escambia County	15.5	15.5	15.5	20.0	24.0
Holmes County	15.0	15.0	15.5	21.5	25.5
Okaloosa County	14.5	15.0	15.0	21.0	25.0
Santa Rosa County	15.0	15.5	15.5	20.5	24.0
Walton County	15.0	15.0	15.0	21.5	25.5
Washington County	15.0	15.0	16.5	21.5	25.5
Regional Clearance Time					
West Florida	15.5	15.5	16.5	22.5	26.5

Table ES-14 – 2020 Clearance Times for Operational Scenarios

	Evacuation Level A Operational Scenario	Evacuation Level B Operational Scenario	Evacuation Level C Operational Scenario	Evacuation Level D Operational Scenario	Evacuation Level E Operational Scenario
Clearance Time to Shelter					
Bay County	12.5	12.5	13.0	13.0	13.0
Escambia County	13.0	13.0	13.0	13.5	14.0
Holmes County	12.5	12.5	13.0	13.0	13.5
Okaloosa County	13.0	13.0	13.0	13.5	14.0
Santa Rosa County	13.0	13.0	13.0	13.5	14.0
Walton County	13.0	13.0	13.5	14.0	14.0
Washington County	12.5	12.5	13.0	13.5	15.5
In-County Clearance Time					
Bay County	15.5	15.5	15.5	21.5	26.5
Escambia County	14.5	15.0	15.5	18.5	23.5
Holmes County	13.0	13.0	13.5	13.5	14.0
Okaloosa County	13.0	14.5	14.5	20.0	25.0
Santa Rosa County	15.0	15.0	15.5	19.5	24.0
Walton County	14.5	14.5	15.5	20.5	25.5
Washington County	13.0	13.0	13.5	14.0	16.0
Out of County Clearance Time					
Bay County	15.5	15.5	16.0	22.0	26.5
Escambia County	15.0	15.5	15.5	19.0	24.0
Holmes County	15.0	15.0	15.5	20.5	25.5
Okaloosa County	14.5	14.5	15.0	20.0	25.0
Santa Rosa County	15.0	15.0	15.5	19.5	24.5
Walton County	15.0	15.0	15.5	20.5	25.5
Washington County	15.0	15.5	16.5	20.5	25.5
Regional Clearance Time					
West Florida	15.5	15.5	16.5	22.0	26.5

Clearance times reported for all scenarios reflect impacts from changes in population from the 2000 and 2010 U.S. Census. The 2010 SRESP study used 2000 U.S. Census data for its base and forecasts using characteristics from American Community Survey for 2006, 2010, and 2015. For the 2013 update to the SRESP, data from the 2010 U.S. Census indicate a decrease in population for the Region as compared to the previous study's 2010 and 2015 population projections. In addition to this decrease, the distribution of the population in the WFRPC region also changed.

Furthermore, the 2013 SRESP update also included additional shelter capacity and roadway improvement projects which resulted in additional roadway capacity on the evacuation roadway network for the WFRPC region. County emergency managers also submitted revised evacuation zones for the six counties within the Region. These changes have impacts on the resulting clearance times reported for 2015 and 2020 of this study update and generally results in lower clearance times as compared to the previous 2010 study. Since the methodology and approach differs in major input variables (a decrease in regional population, re-defined evacuation zones, additional roadway and shelter capacity), SRESP users should be mindful when comparing results from the previous study and the updated study.

Base Scenarios

In-county clearance times for the base scenarios range from 12.5 hours for the evacuation level A scenarios in Okaloosa County to 32 hours for evacuation level E scenario in Bay County in 2015. Clearance Time to Shelter shows a similar pattern, with clearance times for the base scenarios ranging from 12.5 hours for the evacuation level A scenarios in Holmes and Okaloosa Counties to 19 hours in Walton County for evacuation level E scenario in 2015.

In 2020, in-county clearance times for the base scenarios range from 13 hours for the evacuation level A scenarios to 31.5 hours for the evacuation level E scenario. Clearance Time to Shelter shows a similar pattern, with clearance times for the base scenarios ranging from 12.5 hours for the evacuation level A scenarios to 15 hours for evacuation level E scenario in 2020.

Out of county clearance times for the base scenarios range from 14.5 hours for the base evacuation level A scenario to 32.5 hours for the evacuation level E scenario in 2015. Out of county clearance times range from 14.5 hours for the base evacuation level A scenario to 31.5 hours in 2020.

Regional clearance time for the seven county WFRPC region ranges from 16 hours to 32 hours in 2015 and from 16 and 31.5 hours in 2020.

Operational Scenarios

In-county clearance times for the 2015 operational scenarios range from 13 hours to 26.5 hours depending upon the scenario. Clearance Time to Shelter for the operational scenarios ranges from 12.5 hours to 18.5 hours depending upon the county and the scenario.

In 2020, in-county clearance times for the operational scenarios also vary from 13 hours to 26.5 hours depending upon the scenario. Clearance Time to Shelter for the operational scenarios ranges from 12.5 hours to 15.5 hours depending upon the scenario.

Out of county clearance times for the 2015 operational scenarios range from 14.5 hours to 26.5 hours. Out of county clearance times also range from 14.5 hours to 26.5 hours in 2020 depending upon the scenario. Regional clearance time for the seven county WFRPC Region ranges from 15.5 hours to 26.5 hours in both 2015 and 2020.

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. Using the base scenarios, which assume 100% of the vulnerable population is evacuating, along with shadow evacuations and evacuations from adjacent counties, an estimate was made of the evacuating population actually able to evacuate out of each county by the time intervals of 12, 18, 24, and 36 hours. The estimated maximum evacuating population by time interval for 2015 is identified in **Table ES-15** and for 2020 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.

Table ES-15 – Maximum Evacuating Population by Time Interval for 2015

	Evacuation Level A	Evacuation Level B	Evacuation Level C	Evacuation Level D	Evacuation Level E
Estimated Evacuating Population Clearing Bay County					
12-Hour	45,157	54,793	59,856	44,327	45,147
18-Hour	60,209	77,623	87,290	66,491	67,721
24-Hour				88,654	90,295
36-Hour				105,277	122,274
Estimated Evacuating Population Clearing Escambia County					
12-Hour	36,352	46,331	54,809	50,264	55,385
18-Hour	45,440	61,775	79,930	75,396	83,078
24-Hour				100,528	110,770
36-Hour				111,000	138,463
Estimated Evacuating Population Clearing Holmes County					
12-Hour	4,852	5,036	5,356	3,435	3,249
18-Hour	6,065	6,714	7,364	5,152	4,874
24-Hour				6,869	6,498
36-Hour				8,014	8,664
Estimated Evacuating Population Clearing Okaloosa County					
12-Hour	20,688	28,254	42,884	42,243	46,817
18-Hour	24,998	36,495	60,752	63,365	70,226
24-Hour				84,486	93,634
36-Hour				95,047	120,944
Estimated Evacuating Population Clearing Santa Rosa County					
12-Hour	30,233	32,460	43,220	37,051	38,226
18-Hour	37,791	43,280	63,029	55,577	57,340
24-Hour				74,102	76,453
36-Hour				81,821	97,159
Estimated Evacuating Population Clearing Walton County					
12-Hour	24,270	39,228	43,594	26,915	24,505
18-Hour	30,337	52,304	59,942	40,372	36,758
24-Hour				53,829	49,010
36-Hour				62,801	64,326
Estimated Evacuating Population Clearing Washington County					
12-Hour	6,422	6,399	7,092	4,764	4,458
18-Hour	8,027	8,799	10,343	7,145	6,686
24-Hour				9,527	8,915
36-Hour				11,115	11,887

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 2020

	Evacuation Level A	Evacuation Level B	Evacuation Level C	Evacuation Level D	Evacuation Level E
Estimated Evacuating Population Clearing Bay County					
12-Hour	47,848	57,920	59,758	45,997	49,155
18-Hour	63,797	82,053	89,637	68,996	73,733
24-Hour			92,127	91,994	98,310
36-Hour				111,160	129,032
Estimated Evacuating Population Clearing Escambia County					
12-Hour	36,954	48,627	60,959	51,120	57,287
18-Hour	46,192	62,810	81,278	76,679	85,930
24-Hour				102,239	114,574
36-Hour				112,889	140,830
Estimated Evacuating Population Clearing Holmes County					
12-Hour	4,978	5,009	5,178	3,459	3,438
18-Hour	6,222	6,887	7,551	5,189	5,157
24-Hour				6,919	6,876
36-Hour				8,216	8,881
Estimated Evacuating Population Clearing Okaloosa County					
12-Hour	21,473	29,297	44,380	42,922	49,206
18-Hour	25,946	37,842	62,872	64,383	73,809
24-Hour				85,844	98,412
36-Hour				98,363	125,065
Estimated Evacuating Population Clearing Santa Rosa County					
12-Hour	33,217	37,990	50,316	40,119	43,419
18-Hour	41,521	47,488	69,185	60,178	65,129
24-Hour				80,237	86,839
36-Hour				90,267	106,739
Estimated Evacuating Population Clearing Walton County					
12-Hour	27,244	43,782	45,894	29,536	27,819
18-Hour	34,055	58,376	66,929	44,304	41,729
24-Hour				59,072	55,638
36-Hour				70,148	71,866
Estimated Evacuating Population Clearing Washington County					
12-Hour	6,534	6,727	7,454	4,919	4,759
18-Hour	8,440	9,250	10,871	7,378	7,138
24-Hour				9,837	9,518
36-Hour				11,682	12,492

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.

K. Summary and Conclusions

Through a review of the results of the 24 different scenarios (10 base and 10 operational), several conclusions could be reached 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 within 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 management 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;

- Demographic data from the 2010 US Census identifies a change in population for the seven county region from estimates used in previous studies. This change is a decrease from previous 2010 and 2015 population projections used in the 2010 WFRPC Evacuation Transportation Analysis. This population change is reflected in both the 2015 and 2020 population projections used in this study; 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.

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.

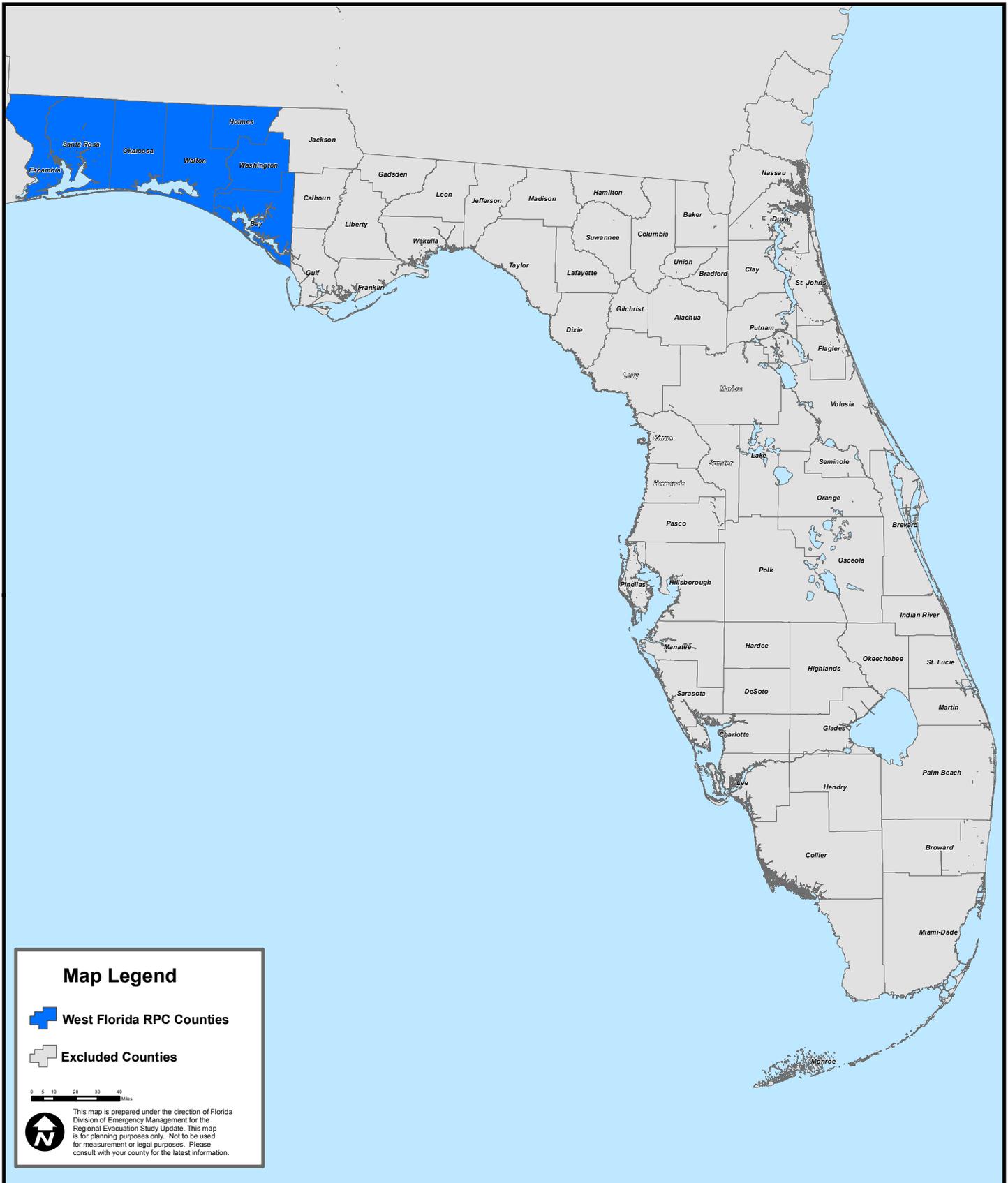
B. Study Area

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

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

Regional Meeting No. 1 – Scenario Development Update Meeting

The first regional meeting for the West Florida region was held on March 5, 2015 at 9:30 AM, as part of the Region 1 FDEM Quarterly Meeting. The purpose of the scenario development update meeting was to review the West Florida small area data, discuss the base scenarios for the region for growth management purposes, and discuss and receive input on the operational scenarios to be evaluated for emergency management purposes.

Regional Meeting No. 2 – Transportation Analysis Update Meeting

The second and final regional meeting (web conference format with CDM Smith) for the West Florida region was held on August 17, 2015 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.

D. Study Comparisons

It is important to note that this study contains significant updates and revisions in comparison to the 2010 SRESP study for the WFRPC region. These revisions include updates to population projections based on the 2010 Census, new evacuation zones based on updated topography data, modifications to the roadway network due to recently completed and planned construction projects, and changes to the location and size of available shelters. These revisions have significant impacts on evacuating vehicle behavior for the region and caused changes to the calculated clearance times in each county. These updates and revisions make comparisons to the previous 2010 study difficult.

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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, and periodically from this time to incorporate features. The methodology used in this West Florida Region Evacuation Transportation Analysis was updated to accommodate new versions of Cube Voyager and Cube Avenue software 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?

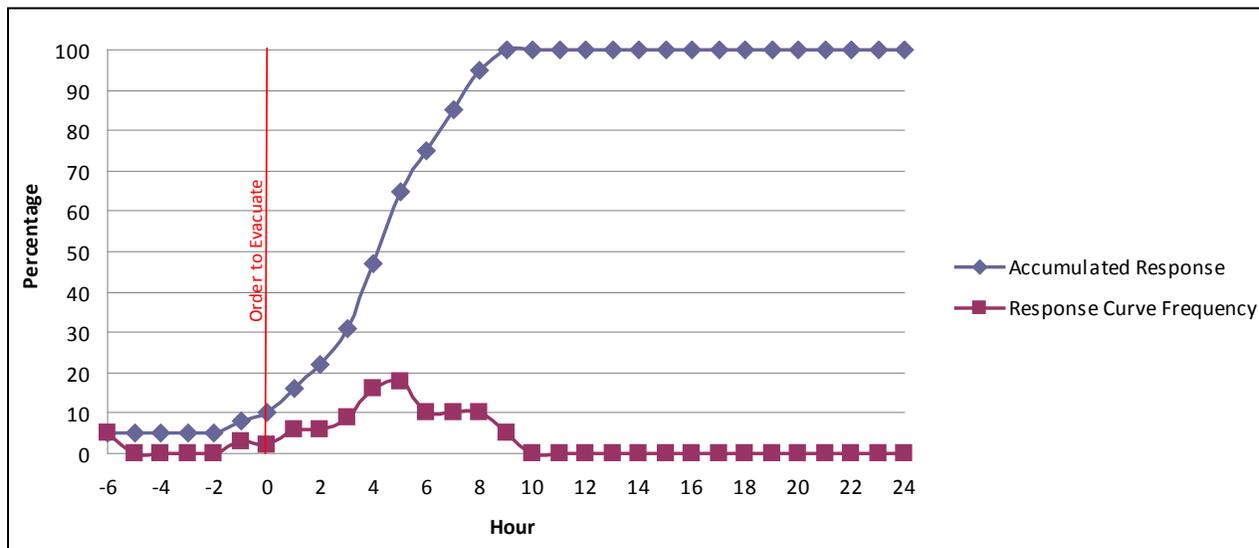
The evacuation rate indicates the percent of residents who will leave their homes to go someplace safer in each storm threat scenario. The evacuation rates are based on the following assumptions: that the storm track passes very close to the area being evacuated; and officials order evacuation for surge 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 West Florida Regional Council developed their small area data by utilizing Census 2010 geography. Data were developed for the following years: 2010, 2015, and 2020.

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 8,829 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 (latest model available) 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 aerials 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, aerials 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 2010 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

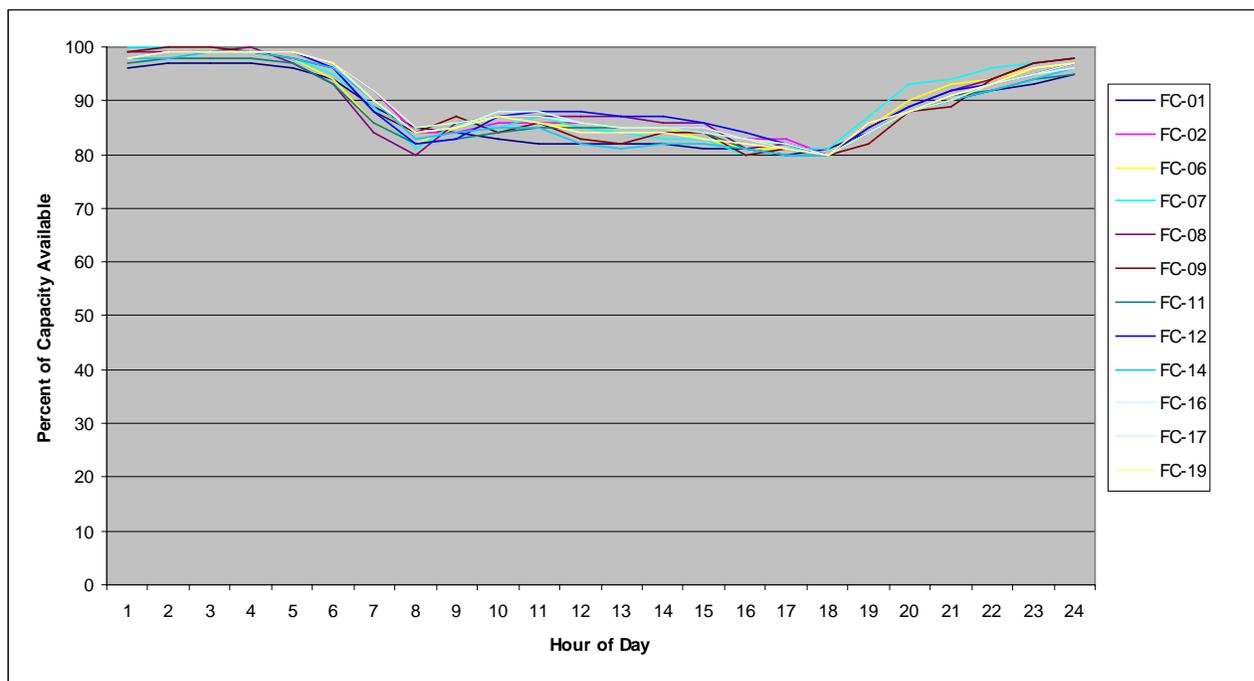
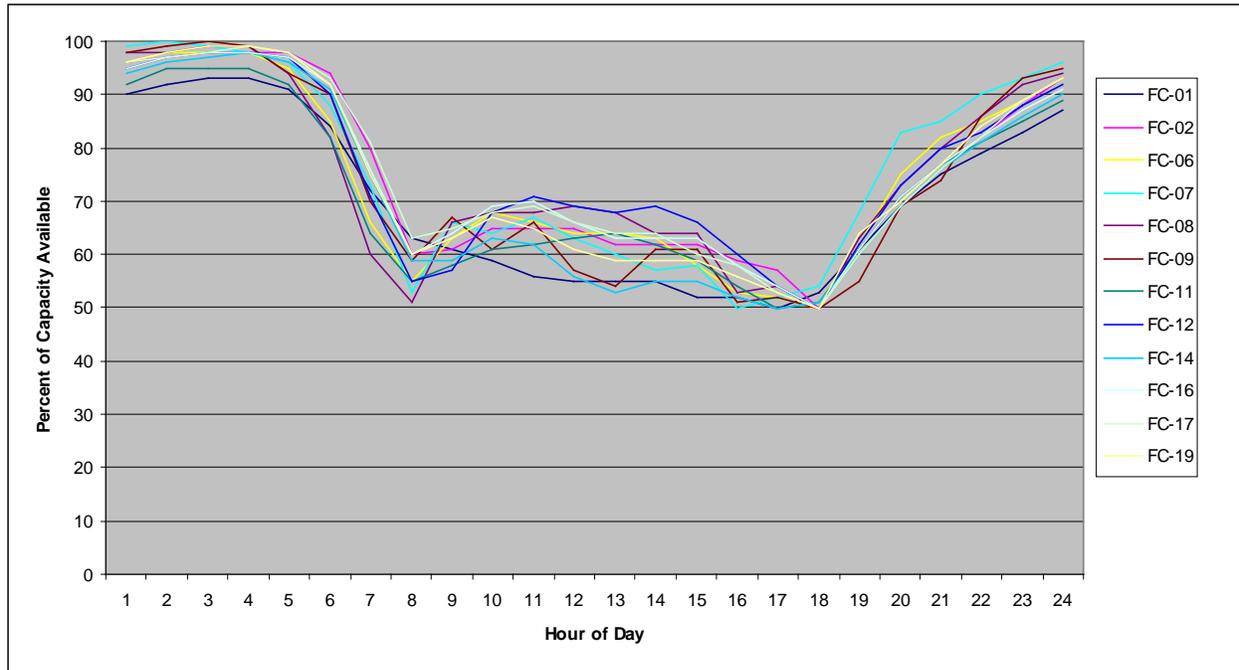
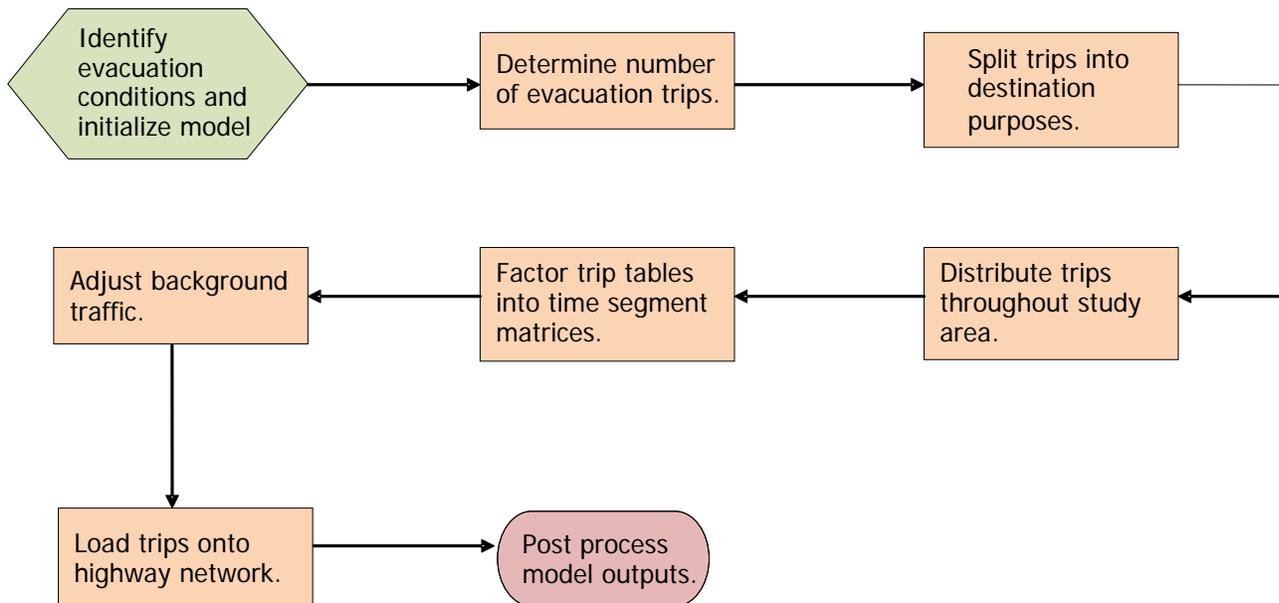


Figure II-3 – Percent of Available Capacity for Other Counties

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

To From	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

CDM Smith 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 West Florida Regional Planning Council area 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 (the latest model available) 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 2010 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



Figure III-1

West Florida Regional Model Area

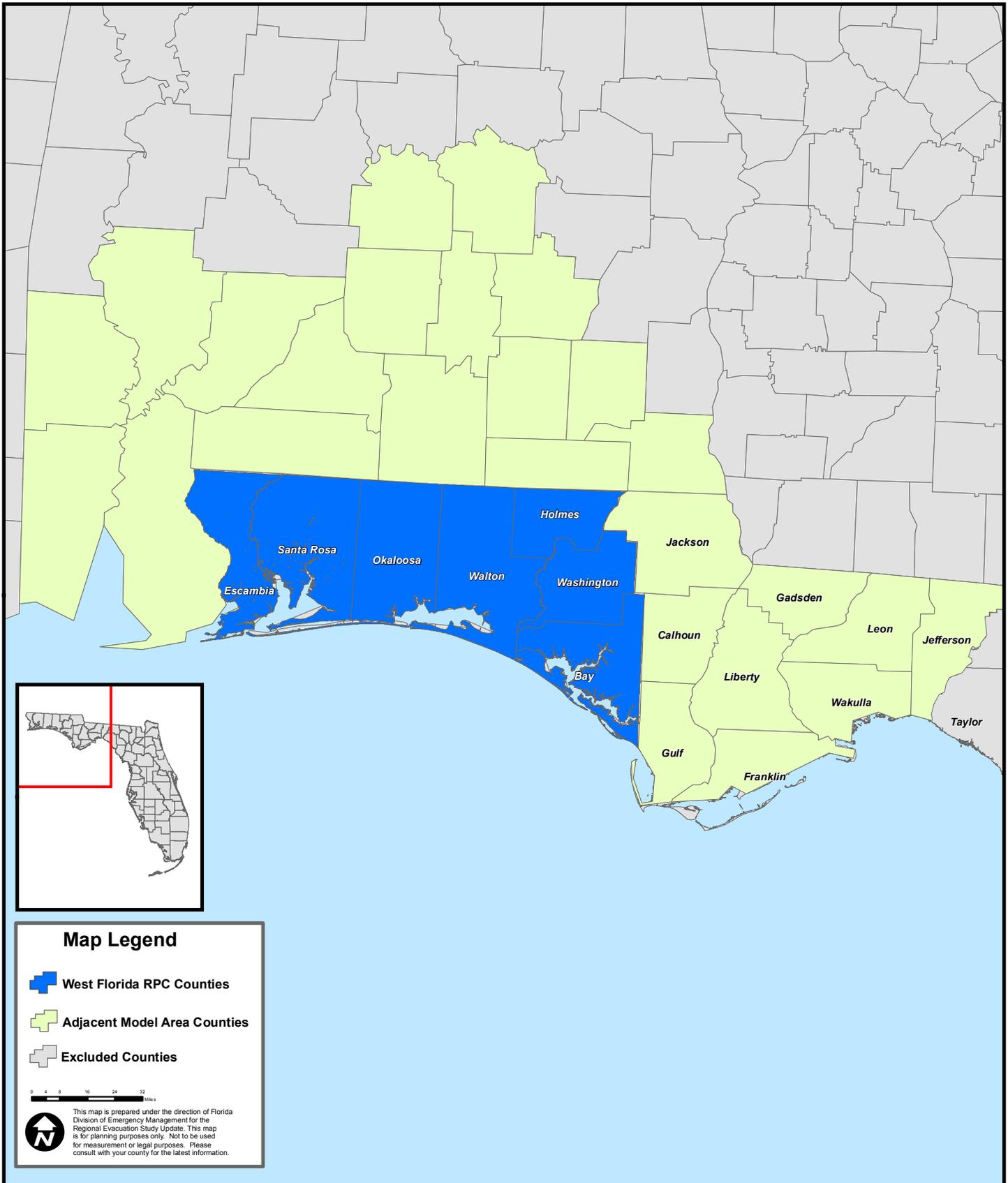


Figure III-2 West Florida Regional Model Network



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 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.

