Florida Statewide Regional Evacuation Study Program

Evacuation Transportation Analysis

Volume 4-9

Florida Division of Emergency Management

Southwest Florida Regional Planning Council

Southwest Florida Region

2017

Includes Hurricane Evacuation Study

Statewide Regional Evacuation Study Program

TABLE OF CONTENTS

Page

Executive Summary ES-1
A. Background and Purpose ES-1
B. Study Area ES-1
C. Input and Coordination ES-1
D. Study Comparisons ES-2
E. Evacuation Modeling Methodology and Framework ES-2
F. Regional Model Implementation ES-2
G. TIME User Interface ES-15
H. Vulnerable Population ES-15
I. Evacuation Model Scenarios ES-21
J. Clearance Time Results ES-21
K. Maximum Evacuating Population Clearances ES-29
L. Summary and Conclusions ES-32

Chapter I – Introduction I-1
A. Background and Purpose I-1
B. Study Area I-1
C. Input and Coordination I-3
D. Study Comparison I-3

Chapter II – Evacuation Modeling Methodology and Framework II-1
A. Behavioral Assumptions II-1
B. Zone System and Highway Network II-3
C. Background Traffic II-6
D. Evacuation Traffic II-8
E. Dynamic Traffic Assignment II-12
F. Prototype Model Development II-13

Chapter III – Regional Model Implementation III-1
A. Regional Model Network III-1
B. Regional Zone System III-4
C. Regional Demographic Characteristics III-6
D. Planned Roadway Improvements III-8
E. Behavioral Assumptions III-11
F. Shelters III-18
G. Evacuation Zones III-18
H. TIME User Interface III-20

Chapter IV – Transportation Analysis IV-1
A. Vulnerable Population IV-1
B. Clearance Time Definitions IV-7
C. Evacuation Model Scenarios IV-7

Page

D. Base Scenarios IV-8
E. Base Scenario Results IV-11
F. Operational Scenarios..... IV-37
G. Operational Scenario Results..... IV-39
H. Maximum Evacuating Population Clearances..... IV-65
I. Sensitivity Analysis..... IV-65
J. Summary and Conclusions..... IV-68

LIST OF FIGURES

Page

Figure ES-1 – Southwest Regional Model Network ES-4
Figure ES-2 – Southwest Regional Model Transportation Evacuation Zone (TEZ) System ES-5
Figure ES-3 – Evacuating Participation Rates: Charlotte County – Site-Built Homes ES-9
Figure ES-4 – Evacuating Participation Rates: Charlotte County – Mobile Homes ES-9
Figure ES-5 – Evacuating Participation Rates: Collier County – Site-Built Homes ES-10
Figure ES-6 – Evacuating Participation Rates: Collier County – Mobile Homes ES-10
Figure ES-7 – Evacuating Participation Rates: Glades County – Site-Built Homes ES-11
Figure ES-8 – Evacuating Participation Rates: Glades County – Mobile Homes ES-11
Figure ES-9 – Evacuating Participation Rates: Hendry County – Site-Built Homes ES-12
Figure ES-10 – Evacuating Participation Rates: Hendry County – Mobile Homes ES-12
Figure ES-11 – Evacuating Participation Rates: Lee County – Site-Built Homes ES-13
Figure ES-12 – Evacuating Participation Rates: Lee County – Mobile Homes ES-13
Figure ES-13 – Evacuating Participation Rates: Sarasota County – Site-Built Homes ES-14
Figure ES-14 – Evacuating Participation Rates: Sarasota County – Mobile Homes ES-14
Figure I-1 – Southwest Florida Regional Planning Council Counties I-2
Figure II-1 – Nine Hour Response Curve II-2
Figure II-2 – Percent of Available Capacity for Coastal Counties II-7
Figure II-3 – Percent of Available Capacity for Other Counties II-8
Figure II-4 – General Model Flow II-9
Figure III-1 – Southwest Regional Model Area III-2
Figure III-2 – Southwest Regional Model Network III-3
Figure III-3 – Southwest Regional Model Transportation Evacuation Zone (TEZ) System III-5
Figure III-4 – Evacuating Participation Rates: Charlotte County – Site-Built Homes III-12
Figure III-5 – Evacuating Participation Rates: Charlotte County – Mobile Homes III-12
Figure III-6 – Evacuating Participation Rates: Collier County – Site-Built Homes III-13
Figure III-7 – Evacuating Participation Rates: Collier County – Mobile Homes III-13
Figure III-8 – Evacuating Participation Rates: Glades County – Site-Built Homes III-14
Figure III-9 – Evacuating Participation Rates: Glades County – Mobile Homes III-14
Figure III-10 – Evacuating Participation Rates: Hendry County – Site-Built Homes III-15
Figure III-11 – Evacuating Participation Rates: Hendry County – Mobile Homes III-15
Figure III-12 – Evacuating Participation Rates: Lee County – Site-Built Homes III-16
Figure III-13 – Evacuating Participation Rates: Lee County – Mobile Homes III-16
Figure III-14 – Evacuating Participation Rates: Sarasota County – Site-Built Homes III-17
Figure III-15 – Evacuating Participation Rates: Sarasota County – Mobile Homes III-17
Figure III-16 – Southwest Florida Regional Evacuation Zones III-19
Figure IV-1 – Critical Roadway Segments with Excessive Vehicle Queues for 2017 Base Scenario Evacuation Level A IV-18
Figure IV-2 – Critical Roadway Segments with Excessive Vehicle Queues for 2017 Base Scenario Evacuation Level B IV-19
Figure IV-3 – Critical Roadway Segments with Excessive Vehicle Queues for 2017 Base Scenario Evacuation Level C IV-20
Figure IV-4 – Critical Roadway Segments with Excessive Vehicle Queues for 2017 Base Scenario Evacuation Level D IV-21

Page

Figure IV-5 – Critical Roadway Segments with Excessive Vehicle Queues for 2017 Base Scenario Evacuation Level E IV-22
Figure IV-6 – Critical Roadway Segments with Excessive Vehicle Queues for 2020 Base Scenario Evacuation Level A IV-23
Figure IV-7 – Critical Roadway Segments with Excessive Vehicle Queues for 2020 Base Scenario Evacuation Level B IV-24
Figure IV-8 – Critical Roadway Segments with Excessive Vehicle Queues for 2020 Base Scenario Evacuation Level C IV-25
Figure IV-9 – Critical Roadway Segments with Excessive Vehicle Queues for 2020 Base Scenario Evacuation Level D IV-26
Figure IV-10 – Critical Roadway Segments with Excessive Vehicle Queues for 2020 Base Scenario Evacuation Level E IV-27
Figure IV-11 – Clearance Time to Shelter Base Scenarios IV-35
Figure IV-12 – In-County Clearance Times Base Scenarios..... IV-35
Figure IV-13 – Out of County Clearance Times Base Scenarios IV-36
Figure IV-14 – Critical Roadway Segments with Excessive Vehicle Queues for 2017 Operational Scenario Evacuation Level A..... IV-46
Figure IV-15 – Critical Roadway Segments with Excessive Vehicle Queues for 2017 Operational Scenario Evacuation Level B..... IV-47
Figure IV-16 – Critical Roadway Segments with Excessive Vehicle Queues for 2017 Operational Scenario Evacuation Level C..... IV-48
Figure IV-17 – Critical Roadway Segments with Excessive Vehicle Queues for 2017 Operational Scenario Evacuation Level D IV-49
Figure IV-18 – Critical Roadway Segments with Excessive Vehicle Queues for 2017 Operational Scenario Evacuation Level E..... IV-50
Figure IV-19 – Critical Roadway Segments with Excessive Vehicle Queues for 2020 Operational Scenario Evacuation Level A..... IV-51
Figure IV-20 – Critical Roadway Segments with Excessive Vehicle Queues for 2020 Operational Scenario Evacuation Level B..... IV-52
Figure IV-21 – Critical Roadway Segments with Excessive Vehicle Queues for 2020 Operational Scenario Evacuation Level C..... IV-53
Figure IV-22 – Critical Roadway Segments with Excessive Vehicle Queues for 2020 Operational Scenario Evacuation Level D IV-54
Figure IV-23 – Critical Roadway Segments with Excessive Vehicle Queues for 2020 Operational Scenario Evacuation Level E..... IV-55
Figure IV-24 – Clearance Time to Shelter Operational Scenarios..... IV-63
Figure IV-25 – In-County Clearance Times Operational Scenarios..... IV-63
Figure IV-26 – Out of County Clearance Times Operational Scenarios IV-64

LIST OF TABLES

Page

Table ES-1 – Southwest Demographic Characteristic Summary ES-6
Table ES-2 – Southwest Region Roadway Improvements, 2011 – 2015 ..... ES-7
Table ES-3 – Southwest Region Roadway Improvements, 2016 – 2020 ..... ES-8
Table ES-4 – Vulnerable Population in the Southwest Region for 2017 ..... ES-16
Table ES-5 – Vulnerable Population in the Southwest Region for 2020 ..... ES-17
Table ES-6 – Vulnerable Population by Destination for 2017 ..... ES-18
Table ES-7 – Vulnerable Population by Destination for 2020 ..... ES-19
Table ES-8 – Vulnerable Shadow Evacuation Population ES-20
Table ES-9 – Base Scenarios ES-22
Table ES-10 – Operational Scenarios ES-23
Table ES-11 – 2017 Clearance Times for Base Scenario ES-24
Table ES-12 – 2020 Clearance Times for Base Scenario ES-25
Table ES-13 – 2017 Clearance Times for Operational Scenarios ES-26
Table ES-14 – 2020 Clearance Times for Operational Scenarios ES-27
Table ES-15 – Maximum Evacuating Population by Time Interval for 2017 ..... ES-30
Table ES-16 – Maximum Evacuating Population by Time Interval for 2020 ..... ES-31
Table II-1 – Out of County Trip Destinations by Region II-11
Table III-1 – Southwest Demographic Characteristics Summary III-7
Table III-2 – Southwest Region Roadway Improvements, 2006 - 2010 ..... III-9
Table III-3 – Southwest Planned Roadway Improvements, 2011-2015 ..... III-10
Table IV-1 – Vulnerable Population in the Southwest Florida Region for 2017 ..... IV-2
Table IV-2 – Vulnerable Population in the Southwest Florida Region for 2020 ..... IV-3
Table IV-3 – Vulnerable Population by Destination for 2017 ..... IV-4
Table IV-4 – Vulnerable Population by Destination for 2020 ..... IV-5
Table IV-5 – Vulnerable Shadow Evacuation Population IV-6
Table IV-6 – Base Scenarios IV-10
Table IV-7 – Evacuating Population by Base Scenario for 2017 ..... IV-12
Table IV-8 – Evacuating Population by Base Scenario for 2020 ..... IV-13
Table IV-9 – Evacuating Vehicles by Base Scenario for 2017 ..... IV-14
Table IV-10 – Evacuating Vehicles by Base Scenario for 2020 ..... IV-15
Table IV-11 – Shelter Demand by Base Scenario IV-16
Table IV-12 – Total Evacuating Vehicles for Base Scenarios IV-17
Table IV-13 – Evacuating Vehicles Leaving Each County by Evacuation Route for the 2015 Base Scenario IV-28
Table IV-14 – Evacuating Vehicles Leaving Each County by Evacuation Route for the 2020 Base Scenario IV-29
Table IV-15 – Evacuating Vehicles Entering Each County by Evacuation Route for the 2015 Base Scenario IV-30
Table IV-16 – Evacuating Vehicles Entering Each County by Evacuation Route for the 2020 Base Scenario IV-31
Table IV-17 – 2017 Clearance Times for Base Scenario IV-33
Table IV-18 – 2020 Clearance Times for Base Scenario IV-34
Table IV-19 – Operational Scenarios IV-38
Table IV-20 – Evacuating Population by Operational Scenario for 2017 ..... IV-40

Page

Table IV-21 – Evacuating Population by Operational Scenario for 2020 ..... IV-41
Table IV-22 – Evacuating Vehicles by Operational Scenario for 2017 ..... IV-42
Table IV-23 – Evacuating Vehicles by Operational Scenario for 2020 ..... IV-43
Table IV-24 – Shelter Demand by Operational Scenario IV-44
Table IV-25 – Total Evacuating Vehicles for Operational Scenarios IV-45
Table IV 26 – Evacuating Vehicles Leaving Each County by Evacuation Route for the 2015 Operational Scenarios IV-56
Table IV-27 – Evacuating Vehicles Leaving Each County by Evacuation Route for the 2020 Operational Scenarios IV-57
Table IV-28 – Evacuating Vehicles Entering Each County by Evacuation Route for the 2015 Operational Scenarios IV-58
Table IV-29 – Evacuating Vehicles Entering Each County by Evacuation Route for the 2020 Operational Scenarios IV-59
Table IV-30 – 2017 Clearance Times for Operational Scenarios IV-61
Table IV-31 – 2020 Clearance Times for Operational Scenarios IV-62
Table IV-32 – Maximum Evacuating Population by Time Interval for 2017 ..... IV-66
Table IV-33 – Maximum Evacuating Population by Time Interval for 2020 ..... IV-67

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 six county Southwest Florida Regional Council area. The transportation modeling methodology includes some processes that are performed at the statewide level, in order to determine the impacts of evacuations from other regions impacting the evacuation clearance times in the Southwest Florida region. While the impact of other regions is included in the Southwest Florida analysis, it is important to note that the results of the transportation analysis presented in this document are only reported for the six counties included in the Southwest Florida RPC. Transportation analysis results for other regions and counties are reported in the corresponding Volume 4 report for those regions.

C. Input and Coordination

The 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, two meetings were held at the local and regional level to receive updated input from local county emergency management and the regional planning council.

2017 Interim Transportation Analysis Update

The National Hurricane Center completed the first of three new 'Superbasin' SLOSH basins for the state of Florida in 2016. This basin covers the southern half of Florida and incudes new modeling parameters and higher resolution than was available previously. Because the basin resulted in changes in surge zones, many counties needed to update their evacuation zones. After the new evacuation zones were created, transportation analysis with evacuation clearance times and shelter demand have to be replaced and updated. Due to the approach of the hurricane season, an 'all-hands on deck' approach was undertaken at FDEM to complete the transportation modeling runs. As this is in between designated Evacuation Study Update cycles, importance was given to fast dissemination of the data to the end users (county emergency managers). The results have been incorporated into this document which was updated only two years ago.

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 SWFRPC region and the most recent 2015 Update. These revisions include updates to the transportation modeling software, TIME. Most parameters stayed the same due to the recent update in 2015, however, the surge zone changes and consequently the evacuation zone changes in many of the counties influenced the evacuation population. Modifications to the roadway network were captured in the 2015 update. These updates and revisions make comparisons to the original 2010 study difficult.

E. 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 Northeast Florida RC 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.

F. Regional Model Implementation

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

- **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 SWFRPC. County level details of the regional model network are provided in the Volume 5-9 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 972 zones located within the six county Southwest 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 Southwest Florida RPC for 2010, 2015, and 2020 is summarized in **Table ES-1**.

Figure ES-1: Regional Model Network

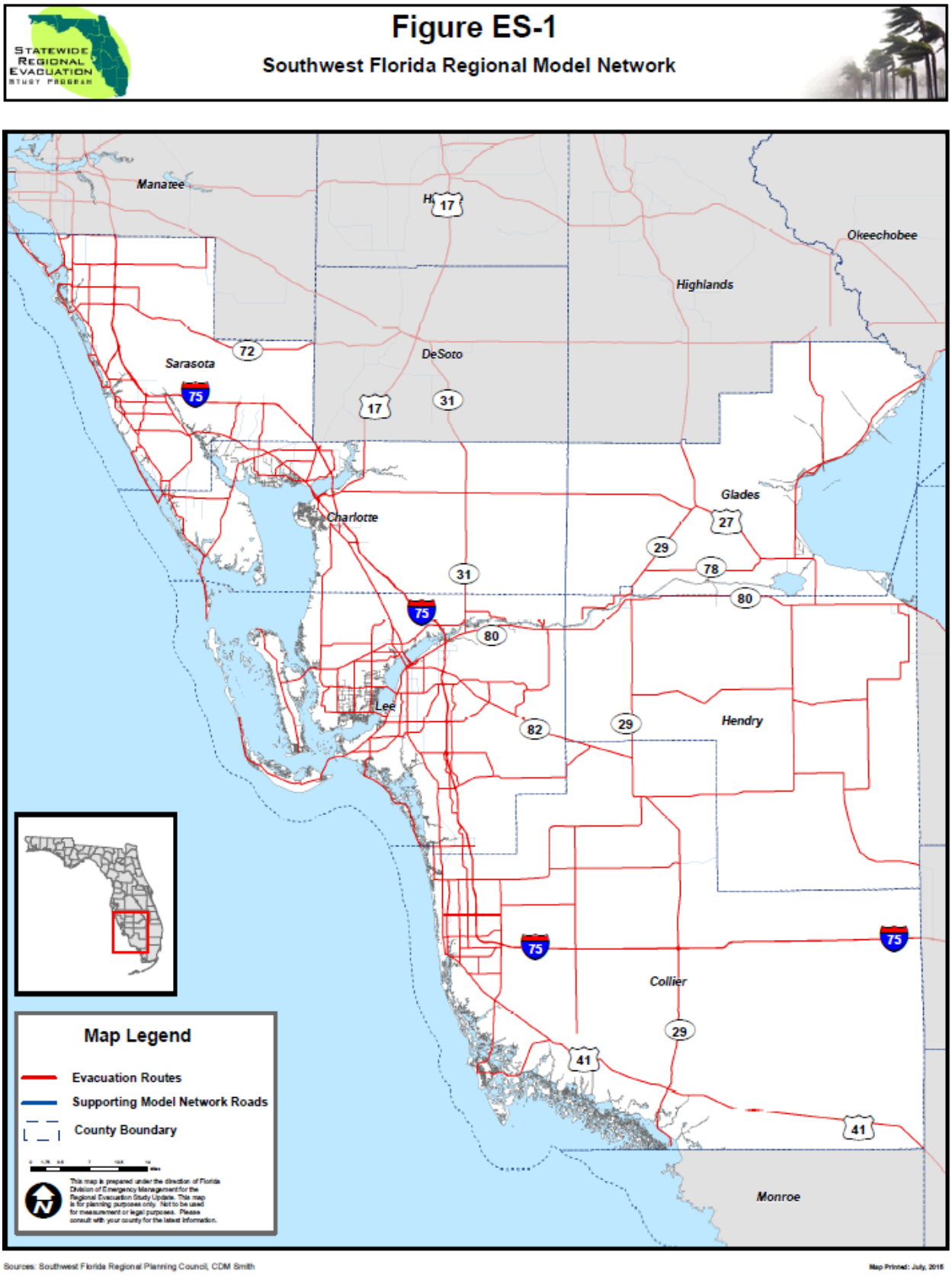
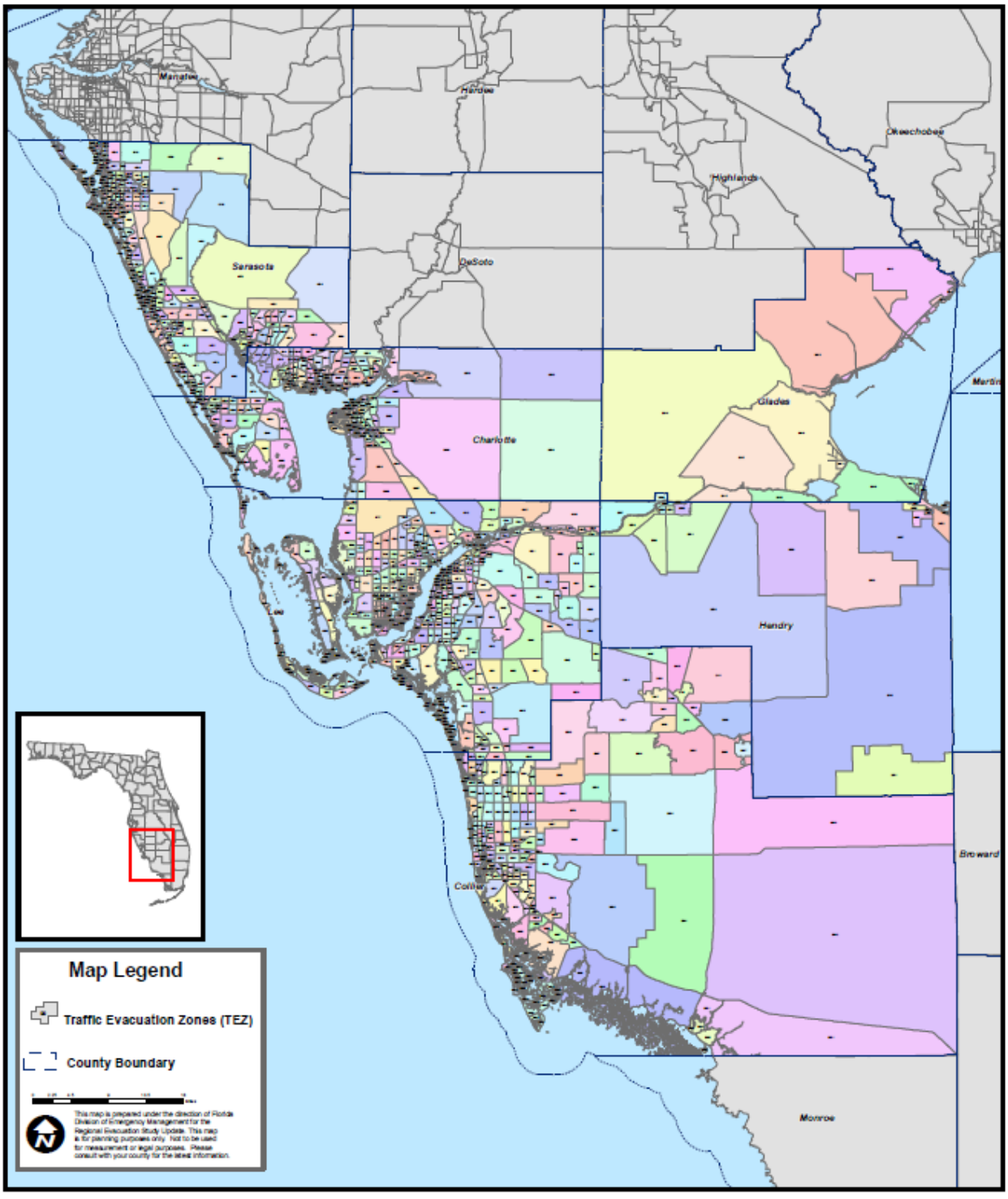


Figure ES-2
Southwest Florida Regional Model Transportation Evacuation Zone System (TEZ)



Sources: Southwest Florida Regional Planning Council, CDM Smith

Map Printed: July, 2015

Lee County has the largest population in the region during all three time periods. The county is expected to reach over 762,000 people by 2020. Sarasota County has the second largest population in the region and is forecasted to have more than 415,000 people by 2020. Glades County has the smallest population in the region; the county is expected to have just more than 12,000 people by 2020.

Table ES-1: Southwest Florida Demographic Characteristic Summary

County	Characteristic	Year		
		2010	2015	2020
Charlotte	Occupied site-built homes	65,788	68,860	72,433
	Population in site-built homes	143,211	149,906	157,675
	Occupied mobile homes	7,582	7,937	8,345
	Population in mobile home	13,755	14,404	15,146
	Hotel/motel units	1,499	5,105	8,782
Collier	Occupied site-built homes	125,148	134,913	149,019
	Population in site-built homes	295,065	318,220	351,535
	Occupied mobile homes	8,031	8,646	9,551
	Population in mobile home	21,909	23,600	26,154
	Hotel/motel units	6,880	24,725	43,547
Glades	Occupied site-built homes	2,106	2,128	2,245
	Population in site-built homes	5,137	5,186	5,443
	Occupied mobile homes	2,427	2,455	2,587
	Population in mobile home	6,264	6,343	6,712
	Hotel/motel units	146	174	252
Hendry	Occupied site-built homes	7,433	7,301	7,548
	Population in site-built homes	21,702	21,320	22,044
	Occupied mobile homes	4,592	4,512	4,659
	Population in mobile home	15,496	15,224	15,721
	Hotel/motel units	384	917	1,549
Lee	Occupied site-built homes	234,977	259,284	293,723
	Population in site-built homes	563,518	621,873	704,312
	Occupied mobile homes	24,841	27,318	30,925
	Population in mobile home	46,748	51,473	58,496
	Hotel/motel units	11,487	33,810	58,158
Sarasota	Occupied site-built homes	161,390	168,313	179,553
	Population in site-built homes	350,438	365,473	389,893
	Occupied mobile homes	14,356	14,964	15,958
	Population in mobile home	23,388	24,374	25,992
	Hotel/motel units	4,778	18,943	33,587

Source: Southwest 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: Southwest Florida Roadway Improvements, 2011–2015

County	Roadway	From	To	Number of Lanes
Charlotte	Toledo Blade Blvd	US 41	Hillsborough Blvd	4
	US 41	Enterprise Dr	Flamingo Blvd	4
	Burntstore Rd	Notre Dame Rd	US 41	4
Collier	SR 82	Hendry County Line	SR 29	4
Hendry	SR 80	CR 833	US 27	4
	SR 80	Birchwood Pkwy	Dalton Ln	4
	SR 29	Spencer	N of Cowboy Way	4
Lee	I-75	S of Colonial Blvd	S of SR 82	6
	I-75	S of SR 82	S of Luckett Rd	6
	I-75	S of Luckett Rd	S of SR 78	6
	I-75 @ Alico Rd			N/A
	I-75 Airport Access @ Southwest Florida Int'l Airport CD System			N/A
	US 41	Corkscrew Rd	San Carlos Blvd	6
	Del Prado Pkwy	NE 7th St	S of Diplomat Pkwy	6
	SR 82	Hendry County Line	Homestead Rd S	4
	SR 82	Homestead Rd S	Shawnee Rd	6
Sarasota	SR 78 (Pine Island)	Burnt Store Rd	W of Chiquita Blvd	4
	I-75 (SR 93) @ University Pkwy			N/A
	I-75 (SR 93)	N of Sumter Blvd	N of River Rd (CR 777)	6

Sources: FDOT SIS First Five Year Plan, FDOT SIS Second Five Year Plan, Northeast Florida Regional 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: Southwest Florida Planned Roadway Improvements, 2016–2020

County	Roadway	From	To	Number of Lanes
Charlotte	I-75 (SR 93)	Lee County Line	S Tuckers Grade	6
	I-75 (SR 93)	S of Harborview Rd	N of Kings Hwy	6
Collier	I-75	SR 951	N of Golden Gate Pkwy	6
Hendry	SR 80	Dalton Ln	CR 833	4
	SR 82	Lee County Line	Collier County Line	4
Lee	SR 82	CR 884 (Lee Blvd)	Shawnee Rd	6
Sarasota	I-75 (SR 93)	Charlotte County Line	Sumter Blvd	6

Sources: FDOT SIS First Five Year Plan, FDOT SIS Second Five Year Plan, Northeast Florida Regional 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 Southwest 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-14**. 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 5-9.

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

- **Shelters** - In order for the transportation model to accurately assign public shelter trips to the correct location, a complete list of available public shelters needs to be available. The shelters were categorized as either primary or other, with primary indicating that the shelter is compliant with American Red Cross standards for a shelter and other indicating all other shelters. In the six county region there are a total of 114 shelters located within the six county region which can host more than 125,000 persons during an evacuation event. Detailed lists of the available public shelters by county are included in Volume 5-9.

