Florida Statewide Regional Evacuation Study Program

Evacuation Transportation Analysis

Volume 4-4

Florida Division of Emergency Management

Northeast Florida Regional Council

Northeast Florida Region

2013

Includes Hurricane Evacuation Study

Statewide Regional Evacuation Study Program

EVACUATION TRANSPORTATION ANALYSIS

VOLUME 4-4

NORTHEAST FLORIDA REGION

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Florida Division of Emergency Management

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EXECUTIVE SUMMARY

The evacuation transportation analysis discussed in this volume documents the methodology, analysis, and results of the transportation component of the Statewide Regional Evacuation Study Program (SRESP). Transportation analysis is probably one of the most important components required for the development of the SRESP. Due to the complex calculations involved to look at various factors including the transportation network and evacuation population as well as the numerous evacuation scenarios that need to be evaluated, the best way to conduct the transportation analysis is through the use of computerized transportation simulation programs, or transportation models.

A. Background and Purpose

One of the objectives of the SRESP is to create consistent and integrated regional evacuation data and mapping, and by doing so, to facilitate knowledge sharing between state, regional, county, and local partners. Over the years, different planning agencies have used different modeling approaches including differing data requirements and approaches with varying degrees of complexity and mixed success. To achieve this objective, it is important for all Regional Planning Councils to adopt the same data format and to use the same modeling methodologies for their transportation analyses. The primary purpose of the transportation component of the SRESP is to develop a unified evacuation transportation modeling framework that can be implemented with the data collected by the Regional Planning Councils.

It is important to note that this study contains significant updates and revisions in comparison to the 2010 SRESP study for the NEFRC 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.

B. Study Area

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

C. Input and Coordination

The SRESP transportation methodology and framework was developed during 2008 and 2009 in coordination with all eleven regional planning councils in Florida, along with the Division of

Emergency Management, Department of Transportation, Department of Economic Opportunity (formerly the Department of Community Affairs), and local county emergency management teams with CDM Smith serving as the transportation consultant.

During the development of this study completed in 2012 and 2014, four meetings were held at the local and regional level to receive updated input from local county emergency management and the regional planning council.

D. Study Comparisons

It is important to note that the 2013 Northeast Florida Regional Evacuation Study contains significant updates and revisions in comparison to the 2010 Regional Evacuation Study for the Northeast Florida region. These revisions include updates to population projections based on the 2010 census, new evacuation zones based on updated storm surge 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 2010 Northeast Florida Regional Evacuation 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 Northeast 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 NEFRC. County level details of the regional model network are provided in the Volume 5-4 report.