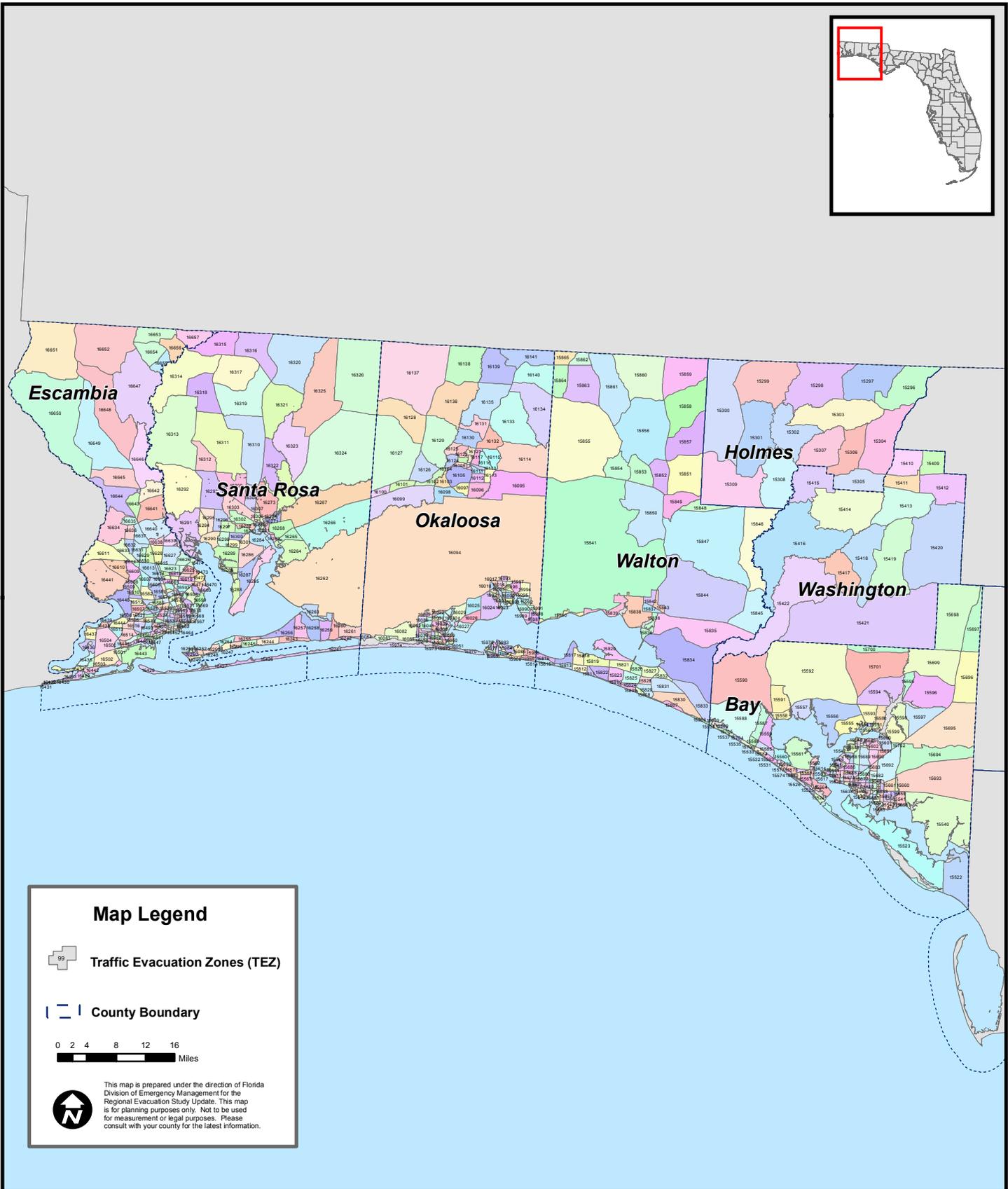
The final TEZ system for the State of Florida has 8,829 zones. Of the total number of zones in Florida, 768 of the zones are located within the seven county West Florida region, as illustrated in **Figure III-3**. In the West Florida region, Escambia County has the largest number of TEZs with 184, and 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



Figure III-3

West Florida Regional Model Transportation Evacuation Zone (TEZ) System



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: 2010, 2015, and 2020.

A snapshot of the key demographic data for each county in the West Florida RPC for 2010, 2015 and 2020 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 305,000 people by 2020. Okaloosa County has the second largest population for all years and is expected to exceed 195,000 people by 2020. The county with the lowest population in the region is Holmes County, which is projected to have 20,676 people in 2020.

Table III-1 - West Florida Demographic Characteristic Summary

County	Characteristic	Year		
		2010	2015	2020
Bay	Occupied site-built homes	58,107	59,913	63,484
	Population in site-built homes	140,509	144,870	153,505
	Occupied mobile homes	10,331	10,647	11,284
	Population in mobile home	24,526	25,285	26,796
	Hotel/motel units	7,887	7,690	7,690
Escambia	Occupied site-built homes	107,550	109,067	110,969
	Population in site-built homes	259,199	262,877	267,438
	Occupied mobile homes	8,688	8,810	8,963
	Population in mobile home	20,461	20,738	21,105
	Hotel/motel units	6,736	7,214	7,214
Holmes	Occupied site-built homes	5,152	5,214	5,340
	Population in site-built homes	12,835	12,986	13,306
	Occupied mobile homes	2,202	2,225	2,282
	Population in mobile home	5,360	5,418	5,553
	Hotel/motel units	200	257	257
Okaloosa	Occupied site-built homes	67,913	71,644	74,254
	Population in site-built homes	165,775	174,811	181,139
	Occupied mobile homes	4,466	4,709	4,880
	Population in mobile home	10,164	10,790	11,224
	Hotel/motel units	5,066	4,931	4,931
Santa Rosa	Occupied site-built homes	49,547	53,320	58,608
	Population in site-built homes	128,778	138,589	152,323
	Occupied mobile homes	7,363	7,925	8,709
	Population in mobile home	18,350	19,750	21,707
	Hotel/motel units	709	791	791
Walton	Occupied site-built homes	17,104	18,845	21,230
	Population in site-built homes	40,760	44,904	50,580
	Occupied mobile homes	5,197	5,725	6,448
	Population in mobile home	12,218	13,463	15,165
	Hotel/motel units	7,012	7,395	8,101
Washington	Occupied site-built homes	5,958	6,102	6,409
	Population in site-built homes	15,096	15,467	16,239
	Occupied mobile homes	2,906	2,976	3,124
	Population in mobile home	7,106	7,274	7,640
	Hotel/motel units	261	261	261

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 2010 network, discussed in section A, and two future year networks to correspond to the 2015 demographic data and the 2020 demographic data. The 2010 base model network was updated to reflect roadway capacity improvement projects completed between 2011 and 2015 to create the 2015 network. The 2015 network was then updated to reflect planned roadway capacity improvement projects expected to be implemented between 2016 and 2020 to create the 2020 network.

The planned roadway improvements that were added to the network generally include only capacity improvement projects such as additional through lanes. **Table III-2** identifies capacity improvement projects completed between 2011 and 2015 that were included in the 2015 network. Likewise, **Table III-3** identifies capacity improvement projects planned for implementation between 2016 and 2020. The tables identify each roadway that will be improved as well as the extent of the improvement.

It is important to note that **Tables 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, 2011-2015

County	Roadway	From	To	Number of Lanes
Bay	SR 77 (Cove/MLK Blvd)	US 98 BUS (SR 30)	SR 75 (US 231)	6
	Grand Lagoon Bridge/Thomas Dr	End of 4 lane	End of 4 lane	4
	South Thomas Dr	SR 30/Front Beach Rd	N Thomas Dr	4
Escambia	I-110 (SR 8A)	Maxwell St	Airport Blvd	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
	Mid-Bay Bridge Rd	N End of Bridge	Range Road	4
	Mid-Bay Bridge Rd	Range Rd	SR 85	2
	SR 85	General Bond Rd	SR 123	6
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
	SR 87	Eglin AFB Boundary	2 Miles S of Yellow River	4
Walton	SR 83 (US 331)	N End of Choctaw Bay Bridge	S of SR 20	4
Washington	SR 79	Strickland Rd	I-10 (SR 8)	4
	SR 79 Holmes Creek Bridge (No. 610008)			4

Sources: FDOT, West Florida Regional Planning Council

Note: Projects included in this table are roadway improvement projects completed between 2011 and 2015 on roadways that are included in the regional transportation model network. Only projects which added roadway capacity, such as additional through lanes, were included. The list is not intended to be all inclusive of every transportation improvement project completed within the region. A list of historical projects completed during the last five years was included in this report because the base regional network developed for the study, along with the base demographic data, is for the year 2010.

Table III-3 - West Florida Planned Roadway Improvements, 2016-2020

County	Roadway	From	To	Number of Lanes
Bay	Baldwin Rd/CR 2312	SR 390/St Andrews Blvd	Minnesota Ave	4
	SR 390 (St. Andrews)	23rd St (SR 368)	Jenks Ave	6
	SR 390 (St. Andrews)	Jenks Ave	Ohio Ave (SR 77)	6
	US 98 at 23rd St (SR 368)			N/A
	Jenks Ave	23rd St	Baldwin Rd	4
Escambia	I-10	SR 291	US 90	6
	US 29 (SR 95)	I-10 (SR 8)	9 and 1/2 Mile Rd	6
	Longleaf Dr	SR 297/Pine Forest Rd	Wymart Rd	4
	SR 10 (US 90A)/9 Mile Rd	SR 297/Pine Forest Rd	SR 95 (US 29)	4
	SR 10 (US 90A)/9 Mile Rd	CR 99/Beulah Rd	SR 8 (I-10)	4
	SR 10 (US 90A)/9 Mile Rd	SR 8 (I-10)	SR 297/Pine Forest Rd	4
Okaloosa	SR 123	N of Turkey Creek	SR 85 N	4
	PJ Adams Pkwy	SR 85 (S Ferdon Blvd)	Key Lime Place	4
	PJ Adams Pkwy	Key Lime Place	Ashley Drive	4
	SR 123	North of SR 85 S	North of Toms Creek	4
	SR 123	North of Toms Creek	North of Turkey Creek	4
Santa Rosa	SR 87	2 Miles S of Yellow River	CR 184	4
	I-10 (SR 8)	East end of Escambia Bay Bridge	SR 281/Avalon Blvd	6
Walton	SR 83 (US 331)	N of SR 20	I-10 (SR 8)	4
	SR 83 (US 331)	S end of Choctawhatchee Bay Bridge	N end of Choctawhatchee Bay Bridge	4
	SR 30 (US 98)	Emerald Bay Dr	Tang-O-Mar Dr	8
	SR 83 (US 331)	N of W Indian Creek Ranch	N of CR 278	4
Washington	SR 77	Bay County Line	CR 276 (Clayton Rd)	4

Sources: FDOT, West Florida Regional Planning Council

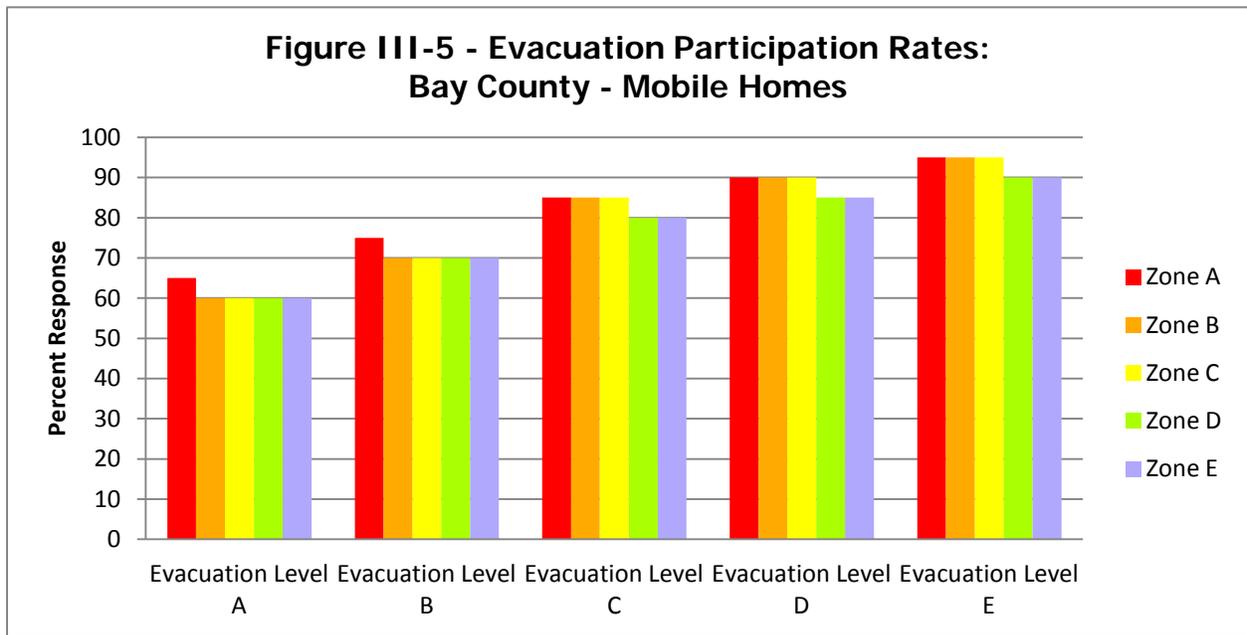
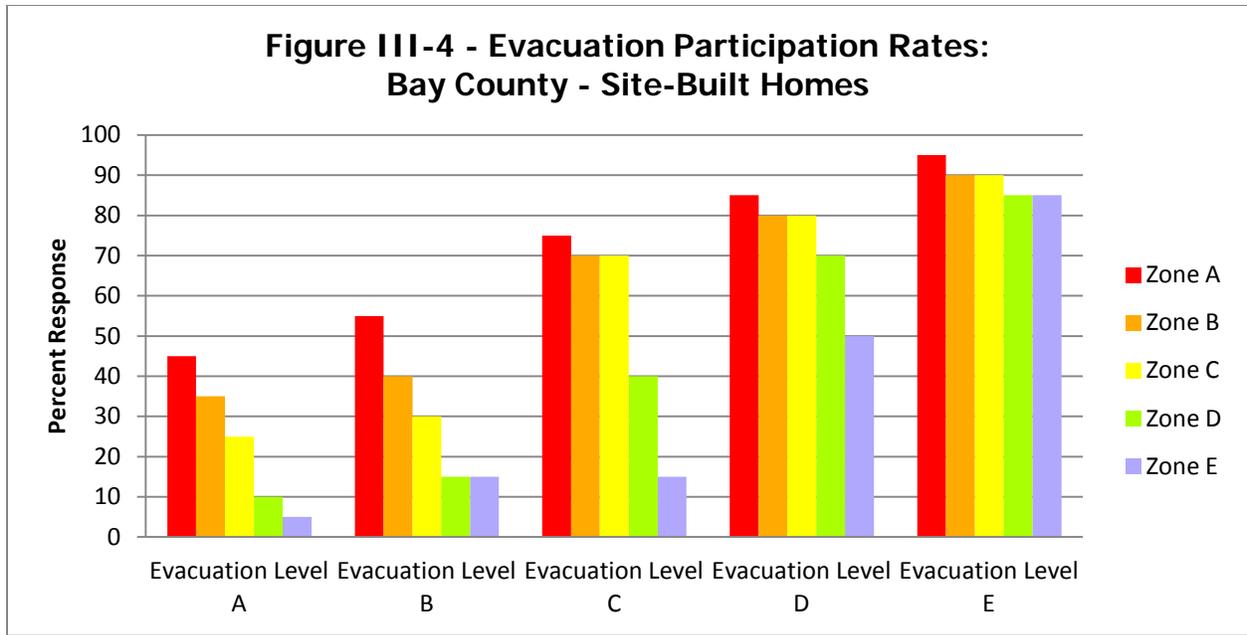
Note: Projects included in this table are roadway improvement projects planned for completion between 2016 and 2020 on roadways that are included in the regional transportation model network. Only projects which are planned to add roadway capacity, such as additional through lanes, were included. The list is not intended to be all inclusive of every transportation improvement project planned for completion within the region.

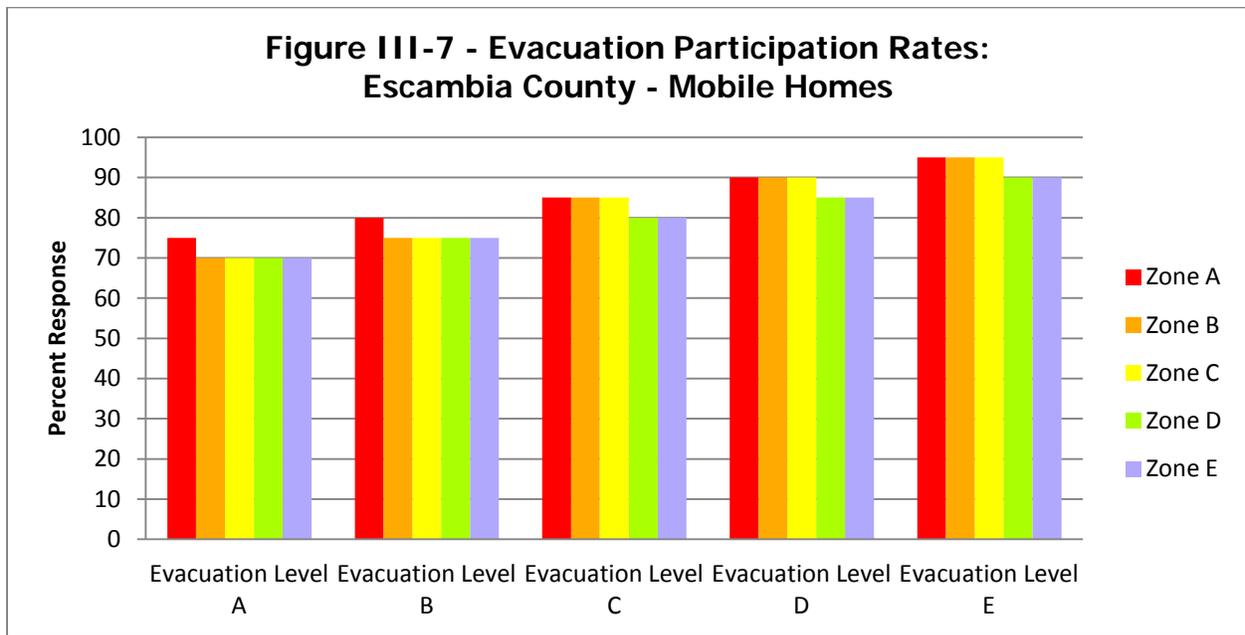
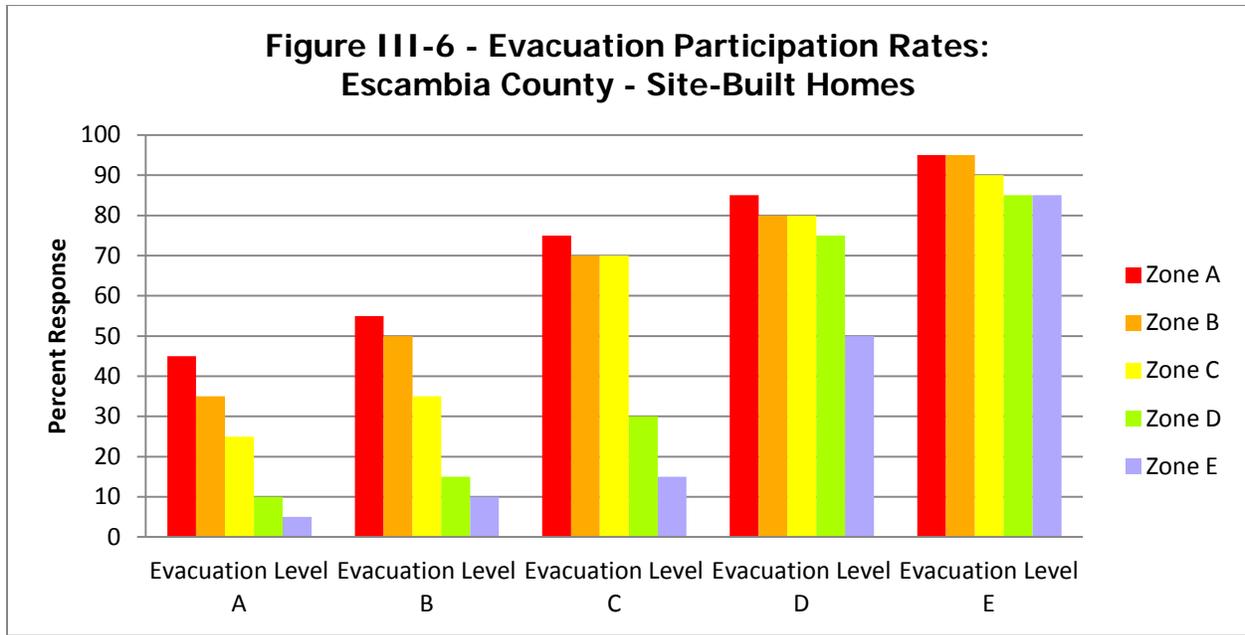
E. Behavioral Assumptions

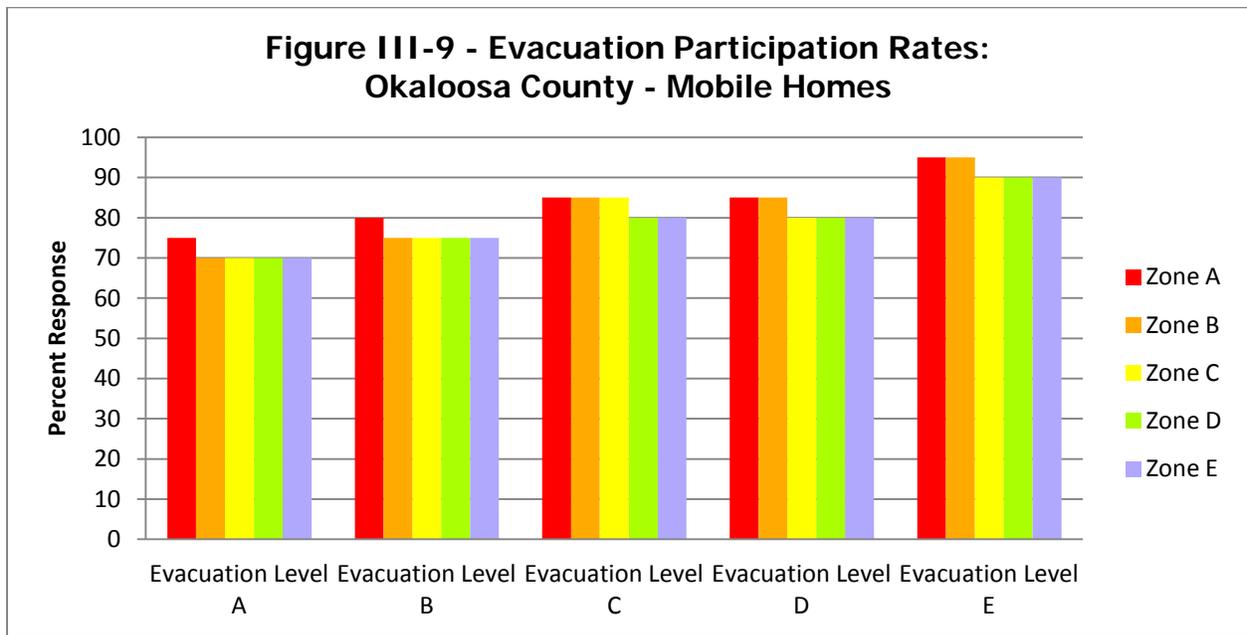
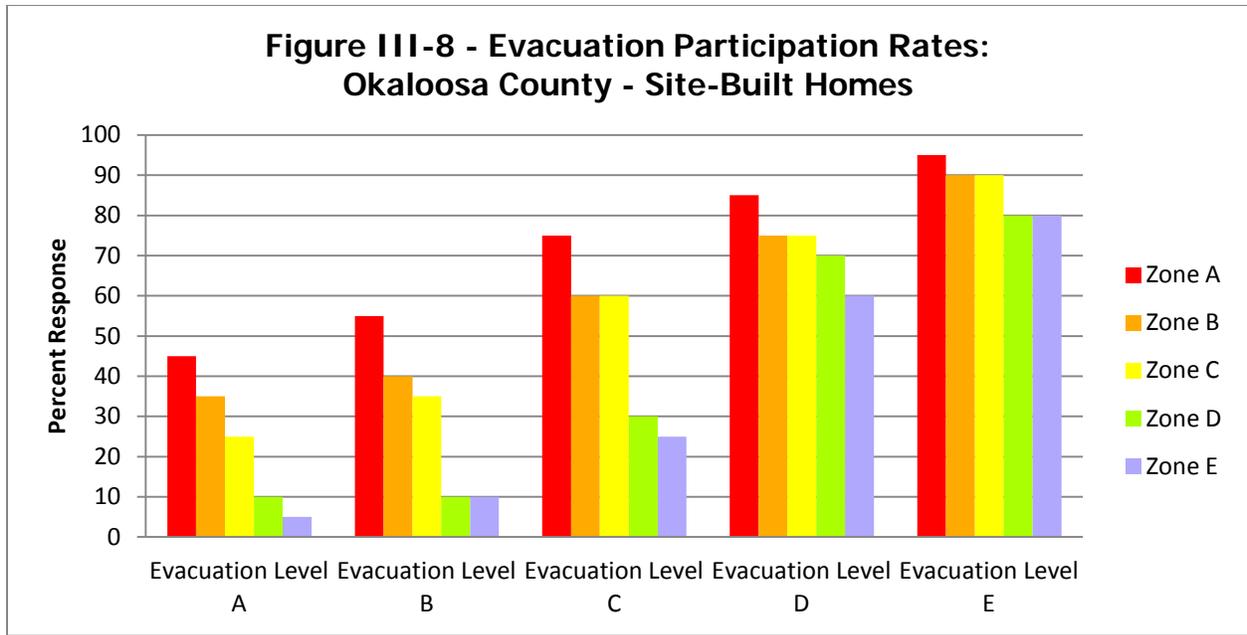
The behavioral assumptions provide important information on the way people respond to an evacuation order and are an important input to the SRESP transportation evacuation model. For the West Florida Region, evacuation rates for site-built homes and mobile/manufactured homes are provided by county and summarized in **Figure III-4** through **Figure III-15**. Other rates, such as out of county trip rates, vehicle use rates, public shelter use rates, friend/relative refuge use rates, hotel/motel refuge use rates, and other refuge use rates, are detailed by county, storm threat, and evacuation zone in Volume 5-4.