Figure ES-3: Evacuation Participation Rates: Charlotte County Site-Built Homes

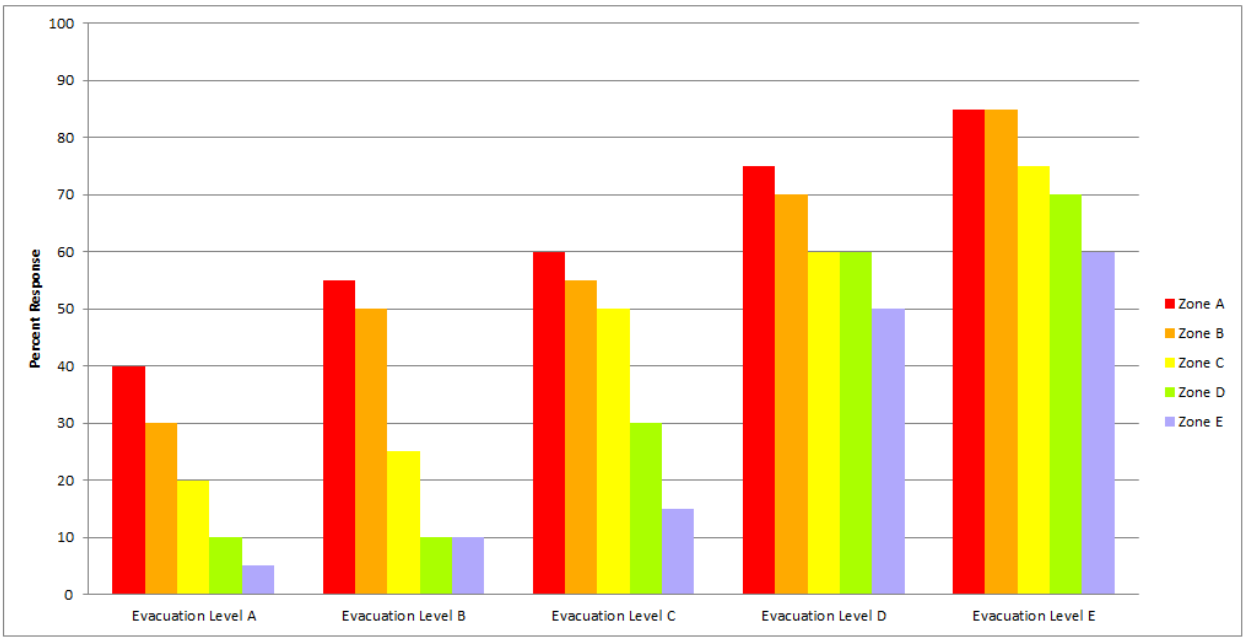


Figure ES-4: Evacuation Participation Rates: Charlotte County Mobile Homes

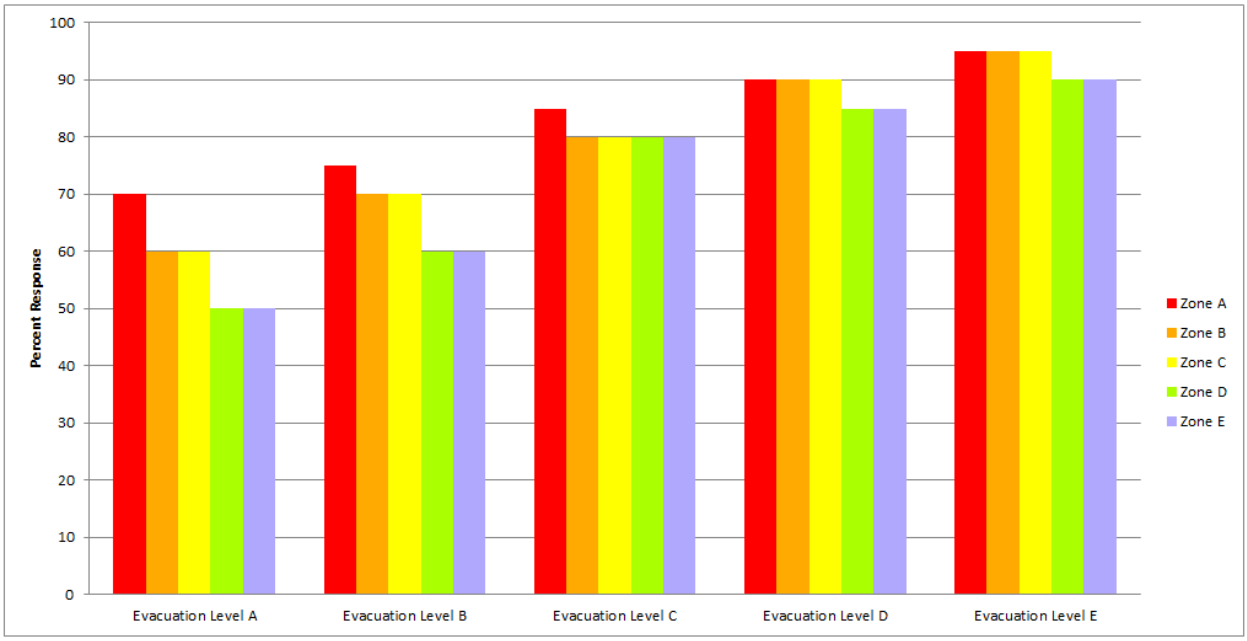


Figure ES-5: Evacuation Participation Rates: Collier County Site-Built Homes

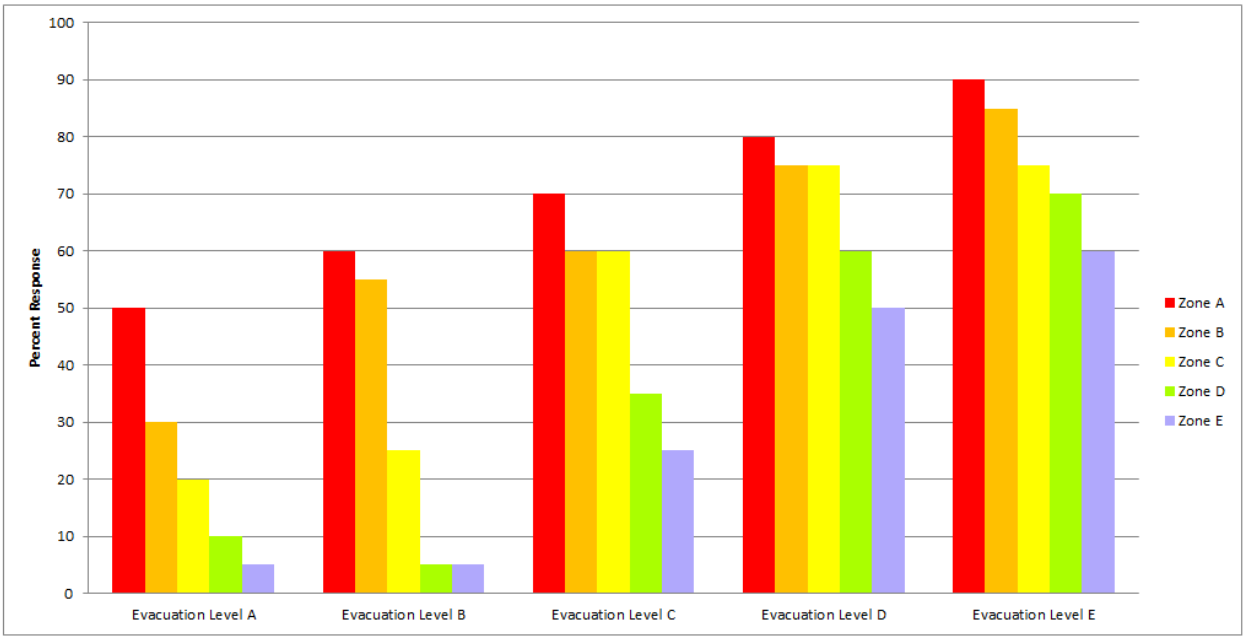


Figure ES-6: Evacuation Participation Rates: Collier County Mobile Homes

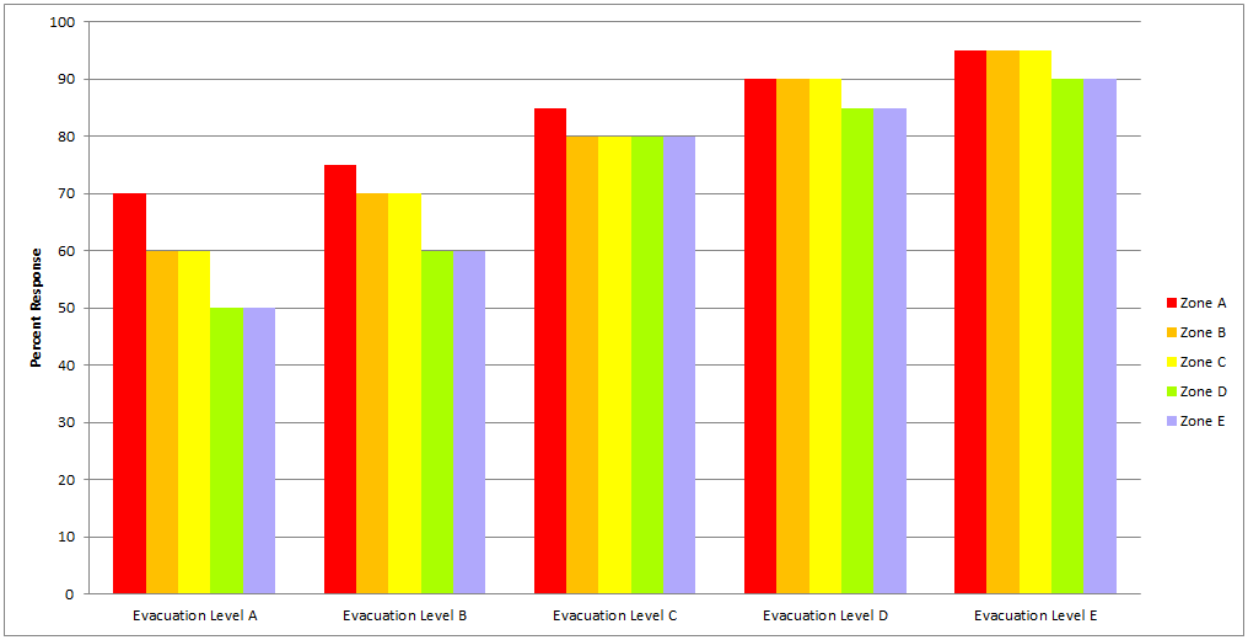


Figure ES-7: Evacuation Participation Rates: Glades County Site-Built Homes

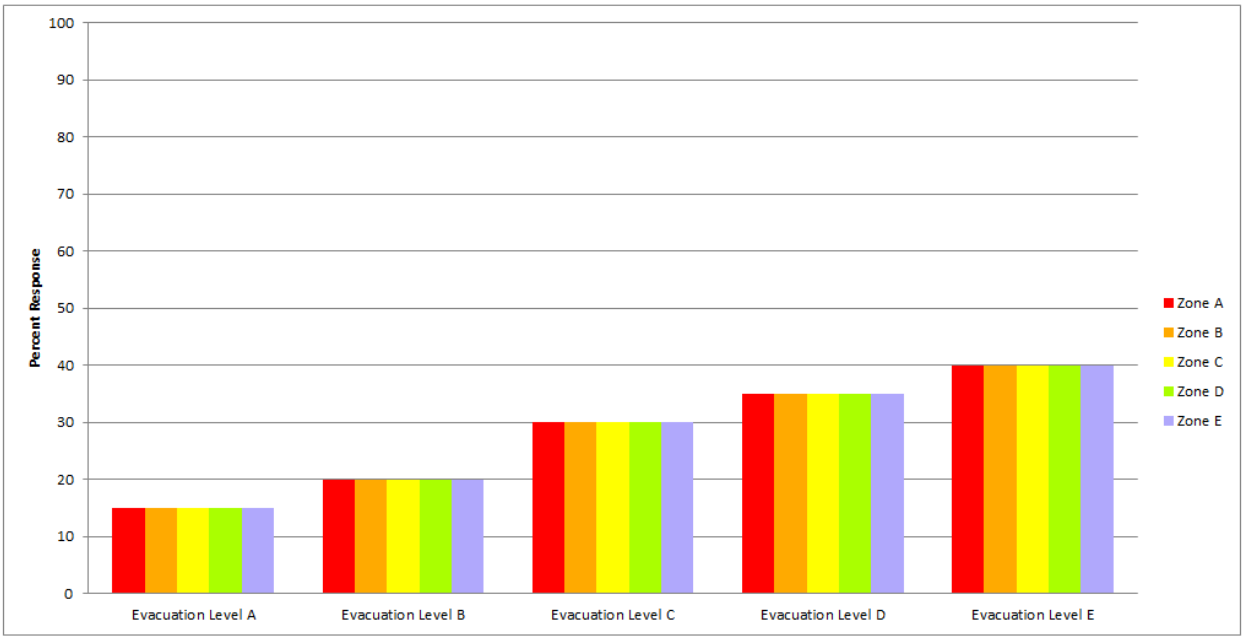


Figure ES-8: Evacuation Participation Rates: Glades County Mobile Homes

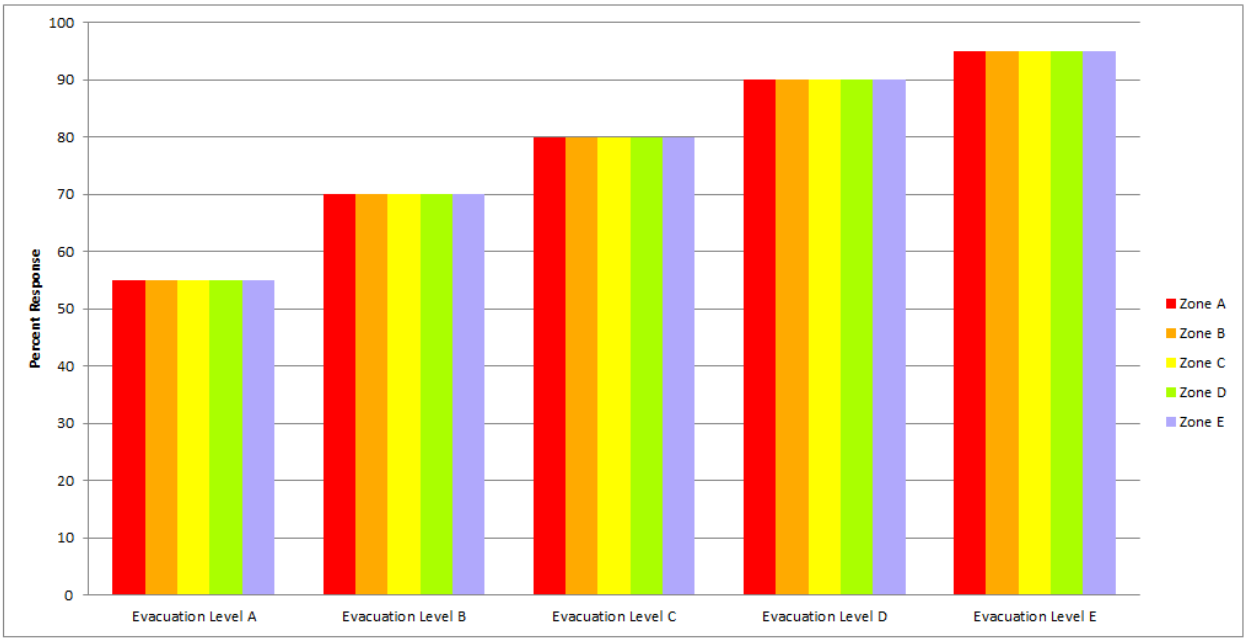


Figure ES-9: Evacuation Participation Rates: Hendry County Site-Built Homes

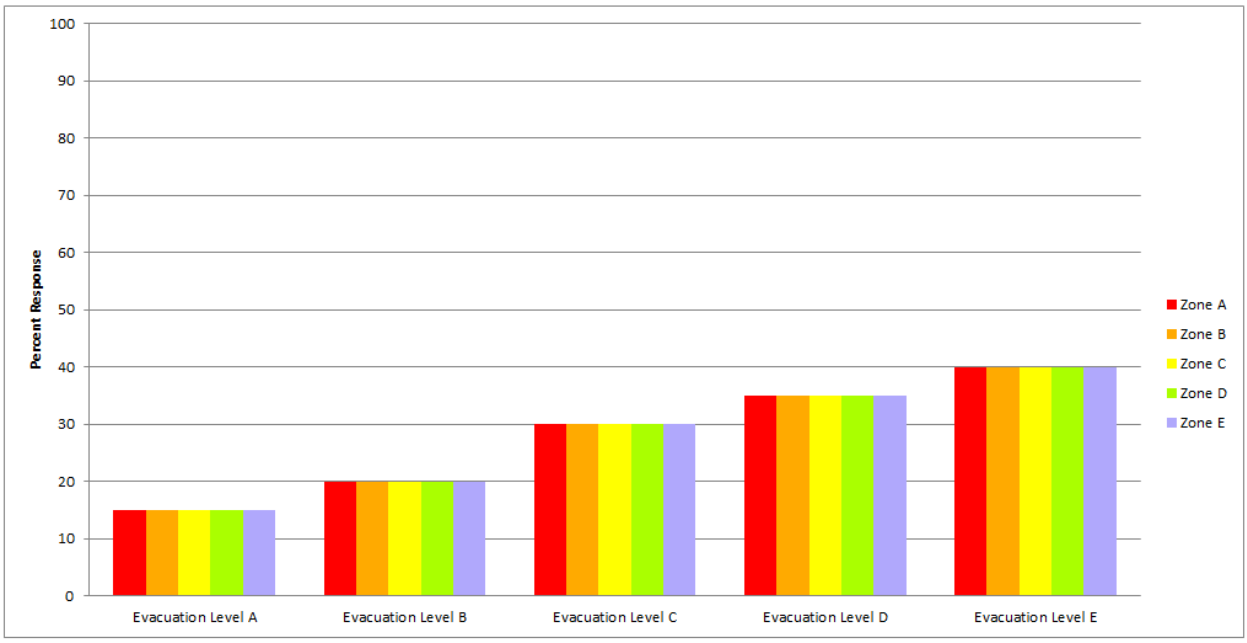


Figure ES-10: Evacuation Participation Rates: Hendry County Mobile Homes

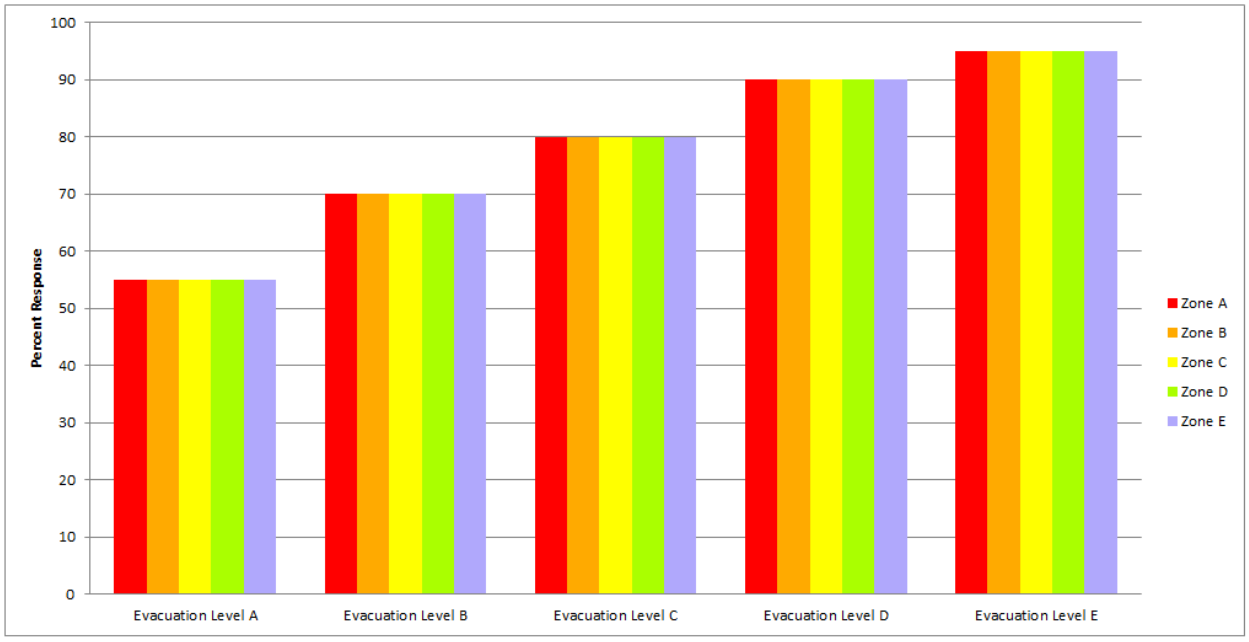


Figure ES-11: Evacuation Participation Rates: Lee County Site-Built Homes

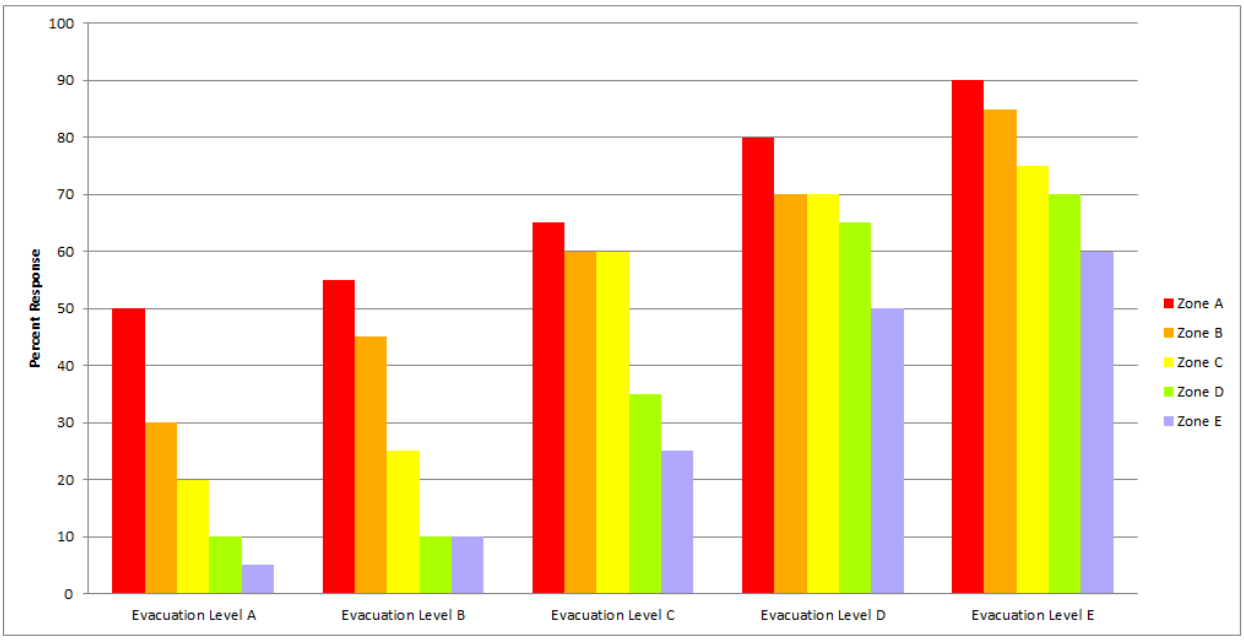


Figure ES-12: Evacuation Participation Rates: Lee County Mobile Homes

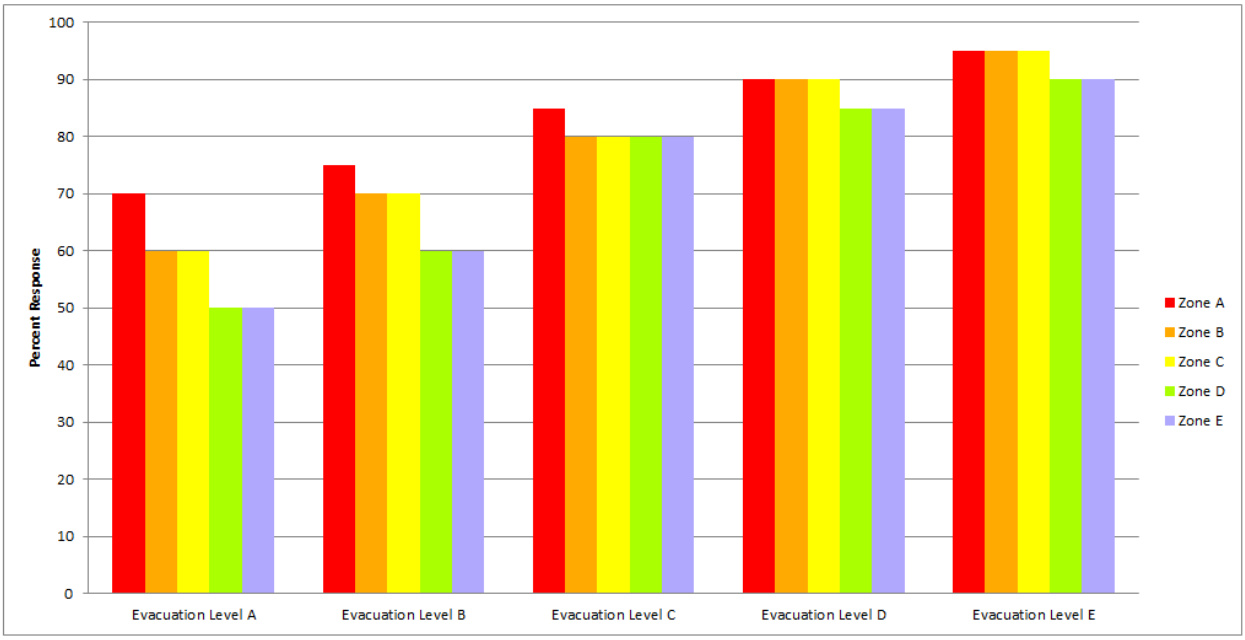


Figure ES-13: Evacuation Participation Rates: Sarasota County Site-Built Homes

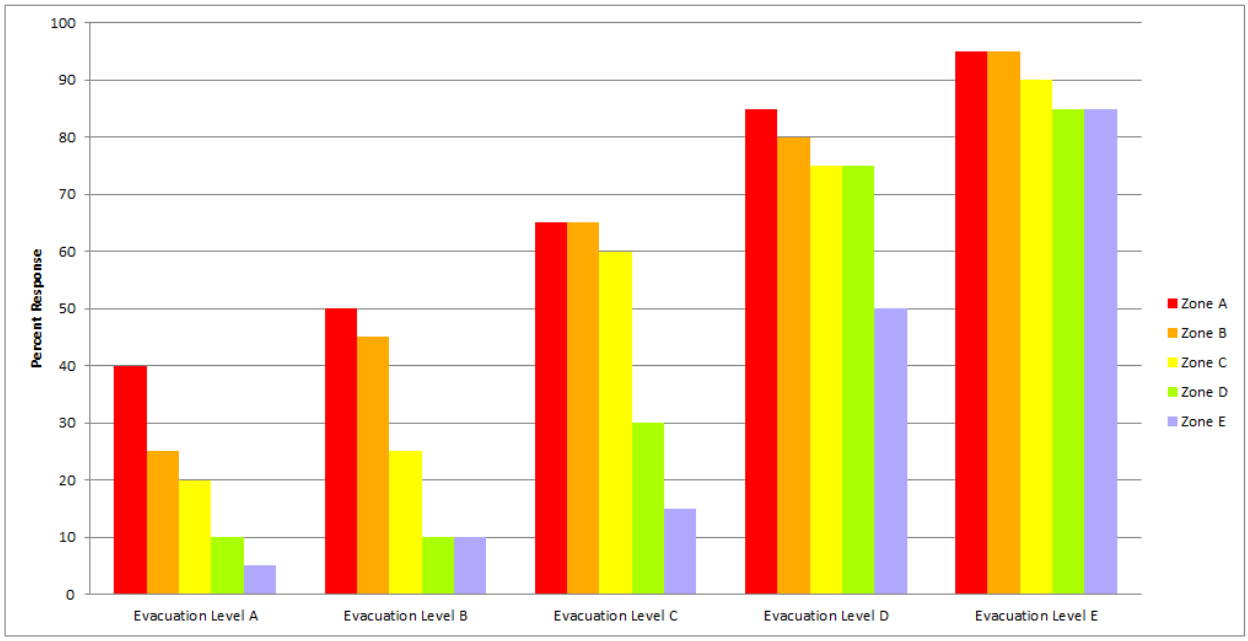
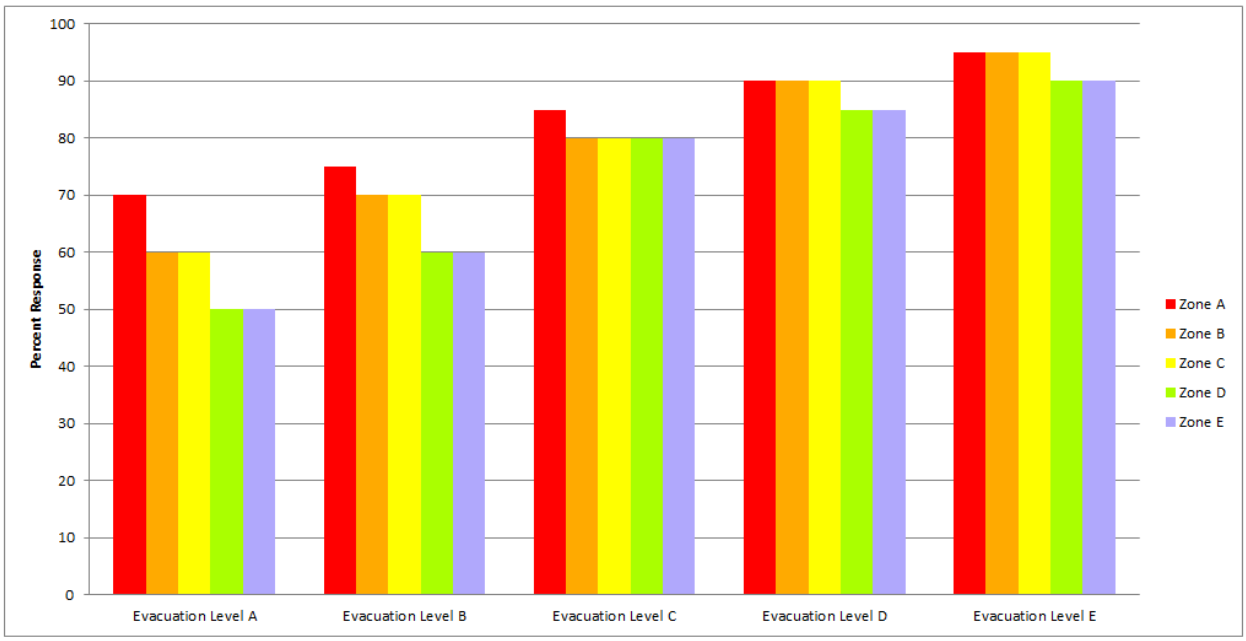


Figure ES-14: Evacuation Participation Rates: Sarasota County Mobile Homes



- **Evacuation Zones** - The final input variable that is needed to complete the transportation evacuation model is the delineation of evacuation zones for all coastal counties. Local county emergency managers have the responsibility of identifying and defining evacuation zones for their county. Within the Southwest Florida region, Charlotte, Collier, Glades, Hendry, Lee and Sarasota Counties have updated and established their evacuation zones based on the results of the new data and information collected as part of the SRESP. County level evacuation zones are included in Volume 5-9.

G. 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.

H. Vulnerable Population

Using a combination of the demographic data, behavioral assumptions, and evacuation zones, the vulnerable population in each county could be determined by evacuation level. For the purposes of the transportation analysis, the vulnerable population, or population-at-risk, is defined as the total population living within the county designated evacuation zones for each evacuation level. This population is living in an area that is at risk for severe flooding during a storm event. The vulnerable population for the Southwest Florida Region for 2017 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 Southwest Florida Region for 2017

	Evacuation Zone A	Evacuation Zone B	Evacuation Zone C	Evacuation Zone D	Evacuation Zone E
Charlotte County					
Site-built Homes	30,919	84,890	28,602	3,556	113
Mobile/Manuf. Homes	3,655	5,651	2,066	2,556	32
TOTAL	34,574	90,541	30,667	6,112	145
Collier County					
Site-built Homes	95,085	52,851	78,967	71,201	4,780
Mobile/Manuf. Homes	8,405	4,644	1,708	810	1,063
TOTAL	103,491	57,495	80,675	72,011	5,843
Glades County					
Site-built Homes	441	273	541	696	193
Mobile/Manuf. Homes	205	392	450	883	285
TOTAL	646	666	991	1,578	478
Hendry County					
Site-built Homes	742	139	248	63	0
Mobile/Manuf. Homes	1,388	155	32	9	0
TOTAL	2,130	294	280	71	0
Lee County					
Site-built Homes	156,881	234,537	136,168	38,822	39,155
Mobile/Manuf. Homes	15,266	9,962	23,379	1,039	1,164
TOTAL	172,146	244,499	159,546	39,861	40,320
Sarasota County					
Site-built Homes	50,229	39,535	79,988	76,363	27,987
Mobile/Manuf. Homes	5,710	6,035	3,032	2,554	829
TOTAL	55,940	45,569	83,019	78,917	28,816

Note: Vulnerable population determined using SRESP behavioral data and county provided evacuation zones. Vulnerable population numbers are not inclusive, meaning population numbers listed for a higher zone are not included in the lower zone. For example, vulnerable population listed for Evacuation Zone B does not include vulnerable population listed for Evacuation Zone A.

Table ES-5: Vulnerable Population in the Southwest Florida Region for 2020

	Evacuation Zone A	Evacuation Zone B	Evacuation Zone C	Evacuation Zone D	Evacuation Zone E
Charlotte County					
Site-built Homes	32,515	89,286	30,083	3,750	119
Mobile/Manuf. Homes	3,847	5,946	2,172	2,679	34
TOTAL	36,362	95,232	32,255	6,429	153
Collier County					
Site-built Homes	105,018	58,386	87,233	78,665	5,283
Mobile/Manuf. Homes	9,332	5,144	1,906	901	1,174
TOTAL	114,349	63,530	89,139	79,566	6,456
Glades County					
Site-built Homes	463	287	570	723	198
Mobile/Manuf. Homes	218	414	474	941	307
TOTAL	681	702	1,045	1,664	504
Hendry County					
Site-built Homes	767	143	256	65	0
Mobile/Manuf. Homes	1,434	160	34	9	0
TOTAL	2,201	304	290	74	0
Lee County					
Site-built Homes	177,728	265,694	154,091	43,980	44,347
Mobile/Manuf. Homes	17,290	11,288	26,655	1,176	1,329
TOTAL	195,018	276,982	180,746	45,155	45,676
Sarasota County					
Site-built Homes	53,584	42,176	85,333	81,458	29,858
Mobile/Manuf. Homes	6,092	6,436	3,234	2,729	884
TOTAL	59,676	48,612	88,566	84,187	30,742

Note: Vulnerable population determined using SRESP behavioral data and county provided evacuation zones. Vulnerable population numbers are not inclusive, meaning population numbers listed for a higher zone are not included in the lower zone. For example, vulnerable population listed for Evacuation Zone B does not include vulnerable population listed for Evacuation Zone A.

In addition, based again on the demographic data, behavioral assumptions, and evacuation zones, the planned destinations of vulnerable population in each county could be determined by evacuation level. Destinations include friends and family, hotel/motel, public shelter, and other locations. Vulnerable population destinations for the Southwest Florida Region are identified in **Table ES-6** for 2017 and in **Table ES-7** for 2020.

Table ES-6: Vulnerable Population by Destination for 2017

	Evacuation Zone A	Evacuation Zone B	Evacuation Zone C	Evacuation Zone D	Evacuation Zone E
Charlotte County					
To Friends and Family	19,381	50,363	17,074	3,617	83
To Hotel/ Motel	8,461	22,353	7,564	1,400	33
To Public Shelter	2,656	7,074	2,495	682	18
To Other Destination	4,076	10,752	3,535	412	11
Collier County					
To Friends and Family	60,012	33,643	47,305	42,288	3,343
To Hotel/ Motel	25,601	14,347	19,867	17,694	1,437
To Public Shelter	7,806	5,414	7,913	8,458	722
To Other Destination	10,072	4,091	5,590	3,571	341
Glades County					
To Friends and Family	377	380	572	903	273
To Hotel/ Motel	75	86	122	202	62
To Public Shelter	97	100	149	237	72
To Other Destination	97	100	149	237	72
Hendry County					
To Friends and Family	0	192	171	44	0
To Hotel/ Motel	144	22	0	7	0
To Public Shelter	426	59	0	14	0
To Other Destination	144	22	0	7	0
Lee County					
To Friends and Family	0	146,201	93,390	23,812	24,075
To Hotel/ Motel	43,037	61,125	39,887	8,024	8,064
To Public Shelter	8,607	12,225	9,146	4,762	4,873
To Other Destination	17,978	24,948	17,124	3,262	3,307
Sarasota County					
To Friends and Family	0	26,738	48,268	47,095	17,207
To Hotel/ Motel	13,699	9,114	17,100	15,783	5,763
To Public Shelter	3,368	4,370	7,501	9,674	3,524
To Other Destination	3,368	5,348	10,150	6,364	2,322

Note: Vulnerable population destinations determined using SRESP behavioral data and county provided evacuation zones. Vulnerable population numbers are not inclusive, meaning population numbers listed for a higher zone are not included in the lower zone. For example, vulnerable population listed for Evacuation Zone B does not include vulnerable population listed for Evacuation Zone A.

Table ES-7: Vulnerable Population by Destination for 2020

	Evacuation Zone A	Evacuation Zone B	Evacuation Zone C	Evacuation Zone D	Evacuation Zone E
Charlotte County					
To Friends and Family	20,384	52,972	17,958	3,804	87
To Hotel/ Motel	8,898	23,511	7,955	1,473	35
To Public Shelter	2,794	7,440	2,624	718	19
To Other Destination	4,287	11,309	3,719	434	11
Collier County					
To Friends and Family	66,308	37,174	52,267	46,724	3,694
To Hotel/ Motel	28,289	15,853	21,953	19,551	1,588
To Public Shelter	8,623	5,981	8,743	9,345	798
To Other Destination	11,129	4,521	6,177	3,946	376
Glades County					
To Friends and Family	398	400	603	951	287
To Hotel/ Motel	79	91	128	214	66
To Public Shelter	102	105	157	250	76
To Other Destination	102	105	157	250	76
Hendry County					
To Friends and Family	1,464	198	177	45	0
To Hotel/ Motel	148	22	0	7	0
To Public Shelter	440	61	0	15	0
To Other Destination	148	22	0	7	0
Lee County					
To Friends and Family	116,146	165,625	105,782	26,976	27,273
To Hotel/ Motel	48,755	69,246	45,186	9,090	9,135
To Public Shelter	9,751	13,849	10,370	5,395	5,521
To Other Destination	20,366	28,263	19,407	3,695	3,747
Sarasota County					
To Friends and Family	37,875	28,524	51,493	50,239	18,357
To Hotel/ Motel	14,614	9,722	18,242	16,837	6,148
To Public Shelter	3,593	4,661	8,002	10,321	3,760
To Other Destination	3,593	5,705	10,828	6,790	2,477

Note: Vulnerable population destinations determined using SRESP behavioral data and county provided evacuation zones. Vulnerable population numbers are not inclusive, meaning population numbers listed for a higher zone are not included in the lower zone. For example, vulnerable population listed for Evacuation Zone B does not include vulnerable population listed for Evacuation Zone A.

The vulnerable shadow population is provided in **Table ES-8** for both 2017 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
2017					
Charlotte County	44,568	18,158	11,469	8,210	8,213
Collier County	65,715	53,768	64,975	45,358	41,861
Glades County	6,835	6,626	6,512	5,590	5,454
Hendry County	17,069	17,916	19,855	20,836	21,843
Lee County	164,910	103,600	77,561	75,793	57,725
Sarasota County	66,437	57,909	65,022	55,287	46,976
2020					
Charlotte County	48,291	23,017	16,955	10,526	13,506
Collier County	79,025	73,047	94,158	74,381	70,514
Glades County	7,228	7,007	6,893	5,229	5,423
Hendry County	17,661	18,537	20,539	20,465	21,551
Lee County	201,095	138,185	117,618	72,463	70,752
Sarasota County	76,177	68,157	78,807	72,237	64,862

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

I. 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 RPC area. The base scenarios for the Southwest 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 Northeast 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 Southwest Florida RPC to continue testing combinations of options and provide additional information to emergency managers.

J. Clearance Time Results

Each of the ten base scenarios and fourteen operational scenarios were modeled for the Southwest Florida Region using the regional evacuation model. Results were derived from the model to summarize the evacuating population, evacuating vehicles, clearance times, and critical congested roadways. Detailed results are discussed in Chapter IV. Clearance times are presented in this executive summary since the determination of clearance time is one of the most important outcomes from the evacuation transportation analysis.

Calculated clearance times are used by county emergency managers as one input to determine when to recommend an evacuation order. This calculation can include the population-at-risk, shadow evacuees, as well as evacuees from other counties anticipated to pass through the county. Clearance time is developed to include the time required for evacuees to secure their homes and prepare to leave, the time spent by all vehicles traveling along the evacuation route network, and the additional time spent on the road caused by traffic and road congestion. Clearance time does not relate to the time any one vehicle spends traveling along the evacuation route network, nor does it guarantee vehicles will safely reach their destination once outside the County. The four clearance times that are calculated as part of the evacuation transportation analysis include: 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 2017	Scenario 2 Level B 2017	Scenario 3 Level C 2017	Scenario 4 Level D 2017	Scenario 5 Level E 2017
Demographic Data	2015	2015	2015	2015	2015
Highway Network	2017	2017	2017	2017	2017
One-Way Operations	None	None	None	None	None
University Population	Fall/Spring	Fall/Spring	Fall/Spring	Fall/Spring	Fall/Spring
Tourist Rate	Default	Default	Default	Default	Default
Shelters Open	Primary	Primary	Primary	Primary	Primary
Response Curve	12-hour	12-hour	12-hour	12-hour	12-hour
Evacuation Phasing	None	None	None	None	None
Behavioral Response	100%	100%	100%	100%	100%
Evacuation Zone	A	B	C	D	E
Counties Evacuating	Charlotte Collier Glades Hendry Lee Sarasota Manatee Monroe (ML)	Charlotte Collier Glades Hendry Lee Sarasota Manatee Monroe (ML)	Charlotte Collier Glades Hendry Lee Sarasota Manatee Monroe (ML)	Charlotte Collier Glades Hendry Lee Sarasota Manatee Monroe (ML)	Charlotte Collier Glades Hendry Lee Sarasota Manatee Monroe (ML)
	Scenario 6 Level A 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	Charlotte Collier Glades Hendry Lee Sarasota Manatee Monroe (ML)	Charlotte Collier Glades Hendry Lee Sarasota Manatee Monroe (ML)	Charlotte Collier Glades Hendry Lee Sarasota Manatee Monroe (ML)	Charlotte Collier Glades Hendry Lee Sarasota Manatee Monroe (ML)	Charlotte Collier Glades Hendry Lee Sarasota Manatee Monroe (ML)

ML – includes mainland portion of Monroe County only.

Table ES-10: Operational Scenarios

	Scenario 1 Level A 2017	Scenario 2 Level B 2017	Scenario 3 Level C 2017	Scenario 4 Level D 2017	Scenario 5 Level E 2017
Demographic Data	2015	2015	2015	2015	2015
Highway Network	2017	2017	2017	2017	2017
One-Way Operations	None	None	None	None	None
University Population	Fall/Spring	Fall/Spring	Fall/Spring	Fall/Spring	Fall/Spring
Tourist Rate	Default	Default	Default	Default	Default
Shelters Open	Primary	Primary	Primary	Primary	Primary
Response Curve	9-hour	12-hour	12-hour	18-hour	18-hour
Evacuation Phasing	None	None	None	None	None
Behavioral Response	Planning	Planning	Planning	Planning	Planning
Evacuation Level	A	B except as noted below	C except as noted below	D except as noted below	E except as noted below
Counties Evacuating	Collier Lee Monroe (ML) Hendry Glades Okeechobee Highlands	Sarasota Charlotte Lee DeSoto Glades (A) Hendry (A) Collier (A) Highlands (A)	Collier Lee Charlotte Sarasota (B) Monroe (ML-B) Glades (B) Hendry (B) Highlands (B) DeSoto (B)	Collier Lee Charlotte Sarasota (C) Monroe (ML-C) Glades (C) Hendry (C) Highlands (C) DeSoto (C) Okeechobee (B)	Collier Lee Charlotte Sarasota Monroe Manatee (D) Glades (D) Hendry (D) Highlands (C) DeSoto (C) Okeechobee (C) Hardee (C) Polk (C)
	Scenario 6 Level A 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	9-hour	12-hour	12-hour	18-hour	18-hour
Evacuation Phasing	None	None	None	None	None
Behavioral Response	Planning	Planning	Planning	Planning	Planning
Evacuation Level	A	B except as noted below	C except as noted below	D except as noted below	E except as noted below
Counties Evacuating	Sarasota Lee Charlotte Manatee DeSoto Highlands Glades	Collier Charlotte Lee DeSoto Glades (A) Hendry (A) Sarasota (A) Highlands (A)	Sarasota Lee Charlotte Collier (B) Manatee (B) Glades (B) Hardee (B) Highlands (B) DeSoto (B) Hendry (B)	Sarasota Lee Charlotte Collier (C) Manatee (C) Glades (C) Hendry (C) Highlands (C) DeSoto (C) Hardee (C)	Broward Palm Beach Martin Highlands (D) Glades (D) Hendry (D) Okeechobee (D) Lee (C) Sarasota (C) Charlotte (C) DeSoto (C) Hardee (C) Collier (B)

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

Table ES-11: 2017 Clearance Times for Base Scenario

	Evacuation Level A Base Scenario 1	**Evacuation Level B** Base Scenario 2	**Evacuation Level C** Base Scenario 3	**Evacuation Level D** Base Scenario 4	**Evacuation Level E** Base Scenario 5
Clearance Time to Shelter					
Charlotte County	13.5	19.0	31.0	45.5	73.5
Collier County	18.0	33.0	43.5	58.5	77.5
Glades County	16.5	17.5	17.5	15.5	17.5
Hendry County	14.5	16.5	22.5	15.5	15.5
Lee County	24.0	34.5	52.0	69.5	84.5
Sarasota County	14.0	23.0	41.5	62.5	78.5
In-County Clearance Time					
Charlotte County	35.5	44.5	63.5	76.0	94.5
Collier County	18.5	33.0	51.5	65.5	81.5
Glades County	26.0	38.5	55.5	67.5	82.5
Hendry County	24.0	35.5	53.5	67.5	82.5
Lee County	24.0	34.5	52.0	69.5	84.5
Sarasota County	33.5	38.0	56.0	68.5	89.0
Out-of-County Clearance Time					
Charlotte County	35.5	44.5	63.5	76.0	94.5
Collier County	18.5	33.0	51.5	65.5	81.5
Glades County	26.0	38.5	55.5	67.5	82.5
Hendry County	24.0	35.5	53.5	67.5	82.5
Lee County	24.0	34.5	52.0	69.5	84.5
Sarasota County	33.5	38.0	56.0	68.5	89.0
Regional Clearance Time					
Southwest	35.5	44.5	63.5	76.0	94.5

Table ES-12: 2020 Clearance Times for Base Scenario

	Evacuation Level A Base Scenario 6	**Evacuation Level B** Base Scenario 7	**Evacuation Level C** Base Scenario 8	**Evacuation Level D** Base Scenario 9	**Evacuation Level E** Base Scenario 10
Clearance Time to Shelter					
Charlotte County	18.5	20.0	52.5	75.0	87.5
Collier County	20.0	38.5	57.0	62.5	94.0
Glades County	16.0	18.5	17.5	18.0	17.5
Hendry County	15.0	15.5	15.5	15.5	15.5
Lee County	25.5	41.0	74.5	73.0	96.0
Sarasota County	14.5	23.5	58.0	90.5	89.0
In-County Clearance Time					
Charlotte County	39.5	47.0	76.5	89.5	96.0
Collier County	22.0	38.5	75.0	69.5	96.0
Glades County	27.0	43.5	77.0	75.5	96.0
Hendry County	26.0	39.5	75.5	76.0	96.0
Lee County	28.0	41.0	75.5	73.5	96.0
Sarasota County	41.0	44.5	78.0	90.5	96.0
Out-of-County Clearance Time					
Charlotte County	39.5	47.0	76.5	89.5	96.0
Collier County	22.0	40.0	75.0	69.5	96.0
Glades County	27.0	43.5	77.0	75.5	96.0
Hendry County	26.0	40.0	75.5	76.0	96.0
Lee County	28.0	41.0	75.5	73.5	96.0
Sarasota County	41.0	44.5	78.0	90.5	96.0
Regional Clearance Time					
Southwest	41.0	47.0	78.0	90.5	96.0

Table ES-13: 2017 Clearance Times for Operational Scenarios

	Evacuation Level A Operational Scenario	Evacuation Level B Operational Scenario	Evacuation Level C Operational Scenario	Evacuation Level D Operational Scenario	Evacuation Level E Operational Scenario
Clearance Time to Shelter					
Charlotte County	N/A	13.0	15.0	19.0	41.5
Collier County	12.0	14.0	31.0	33.0	48.0
Glades County	10.0	16.5	15.5	20.0	23.5
Hendry County	11.5	14.5	15.5	20.0	20.0
Lee County	18.0	19.0	31.5	36.0	59.0
Sarasota County	N/A	14.0	16.0	21.0	53.5
In-County Clearance Time					
Charlotte County	N/A	18.5	32.5	45.0	59.5
Collier County	14.5	16.5	31.0	33.5	57.5
Glades County	18.0	23.5	33.0	35.0	59.5
Hendry County	17.5	23.0	32.0	34.5	58.5
Lee County	18.0	19.0	32.0	36.0	59.0
Sarasota County	N/A	21.0	34.0	39.0	61.0
Out-of-County Clearance Time					
Charlotte County	N/A	19.0	32.5	45.0	59.5
Collier County	14.5	16.5	31.5	33.5	57.5
Glades County	18.0	23.5	33.0	35.0	59.5
Hendry County	17.5	23.0	32.0	34.5	58.5
Lee County	18.0	19.0	32.0	36.0	59.0
Sarasota County	N/A	21.0	34.0	39.0	61.0
Regional Clearance Time					
Southwest	19.0	23.5	33.5	45.0	61.0

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					
Charlotte County	12.5	13.5	18.5	26.0	19.0
Collier County	N/A	19.5	26.0	37.5	25.0
Glades County	10.0	16.0	16.0	19.0	22.0
Hendry County	N/A	14.5	15.0	21.0	29.5
Lee County	16.0	23.5	33.0	43.5	39.5
Sarasota County	10.5	14.5	19.5	32.5	22.0
In-County Clearance Time					
Charlotte County	17.5	26.5	36.0	51.0	46.0
Collier County	N/A	19.5	32.0	41.5	37.0
Glades County	17.5	28.0	34.5	44.0	44.5
Hendry County	N/A	25.0	32.0	44.0	41.5
Lee County	17.0	24.0	33.0	44.0	40.0
Sarasota County	23.5	30.5	36.0	46.0	46.5
Out-of-County Clearance Time					
Charlotte County	17.5	26.5	36.0	51.0	46.0
Collier County	N/A	19.5	32.0	41.5	37.0
Glades County	17.5	28.0	34.5	44.0	44.5
Hendry County	N/A	25.0	32.0	44.0	41.5
Lee County	17.0	24.0	33.0	44.0	40.0
Sarasota County	23.5	30.5	36.0	46.0	46.5
Regional Clearance Time					
Southwest	23.5	30.5	36.0	51.0	46.5

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 an increase in population for the Region as compared to the previous study's 2010 and 2015 population projections. In addition to this increase, the distribution of the population in the SWFRPC 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 SWFRPC 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 2017 and 2020 of this study update. Since the methodology and approach differs in major input variables (an increase 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 18.5 hours in Collier County for the evacuation level A scenario 1 to 94.5 hours in Charlotte County for evacuation level E scenario 5 in 2017. Clearance Time to Shelter shows a similar pattern, with clearance times for the base scenarios ranging from 13.5 hours in Charlotte County for the evacuation level A scenario 1 to 84.5 hours for Lee County for evacuation level E scenario 5 in 2017.

In 2020, in-county clearance times for the base scenarios increase slightly to between 22 hours in Collier County for the evacuation level A scenario 7 and 96 hours for the evacuation level E scenario 12. Clearance Time to Shelter shows a similar pattern, with clearance times for the base scenarios ranging from 14.5 hours in Sarasota County for the evacuation level A scenario 7 to 96 hours for Lee County for evacuation level E scenario 12 in 2020.

In 2017, Out-of-county clearance times for the base scenarios range from 18.5 hours in Collier County for the base evacuation level A scenario 1 to 94.5 hours in Charlotte County for the evacuation level E scenario 5. Out-of-county clearance times remain relatively constant in 2020, with Collier County at 22 hours for evacuation level A scenario 7 and 96 hours for evacuation level E scenario 12.

Regional clearance time for the six county SWFRPC region ranges from 35.5 hours to 94.5 hours in 2017 and from 41 to 96 hours in 2020.

Operational Scenarios

In-county clearance times for the 2017 operational scenarios range from 14.5 hours to 61 hours depending upon the scenario. Clearance Time to Shelter shows a similar pattern, with clearance times for the operational scenarios ranging from 10 hours to 59 hours depending upon the county and the scenario.

In 2020, in-county clearance times for the operational scenarios vary from 17 hours to 51 hours for the level D evacuation in Charlotte County. The 2020 level E evacuation includes vehicle trips evacuating from the Treasure Coast region, which is why clearance times within the Southwest region are lower for the operational level E scenario than the operational level D

scenario. Clearance Time to Shelter shows a similar pattern, with clearance times for the base scenarios ranging from 10 hours to 43.5 hours depending upon the scenario.

Out-of-county clearance times for the 2017 operational scenarios range from 14.5 hours to 61 hours for the evacuation level E scenario. Out-of-county clearance times for all counties in 2020 range from 17 to 51 hours depending upon the scenario. Regional clearance time for the six-county SWFRPC region ranges from 19 hours to 61 hours in 2017 and between 23.5 and 51 hours in 2020.

K. Maximum Evacuating Population Clearances

From an emergency management standpoint, it is important to get an understanding of the maximum proportion of the evacuating population that can be expected to evacuate at various time intervals during an evacuation. 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 2017 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 2017

	Evacuation Level A	Evacuation Level B	Evacuation Level C	Evacuation Level D	Evacuation Level E
Estimated Evacuating Population Clearing Charlotte County					
12-Hour	26,752	38,635	31,606	26,859	21,619
18-Hour	40,128	57,953	47,410	40,288	32,429
24-Hour	53,504	77,271	63,213	53,717	43,239
36-Hour	79,142	143,273	167,251	170,105	170,253
Estimated Evacuating Population Clearing Collier County					
12-Hour	109,755	78,092	71,449	65,776	53,209
18-Hour	164,633	117,139	107,174	98,665	79,813
24-Hour	169,206	156,185	142,898	131,553	106,417
36-Hour		214,754	306,636	359,030	361,376
Estimated Evacuating Population Clearing Glades County					
12-Hour	3,453	2,474	1,906	1,684	1,427
18-Hour	5,179	3,711	2,859	2,526	2,141
24-Hour	6,906	4,948	3,811	3,367	2,855
36-Hour	7,481	7,937	8,814	9,471	9,813
Estimated Evacuating Population Clearing Hendry County					
12-Hour	9,600	6,875	5,060	4,198	3,581
18-Hour	14,399	10,313	7,590	6,296	5,371
24-Hour	19,199	13,751	10,120	8,395	7,162
36-Hour	19,199	20,340	22,559	23,611	24,618
Estimated Evacuating Population Clearing Lee County					
12-Hour	168,528	180,955	150,866	119,455	101,410
18-Hour	252,792	271,432	226,299	179,183	152,115
24-Hour	337,056	361,910	301,732	238,911	202,820
36-Hour	337,056	520,245	653,752	691,845	714,097
Estimated Evacuating Population Clearing Sarasota County					
12-Hour	43,837	50,343	53,475	55,836	45,740
18-Hour	65,755	75,514	80,213	83,754	68,610
24-Hour	87,673	100,685	106,950	111,673	91,480
36-Hour	122,377	159,418	249,550	318,732	339,237

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 Charlotte County					
12-Hour	25,717	39,475	28,362	24,242	22,992
18-Hour	38,576	59,213	42,542	36,363	34,488
24-Hour	51,435	78,950	56,723	48,484	45,984
36-Hour	84,653	154,611	180,805	180,805	183,937
Estimated Evacuating Population Clearing Collier County					
12-Hour	105,477	75,278	57,788	72,685	52,944
18-Hour	158,215	112,917	86,682	109,027	79,417
24-Hour	210,953	150,556	115,576	145,369	105,889
36-Hour	193,374	250,926	361,176	420,965	423,555
Estimated Evacuating Population Clearing Glades County					
12-Hour	3,515	2,314	1,452	1,481	1,252
18-Hour	5,273	3,471	2,179	2,222	1,878
24-Hour	7,030	4,628	2,905	2,963	2,505
36-Hour	7,909	8,389	9,320	9,320	10,018
Estimated Evacuating Population Clearing Hendry County					
12-Hour	9,167	6,312	3,709	3,684	3,052
18-Hour	13,751	9,468	5,563	5,526	4,579
24-Hour	18,334	12,625	7,417	7,368	6,105
36-Hour	19,862	21,041	23,333	23,333	24,419
Estimated Evacuating Population Clearing Lee County					
12-Hour	169,763	178,591	122,442	125,774	101,791
18-Hour	254,644	267,887	183,663	188,661	152,687
24-Hour	339,525	357,182	244,884	251,548	203,583
36-Hour	396,113	610,186	770,365	770,365	814,330
Estimated Evacuating Population Clearing Sarasota County					
12-Hour	39,762	47,581	42,409	46,844	47,081
18-Hour	59,643	71,371	63,614	70,265	70,621
24-Hour	79,524	95,161	84,819	93,687	94,161
36-Hour	135,853	176,445	275,661	353,279	376,645

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.