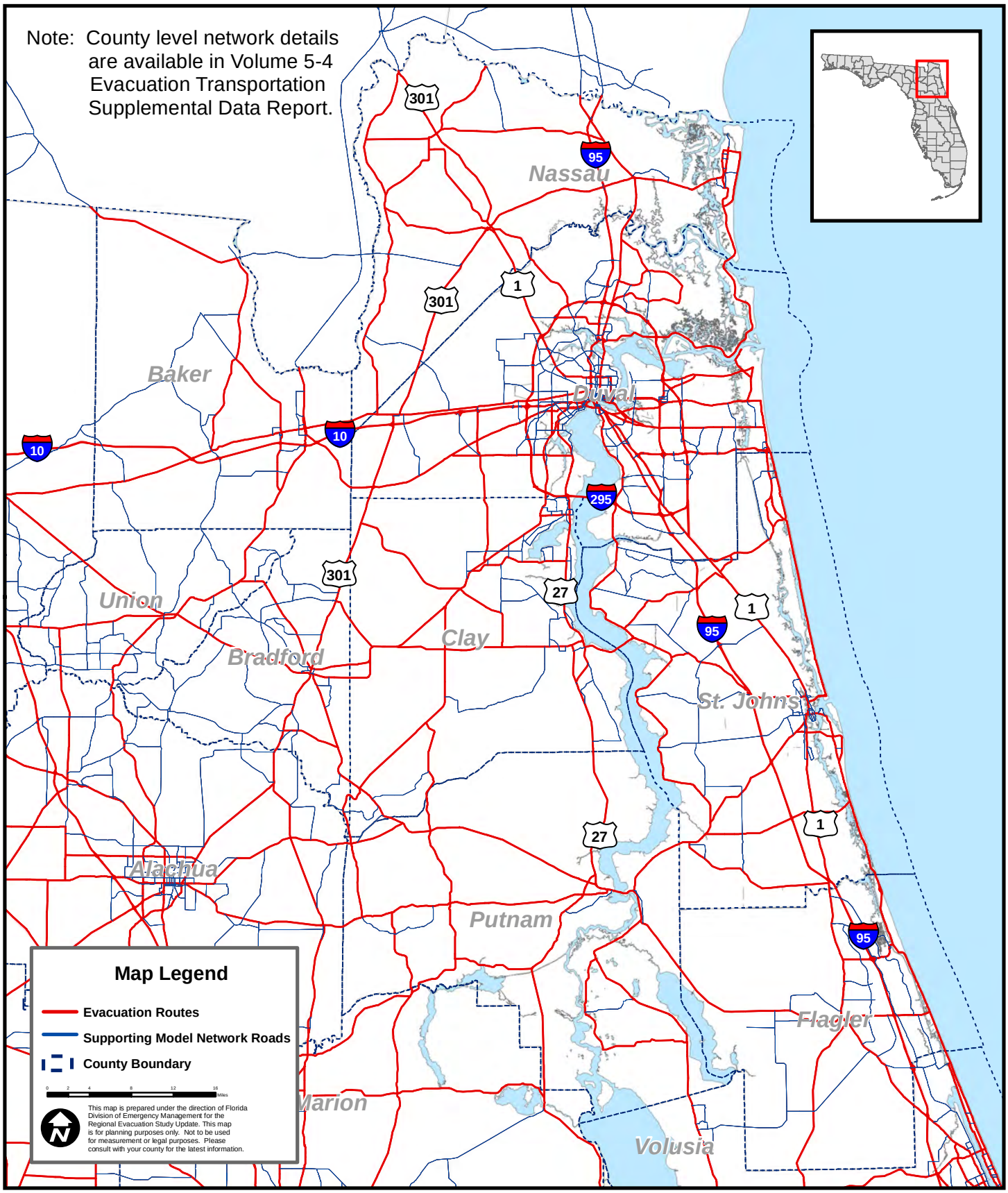
- **Regional Zone System** - The regional zone system is based on Traffic Evacuation Zones (TEZ) and contains the regional demographic information, which includes housing

and population data that is essential to modeling evacuation traffic. There are 1,025 zones located within the seven county Northeast Florida region, as illustrated in **Figure ES-2**, which has nto changed since the 2010 SRESP Study.

- **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 Northeast Florida RC for 2010, 2015, and 2020 is summarized in **Table ES-1**.