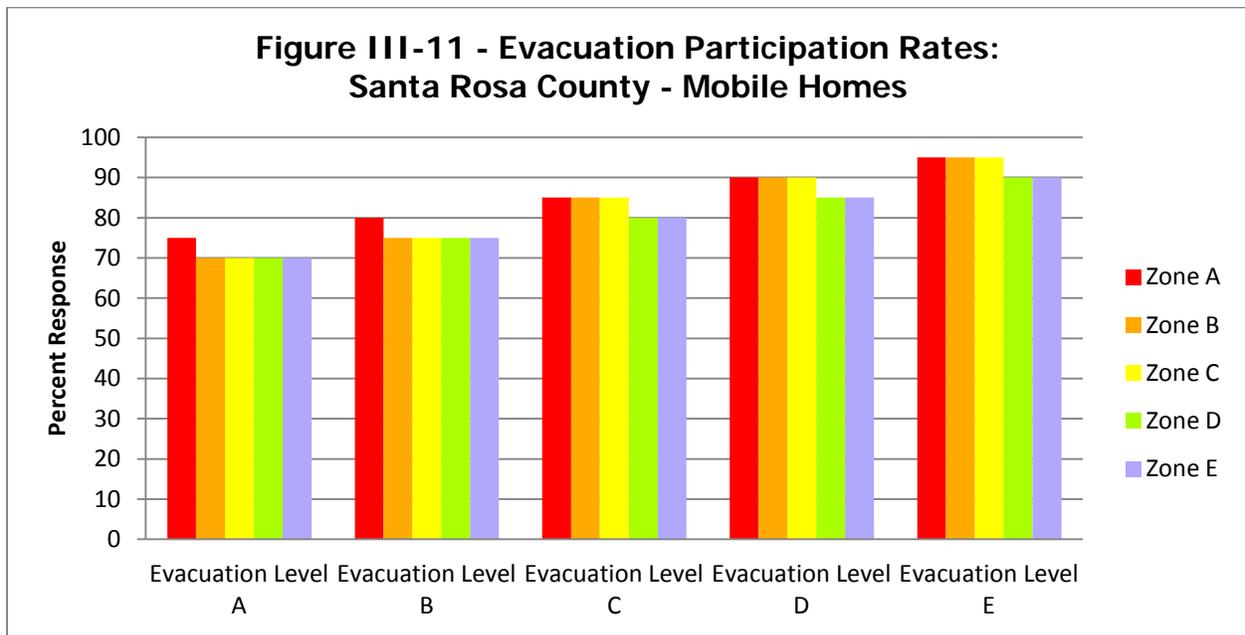
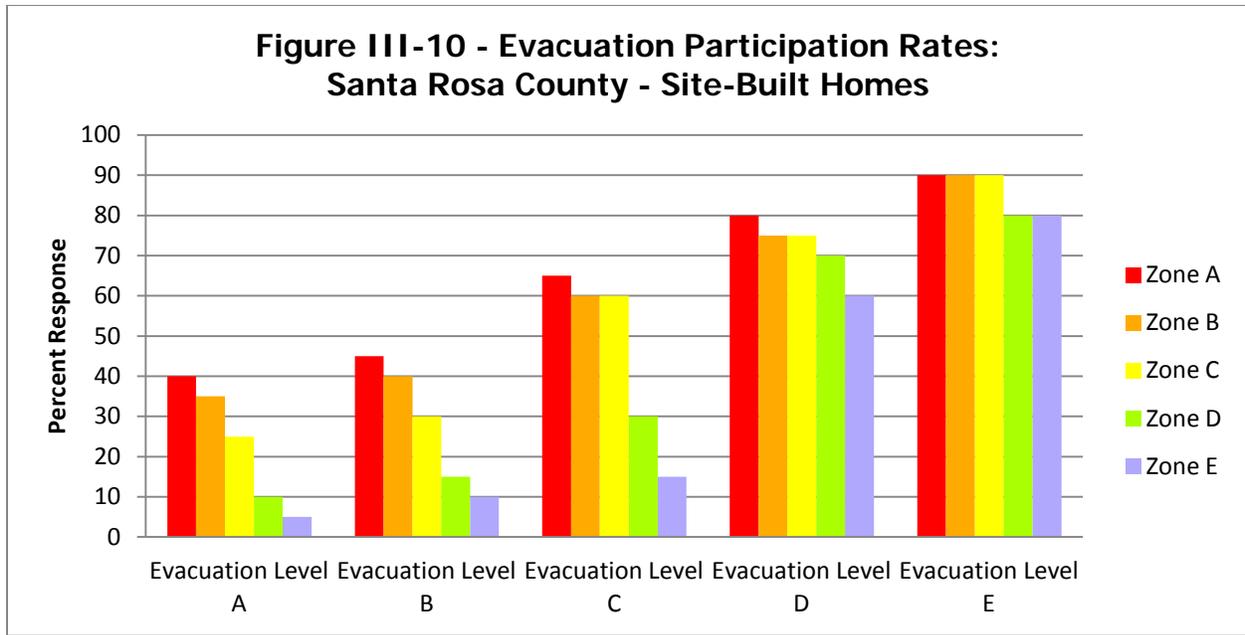
A review of the evacuation rates for the West Florida Region illustrates that evacuation participation rates increase as the evacuation level increases, and participation rates for persons living in mobile/manufactured homes are generally higher than for persons living in site-built homes. It should 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-15.

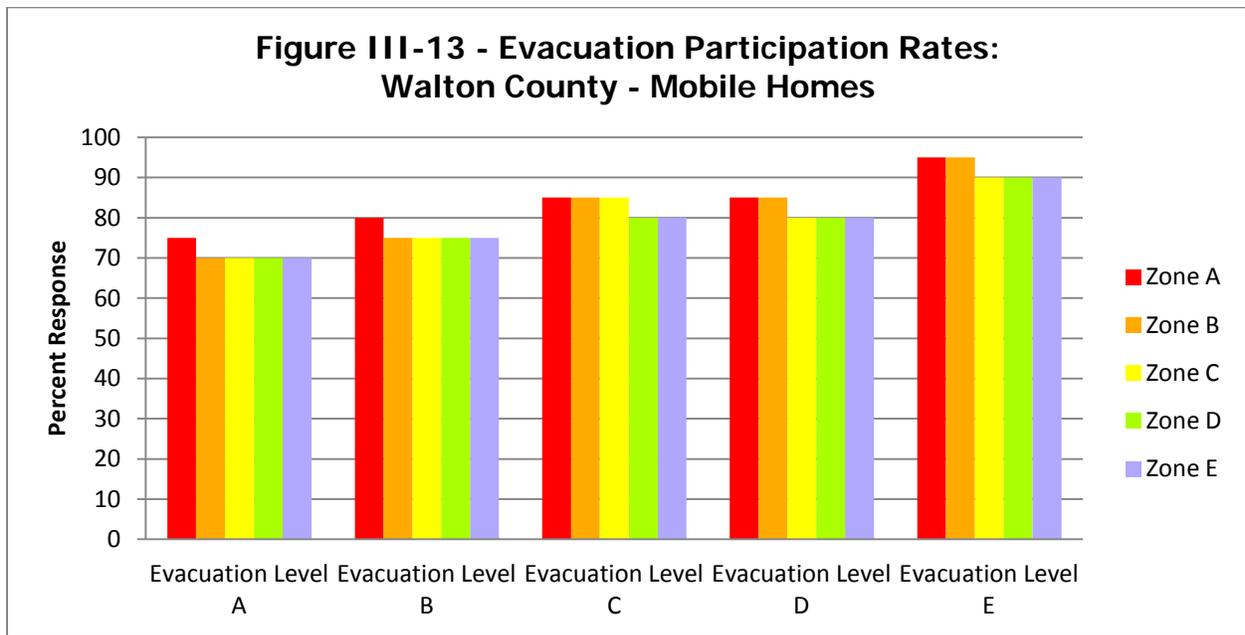
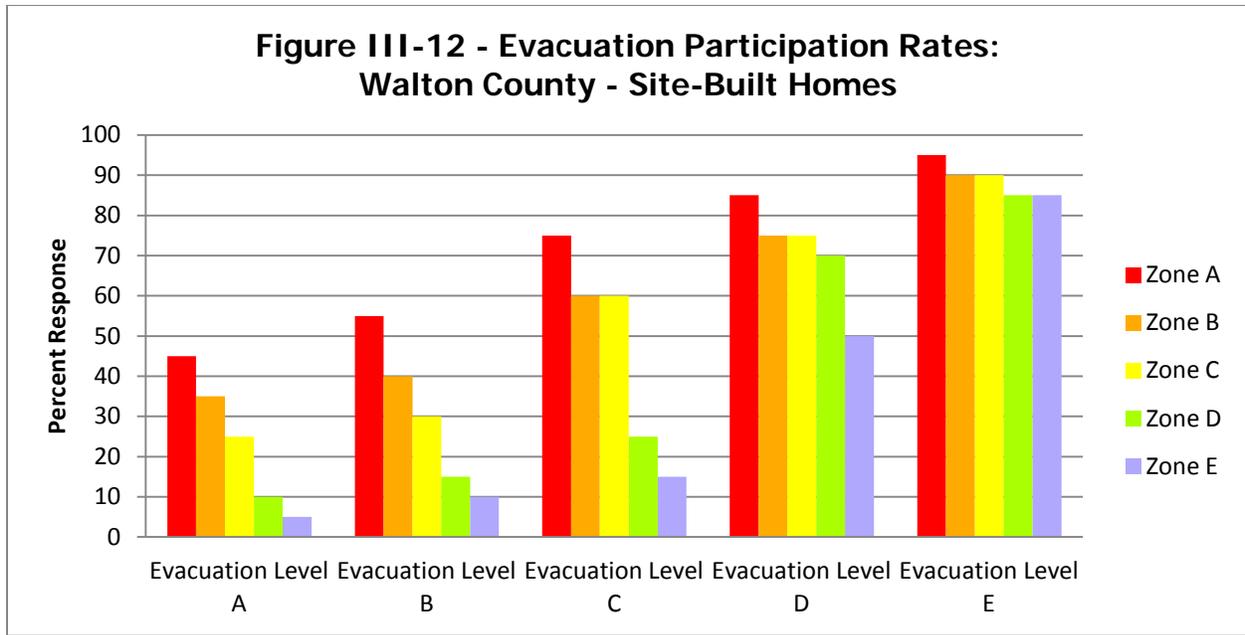
For example, if an evacuation order was issued for Bay County for persons living in evacuation zone A, the county could expect a 45 percent participation rate from persons living in site-built homes in evacuation zone A (Figure III-4) and an 65 percent participation rate from persons living in mobile/manufactured 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).











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 is a total of 77 primary and other shelters. The number of primary and other shelters in each county in the region is listed below:

- Bay – 28
- Escambia – 15
- Holmes – 7
- Okaloosa – 8
- Santa Rosa – 7
- Walton – 7
- Washington – 5

All together, the 77 shelters located within the seven county region can host more than 79,000 persons during an evacuation event. Detailed lists of the available public shelters by county are included in Volume 5-4.

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. Evacuation zones for the West Florida Region are illustrated in **Figure III-16**. County level evacuation zone maps are also included in Volume 5-4.

H. TIME User Interface

CDM Smith 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 2010, 2015 and 2020. The time period determines which set of demographic data and which version of the model network will be used.

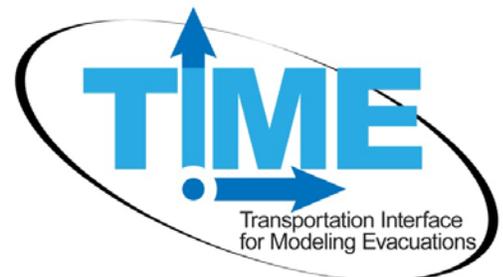
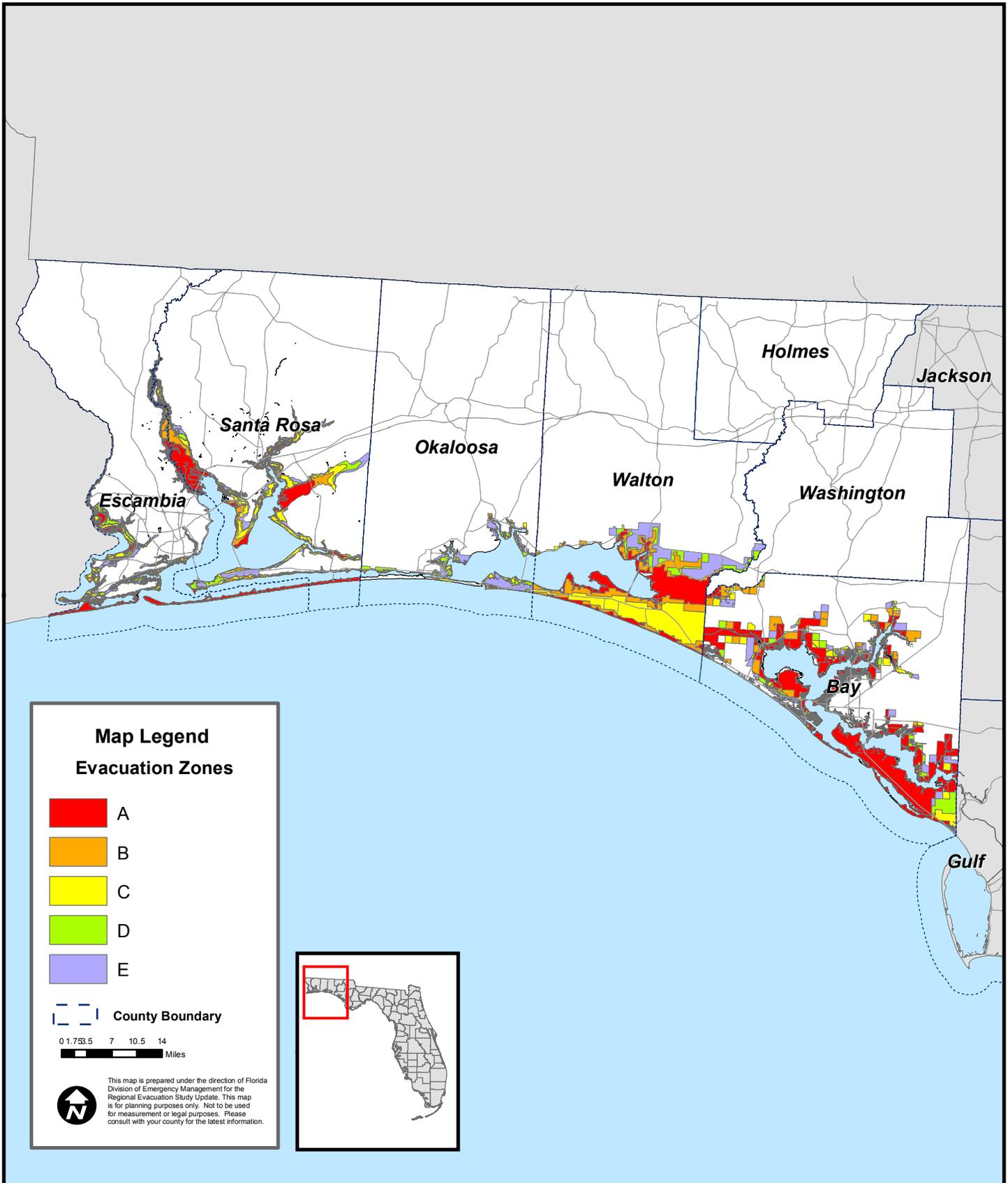




Figure III-14 West Florida Regional Model Transportation Evacuation Zone System



- **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, including I-10.
- **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 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.

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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 2015 is identified in **Table IV-1**, summarized by evacuation zone and split between site-built homes and mobile/manufactured homes. Vulnerable population for 2020 is summarized in **Table IV-2**.

Table IV-1 – Vulnerable Population in the West Florida Region for 2015

	Evacuation Zone A	Evacuation Zone B	Evacuation Zone C	Evacuation Zone D	Evacuation Zone E
Bay County					
Site-built Homes	25,150	5,289	6,934	7,732	11,808
Mobile/Manuf. Homes	2,863	810	784	776	1,074
TOTAL	28,013	6,099	7,718	8,508	12,882
Escambia County					
Site-built Homes	5,799	5,038	7,892	7,148	9,308
Mobile/Manuf. Homes	240	373	503	520	655
TOTAL	6,038	5,411	8,395	7,667	9,963
Okaloosa County					
Site-built Homes	919	4,109	12,435	17,205	27,350
Mobile/Manuf. Homes	16	52	271	408	351
TOTAL	935	4,161	12,706	17,613	27,702
Santa Rosa County					
Site-built Homes	6,849	6,011	12,683	4,747	13,263
Mobile/Manuf. Homes	977	576	1,161	549	766
TOTAL	7,826	6,587	13,844	5,295	14,028
Walton County					
Site-built Homes	6,619	7,879	6,674	441	807
Mobile/Manuf. Homes	1,146	1,050	726	311	612
TOTAL	7,765	8,929	7,400	752	1,419

Note: Vulnerable population determined using SRESP small area 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 2020

	Evacuation Zone A	Evacuation Zone B	Evacuation Zone C	Evacuation Zone D	Evacuation Zone E
Bay County					
Site-built Homes	26,647	5,605	7,347	8,192	12,511
Mobile/Manuf. Homes	3,034	858	831	824	1,139
TOTAL	29,682	6,463	8,178	9,015	13,650
Escambia County					
Site-built Homes	5,898	5,126	8,030	7,273	9,470
Mobile/Manuf. Homes	243	378	511	528	666
TOTAL	6,141	5,505	8,541	7,801	10,136
Okaloosa County					
Site-built Homes	952	4,259	12,888	17,832	28,343
Mobile/Manuf. Homes	17	53	282	422	366
TOTAL	969	4,313	13,170	18,254	28,710
Santa Rosa County					
Site-built Homes	7,528	6,606	13,940	5,218	14,579
Mobile/Manuf. Homes	1,073	633	1,276	602	840
TOTAL	8,601	7,239	15,216	5,820	15,419
Walton County					
Site-built Homes	7,456	8,873	7,517	497	910
Mobile/Manuf. Homes	1,290	1,184	817	350	689
TOTAL	8,746	10,057	8,334	847	1,599

Note: Vulnerable population determined using SRESP small area 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 IV-3** for 2015 and in **Table IV-4** for 2020.

Table IV-3 – Vulnerable Population by Destination for 2015

	Evacuation Zone A	Evacuation Zone B	Evacuation Zone C	Evacuation Zone D	Evacuation Zone E
Bay County					
To Friends and Family	17,094	3,741	4,709	5,183	7,836
To Hotel/ Motel	6,574	1,403	1,812	2,011	3,059
To Public Shelter	1,544	345	425	232	344
To Other Destination	2,801	610	772	1,083	1,642
Escambia County					
To Friends and Family	4,215	3,769	5,852	5,341	6,941
To Hotel/ Motel	1,196	1,064	1,654	1,507	1,960
To Public Shelter	314	289	445	409	531
To Other Destination	314	289	445	409	531
Okaloosa County					
To Friends and Family	562	2,499	7,637	10,588	16,639
To Hotel/ Motel	232	1,035	3,149	4,362	6,890
To Public Shelter	19	85	262	881	1,385
To Other Destination	122	542	1,657	1,782	2,788
Santa Rosa County					
To Friends and Family	4,451	3,709	7,788	2,995	7,830
To Hotel/ Motel	2,152	1,861	3,921	1,479	4,055
To Public Shelter	235	358	750	292	740
To Other Destination	988	659	1,384	530	1,403
Walton County					
To Friends and Family	4,385	5,016	4,143	444	842
To Hotel/ Motel	1,827	2,127	1,777	157	294
To Public Shelter	190	289	237	38	71
To Other Destination	1,363	1,497	1,243	113	213

Note: Vulnerable population destinations determined using SRESP small area 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 2020

	Evacuation Zone A	Evacuation Zone B	Evacuation Zone C	Evacuation Zone D	Evacuation Zone E
Bay County					
To Friends and Family	18,112	3,963	4,990	5,491	8,304
To Hotel/ Motel	6,965	1,487	1,920	2,130	3,242
To Public Shelter	1,636	366	450	246	364
To Other Destination	2,968	646	818	1,147	1,740
Escambia County					
To Friends and Family	4,287	3,834	5,953	5,434	7,062
To Hotel/ Motel	1,216	1,082	1,683	1,534	1,994
To Public Shelter	319	294	453	416	540
To Other Destination	319	294	453	416	540
Okaloosa County					
To Friends and Family	582	2,590	7,916	10,974	17,244
To Hotel/ Motel	241	1,073	3,264	4,521	7,141
To Public Shelter	20	88	272	913	1,435
To Other Destination	126	562	1,718	1,847	2,889
Santa Rosa County					
To Friends and Family	4,891	4,076	8,560	3,291	8,606
To Hotel/ Motel	2,366	2,045	4,310	1,626	4,458
To Public Shelter	258	394	825	321	813
To Other Destination	1,086	724	1,522	582	1,542
Walton County					
To Friends and Family	4,939	5,650	4,666	501	948
To Hotel/ Motel	2,058	2,396	2,002	177	331
To Public Shelter	214	325	266	42	80
To Other Destination	1,536	1,686	1,400	127	240

Note: Vulnerable population destinations determined using SRESP small area 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.

The vulnerable shadow population is provided in **Table IV-5** for both 2015 and 2020. 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 IV-5 – Vulnerable Shadow Evacuation Population

	Evacuation Level A	Evacuation Level B	Evacuation Level C	Evacuation Level D	Evacuation Level E
2015					
Bay County	32,196	43,511	45,460	54,939	59,054
Escambia County	39,402	50,326	60,086	83,488	100,989
Holmes County	6,065	6,714	7,364	8,014	8,664
Okaloosa County	24,063	31,399	42,950	59,632	57,827
Santa Rosa County	29,965	28,868	34,773	48,270	49,579
Walton County	22,572	35,610	35,848	37,955	38,061
Washington County	8,027	8,799	10,343	11,115	11,887
2020					
Bay County	34,115	45,909	47,805	57,823	62,045
Escambia County	40,051	51,164	61,091	84,901	102,706
Holmes County	6,222	6,887	7,551	8,216	8,881
Okaloosa County	24,977	32,560	44,421	61,658	59,650
Santa Rosa County	32,920	31,648	38,129	53,392	54,445
Walton County	25,309	39,573	39,791	42,164	42,283
Washington County	8,440	9,250	10,871	11,682	12,492

Note: Vulnerable shadow population determined using SRESP behavioral data and county provided evacuation zones. As opposed to Tables IV-1 through IV-4, vulnerable population numbers used for this table are inclusive, meaning population numbers listed for a higher zone are included in the lower zone. For example, vulnerable population listed for Evacuation Zone B does include vulnerable population listed for Evacuation Zone A. The resulting numbers are then subtracted from the evacuating population as reported in the modeling results to provide the vulnerable shadow evacuation population amount by county, per evacuation level.

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 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 2015 time period and five scenarios for the 2020 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 2015 scenarios use the 2015 network and the five 2020 scenarios use the 2020 network, which includes planned roadway capacity improvement

projects expected to be implemented by 2020;

- **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:
- **Behavioral Response** - For five evacuation levels (A, B, C, D, or E) in both the 2015 and 2020 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);
 - 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

	Scenario 1 Level A 2015	Scenario 2 Level B 2015	Scenario 3 Level C 2015	Scenario 4 Level D 2015	Scenario 5 Level E 2015
Demographic Data	2015	2015	2015	2015	2015
Highway Network	2015	2015	2015	2015	2015
One-Way Operations	None	None	None	None	None
University Population	Fall/Spring	Fall/Spring	Fall/Spring	Fall/Spring	Fall/Spring
Tourist Rate	Default	Default	Default	Default	Default
Shelters Open	Primary	Primary	Primary	Primary	Primary
Response Curve	12-hour	12-hour	12-hour	12-hour	12-hour
Evacuation Phasing	None	None	None	None	None
Behavioral Response	100%	100%	100%	100%	100%
Evacuation Zone	A	B	C	D	E
Counties Evacuating	Bay Escambia Holmes Okaloosa Santa Rosa Walton Washington Baldwin (AL) Gulf				
	Scenario 6 Level A 2020	Scenario 7 Level B 2020	Scenario 8 Level C 2020	Scenario 9 Level D 2020	Scenario 10 Level E 2020
Demographic Data	2020	2020	2020	2020	2020
Highway Network	2020	2020	2020	2020	2020
One-Way Operations	None	None	None	None	None
University Population	Fall/Spring	Fall/Spring	Fall/Spring	Fall/Spring	Fall/Spring
Tourist Rate	Default	Default	Default	Default	Default
Shelters Open	Primary	Primary	Primary	Primary	Primary
Response Curve	12-hour	12-hour	12-hour	12-hour	12-hour
Evacuation Phasing	None	None	None	None	None
Behavioral Response	100%	100%	100%	100%	100%
Evacuation Zone	A	B	C	D	E
Counties Evacuating	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 as reported from the modeling results for the base scenarios is summarized by county for 2015 in **Table IV-7** and for 2020 in **Table IV-8**.

Within the seven county region, total evacuating population ranges from more than 212,800 persons for a base scenario level A evacuation to more than 563,700 for a base scenario level E evacuation in 2015. By 2020, this range increases within the seven counties to more than 226,100 persons for a base scenario level A evacuation and more than 594,900 for a base scenario level E evacuation.

Table IV-7 – Evacuating Population by Base Scenario for 2015

	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
Bay County					
Site-built Homes	34,511	48,655	55,441	73,000	87,690
Mobile/Manuf. Homes	25,286	25,286	25,286	25,286	25,286
Tourists	412	3,682	6,563	6,991	9,298
TOTAL	60,209	77,623	87,290	105,277	122,274
Escambia County					
Site-built Homes	22,155	38,462	56,536	87,606	115,069
Mobile/Manuf. Homes	20,742	20,742	20,742	20,742	20,742
Tourists	2,543	2,571	2,652	2,652	2,652
TOTAL	45,440	61,775	79,930	111,000	138,463
Holmes County					
Site-built Homes	650	1,299	1,949	2,599	3,249
Mobile/Manuf. Homes	5,415	5,415	5,415	5,415	5,415
Tourists	0	0	0	0	0
TOTAL	6,065	6,714	7,364	8,014	8,664
Okaloosa County					
Site-built Homes	14,198	25,124	46,390	79,290	101,505
Mobile/Manuf. Homes	10,800	10,800	10,800	10,800	10,800
Tourists	0	571	3,562	4,957	8,639
TOTAL	24,998	36,495	60,752	95,047	120,944
Santa Rosa County					
Site-built Homes	18,024	23,457	43,206	61,998	76,799
Mobile/Manuf. Homes	19,767	19,767	19,767	19,767	19,767
Tourists	0	56	56	56	593
TOTAL	37,791	43,280	63,029	81,821	97,159
Walton County					
Site-built Homes	12,278	18,933	23,705	26,564	28,089
Mobile/Manuf. Homes	13,473	13,473	13,473	13,473	13,473
Tourists	4,586	19,898	22,764	22,764	22,764
TOTAL	30,337	52,304	59,942	62,801	64,326
Washington County					
Site-built Homes	772	1,544	3,088	3,860	4,632
Mobile/Manuf. Homes	7,255	7,255	7,255	7,255	7,255
Tourists	0	0	0	0	0
TOTAL	8,027	8,799	10,343	11,115	11,887

Table IV-8 – Evacuating Population by Base Scenario for 2020

	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
Bay County					
Site-built Homes	36,571	51,557	58,750	77,355	92,920
Mobile/Manuf. Homes	26,814	26,814	26,814	26,814	26,814
Tourists	412	3,682	6,563	6,991	9,298
TOTAL	63,797	82,053	92,127	111,160	129,032
Escambia County					
Site-built Homes	22,540	39,130	57,517	89,128	117,069
Mobile/Manuf. Homes	21,109	21,109	21,109	21,109	21,109
Tourists	2,543	2,571	2,652	2,652	2,652
TOTAL	46,192	62,810	81,278	112,889	140,830
Holmes County					
Site-built Homes	665	1,330	1,994	2,659	3,324
Mobile/Manuf. Homes	5,557	5,557	5,557	5,557	5,557
Tourists	0	0	0	0	0
TOTAL	6,222	6,887	7,551	8,216	8,881
Okaloosa County					
Site-built Homes	14,716	26,041	48,080	82,176	105,196
Mobile/Manuf. Homes	11,230	11,230	11,230	11,230	11,230
Tourists	0	571	3,562	4,957	8,639
TOTAL	25,946	37,842	62,872	98,363	125,065
Santa Rosa County					
Site-built Homes	19,797	25,764	47,461	68,109	84,372
Mobile/Manuf. Homes	21,724	21,724	21,724	21,724	21,724
Tourists	0	0	0	434	643
TOTAL	41,521	47,488	69,185	90,267	106,739
Walton County					
Site-built Homes	13,827	21,322	26,696	29,915	31,633
Mobile/Manuf. Homes	15,172	15,172	15,172	15,172	15,172
Tourists	5,056	21,882	25,061	25,061	25,061
TOTAL	34,055	58,376	66,929	70,148	71,866
Washington County					
Site-built Homes	811	1,621	3,242	4,053	4,863
Mobile/Manuf. Homes	7,629	7,629	7,629	7,629	7,629
Tourists	0	0	0	0	0
TOTAL	8,440	9,250	10,871	11,682	12,492

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 2015 in **Table IV-9** and for 2020 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 slightly less than 125,000 vehicles evacuate from the seven county RPC for a base scenario level A evacuation in 2015, and this number increases to over 308,800 evacuating vehicles from the seven county region for a base scenario level E evacuation in 2015. By 2020, the number of evacuating vehicles is expected to increase to more than 132,700 vehicles for a base scenario level A evacuation and more than 325,800 evacuating vehicles for a base scenario level E evacuation.