L. Summary and Conclusions

Through a review of the results of the 20 different scenarios (10 base and 10 operational), several conclusions could be reached regarding the transportation analysis, including the following:

- Critical transportation facilities within the SWFRPC region include I-75, US 41, SR 80, SR 82, SR 29, SR 78, SR 31, and US 17. For large storm events, such as level D and E evacuations, other State facilities also play an important role in evacuations;

- During the level A and B evacuation scenarios, the roadway segments with the highest vehicle queues are primarily concentrated along the major Interstate and State Highway system. During these levels of evacuation, State and County officials should coordinate personnel resources to provide sufficient traffic control at interchanges and major intersections along these routes;

- In contrast, for the higher level C, D, and E evacuation scenarios, many other roadway facilities, both within and outside of the region, will require personnel resources for sufficient traffic control at interchanges and major intersections;

- The SWFRPC counties, in coordination with the State, should continue public information campaigns to clearly define those that are vulnerable and should evacuate verses those who choose to evacuate on their own. Shadow evacuations in inland areas of the counties impact the ability of the vulnerable population to evacuate;

- The Florida Department of Transportation should continue to work with local counties on implementing intelligent transportation system (ITS) technology, which will provide enhanced monitoring and notification systems to provide evacuating traffic with up to date information regarding expected travel times and alternate routes;

- The State can use the data and information provided in this report (specifically the evacuating vehicle maps in Volume 5-9) to estimate fuel and supply requirements along major evacuation routes to aid motorists during the evacuation process;

- For major evacuation routes that have signalized traffic control at major intersections, traffic signal timing patterns should be adjusted during the evacuation process to provide maximum green time for evacuating vehicles in the predominate north and east directions; and,

- The counties within the Southwest Florida Region are encouraged to test additional transportation scenarios beyond what has been provided in this study. Each model run will provide additional information for the region to use in planning for an evacuation. Counties interested in testing various response curves for each scenario can easily do so using the TIME interface to calculate clearance times for different evacuation conditions, such as different evacuation levels, different behavioral response assumptions, and different response curves.

This page intentionally left blank.

CHAPTER I
INTRODUCTION

The evacuation transportation analysis discussed in this volume documents the methodology, analysis, and results of the transportation component of the Statewide Regional Evacuation Study Program (SRESP). Among the many analyses required for the SRESP study, transportation analysis is probably one of the most important components in the process. By bringing together storm intensity, transportation network, shelters, and evacuation population, transportation analysis explicitly links people's behavioral responses to the regional evacuation infrastructure and helps formulate effective and responsive evacuation policy options. Due to the complex calculations involved and numerous evacuation scenarios that need to be evaluated, the best way to conduct the transportation analysis is through the use of computerized transportation simulation programs, or transportation models.

A. Background and Purpose

Over the years, different planning agencies have used different modeling approaches with varying degrees of complexity and mixed success. Some have used full-blown conventional transportation models such as the standard Florida model FSUTMS; others have used a combination of a simplified conventional model and a spreadsheet program, such as the Abbreviated Transportation Model (ATM). These models have different data requirements, use different behavioral assumptions, employ different traffic assignment algorithms, and produce traffic analysis results with different levels of detail and accuracy. These differences make it difficult for planning agencies to share information and data with each other. They also may produce undesirable conditions for staff training and knowledge sharing.

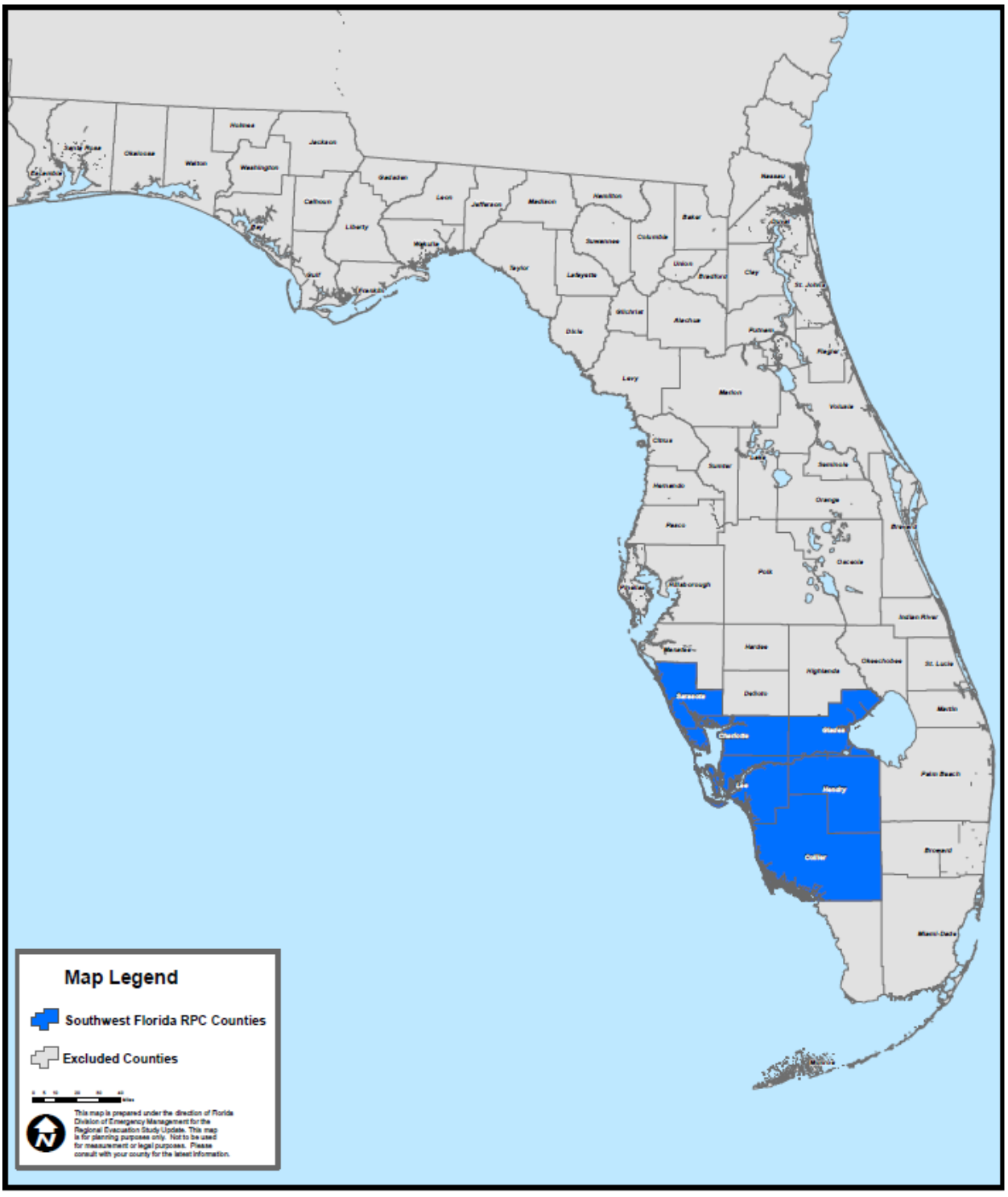
One of the objectives of the SRESP is to create consistent and integrated regional evacuation data and mapping, and by doing so, to facilitate knowledge sharing between state, regional, county, and local partners. To achieve this objective, it is important for all Regional Planning Councils to adopt the same data format and to use the same modeling methodologies for their transportation analyses. The primary purpose of the transportation component of the SRESP is to develop a unified evacuation transportation modeling framework that can be implemented with the data collected by the Regional Planning Councils.

B. Study Area

The study area for this analysis includes the six county Southwest 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 Southwest Florida region. While the impact of other regions is included in the Southwest Florida analysis, it is important to note that the results of the transportation analysis presented in this document are only reported for the six counties included in the Southwest Florida RPC. Transportation analysis results for other regions and counties are reported in the corresponding Volume 4 report for those regions.

Figure I-1

Southwest 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 Southwest Florida region was held on March 20, 2015 at 1:30 PM. The purpose of the scenario development update meeting was to review the Southwest 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 for the Southwest Florida region was held on August 10, 2015 at 2:00 PM. 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 SWFRPC 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.

This page intentionally left blank.

CHAPTER II
EVACUATION MODELING METHODOLOGY AND FRAMEWORK

The evacuation modeling methodology and framework was developed during 2008 and 2009 in coordination with all eleven Regional Planning Councils and the Division of Emergency Management, and periodically from this time to incorporate features. The methodology used in this Southwest 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?

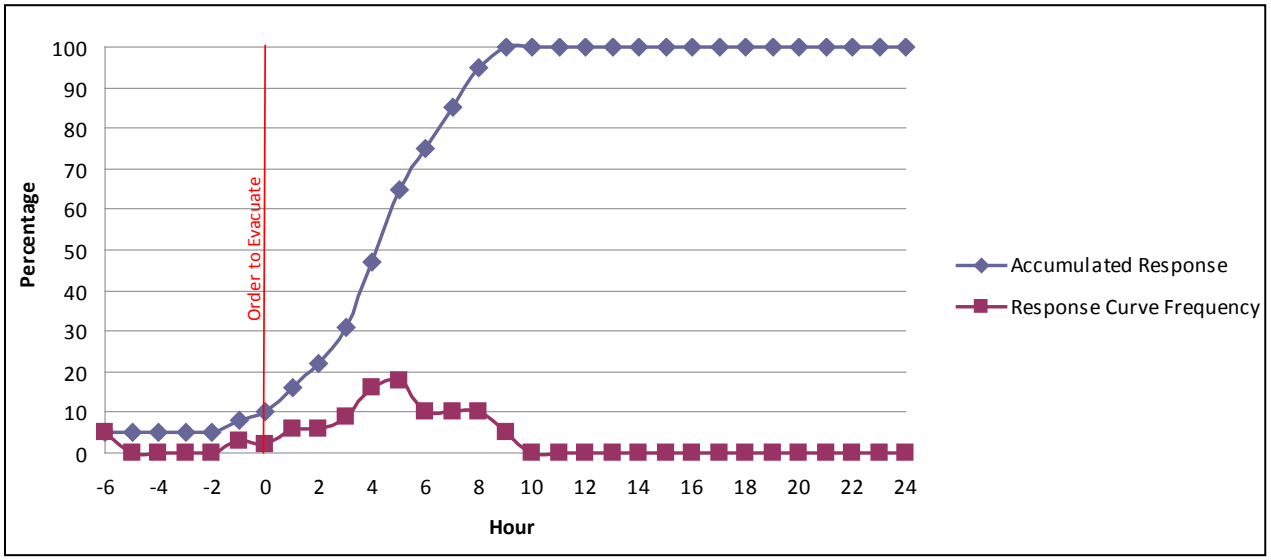
The evacuation rate indicates the percent of residents who will leave their homes to go some place safer in each storm threat scenario. The evacuation rates are based on the following assumptions: that the storm track passes very close to the area being evacuated; and officials order evacuation for surge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

When will they leave?

Consistent with behavior observed in past evacuations, evacuees do not begin their journey toward safety all at the same time. Rather, evacuees each begin their trips at different times based on their unique characteristics and constraints. Some individuals will prefer to evacuate soon after an order is given. Others may need to spend time securing personal property or seeing to the welfare of their relatives before they feel comfortable evacuating. Yet others will underestimate the threat posed to them by an oncoming storm and may not evacuate until very late. A set of evacuation response curves show the proportion of evacuation by increment of time for evacuation orders that were issued.

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

Figure II-1 – Nine Hour Response Curve



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

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

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

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

B. Zone System and Highway Network

The SRESP evacuation model relies upon data that covers the entire State of Florida as well as areas covering the States of Georgia, Alabama, Mississippi, South Carolina, North Carolina, and Tennessee. While the primary focus of the model is with evacuation behavior within Florida, areas outside of the state had to be considered in order to allow a more precise routing of evacuation traffic. This allows the model to measure the flow of traffic across the state line if needed.

Zone System
The data included in this system contain the demographic information crucial to modeling evacuation traffic. The demographic information is labeled as "small area data". These data provide population and dwelling unit information that will identify where the individuals in the region reside. The planning assumptions developed from the behavioral analysis conducted for this study were applied to these demographic data. The result is a set of evacuation trips generated by the evacuation model. The number of these trips will vary depending on the hazard conditions that prompt the evacuation.

The Southwest 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 17,328 zones. This number provides sufficient detail to accurately accommodate the assignment of evacuation trips onto an evacuation network. Furthermore, additional roadway segments have been included in the model's highway network to facilitate the movement of evacuation trips onto and off of the evacuation network. Each TEZ has a unique identification number that will be used by the model to connect evacuation trip generation to the evacuation highway network.

Highway Network

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

- Florida Statewide Model Network – The 2005 base year statewide model was used as a basis for developing the evacuation model. The statewide model was obtained from the Florida Department of Transportation (FDOT) Systems Planning Office;

- Evacuation Routes – Evacuation routes in each Regional Planning Council (RPC) area were obtained from the RPCs themselves. The RPCs relied on their constituent counties to provide them with information on which roads were to be included as evacuation routes;

- Florida Highway Data Software (FHD) – The 2006 Florida Highway Data software was obtained from FDOT. This software was used to view and query data extracted from the Roadway Characteristics Inventory (RCI) which includes number of lanes, facility types, speed limits, etc.;

- FDOT Quality/Level of Service Handbook – The 2002 FDOT Quality/Level of Service Handbook (QLOS) and the 2007 LOS Issue Papers (2002 FDOT QLOS addendum) were obtained from the FDOT Systems Planning Office website. The QLOS handbook and the LOS tables were used to establish roadway capacities for evacuation purposes; and,

- Microsoft and Google 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 2006 conditions to correspond to the SRESP base year;
- Additional facilities had to be added to the network to accommodate evacuation traffic behavior;
- Many attributes from the original data set were removed and new ones were added specifically tailored for trip activity for evacuation modeling purposes;
- Based on RPC input, any missing facilities instrumental for evacuations were coded into

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

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

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

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

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

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

Roadway Attributes
The roadway attributes contain the highway characteristics for each link in the highway network. Some of the attributes like DISTANCE, FTYPE, ATYPE, etc., were retained from the

highway network database and other attributes like DENSITY and EVAC_RTE are specific to the evacuation modeling and were included in the network.

Reverse Lane Operations

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

C. Background Traffic

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

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

Methodology used to Account for Background Traffic

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

The effect that background traffic has on evacuation traffic can be stated in terms of available capacity. The more background traffic there is on a segment of road, the less capacity is available for evacuation traffic to use. Following this logic, it becomes apparent that by causing the available capacity to fluctuate throughout the evacuation event, one is able to sufficiently account for the impact of background traffic. FDOT's Florida Traffic Information DVD was used to develop average peaking characteristics for various functional classes of roadways throughout the state. These characteristics were analyzed to determine how much capacity is

available throughout a given day during an evacuation.

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

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

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

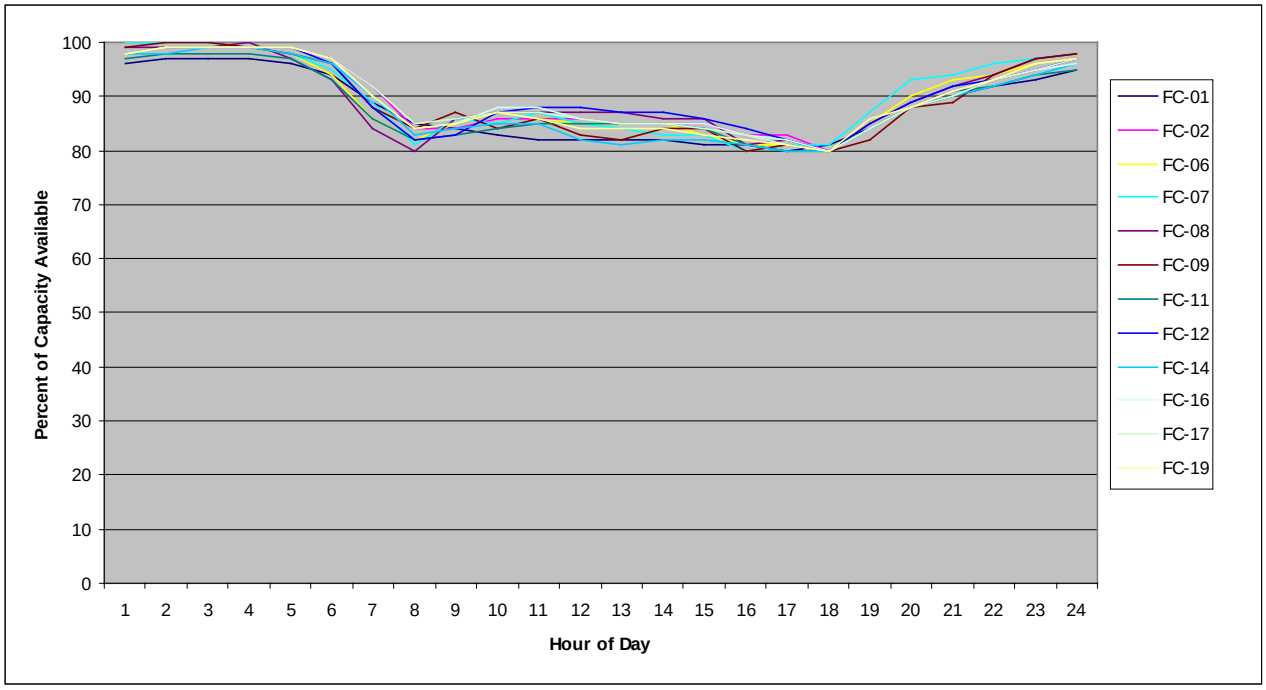
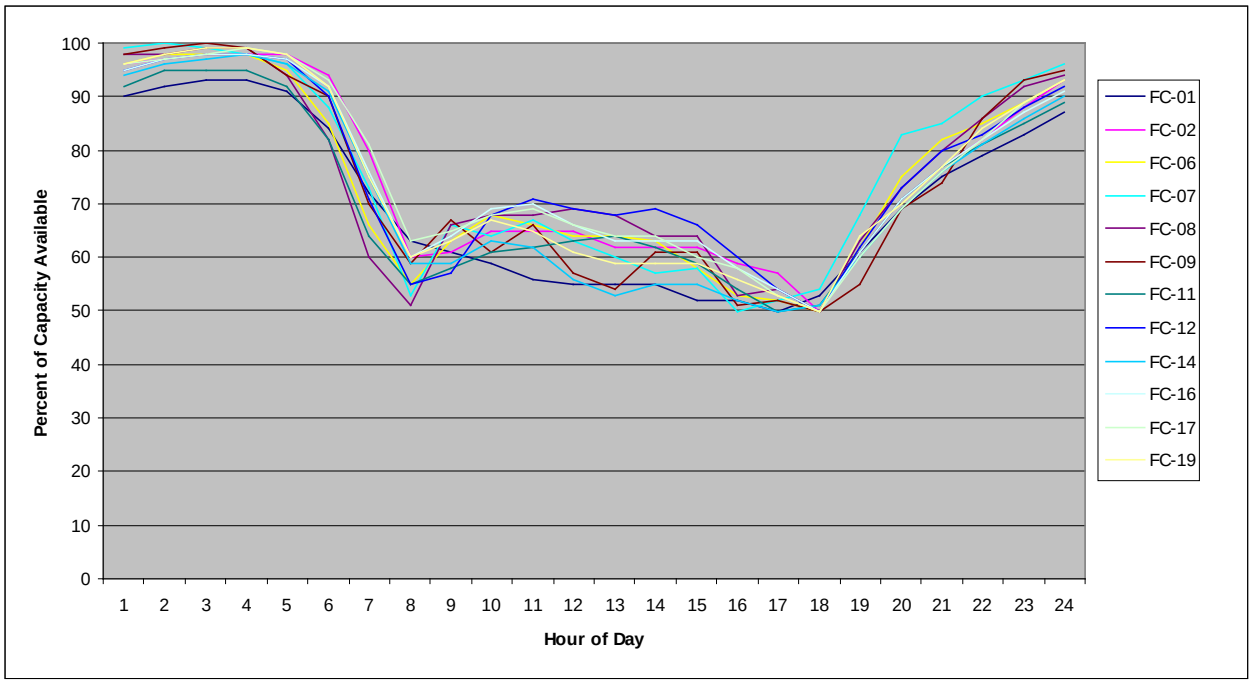


Figure II-3 – Percent of Available Capacity for Other Counties

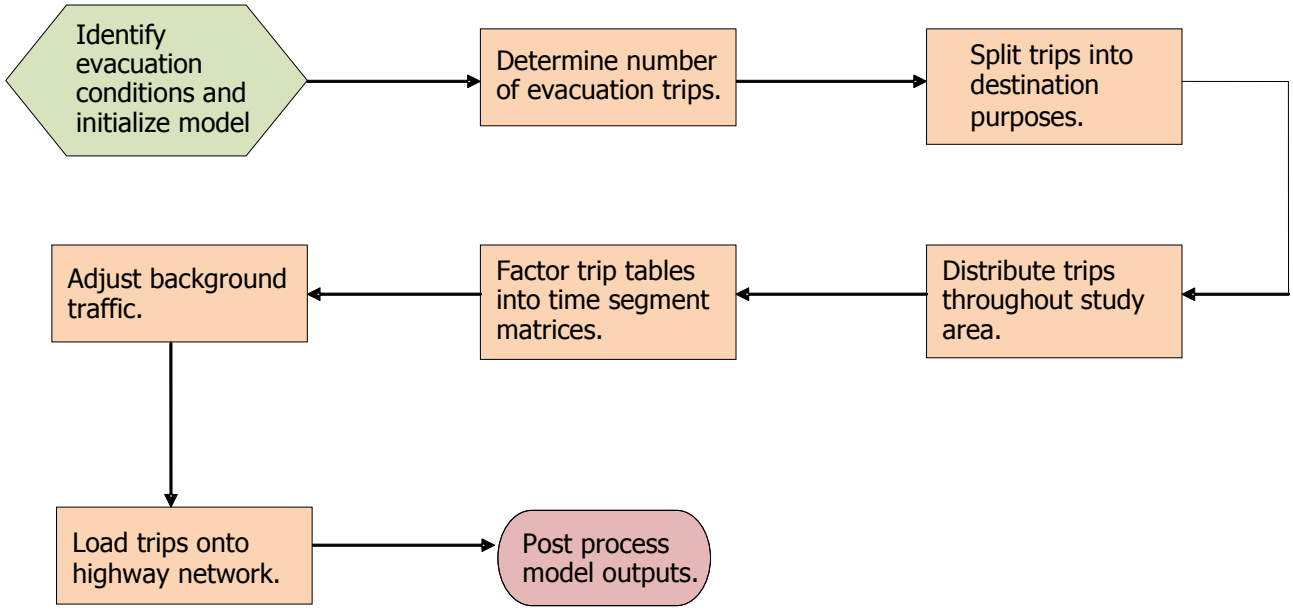


D. Evacuation Traffic

The model flow for the evacuation model is divided into a total of eight modeling steps. The following eight steps are represented graphically in the flowchart in **Figure II-4**:

1. Identify evacuation conditions and initialize model;
2. Determine number of evacuation trips;
3. Split trips into destination purposes;
4. Distribute trips throughout study area;
5. Factor trip tables into time segment matrices;
6. Adjust background traffic;
7. Load trips onto highway network; and,
8. Post process model outputs.

Figure II-4 - General Model Flow



Initializing the Model

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

Number of Evacuating Trips

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

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

Production Ends

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

Attraction Ends

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

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

Splitting Trips into Destination Purposes

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

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

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

Trip End Balancing

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

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

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

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

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

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

From \ To	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-coochee	2.4%	1.7%	12.4%	7.4%	3.3%	1.0%	0.7%	6.5%	0.5%	1.2%	15.0%	48.0%

Source: Derived from SRESP Behavioral Data and Planning Assumptions

Trip Distribution

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

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

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

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

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

E. Dynamic Traffic Assignment

Dynamic traffic assignment (DTA) was utilized because it is sensitive to individual time increments. DTA works by assigning a certain number of vehicles to the highway network in a given interval of time. The model then tracks the progress of these trips through the network over the interval. Another set of vehicles is assigned during the following time interval. The model then tracks the progress of these trips through the network along with the progress of the trips loaded in the previous time interval. As vehicles begin to arrive at the same segments of roadway, they interact with one another to create congestion. When vehicles that were loaded to the network in subsequent intervals of time arrive at the congested links, they contribute to the congestion as well. This results in a slowing down of the traffic and eventually spill-backs and queuing delays.

It is this time dependent feature of DTA that makes it well suited to evacuation modeling. By dynamically adjusting the travel times and speeds of the vehicles moving through the network as they respond to congestion the model is able to do the following:

- The evacuation model is able to estimate the critical clearance time statistics needed for this study;
- The model takes into account the impact of compounded congestion from multiple congestion points;
- The model is able to adjust the routing of traffic throughout the network as a function of congestion as it occurs throughout the evacuation; and,
- The model is capable of adjusting its capacities from time segment to time segment, making it possible to represent such phenomena as reverse lane operations and background traffic.

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

- **Capacity -** The SRESP evacuation model uses hourly lane capacities derived from the Florida Department of Transportation Quality/Level-of-Service Handbook. These capacities are initially set to represent Level-of-Service E conditions. These capacities are then further increased by an additional 20 percent for freeway links and 10 percent for non-freeway links. These increases in capacity are meant to reflect high volume usage typically found during an evacuation, optimal green timing of traffic signals and traffic control typically controlled during an evacuation by law enforcement personnel, and the use of shoulder and emergency lanes;

- **Storage -** Storage determines how many vehicles can remain standing on a length of roadway at any moment in time. The evacuation model assumes that storage is set to 250 vehicles per lane per mile. This assumes approximately 21 feet of space are "occupied" by any given vehicle. Given the mix of vehicles on a roadway network (including compacts, SUVs, trailers, and trucks) this spacing appears to be reasonable for stand-still traffic;

- **Time Intervals -** In order to properly implement a DTA model, the assignment process needs to be segmented according to a set of time intervals. Half-hour intervals provide sufficient detail to satisfy the planning needs of both emergency management and growth management concerns. The model calculates vehicle assignments over 192 such intervals for a 96 hour model period. This is sufficient to capture all evacuation activity during an event and allows sufficient time for the evacuation traffic to clear at both the county and regional level; and,

- **One-Way Evacuation Operation -** The State of Florida has recently published a series of one-way evacuation operation plans for major corridors throughout the state. The intention of these plans is to fully maximize the available capacity on a freeway by using all lanes to move evacuees away from danger. The model will emulate one-way operations by simultaneously increasing the capacity of links headed away from the threatened area and eliminating the capacity of links headed toward the threatened area. The capacity of links headed away from the threatened area will increase by 66 percent, which is consistent with capacity increases used by Florida's Turnpike Enterprise. Past experience of reverse lane operations have shown that capacities do not double, as is commonly assumed, but increase by a lower percentage of about two thirds.

F. Prototype Model Development

Wilbur Smith Associates developed the prototype model to test the modeling methodology used to calculate evacuation clearance times. The prototype model demonstrated the viability of the methodology developed for this study. This included the use of dynamic traffic assignment, background traffic curves, regional sub-area trip balancing, the use of survey rates, the use of 100% participation rates, response curves, and county-by-county phasing of evacuations.

The prototype model served as the backbone for all regional evacuation models that have been developed for this study. The models implemented for each RPC use a structure similar to the prototype with identical methodology.

The SRESP evacuation model relies upon data that covers the entire State of Florida as well as areas covering the States of Georgia, Alabama, Mississippi, South Carolina, North Carolina, and Tennessee. While the primary focus of the model is with evacuation behavior within Florida, areas outside of the state had to be considered in order to allow a more precise routing of evacuation traffic. This allows the model to measure the flow of traffic across the state line if needed.

This page intentionally left blank.

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 Southwest Florida Region, the regional model network includes the six counties within the Southwest Florida RPC plus fifteen other counties surrounding the region, as illustrated in **Figure III-1**.

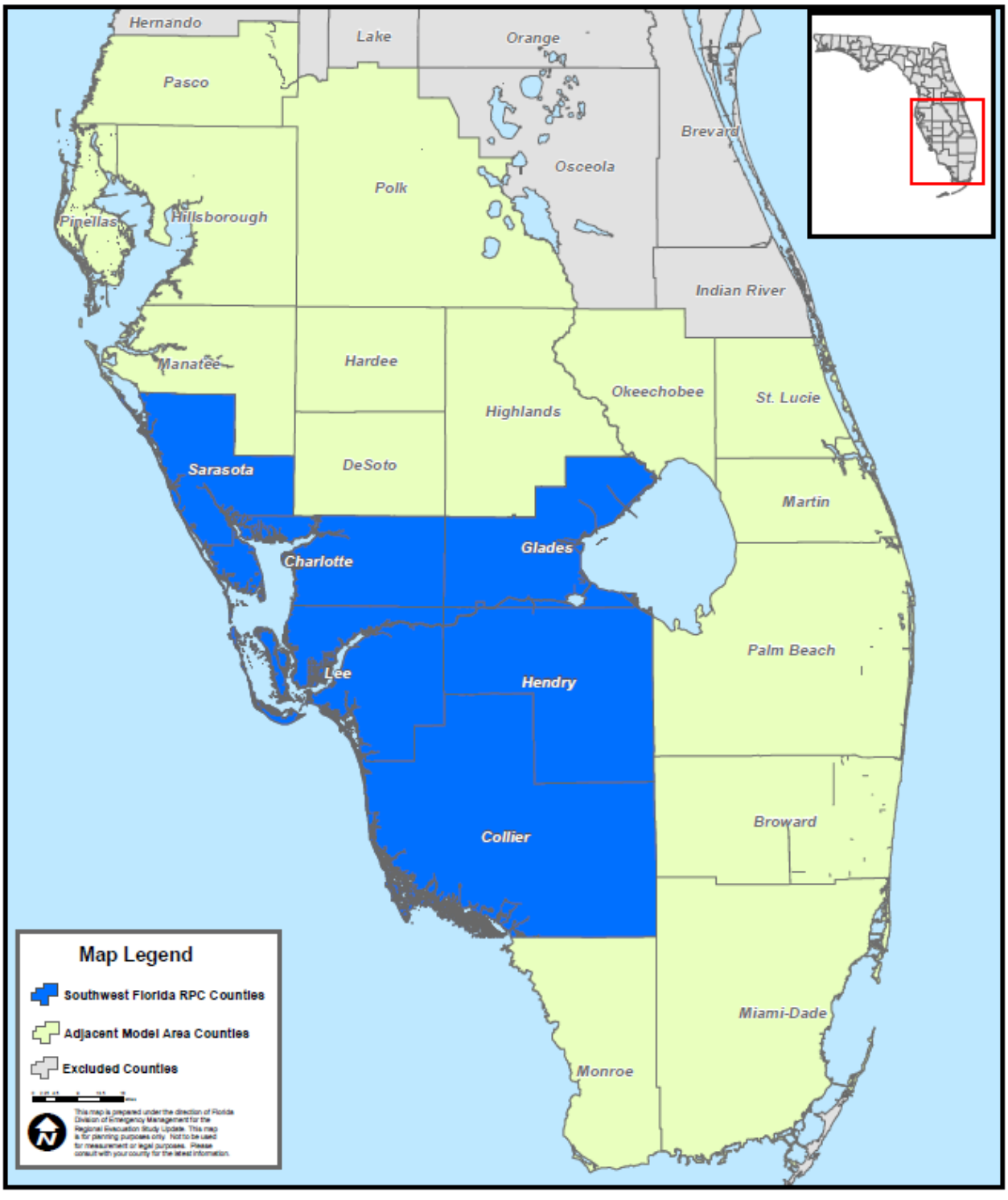
This chapter discusses the input data used in evaluating evacuation transportation conditions for the Southwest Florida Region. It is important to note that the input data discussed in this chapter is included only for the counties within the Southwest Florida RPC, as these are the counties that the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

A. Regional Model Network

The road network is a key component of the evacuation model. The roadway variables in the network include area type, functional class, number of through lanes, capacity, speed, and several others. The regional model network consists of the RPC designated evacuation routes as well as a supporting roadway network that facilitates movement of evacuation traffic. The 2005 Florida Department of Transportation (FDOT) Statewide Model Network was used as a basis for developing the regional model network, while the evacuation routes were obtained from the Southwest Florida RPC. The RPC relied on the emergency managers of its constituent counties to provide it with information on which roads were to be included as evacuation routes. The resulting model network was updated to 2006 conditions and is referred to as the base model network. **Figure III-2** identifies the model network and evacuation routes for the SWFRPC. County level details of the regional model network are provided in the Volume 5 report. The regional model network for the Southwest Florida region includes key roadways within the six county region, including I-75, US 41, US 27, US 17, SR 29, SR 78, SR 72, SR 45, SR 31, SR 82, and SR 80 .

Figure III-1

Southwest Florida Regional Model Area

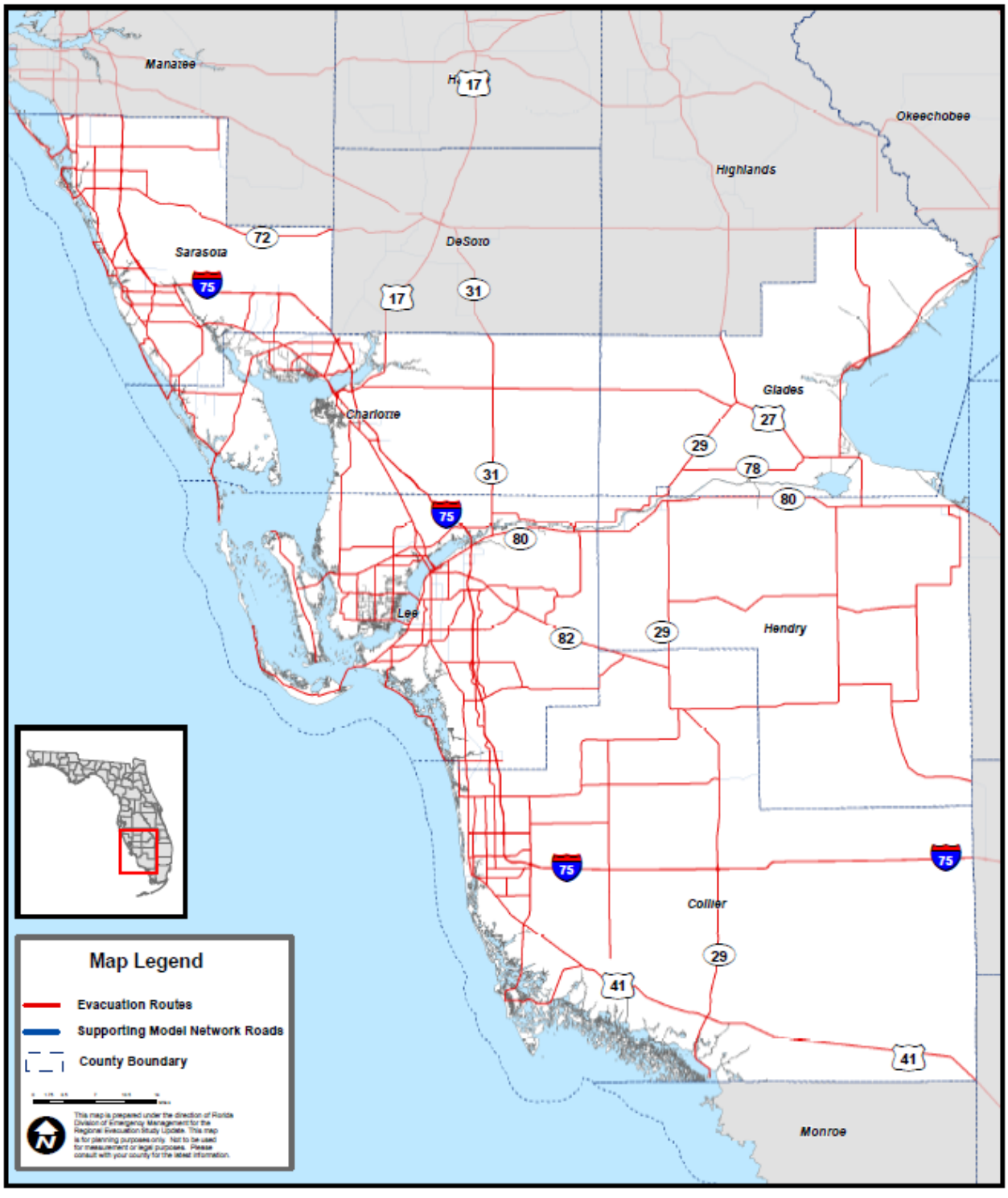


Sources: Southwest Florida Regional Planning Council, CDM Smith

Map Printed: July, 2016

Figure III-2

Southwest Florida Regional Model Network



Sources: Southwest Florida Regional Planning Council, CDM Smith

Map Printed: July, 2015

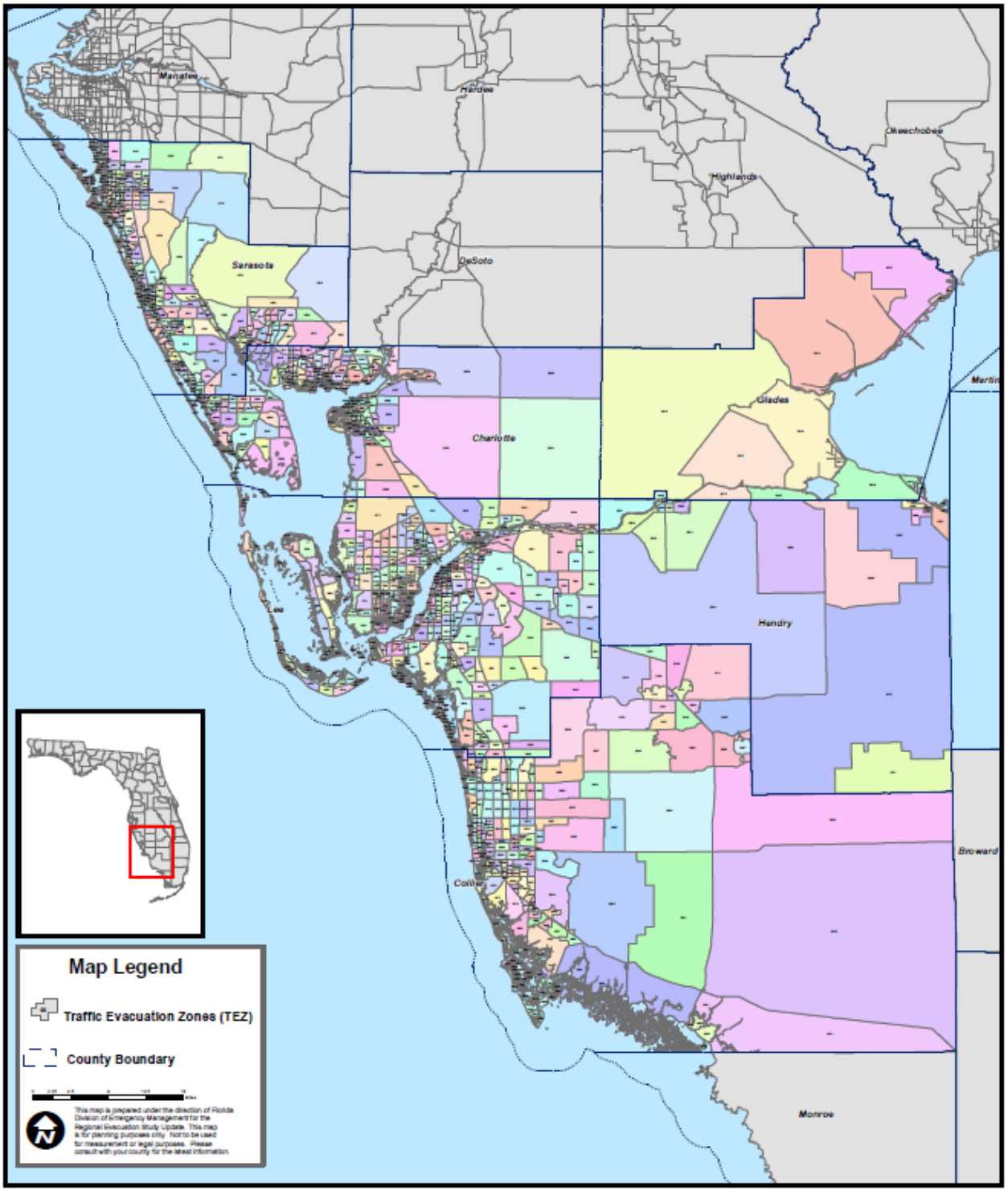
B. Regional Zone System

The regional zone system is based on Traffic Evacuation Zones (TEZ) and contains the regional demographic information, which includes housing and population data that is essential to modeling evacuation traffic, as discussed in Chapter II. The regional demographic characteristics identify where the individuals in the region reside, as well as where the vulnerable populations are located. The TEZs are aggregations of the smaller small area data geographies provided by the RPC. Each traffic evacuation zone has a unique identification 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, 972 of the zones are located within the six county Southwest Florida region, as illustrated in **Figure III-3**. In the Southwest Florida region, Lee County has the largest number of TEZs with 337, and Sarasota County follows with 275 TEZs. Charlotte County contains 175 TEZs; Collier County, 156 TEZs. Hendry and Glades Counties have the lowest number of TEZs in the RPC with 21 and 8 zones, respectively. The larger number of TEZs generally reflects counties with denser urban structure and/or higher population densities.

- Charlotte – 175
- Collier – 156
- Glades – 8
- Hendry – 21
- Lee – 337
- Sarasota – 275

Figure III-3
Southwest Florida Regional Model Transportation Evacuation Zone System (TEZ)



Sources: Southwest Florida Regional Planning Council, CDM Smith

Map Printed: July, 2015

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 Southwest 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.

Lee County has the largest population in the region during all three time periods. The county is expected to reach over 762,000 people by 2020. Sarasota County has the second largest population in the region and is forecasted to have more than 415,000 people by 2020. Glades County has the smallest population in the region; the county is expected to have just more than 12,000 people by 2020.

Within the Southwest Florida region, the number of mobile homes account for 11 percent of all occupied homes between 2010 and 2020. Lee County has the highest number of mobile homes followed by Sarasota. Glades County has the lowest number of mobile homes; however, in each time period the number of mobile homes in Glades is greater than the number of site-built homes.