Figure ES-1

Northeast Florida Regional Model Network

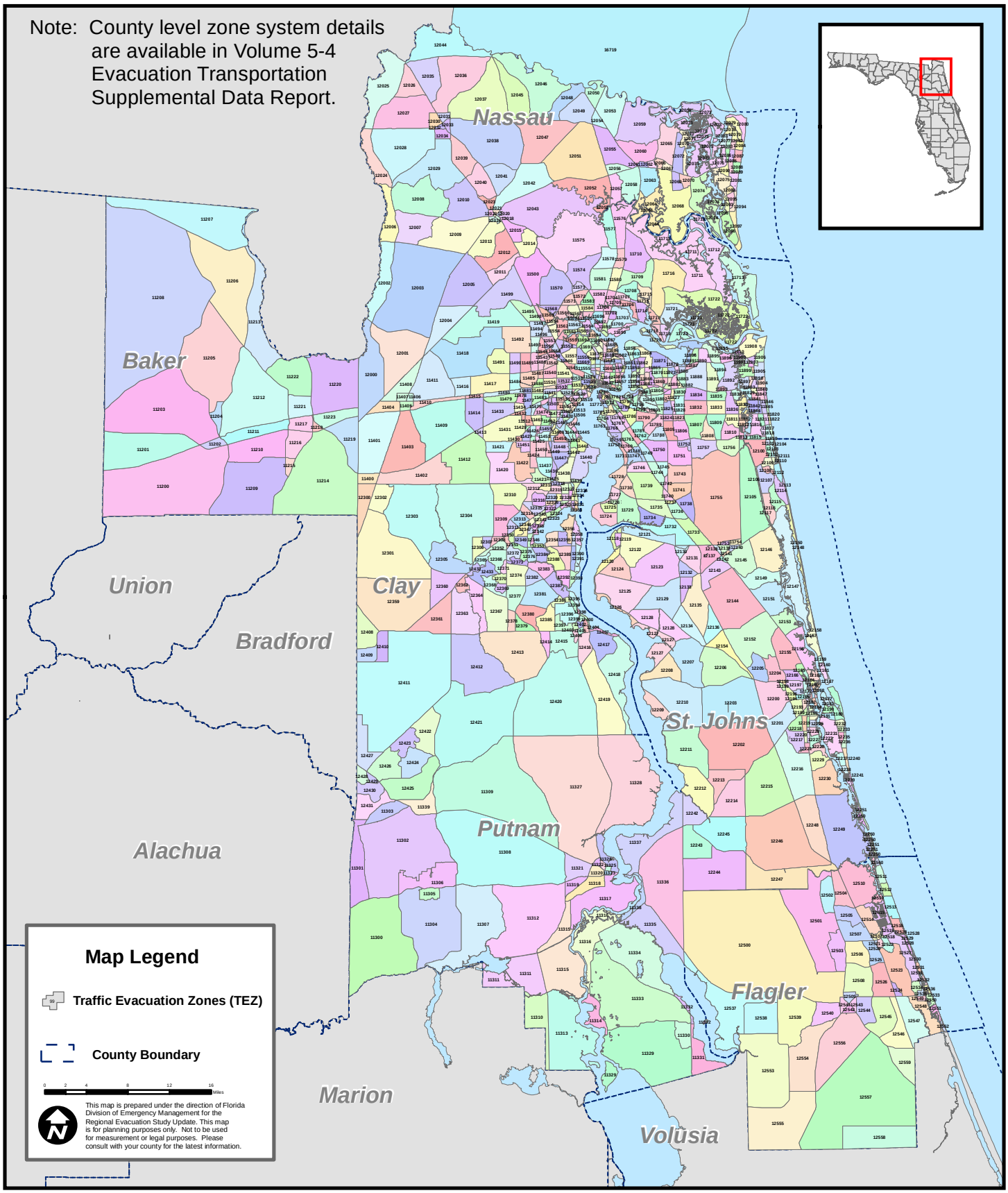


Sources: Northeast Florida Regional Council, CDM Smith

Map Printed: April, 2014

Figure ES-2

Northeast Florida Regional Model Transportation Evacuation (TEZ) Zone System



Sources: Northeast Florida Regional Council, CDM Smith

Map Printed: April , 2014

Table ES-1 – Northeast Florida Demographic Characteristic Summary

County	Characteristic	Year		
		2010	2015	2020
Baker	Occupied site-built homes	5,311	5,512	5,583
	Population in site-built homes	14,536	15,224	16,355
	Occupied mobile homes	3,460	3,628	4,306
	Population in mobile home	10,234	10,655	11,516
	Hotel/motel units	147	147	147
Clay	Occupied site-built homes	59,567	63,775	70,995
	Population in site-built homes	164,093	174,855	194,875
	Occupied mobile homes	9,222	9,838	10,960
	Population in mobile home	25,515	27,299	30,419
	Hotel/motel units	1,416	1,416	1,416
Duval	Occupied site-built homes	324,088	332,957	348,228
	Population in site-built homes	797,528	820,808	858,503
	Occupied mobile homes	18,463	19,012	19,912
	Population in mobile home	46,923	48,757	50,994
	Hotel/motel units	18,017	18,017	18,017
Flagler	Occupied site-built homes	37,165	41,075	49,150
	Population in site-built homes	90,933	101,152	120,547
	Occupied mobile homes	2,023	2,221	2,661
	Population in mobile home	4,739	5,448	6,499
	Hotel/motel units	935	935	935
Nassau	Occupied site-built homes	21,763	22,876	25,291
	Population in site-built homes	53,331	57,740	62,169
	Occupied mobile homes	6,928	7,338	8,105
	Population in mobile home	19,161	20,491	22,349
	Hotel/motel units	1,816	1,816	1,816
Putnam	Occupied site-built homes	17,810	17,614	17,815
	Population in site-built homes	43,311	42,831	43,334
	Occupied mobile homes	11,600	11,459	11,600
	Population in mobile home	29,650	29,303	29,646
	Hotel/motel units	618	618	618