Table IV-9 – Evacuating Vehicles by Base Scenario for 2015

	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
Bay County					
Site-built Homes	19,181	26,689	30,556	39,984	47,771
Mobile/Manuf. Homes	16,909	16,909	16,909	16,909	16,909
Tourists	177	1,416	2,536	2,720	3,581
TOTAL	36,267	45,014	50,001	59,613	68,261
Escambia County					
Site-built Homes	12,286	20,768	30,216	46,016	59,707
Mobile/Manuf. Homes	12,595	12,595	12,595	12,595	12,595
Tourists	1,191	1,203	1,242	1,242	1,242
TOTAL	26,072	34,566	44,053	59,853	73,544
Holmes County					
Site-built Homes	336	673	1,009	1,345	1,682
Mobile/Manuf. Homes	2,883	2,883	2,883	2,883	2,883
Tourists	0	0	0	0	0
TOTAL	3,219	3,556	3,892	4,228	4,565
Okaloosa County					
Site-built Homes	8,506	14,888	27,970	47,608	60,386
Mobile/Manuf. Homes	7,794	7,794	7,794	8,281	8,281
Tourists	0	190	1,433	1,982	3,190
TOTAL	16,300	22,872	37,197	57,871	71,857
Santa Rosa County					
Site-built Homes	10,151	13,329	23,866	33,898	41,533
Mobile/Manuf. Homes	11,490	11,490	11,490	11,490	11,490
Tourists	0	25	25	25	270
TOTAL	21,641	24,844	35,381	45,413	53,293
Walton County					
Site-built Homes	7,246	11,212	14,084	15,864	16,810
Mobile/Manuf. Homes	9,233	9,233	9,233	9,233	9,233
Tourists	820	4,664	5,156	5,156	5,156
TOTAL	17,299	25,109	28,473	30,253	31,199
Washington County					
Site-built Homes	392	783	1,567	1,959	2,350
Mobile/Manuf. Homes	3,762	3,762	3,762	3,762	3,762
Tourists	0	0	0	0	0
TOTAL	4,154	4,545	5,329	5,721	6,112

Table IV-10 – Evacuating Vehicles by Base Scenario for 2020

	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
Bay County					
Site-built Homes	20,324	28,279	32,377	42,370	50,622
Mobile/Manuf. Homes	17,927	17,927	17,927	17,927	17,927
Tourists	177	1,416	2,536	2,720	3,581
TOTAL	38,428	47,622	52,840	63,017	72,130
Escambia County					
Site-built Homes	12,499	21,128	30,738	46,813	60,741
Mobile/Manuf. Homes	12,813	12,813	12,813	12,813	12,813
Tourists	1,191	1,203	1,242	1,242	1,242
TOTAL	26,503	35,144	44,793	60,868	74,796
Holmes County					
Site-built Homes	344	688	1,032	1,376	1,721
Mobile/Manuf. Homes	2,962	2,962	2,962	2,962	2,962
Tourists	0	0	0	0	0
TOTAL	3,306	3,650	3,994	4,338	4,683
Okaloosa County					
Site-built Homes	8,816	15,432	28,991	49,347	62,591
Mobile/Manuf. Homes	8,075	8,075	8,075	8,580	8,580
Tourists	0	190	1,433	1,982	3,190
TOTAL	16,891	23,697	38,499	59,909	74,361
Santa Rosa County					
Site-built Homes	11,147	14,637	26,211	37,233	45,622
Mobile/Manuf. Homes	12,627	12,627	12,627	12,627	12,627
Tourists	0	0	0	196	294
TOTAL	23,774	27,264	38,838	50,056	58,543
Walton County					
Site-built Homes	8,170	12,641	15,878	17,883	18,948
Mobile/Manuf. Homes	10,393	10,393	10,393	10,393	10,393
Tourists	892	5,057	5,601	5,601	5,601
TOTAL	19,455	28,091	31,872	33,877	34,942
Washington County					
Site-built Homes	411	823	1,646	2,057	2,469
Mobile/Manuf. Homes	3,957	3,957	3,957	3,957	3,957
Tourists	0	0	0	0	0
TOTAL	4,368	4,780	5,603	6,014	6,426

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 16,800 persons for the base scenario level A evacuation in 2015 to 38,400 persons for the base scenario level E evacuation. By 2020, the public shelter demand is expected to increase to over 17,700 persons for the level A evacuation and over 40,500 persons for the level E evacuation.

Table IV-11 – Shelter Demand by Base Scenario

	Evacuation Level A	Evacuation Level B	Evacuation Level C	Evacuation Level D	Evacuation Level E
2015					
Bay County	5,001	6,016	6,423	7,287	8,155
Escambia County	4,094	5,393	6,782	9,269	11,559
Holmes County	862	925	986	1,049	1,112
Okaloosa County	1,310	1,778	2,814	4,729	6,027
Santa Rosa County	3,045	3,341	4,736	6,085	7,235
Walton County	1,360	2,048	2,257	2,555	2,708
Washington County	1,153	1,262	1,478	1,587	1,696
2020					
Bay County	5,300	6,368	6,793	7,707	8,623
Escambia County	4,164	5,483	6,897	9,428	11,757
Holmes County	886	949	1,014	1,077	1,140
Okaloosa County	1,358	1,843	2,912	4,893	6,238
Santa Rosa County	3,345	3,669	5,202	6,701	7,949
Walton County	1,528	2,288	2,522	2,858	3,032
Washington County	1,214	1,326	1,554	1,669	1,783

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

	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
2015	175,586	234,684	288,405	380,614	435,657
2020	183,397	244,471	300,568	395,792	452,760

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 2015 and 2020.

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 the evacuation scenarios. During the level A evacuation scenarios, the roadway segments with the highest vehicle queues are primarily concentrated along 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.



Figure IV-1

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

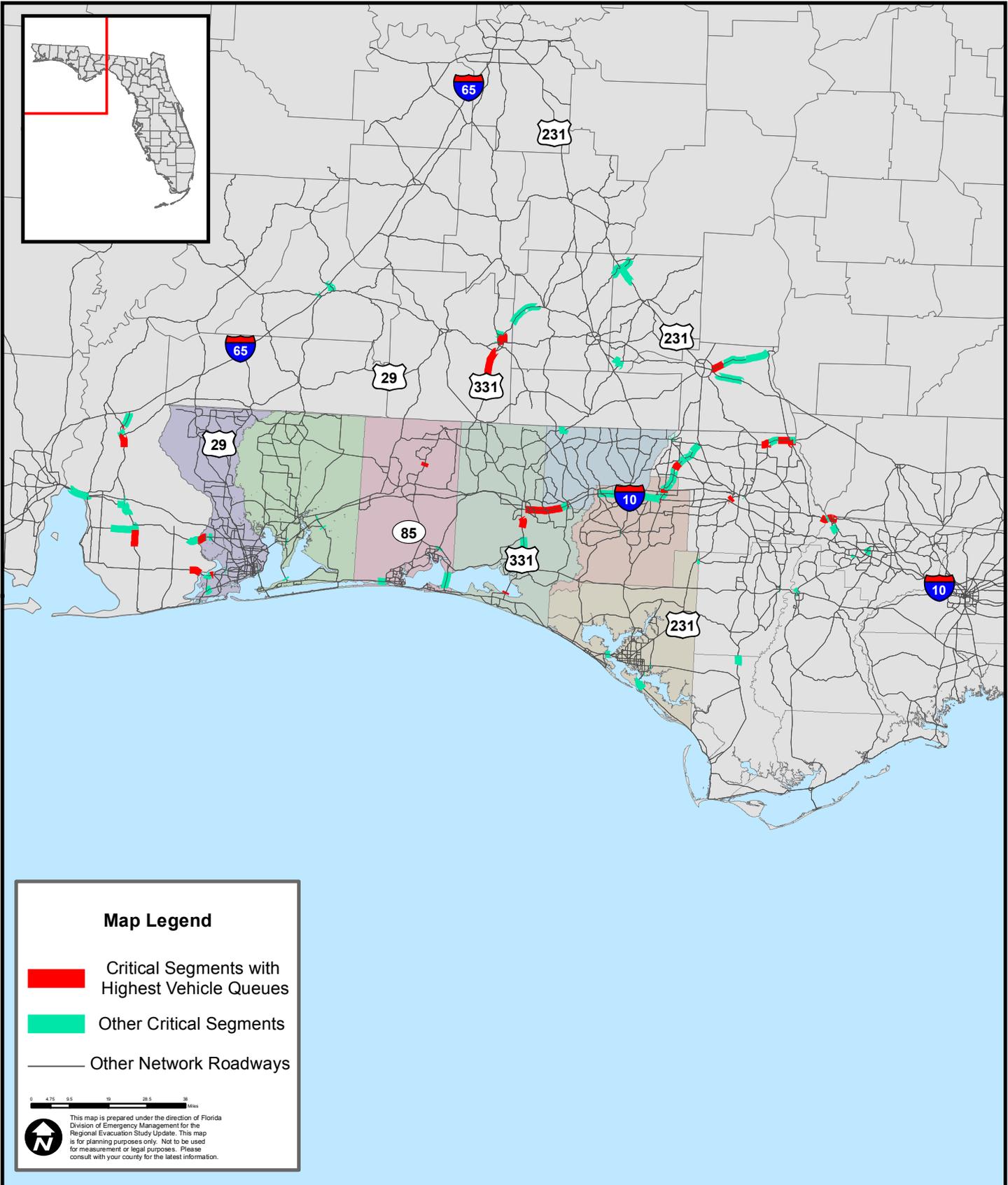




Figure IV-2

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

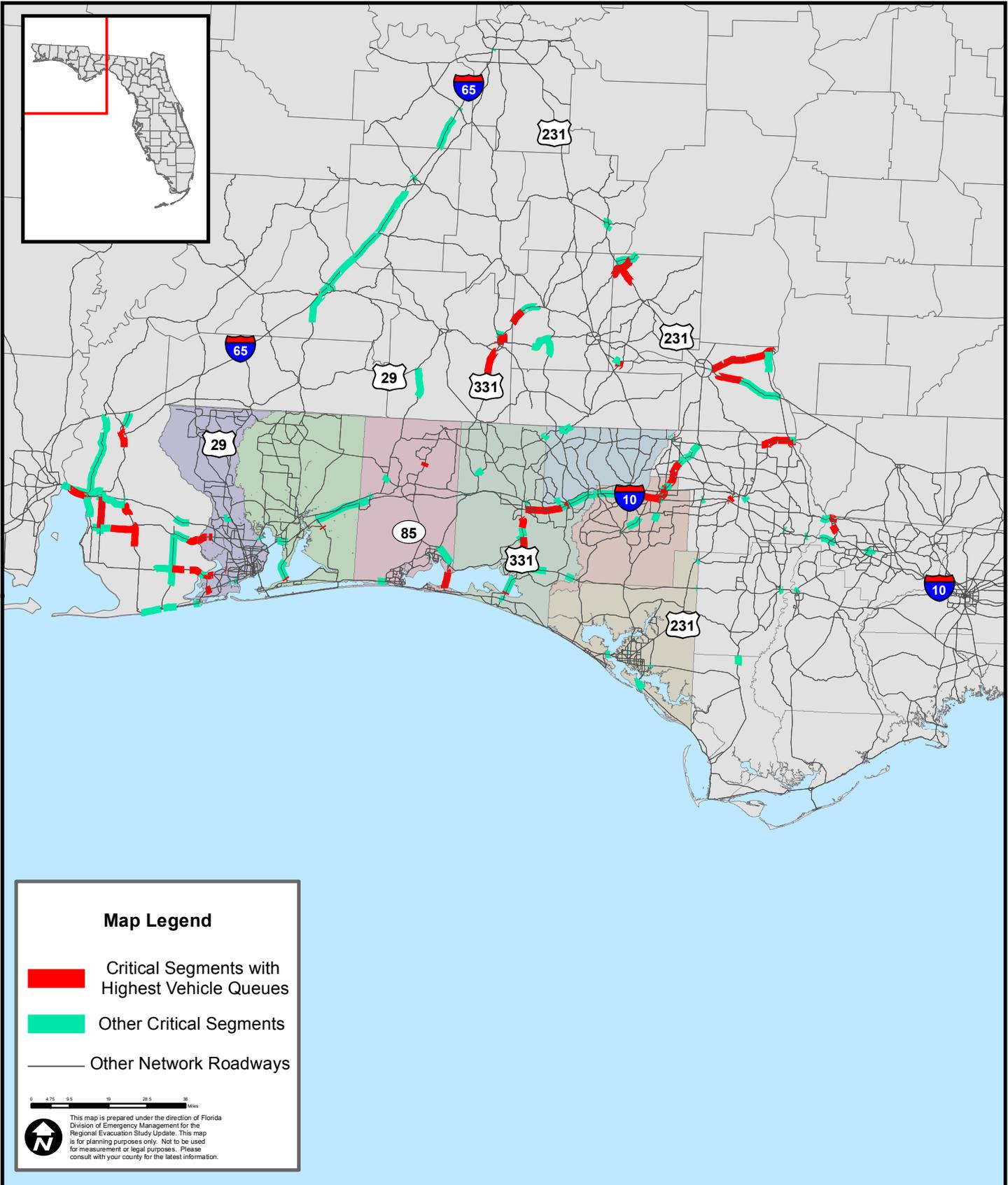




Figure IV-3

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

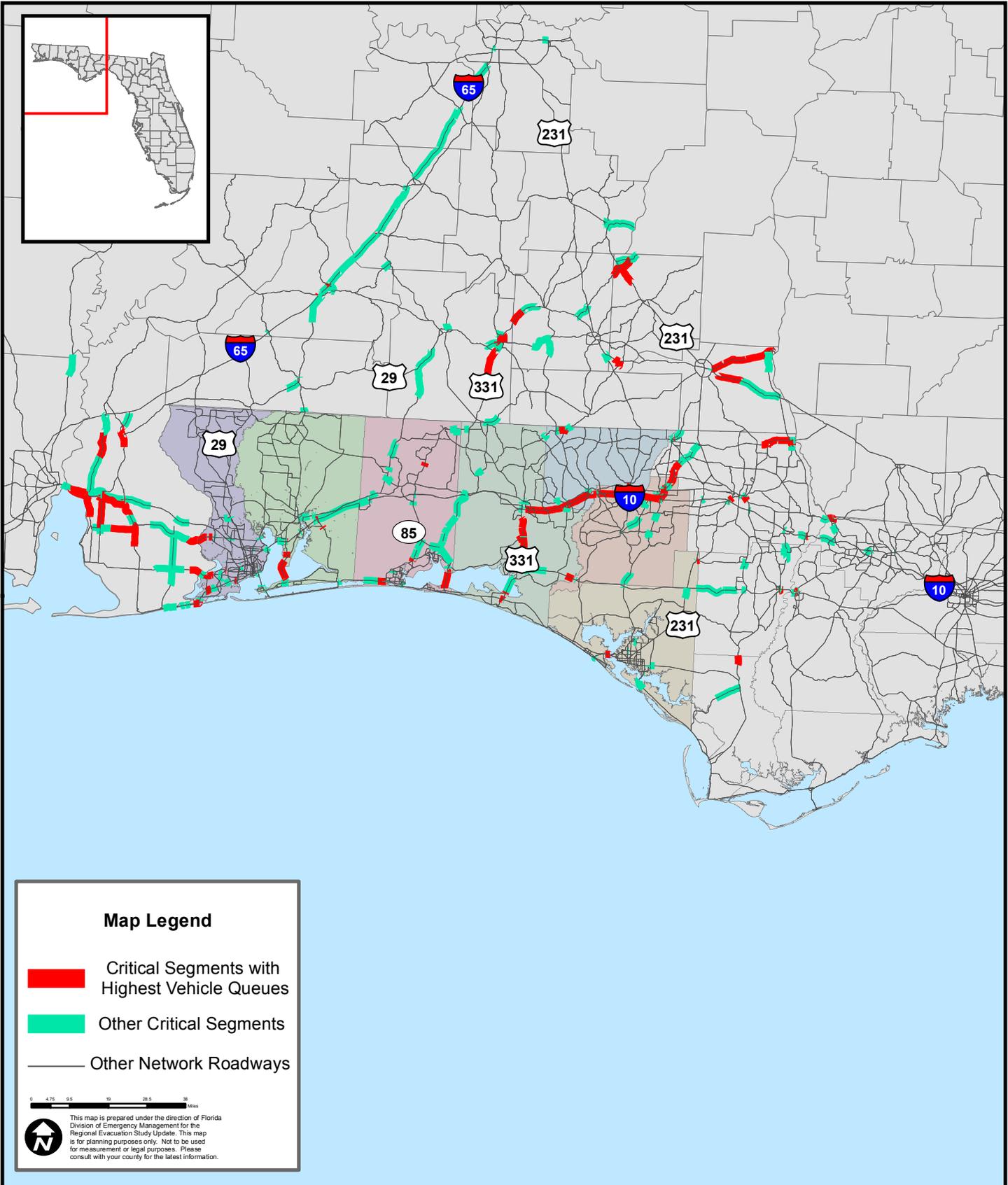




Figure IV-4

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

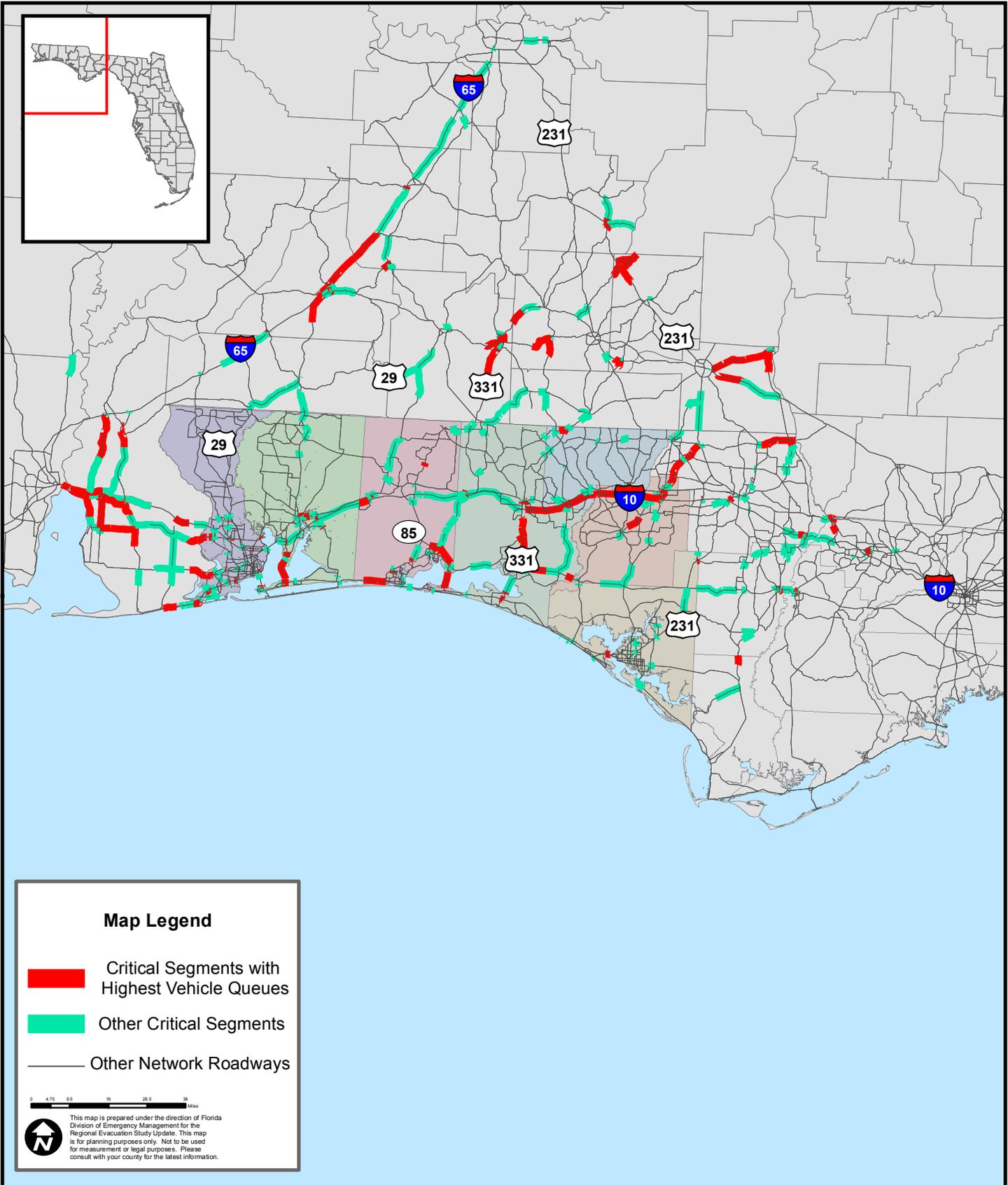




Figure IV-5

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





Figure IV-6

Critical Roadway Segments with Excessive Vehicle Queues for 2020 Base Scenario Evacuation Level A

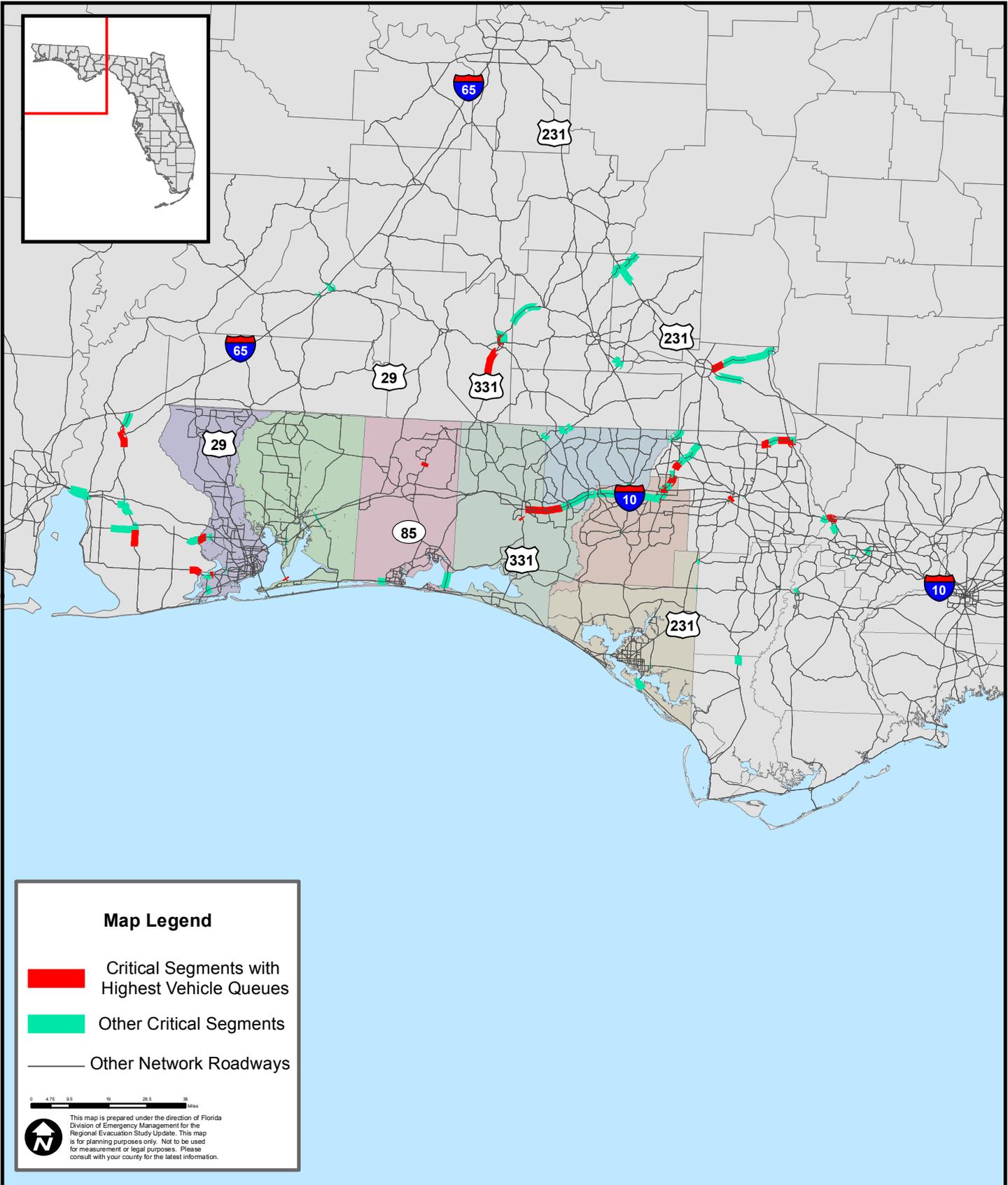




Figure IV-7

Critical Roadway Segments with Excessive Vehicle Queues for 2020 Base Scenario Evacuation Level B

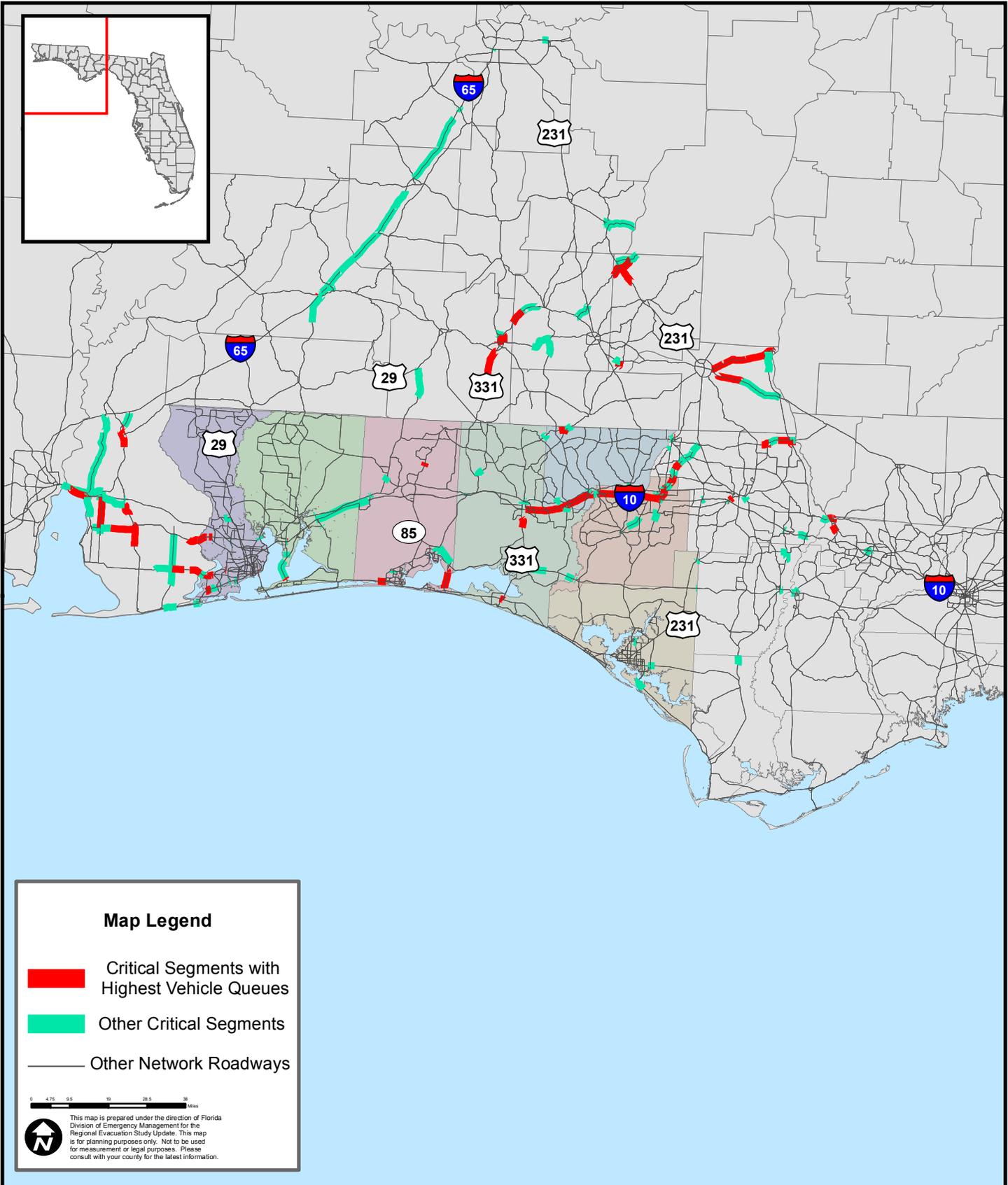




Figure IV-8

Critical Roadway Segments with Excessive Vehicle Queues for 2020 Base Scenario Evacuation Level C