Table III-1 - Southwest Florida Demographic Characteristic Summary

County	Characteristic	Year		
		2010	2015	2020
Charlotte	Occupied site-built homes	65,788	68,860	72,433
	Population in site-built homes	143,211	149,906	157,675
	Occupied mobile homes	7,582	7,937	8,345
	Population in mobile home	13,755	14,404	15,146
	Hotel/motel units	1,499	5,105	8,782
Collier	Occupied site-built homes	125,148	134,913	149,019
	Population in site-built homes	295,065	318,220	351,535
	Occupied mobile homes	8,031	8,646	9,551
	Population in mobile home	21,909	23,600	26,154
	Hotel/motel units	6,880	24,725	43,547
Glades	Occupied site-built homes	2,106	2,128	2,245
	Population in site-built homes	5,137	5,186	5,443
	Occupied mobile homes	2,427	2,455	2,587
	Population in mobile home	6,264	6,343	6,712
	Hotel/motel units	146	174	252
Hendry	Occupied site-built homes	7,433	7,301	7,548
	Population in site-built homes	21,702	21,320	22,044
	Occupied mobile homes	4,592	4,512	4,659
	Population in mobile home	15,496	15,224	15,721
	Hotel/motel units	384	917	1,549
Lee	Occupied site-built homes	234,977	259,284	293,723
	Population in site-built homes	563,518	621,873	704,312
	Occupied mobile homes	24,841	27,318	30,925
	Population in mobile home	46,748	51,473	58,496
	Hotel/motel units	11,487	33,810	58,158
Sarasota	Occupied site-built homes	161,390	168,313	179,553
	Population in site-built homes	350,438	365,473	389,893
	Occupied mobile homes	14,356	14,964	15,958
	Population in mobile home	23,388	24,374	25,992
	Hotel/motel units	4,778	18,943	33,587

Source: Southwest 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 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: Southwest Florida Region Roadway Improvements, 2011-2015

County	Roadway	From	To	Number of Lanes
Charlotte	Toledo Blade Blvd	US 41	Hillsborough Blvd	4
	US 41	Enterprise Dr	Flamingo Blvd	4
	Burntstore Rd	Notre Dame Rd	US 41	4
Collier	SR 82	Hendry County Line	SR 29	4
Hendry	SR 80	CR 833	US 27	4
	SR 80	Birchwood Pkwy	Dalton Ln	4
	SR 29	Spencer	N of Cowboy Way	4
Lee	I-75	S of Colonial Blvd	S of SR 82	6
	I-75	S of SR 82	S of Luckett Rd	6
	I-75	S of Luckett Rd	S of SR 78	6
	I-75 @ Alico Rd			N/A
	I-75 Airport Access @ Southwest Florida Int'l Airport CD System			N/A
	US 41	Corkscrew Rd	San Carlos Blvd	6
	Del Prado Pkwy	NE 7th St	S of Diplomat Pkwy	6
	SR 82	Hendry County Line	Homestead Rd S	4
	SR 82	Homestead Rd S	Shawnee Rd	6
Sarasota	SR 78 (Pine Island)	Burnt Store Rd	W of Chiquita Blvd	4
	I-75 (SR 93) @ University Pkwy			N/A
	I-75 (SR 93)	N of Sumter Blvd	N of River Rd (CR 777)	6

Sources: FDOT SIS First Five Year Plan, FDOT SIS Second Five Year Plan, Northeast Florida Regional 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: Southwest Florida Planned Roadway Improvements, 2016-2020

County	Roadway	From	To	Number of Lanes
Charlotte	I-75 (SR 93)	Lee County Line	S Tuckers Grade	6
	I-75 (SR 93)	S of Harborview Rd	N of Kings Hwy	6
Collier	I-75	SR 951	N of Golden Gate Pkwy	6
Hendry	SR 80	Dalton Ln	CR 833	4
	SR 82	Lee County Line	Collier County Line	4
Lee	SR 82	CR 884 (Lee Blvd)	Shawnee Rd	6
Sarasota	I-75 (SR 93)	Charlotte County Line	Sumter Blvd	6

Sources: FDOT SIS First Five Year Plan, FDOT SIS Second Five Year Plan, Northeast Florida Regional 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 Southwest 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 5-9.

A review of the evacuation rates for the Southwest 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 Charlotte County for persons living in evacuation zone A, the county could expect a 50 percent participation rate from persons living in site-built homes in evacuation zone A (**Figure III-4**) and a 75 percent participation rate from persons living in mobile/manufactured homes in evacuation zone A (**Figure III-5**). In addition, Charlotte County can expect shadow evacuations to occur for persons living in site-built homes at a rate of 30 percent from evacuation zone B, 10 percent from evacuation zone C, and 10 percent for evacuation zone D, which also includes zone E (**Figure III-4**). Likewise, for persons living in mobile/manufactured homes, Charlotte County can expect shadow evacuations to occur at a rate of 75 percent from evacuation zone B, and 65 percent each from evacuation zones C and D (**Figure III-5**).

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

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

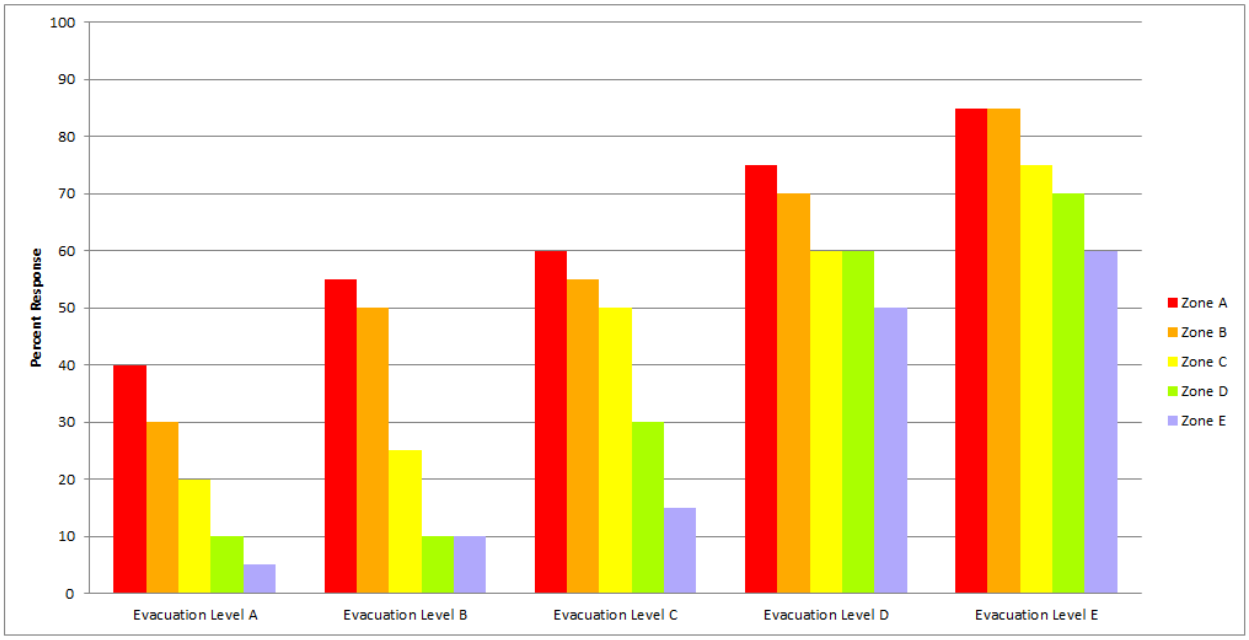


Figure III-5: Evacuation Participation Rates: Charlotte County Mobile Homes

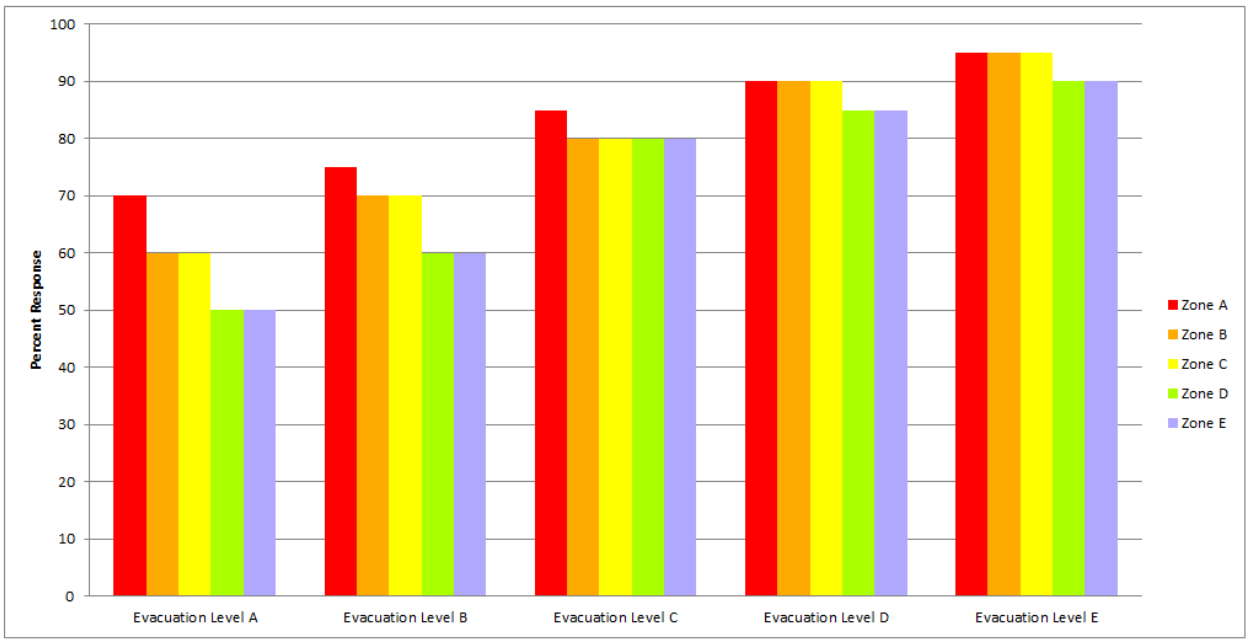


Figure III-6: Evacuation Participation Rates: Collier County Site-Built Homes

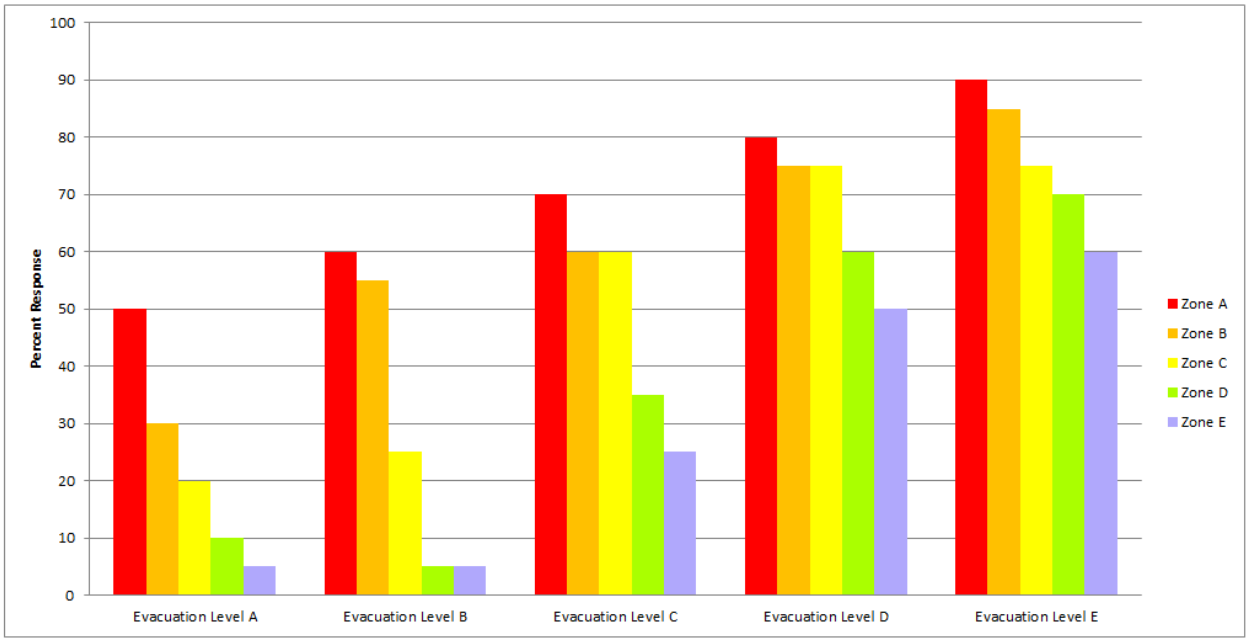


Figure III-7: Evacuation Participation Rates: Collier County Mobile Homes

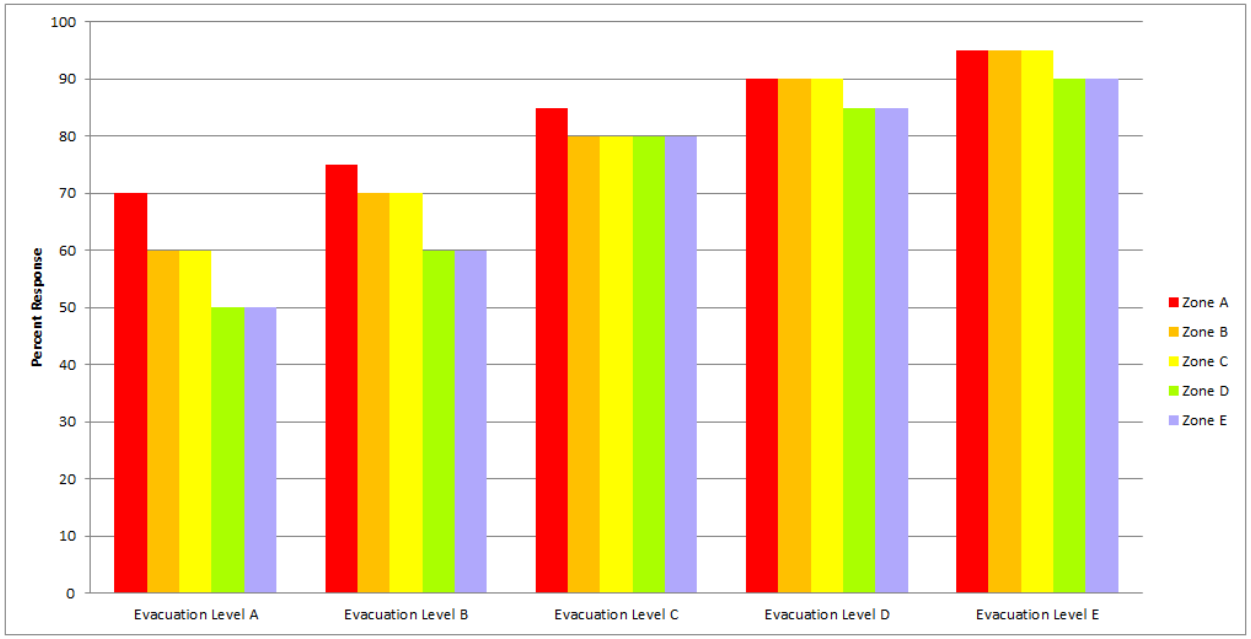


Figure III-8: Evacuation Participation Rates: Glades County Site-Built Homes

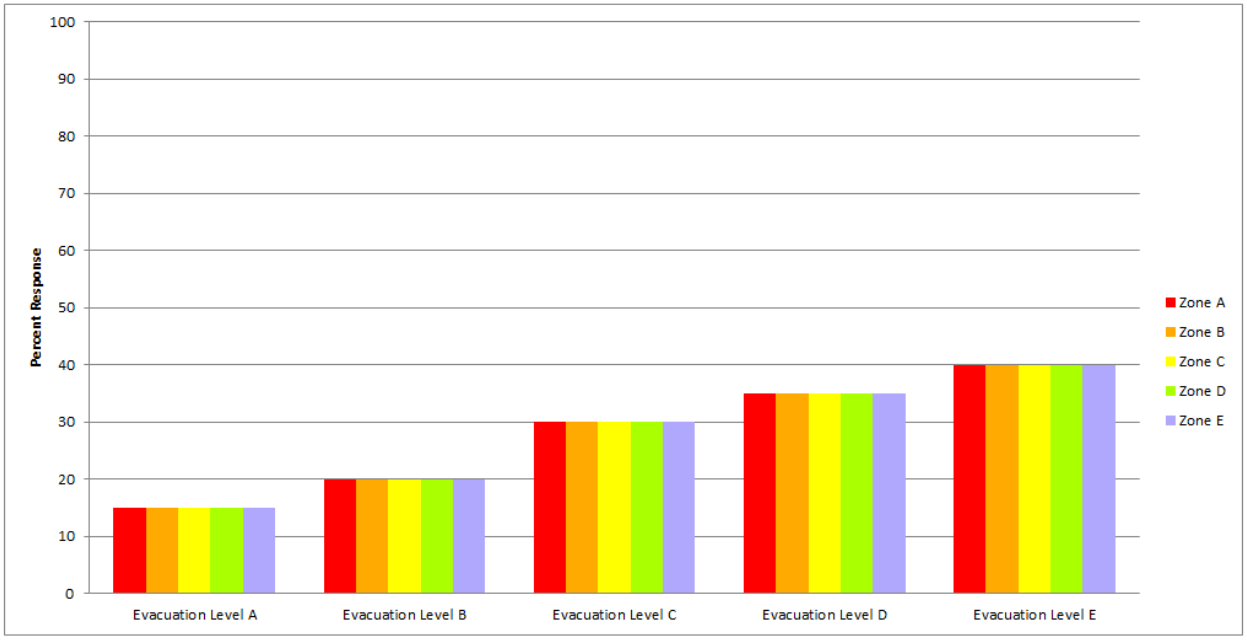


Figure III-9: Evacuation Participation Rates: Glades County Mobile Homes

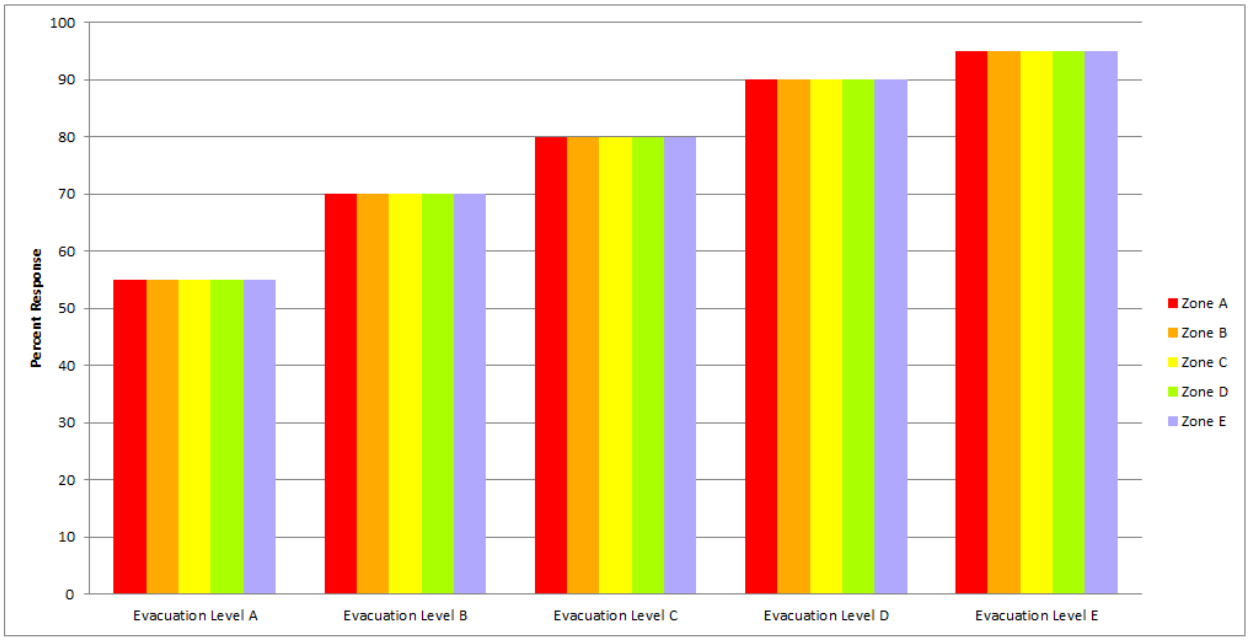


Figure III-10: Evacuation Participation Rates: Hendry County Site-Built Homes

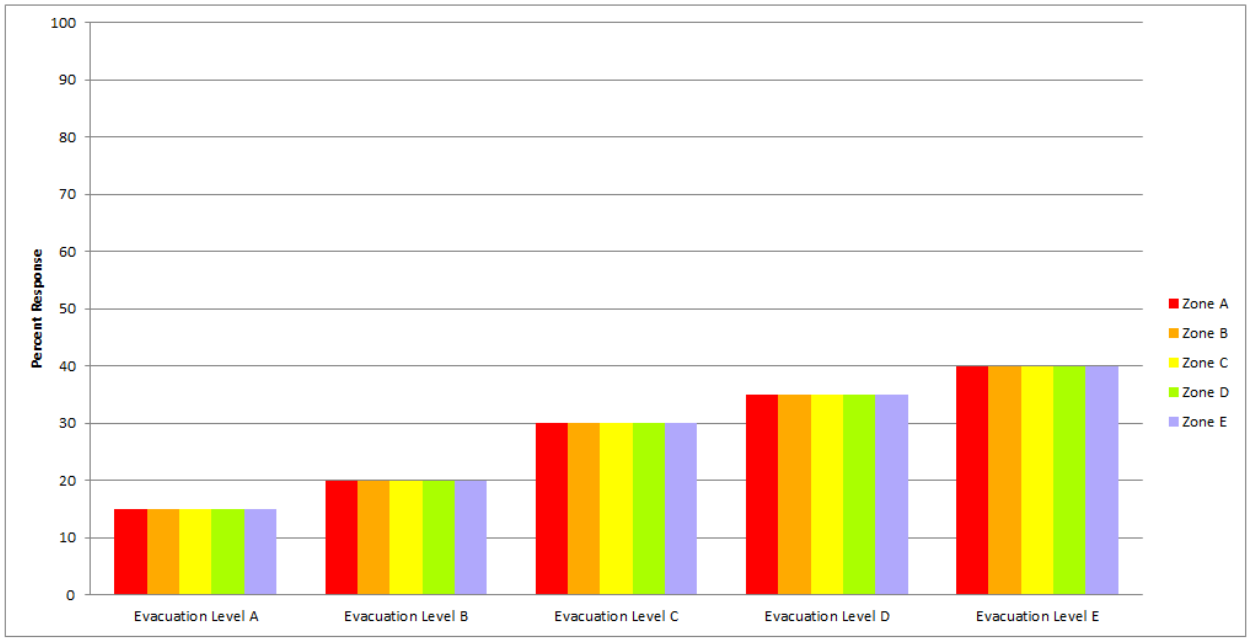


Figure III-11: Evacuation Participation Rates: Hendry County Mobile Homes

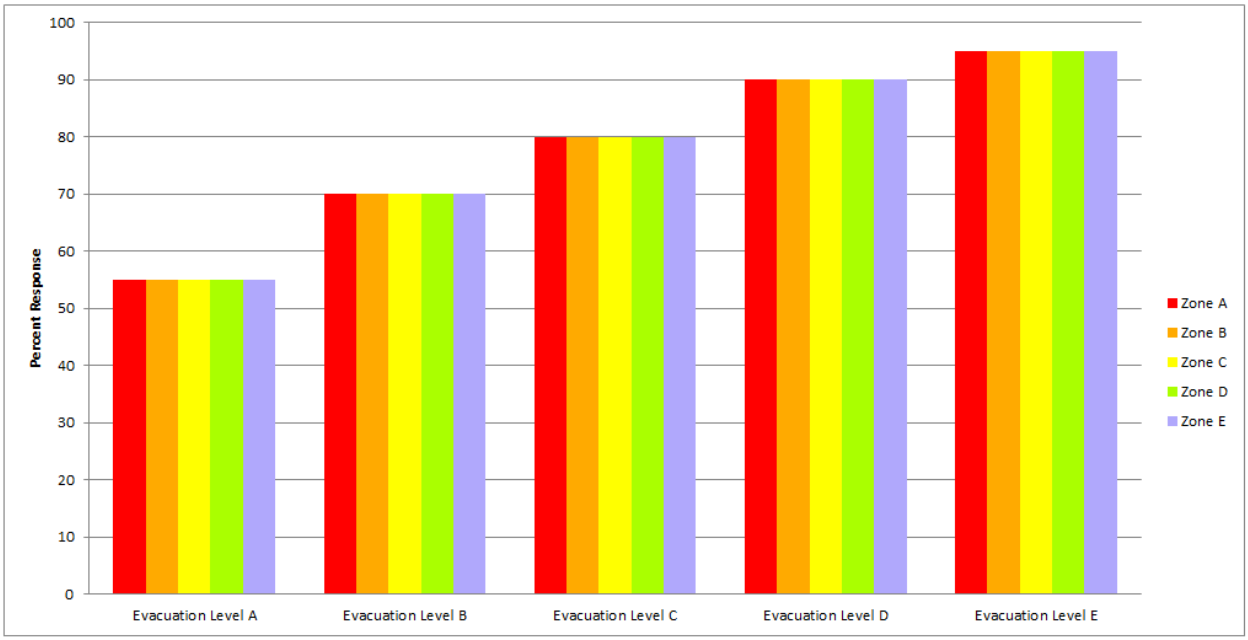


Figure III-12: Evacuation Participation Rates: Lee County Site-Built Homes

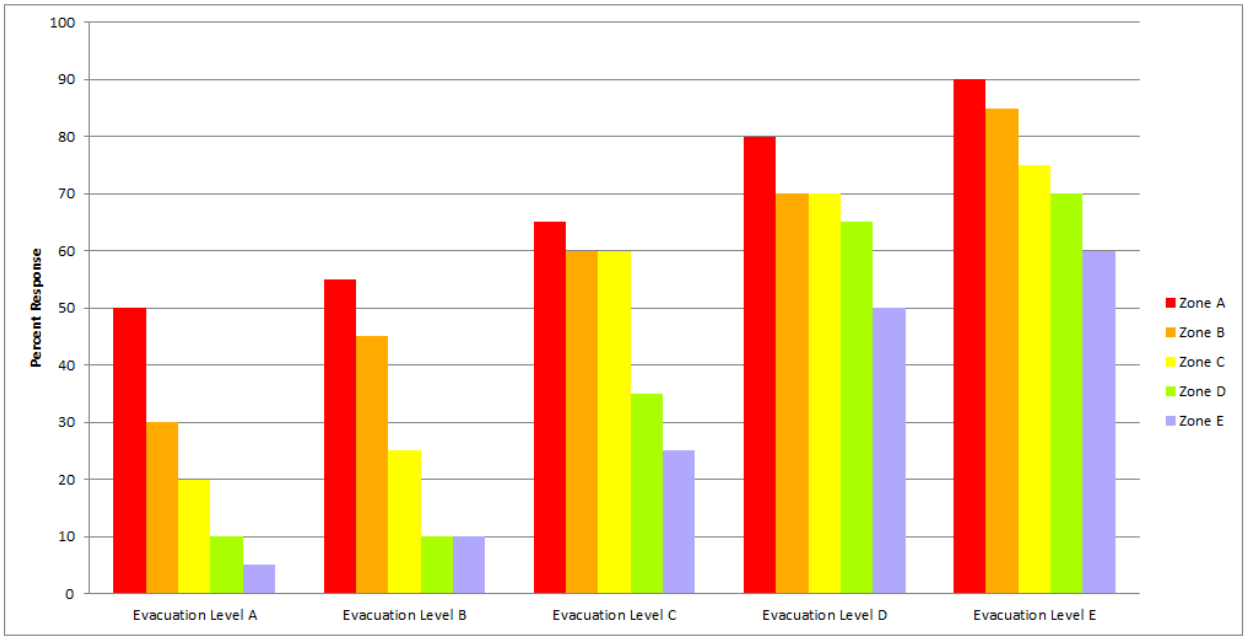


Figure III-13: Evacuation Participation Rates: Lee County Mobile Homes

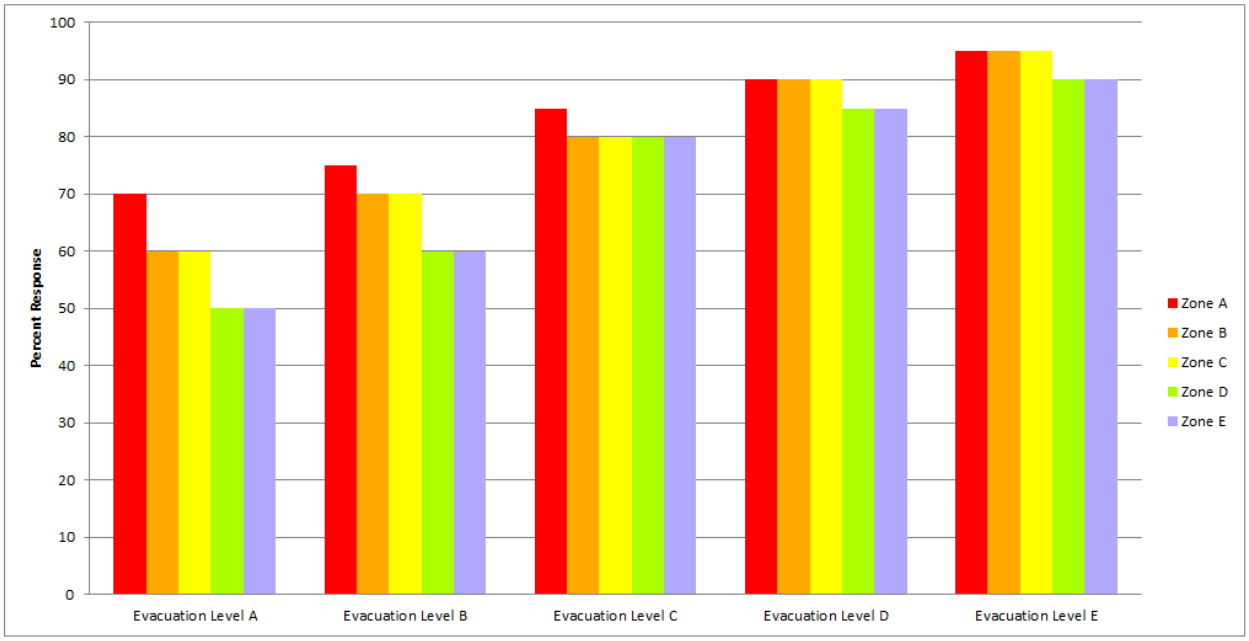


Figure III-14: Evacuation Participation Rates: Sarasota County Site-Built Homes

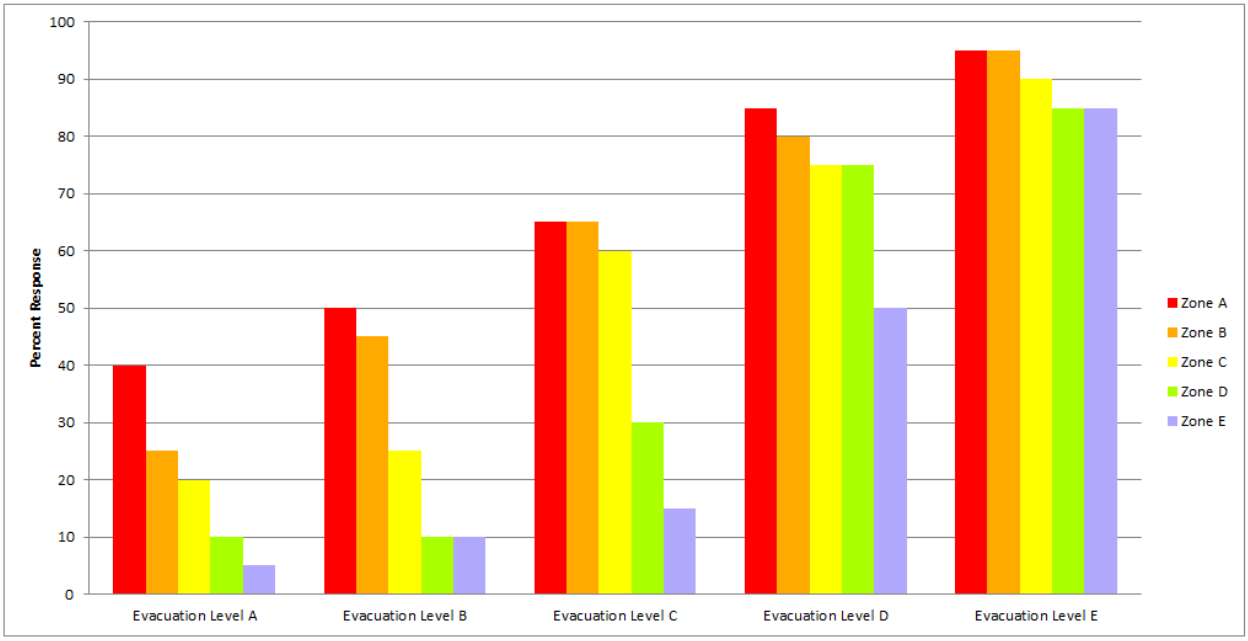
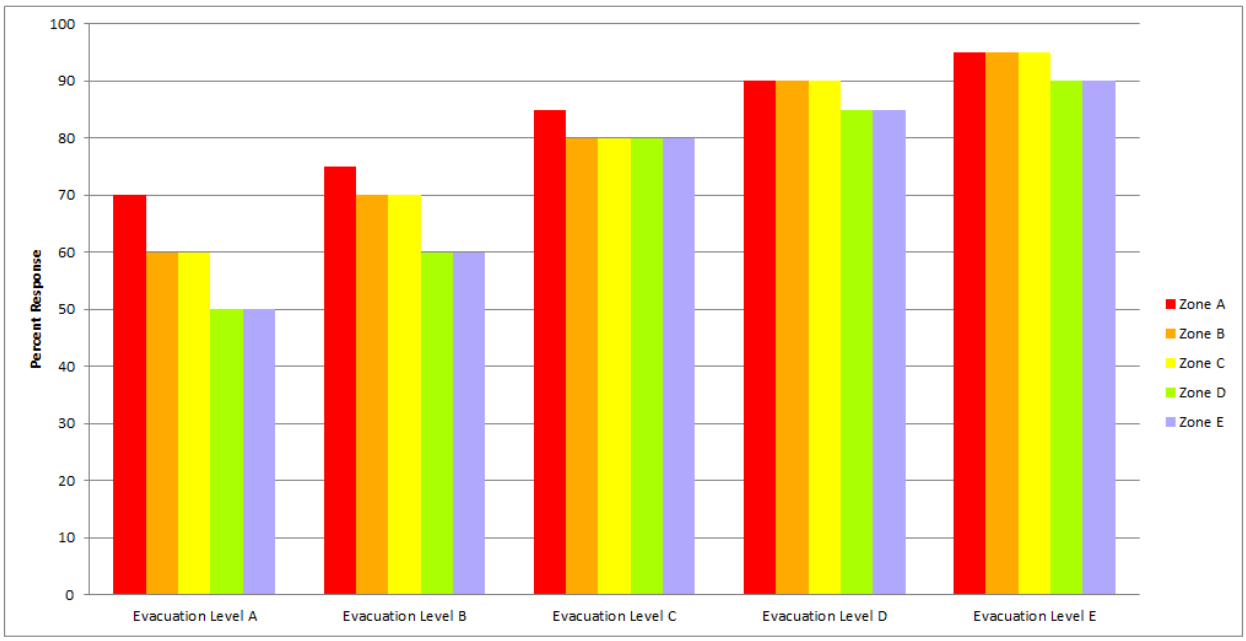


Figure III-15: Evacuation Participation Rates: Sarasota County Mobile Homes



F. Shelters

In order for the transportation model to accurately assign public shelter trips to the correct location, a complete list of available public shelters needs to be available. The Southwest 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 six county region there are a total of 114 shelters, including 4 in Charlotte County, 38 in Collier County, 8 in Glades County, 11 in Hendry County, 30 in Lee County, and 23 in Sarasota County. All together, the 114 shelters located within the six county region can host more than 125,000 persons during an evacuation event. Detailed lists of the available public shelters by county are included in Volume 5-9.

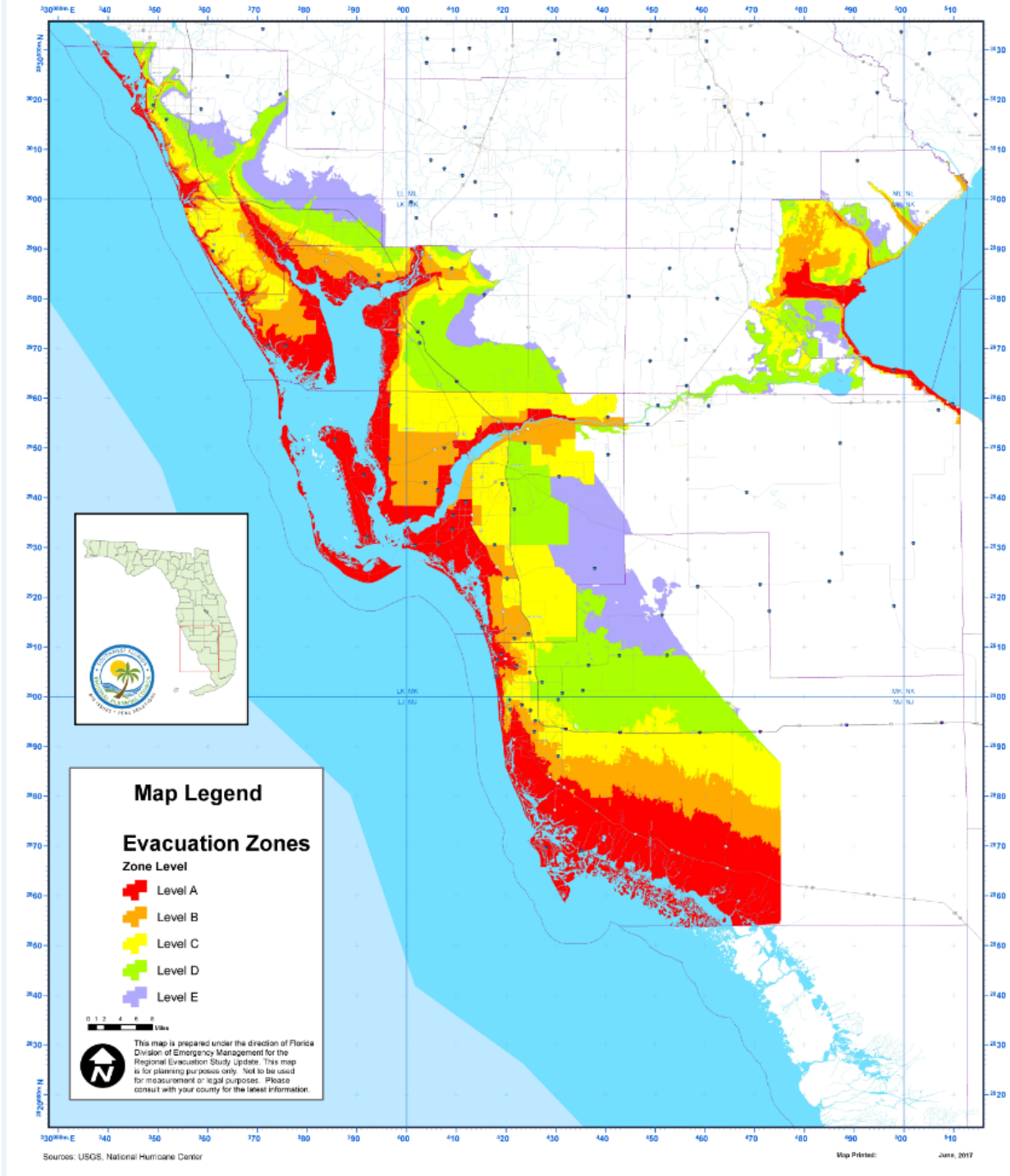
G. Evacuation Zones

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. All six counties within the Southwest Florida region have updated and established their evacuation zones based on the results of the new data and information collected as part of the SRESP. Evacuation zones for the Southwest Florida Region are illustrated in **Figure III-16**. County level evacuation zones are included in Volume 5-9.

Figure III-16

Southwest Florida Regional Evacuation Zones

2017 Evacuation Study Summary Update



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.

- **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. For example, the Northeast Florida RC may want to take into account additional traffic that would be generated by visitors for a large sporting event. 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 Northeast Florida's model network and include both coastal and inland counties. The coastal counties in Florida include Nassau, Duval, Flagler, St. Johns, Volusia, and Brevard Counties; Georgia coastal counties include Camden and Glynn. The inland counties in Florida are Baker, Clay, Putnam, Madison, Suwannee, Lafayette, Columbia, Union, Bradford, Alachua, Marion, Lake, Seminole, Orange, and Osceola Counties. The inland counties in Georgia are Brantley, Charlton, Ware, Clinch, Echols, and Lowndes 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 (with an exception with zone F). 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.

This page intentionally left blank.

CHAPTER IV
TRANSPORTATION ANALYSIS

The transportation analysis brings together key factors such as evacuation level, transportation network, shelters, and evacuation population, and explicitly links people's behavioral responses to the regional evacuation infrastructure. The results of this analysis help to formulate effective and responsive evacuation policy options. Two distinct sets of analyses were conducted using the SRESP evacuation transportation model, including one set of analysis for growth management purposes and one set of analysis for emergency management purposes. The results of this analysis are discussed in this chapter.

A. Vulnerable Population

Using a combination of the demographic data, behavioral assumptions, and evacuation zones, the vulnerable population in each county could be determined by evacuation level. For the purposes of the transportation analysis, the vulnerable population, or population-at-risk, is defined as the total population living within the county designated evacuation zones for each evacuation level. This population is living in an area that is at risk for severe flooding during a storm event. The vulnerable population for the Southwest Florida Region for 2017 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**.

The vulnerable population in the Southwest Florida Region includes population from all six counties in the region and varies by evacuation zone. Charlotte County, for example, has just over 90,000 vulnerable residents in evacuation zone B and only slightly more than 30,000 vulnerable residents in evacuation zone C in 2017. The vulnerable population living in site-built homes far exceeds the vulnerable population living in mobile/manufactured homes in all regional counties except for Glades and Hendry where they vary by evacuation zone.

Table IV-1: Vulnerable Population in the Southwest Florida Region for 2017

	Evacuation Zone A	Evacuation Zone B	Evacuation Zone C	Evacuation Zone D	Evacuation Zone E
Charlotte County					
Site-built Homes	30,919	84,890	28,602	3,556	113
Mobile/Manuf. Homes	3,655	5,651	2,066	2,556	32
TOTAL	34,574	90,541	30,667	6,112	145
Collier County					
Site-built Homes	95,085	52,851	78,967	71,201	4,780
Mobile/Manuf. Homes	8,405	4,644	1,708	810	1,063
TOTAL	103,491	57,495	80,675	72,011	5,843
Glades County					
Site-built Homes	441	273	541	696	193
Mobile/Manuf. Homes	205	392	450	883	285
TOTAL	646	666	991	1,578	478
Hendry County					
Site-built Homes	742	139	248	63	0
Mobile/Manuf. Homes	1,388	155	32	9	0
TOTAL	2,130	294	280	71	0
Lee County					
Site-built Homes	156,881	234,537	136,168	38,822	39,155
Mobile/Manuf. Homes	15,266	9,962	23,379	1,039	1,164
TOTAL	172,146	244,499	159,546	39,861	40,320
Sarasota County					
Site-built Homes	50,229	39,535	79,988	76,363	27,987
Mobile/Manuf. Homes	5,710	6,035	3,032	2,554	829
TOTAL	55,940	45,569	83,019	78,917	28,816

Note: Vulnerable population determined using SRESP behavioral data and county provided evacuation zones. Vulnerable population numbers are not inclusive, meaning population numbers listed for a higher zone are not included in the lower zone. For example, vulnerable population listed for Evacuation Zone B does not include vulnerable population listed for Evacuation Zone A.