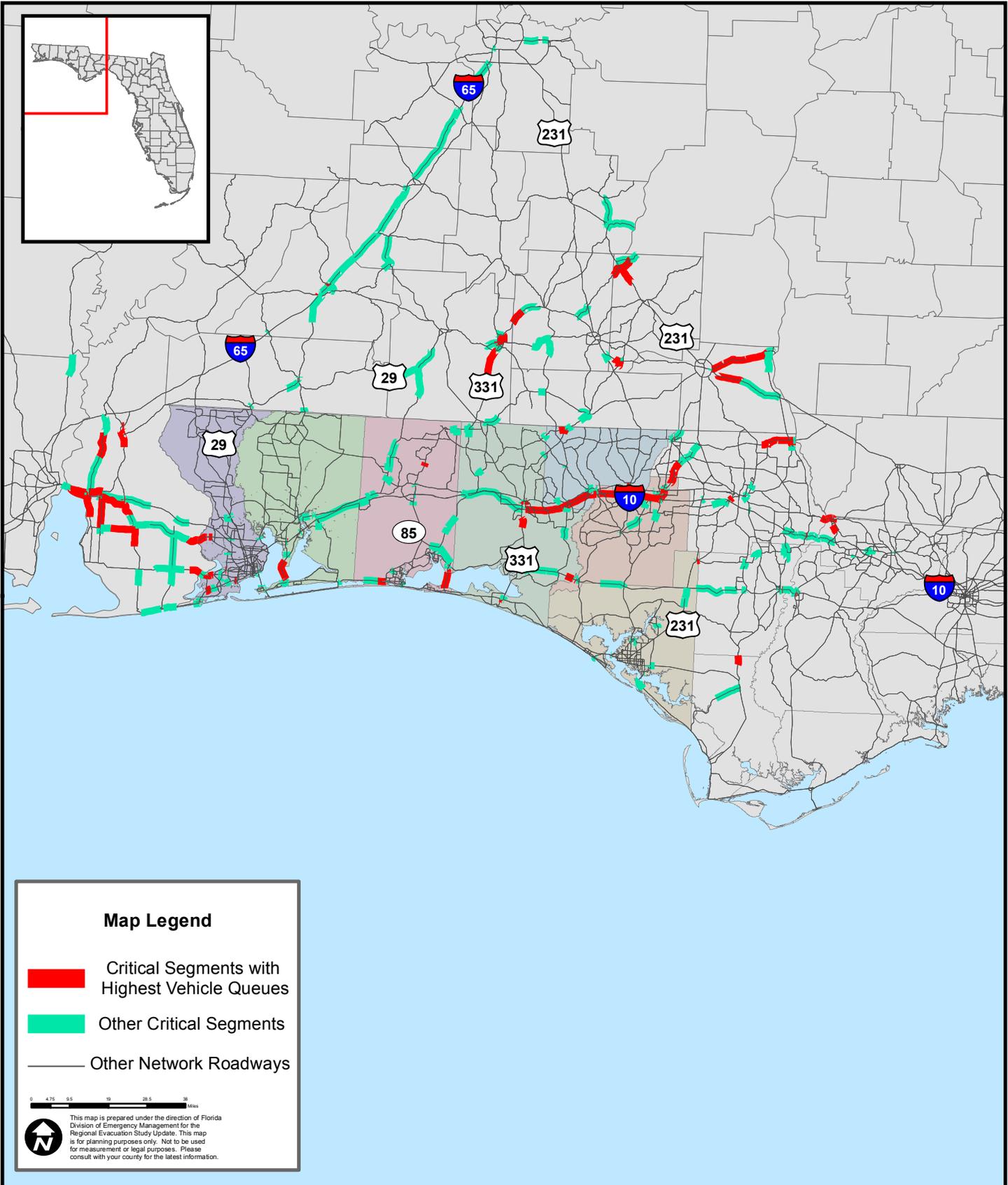




Figure IV-9

Critical Roadway Segments with Excessive Vehicle Queues for 2020 Base Scenario Evacuation Level D

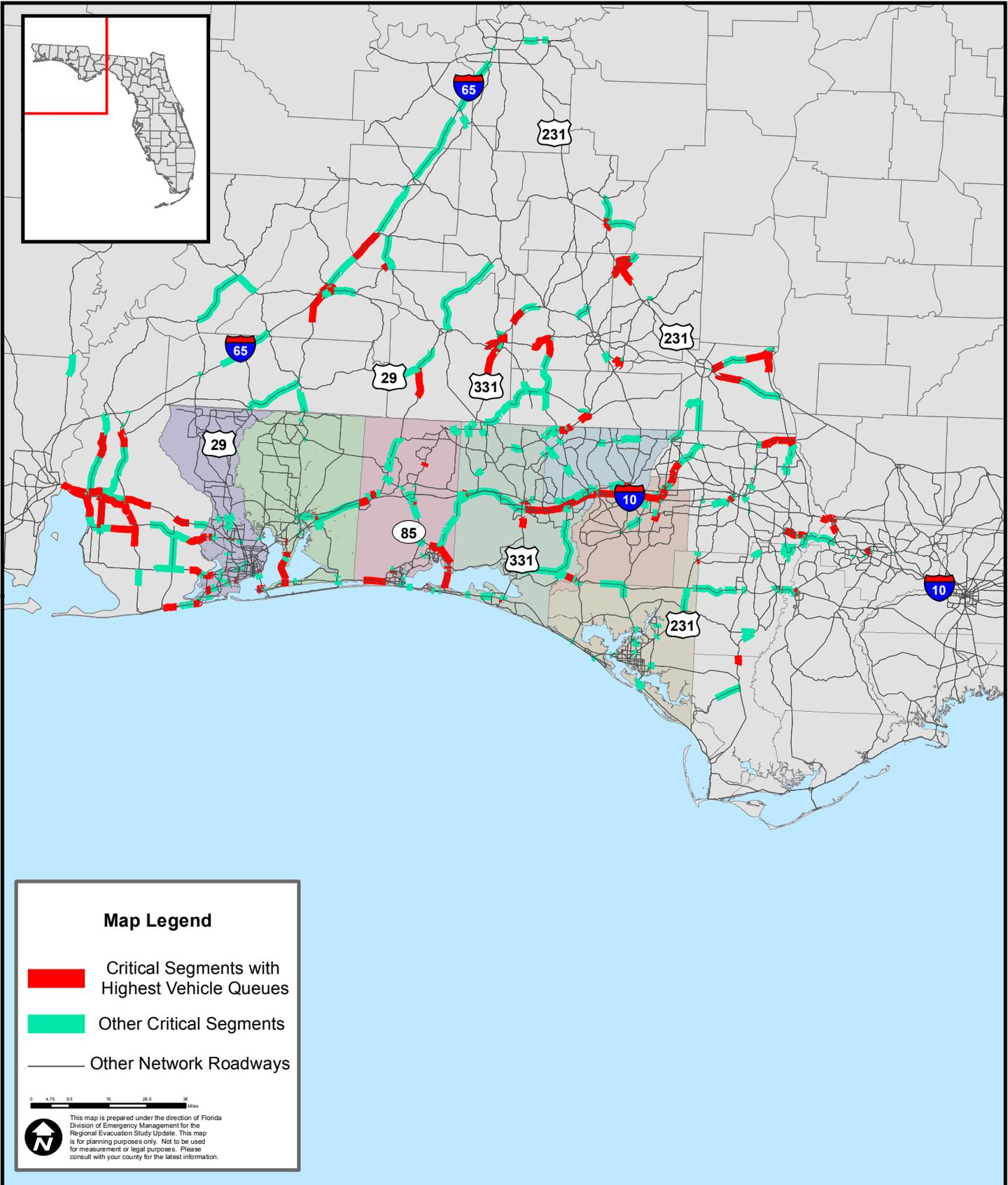
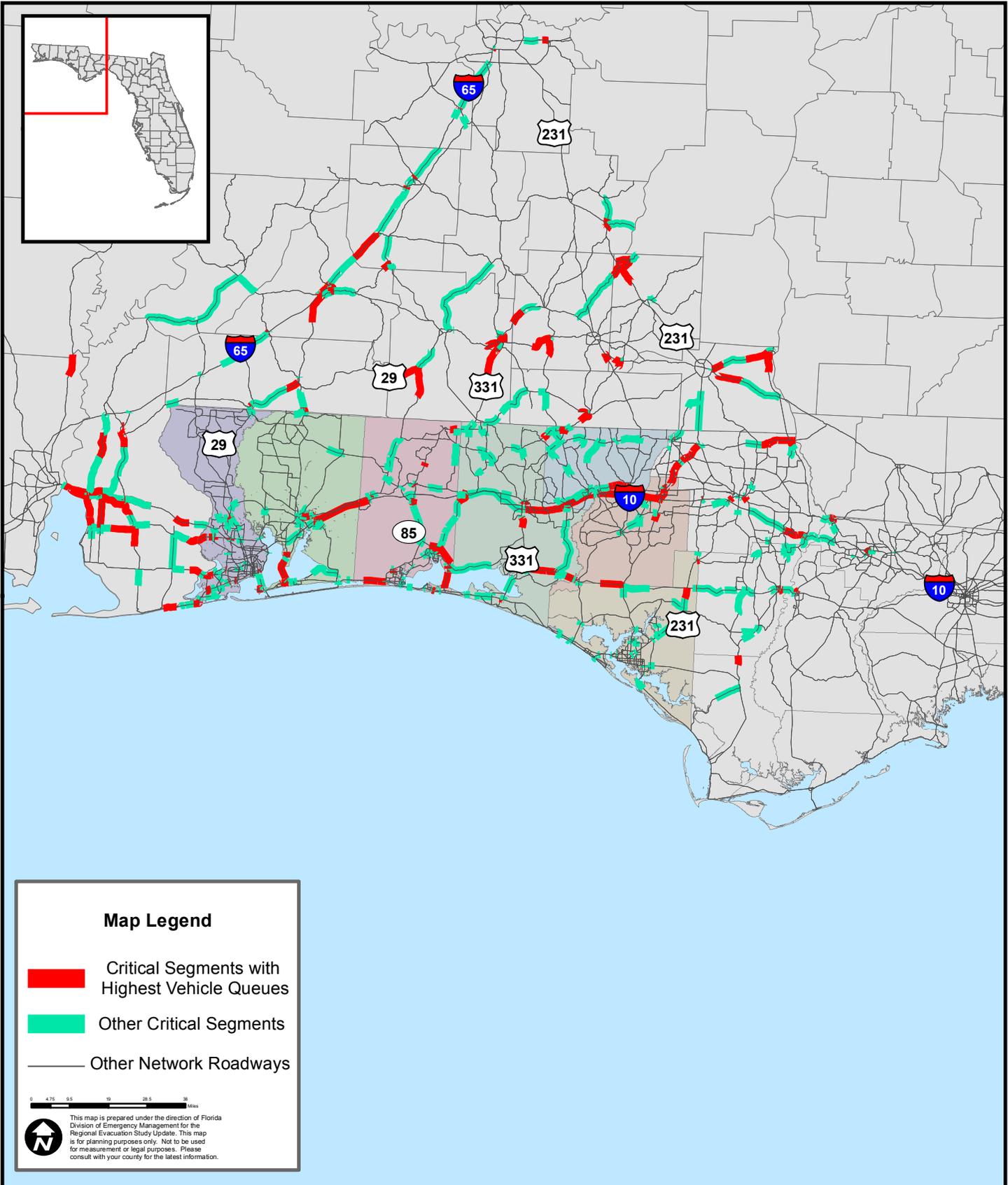




Figure IV-10

Critical Roadway Segments with Excessive Vehicle Queues for 2020 Base Scenario Evacuation Level E



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 2015 and **Table IV-14** for 2020. In addition, evacuating vehicles entering each county by major evacuation route are identified in **Table IV-15** for 2015 and **Table IV-16** for 2020. Detailed volume figures for all evacuation routes in the West Florida Region for each base scenario are included in Volume 5-4.

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 2015 Base Scenario

	Evacuation Level A Scenario	Evacuation Level B Scenario	Evacuation Level C Scenario	Evacuation Level D Scenario	Evacuation Level E Scenario
Bay County					
SR 20 Eastbound	2,500	3,800	4,600	6,500	6,600
SR 20 Westbound	800	1,000	1,100	1,300	1,800
SR 22 Eastbound	100	200	300	300	600
SR 77 Northbound	1,100	1,800	2,800	3,700	4,500
SR 79 Northbound	1,600	2,700	4,400	6,200	7,900
US 231 Northbound	8,300	9,300	10,200	13,200	13,800
US 98 Southbound	100	200	200	400	900
US 98 Westbound	1,800	2,400	2,700	3,100	3,400
Escambia County					
I-10 Eastbound	19,500	27,800	31,400	41,100	39,900
I-10 Westbound	7,300	10,100	12,700	15,300	16,900
US 29 Northbound	3,900	7,500	11,800	17,400	20,900
US 90 Eastbound	400	600	1,400	4,700	7,400
US 90 Westbound	-	-	900	2,000	3,100
US 97 Northbound	200	200	400	2,400	3,500
US 98 Eastbound	800	1,200	1,900	3,900	4,300
US 98 Westbound	300	600	800	1,400	1,700
Holmes County					
I-10 Eastbound	16,600	19,700	23,200	28,800	31,900
I-10 Westbound	700	800	1,000	1,300	1,500
SR 2 Eastbound	1,000	2,100	2,900	4,400	4,200
SR 81 Northbound	400	1,000	1,900	4,500	4,800
US 90 Eastbound	1,500	3,500	4,500	5,800	6,700
Okaloosa County					
I-10 Eastbound	15,800	22,400	28,800	38,100	38,600
I-10 Westbound	4,900	6,600	7,600	8,700	9,900
SR 20 Eastbound	500	1,000	3,000	5,400	6,800
SR 285 Northbound	4,700	7,000	8,700	9,800	12,900
US 189 Northbound	2,000	4,200	5,800	8,000	8,800
US 4 Westbound	400	600	1,100	1,500	2,100
US 85 Eastbound	6,600	7,500	8,700	10,300	10,700
US 98 Eastbound	1,100	1,500	2,400	6,500	8,800
US 98 Westbound	1,400	2,400	4,100	6,400	7,700
Santa Rosa County					
I-10 Eastbound	22,900	30,700	34,700	42,800	42,400
I-10 Westbound	5,700	7,400	8,900	11,100	12,600
US 4 Westbound	100	100	200	700	1,700
US 87 Northbound	2,600	3,100	4,700	6,700	7,000
US 90 Eastbound	200	1,300	3,100	6,000	7,000
US 98 Eastbound	2,100	3,000	4,700	8,500	9,600
US 98 Westbound	4,900	6,300	9,300	12,600	14,800

Table IV-13 – 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
Walton County					
I-10 Eastbound	20,300	24,400	26,300	30,000	32,800
SR 2 Eastbound	2,100	3,500	4,900	7,300	6,900
SR 20 Eastbound	1,800	4,200	5,700	7,500	8,100
SR 81 Northbound	1,500	2,600	4,100	5,100	6,400
US 331 Northbound	1,300	2,400	3,600	5,800	7,300
US 90 Eastbound	500	2,500	4,000	6,900	7,100
US 98 Eastbound	1,300	2,200	4,500	9,100	11,400
US 98 Westbound	3,100	5,300	6,200	6,100	6,200
Washington County					
I-10 Eastbound	13,900	19,600	23,900	30,000	33,900
I-10 Westbound	600	600	700	800	900
SR 20 Eastbound	500	900	1,600	3,000	2,800
SR 20 Westbound	1,200	1,700	2,300	3,200	3,900
SR 273 Northbound	7,400	8,800	10,400	12,100	13,000
US 90 Eastbound	500	800	600	900	2,000

Table IV-14 – Evacuating Vehicles Leaving Each County by Evacuation Route for the 2020 Base Scenario

	Evacuation Level A Scenario	Evacuation Level B Scenario	Evacuation Level C Scenario	Evacuation Level D Scenario	Evacuation Level E Scenario
Bay County					
SR 20 Eastbound	2,700	4,100	4,700	7,500	8,300
SR 20 Westbound	800	1,100	1,200	1,400	1,700
SR 22 Eastbound	100	200	300	300	600
SR 77 Northbound	1,200	2,000	3,100	4,300	5,700
SR 79 Northbound	1,700	2,800	4,300	6,500	8,400
US 231 Northbound	8,600	9,700	10,400	13,400	15,300
US 98 Southbound	200	200	200	700	1,000
US 98 Westbound	1,900	2,400	2,800	3,200	3,500
Escambia County					
I-10 Eastbound	19,100	28,400	31,000	39,100	38,500
I-10 Westbound	7,900	10,600	12,900	15,500	17,200
US 29 Northbound	4,300	7,800	12,200	17,900	22,200
US 90 Eastbound	400	600	1,500	5,100	7,200
US 90 Westbound	-	-	1,100	2,500	3,400
US 97 Northbound	200	300	800	2,700	3,400
US 98 Eastbound	900	1,300	2,100	4,800	5,400
US 98 Westbound	300	600	800	1,400	1,800
Holmes County					
I-10 Eastbound	16,600	19,800	23,900	29,400	32,400
I-10 Westbound	700	800	1,100	1,500	1,600
SR 2 Eastbound	1,300	2,600	2,500	4,000	4,800
SR 81 Northbound	500	1,600	2,700	5,000	6,000
US 90 Eastbound	2,000	3,700	4,700	5,700	6,700
Okaloosa County					
I-10 Eastbound	15,900	22,900	26,400	34,900	34,900
I-10 Westbound	5,300	7,200	8,000	9,200	10,500
SR 20 Eastbound	700	1,100	2,500	5,000	6,400
SR 285 Northbound	4,600	6,700	8,100	10,000	12,100
US 189 Northbound	2,100	4,600	7,000	8,400	9,000
US 4 Westbound	400	600	1,100	1,500	1,600
US 85 Eastbound	6,500	7,600	8,500	9,600	10,200
US 98 Eastbound	1,100	1,700	3,500	10,000	13,100
US 98 Westbound	1,500	2,400	4,100	6,500	7,800
Santa Rosa County					
I-10 Eastbound	22,900	31,600	34,100	41,800	42,200
I-10 Westbound	6,200	8,100	9,800	11,800	13,500
US 4 Westbound	100	100	200	1,100	2,600
US 87 Northbound	2,800	3,300	5,200	6,400	6,900
US 90 Eastbound	200	1,500	3,000	5,300	5,700
US 98 Eastbound	2,300	3,100	5,500	10,400	11,000
US 98 Westbound	5,000	6,500	9,400	13,100	15,100

Table IV-14 – Evacuating Vehicles Leaving Each County by Evacuation Route for the 2020 Base Scenario

	Evacuation Level A Scenario	Evacuation Level B Scenario	Evacuation Level C Scenario	Evacuation Level D Scenario	Evacuation Level E Scenario
Walton County					
I-10 Eastbound	21,100	24,400	26,000	30,600	33,800
SR 2 Eastbound	2,200	3,900	4,700	7,400	6,700
SR 20 Eastbound	1,600	4,000	6,000	8,400	8,800
SR 81 Northbound	1,000	2,400	3,600	5,400	6,300
US 331 Northbound	1,500	2,600	4,400	6,300	8,300
US 90 Eastbound	1,100	3,100	4,700	5,900	6,700
US 98 Eastbound	1,400	2,000	4,000	10,000	12,700
US 98 Westbound	3,100	5,000	5,800	5,900	6,000
Washington County					
I-10 Eastbound	14,000	20,000	24,700	31,100	34,100
I-10 Westbound	700	700	700	900	900
SR 20 Eastbound	500	1,000	1,600	3,300	3,800
SR 20 Westbound	1,300	1,900	2,400	2,800	3,600
SR 273 Northbound	7,600	9,100	10,700	12,400	13,200
US 90 Eastbound	500	500	700	600	1,800

Table IV-15 – 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
Bay County					
SR 20 Eastbound	500	900	1,600	3,000	2,800
US 98 Westbound	800	1,100	1,600	1,500	1,500
Escambia County					
I-10 Eastbound	6,600	10,900	14,300	25,700	24,900
I-10 Westbound	5,700	7,400	8,900	11,100	12,600
US 4 Westbound	100	100	200	700	1,700
US 90 Eastbound	3,800	5,700	6,000	7,100	6,900
US 98 Eastbound	5,100	5,800	5,900	6,100	5,900
US 98 Westbound	4,900	6,300	9,300	12,600	14,800
Holmes County					
I-10 Westbound	200	300	300	400	400
SR 2 Eastbound	2,100	3,500	4,900	7,300	6,900
SR 81 Northbound	1,500	2,600	4,100	5,100	6,400
US 90 Eastbound	500	2,500	4,000	6,900	7,100
Okaloosa County					
I-10 Eastbound	22,900	30,700	34,700	42,800	42,400
US 90 Eastbound	200	1,300	3,100	6,000	7,000
US 98 Eastbound	2,100	3,000	4,700	8,500	9,600
US 98 Westbound	3,100	5,300	6,200	6,100	6,200
Santa Rosa County					
I-10 Eastbound	19,500	27,800	31,400	41,100	39,900
I-10 Westbound	4,900	6,600	7,600	8,700	9,900
US 4 Westbound	400	600	1,100	1,500	2,100
US 90 Eastbound	200	400	1,200	4,400	7,000
US 98 Eastbound	800	1,200	1,900	3,900	4,300
US 98 Westbound	1,400	2,400	4,100	6,400	7,700
Walton County					
I-10 Eastbound	15,800	22,400	28,800	38,100	38,600
I-10 Westbound	700	800	1,000	1,300	1,500
SR 20 Eastbound	500	1,000	3,000	5,400	6,800
SR 20 Westbound	1,200	1,700	2,300	3,200	3,900
US 85 Eastbound	6,600	7,500	8,700	10,300	10,700
US 98 Eastbound	1,100	1,500	2,400	6,500	8,800
US 98 Westbound	1,800	2,400	2,700	3,100	3,400
Washington County					
I-10 Eastbound	21,100	25,600	28,200	33,100	37,200
I-10 Westbound	100	200	200	200	200
SR 20 Eastbound	1,800	4,200	5,700	7,500	8,100
SR 20 Westbound	800	1,000	1,100	1,300	1,800
SR 77 Northbound	1,100	1,800	2,800	3,700	4,500
SR 79 Northbound	1,600	2,700	4,400	6,200	7,900
US 90 Eastbound	1,200	3,400	5,000	7,600	8,300

Table IV-16 – Evacuating Vehicles Entering Each County by Evacuation Route for the 2020 Base Scenario

	Evacuation Level A Scenario	Evacuation Level B Scenario	Evacuation Level C Scenario	Evacuation Level D Scenario	Evacuation Level E Scenario
Bay County					
SR 20 Eastbound	500	1,000	1,600	3,300	3,800
US 98 Westbound	800	1,100	1,600	1,500	1,500
Escambia County					
I-10 Eastbound	6,500	11,400	14,300	24,000	23,800
I-10 Westbound	6,200	8,100	9,800	11,800	13,500
US 4 Westbound	100	100	200	1,100	2,600
US 90 Eastbound	3,800	5,700	6,000	7,000	6,600
US 98 Eastbound	5,100	5,900	5,900	6,000	6,000
US 98 Westbound	5,000	6,500	9,400	13,100	15,100
Holmes County					
I-10 Westbound	300	300	300	400	400
SR 2 Eastbound	2,200	3,900	4,700	7,400	6,700
SR 81 Northbound	1,000	2,400	3,600	5,400	6,300
US 90 Eastbound	1,100	3,100	4,700	5,900	6,700
Okaloosa County					
I-10 Eastbound	22,900	31,600	34,100	41,800	42,200
US 90 Eastbound	200	1,500	3,000	5,300	5,700
US 98 Eastbound	2,300	3,100	5,500	10,400	11,000
US 98 Westbound	3,100	5,000	5,800	5,900	6,000
Santa Rosa County					
I-10 Eastbound	19,100	28,400	31,000	39,100	38,500
I-10 Westbound	5,300	7,200	8,000	9,200	10,500
US 4 Westbound	400	600	1,100	1,500	1,600
US 90 Eastbound	300	400	1,200	4,700	6,800
US 98 Eastbound	900	1,300	2,100	4,800	5,400
US 98 Westbound	1,500	2,400	4,100	6,500	7,800
Walton County					
I-10 Eastbound	15,900	22,900	26,400	34,900	34,900
I-10 Westbound	700	800	1,100	1,500	1,600
SR 20 Eastbound	700	1,100	2,500	5,000	6,400
SR 20 Westbound	1,300	1,900	2,400	2,800	3,600
US 85 Eastbound	6,500	7,600	8,500	9,600	10,200
US 98 Eastbound	1,100	1,700	3,500	10,000	13,100
US 98 Westbound	1,900	2,400	2,800	3,200	3,500
Washington County					
I-10 Eastbound	21,700	25,800	28,100	33,300	37,300
I-10 Westbound	200	200	200	200	200
SR 20 Eastbound	1,600	4,000	6,000	8,400	8,800
SR 20 Westbound	800	1,100	1,200	1,400	1,700
SR 77 Northbound	1,200	2,000	3,100	4,300	5,700
SR 79 Northbound	1,700	2,800	4,300	6,500	8,400
US 90 Eastbound	1,500	3,900	5,400	7,700	8,700

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 12.5 hours for the evacuation level A scenarios in Okaloosa County to 32 hours for evacuation level E scenario in Bay County in 2015. Clearance Time to Shelter shows a similar pattern, with clearance times for the base scenarios ranging from 12.5 hours for the evacuation level A scenarios in Holmes and Okaloosa Counties to 19 hours in Walton County for evacuation level E scenario in 2015.

In 2020, in-county clearance times for the base scenarios range from 13 hours for the evacuation level A scenarios to 31.5 hours for the evacuation level E scenario. Clearance Time to Shelter shows a similar pattern, with clearance times for the base scenarios ranging from 12.5 hours for the evacuation level A scenarios to 15 hours for evacuation level E scenario in 2020.

Out of county clearance times for the base scenarios range from 14.5 hours for the base evacuation level A scenario to 32.5 hours for the evacuation level E scenario in 2015. Out of county clearance times range from 14.5 hours for the base evacuation level A scenario to 31.5 hours in 2020.

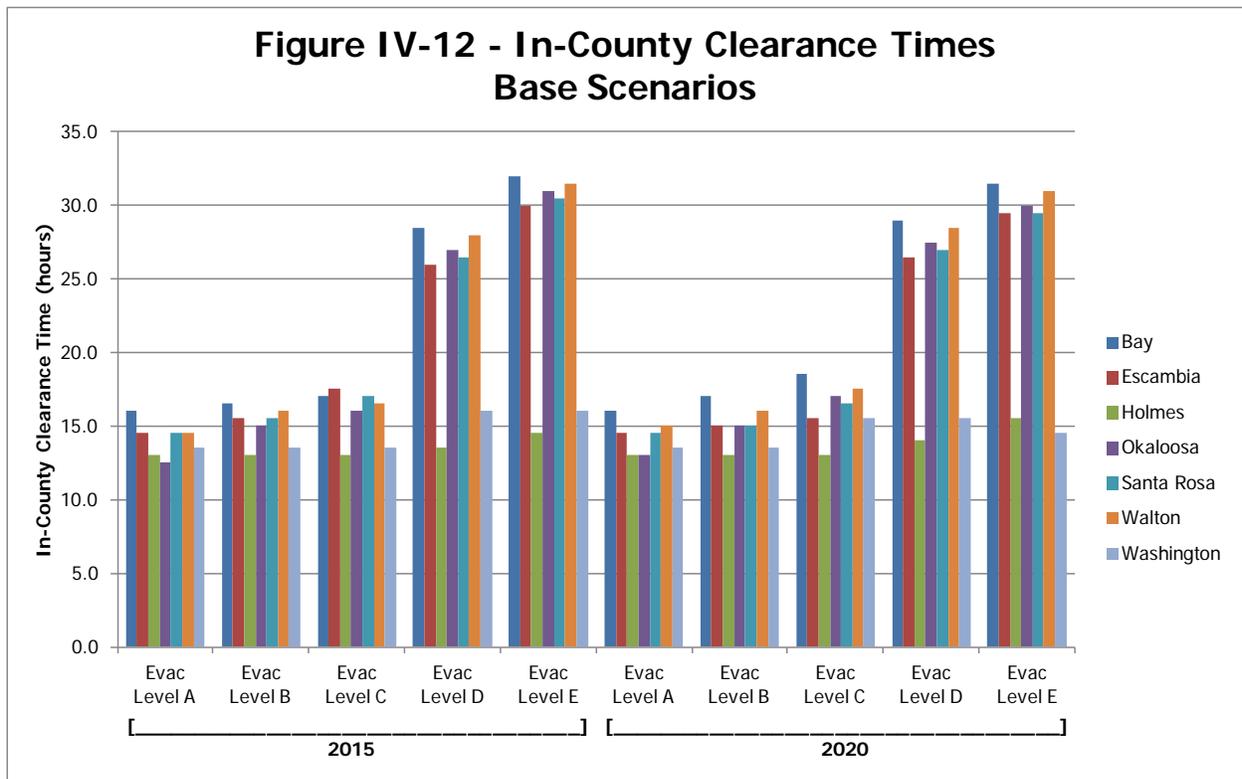
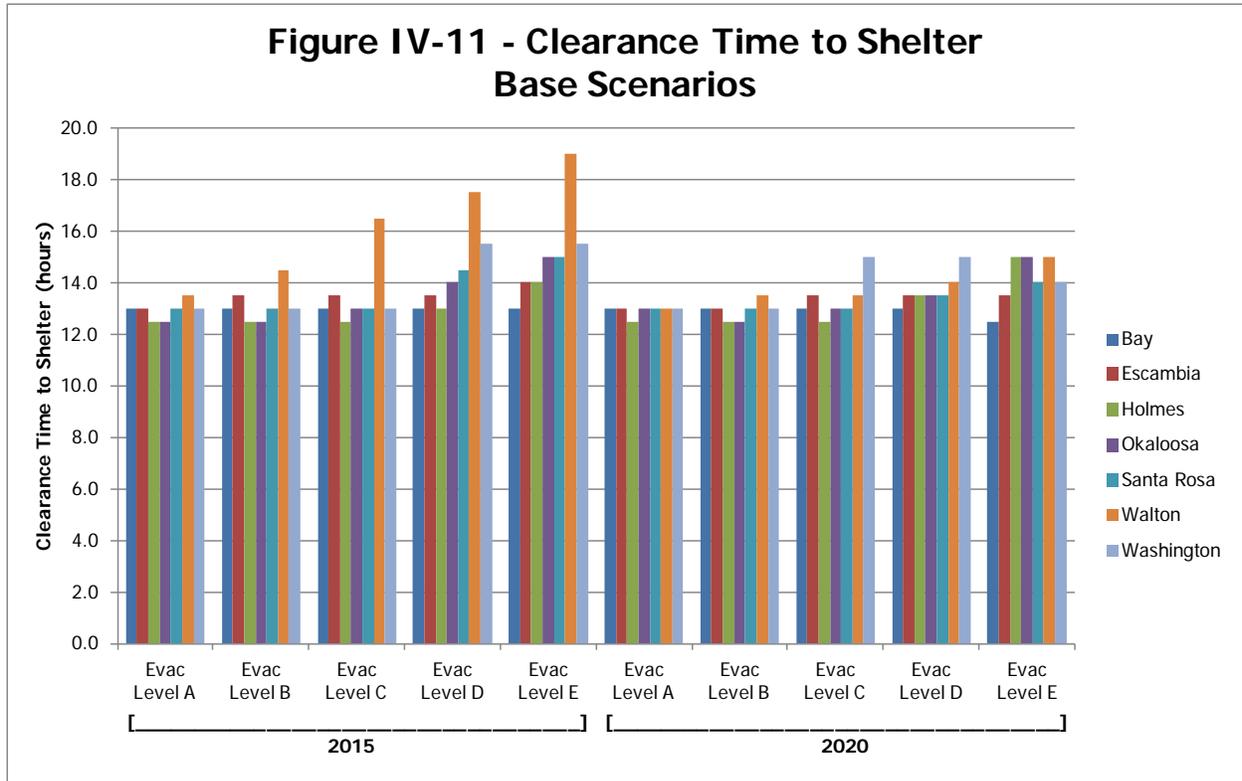
Regional clearance time for the seven county WFRPC region ranges from 16 hours to 32 hours in 2015 and from 16 and 31.5 hours in 2020.

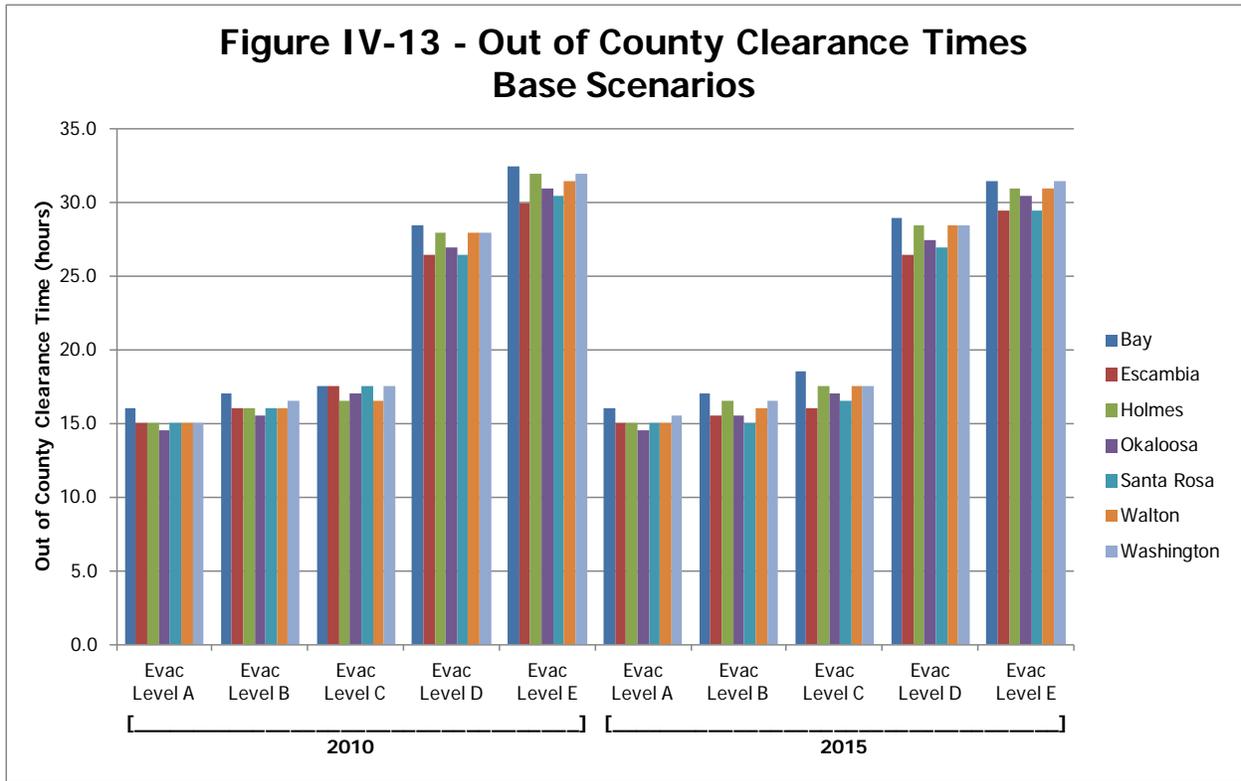
Table IV-17 – 2015 Clearance Times for Base Scenario

	Evacuation Level A Base Scenario	Evacuation Level B Base Scenario	Evacuation Level C Base Scenario	Evacuation Level D Base Scenario	Evacuation Level E Base Scenario
Clearance Time to Shelter					
Bay County	13.0	13.0	13.0	13.0	13.0
Escambia County	13.0	13.5	13.5	13.5	14.0
Holmes County	12.5	12.5	12.5	13.0	14.0
Okaloosa County	12.5	12.5	13.0	14.0	15.0
Santa Rosa County	13.0	13.0	13.0	14.5	15.0
Walton County	13.5	14.5	16.5	17.5	19.0
Washington County	13.0	13.0	13.0	15.5	15.5
In-County Clearance Time					
Bay County	16.0	16.5	17.0	28.5	32.0
Escambia County	14.5	15.5	17.5	26.0	30.0
Holmes County	13.0	13.0	13.0	13.5	14.5
Okaloosa County	12.5	15.0	16.0	27.0	31.0
Santa Rosa County	14.5	15.5	17.0	26.5	30.5
Walton County	14.5	16.0	16.5	28.0	31.5
Washington County	13.5	13.5	13.5	16.0	16.0
Out of County Clearance Time					
Bay County	16.0	17.0	17.5	28.5	32.5
Escambia County	15.0	16.0	17.5	26.5	30.0
Holmes County	15.0	16.0	16.5	28.0	32.0
Okaloosa County	14.5	15.5	17.0	27.0	31.0
Santa Rosa County	15.0	16.0	17.5	26.5	30.5
Walton County	15.0	16.0	16.5	28.0	31.5
Washington County	15.0	16.5	17.5	28.0	32.0
Regional Clearance Time					
West Florida	16.0	17.0	17.5	28.5	32.0

Table IV-18 – 2020 Clearance Times for Base Scenario

	Evacuation Level A Base Scenario	Evacuation Level B Base Scenario	Evacuation Level C Base Scenario	Evacuation Level D Base Scenario	Evacuation Level E Base Scenario
Clearance Time to Shelter					
Bay County	13.0	13.0	13.0	13.0	12.5
Escambia County	13.0	13.0	13.5	13.5	13.5
Holmes County	12.5	12.5	12.5	13.5	15.0
Okaloosa County	13.0	12.5	13.0	13.5	15.0
Santa Rosa County	13.0	13.0	13.0	13.5	14.0
Walton County	13.0	13.5	13.5	14.0	15.0
Washington County	13.0	13.0	15.0	15.0	14.0
In-County Clearance Time					
Bay County	16.0	17.0	18.5	29.0	31.5
Escambia County	14.5	15.0	15.5	26.5	29.5
Holmes County	13.0	13.0	13.0	14.0	15.5
Okaloosa County	13.0	15.0	17.0	27.5	30.0
Santa Rosa County	14.5	15.0	16.5	27.0	29.5
Walton County	15.0	16.0	17.5	28.5	31.0
Washington County	13.5	13.5	15.5	15.5	14.5
Out of County Clearance Time					
Bay County	16.0	17.0	18.5	29.0	31.5
Escambia County	15.0	15.5	16.0	26.5	29.5
Holmes County	15.0	16.5	17.5	28.5	31.0
Okaloosa County	14.5	15.5	17.0	27.5	30.5
Santa Rosa County	15.0	15.0	16.5	27.0	29.5
Walton County	15.0	16.0	17.5	28.5	31.0
Washington County	15.5	16.5	17.5	28.5	31.5
Regional Clearance Time					
West Florida	16.0	17.0	18.5	29.0	31.5





F. Operational Scenarios

The transportation analysis also included ten region wide operational scenarios selected by the county emergency managers and WFRPC 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.). Operational Scenarios 1 through 5 are for year 2015 while Scenarios 6 through 10 are for year 2020. 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 impacts from the Apalachee Region and impacts from the Mobile, AL area. For this reason, the WFRPC and local county emergency managers selected operational scenarios similar to the base scenarios, with the only exceptions 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

	Scenario 1 Level A 2015	Scenario 2 Level B 2015	Scenario 3 Level C 2015	Scenario 4 Level D 2015	Scenario 5 Level E 2015
Demographic Data	2015	2015	2015	2015	2015
Highway Network	2015	2015	2015	2015	2015
One-Way Operations	None	None	None	None	None
University Population	Fall/Spring	Fall/Spring	Fall/Spring	Fall/Spring	Fall/Spring
Tourist Rate	Default	Default	Default	Default	Default
Shelters Open	Primary	Primary	Primary	Primary	Primary
Response Curve	12-hour	12-hour	12-hour	12-hour	12-hour
Evacuation Phasing	None	None	None	None	None
Behavioral Response	Planning	Planning	Planning	Planning	Planning
Evacuation Zone	A	B	C	D	E
Counties Evacuating	Bay Escambia Holmes Okaloosa Santa Rosa Walton Washington Baldwin (AL) Gulf				
	Scenario 6 Level A 2020	Scenario 7 Level B 2020	Scenario 8 Level C 2020	Scenario 9 Level D 2020	Scenario 10 Level E 2020
Demographic Data	2020	2020	2020	2020	2020
Highway Network	2020	2020	2020	2020	2020
One-Way Operations	None	None	None	None	None
University Population	Fall/Spring	Fall/Spring	Fall/Spring	Fall/Spring	Fall/Spring
Tourist Rate	Default	Default	Default	Default	Default
Shelters Open	Primary	Primary	Primary	Primary	Primary
Response Curve	12-hour	12-hour	12-hour	12-hour	12-hour
Evacuation Phasing	None	None	None	None	None
Behavioral Response	Planning	Planning	Planning	Planning	Planning
Evacuation Zone	A	B	C	D	E
Counties Evacuating	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 as reported from the modeling results for the operational scenarios is summarized by county for 2015 in **Table IV-20** and for 2020 in **Table IV-21**.

Within the seven county region, total evacuating population ranges from more than 147,000 persons for the operational scenario level A evacuation to more than 522,000 persons for the operational scenario level E evacuation in 2015. By 2020, this range increases within the seven counties to more than 156,000 persons for the operational scenario level A evacuation and more than 550,700 persons for the operational scenario level E evacuation.

Table IV-20 – Evacuating Population by Operational Scenario for 2015

	Evacuation Level A Operational Scenario	Evacuation Level B Operational Scenario	Evacuation Level C Operational Scenario	Evacuation Level D Operational Scenario	Evacuation Level E Operational Scenario
Bay County					
Site-built Homes	20,669	34,157	45,483	64,462	82,281
Mobile/Manuf. Homes	15,315	16,894	19,502	20,766	22,031
Tourists	412	3,682	6,563	6,991	9,298
TOTAL	36,396	54,733	71,548	92,219	113,610
Escambia County					
Site-built Homes	18,952	33,310	51,193	82,354	111,266
Mobile/Manuf. Homes	12,686	13,723	15,727	16,764	17,801
Tourists	2,543	2,571	2,652	2,652	2,652
TOTAL	34,181	49,604	69,572	101,770	131,719
Holmes County					
Site-built Homes	650	1,299	1,949	2,599	3,249
Mobile/Manuf. Homes	3,249	3,520	4,061	4,332	4,873
Tourists	0	0	0	0	0
TOTAL	3,899	4,819	6,010	6,931	8,122
Okaloosa County					
Site-built Homes	13,692	22,241	39,540	69,850	90,894
Mobile/Manuf. Homes	6,591	7,131	8,172	8,643	9,238
Tourists	0	571	3,562	4,957	8,639
TOTAL	20,283	29,943	51,274	83,450	108,771
Santa Rosa County					
Site-built Homes	13,904	16,080	33,336	54,531	70,647
Mobile/Manuf. Homes	12,312	13,300	15,162	16,150	17,139
Tourists	0	56	56	56	593
TOTAL	26,216	29,436	48,554	70,737	88,379
Walton County					
Site-built Homes	8,631	11,210	16,209	21,788	26,112
Mobile/Manuf. Homes	8,526	9,200	10,444	10,888	11,755
Tourists	4,586	19,898	22,764	22,764	22,764
TOTAL	21,743	40,308	49,417	55,440	60,631
Washington County					
Site-built Homes	772	1,544	3,088	3,860	4,632
Mobile/Manuf. Homes	3,628	3,991	4,716	5,442	6,167
Tourists	0	0	0	0	0
TOTAL	4,400	5,535	7,804	9,302	10,799

Table IV-21 – Evacuating Population by Operational Scenario for 2020

	Evacuation Level A Operational Scenario	Evacuation Level B Operational Scenario	Evacuation Level C Operational Scenario	Evacuation Level D Operational Scenario	Evacuation Level E Operational Scenario
Bay County					
Site-built Homes	21,903	36,195	48,197	68,307	87,189
Mobile/Manuf. Homes	16,240	17,915	20,681	22,022	23,363
Tourists	412	3,682	6,563	6,991	9,298
TOTAL	38,555	57,792	75,441	97,320	119,850
Escambia County					
Site-built Homes	19,281	33,888	52,081	83,784	113,200
Mobile/Manuf. Homes	12,910	13,965	16,004	17,060	18,115
Tourists	2,543	2,571	2,652	2,652	2,652
TOTAL	34,734	50,424	70,737	103,496	133,967
Holmes County					
Site-built Homes	665	1,330	1,994	2,659	3,324
Mobile/Manuf. Homes	3,334	3,612	4,168	4,445	5,001
Tourists	0	0	0	0	0
TOTAL	3,999	4,942	6,162	7,104	8,325
Okaloosa County					
Site-built Homes	14,191	23,049	40,979	72,390	94,197
Mobile/Manuf. Homes	6,853	7,414	8,497	8,988	9,606
Tourists	0	571	3,562	4,957	8,639
TOTAL	21,044	31,034	53,038	86,335	112,442
Santa Rosa County					
Site-built Homes	15,273	17,664	36,620	59,907	77,613
Mobile/Manuf. Homes	13,531	14,617	16,664	17,750	18,836
Tourists	0	0	0	434	643
TOTAL	28,804	32,281	53,284	78,091	97,092
Walton County					
Site-built Homes	9,720	12,624	18,254	24,537	29,406
Mobile/Manuf. Homes	9,601	10,360	11,760	12,261	13,237
Tourists	5,056	21,882	25,061	25,061	25,061
TOTAL	24,377	44,866	55,075	61,859	67,704
Washington County					
Site-built Homes	811	1,621	3,242	4,053	4,863
Mobile/Manuf. Homes	3,814	4,196	4,959	5,721	6,484
Tourists	0	0	0	0	0
TOTAL	4,625	5,817	8,201	9,774	11,347

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 2015 in **Table IV-22** and for 2020 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 84,800 vehicles evacuate from the seven county RPC for the operational scenario level A evacuation in 2015, and this number increases to more than 283,300 evacuating vehicles from the seven county region for the operational scenario level E evacuation in 2015. By 2020, the number of evacuating vehicles is expected to increase to more than 89,900 vehicles for the operational scenario level A evacuation and slightly more than 298,800 evacuating vehicles for the operational scenario level E evacuation.

Table IV-22 – Evacuating Vehicles by Operational Scenario for 2015

	Evacuation Level A Operational Scenario	Evacuation Level B Operational Scenario	Evacuation Level C Operational Scenario	Evacuation Level D Operational Scenario	Evacuation Level E Operational Scenario
Bay County					
Site-built Homes	11,408	18,532	24,937	35,157	44,720
Mobile/Manuf. Homes	10,226	11,253	12,989	13,835	14,680
Tourists	177	1,416	2,536	2,720	3,581
TOTAL	21,811	31,201	40,462	51,712	62,981
Escambia County					
Site-built Homes	10,182	17,500	26,934	42,858	57,490
Mobile/Manuf. Homes	7,688	8,318	9,540	10,169	10,799
Tourists	1,191	1,203	1,242	1,242	1,242
TOTAL	19,061	27,021	37,716	54,269	69,531
Holmes County					
Site-built Homes	336	673	1,009	1,345	1,682
Mobile/Manuf. Homes	1,730	1,874	2,162	2,307	2,595
Tourists	0	0	0	0	0
TOTAL	2,066	2,547	3,171	3,652	4,277
Okaloosa County					
Site-built Homes	8,186	13,045	23,485	41,506	53,682
Mobile/Manuf. Homes	4,804	5,193	5,929	6,629	7,110
Tourists	0	190	1,433	1,982	3,190
TOTAL	12,990	18,428	30,847	50,117	63,982
Santa Rosa County					
Site-built Homes	7,673	8,955	18,060	29,485	37,909
Mobile/Manuf. Homes	7,156	7,731	8,814	9,388	9,963
Tourists	0	25	25	25	270
TOTAL	14,829	16,711	26,899	38,898	48,142
Walton County					
Site-built Homes	5,128	6,701	9,655	13,047	15,646
Mobile/Manuf. Homes	5,833	6,294	7,148	7,461	8,049
Tourists	820	4,664	5,156	5,156	5,156
TOTAL	11,781	17,659	21,959	25,664	28,851
Washington County					
Site-built Homes	392	783	1,567	1,959	2,350
Mobile/Manuf. Homes	1,881	2,069	2,445	2,822	3,198
Tourists	0	0	0	0	0
TOTAL	2,273	2,852	4,012	4,781	5,548

Table IV-23 – Evacuating Vehicles by Operational Scenario for 2020

	Evacuation Level A Operational Scenario	Evacuation Level B Operational Scenario	Evacuation Level C Operational Scenario	Evacuation Level D Operational Scenario	Evacuation Level E Operational Scenario
Bay County					
Site-built Homes	12,088	19,637	26,424	37,255	47,389
Mobile/Manuf. Homes	10,841	11,931	13,772	14,668	15,564
Tourists	177	1,416	2,536	2,720	3,581
TOTAL	23,106	32,984	42,732	54,643	66,534
Escambia County					
Site-built Homes	10,358	17,802	27,399	43,599	58,484
Mobile/Manuf. Homes	7,821	8,462	9,705	10,346	10,986
Tourists	1,191	1,203	1,242	1,242	1,242
TOTAL	19,370	27,467	38,346	55,187	70,712
Holmes County					
Site-built Homes	344	688	1,032	1,376	1,721
Mobile/Manuf. Homes	1,777	1,925	2,221	2,369	2,665
Tourists	0	0	0	0	0
TOTAL	2,121	2,613	3,253	3,745	4,386
Okaloosa County					
Site-built Homes	8,485	13,521	24,343	43,022	55,642
Mobile/Manuf. Homes	4,976	5,380	6,142	6,868	7,366
Tourists	0	190	1,433	1,982	3,190
TOTAL	13,461	19,091	31,918	51,872	66,198
Santa Rosa County					
Site-built Homes	8,426	9,834	19,836	32,387	41,641
Mobile/Manuf. Homes	7,865	8,496	9,687	10,318	10,949
Tourists	0	0	0	196	294
TOTAL	16,291	18,330	29,523	42,901	52,884
Walton County					
Site-built Homes	5,782	7,554	10,884	14,706	17,636
Mobile/Manuf. Homes	6,566	7,085	8,047	8,399	9,061
Tourists	892	5,057	5,601	5,601	5,601
TOTAL	13,240	19,696	24,532	28,706	32,298
Washington County					
Site-built Homes	411	823	1,646	2,057	2,469
Mobile/Manuf. Homes	1,979	2,177	2,572	2,968	3,364
Tourists	0	0	0	0	0
TOTAL	2,390	3,000	4,218	5,025	5,833

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 more than 11,300 persons for the operational scenario level A evacuation in 2015 to more than 35,600 persons for the operational scenario level E evacuation. By 2020, the public shelter demand is expected to increase to 12,000 persons for the level A evacuation and more than 37,500 persons for the level E evacuation.

Table IV-24 – Shelter Demand by Operational Scenario

	Evacuation Level A Operational Scenario	Evacuation Level B Operational Scenario	Evacuation Level C Operational Scenario	Evacuation Level D Operational Scenario	Evacuation Level E Operational Scenario
2015					
Bay County	3,045	4,216	5,178	6,344	7,554
Escambia County	2,993	4,299	5,914	8,529	11,022
Holmes County	542	644	786	890	1,030
Okaloosa County	1,023	1,471	2,475	4,168	5,361
Santa Rosa County	2,152	2,368	3,785	5,334	6,642
Walton County	966	1,558	1,837	2,244	2,536
Washington County	631	792	1,114	1,326	1,541
2020					
Bay County	3,226	4,460	5,472	6,708	7,985
Escambia County	3,043	4,370	6,014	8,673	11,209
Holmes County	557	662	807	912	1,058
Okaloosa County	1,060	1,523	2,560	4,312	5,546
Santa Rosa County	2,364	2,599	4,155	5,877	7,295
Walton County	1,086	1,735	2,048	2,507	2,836
Washington County	664	833	1,171	1,395	1,619

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

	Evacuation Level A Operational Scenario	Evacuation Level B Operational Scenario	Evacuation Level C Operational Scenario	Evacuation Level D Operational Scenario	Evacuation Level E Operational Scenario
2015	122,903	165,002	232,657	326,142	397,929
2020	128,092	171,797	242,146	339,173	413,510

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 2015 and 2020.

SR 85, US 331, SR 285, I-10, US 231, US 29, SR 77, SR 79, SR87, 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.