Table IV-2: Vulnerable Population in the Southwest Florida Region for 2020

	Evacuation Zone A	Evacuation Zone B	Evacuation Zone C	Evacuation Zone D	Evacuation Zone E
Charlotte County					
Site-built Homes	32,515	89,286	30,083	3,750	119
Mobile/Manuf. Homes	3,847	5,946	2,172	2,679	34
TOTAL	36,362	95,232	32,255	6,429	153
Collier County					
Site-built Homes	105,018	58,386	87,233	78,665	5,283
Mobile/Manuf. Homes	9,332	5,144	1,906	901	1,174
TOTAL	114,349	63,530	89,139	79,566	6,456
Glades County					
Site-built Homes	463	287	570	723	198
Mobile/Manuf. Homes	218	414	474	941	307
TOTAL	681	702	1,045	1,664	504
Hendry County					
Site-built Homes	767	143	256	65	0
Mobile/Manuf. Homes	1,434	160	34	9	0
TOTAL	2,201	304	290	74	0
Lee County					
Site-built Homes	177,728	265,694	154,091	43,980	44,347
Mobile/Manuf. Homes	17,290	11,288	26,655	1,176	1,329
TOTAL	195,018	276,982	180,746	45,155	45,676
Sarasota County					
Site-built Homes	53,584	42,176	85,333	81,458	29,858
Mobile/Manuf. Homes	6,092	6,436	3,234	2,729	884
TOTAL	59,676	48,612	88,566	84,187	30,742

Note: Vulnerable population determined using SRESP behavioral data and county provided evacuation zones. Vulnerable population numbers are not inclusive, meaning population numbers listed for a higher zone are not included in the lower zone. For example, vulnerable population listed for Evacuation Zone B does not include vulnerable population listed for Evacuation Zone A.

In addition, based again on the demographic data, behavioral assumptions, and evacuation zones, the planned destinations of vulnerable population in each county could be determined by evacuation level. Destinations include friends and family, hotel/motel, public shelter, and other locations. Vulnerable population destinations for the Southwest Florida Region are identified in **Table IV-3** for 2017 and in **Table IV-4** for 2020.

Table IV-3: Vulnerable Population by Destination for 2017

	Evacuation Zone A	Evacuation Zone B	Evacuation Zone C	Evacuation Zone D	Evacuation Zone E
Charlotte County					
To Friends and Family	19,381	50,363	17,074	3,617	83
To Hotel/ Motel	8,461	22,353	7,564	1,400	33
To Public Shelter	2,656	7,074	2,495	682	18
To Other Destination	4,076	10,752	3,535	412	11
Collier County					
To Friends and Family	60,012	33,643	47,305	42,288	3,343
To Hotel/ Motel	25,601	14,347	19,867	17,694	1,437
To Public Shelter	7,806	5,414	7,913	8,458	722
To Other Destination	10,072	4,091	5,590	3,571	341
Glades County					
To Friends and Family	377	380	572	903	273
To Hotel/ Motel	75	86	122	202	62
To Public Shelter	97	100	149	237	72
To Other Destination	97	100	149	237	72
Hendry County					
To Friends and Family	0	192	171	44	0
To Hotel/ Motel	144	22	0	7	0
To Public Shelter	426	59	0	14	0
To Other Destination	144	22	0	7	0
Lee County					
To Friends and Family	0	146,201	93,390	23,812	24,075
To Hotel/ Motel	43,037	61,125	39,887	8,024	8,064
To Public Shelter	8,607	12,225	9,146	4,762	4,873
To Other Destination	17,978	24,948	17,124	3,262	3,307
Sarasota County					
To Friends and Family	0	26,738	48,268	47,095	17,207
To Hotel/ Motel	13,699	9,114	17,100	15,783	5,763
To Public Shelter	3,368	4,370	7,501	9,674	3,524
To Other Destination	3,368	5,348	10,150	6,364	2,322

Note: Vulnerable population destinations determined using SRESP behavioral data and county provided evacuation zones. Vulnerable population numbers are not inclusive, meaning population numbers listed for a higher zone are not included in the lower zone. For example, vulnerable population listed for Evacuation Zone B does not include vulnerable population listed for Evacuation Zone A.

Table IV-4: Vulnerable Population by Destination for 2020

	Evacuation Zone A	Evacuation Zone B	Evacuation Zone C	Evacuation Zone D	Evacuation Zone E
Charlotte County					
To Friends and Family	20,384	52,972	17,958	3,804	87
To Hotel/ Motel	8,898	23,511	7,955	1,473	35
To Public Shelter	2,794	7,440	2,624	718	19
To Other Destination	4,287	11,309	3,719	434	11
Collier County					
To Friends and Family	66,308	37,174	52,267	46,724	3,694
To Hotel/ Motel	28,289	15,853	21,953	19,551	1,588
To Public Shelter	8,623	5,981	8,743	9,345	798
To Other Destination	11,129	4,521	6,177	3,946	376
Glades County					
To Friends and Family	398	400	603	951	287
To Hotel/ Motel	79	91	128	214	66
To Public Shelter	102	105	157	250	76
To Other Destination	102	105	157	250	76
Hendry County					
To Friends and Family	1,464	198	177	45	0
To Hotel/ Motel	148	22	0	7	0
To Public Shelter	440	61	0	15	0
To Other Destination	148	22	0	7	0
Lee County					
To Friends and Family	116,146	165,625	105,782	26,976	27,273
To Hotel/ Motel	48,755	69,246	45,186	9,090	9,135
To Public Shelter	9,751	13,849	10,370	5,395	5,521
To Other Destination	20,366	28,263	19,407	3,695	3,747
Sarasota County					
To Friends and Family	37,875	28,524	51,493	50,239	18,357
To Hotel/ Motel	14,614	9,722	18,242	16,837	6,148
To Public Shelter	3,593	4,661	8,002	10,321	3,760
To Other Destination	3,593	5,705	10,828	6,790	2,477

Note: Vulnerable population destinations determined using SRESP behavioral data and county provided evacuation zones. Vulnerable population numbers are not inclusive, meaning population numbers listed for a higher zone are not included in the lower zone. For example, vulnerable population listed for Evacuation Zone B does not include vulnerable population listed for Evacuation Zone A.

The vulnerable shadow population is provided in **Table IV-5** for both 2017 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. Vulnerable shadow population for the six county region ranges from over 180,000 to over 365,000 persons for 2017, depending upon the evacuation level. For 2020, the range increases to between 245,000 and 430,000 persons.

Table IV-5: Vulnerable Shadow Evacuation Population

	Evacuation Level A	Evacuation Level B	Evacuation Level C	Evacuation Level D	Evacuation Level E
2017					
Charlotte County	44,568	18,158	11,469	8,210	8,213
Collier County	65,715	53,768	64,975	45,358	41,861
Glades County	6,835	6,626	6,512	5,590	5,454
Hendry County	17,069	17,916	19,855	20,836	21,843
Lee County	164,910	103,600	77,561	75,793	57,725
Sarasota County	66,437	57,909	65,022	55,287	46,976
2020					
Charlotte County	48,291	23,017	16,955	10,526	13,506
Collier County	79,025	73,047	94,158	74,381	70,514
Glades County	7,228	7,007	6,893	5,229	5,423
Hendry County	17,661	18,537	20,539	20,465	21,551
Lee County	201,095	138,185	117,618	72,463	70,752
Sarasota County	76,177	68,157	78,807	72,237	64,862

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

B. Clearance Time Definitions

The determination of clearance time is one of the most important outcomes from the evacuation transportation analysis. Calculated clearance times are used by county emergency managers as one input to determine when to recommend an evacuation order. This calculation can include the population-at-risk, shadow evacuees, as well as evacuees from other counties anticipated to pass through the county. Clearance time is developed to include the time required for evacuees to secure their homes and prepare to leave, the time spent by all vehicles traveling along the evacuation route network, and the additional time spent on the road caused by traffic and road congestion. Clearance time does not relate to the time any one vehicle spends traveling along the evacuation route network, nor does it guarantee vehicles will safely reach their destination once outside the County. The Glossary of the SRESP contains the agreed upon language of the four clearance times that are calculated as part of the evacuation transportation analysis. Below provides a simplified explanation of these clearance times:

- **Clearance Time to Shelter** - The time necessary for all in-County trips to have reached their destination within the County. This does not mean all traffic movement in the County has ended; rather it means that everyone going to a point of safety **AND** that point is in the County, has reached their shelter.

  While this is primarily a growth management number, it gives emergency managers information about how long it will take for shelters to fill-up once an evacuation order is given.

- **In-County Clearance Time** - The time necessary for all in-County trips to have reached their destination **AND** all out of county trips have left the Evacuation Zone **AND** traffic originating from outside the County that passes through the Evacuation Zone has also cleared the Zone. This does not mean all traffic movement in the County has ended; rather it means that everyone going to a point of safety **AND** that point is in the County, has reached their shelter **AND** the Evacuation Zone is clear.

  This gives you vital planning information regarding how long it will take to clear the most vulnerable zones once an evacuation order is given.

- **Out of County Clearance Time** - The time necessary for all in-County trips to have reached their destination **AND** all out of county trips have left the County **AND** traffic originating from outside the County that pass through the County has also cleared the County. This does not mean all traffic movement in the County has ended; rather it means that everyone going to a point of safety has reached their shelter or left the County.

- **Regional Clearance Time** - The time that is the highest time for any County Clearance time in the designated region. Calculated from last vehicle assigned an external destination exits the region.

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

D. Base Scenarios

A total of ten base scenarios were developed through discussions with the SRESP Statewide Work Group and are identical for all eleven RPCs. The SRESP requires a consistent set of base scenarios that will be used by all regions across the State to provide a consistent background between regions.

The base scenarios also allow the results to be used consistently from region to region for other purposes, such as growth management. The ten base scenarios were developed to include the following assumptions:

- **Analysis Time Period** – Five scenarios for the 2017 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 2017 scenarios use the 2017 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 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 Charlotte, Collier, Glades, Hendry, Lee, Sarasota, Manatee, and mainland Monroe 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 Charlotte, Collier, Glades, Hendry, Lee, Sarasota, Manatee, and mainland Monroe 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 Charlotte, Collier, Glades, Hendry, Lee, Sarasota, Manatee, and mainland Monroe Counties); and,
  - For the remaining counties in the Southwest Florida model network, no evacuations are assumed, including shadow evacuations.

For base scenario 10, the model exceeded its 96 hour limitation. This means that by the 96th hour of the evacuation event, the model had still not cleared and the model run terminated without reporting valid clearance times.

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

Table IV-6: Base Scenarios

	Scenario 1 Level A 2017	Scenario 2 Level B 2017	Scenario 3 Level C 2017	Scenario 4 Level D 2017	Scenario 5 Level E 2017
Demographic Data	2015	2015	2015	2015	2015
Highway Network	2017	2017	2017	2017	2017
One-Way Operations	None	None	None	None	None
University Population	Fall/Spring	Fall/Spring	Fall/Spring	Fall/Spring	Fall/Spring
Tourist Rate	Default	Default	Default	Default	Default
Shelters Open	Primary	Primary	Primary	Primary	Primary
Response Curve	12-hour	12-hour	12-hour	12-hour	12-hour
Evacuation Phasing	None	None	None	None	None
Behavioral Response	100%	100%	100%	100%	100%
Evacuation Zone	A	B	C	D	E
Counties Evacuating	Charlotte Collier Glades Hendry Lee Sarasota Manatee Monroe (ML)	Charlotte Collier Glades Hendry Lee Sarasota Manatee Monroe (ML)	Charlotte Collier Glades Hendry Lee Sarasota Manatee Monroe (ML)	Charlotte Collier Glades Hendry Lee Sarasota Manatee Monroe (ML)	Charlotte Collier Glades Hendry Lee Sarasota Manatee Monroe (ML)
	Scenario 6 Level A 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	Charlotte Collier Glades Hendry Lee Sarasota Manatee Monroe (ML)	Charlotte Collier Glades Hendry Lee Sarasota Manatee Monroe (ML)	Charlotte Collier Glades Hendry Lee Sarasota Manatee Monroe (ML)	Charlotte Collier Glades Hendry Lee Sarasota Manatee Monroe (ML)	Charlotte Collier Glades Hendry Lee Sarasota Manatee Monroe (ML)

ML – includes mainland portion of Monroe County only.

E. Base Scenario Results

Each of the ten base scenarios were modeled for the Southwest Florida Region using the regional evacuation model. Results were derived from the model to summarize the evacuating population, evacuating vehicles, clearance times, and critical congested roadways. Each of these results are discussed in the following sections.

Evacuating Population

It is important to determine the evacuating population for each of the base scenarios in order to understand the magnitude of the evacuation effort, including estimated population that is evacuating and the county level shelter demand. Evacuating population for the base scenarios is summarized by county for 2017 in **Table IV-7** and for 2020 in **Table IV-8**.

Within the six county region, total evacuating population ranges from more than 734,400 persons for a base scenario level A evacuation to nearly 1.62 million persons for a base scenario level E evacuation in 2017. By 2020, this range increases within the six counties to more than 837,000 persons for a base scenario level A evacuation and over 1.83 million persons for a base scenario level E evacuation.

Evacuating Vehicles

From a transportation standpoint, the number of evacuating vehicles is more important than the evacuating population. Evacuating vehicles for the base scenarios is summarized by county for 2017 in **Table IV-9** and for 2020 in **Table IV-10**.

The total number of evacuating vehicles within the six county region for the base scenarios also varies by evacuation level. Over 398,700 vehicles evacuate from the six county RPC for a base scenario level A evacuation in 2017, and this number increases to nearly 844,000 evacuating vehicles from the six county region for a base scenario level E evacuation in 2017. By 2020, the number of evacuating vehicles is expected to increase to over 451,300 vehicles for a base scenario level A evacuation and more than 962,200 evacuating vehicles for a base scenario level E evacuation.

Shelter Demand

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

Public shelter demand in the six county region ranges from roughly 54,500 persons for the base scenario level A evacuation in 2017 to roughly 123,800 persons for the base scenario level E evacuation. By 2020, the public shelter demand is expected to increase to above 61,800 persons for the level A evacuation and nearly 139,000 persons for the level E evacuation.

Table IV-7: Evacuating Population by Base Scenario for 2017

	Evac Level A (Scenario 1)	**Evac Level B** (Scenario 2)	**Evac Level C** (Scenario 3)	**Evac Level D** (Scenario 4)	**Evac Level E** (Scenario 5)
Charlotte					
Site-built Homes	62,548	123,414	145,721	148,340	148,488
Mobile/Manuf. Homes	14,381	14,381	14,381	14,381	14,381
Tourists	2,213	5,478	7,149	7,384	7,384
TOTAL	79,142	143,273	167,251	170,105	170,253
Collier					
Site-built Homes	131,671	168,310	249,363	298,187	300,532
Mobile/Manuf. Homes	23,619	23,619	23,619	23,619	23,619
Tourists	13,916	22,825	33,654	37,224	37,225
TOTAL	169,206	214,754	306,636	359,030	361,376
Glades					
Site-built Homes	1,154	1,610	2,438	3,088	3,366
Mobile/Manuf. Homes	6,327	6,327	6,327	6,327	6,327
Tourists	0	0	49	56	120
TOTAL	7,481	7,937	8,814	9,471	9,813
Hendry					
Site-built Homes	3,831	4,029	7,191	8,243	9,250
Mobile/Manuf. Homes	15,233	13,643	15,233	15,233	15,233
Tourists	135	135	135	135	135
TOTAL	19,199	17,807	22,559	23,611	24,618
Lee					
Site-built Homes	261,204	434,136	552,927	588,722	609,132
Mobile/Manuf. Homes	51,491	51,491	51,491	51,491	51,491
Tourists	24,361	34,618	49,334	51,632	53,474
TOTAL	337,056	520,245	653,752	691,845	714,097
Sarasota					
Site-built Homes	89,744	124,823	210,650	273,980	292,565
Mobile/Manuf. Homes	24,358	24,358	24,358	24,358	24,358
Tourists	8,275	10,237	14,550	20,394	22,314
TOTAL	122,377	159,418	249,550	318,732	339,237

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

	Evac Level A (Scenario 6)	**Evac Level B** (Scenario 7)	**Evac Level C** (Scenario 8)	**Evac Level D** (Scenario 9)	**Evac Level E** (Scenario 10)
Charlotte					
Site-built Homes	65,815	185,968	153,315	156,076	156,232
Mobile/Manuf. Homes	15,160	26,099	15,160	15,160	15,160
Tourists	3,678	38,859	12,330	12,701	12,701
TOTAL	84,653	250,926	180,805	183,937	184,093
Collier					
Site-built Homes	145,487	185,968	275,519	329,464	332,053
Mobile/Manuf. Homes	26,099	26,099	26,099	26,099	26,099
Tourists	21,788	38,859	59,558	65,402	65,403
TOTAL	193,374	250,926	361,176	420,965	423,555
Glades					
Site-built Homes	1,211	1,691	2,561	3,240	3,530
Mobile/Manuf. Homes	6,698	6,698	6,698	6,698	6,698
Tourists	0	0	61	80	188
TOTAL	7,909	8,389	9,320	10,018	10,416
Hendry					
Site-built Homes	3,954	4,162	7,424	8,510	9,550
Mobile/Manuf. Homes	15,739	14,096	15,739	15,739	15,739
Tourists	169	170	170	170	170
TOTAL	19,862	18,428	23,333	24,419	25,459
Lee					
Site-built Homes	295,938	491,878	626,305	666,859	689,981
Mobile/Manuf. Homes	58,479	58,479	58,479	58,479	58,479
Tourists	41,696	59,829	85,581	88,992	91,848
TOTAL	396,113	610,186	770,365	814,330	840,308
Sarasota					
Site-built Homes	95,741	133,162	224,743	292,304	312,133
Mobile/Manuf. Homes	25,979	25,979	25,979	25,979	25,979
Tourists	14,133	17,304	24,939	34,996	38,533
TOTAL	135,853	176,445	275,661	353,279	376,645

Table IV-9: Evacuating Vehicles by Base Scenario for 2017

	Evac Level A (Scenario 1)	**Evac Level B** (Scenario 2)	**Evac Level C** (Scenario 3)	**Evac Level D** (Scenario 4)	**Evac Level E** (Scenario 5)
Charlotte					
Site-built Homes	34,020	65,889	77,168	78,573	78,652
Mobile/Manuf. Homes	9,871	9,871	9,871	9,871	9,871
Tourists	1,015	2,513	3,279	3,387	3,387
TOTAL	44,906	78,273	90,318	91,831	91,910
Collier					
Site-built Homes	73,550	94,618	135,348	160,924	162,048
Mobile/Manuf. Homes	10,613	10,613	10,613	10,613	10,613
Tourists	5,896	9,672	14,260	15,773	15,773
TOTAL	90,059	114,903	160,221	187,310	188,434
Glades					
Site-built Homes	641	958	1,412	1,764	1,920
Mobile/Manuf. Homes	3,873	3,873	3,873	3,873	3,873
Tourists	0	0	20	23	49
TOTAL	4,514	4,831	5,305	5,660	5,842
Hendry					
Site-built Homes	1,632	1,656	3,012	3,444	3,857
Mobile/Manuf. Homes	5,561	4,991	5,561	5,561	5,561
Tourists	46	46	46	46	46
TOTAL	7,239	6,693	8,619	9,051	9,464
Lee					
Site-built Homes	141,066	230,321	288,236	305,329	315,168
Mobile/Manuf. Homes	30,424	30,424	30,424	30,424	30,424
Tourists	10,151	14,424	20,556	21,513	22,281
TOTAL	181,641	275,169	339,216	357,266	367,873
Sarasota					
Site-built Homes	48,823	66,787	111,328	143,073	152,407
Mobile/Manuf. Homes	17,718	17,718	17,718	17,718	17,718
Tourists	3,813	4,718	6,705	9,398	10,283
TOTAL	70,354	89,223	135,751	170,189	180,408

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

	Evac Level A (Scenario 6)	**Evac Level B** (Scenario 7)	**Evac Level C** (Scenario 8)	**Evac Level D** (Scenario 9)	**Evac Level E** (Scenario 10)
Charlotte					
Site-built Homes	35,800	69,333	81,192	82,670	82,754
Mobile/Manuf. Homes	10,405	10,405	10,405	10,405	10,405
Tourists	1,687	4,403	5,656	5,826	5,826
TOTAL	47,892	84,141	97,253	98,901	98,985
Collier					
Site-built Homes	81,260	104,538	149,540	177,796	179,034
Mobile/Manuf. Homes	11,676	11,676	11,676	11,676	11,676
Tourists	9,232	16,466	25,236	27,713	27,713
TOTAL	102,168	132,680	186,452	217,185	218,423
Glades					
Site-built Homes	674	1,008	1,486	1,857	2,021
Mobile/Manuf. Homes	4,083	4,083	4,083	4,083	4,083
Tourists	0	0	25	33	78
TOTAL	4,757	5,091	5,594	5,973	6,182
Hendry					
Site-built Homes	1,685	1,710	3,108	3,554	3,981
Mobile/Manuf. Homes	5,741	5,151	5,741	5,741	5,741
Tourists	58	58	58	58	58
TOTAL	7,484	6,919	8,907	9,353	9,780
Lee					
Site-built Homes	159,817	260,915	326,491	345,853	356,997
Mobile/Manuf. Homes	34,427	34,427	34,427	34,427	34,427
Tourists	17,373	24,929	35,659	37,080	38,270
TOTAL	211,617	320,271	396,577	417,360	429,694
Sarasota					
Site-built Homes	52,070	71,224	118,736	152,596	162,551
Mobile/Manuf. Homes	18,884	18,884	18,884	18,884	18,884
Tourists	6,513	7,974	11,493	16,127	17,757
TOTAL	77,467	98,082	149,113	187,607	199,192

Table IV-11: Shelter Demand by Base Scenario

	Evac Level A (Scenario 1)	**Evac Level B** (Scenario 2)	**Evac Level C** (Scenario 3)	**Evac Level D** (Scenario 4)	**Evac Level E** (Scenario 5)
2017					
Charlotte County	6,408	11,270	13,041	13,357	13,366
Collier County	13,906	18,100	26,516	32,316	32,566
Glades County	1,252	1,339	1,469	1,565	1,613
Hendry County	2,666	2,464	3,176	3,336	3,489
Lee County	18,648	27,443	34,358	38,191	40,393
Sarasota County	12,617	15,416	22,994	30,305	32,375
2020					
Charlotte County	6,806	12,032	13,938	14,275	14,286
Collier County	15,620	20,554	30,211	36,697	36,972
Glades County	1,321	1,412	1,548	1,652	1,702
Hendry County	2,753	2,544	3,280	3,445	3,602
Lee County	21,691	31,918	40,117	44,491	47,018
Sarasota County	13,688	16,720	24,944	32,910	35,187

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 six counties within the RPC, for a total of eight evacuating counties.

Table IV-12: Total Evacuating Vehicles for Base Scenarios

	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5
2017	398,713	569,092	739,430	821,307	843,931
	Scenario 6	**Scenario 7**	**Scenario 8**	**Scenario 9**	**Scenario 10**
2020	451,385	647,184	843,896	936,379	962,256

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 Southwest Florida Region are identified in **Figures IV-1** through **IV-13** for each of the base scenarios for 2017 and 2020.

Through a review of the critical roadway segment figures, it is clear that I-75, US 41, SR 82, SR 29, SR 78, SR 31, and US 17 are critical facilities for all evacuation scenarios. During the level A evacuation scenarios, the roadway segments with the highest vehicle queues are primarily concentrated along the major Interstate and State Highway system. In contrast, for the level E evacuation scenarios, the roadway segments with the highest vehicle queues include other roadways within the region.

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 2017 and **Table IV-14** for 2020. In addition, evacuating vehicles entering each county by major evacuation route are identified in **Table IV-15** for 2017 and **Table IV-16** for 2020. Detailed volume figures for all evacuation routes in the Southwest Florida Region for each base scenario are included in Volume 5-9.

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

Figure IV-1

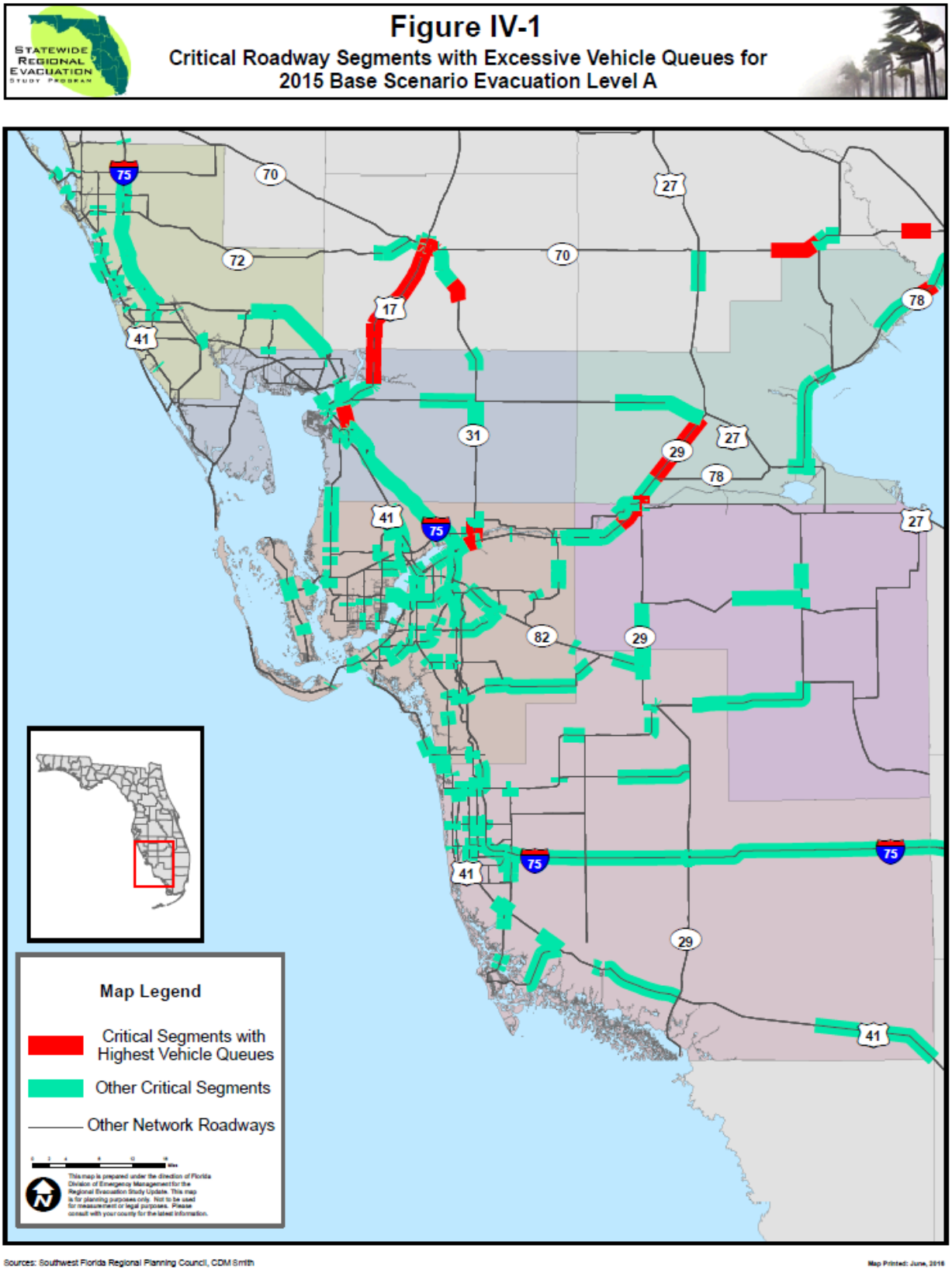


Figure IV-1
Critical Roadway Segments with Excessive Vehicle Queues for
2015 Base Scenario Evacuation Level A
Map Legend
Critical Segments with Highest Vehicle Queues
Other Critical Segments
Other Network Roadways
Sources: Southwest Florida Regional Planning Council, CDM Smith
Map Printed: June, 2016

Figure IV-2

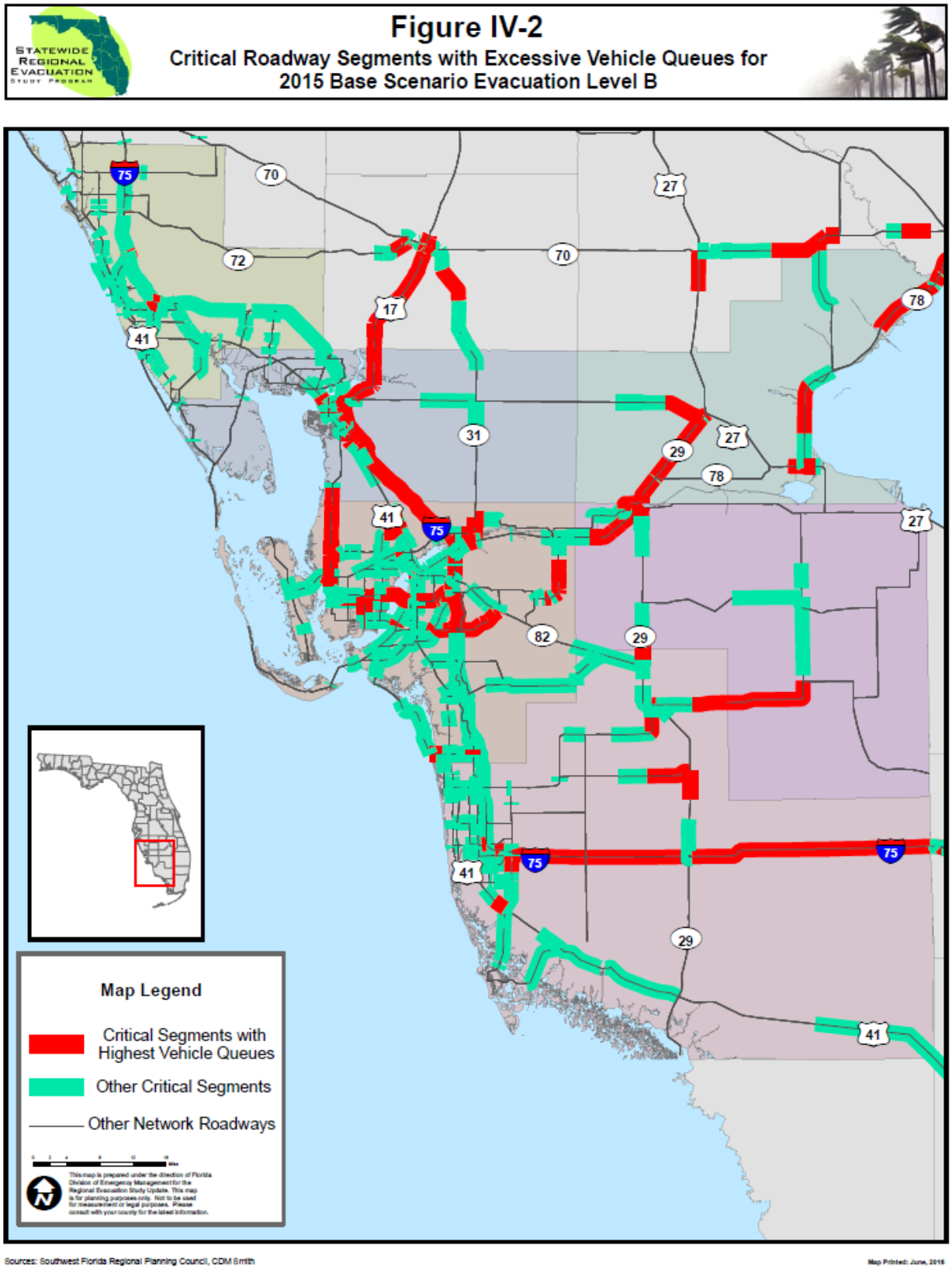


Figure IV-2
Critical Roadway Segments with Excessive Vehicle Queues for
2015 Base Scenario Evacuation Level B
Map Legend
Critical Segments with Highest Vehicle Queues
Other Critical Segments
Other Network Roadways
Sources: Southwest Florida Regional Planning Council, CDM Smith

Figure IV-3

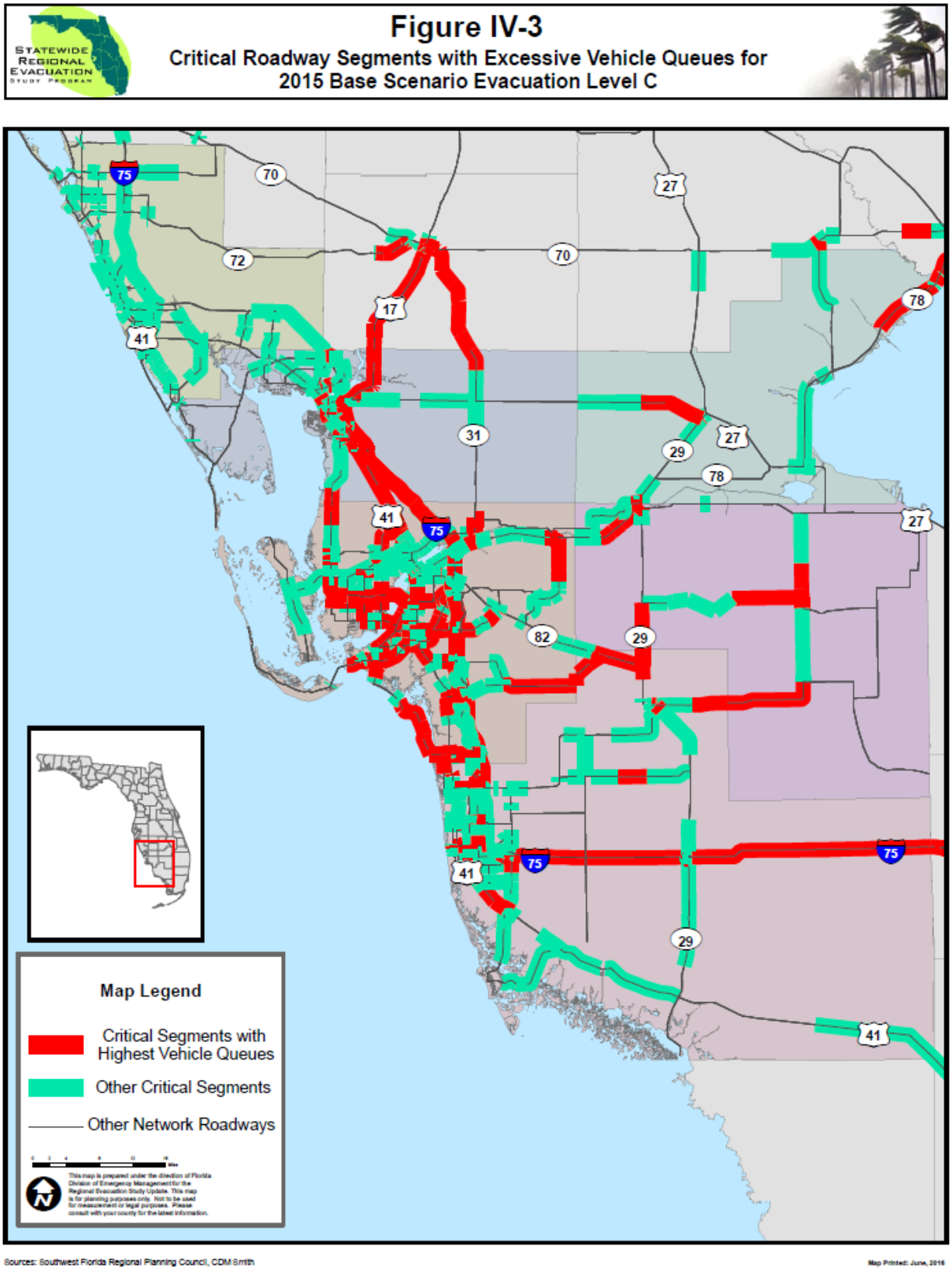


Figure IV-3
Critical Roadway Segments with Excessive Vehicle Queues for
2015 Base Scenario Evacuation Level C
Map Legend
Critical Segments with Highest Vehicle Queues
Other Critical Segments
Other Network Roadways
Sources: Southwest Florida Regional Planning Council, CDM Smith
Map Printed: June, 2016

Figure IV-4

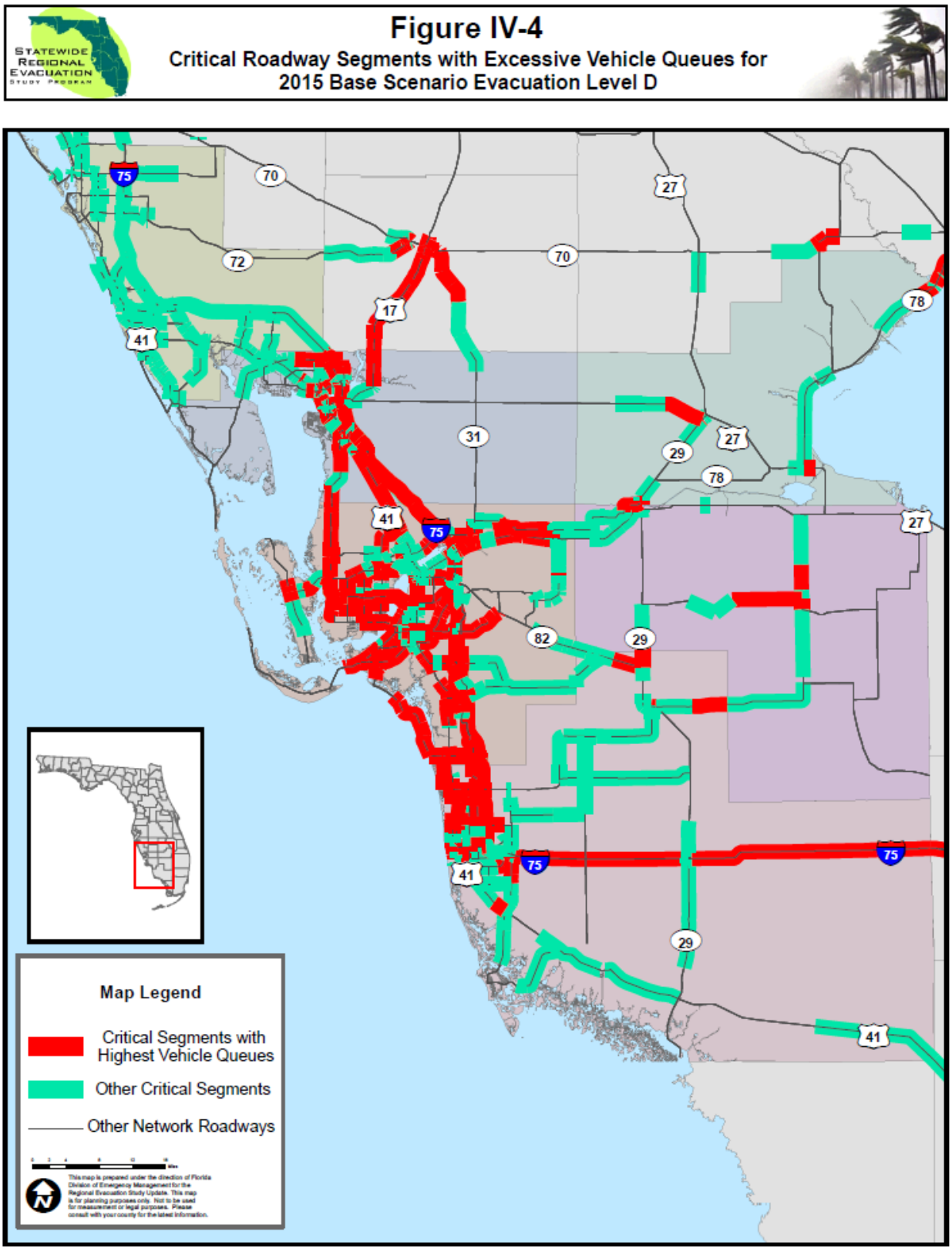


Figure IV-4
Critical Roadway Segments with Excessive Vehicle Queues for
2015 Base Scenario Evacuation Level D
Map Legend
Critical Segments with Highest Vehicle Queues
Other Critical Segments
Other Network Roadways
Sources: Southwest Florida Regional Planning Council, CDM Smith
Map Printed: June, 2016

Figure IV-5

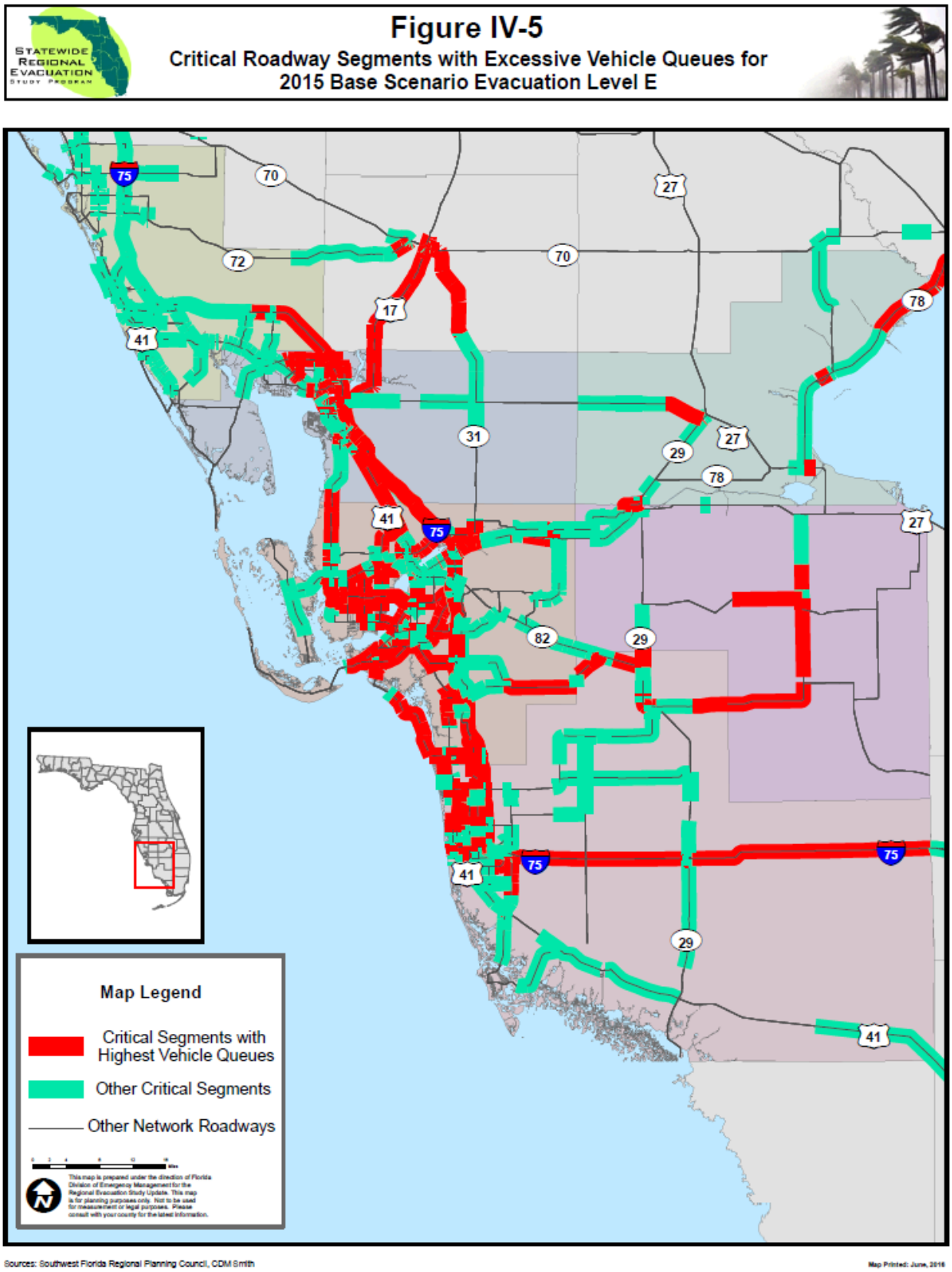


Figure IV-5
Critical Roadway Segments with Excessive Vehicle Queues for
2015 Base Scenario Evacuation Level E
Map Legend
Critical Segments with Highest Vehicle Queues
Other Critical Segments
Other Network Roadways
Sources: Southwest Florida Regional Planning Council, CDM Smith