Figure IV-14

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

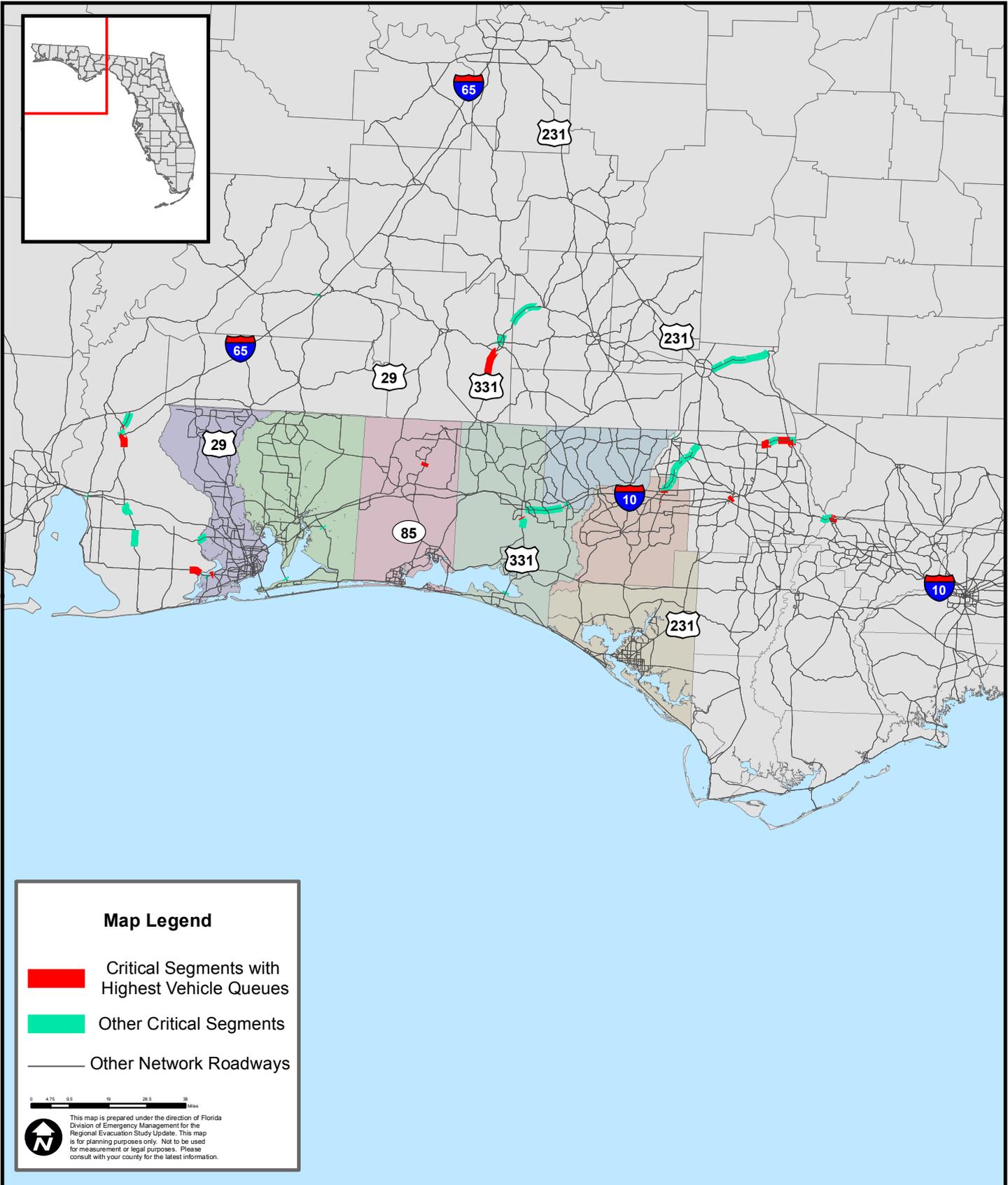




Figure IV-15

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

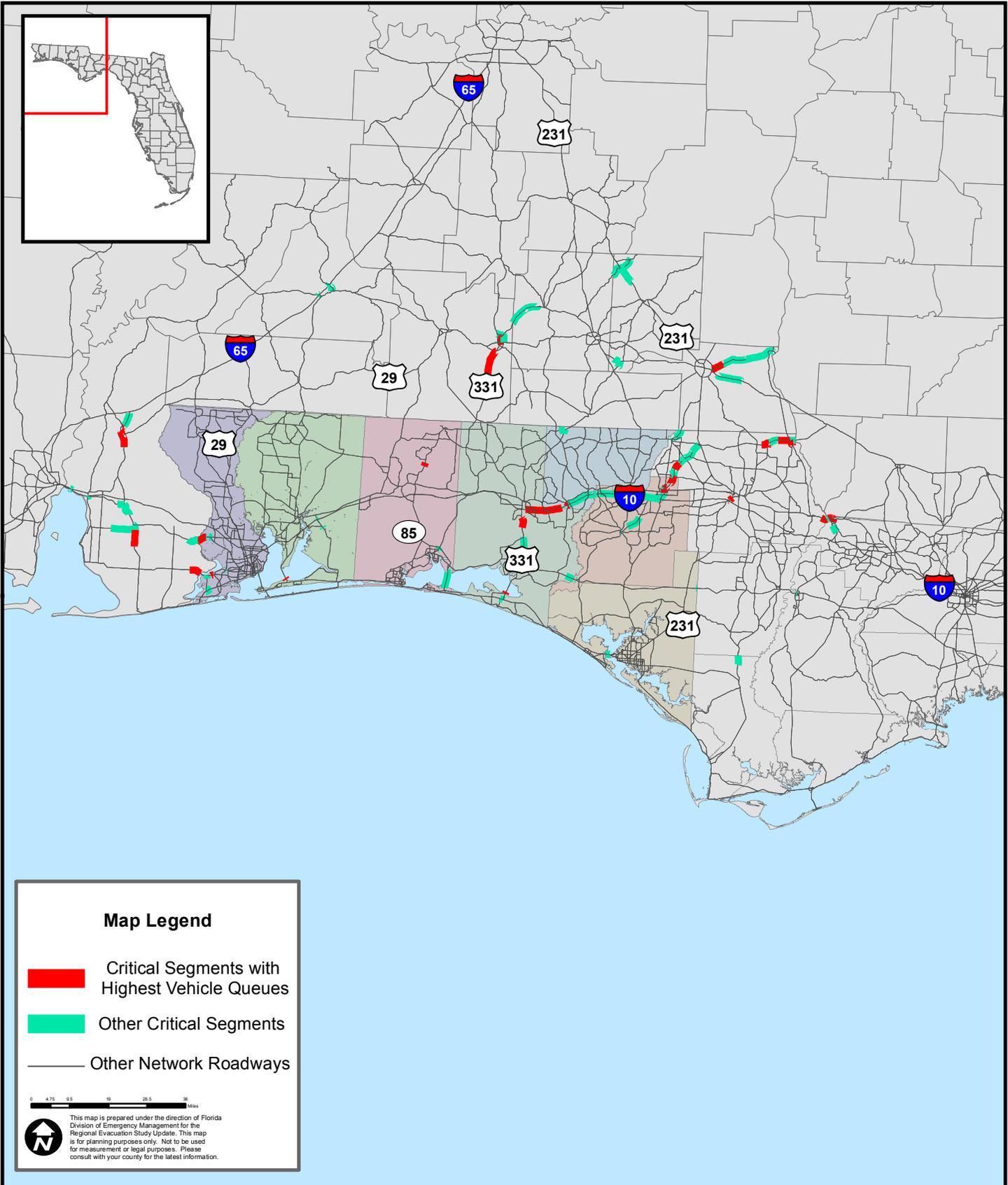




Figure IV-16

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

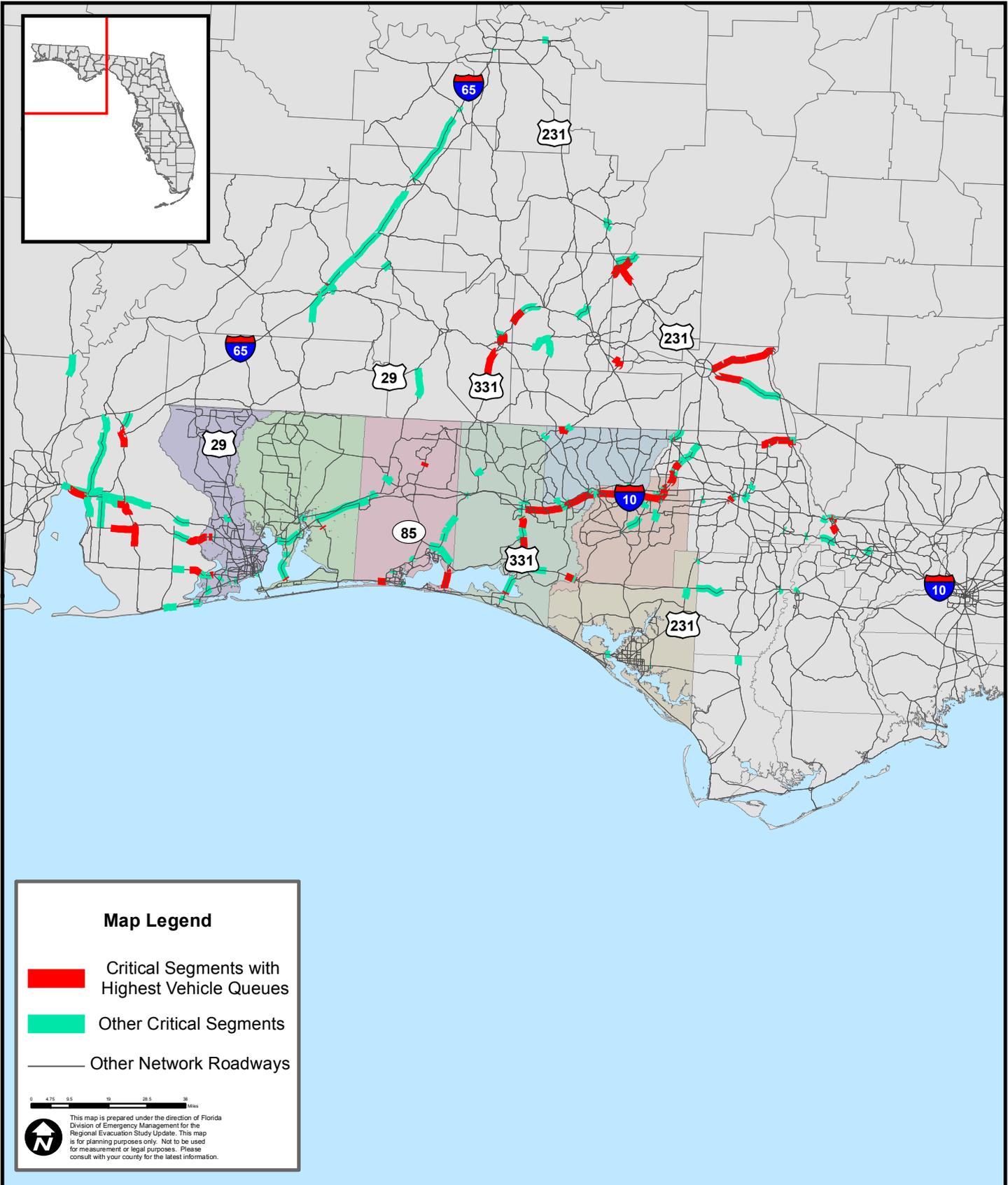




Figure IV-17

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





Figure IV-18

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





Figure IV-19

Critical Roadway Segments with Excessive Vehicle Queues for 2020 Operational Scenario Evacuation Level A

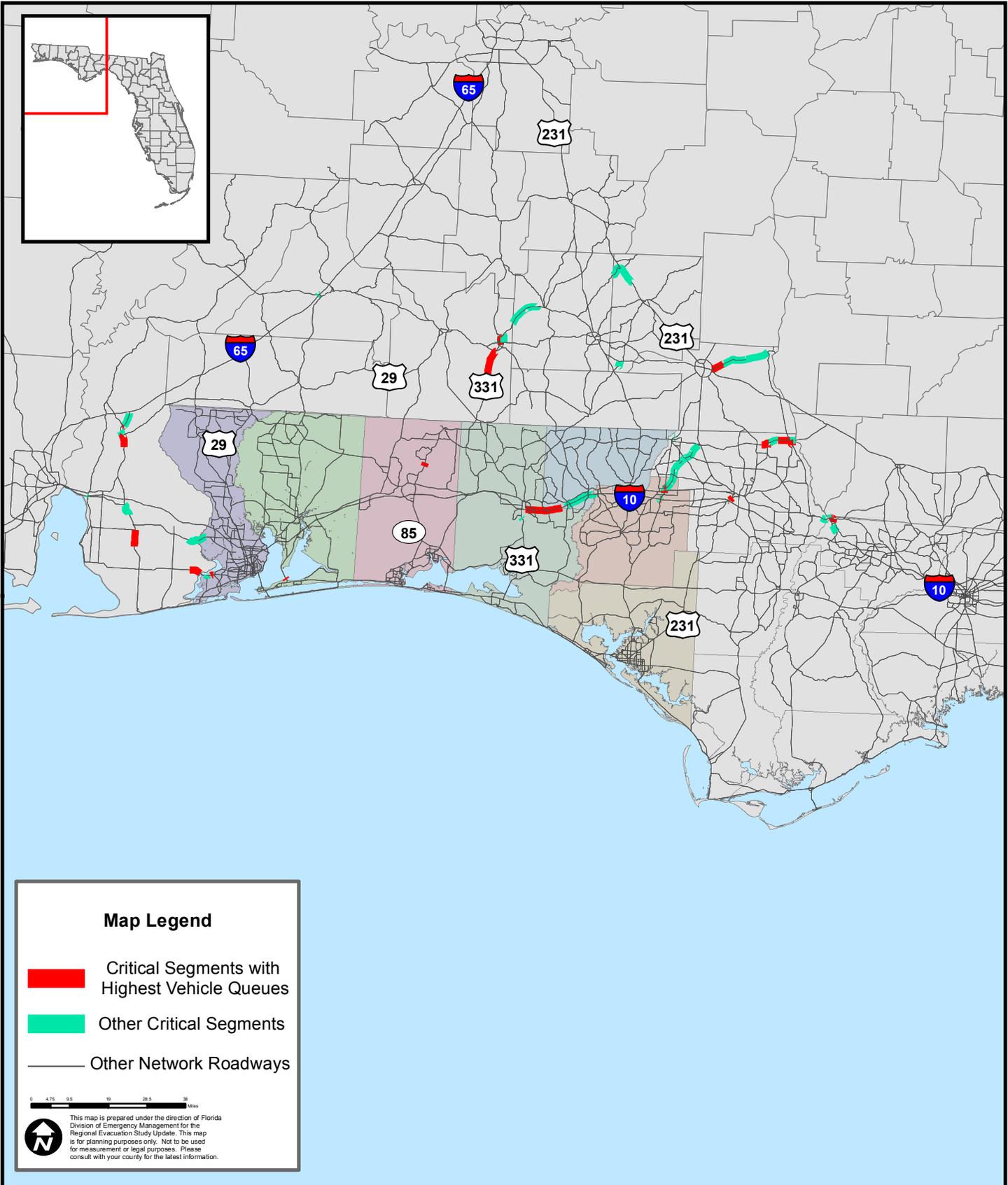




Figure IV-20

Critical Roadway Segments with Excessive Vehicle Queues for 2020 Operational Scenario Evacuation Level B

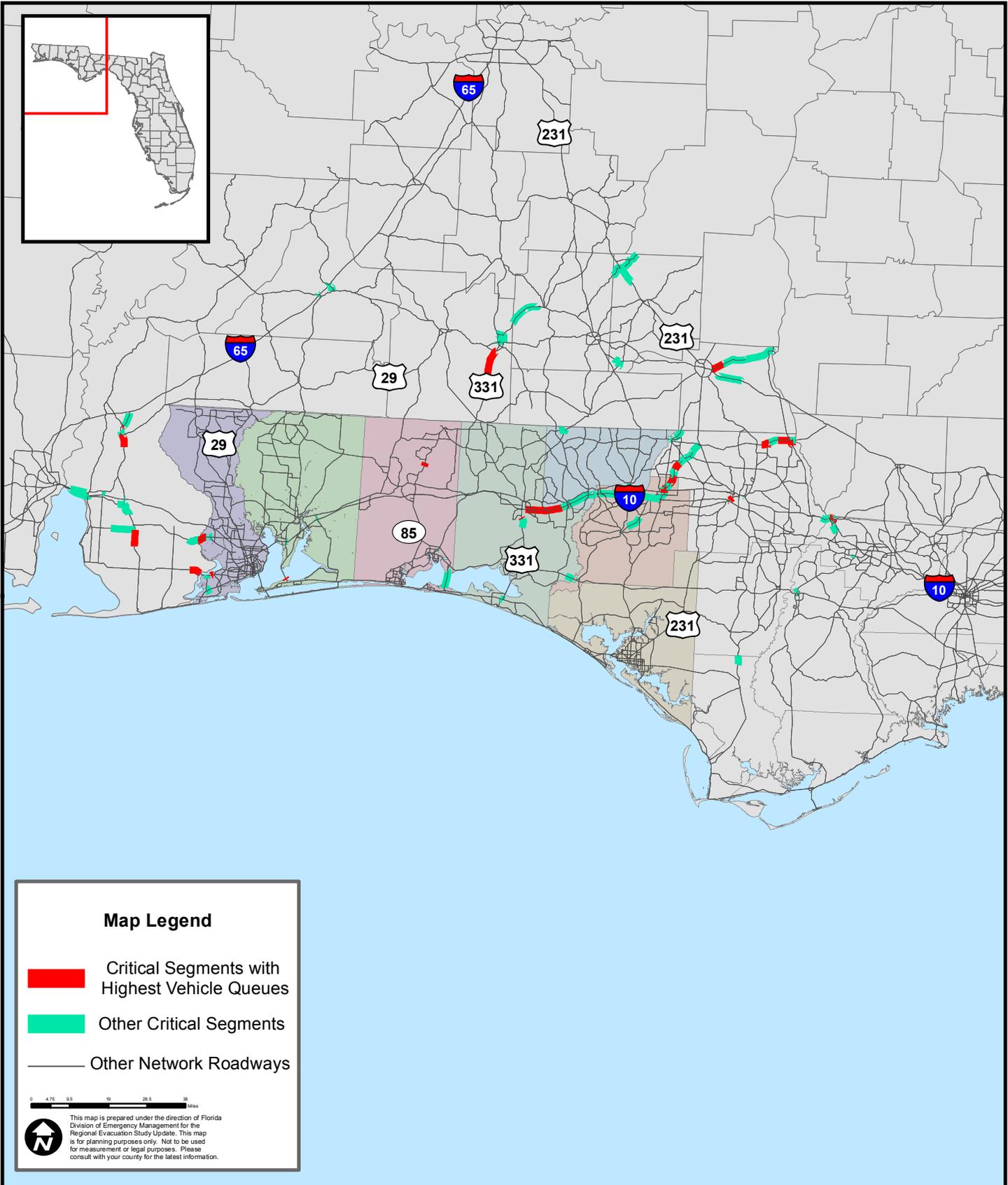




Figure IV-21

Critical Roadway Segments with Excessive Vehicle Queues for 2020 Operational Scenario Evacuation Level C

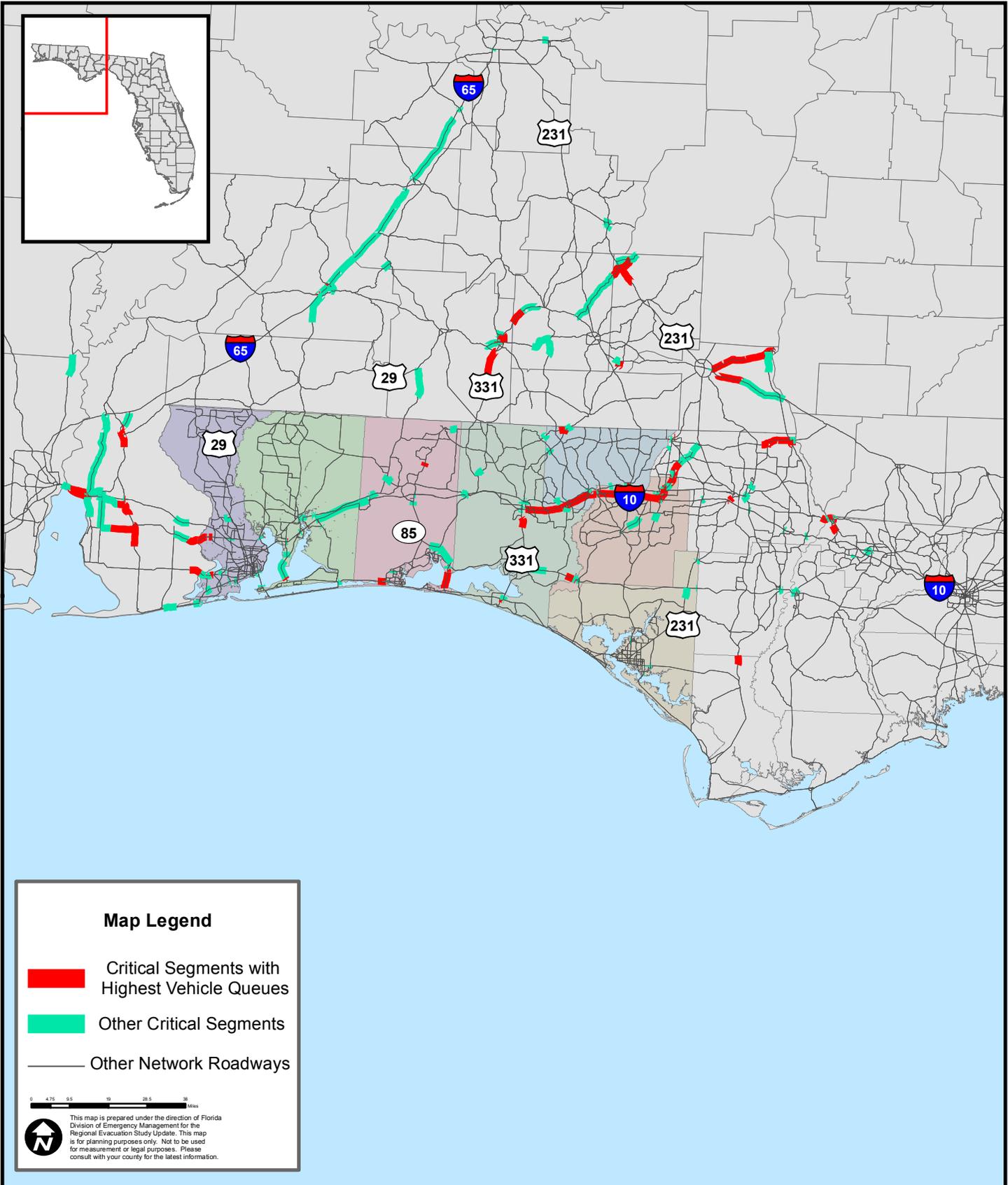




Figure IV-22

Critical Roadway Segments with Excessive Vehicle Queues for 2020 Operational Scenario Evacuation Level D

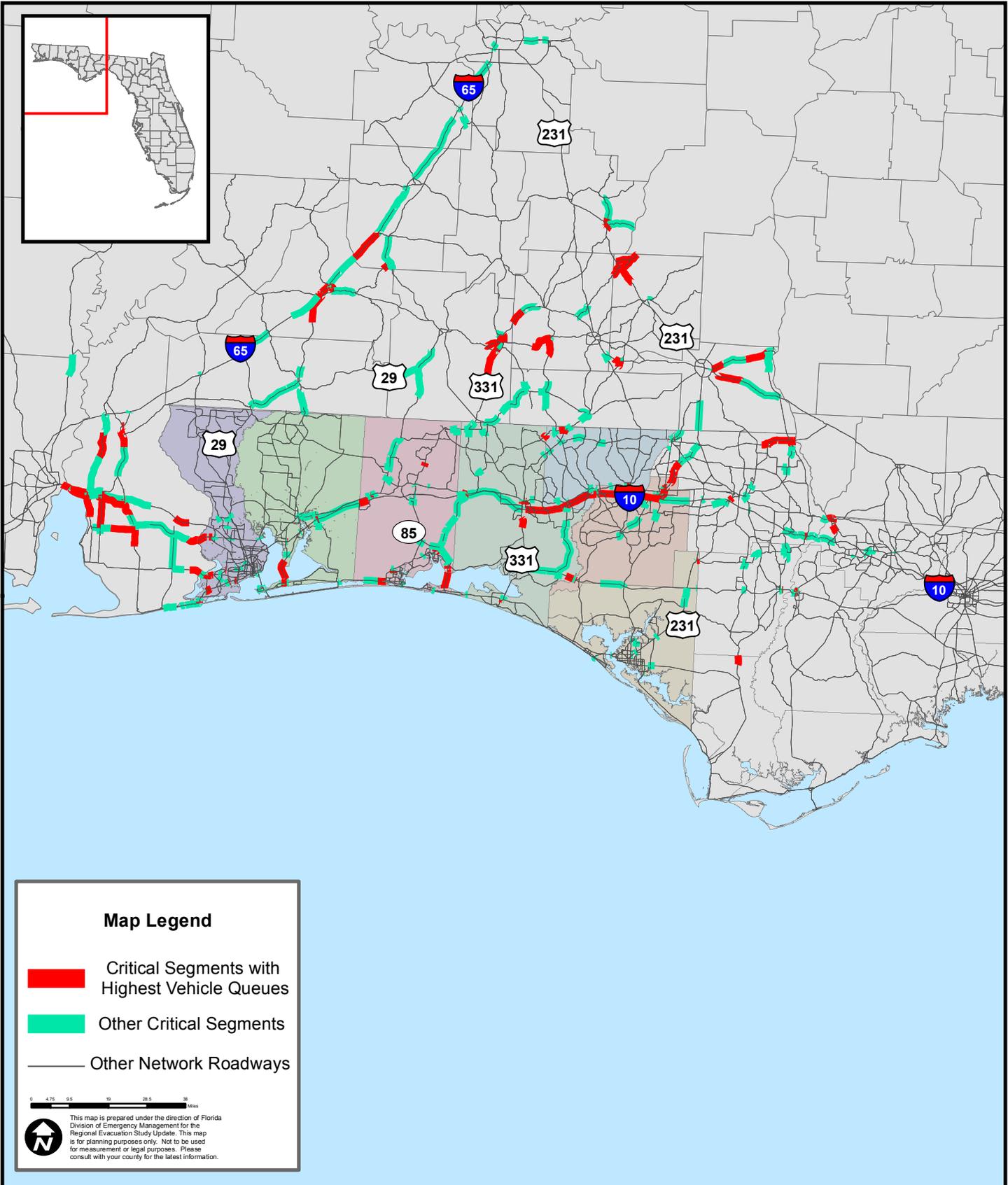




Figure IV-23

Critical Roadway Segments with Excessive Vehicle Queues for 2020 Operational Scenario Evacuation Level E



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 2015 and **Table IV-27** for 2020. In addition, evacuating vehicles entering each county by major evacuation route are identified in **Table IV-28** for 2015 and **Table IV-29** for 2020. Detailed volume figures for all evacuation routes in the West Florida Region for each operational scenario are included in Volume 5-4.

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-26 – 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
Bay County					
SR 20 Eastbound	1,000	2,200	3,800	5,300	7,200
SR 20 Westbound	400	700	800	1,100	1,600
SR 22 Eastbound	100	100	100	300	500
SR 77 Northbound	800	900	1,600	3,000	3,800
SR 79 Northbound	1,000	1,800	3,000	4,800	7,000
US 231 Northbound	5,100	6,700	8,200	10,800	13,100
US 98 Southbound	100	100	100	200	700
US 98 Westbound	1,200	1,800	2,200	2,600	3,200
Escambia County					
I-10 Eastbound	15,100	19,700	27,000	35,500	39,100
I-10 Westbound	5,000	7,600	11,000	13,900	15,600
US 29 Northbound	2,000	4,100	8,400	14,300	18,200
US 90 Eastbound	300	400	600	3,600	5,700
US 90 Westbound	0	0	200	1,100	2,900
US 97 Northbound	100	200	300	1,700	2,700
US 98 Eastbound	600	800	1,100	2,800	4,700
US 98 Westbound	300	500	700	1,400	1,500
Holmes County					
I-10 Eastbound	14,300	16,600	20,600	26,100	30,200
I-10 Westbound	300	500	700	1,000	1,300
SR 2 Eastbound	700	1,100	2,300	3,400	4,500
SR 81 Northbound	200	300	1,000	2,600	4,200
US 90 Eastbound	700	1,800	3,400	5,300	5,800
Okaloosa County					
I-10 Eastbound	11,700	15,500	23,300	32,800	37,300
I-10 Westbound	3,300	5,100	6,300	7,800	9,200
SR 20 Eastbound	500	800	1,900	4,000	6,000
SR 285 Northbound	3,600	5,200	8,000	9,600	10,900
US 189 Northbound	700	1,900	4,500	7,200	8,700
US 4 Westbound	300	400	800	1,300	1,800
US 85 Eastbound	6,200	6,500	7,300	9,400	9,200
US 98 Eastbound	800	1,000	1,600	5,400	8,400
US 98 Westbound	900	1,700	3,200	5,000	6,700
Santa Rosa County					
I-10 Eastbound	17,600	22,500	30,100	37,800	40,700
I-10 Westbound	3,800	5,600	7,200	9,600	11,700
US 4 Westbound	0	0	100	600	1,300
US 87 Northbound	1,800	2,200	3,700	5,500	6,400
US 90 Eastbound	100	100	1,800	4,500	6,500
US 98 Eastbound	1,400	1,600	3,000	6,400	9,500
US 98 Westbound	3,400	4,600	7,200	10,400	12,900

Table IV-26 – 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
Walton County					
I-10 Eastbound	17,000	20,600	24,600	27,800	30,900
SR 2 Eastbound	700	2,000	4,200	5,800	7,000
SR 20 Eastbound	800	2,600	4,600	6,600	8,000
SR 81 Northbound	800	1,600	2,300	4,700	5,400
US 331 Northbound	1,000	1,400	2,500	4,500	7,300
US 90 Eastbound	100	500	2,500	5,500	7,000
US 98 Eastbound	1,000	1,300	2,500	6,300	9,800
US 98 Westbound	2,000	3,500	4,600	5,300	6,000
Washington County					
I-10 Eastbound	10,600	14,200	19,500	27,200	30,800
I-10 Westbound	300	500	600	700	800
SR 20 Eastbound	400	500	1,100	1,900	2,900
SR 20 Westbound	700	1,000	1,600	2,500	3,600
SR 273 Northbound	6,300	7,800	9,500	11,300	12,500
US 90 Eastbound	100	200	500	1,000	1,400

Table IV-27 – Evacuating Vehicles Leaving Each County by Evacuation Route for the 2020 Operational Scenario

	Evacuation Level A Scenario	Evacuation Level B Scenario	Evacuation Level C Scenario	Evacuation Level D Scenario	Evacuation Level E Scenario
Bay County					
SR 20 Eastbound	1,200	2,400	3,900	5,400	7,400
SR 20 Westbound	400	800	1,000	1,200	1,500
SR 22 Eastbound	100	100	100	400	600
SR 77 Northbound	800	1,000	1,700	3,700	4,700
SR 79 Northbound	1,100	2,000	3,000	4,700	7,500
US 231 Northbound	5,300	7,100	8,900	11,700	13,400
US 98 Southbound	100	100	100	300	900
US 98 Westbound	1,200	1,800	2,200	2,800	3,300
Escambia County					
I-10 Eastbound	15,100	19,500	27,000	35,600	38,500
I-10 Westbound	5,500	8,100	11,300	14,000	16,000
US 29 Northbound	2,000	4,400	8,800	15,100	20,700
US 90 Eastbound	400	400	600	3,600	6,000
US 90 Westbound	0	0	600	1,600	3,100
US 97 Northbound	100	200	300	1,900	3,200
US 98 Eastbound	600	800	1,200	3,100	4,900
US 98 Westbound	300	500	700	1,400	1,600
Holmes County					
I-10 Eastbound	14,500	16,800	21,000	26,700	30,600
I-10 Westbound	400	400	800	1,000	1,400
SR 2 Eastbound	800	1,400	2,200	3,800	4,400
SR 81 Northbound	200	400	1,400	3,300	5,000
US 90 Eastbound	800	2,000	3,500	4,900	6,200
Okaloosa County					
I-10 Eastbound	11,900	15,500	22,800	30,300	34,200
I-10 Westbound	3,500	5,500	6,900	8,300	9,800
SR 20 Eastbound	700	1,000	1,900	4,100	5,700
SR 285 Northbound	3,600	5,000	7,500	9,100	10,700
US 189 Northbound	800	2,100	5,200	7,800	8,900
US 4 Westbound	300	500	800	1,500	1,500
US 85 Eastbound	6,200	6,400	7,900	9,400	9,900
US 98 Eastbound	900	1,100	2,200	6,700	11,300
US 98 Westbound	1,100	1,800	3,200	5,000	6,900
Santa Rosa County					
I-10 Eastbound	17,900	22,600	30,200	37,900	41,000
I-10 Westbound	4,100	6,000	7,900	10,400	12,500
US 4 Westbound	100	100	200	700	1,900
US 87 Northbound	1,900	2,500	3,900	6,200	6,900
US 90 Eastbound	100	100	2,100	4,500	6,000
US 98 Eastbound	1,500	1,700	3,300	7,500	10,100
US 98 Westbound	3,700	4,800	7,500	10,800	13,500

Table IV-27 – Evacuating Vehicles Leaving Each County by Evacuation Route for the 2020 Operational Scenario

	Evacuation Level A Scenario	Evacuation Level B Scenario	Evacuation Level C Scenario	Evacuation Level D Scenario	Evacuation Level E Scenario
Walton County					
I-10 Eastbound	17,900	21,700	23,900	27,900	32,000
SR 2 Eastbound	900	2,100	4,300	6,300	6,700
SR 20 Eastbound	700	2,200	4,600	7,100	8,400
SR 81 Northbound	600	900	2,800	4,300	6,000
US 331 Northbound	1,000	1,500	2,500	5,000	7,200
US 90 Eastbound	100	1,000	3,200	5,900	5,800
US 98 Eastbound	1,000	1,300	2,300	6,100	10,900
US 98 Westbound	2,000	3,500	4,500	5,200	5,800
Washington County					
I-10 Eastbound	10,700	14,300	20,200	27,600	31,900
I-10 Westbound	400	400	600	700	800
SR 20 Eastbound	400	600	1,100	2,700	3,100
SR 20 Westbound	700	1,200	1,900	2,500	3,200
SR 273 Northbound	6,600	7,900	9,700	11,600	12,800
US 90 Eastbound	100	200	400	900	1,200

Table IV-28 – 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
Bay County					
SR 20 Eastbound	400	500	1,100	1,900	2,900
US 98 Westbound	600	800	1,200	1,300	1,400
Escambia County					
I-10 Eastbound	5,200	7,000	10,500	18,800	22,500
I-10 Westbound	3,800	5,600	7,200	9,600	11,700
US 4 Westbound	0	0	100	600	1,300
US 90 Eastbound	2,000	3,300	4,900	6,300	6,600
US 98 Eastbound	4,900	4,800	5,100	5,600	5,700
US 98 Westbound	3,400	4,600	7,200	10,400	12,900
Holmes County					
I-10 Westbound	200	200	300	300	300
SR 2 Eastbound	700	2,000	4,200	5,800	7,000
SR 81 Northbound	800	1,600	2,300	4,700	5,400
US 90 Eastbound	100	500	2,500	5,500	7,000
Okaloosa County					
I-10 Eastbound	17,600	22,500	30,100	37,800	40,700
US 90 Eastbound	100	100	1,800	4,500	6,500
US 98 Eastbound	1,400	1,600	3,000	6,400	9,500
US 98 Westbound	2,000	3,500	4,600	5,300	6,000
Santa Rosa County					
I-10 Eastbound	15,100	19,700	27,000	35,500	39,100
I-10 Westbound	3,300	5,100	6,300	7,800	9,200
US 4 Westbound	300	400	800	1,300	1,800
US 90 Eastbound	200	200	400	3,300	5,300
US 98 Eastbound	600	800	1,100	2,800	4,700
US 98 Westbound	900	1,700	3,200	5,000	6,700
Walton County					
I-10 Eastbound	11,700	15,500	23,300	32,800	37,300
I-10 Westbound	300	500	700	1,000	1,300
SR 20 Eastbound	500	800	1,900	4,000	6,000
SR 20 Westbound	700	1,000	1,600	2,500	3,600
US 85 Eastbound	6,200	6,500	7,300	9,400	9,200
US 98 Eastbound	800	1,000	1,600	5,400	8,400
US 98 Westbound	1,200	1,800	2,200	2,600	3,200
Washington County					
I-10 Eastbound	17,700	21,400	25,400	30,700	34,700
I-10 Westbound	100	100	200	200	200
SR 20 Eastbound	800	2,600	4,600	6,600	8,000
SR 20 Westbound	400	700	800	1,100	1,600
SR 77 Northbound	800	900	1,600	3,000	3,800
SR 79 Northbound	1,000	1,800	3,000	4,800	7,000
US 90 Eastbound	300	1,300	3,500	6,000	7,400

Table IV-29 – Evacuating Vehicles Entering Each County by Evacuation Route for the 2020 Operational Scenario

	Evacuation Level A Scenario	Evacuation Level B Scenario	Evacuation Level C Scenario	Evacuation Level D Scenario	Evacuation Level E Scenario
Bay County					
SR 20 Eastbound	400	600	1,100	2,700	3,100
US 98 Westbound	600	800	1,200	1,300	1,400
Escambia County					
I-10 Eastbound	5,200	6,900	10,600	19,200	23,300
I-10 Westbound	4,100	6,000	7,900	10,400	12,500
US 4 Westbound	100	100	200	700	1,900
US 90 Eastbound	2,000	3,300	4,800	6,300	6,600
US 98 Eastbound	4,800	4,800	5,000	5,500	5,800
US 98 Westbound	3,700	4,800	7,500	10,800	13,500
Holmes County					
I-10 Westbound	200	200	300	300	400
SR 2 Eastbound	900	2,100	4,300	6,300	6,700
SR 81 Northbound	600	900	2,800	4,300	6,000
US 90 Eastbound	100	1,000	3,200	5,900	5,800
Okaloosa County					
I-10 Eastbound	17,900	22,600	30,200	37,900	41,000
US 90 Eastbound	100	100	2,100	4,500	6,000
US 98 Eastbound	1,500	1,700	3,300	7,500	10,100
US 98 Westbound	2,000	3,500	4,500	5,200	5,800
Santa Rosa County					
I-10 Eastbound	15,100	19,500	27,000	35,600	38,500
I-10 Westbound	3,500	5,500	6,900	8,300	9,800
US 4 Westbound	300	500	800	1,500	1,500
US 90 Eastbound	200	300	400	3,300	5,700
US 98 Eastbound	600	800	1,200	3,100	4,900
US 98 Westbound	1,100	1,800	3,200	5,000	6,900
Walton County					
I-10 Eastbound	11,900	15,500	22,800	30,300	34,200
I-10 Westbound	400	400	800	1,000	1,400
SR 20 Eastbound	700	1,000	1,900	4,100	5,700
SR 20 Westbound	700	1,200	1,900	2,500	3,200
US 85 Eastbound	6,200	6,400	7,900	9,400	9,900
US 98 Eastbound	900	1,100	2,200	6,700	11,300
US 98 Westbound	1,200	1,800	2,200	2,800	3,300
Washington County					
I-10 Eastbound	18,400	22,100	25,700	31,000	34,600
I-10 Westbound	100	100	200	200	200
SR 20 Eastbound	700	2,200	4,600	7,100	8,400
SR 20 Westbound	400	800	1,000	1,200	1,500
SR 77 Northbound	800	1,000	1,700	3,700	4,700
SR 79 Northbound	1,100	2,000	3,000	4,700	7,500
US 90 Eastbound	300	1,500	3,700	6,300	8,100

Clearance Times

Clearance times for each of the operational scenarios are summarized in **Table IV-30** and **IV-31**, as well as **Figures IV-31, IV-32, IV-33, IV-34, IV-35** and **IV-36**. 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 2015 operational scenarios range from 13 hours to 26.5 hours depending upon the scenario. Clearance Time to Shelter for the operational scenarios ranges from 12.5 hours to 18.5 hours depending upon the county and the scenario.

In 2020, in-county clearance times for the operational scenarios also vary from 13 hours to 26.5 hours depending upon the scenario. Clearance Time to Shelter for the operational scenarios ranges from 12.5 hours to 15.5 hours depending upon the scenario.

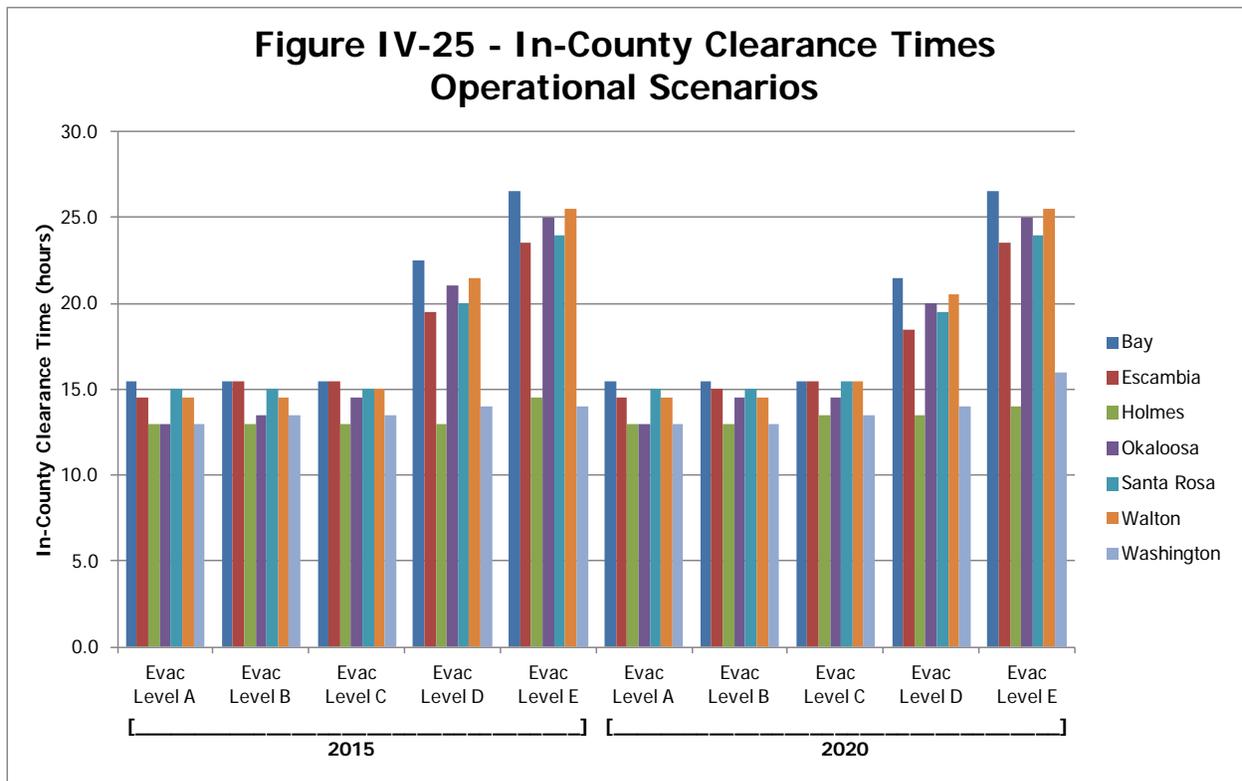
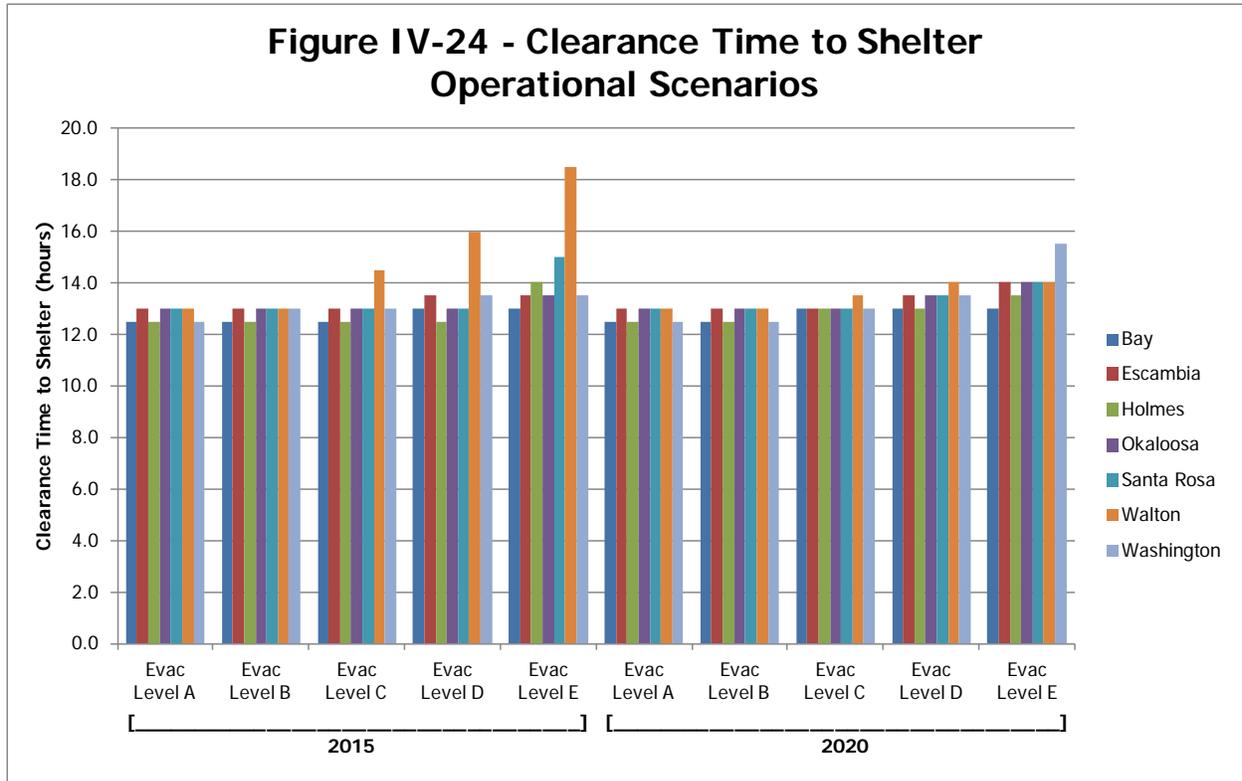
Out of county clearance times for the 2015 operational scenarios range from 14.5 hours to 26.5 hours. Out of county clearance times also range from 14.5 hours to 26.5 hours in 2020 depending upon the scenario. Regional clearance time for the seven county WFRPC Region ranges from 15.5 hours to 26.5 hours in both 2015 and 2020.

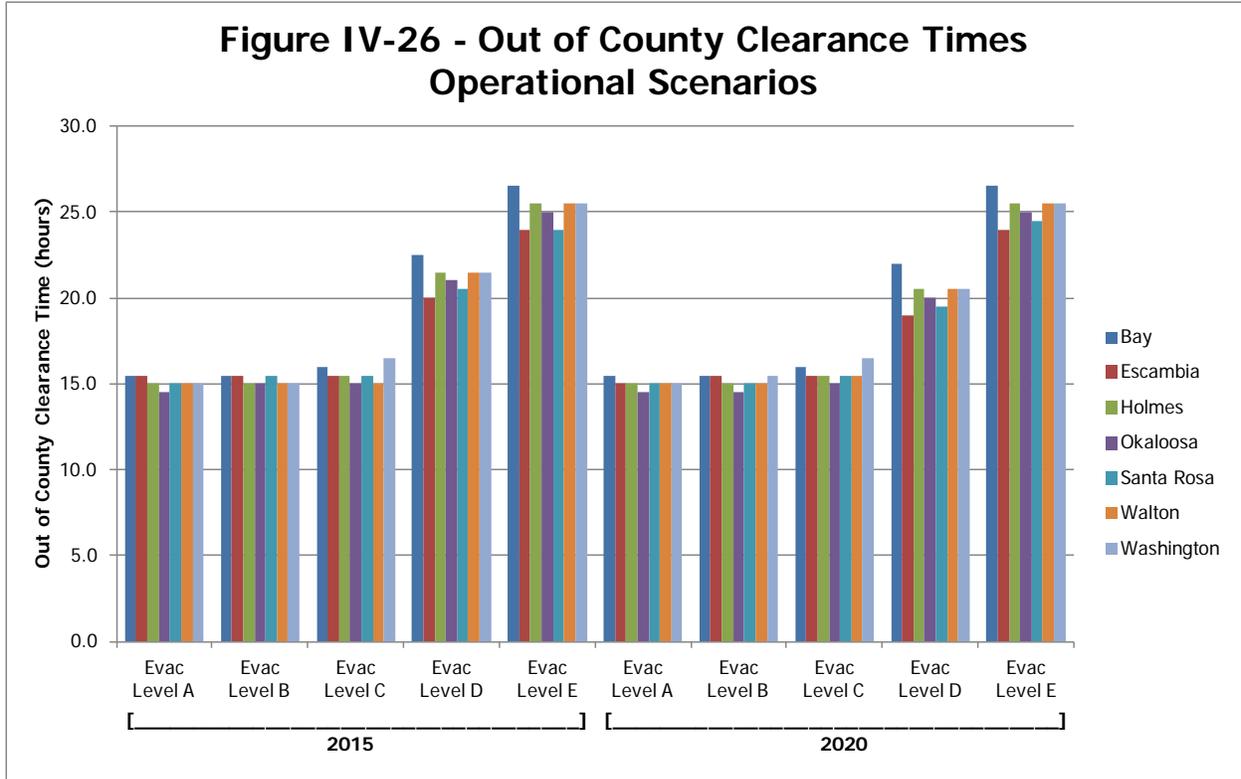
Table IV-30 – 2015 Clearance Times for Operational Scenarios

	Evacuation Level A Operational Scenario	Evacuation Level B Operational Scenario	Evacuation Level C Operational Scenario	Evacuation Level D Operational Scenario	Evacuation Level E Operational Scenario
Clearance Time to Shelter					
Bay County	12.5	12.5	12.5	13.0	13.0
Escambia County	13.0	13.0	13.0	13.5	13.5
Holmes County	12.5	12.5	12.5	12.5	14.0
Okaloosa County	13.0	13.0	13.0	13.0	13.5
Santa Rosa County	13.0	13.0	13.0	13.0	15.0
Walton County	13.0	13.0	14.5	16.0	18.5
Washington County	12.5	13.0	13.0	13.5	13.5
In-County Clearance Time					
Bay County	15.5	15.5	15.5	22.5	26.5
Escambia County	14.5	15.5	15.5	19.5	23.5
Holmes County	13.0	13.0	13.0	13.0	14.5
Okaloosa County	13.0	13.5	14.5	21.0	25.0
Santa Rosa County	15.0	15.0	15.0	20.0	24.0
Walton County	14.5	14.5	15.0	21.5	25.5
Washington County	13.0	13.5	13.5	14.0	14.0
Out of County Clearance Time					
Bay County	15.5	15.5	16.0	22.5	26.5
Escambia County	15.5	15.5	15.5	20.0	24.0
Holmes County	15.0	15.0	15.5	21.5	25.5
Okaloosa County	14.5	15.0	15.0	21.0	25.0
Santa Rosa County	15.0	15.5	15.5	20.5	24.0
Walton County	15.0	15.0	15.0	21.5	25.5
Washington County	15.0	15.0	16.5	21.5	25.5
Regional Clearance Time					
West Florida	15.5	15.5	16.5	22.5	26.5

Table IV-31 – 2020 Clearance Times for Operational Scenarios

	Evacuation Level A Operational Scenario	Evacuation Level B Operational Scenario	Evacuation Level C Operational Scenario	Evacuation Level D Operational Scenario	Evacuation Level E Operational Scenario
Clearance Time to Shelter					
Bay County	12.5	12.5	13.0	13.0	13.0
Escambia County	13.0	13.0	13.0	13.5	14.0
Holmes County	12.5	12.5	13.0	13.0	13.5
Okaloosa County	13.0	13.0	13.0	13.5	14.0
Santa Rosa County	13.0	13.0	13.0	13.5	14.0
Walton County	13.0	13.0	13.5	14.0	14.0
Washington County	12.5	12.5	13.0	13.5	15.5
In-County Clearance Time					
Bay County	15.5	15.5	15.5	21.5	26.5
Escambia County	14.5	15.0	15.5	18.5	23.5
Holmes County	13.0	13.0	13.5	13.5	14.0
Okaloosa County	13.0	14.5	14.5	20.0	25.0
Santa Rosa County	15.0	15.0	15.5	19.5	24.0
Walton County	14.5	14.5	15.5	20.5	25.5
Washington County	13.0	13.0	13.5	14.0	16.0
Out of County Clearance Time					
Bay County	15.5	15.5	16.0	22.0	26.5
Escambia County	15.0	15.5	15.5	19.0	24.0
Holmes County	15.0	15.0	15.5	20.5	25.5
Okaloosa County	14.5	14.5	15.0	20.0	25.0
Santa Rosa County	15.0	15.0	15.5	19.5	24.5
Walton County	15.0	15.0	15.5	20.5	25.5
Washington County	15.0	15.5	16.5	20.5	25.5
Regional Clearance Time					
West Florida	15.5	15.5	16.5	22.0	26.5





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 2015 is identified in **Table IV-32** and for 2020 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 2015

	Evacuation Level A	Evacuation Level B	Evacuation Level C	Evacuation Level D	Evacuation Level E
Estimated Evacuating Population Clearing Bay County					
12-Hour	45,157	54,793	59,856	44,327	45,147
18-Hour	60,209	77,623	87,290	66,491	67,721
24-Hour				88,654	90,295
36-Hour				105,277	122,274
Estimated Evacuating Population Clearing Escambia County					
12-Hour	36,352	46,331	54,809	50,264	55,385
18-Hour	45,440	61,775	79,930	75,396	83,078
24-Hour				100,528	110,770
36-Hour				111,000	138,463
Estimated Evacuating Population Clearing Holmes County					
12-Hour	4,852	5,036	5,356	3,435	3,249
18-Hour	6,065	6,714	7,364	5,152	4,874
24-Hour				6,869	6,498
36-Hour				8,014	8,664
Estimated Evacuating Population Clearing Okaloosa County					
12-Hour	20,688	28,254	42,884	42,243	46,817
18-Hour	24,998	36,495	60,752	63,365	70,226
24-Hour				84,486	93,634
36-Hour				95,047	120,944
Estimated Evacuating Population Clearing Santa Rosa County					
12-Hour	30,233	32,460	43,220	37,051	38,226
18-Hour	37,791	43,280	63,029	55,577	57,340
24-Hour				74,102	76,453
36-Hour				81,821	97,159
Estimated Evacuating Population Clearing Walton County					
12-Hour	24,270	39,228	43,594	26,915	24,505
18-Hour	30,337	52,304	59,942	40,372	36,758
24-Hour				53,829	49,010
36-Hour				62,801	64,326
Estimated Evacuating Population Clearing Washington County					
12-Hour	6,422	6,399	7,092	4,764	4,458
18-Hour	8,027	8,799	10,343	7,145	6,686
24-Hour				9,527	8,915
36-Hour				11,115	11,887

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

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

	Evacuation Level A	Evacuation Level B	Evacuation Level C	Evacuation Level D	Evacuation Level E
Estimated Evacuating Population Clearing Bay County					
12-Hour	47,848	57,920	59,758	45,997	49,155
18-Hour	63,797	82,053	89,637	68,996	73,733
24-Hour			92,127	91,994	98,310
36-Hour				111,160	129,032
Estimated Evacuating Population Clearing Escambia County					
12-Hour	36,954	48,627	60,959	51,120	57,287
18-Hour	46,192	62,810	81,278	76,679	85,930
24-Hour				102,239	114,574
36-Hour				112,889	140,830
Estimated Evacuating Population Clearing Holmes County					
12-Hour	4,978	5,009	5,178	3,459	3,438
18-Hour	6,222	6,887	7,551	5,189	5,157
24-Hour				6,919	6,876
36-Hour				8,216	8,881
Estimated Evacuating Population Clearing Okaloosa County					
12-Hour	21,473	29,297	44,380	42,922	49,206
18-Hour	25,946	37,842	62,872	64,383	73,809
24-Hour				85,844	98,412
36-Hour				98,363	125,065
Estimated Evacuating Population Clearing Santa Rosa County					
12-Hour	33,217	37,990	50,316	40,119	43,419
18-Hour	41,521	47,488	69,185	60,178	65,129
24-Hour				80,237	86,839
36-Hour				90,267	106,739
Estimated Evacuating Population Clearing Walton County					
12-Hour	27,244	43,782	45,894	29,536	27,819
18-Hour	34,055	58,376	66,929	44,304	41,729
24-Hour				59,072	55,638
36-Hour				70,148	71,866
Estimated Evacuating Population Clearing Washington County					
12-Hour	6,534	6,727	7,454	4,919	4,759
18-Hour	8,440	9,250	10,871	7,378	7,138
24-Hour				9,837	9,518
36-Hour				11,682	12,492

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 24 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 within 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 management 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 5-4) 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;
- Demographic data from the 2010 US Census identifies a change in population for the seven county region from estimates used in previous studies. This change is a decrease from previous 2010 and 2015 population projections used in the 2010 WFRPC Evacuation Transportation Analysis. This population change is reflected in both the 2015 and 2020 population projections used in this study; 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.



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