Figure IV-6

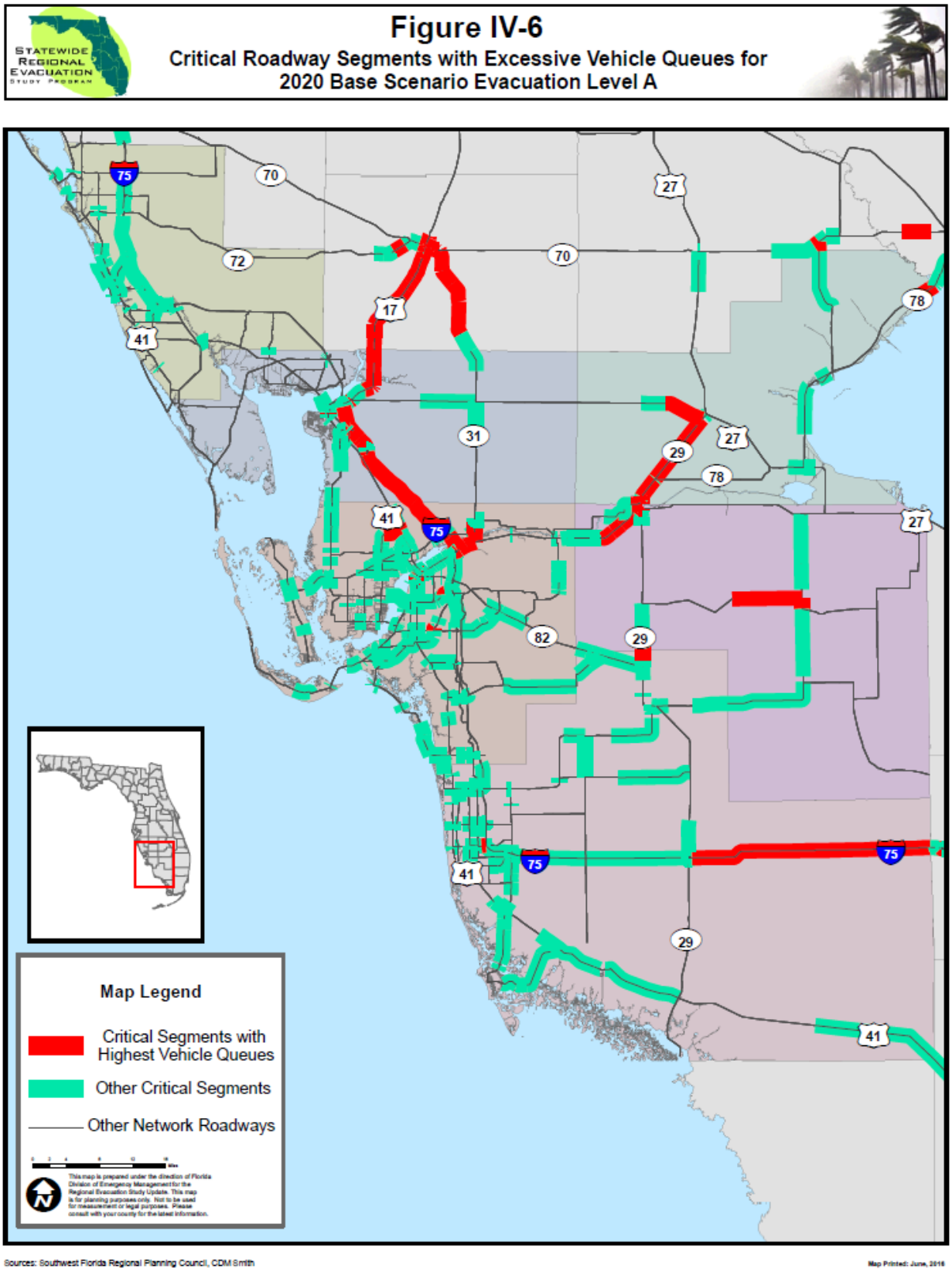


Figure IV-6
Critical Roadway Segments with Excessive Vehicle Queues for
2020 Base Scenario Evacuation Level A
STATEWIDE REGIONAL EVACUATION STUDY PROGRAM
75
70
72
41
17
31
27
29
78
82
Map Legend
Critical Segments with Highest Vehicle Queues
Other Critical Segments
Other Network Roadways
Sources: Southwest Florida Regional Planning Council, CDM Smith

Figure IV-7

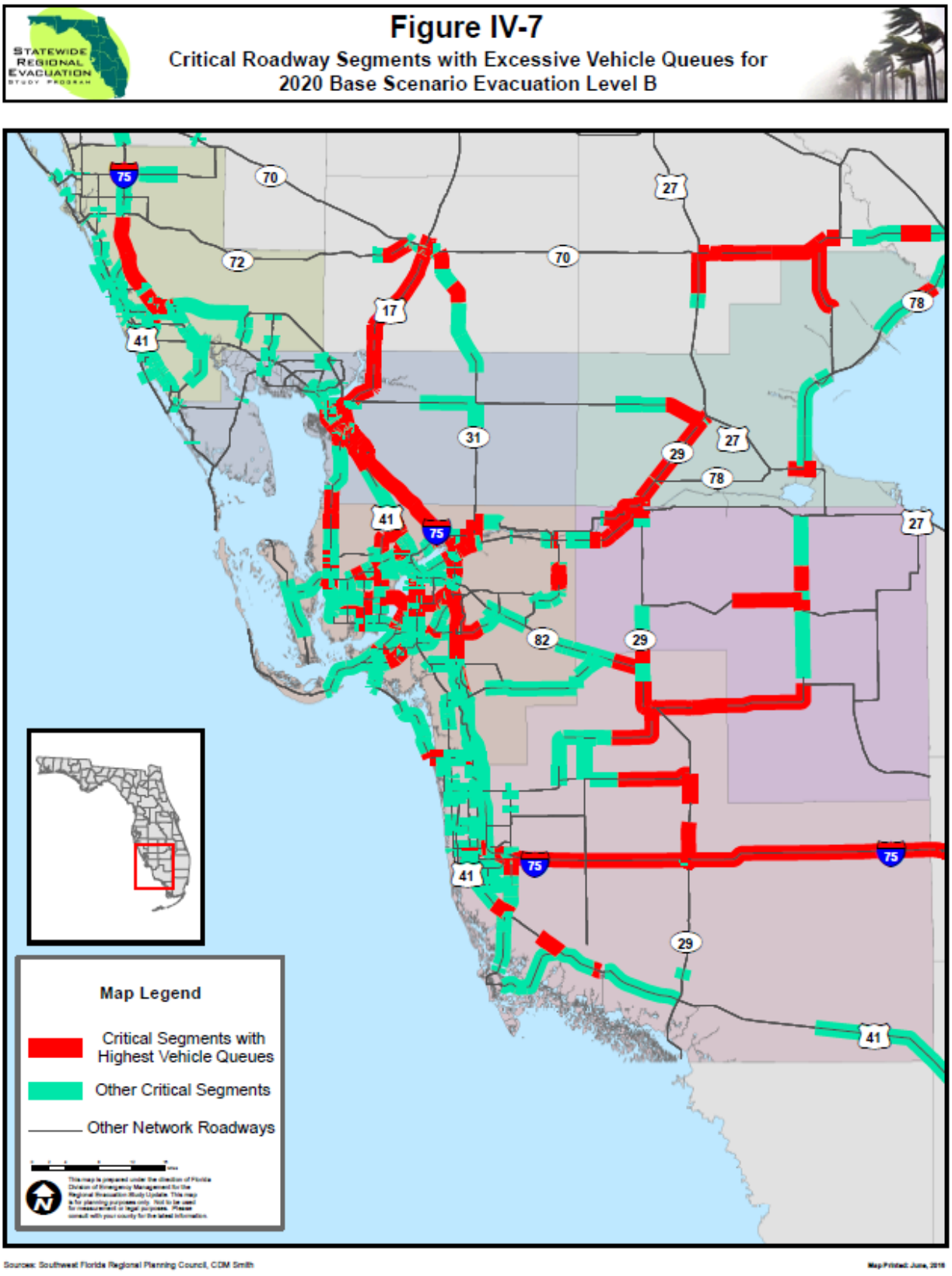


Figure IV-7
Critical Roadway Segments with Excessive Vehicle Queues for
2020 Base Scenario Evacuation Level B
Map Legend
Critical Segments with Highest Vehicle Queues
Other Critical Segments
Other Network Roadways
Sources: Southwest Florida Regional Planning Council, CDM Smith

Figure IV-8

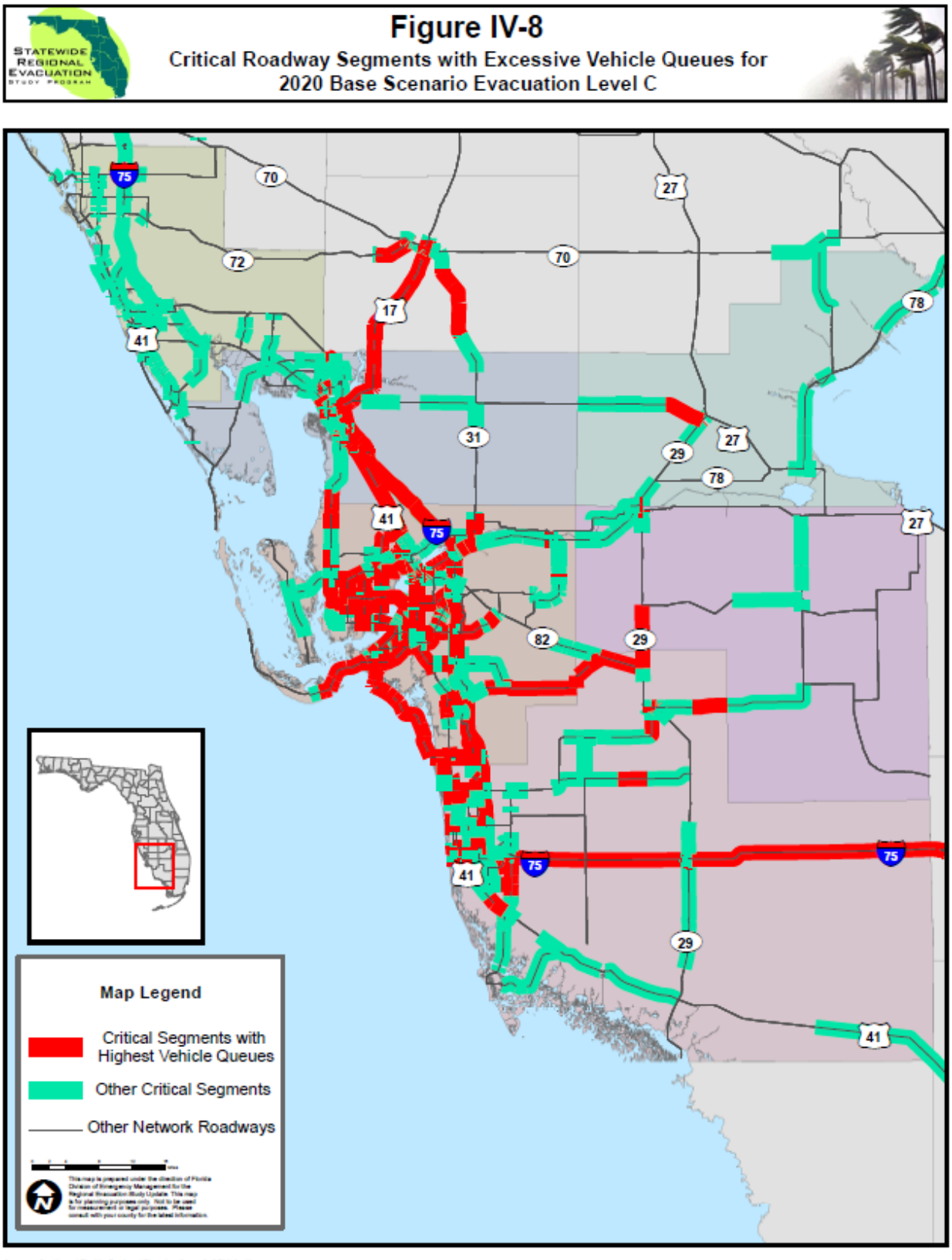


Figure IV-8
Critical Roadway Segments with Excessive Vehicle Queues for
2020 Base Scenario Evacuation Level C
Map Legend
Critical Segments with Highest Vehicle Queues
Other Critical Segments
Other Network Roadways
Sources: Southwest Florida Regional Planning Council, CDM Smith

Figure IV-9

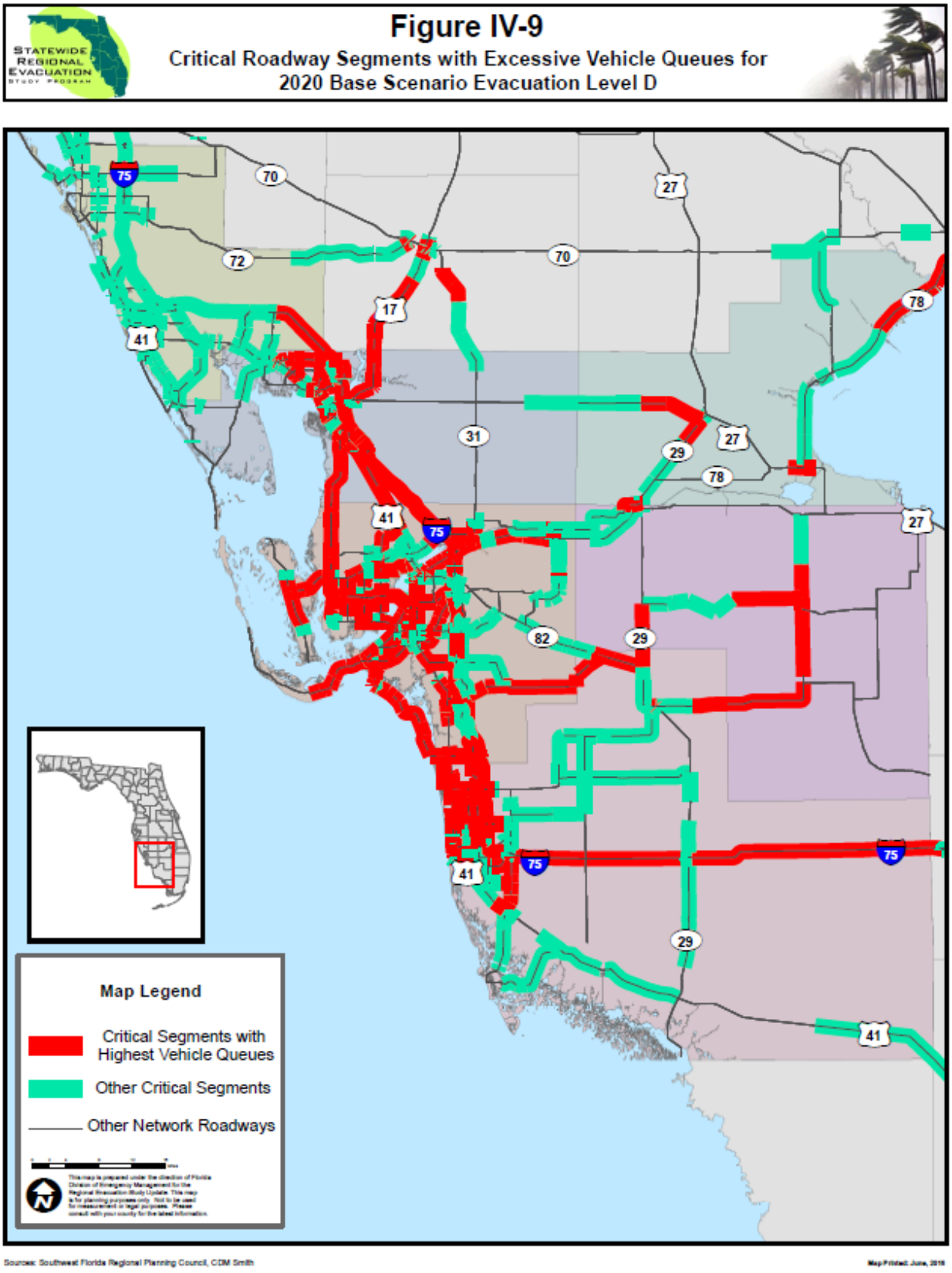


Figure IV-9
Critical Roadway Segments with Excessive Vehicle Queues for
2020 Base Scenario Evacuation Level D
Map Legend
Critical Segments with Highest Vehicle Queues
Other Critical Segments
Other Network Roadways
Sources: Southwest Florida Regional Planning Council, CDM Smith

Figure IV-10

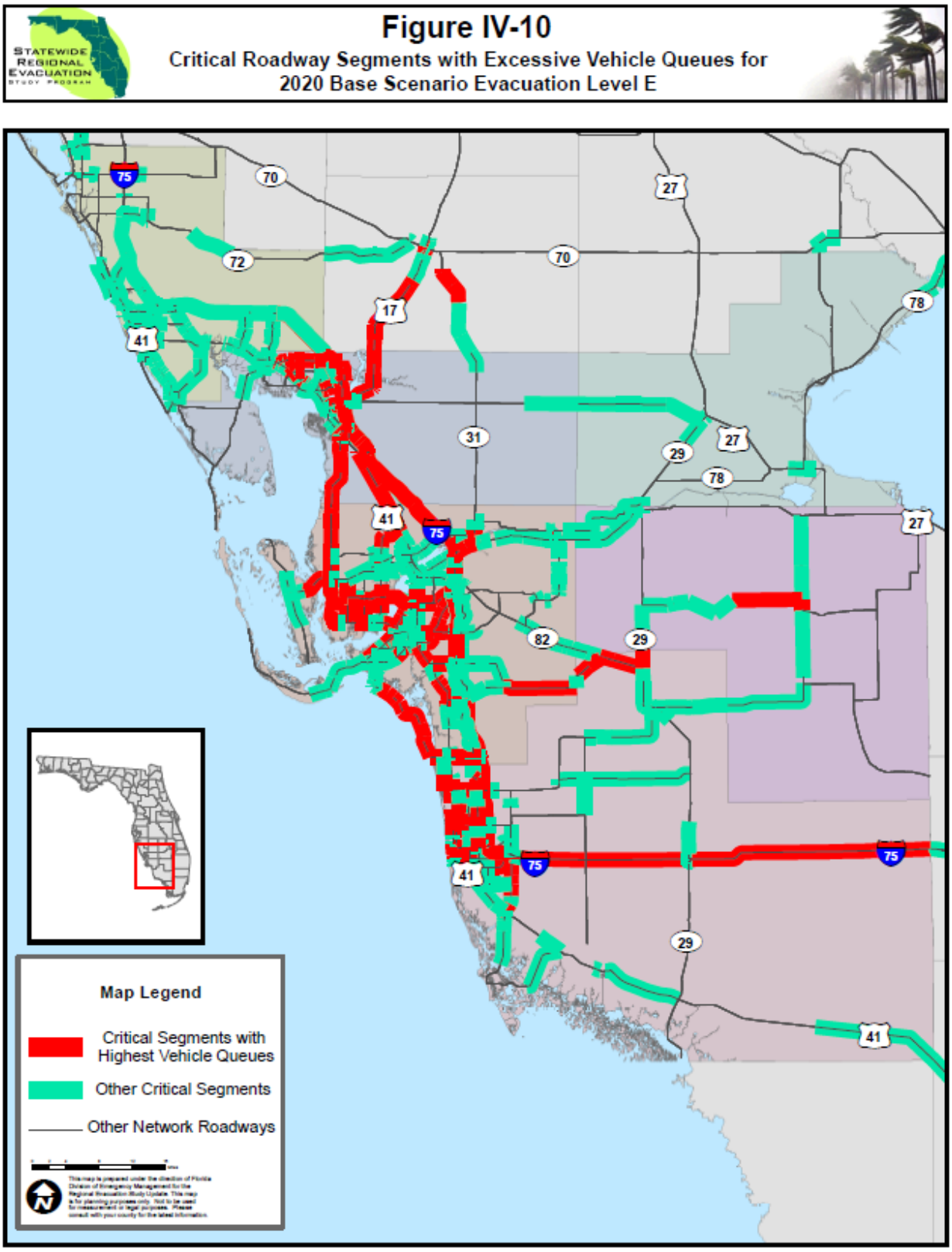


Figure IV-10
Critical Roadway Segments with Excessive Vehicle Queues for
2020 Base Scenario Evacuation Level E
Map Legend
Critical Segments with Highest Vehicle Queues
Other Critical Segments
Other Network Roadways
Sources: Southwest Florida Regional Planning Council, CDM Smith

Table IV-13: Evacuating Vehicles Leaving Each County by Evacuation Route for the 2017 Base Scenario

	Evacuation Level A Base Scenario 1	**Evacuation Level B** Base Scenario 2	**Evacuation Level C** Base Scenario 3	**Evacuation Level D** Base Scenario 4	**Evacuation Level E** Base Scenario 5
Charlotte County					
US 41 Northbound	12,600	21,200	15,700	7,000	17,000
I-75 Northbound	74,200	123,100	144,600	118,700	104,000
US 41 Southbound	-	-	100	100	200
I-75 Southbound	6,300	10,700	15,900	23,400	27,300
US 17 Northbound	17,200	25,300	29,900	32,100	45,200
SR 31 Southbound	100	400	500	1,500	1,800
SR 31 Northbound	12,600	14,900	19,000	16,400	16,600
SR 776 Northbound	6,900	10,400	8,900	8,300	8,000
Collier County					
I-75 Northbound	24,900	40,500	47,800	45,400	43,800
SR 82 Northbound	600	900	1,600	3,600	800
SR 29 Northbound	15,700	22,100	38,100	39,700	42,800
I-75 Southbound	46,400	89,000	127,100	135,600	150,700
US 41 Southbound	9,900	14,600	23,300	28,800	20,600
US 41 Northbound	300	3,000	1,900	1,700	1,800
Glades County					
SR 29 Southbound	100	300	800	1,300	1,700
US 27 Southbound	2,100	3,900	6,100	8,500	9,200
SR 78 Northbound	14,400	13,700	17,700	26,600	26,000
Hendry County					
SR 80 Westbound	900	2,100	1,700	1,400	2,100
SR 29 Northbound	23,900	32,500	41,700	44,800	37,100
US 27 Northbound	12,300	19,200	24,000	32,400	34,500
US 27 Southbound	9,100	16,800	19,900	18,900	19,200
Lee County					
US 41 Northbound	28,100	44,000	48,100	49,900	38,500
I-75 Northbound	55,800	77,100	93,000	88,100	83,600
US 41 Southbound	1,400	4,100	5,500	7,100	7,700
I-75 Southbound	24,600	38,000	57,500	66,500	78,100
SR 82 Southbound	7,500	11,100	20,200	27,100	24,000
SR 80 Eastbound	23,700	40,800	41,500	49,400	52,000
SR 31 Northbound	15,100	27,200	32,400	22,300	42,000
SR 78 Eastbound	6,900	5,400	17,700	24,900	19,100
Sarasota County					
US 41 Northbound	3,400	7,300	6,900	6,900	2,900
I-75 Northbound	91,000	145,300	158,700	167,600	165,100
SR 776 Southbound	-	200	400	400	500
US 41 Southbound	600	1,500	4,700	6,400	6,500
I-75 Southbound	3,300	5,400	10,800	16,800	21,700

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

	Evacuation Level A Base Scenario 6	**Evacuation Level B** Base Scenario 7	**Evacuation Level C** Base Scenario 8	**Evacuation Level D** Base Scenario 9	**Evacuation Level E** Base Scenario 10
Charlotte County					
US 41 Northbound	9,500	34,300	18,200	10,200	16,300
I-75 Northbound	96,400	130,700	157,400	146,500	180,300
US 41 Southbound	-	100	100	200	100
I-75 Southbound	6,000	11,300	18,600	26,200	28,900
US 17 Northbound	19,400	28,100	36,500	43,100	38,000
SR 31 Southbound	300	400	600	4,500	100
SR 31 Northbound	16,900	20,400	21,800	21,500	19,800
SR 776 Northbound	7,600	10,700	9,000	8,400	13,800
Collier County					
I-75 Northbound	27,600	45,400	53,300	51,100	62,900
SR 82 Northbound	800	1,600	1,500	1,800	1,000
SR 29 Northbound	16,400	31,100	37,900	44,200	50,900
I-75 Southbound	51,200	102,300	134,900	158,700	168,700
US 41 Southbound	12,600	17,700	38,800	25,400	22,300
US 41 Northbound	900	3,300	2,700	2,300	2,000
Glades County					
SR 29 Southbound	100	100	700	1,100	900
US 27 Southbound	1,400	3,300	6,200	8,600	7,500
SR 78 Northbound	15,500	19,300	25,300	28,600	27,900
Hendry County					
SR 80 Westbound	900	3,000	1,900	1,800	1,500
SR 29 Northbound	20,300	32,200	37,800	43,800	49,300
US 27 Northbound	16,100	27,800	33,000	31,100	34,500
US 27 Southbound	11,100	24,400	25,700	25,700	17,000
Lee County					
US 41 Northbound	32,400	55,500	57,400	57,900	62,200
I-75 Northbound	64,900	89,300	104,200	99,100	131,100
US 41 Southbound	3,200	1,600	6,100	6,800	7,700
I-75 Southbound	29,900	47,600	67,500	71,300	84,700
SR 82 Southbound	10,700	14,900	26,400	29,100	29,800
SR 80 Eastbound	22,300	38,000	43,900	68,200	61,600
SR 31 Northbound	24,600	33,600	37,200	47,900	26,900
Sarasota County					
US 41 Northbound	3,800	4,700	10,200	3,400	14,500
I-75 Northbound	100,600	166,600	182,700	199,900	220,700
SR 776 Southbound	-	300	600	500	100
US 41 Southbound	500	1,700	5,200	6,700	5,300
I-75 Southbound	3,000	5,100	11,800	18,600	17,400

Table IV-15: Evacuating Vehicles Entering Each County by Evacuation Route for the 2017 Base Scenario

	Evacuation Level A Base Scenario 1	**Evacuation Level B** Base Scenario 2	**Evacuation Level C** Base Scenario 3	**Evacuation Level D** Base Scenario 4	**Evacuation Level E** Base Scenario 5
Charlotte County					
SR 776 Southbound	-	200	400	400	500
US 41 Southbound	600	1,500	4,700	6,400	6,500
I-75 Southbound	3,300	5,400	10,800	16,800	21,700
US 41Northbound	28,100	44,000	48,100	49,900	38,500
I-75 Northbound	55,800	77,100	93,000	88,100	83,600
SR 31 Northbound	15,100	27,200	32,400	22,300	42,000
Collier County					
SR 29 Southbound	1,400	4,100	5,500	7,100	7,700
SR 82 Southbound	24,600	38,000	57,500	66,500	78,100
US 41 Southbound	7,600	11,100	20,200	27,100	24,000
Glades County					
SR 29 Northbound	23,900	32,500	41,700	44,800	37,100
US 27 Northbound	12,300	19,200	24,000	32,400	34,500
Hendry County					
SR 29 Southbound	100	300	800	1,300	1,700
SR 29 Northbound	15,700	22,100	38,100	39,700	42,800
US 27 Southbound	2,100	3,900	6,100	8,500	9,200
SR 80 Eastbound	23,700	40,800	41,500	49,400	52,000
Lee County					
US 41 Southbound	-	-	100	100	200
I-75 Southbound	6,300	10,700	15,900	23,400	27,300
I-75 Northbound	24,900	40,500	47,800	45,400	43,800
SR 80 Westbound	900	2,100	1,700	1,400	2,100
US 41 Northbound	300	3,000	1,900	1,700	1,800
SR 31 Southbound	100	400	500	1,500	1,800
SR 82 Northbound	600	900	1,600	3,600	800
Sarasota County					
US 41 Northbound	12,600	21,200	15,700	7,000	17,000
I-75 Northbound	74,200	123,100	144,600	118,700	104,000
SR 776 Northbound	6,900	10,400	8,900	8,300	8,000

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

	Evacuation Level A Base Scenario 6	**Evacuation Level B** Base Scenario 7	**Evacuation Level C** Base Scenario 8	**Evacuation Level D** Base Scenario 9	**Evacuation Level E** Base Scenario 10
Charlotte County					
SR 776 Southbound	-	300	600	500	100
US 41 Southbound	500	1,700	5,200	6,700	5,300
I-75 Southbound	3,000	5,100	11,800	18,600	17,400
US 41Northbound	32,400	55,500	57,400	57,900	62,200
I-75 Northbound	64,900	89,300	104,200	99,100	131,100
SR 31 Northbound	24,600	33,600	37,200	47,900	26,900
Collier County					
SR 29 Southbound	3,200	1,600	6,100	6,800	7,700
SR 82 Southbound	29,900	47,600	67,500	71,300	84,700
US 41 Southbound	10,700	14,900	26,400	29,100	29,800
Glades County					
SR 29 Northbound	20,300	32,200	37,800	43,800	49,300
US 27 Northbound	16,100	27,800	33,000	31,100	34,500
Hendry County					
SR 29 Southbound	100	100	700	1,100	900
SR 29 Northbound	16,400	31,100	37,900	44,200	50,900
US 27 Southbound	1,400	3,300	6,200	8,600	7,500
SR 80 Eastbound	22,300	38,000	43,900	68,200	61,600
Lee County					
US 41 Southbound	-	100	100	200	100
I-75 Southbound	6,000	11,300	18,600	26,200	28,900
I-75 Northbound	27,600	45,400	53,300	51,100	62,900
SR 80 Westbound	900	3,000	1,900	1,800	1,500
US 41 Northbound	900	3,300	2,700	2,300	2,000
SR 31 Southbound	300	400	600	4,500	100
SR 82 Northbound	800	1,600	1,500	1,800	1,000
Sarasota County					
US 41 Northbound	9,500	34,300	18,200	10,200	16,300
I-75 Northbound	96,400	130,700	157,400	146,500	180,300
SR 776 Northbound	7,600	10,700	9,000	8,400	13,800

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 2020, in-county clearance times for the base scenarios increase slightly to between 22 hours in Collier County for the evacuation level A scenario 7 and 96 hours for the evacuation level E scenario 12. Clearance Time to Shelter shows a similar pattern, with clearance times for the base scenarios ranging from 14.5 hours in Sarasota County for the evacuation level A scenario 7 to 96 hours for Lee County for evacuation level E scenario 12 in 2020.

In 2017, Out-of-county clearance times for the base scenarios range from 18.5 hours in Collier County for the base evacuation level A scenario 1 to 94.5 hours in Charlotte County for the evacuation level E scenario 5. Out-of-county clearance times remain relatively constant in 2020, with Collier County at 22 hours for evacuation level A scenario 7 and 96 hours for evacuation level E scenario 12.

Regional clearance time for the six county SWFRPC region ranges from 35.5 hours to 94.5 hours in 2017 and from 41 to 96 hours in 2020.

Table IV-17: 2017 Clearance Times for Base Scenario

	Evacuation Level A Base Scenario 1	**Evacuation Level B** Base Scenario 2	**Evacuation Level C** Base Scenario 3	**Evacuation Level D** Base Scenario 4	**Evacuation Level E** Base Scenario 5
Clearance Time to Shelter					
Charlotte County	13.5	19.0	31.0	45.5	73.5
Collier County	18.0	33.0	43.5	58.5	77.5
Glades County	16.5	17.5	17.5	15.5	17.5
Hendry County	14.5	16.5	22.5	15.5	15.5
Lee County	24.0	34.5	52.0	69.5	84.5
Sarasota County	14.0	23.0	41.5	62.5	78.5
In-County Clearance Time					
Charlotte County	35.5	44.5	63.5	76.0	94.5
Collier County	18.5	33.0	51.5	65.5	81.5
Glades County	26.0	38.5	55.5	67.5	82.5
Hendry County	24.0	35.5	53.5	67.5	82.5
Lee County	24.0	34.5	52.0	69.5	84.5
Sarasota County	33.5	38.0	56.0	68.5	89.0
Out-of-County Clearance Time					
Charlotte County	35.5	44.5	63.5	76.0	94.5
Collier County	18.5	33.0	51.5	65.5	81.5
Glades County	26.0	38.5	55.5	67.5	82.5
Hendry County	24.0	35.5	53.5	67.5	82.5
Lee County	24.0	34.5	52.0	69.5	84.5
Sarasota County	33.5	38.0	56.0	68.5	89.0
Regional Clearance Time					
Southwest	35.5	44.5	63.5	76.0	94.5

Table IV-18: 2020 Clearance Times for Base Scenario

	Evacuation Level A Base Scenario 7	**Evacuation Level B** Base Scenario 8	**Evacuation Level C** Base Scenario 9	**Evacuation Level D** Base Scenario 10	**Evacuation Level E** Base Scenario 12
Clearance Time to Shelter					
Charlotte County	18.5	20.0	52.5	75.0	87.5
Collier County	20.0	38.5	57.0	62.5	94.0
Glades County	16.0	18.5	17.5	18.0	17.5
Hendry County	15.0	15.5	15.5	15.5	15.5
Lee County	25.5	41.0	74.5	73.0	96.0
Sarasota County	14.5	23.5	58.0	90.5	89.0
In-County Clearance Time					
Charlotte County	39.5	47.0	76.5	89.5	96.0
Collier County	22.0	38.5	75.0	69.5	96.0
Glades County	27.0	43.5	77.0	75.5	96.0
Hendry County	26.0	39.5	75.5	76.0	96.0
Lee County	28.0	41.0	75.5	73.5	96.0
Sarasota County	41.0	44.5	78.0	90.5	96.0
Out-of-County Clearance Time					
Charlotte County	39.5	47.0	76.5	89.5	96.0
Collier County	22.0	40.0	75.0	69.5	96.0
Glades County	27.0	43.5	77.0	75.5	96.0
Hendry County	26.0	40.0	75.5	76.0	96.0
Lee County	28.0	41.0	75.5	73.5	96.0
Sarasota County	41.0	44.5	78.0	90.5	96.0
Regional Clearance Time					
Southwest	41.0	47.0	78.0	90.5	96.0

Figure IV-11 - Clearance Time to Shelter Base Scenarios

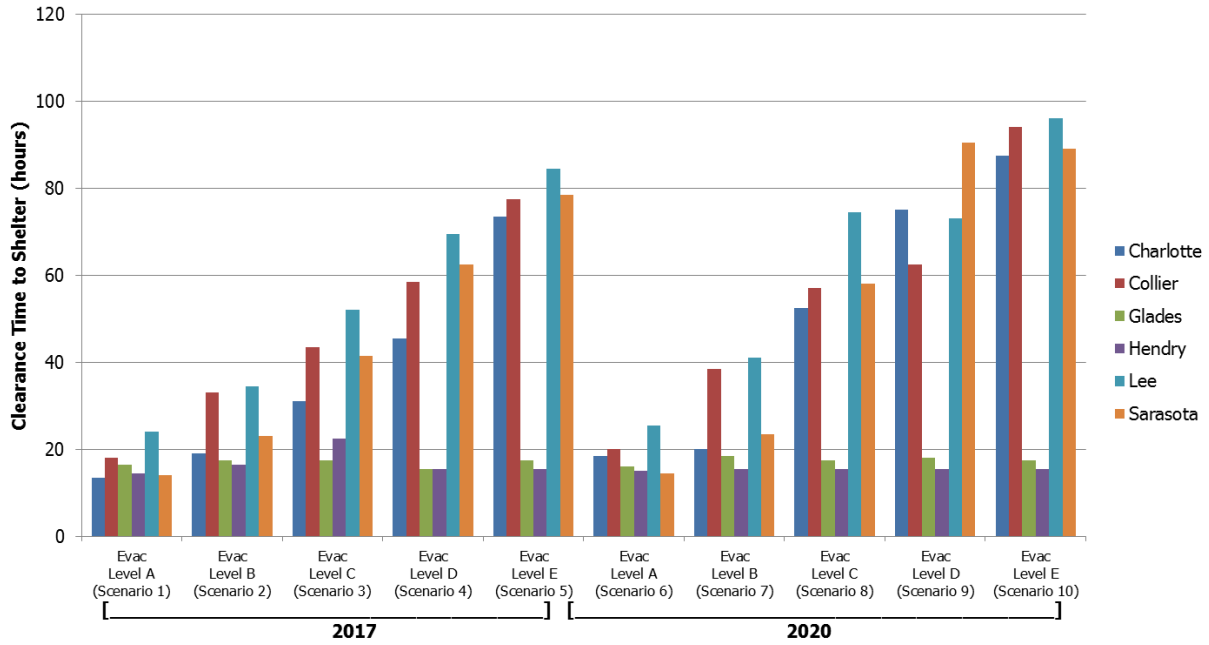
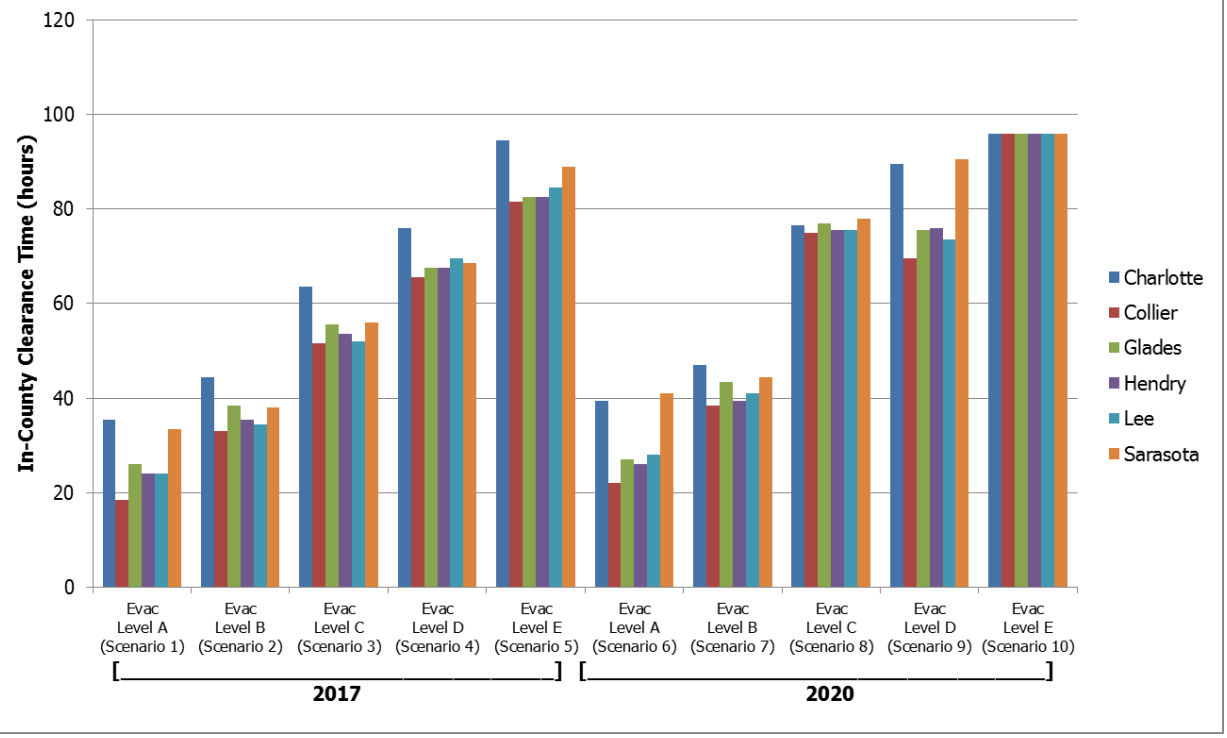


Figure IV-12 - In-County Clearance Times Base Scenarios



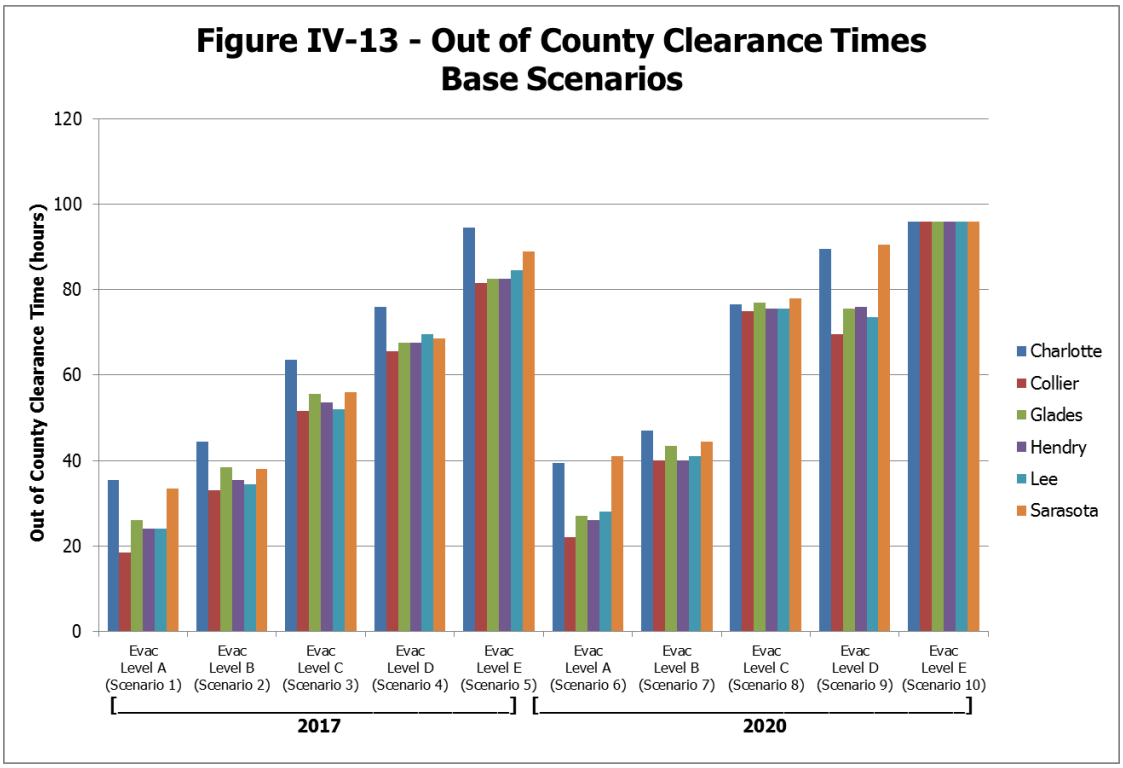


Figure IV-13 - Out of County Clearance Times
Base Scenarios
Out of County Clearance Time (hours)
120
100
80
60
40
20
0
Evac Level A (Scenario 1)
Evac Level B (Scenario 2)
Evac Level C (Scenario 3)
Evac Level D (Scenario 4)
Evac Level E (Scenario 5)
Evac Level A (Scenario 6)
Evac Level B (Scenario 7)
Evac Level C (Scenario 8)
Evac Level D (Scenario 9)
Evac Level E (Scenario 10)
2017
2020
Charlotte
Collier
Glades
Hendry
Lee
Sarasota

F. Operational Scenarios

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

The thirteen operational scenarios selected for analysis in the Southwest Florida Region are illustrated in **Table IV-19**. All ten operational scenarios used the default tourist and university population rates, along with the planning assumption behavioral response rates. The Southwest Florida region's largest issues in terms of evacuation response typically come from direct impact storms from the Gulf of Mexico. The ten operational scenarios were developed to estimate response and evacuation conditions for a variety of Gulf of Mexico storms and include the following:

- 2015 Level A – Mild Gulf direct hit to south part of SWFRPC region;
- 2015 Level B – Moderate Gulf direct hit to north part of SWFRPC region;
- 2015 Level C – Moderate Gulf direct hit to south part of SWFRPC region;
- 2015 Level D – Severe Gulf direct hit to south part of SWFRPC region;
- 2015 Level E – Severe Gulf direct hit to entire SWFRPC region;
- 2020 Level A – Mild Gulf direct hit to north part of SWFRPC region;
- 2020 Level B – Moderate Gulf direct hit to south part of SWFRPC region;
- 2020 Level C – Moderate Gulf direct hit to north part of SWFRPC region;
- 2020 Level D – Severe Gulf direct hit to north part of SWFRPC region; and,
- 2020 Level E – Severe East Coast direct hit to Palm Beach crossing storm.

All operational scenarios did not use phased evacuations, but did include a mixture of fast and slow response conditions. In addition, only primary shelters were open in all scenarios.

Table IV-19: Operational Scenarios

	Scenario 1 Level A 2017	Scenario 2 Level B 2017	Scenario 3 Level C 2017	Scenario 4 Level D 2017	Scenario 5 Level E 2017
Demographic Data	2015	2015	2015	2015	2015
Highway Network	2017	2017	2017	2017	2017
One-Way Operations	None	None	None	None	None
University Population	Fall/Spring	Fall/Spring	Fall/Spring	Fall/Spring	Fall/Spring
Tourist Rate	Default	Default	Default	Default	Default
Shelters Open	Primary	Primary	Primary	Primary	Primary
Response Curve	9-hour	12-hour	12-hour	18-hour	18-hour
Evacuation Phasing	None	None	None	None	None
Behavioral Response	Planning	Planning	Planning	Planning	Planning
Evacuation Level	A	B except as noted below	C except as noted below	D except as noted below	E except as noted below
Counties Evacuating	Collier Lee Monroe (ML) Hendry Glades Okeechobee Highlands	Sarasota Charlotte Lee DeSoto Glades (A) Hendry (A) Collier (A) Highlands (A)	Collier Lee Charlotte Sarasota (B) Monroe (ML-B) Glades (B) Hendry (B) Highlands (B) DeSoto (B)	Collier Lee Charlotte Sarasota (C) Monroe (ML-C) Glades (C) Hendry (C) Highlands (C) DeSoto (C) Okeechobee (B)	Collier Lee Charlotte Sarasota Monroe Manatee (D) Glades (D) Hendry (D) Highlands (C) DeSoto (C) Okeechobee (C) Hardee (C) Polk (C)
	Scenario 6 Level A 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	9-hour	12-hour	12-hour	18-hour	18-hour
Evacuation Phasing	None	None	None	None	None
Behavioral Response	Planning	Planning	Planning	Planning	Planning
Evacuation Level	A	B except as noted below	C except as noted below	D except as noted below	E except as noted below
Counties Evacuating	Sarasota Lee Charlotte Manatee DeSoto Highlands Glades	Collier Charlotte Lee DeSoto Glades (A) Hendry (A) Sarasota (A) Highlands (A)	Sarasota Lee Charlotte Collier (B) Manatee (B) Glades (B) Hardee (B) Highlands (B) DeSoto (B) Hendry (B)	Sarasota Lee Charlotte Collier (C) Manatee (C) Glades (C) Hendry (C) Highlands (C) DeSoto (C) Hardee (C)	Broward Palm Beach Martin Highlands (D) Glades (D) Hendry (D) Okeechobee (D) Lee (C) Sarasota (C) Charlotte (C) DeSoto (C) Hardee (C) Collier (B)

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

G. Operational Scenario Results

Each of the ten operational scenarios were modeled for the Southwest Florida Region using the regional evacuation model. Results were derived from the model to summarize the evacuating population, evacuating vehicles, clearance times, and critical congested roadways. The results are discussed in the following sections.

Evacuating Population

Similar to the base scenarios, the evacuating population was estimated for the six county region. Evacuating population for the operational scenarios is summarized by county for 2017 in **Table IV-20** and for 2020 in **Table IV-21**.

Within the six county region, total evacuating population ranges from 367,730 persons for the operational scenario level A evacuation to nearly 1.4 million persons for the operational scenario level E evacuation in 2017. By 2020, this range increases within the six counties to more than 442,000 persons for the operational scenario level A evacuation and more than 1.35 million persons for the operational scenario level D evacuation. The 2020 level E evacuation includes fewer evacuating population from the six county region since it tests the effect of a Treasure Coast evacuation on the SWFRPC.

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 2017 in **Table IV-22** and for 2020 in **Table IV-23**.

The total number of evacuating vehicles within the six county region for the operational scenarios also varies by evacuation level. A total of more than 192,500 vehicles evacuate from the six county RPC for the operational scenario level A evacuation in 2017, and this number increases to nearly 720,000 evacuating vehicles from the six county region for the operational scenario level E evacuation in 2017. By 2020, the number of evacuating vehicles is expected to increase to nearly 236,000 vehicles for the operational scenario level A evacuation and nearly 698,000 evacuating vehicles for the operational scenario level D evacuation.

Shelter Demand

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

Public shelter demand in the six county region ranges from 25,155 persons for the operational scenario level A evacuation in 2017 to just over 104,000 persons for the operational scenario level E evacuation. By 2017, the public shelter demand is expected to increase to more than 29,800 persons for the level A evacuation and more than 97,500 persons for the level D evacuation.

Table IV-20: Evacuating Population by Operational Scenario for 2017

	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
Charlotte County					
Site-built Homes	0	67,064	80,828	102,260	122,841
Mobile/Manuf. Homes	0	9,924	11,643	12,769	13,488
Tourists	0	5,478	7,149	7,384	7,384
TOTAL	0	82,466	99,620	122,413	143,713
Collier County					
Site-built Homes	85,511	85,511	169,992	219,467	241,338
Mobile/Manuf. Homes	14,129	14,129	18,619	20,467	31,647
Tourists	13,916	13,916	33,654	37,224	37,225
TOTAL	113,556	113,556	222,265	277,158	300,210
Glades County					
Site-built Homes	779	779	1,039	1,559	1,819
Mobile/Manuf. Homes	3,480	3,480	4,429	5,061	5,694
Tourists	0	0	0	49	56
TOTAL	4,259	4,259	5,468	6,669	7,569
Hendry County					
Site-built Homes	3,022	3,022	4,267	6,401	7,051
Mobile/Manuf. Homes	7,504	7,504	10,663	12,186	12,279
Tourists	135	135	135	135	135
TOTAL	10,661	10,661	15,065	18,722	19,465
Lee County					
Site-built Homes	182,756	234,561	349,597	432,472	496,835
Mobile/Manuf. Homes	32,137	36,488	41,891	46,165	48,739
Tourists	24,361	34,618	49,334	51,632	53,474
TOTAL	239,254	305,667	440,822	530,269	599,048
Sarasota County					
Site-built Homes	0	41,420	77,941	147,214	264,399
Mobile/Manuf. Homes	0	11,967	16,441	19,400	22,599
Tourists	0	4,718	10,237	14,550	22,314
TOTAL	0	58,105	104,619	181,164	309,312

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
Charlotte County					
Site-built Homes	46,308	70,562	85,042	107,594	85,042
Mobile/Manuf. Homes	9,163	10,463	12,274	13,462	12,274
Tourists	3,678	9,598	12,330	12,701	12,330
TOTAL	59,149	90,623	109,646	133,757	109,646
Collier County					
Site-built Homes	0	119,406	119,406	187,822	119,406
Mobile/Manuf. Homes	0	17,376	17,376	20,577	17,376
Tourists	0	38,359	38,859	59,558	38,859
TOTAL	0	175,641	175,641	267,957	175,641
Glades County					
Site-built Homes	818	818	1,091	1,636	1,909
Mobile/Manuf. Homes	3,684	3,684	4,688	5,358	6,028
Tourists	0	0	0	61	80
TOTAL	4,502	4,502	5,779	7,055	8,017
Hendry County					
Site-built Homes	0	3,122	4,162	6,611	7,713
Mobile/Manuf. Homes	0	7,753	9,867	12,592	14,165
Tourists	0	169	170	170	170
TOTAL	0	11,044	14,199	19,373	22,048
Lee County					
Site-built Homes	207,042	265,732	395,997	489,878	395,997
Mobile/Manuf. Homes	36,493	41,438	47,573	52,431	47,573
Tourists	41,696	59,829	85,581	88,992	85,581
TOTAL	285,231	366,999	529,151	631,301	529,151
Sarasota County					
Site-built Homes	63,586	63,586	157,062	234,090	157,062
Mobile/Manuf. Homes	15,438	15,438	20,691	22,804	20,691
Tourists	14,133	14,133	24,939	34,996	24,939
TOTAL	93,157	93,157	202,692	291,890	202,692

Table IV-22: Evacuating Vehicles by Operational Scenario for 2017

	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
Charlotte County					
Site-built Homes	0	35,752	42,904	54,296	65,140
Mobile/Manuf. Homes	0	6,835	7,991	8,769	9,262
Tourists	0	2,513	3,279	3,387	3,387
TOTAL	0	45,100	54,174	66,452	77,789
Collier County					
Site-built Homes	47,205	47,205	92,213	118,323	130,567
Mobile/Manuf. Homes	6,542	6,542	8,516	9,311	9,842
Tourists	5,896	5,896	14,260	15,773	15,773
TOTAL	59,643	59,643	114,989	143,407	156,182
Glades County					
Site-built Homes	449	449	599	899	1,049
Mobile/Manuf. Homes	2,130	2,130	2,711	3,098	3,486
Tourists	0	0	0	20	23
TOTAL	2,579	2,579	3,310	4,017	4,558
Hendry County					
Site-built Homes	1,242	1,242	1,765	5,647	2,898
Mobile/Manuf. Homes	2,745	2,745	3,892	4,449	4,492
Tourists	46	46	46	46	46
TOTAL	4,033	4,033	5,703	7,142	7,436
Lee County					
Site-built Homes	97,022	123,914	182,147	224,829	258,415
Mobile/Manuf. Homes	19,088	21,621	24,797	27,289	28,810
Tourists	10,151	14,424	20,556	21,513	22,281
TOTAL	126,261	159,959	227,500	273,631	309,506
Sarasota County					
Site-built Homes	0	41,420	41,420	77,502	137,928
Mobile/Manuf. Homes	0	11,967	11,967	14,103	16,443
Tourists	0	4,718	4,718	6,705	10,283
TOTAL	0	58,105	58,105	98,310	164,654

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
Charlotte County					
Site-built Homes	24,725	37,620	45,142	57,129	45,142
Mobile/Manuf. Homes	6,327	7,204	8,423	9,243	8,423
Tourists	1,687	4,403	5,656	5,826	5,656
TOTAL	32,739	49,227	59,221	72,198	59,221
Collier County					
Site-built Homes	0	66,317	66,317	101,881	66,317
Mobile/Manuf. Homes	0	8,008	8,008	9,371	8,008
Tourists	0	16,466	16,466	25,236	16,466
TOTAL	0	90,791	90,791	136,488	90,791
Glades County					
Site-built Homes	473	473	631	946	1,103
Mobile/Manuf. Homes	2,246	2,246	2,858	3,267	3,675
Tourists	0	0	0	25	33
TOTAL	2,719	2,719	3,489	4,238	4,811
Hendry County					
Site-built Homes	0	1,282	1,710	2,733	3,189
Mobile/Manuf. Homes	0	2,833	3,606	4,593	5,167
Tourists	0	58	58	58	58
TOTAL	0	4,173	5,374	7,384	8,414
Lee County					
Site-built Homes	109,910	140,371	206,324	254,671	206,324
Mobile/Manuf. Homes	21,601	24,466	28,060	30,879	28,060
Tourists	17,373	24,929	35,659	37,080	35,659
TOTAL	148,884	189,766	270,043	322,630	270,043
Sarasota County					
Site-built Homes	33,842	33,842	82,661	12,309	82,661
Mobile/Manuf. Homes	11,230	11,230	15,030	16,580	15,030
Tourists	6,513	6,513	11,493	16,127	11,493
TOTAL	51,585	5,185	109,184	155,016	109,184

Table IV-24: Shelter Demand by Operational Scenario

	Evacuation Level A	Evacuation Level B	Evacuation Level C	Evacuation Level D	Evacuation Level E
2017					
Charlotte County	0	6,399	7,718	9,555	11,235
Collier County	10,029	9,363	18,779	24,054	26,346
Glades County	716	716	919	1,112	1,260
Hendry County	1,480	1,480	2,098	2,631	2,738
Lee County	12,930	16,330	23,730	29,461	33,219
Sarasota County	0	10,417	10,417	17,261	29,276
2020					
Charlotte County	4,619	6,908	8,336	10,277	8,336
Collier County	0	13,751	13,751	21,665	13,751
Glades County	753	753	9,689	1,173	1,330
Hendry County	0	1,528	1,972	2,716	3,097
Lee County	15,214	19,331	28,079	34,604	28,079
Sarasota County	9,293	9,293	18,827	27,112	18,827

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. The number of counties varies by scenario, with the 2017 Level E scenario including 13 counties stretching from Monroe County to Manatee County.

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
2017	192,516	329,419	463,781	592,959	720,125
2020	235,927	341,861	538,102	697,954	542,464

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 Southwest Florida region are identified in **Figures IV-14** through **IV-23** for each of the operational scenarios for 2017 and 2020.

I-75, US 41, SR 82, SR 29, SR 78, SR 31, and US 17 are critical facilities for the operational scenarios as well. Critical segments do vary by scenario, however, as the location of the evacuation event determines which portions of the region experience congestion and queuing. For example, for the level E operational scenario for 2017 where the Treasure Coast region is evacuating, I-95 and US 441 along Florida's east coast experience higher queuing than elsewhere within the Southwest region.

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 2017 and **Table IV-27** for 2020. In addition, evacuating vehicles entering each county by major evacuation route are identified in **Table IV-28** for 2017 and **Table IV-29** for 2020. Detailed volume figures for all evacuation routes in the Southwest Florida Region for each operational scenario are included in Volume 5-9.

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

Figure IV-14

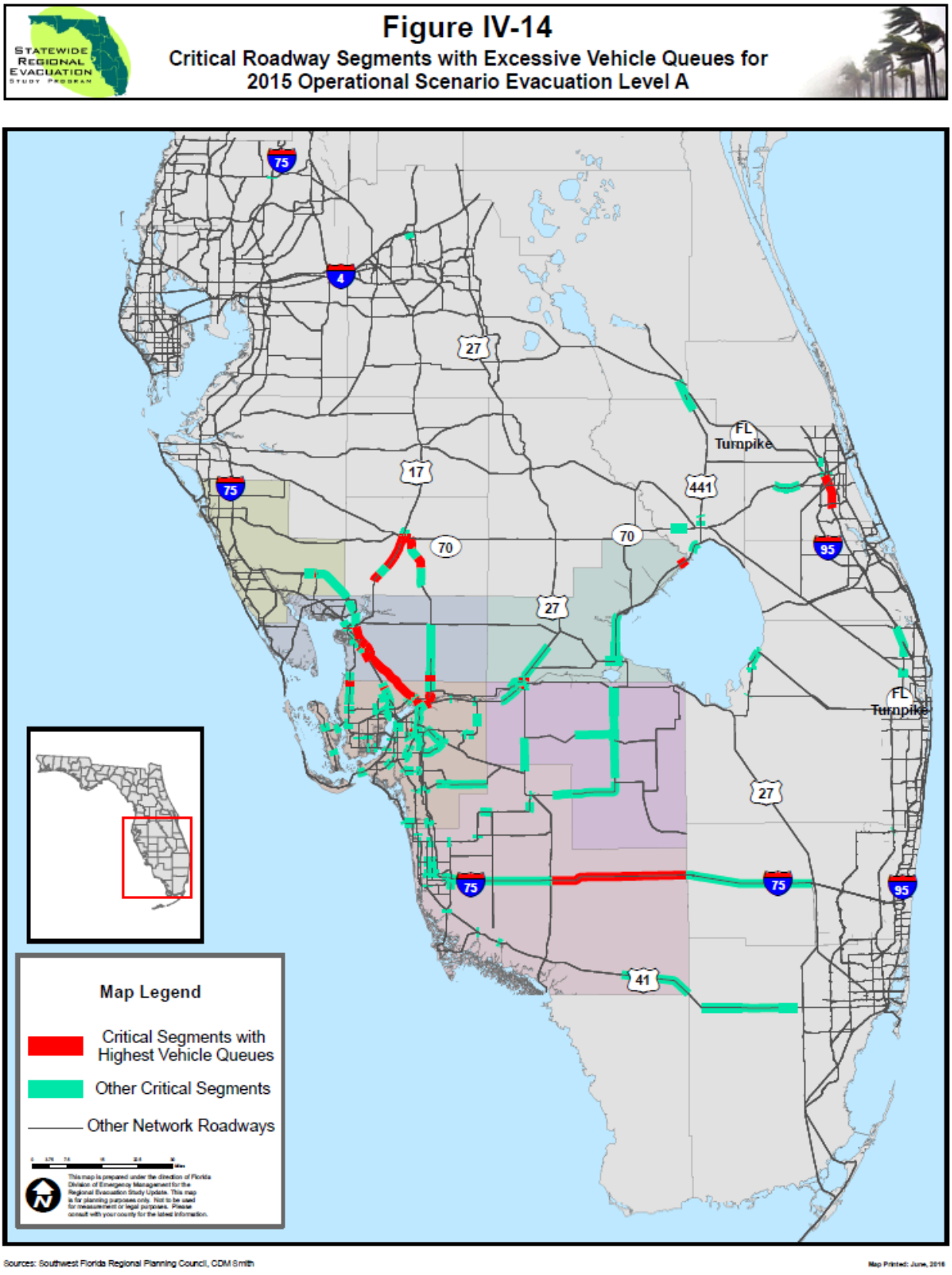


Figure IV-14
Critical Roadway Segments with Excessive Vehicle Queues for
2015 Operational Scenario Evacuation Level A
75
4
27
17
70
441
95
FL Turnpike
41
Map Legend
Critical Segments with Highest Vehicle Queues
Other Critical Segments
Other Network Roadways
Sources: Southwest Florida Regional Planning Council, CDM Smith

Figure IV-15

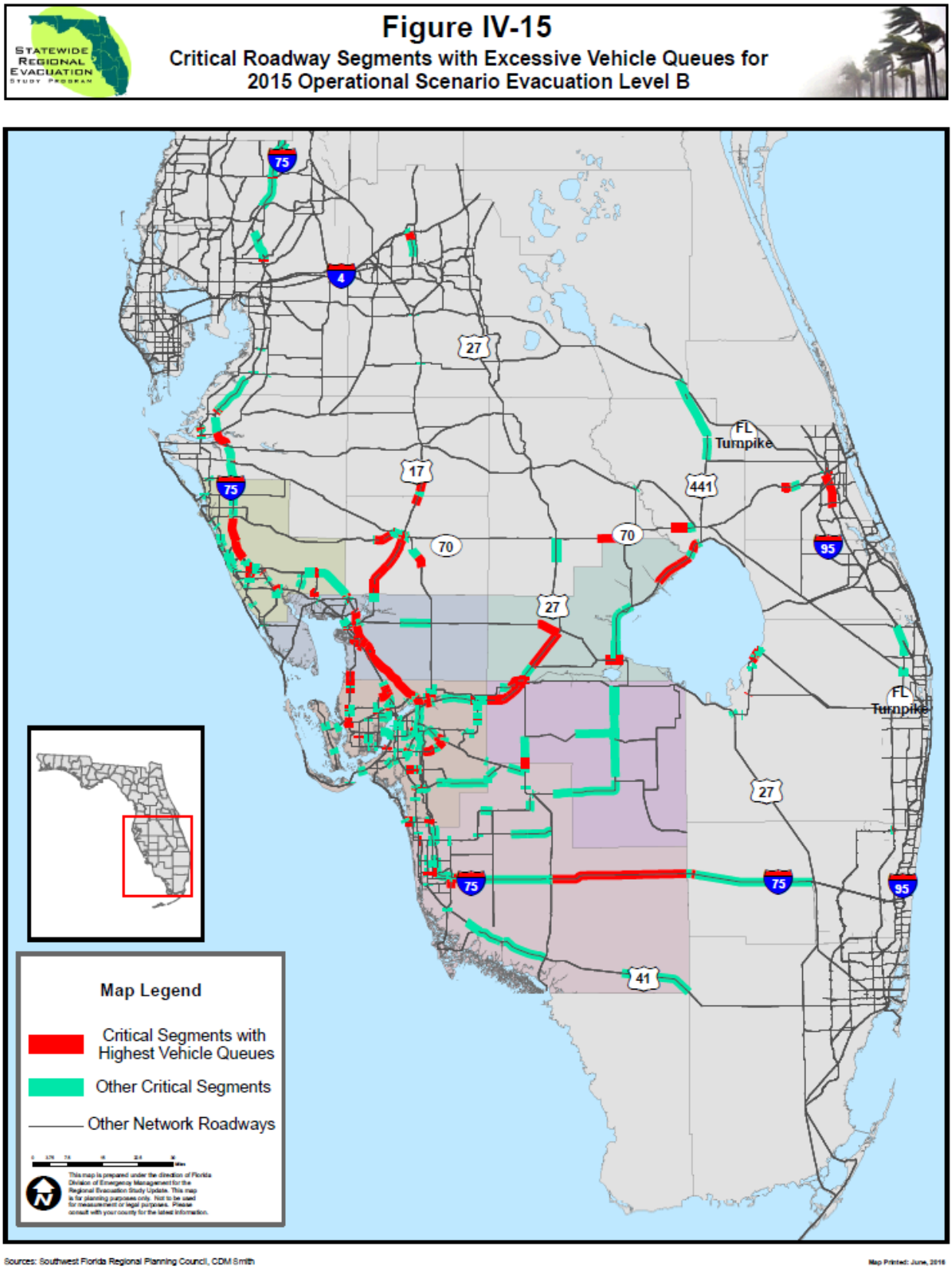


Figure IV-15
Critical Roadway Segments with Excessive Vehicle Queues for
2015 Operational Scenario Evacuation Level B
STATEWIDE REGIONAL EVACUATION STUDY PROGRAM
75
4
27
17
70
441
FL Turnpike
95
41
Map Legend
Critical Segments with Highest Vehicle Queues
Other Critical Segments
Other Network Roadways
Sources: Southwest Florida Regional Planning Council, CDM Smith

Figure IV-16

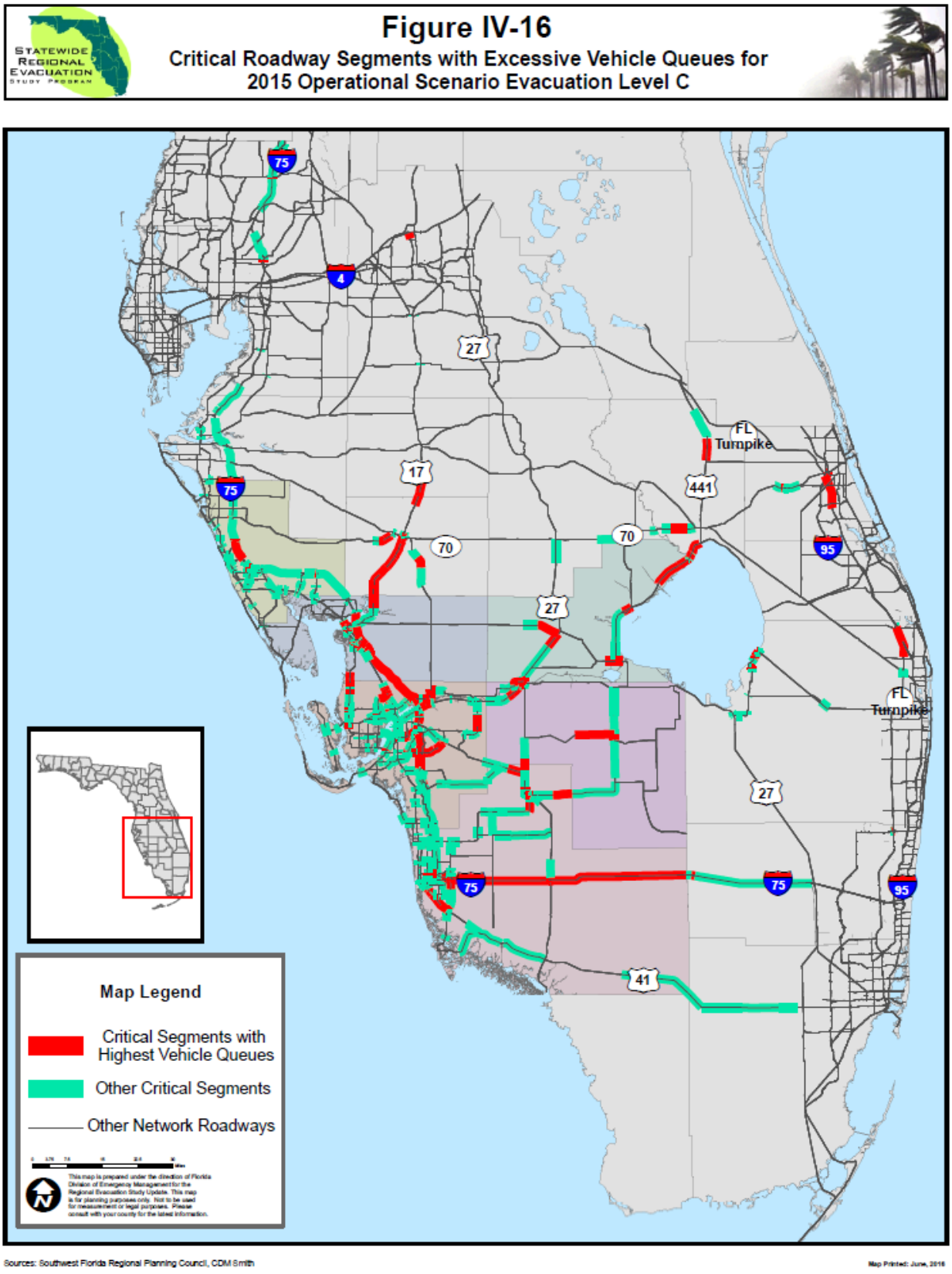


Figure IV-16
Critical Roadway Segments with Excessive Vehicle Queues for
2015 Operational Scenario Evacuation Level C
STATEWIDE REGIONAL EVACUATION STUDY PROGRAM
75
4
27
17
70
441
FL Turnpike
95
41
Map Legend
Critical Segments with Highest Vehicle Queues
Other Critical Segments
Other Network Roadways
Sources: Southwest Florida Regional Planning Council, CDM Smith
Map Printed: June, 2016

Figure IV-17

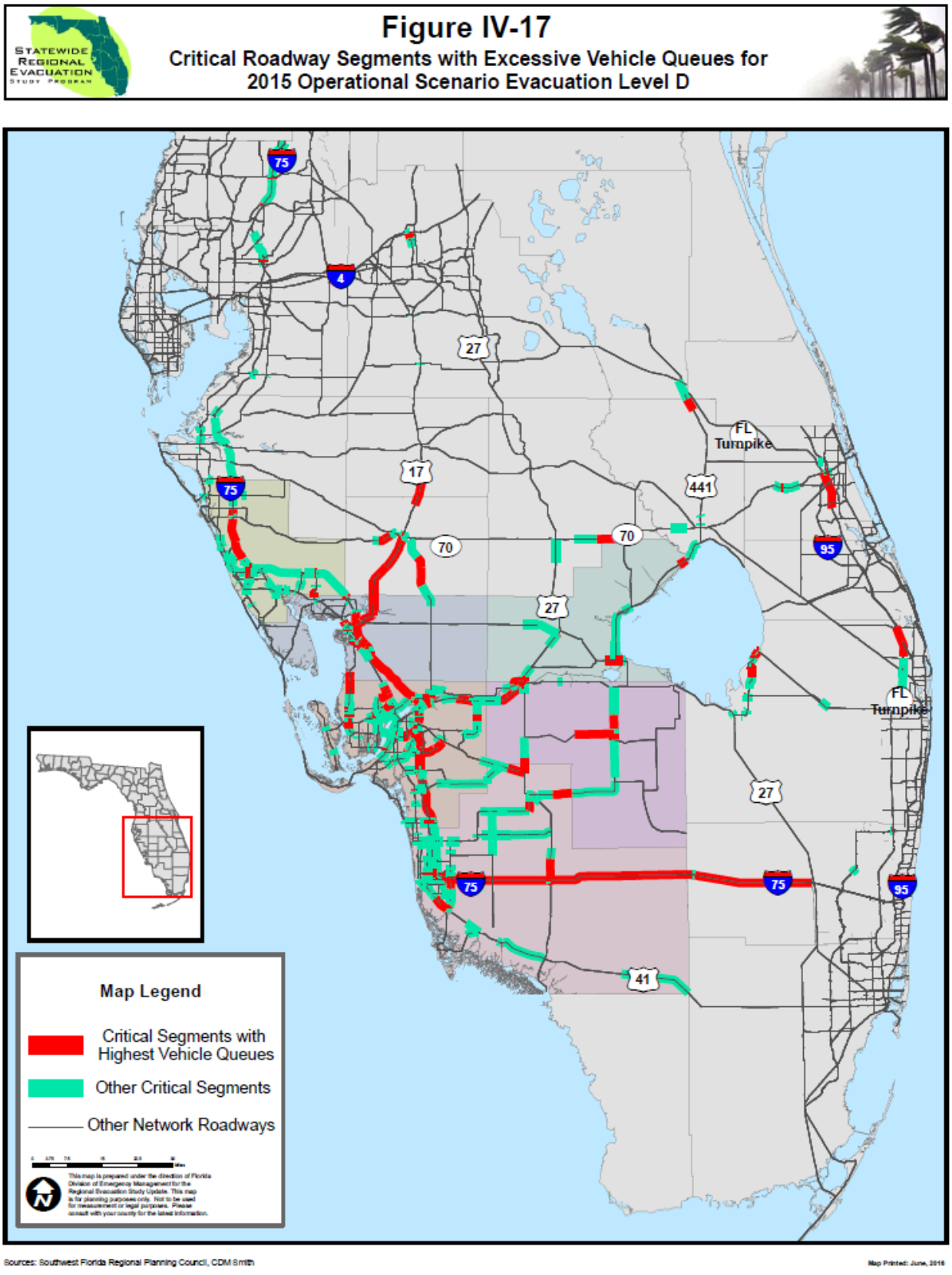


Figure IV-17
Critical Roadway Segments with Excessive Vehicle Queues for
2015 Operational Scenario Evacuation Level D
75
4
27
17
70
441
FL Turnpike
95
41
Map Legend
Critical Segments with Highest Vehicle Queues
Other Critical Segments
Other Network Roadways
Sources: Southwest Florida Regional Planning Council, CDM Smith

Figure IV-18

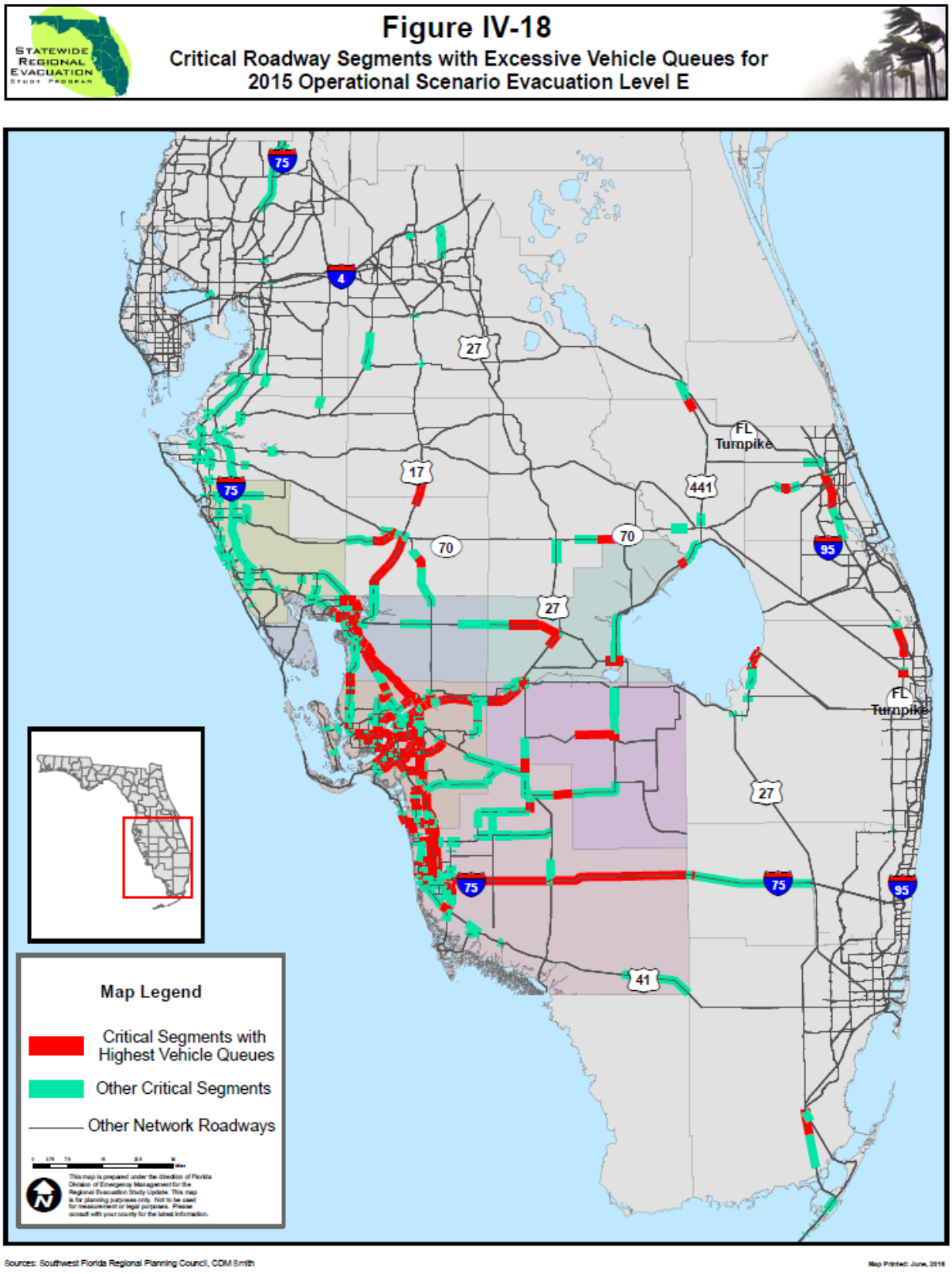


Figure IV-18
Critical Roadway Segments with Excessive Vehicle Queues for
2015 Operational Scenario Evacuation Level E
STATEWIDE REGIONAL EVACUATION STUDY PROGRAM
75
4
27
17
441
70
95
FL Turnpike
41
Map Legend
Critical Segments with Highest Vehicle Queues
Other Critical Segments
Other Network Roadways
Sources: Southwest Florida Regional Planning Council, CDM Smith

Figure IV-19

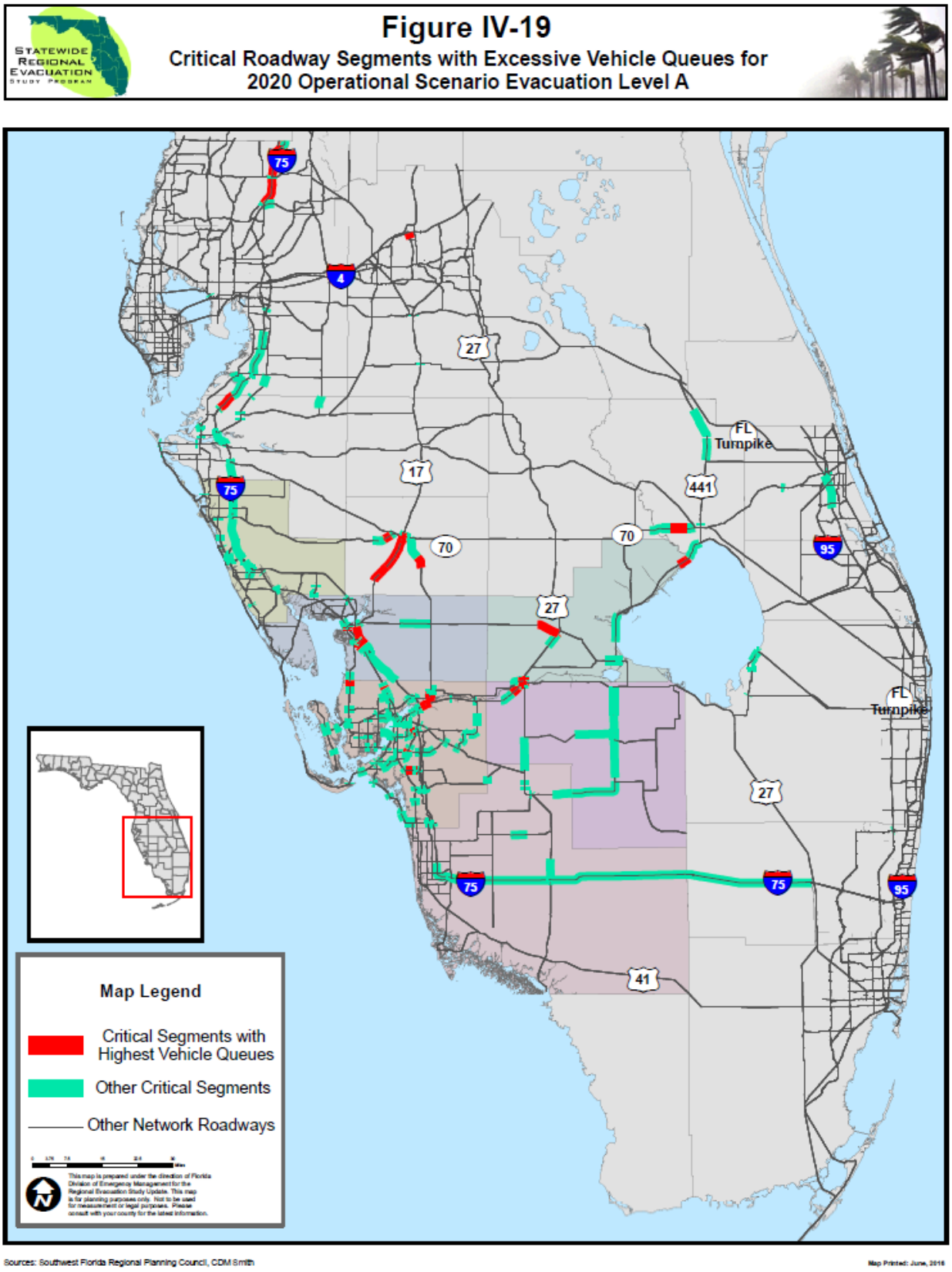


Figure IV-19
Critical Roadway Segments with Excessive Vehicle Queues for
2020 Operational Scenario Evacuation Level A
75
4
27
17
70
441
FL Turnpike
95
41
Map Legend
Critical Segments with Highest Vehicle Queues
Other Critical Segments
Other Network Roadways
Sources: Southwest Florida Regional Planning Council, CDM Smith

Figure IV-20

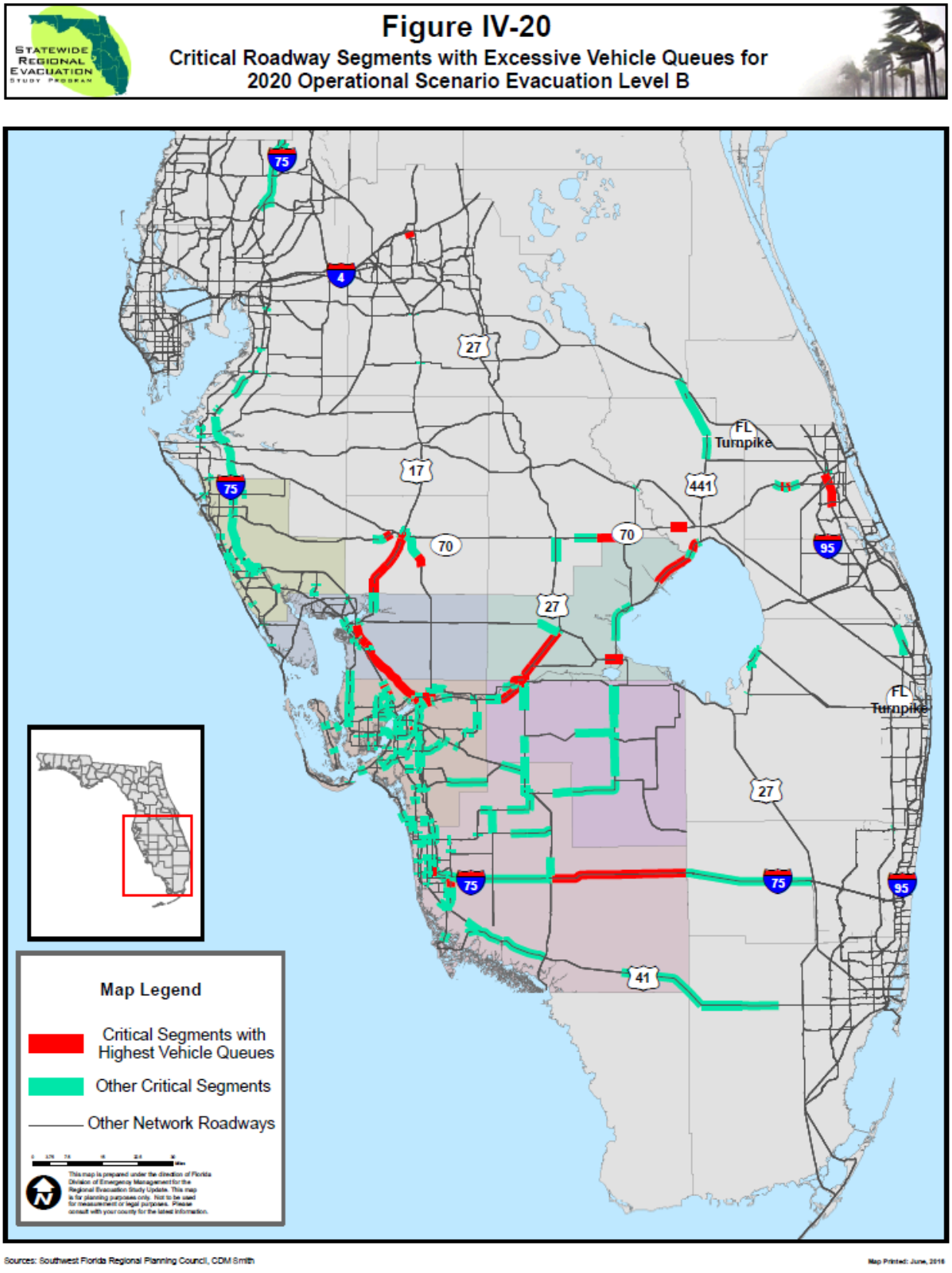


Figure IV-20
Critical Roadway Segments with Excessive Vehicle Queues for
2020 Operational Scenario Evacuation Level B
75
4
27
17
70
441
FL Turnpike
95
41
Map Legend
Critical Segments with Highest Vehicle Queues
Other Critical Segments
Other Network Roadways
Sources: Southwest Florida Regional Planning Council, CDM Smith

Figure IV-21

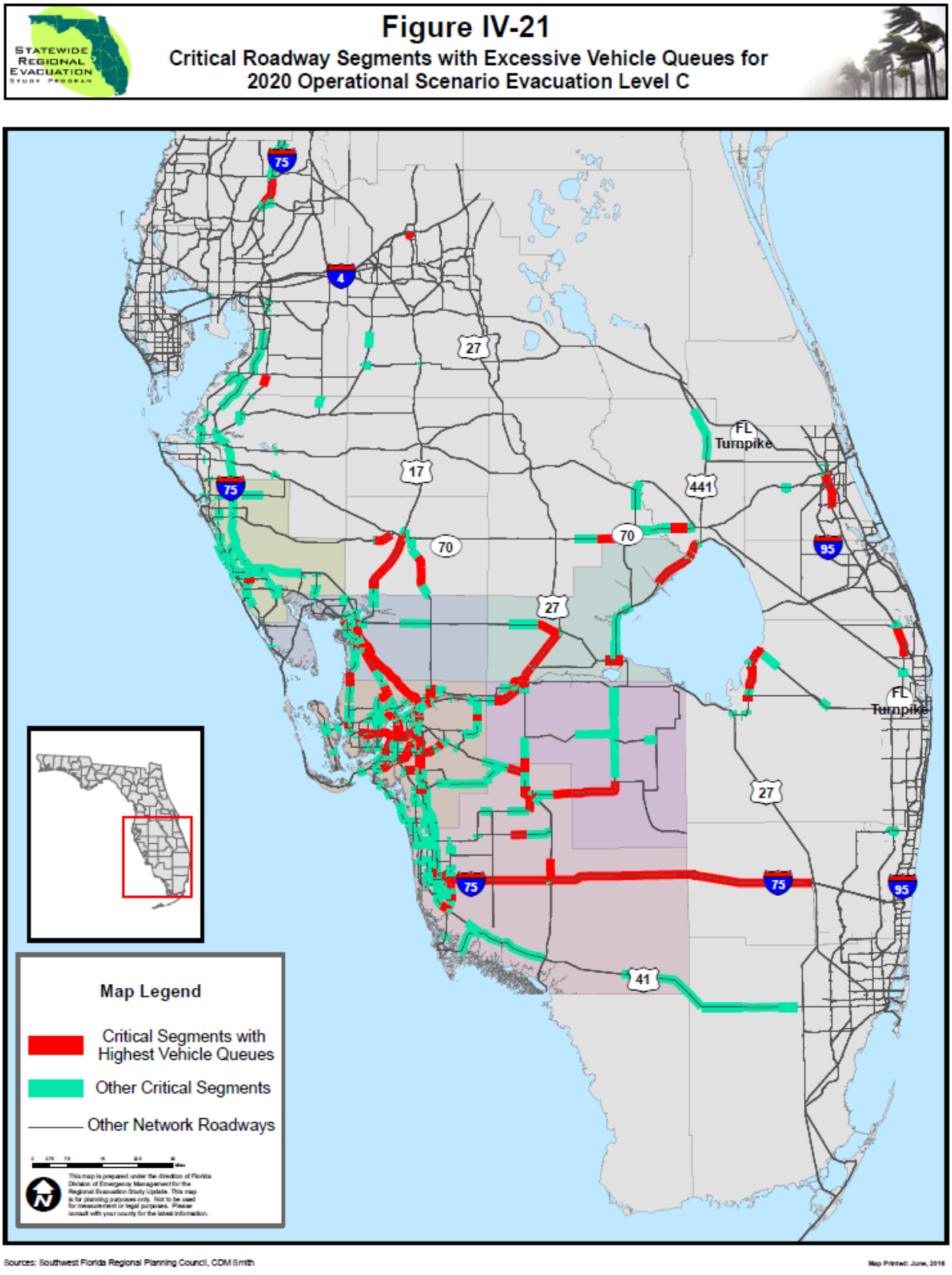


Figure IV-21
Critical Roadway Segments with Excessive Vehicle Queues for
2020 Operational Scenario Evacuation Level C
75
4
27
17
70
441
FL Turnpike
95
41
Map Legend
Critical Segments with Highest Vehicle Queues
Other Critical Segments
Other Network Roadways
Sources: Southwest Florida Regional Planning Council, CDM Smith

Figure IV-22

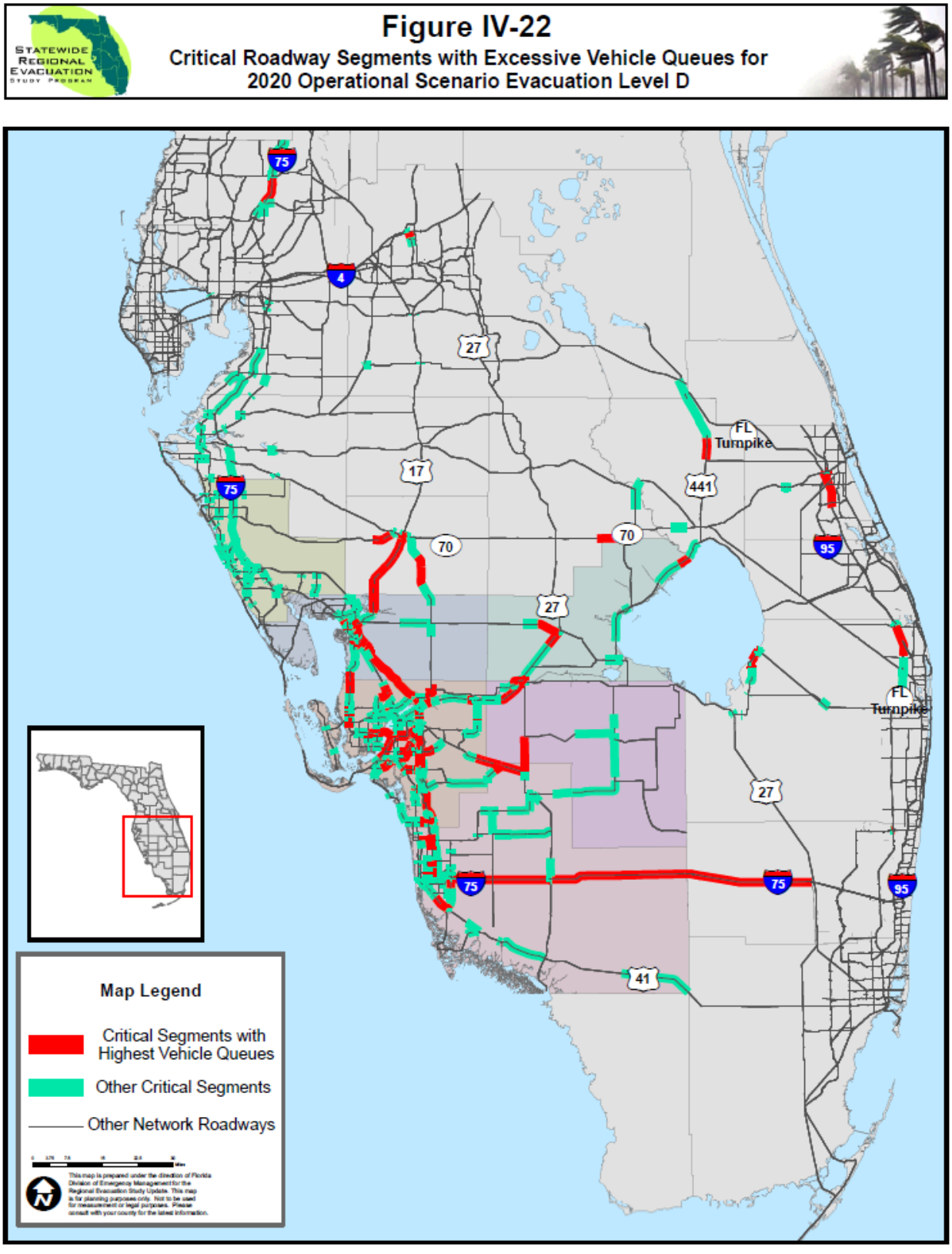


Figure IV-22
Critical Roadway Segments with Excessive Vehicle Queues for
2020 Operational Scenario Evacuation Level D
75
4
27
17
70
441
FL Turnpike
95
41
Map Legend
Critical Segments with Highest Vehicle Queues
Other Critical Segments
Other Network Roadways
Sources: Southwest Florida Regional Planning Council, CDM Smith

Figure IV-23

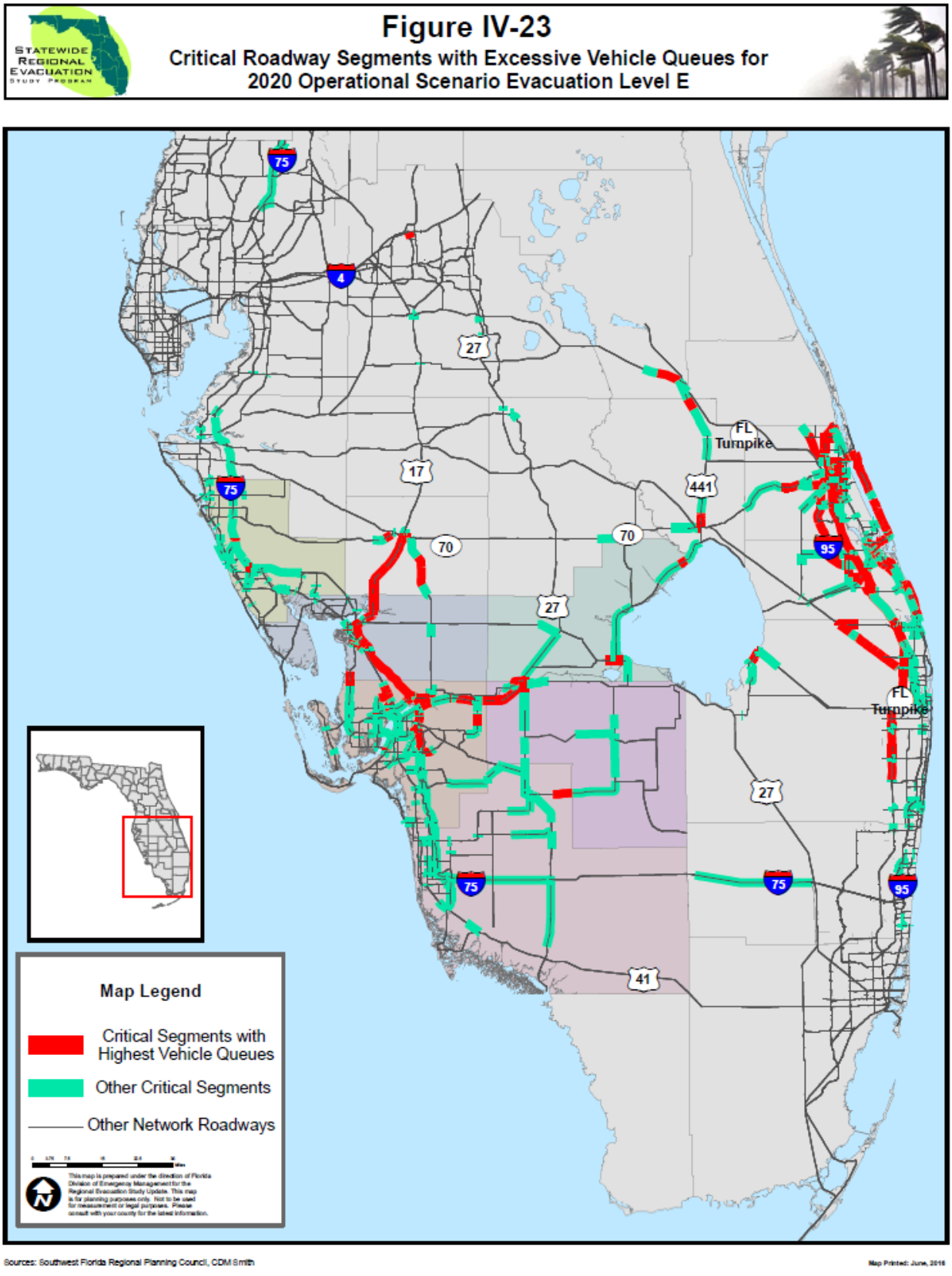


Figure IV-23
Critical Roadway Segments with Excessive Vehicle Queues for
2020 Operational Scenario Evacuation Level E
STATEWIDE REGIONAL EVACUATION STUDY PROGRAM
75
4
27
17
70
441
95
FL Turnpike
41
Map Legend
Critical Segments with Highest Vehicle Queues
Other Critical Segments
Other Network Roadways
Sources: Southwest Florida Regional Planning Council, CDM Smith
Map Printed: June, 2016

Table IV-26: Evacuating Vehicles Leaving Each County by Evacuation Route for the 2017 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
Charlotte County					
US 41 Northbound	2,100	11,500	21,200	20,500	11,200
I-75 Northbound	53,500	60,500	93,400	121,800	118,200
US 41 Southbound	-	-	100	100	100
I-75 Southbound	100	5,400	6,200	9,800	17,600
US 17 Northbound	10,500	14,300	21,200	27,700	30,200
SR 31 Southbound	-	300	600	300	400
SR 31 Northbound	9,800	9,900	14,200	15,000	14,700
SR 776 Northbound	600	7,900	10,100	9,800	9,400
Collier County					
I-75 Northbound	18,500	18,600	34,700	42,700	46,400
SR 82 Northbound	400	300	1,200	1,100	1,000
SR 29 Northbound	9,300	13,500	20,000	26,800	34,900
I-75 Southbound	29,600	38,800	69,700	90,400	117,000
US 41 Southbound	3,700	6,100	14,300	16,300	18,400
US 41 Northbound	500	-	1,300	800	900
Glades County					
SR 29 Southbound	-	-	100	100	700
US 27 Southbound	200	1,900	2,300	3,600	7,400
SR 78 Northbound	9,300	12,000	10,500	17,200	19,900
Hendry County					
SR 80 Westbound	500	700	1,000	700	1,100
SR 29 Northbound	14,500	17,900	25,000	28,500	36,900
US 27 Northbound	8,100	10,000	15,100	14,100	22,500
US 27 Southbound	4,300	6,500	12,500	20,200	18,300
Lee County					
US 41 Northbound	19,400	24,700	33,700	47,300	33,500
I-75 Northbound	42,900	44,700	77,900	92,400	90,700
US 41 Southbound	100	1,700	5,500	7,800	10,100
I-75 Southbound	13,900	23,500	28,500	34,400	50,600
SR 82 Southbound	5,500	6,600	9,800	16,900	23,100
SR 80 Eastbound	12,300	20,200	26,000	29,400	44,100
SR 31 Northbound	12,200	12,700	17,900	17,700	21,300
SR 78 Eastbound	1,000	3,300	9,200	10,600	13,000
Sarasota County					
US 41 Northbound	-	10,200	12,000	14,300	6,600
I-75 Northbound	43,300	65,600	94,900	128,300	151,000
SR 776 Southbound	-	-	-	-	100
US 41 Southbound	-	500	500	900	4,800
I-75 Southbound	-	2,400	2,400	5,700	14,200

Table IV-27: Evacuating Vehicles Leaving Each County by Evacuation Route for the 2020 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
Charlotte County					
US 41 Northbound	2,200	8,200	8,500	11,500	19,100
I-75 Northbound	44,300	97,800	107,800	134,200	129,500
US 41 Southbound	-	-	100	100	100
I-75 Southbound	5,300	4,700	9,300	13,500	8,400
US 17 Northbound	9,600	18,900	22,800	29,700	25,600
SR 31 Southbound	200	700	900	500	600
SR 31 Northbound	10,200	16,400	18,000	18,500	21,900
SR 776 Northbound	5,600	9,000	8,500	9,200	10,200
Collier County					
I-75 Northbound	-	33,100	32,600	42,900	45,800
SR 82 Northbound	300	700	900	1,100	800
SR 29 Northbound	6,800	16,400	24,500	35,000	22,100
I-75 Southbound	24,700	52,700	84,000	102,000	70,100
US 41 Southbound	1,700	11,600	14,200	18,600	6,800
US 41 Northbound	-	3,200	1,100	800	1,700
Glades County					
SR 29 Southbound	100	0	100	100	200
US 27 Southbound	900	1,200	2,700	4,700	2,600
SR 78 Northbound	10,000	14,500	17,200	15,700	26,100
Hendry County					
SR 80 Westbound	100	800	3,100	2,100	2,000
SR 29 Northbound	11,000	20,600	27,200	34,300	37,800
US 27 Northbound	6,100	16,800	13,600	21,800	31,900
US 27 Southbound	4,600	8,100	21,300	24,300	5,300
Lee County					
US 41 Northbound	17,800	34,500	39,300	46,100	47,000
I-75 Northbound	27,600	68,800	76,000	96,400	100,500
US 41 Southbound	3,500	1,700	5,100	7,400	5,600
I-75 Southbound	28,500	23,900	39,400	47,100	36,400
SR 82 Southbound	5,800	11,000	14,700	23,700	9,900
SR 80 Eastbound	13,900	20,000	27,100	35,500	26,800
SR 31 Northbound	12,000	19,800	22,500	19,800	23,700
SR 78 Eastbound	1,300	1,500	8,500	13,200	9,200
Sarasota County					
US 41 Northbound	1,900	11,900	5,900	6,200	19,400
I-75 Northbound	57,300	83,000	118,700	156,400	121,500
SR 776 Southbound	-	-	100	100	-
US 41 Southbound	400	400	1,500	3,600	800
I-75 Southbound	2,500	1,600	6,300	10,500	5,100

Table IV-28: Evacuating Vehicles Entering Each County by Evacuation Route for the 2017 Operational Scenarios

	Evacuation Level A Operational Scenario 1	**Evacuation Level B Operational** Scenario 2	**Evacuation Level C Operational** Scenario 3	**Evacuation Level D Operational** Scenario 4	**Evacuation Level E Operational** Scenario 5
Charlotte County					
SR 776 Southbound	-	-	-	-	100
US 41 Southbound	-	500	500	900	4,800
I-75 Southbound	-	2,400	2,400	5,700	14,200
US 41 Northbound	19,400	24,700	33,700	47,300	33,500
I-75 Northbound	42,900	44,700	77,900	92,400	90,700
SR 31 Northbound	12,200	12,700	17,900	17,700	21,300
Collier County					
SR 29 Southbound	100	1,700	5,500	7,800	10,100
SR 82 Southbound	13,900	23,500	28,500	34,400	50,600
US 41 Southbound	5,500	6,600	9,800	16,900	23,100
Glades County					
SR 29 Northbound	14,500	17,900	25,000	28,500	36,900
US 27 Northbound	8,100	10,000	15,100	14,100	22,500
Hendry County					
SR 29 Southbound	-	-	100	100	700
SR 29 Northbound	9,300	13,500	20,000	26,800	34,900
US 27 Southbound	200	1,900	2,300	3,600	7,400
SR 80 Eastbound	12,300	20,200	26,000	29,400	44,100
Lee County					
US 41 Southbound	-	-	100	100	100
I-75 Southbound	100	5,400	6,200	9,800	17,600
I-75 Northbound	18,500	18,600	34,700	42,700	46,400
SR 80 Westbound	500	700	1,000	700	1,100
US 41 Northbound	500	-	1,300	800	900
SR 31 Southbound	-	300	600	300	400
SR 82 Northbound	400	300	1,200	1,100	1,000
Sarasota County					
US 41 Northbound	2,100	11,500	21,200	20,500	11,200
I-75 Northbound	53,500	60,500	93,400	121,800	118,200
SR 776 Northbound	600	7,900	10,100	9,800	9,400

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

	Evacuation Level A Operational Scenario 6	**Evacuation Level B Operational** Scenario 7	**Evacuation Level C Operational** Scenario 8	**Evacuation Level D Operational** Scenario 9	**Evacuation Level E Operational** Scenario 10
Charlotte County					
SR 776 Southbound	100	-	-	100	-
US 41 Southbound	4,800	400	400	1,500	800
I-75 Southbound	14,200	2,500	1,600	6,300	5,100
US 41 Northbound	33,500	17,800	34,500	39,300	47,000
I-75 Northbound	90,700	27,600	68,800	76,000	100,500
SR 31 Northbound	21,300	12,000	19,800	22,500	23,700
Collier County					
SR 29 Southbound	3,500	1,700	5,100	7,400	5,600
SR 82 Southbound	28,500	23,900	39,400	47,100	36,400
US 41 Southbound	5,800	11,000	14,700	23,700	9,900
Glades County					
SR 29 Northbound	11,000	20,600	27,200	34,300	37,800
US 27 Northbound	6,100	16,800	13,600	21,800	31,900
Hendry County					
SR 29 Southbound	100	-	100	100	200
SR 29 Northbound	6,800	16,400	24,500	35,000	22,100
US 27 Southbound	900	1,200	2,700	4,700	2,600
SR 80 Eastbound	13,900	20,000	27,100	35,500	26,800
Lee County					
US 41 Southbound	-	-	100	100	100
I-75 Southbound	5,300	4,700	9,300	13,500	8,400
I-75 Northbound	-	33,100	32,600	42,900	45,800
SR 80 Westbound	100	800	3,100	2,100	2,000
US 41 Northbound	-	3,200	1,100	800	1,700
SR 31 Southbound	200	700	900	500	600
SR 82 Northbound	300	700	900	1,100	800
Sarasota County					
US 41 Northbound	2,200	8,200	8,500	11,500	19,100
I-75 Northbound	44,300	97,800	107,800	134,200	129,500
SR 776 Northbound	5,600	9,000	8,500	9,200	10,200

Clearance Times

Clearance times for each of the operational scenarios are summarized in **Table IV-30** and **IV-31**, as well as **Figures IV-24, IV-25,** and **IV-26**. Clearance time includes several components, including the mobilization time for the evacuating population to prepare for an evacuation (pack supplies and personal belongs, load their vehicle, etc.), the actual time spent traveling on the roadway network, and the delay time caused by traffic congestion.

In-county clearance times for the 2017 operational scenarios range from 14.5 hours to 61 hours depending upon the scenario. Clearance Time to Shelter shows a similar pattern, with clearance times for the operational scenarios ranging from 10 hours to 59 hours depending upon the county and the scenario.

In 2020, in-county clearance times for the operational scenarios vary from 17 hours to 51 hours for the level D evacuation in Charlotte County. The 2020 level E evacuation includes vehicle trips evacuating from the Treasure Coast region, which is why clearance times within the Southwest region are lower for the operational level E scenario than the operational level D scenario. Clearance Time to Shelter shows a similar pattern, with clearance times for the base scenarios ranging from 10 hours to 43.5 hours depending upon the scenario.

Out-of-county clearance times for the 2017 operational scenarios range from 14.5 hours to 61 hours for the evacuation level E scenario. Out-of-county clearance times for all counties in 2020 range from 17 to 51 hours depending upon the scenario. Regional clearance time for the six-county SWFRPC region ranges from 19 hours to 61 hours in 2017 and between 23.5 and 51 hours in 2020.

Table IV-30: 2017 Clearance Times for Operational Scenarios

	Evacuation Level A Operational Scenario	Evacuation Level B Operational Scenario	Evacuation Level C Operational Scenario	Evacuation Level D Operational Scenario	Evacuation Level E Operational Scenario
Clearance Time to Shelter					
Charlotte County	N/A	13.0	15.0	19.0	41.5
Collier County	12.0	14.0	31.0	33.0	48.0
Glades County	10.0	16.5	15.5	20.0	23.5
Hendry County	11.5	14.5	15.5	20.0	20.0
Lee County	18.0	19.0	31.5	36.0	59.0
Sarasota County	N/A	14.0	16.0	21.0	53.5
In-County Clearance Time					
Charlotte County	N/A	18.5	32.5	45.0	59.5
Collier County	14.5	16.5	31.0	33.5	57.5
Glades County	18.0	23.5	33.0	35.0	59.5
Hendry County	17.5	23.0	32.0	34.5	58.5
Lee County	18.0	19.0	32.0	36.0	59.0
Sarasota County	N/A	21.0	34.0	39.0	61.0
Out-of-County Clearance Time					
Charlotte County	N/A	19.0	32.5	45.0	59.5
Collier County	14.5	16.5	31.5	33.5	57.5
Glades County	18.0	23.5	33.0	35.0	59.5
Hendry County	17.5	23.0	32.0	34.5	58.5
Lee County	18.0	19.0	32.0	36.0	59.0
Sarasota County	N/A	21.0	34.0	39.0	61.0
Regional Clearance Time					
Southwest	19.0	23.5	33.5	45.0	61.0

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					
Charlotte County	12.5	13.5	18.5	26.0	19.0
Collier County	N/A	19.5	26.0	37.5	25.0
Glades County	10.0	16.0	16.0	19.0	22.0
Hendry County	N/A	14.5	15.0	21.0	29.5
Lee County	16.0	23.5	33.0	43.5	39.5
Sarasota County	10.5	14.5	19.5	32.5	22.0
In-County Clearance Time					
Charlotte County	17.5	26.5	36.0	51.0	46.0
Collier County	N/A	19.5	32.0	41.5	37.0
Glades County	17.5	28.0	34.5	44.0	44.5
Hendry County	N/A	25.0	32.0	44.0	41.5
Lee County	17.0	24.0	33.0	44.0	40.0
Sarasota County	23.5	30.5	36.0	46.0	46.5
Out-of-County Clearance Time					
Charlotte County	17.5	26.5	36.0	51.0	46.0
Collier County	N/A	19.5	32.0	41.5	37.0
Glades County	17.5	28.0	34.5	44.0	44.5
Hendry County	N/A	25.0	32.0	44.0	41.5
Lee County	17.0	24.0	33.0	44.0	40.0
Sarasota County	23.5	30.5	36.0	46.0	46.5
Regional Clearance Time					
Southwest	23.5	30.5	36.0	51.0	46.5

Figure IV-24 - Clearance Time to Shelter Operational Scenarios

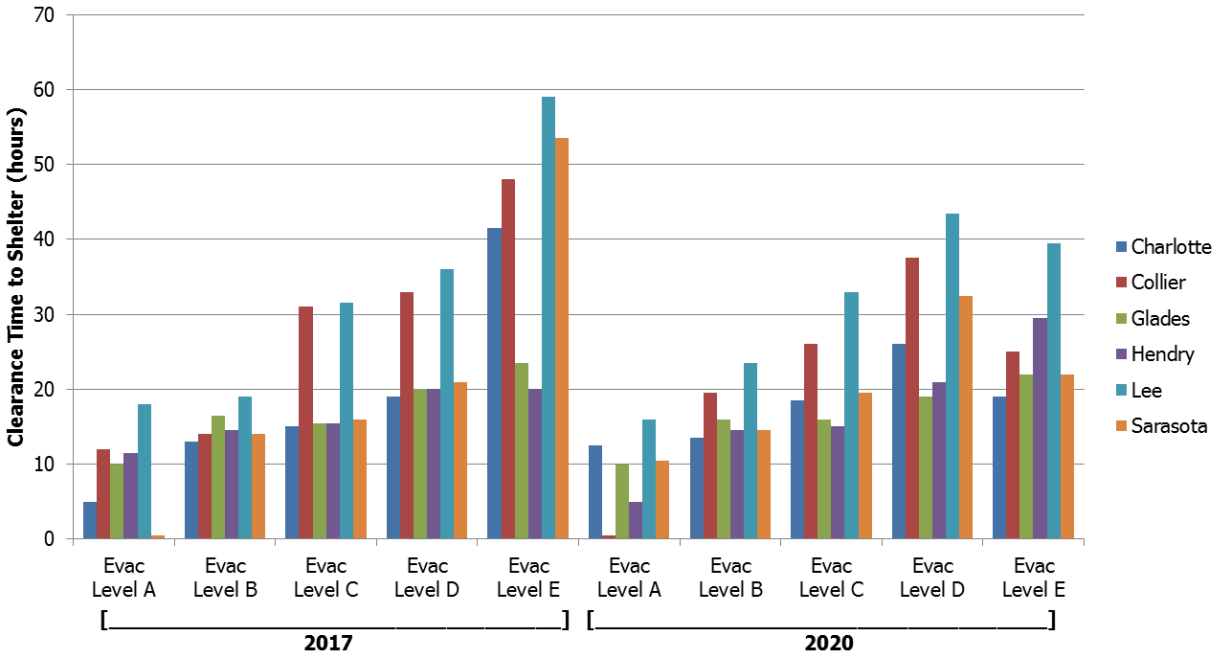
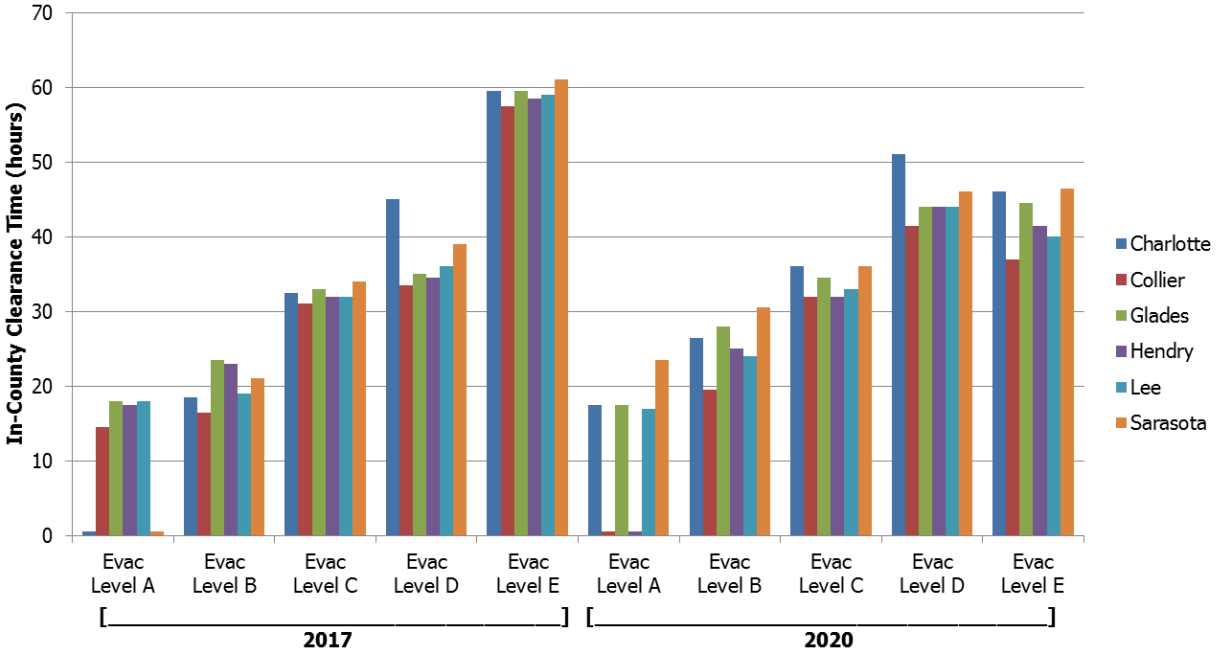


Figure IV-25 - In-County Clearance Times Operational Scenarios



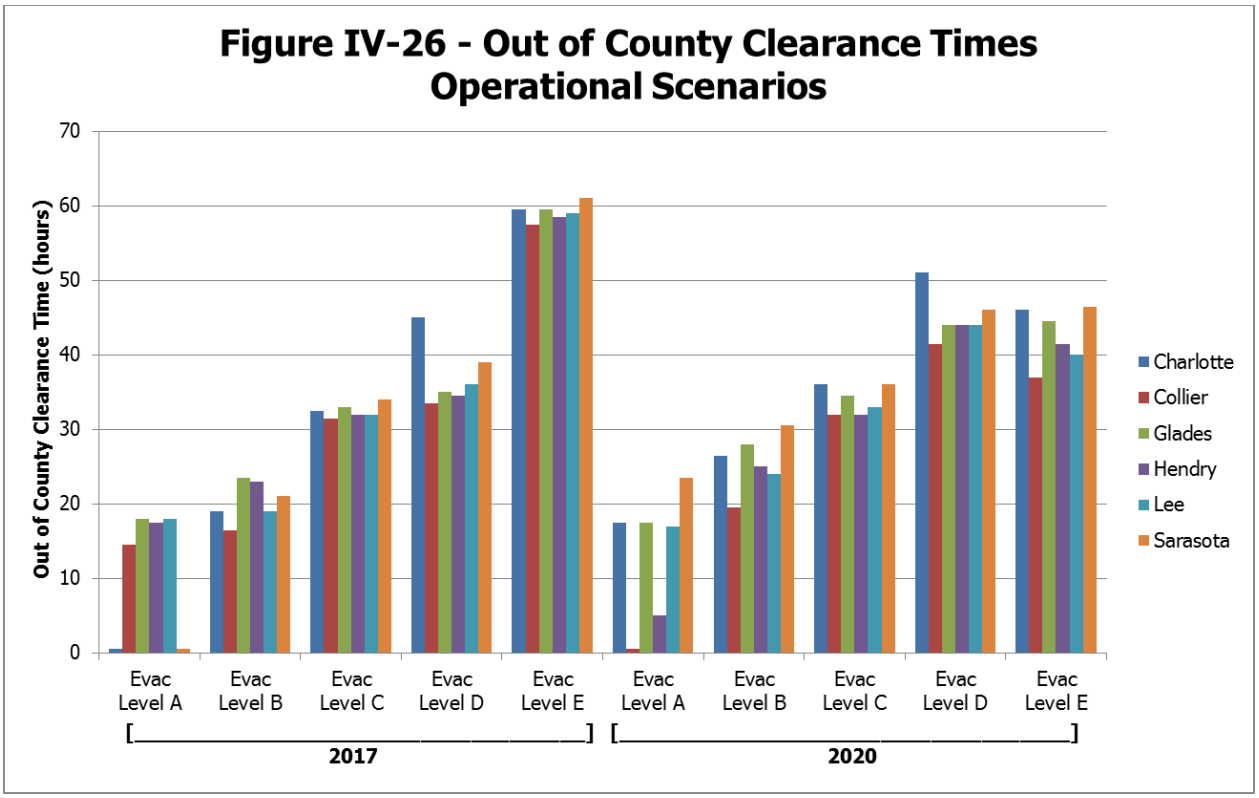


Figure IV-26 - Out of County Clearance Times
Operational Scenarios
Out of County Clearance Time (hours)
70
60
50
40
30
20
10
0
Evac Level A
Evac Level B
Evac Level C
Evac Level D
Evac Level E
Evac Level A
Evac Level B
Evac Level C
Evac Level D
Evac Level E
2017
2020
Charlotte
Collier
Glades
Hendry
Lee
Sarasota

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 2017 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 2017

	Evac Level A Scenario 1	**Evac Level B** Scenario 2	**Evac Level C** Scenario 3	**Evac Level D** Scenario 4	**Evac Level E** Scenario 5
Estimated Evacuating Population Clearing Charlotte County					
12-Hour	26,752	38,635	31,606	26,859	21,619
18-Hour	40,128	57,953	47,410	40,288	32,429
24-Hour	53,504	77,271	63,213	53,717	43,239
36-Hour	79,142	143,273	167,251	170,105	170,253
Estimated Evacuating Population Clearing Collier County					
12-Hour	109,755	78,092	71,449	65,776	53,209
18-Hour	164,633	117,139	107,174	98,665	79,813
24-Hour	169,206	156,185	142,898	131,553	106,417
36-Hour		214,754	306,636	359,030	361,376
Estimated Evacuating Population Clearing Glades County					
12-Hour	3,453	2,474	1,906	1,684	1,427
18-Hour	5,179	3,711	2,859	2,526	2,141
24-Hour	6,906	4,948	3,811	3,367	2,855
36-Hour	7,481	7,937	8,814	9,471	9,813
Estimated Evacuating Population Clearing Hendry County					
12-Hour	9,600	6,875	5,060	4,198	3,581
18-Hour	14,399	10,313	7,590	6,296	5,371
24-Hour	19,199	13,751	10,120	8,395	7,162
36-Hour	19,199	20,340	22,559	23,611	24,618
Estimated Evacuating Population Clearing Lee County					
12-Hour	168,528	180,955	150,866	119,455	101,410
18-Hour	252,792	271,432	226,299	179,183	152,115
24-Hour	337,056	361,910	301,732	238,911	202,820
36-Hour	337,056	520,245	653,752	691,845	714,097
Estimated Evacuating Population Clearing Sarasota County					
12-Hour	43,837	50,343	53,475	55,836	45,740
18-Hour	65,755	75,514	80,213	83,754	68,610
24-Hour	87,673	100,685	106,950	111,673	91,480
36-Hour	122,377	159,418	249,550	318,732	339,237

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

	Evac Level A Scenario 6	**Evac Level B** Scenario 7	**Evac Level C** Scenario 8	**Evac Level D** Scenario 9	**Evac Level E** Scenario 10
Estimated Evacuating Population Clearing Charlotte County					
12-Hour	25,717	39,475	28,362	24,242	22,992
18-Hour	38,576	59,213	42,542	36,363	34,488
24-Hour	51,435	78,950	56,723	48,484	45,984
36-Hour	84,653	154,611	180,805	180,805	183,937
Estimated Evacuating Population Clearing Collier County					
12-Hour	105,477	75,278	57,788	72,685	52,944
18-Hour	158,215	112,917	86,682	109,027	79,417
24-Hour	210,953	150,556	115,576	145,369	105,889
36-Hour	193,374	250,926	361,176	420,965	423,555
Estimated Evacuating Population Clearing Glades County					
12-Hour	3,515	2,314	1,452	1,481	1,252
18-Hour	5,273	3,471	2,179	2,222	1,878
24-Hour	7,030	4,628	2,905	2,963	2,505
36-Hour	7,909	8,389	9,320	9,320	10,018
Estimated Evacuating Population Clearing Hendry County					
12-Hour	9,167	6,312	3,709	3,684	3,052
18-Hour	13,751	9,468	5,563	5,526	4,579
24-Hour	18,334	12,625	7,417	7,368	6,105
36-Hour	19,862	21,041	23,333	23,333	24,419
Estimated Evacuating Population Clearing Lee County					
12-Hour	169,763	178,591	122,442	125,774	101,791
18-Hour	254,644	267,887	183,663	188,661	152,687
24-Hour	339,525	357,182	244,884	251,548	203,583
36-Hour	396,113	610,186	770,365	770,365	814,330
Estimated Evacuating Population Clearing Sarasota County					
12-Hour	39,762	47,581	42,409	46,844	47,081
18-Hour	59,643	71,371	63,614	70,265	70,621
24-Hour	79,524	95,161	84,819	93,687	94,161
36-Hour	135,853	176,445	275,661	353,279	376,645

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

- For mid-level evacuations such as C and sometimes D, clearance time varied by as much as 25 percent during the sensitivity analysis. The number of evacuating vehicles is considerably higher than for levels A and B, and lower response curves tend to load the transportation network faster than longer response curves. The variability in clearance times is less in these cases than for low evacuation levels; and,

- For high-level evacuations such as some level D evacuations and all E evacuations, clearance time variability is reduced to about 10 to 15 percent. Large evacuations involve large numbers of evacuating vehicles, and the sensitivity test identified that clearance times are not as dependent on the response curve as lower level evacuations since it takes a significant amount of time to evacuate a large number of vehicles.

The counties within the Southwest Florida Region are encouraged to test additional scenarios beyond what has been provided in this study. Each model run will provide additional information for the region to use in determining when to order an evacuation. Due to advancements in computer technology and the nature of the developed transportation evacuation methodology, this study includes a more detailed and time consuming analysis process than used in previous years studies. Counties interested in testing various response curves for each scenario can easily do so using the TIME interface to calculate clearance times for different response curves.

J. Summary and Conclusions

Through a review of the results of the 20 different scenarios (10 base and 10 operational), several conclusions could be reached regarding the transportation analysis, including the following:

- Critical transportation facilities within the SWFRPC region include I-75, US 41, US 27, US 17, US 301, SR 29, SR 78, SR 74, SR 72, SR 31, SR 82 and US 80. For large storm events, such as level D and E evacuations, other State facilities also play an important role in evacuations;

- During the level A and B evacuation scenarios, the roadway segments with the highest vehicle queues are primarily concentrated along the major Interstate and State Highway system. During these levels of evacuation, State and County officials should coordinate personnel resources to provide sufficient traffic control at interchanges and major intersections along these routes;

- In contrast, for the higher level C, D, and E evacuation scenarios, many other roadway facilities, both within and outside of the region, will require personnel resources for sufficient traffic control at interchanges and major intersections;

- The SWFRPC counties, in coordination with the State, should continue public information campaigns to clearly define those that are vulnerable and should evacuate verses those who choose to evacuate on their own. Shadow evacuations in inland areas of the counties impact the ability of the vulnerable population to evacuate;

- The Florida Department of Transportation should continue to work with local counties on implementing intelligent transportation system (ITS) technology, which will provide

enhanced monitoring and notification systems to provide evacuating traffic with up to date information regarding expected travel times and alternate routes;

- The State can use the data and information provided in this report (specifically the evacuating vehicle maps in Volume 5-9) to estimate fuel and supply requirements along major evacuation routes to aid motorists during the evacuation process;

- For major evacuation routes that have signalized traffic control at major intersections, traffic signal timing patterns should be adjusted during the evacuation process to provide maximum green time for evacuating vehicles in the predominate north and east directions; and,

- The counties within the Southwest Florida Region are encouraged to test additional transportation scenarios beyond what has been provided in this study. Each model run will provide additional information for the region to use in planning for an evacuation. Counties interested in testing various response curves for each scenario can easily do so using the TIME interface to calculate clearance times for different evacuation conditions, such as different evacuation levels, different behavioral response assumptions, and different response curves.

This page intentionally left blank.