St. Johns	Occupied site-built homes	67,791	76,389	88,900
	Population in site-built homes	168,553	189,387	219,583
	Occupied mobile homes	7,546	8,433	9,839
	Population in mobile home	18,686	20,955	24,301
	Hotel/motel units	5,481	5,481	5,481

Source: Northeast Florida Regional 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 – Northeast Florida Roadway Improvements, 2011 – 2015

County	Roadway	From	To	Number of Lanes
Duval	Beach Blvd (US 90 / SR 212)	@ ICWW		6
	Hodges Blvd	Atlantic Blvd	Beach Blvd	4
	Kernan Blvd	Matthew Unger Dr	Glen Kerrnan Pkwy	6
	Kernan Blvd	McCormick Rd	Matthew Unger Dr	4
	New World Ave	103rd St	Branan Field/Chaffee Rd	4
	Old St. Augustine Rd	@ I-295		6
	Old St. Augustine Rd	Hood Landing Rd	I-95	5
	Tallulah Ave (SR 111)	68th St	Main St	2
	US 301	(future) Baldwin Bypass	Nassau County Line	4
Nassau	US 301	Duval County Line	South of Callahan	4
St. Johns	CR 210	US 1	CR 210A	4
	CR 210	Russell Sampson Rd	CE Wilson Rd	6
	CR 2209	Racetrack Rd	CR 244	4
	CR 2209	CR 244	CR 210	4
	CR 244	CR 210	SR 16A	2
	International Golf Parkway	Royal Pines Pkwy	SR 16	4
	Pacetti Road	Samara Lakes	SR 16	4
	SR 207	Holmes Blvd	SR 312	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 - Northeast Florida Planned Roadway Improvements, 2016–2020

County	Roadway	From	To	Number of Lanes
Clay	Cheswick Oak Ave Extension	Branan-Field Rd (SR 23)	Cheswick Oak Ave	4
	College Dr Extension	Blanding Blvd (SR 21)	Cheswick Oak Ave	4
	First Coast Outer Beltway	I-10	Blanding Blvd (SR 21)	6
Duval	Branan-Field/Chaffee Rd (SR 23)	103rd St (SR 134)	New World Ave.	6
	SR 9A (I-295)	Heckscher Dr (SR 105)	I-95 (North)	6
	SR 9B	I-95	US1	4
	First Coast Outer Beltway	I-10	Blanding Blvd (SR 21)	6
Nassau	SR A1A	I-95	Still Quarters Rd	6
	SR A1A	Still Quarters Rd	Ruben Ln	6
	SR A1A	Ruben Ln	Scott Rd	6
	Chester River Rd	SR A1A	Green Pine Rd	4
St. Johns	SR 313 (SR 312 Extension)	SR 207	CR 214 (King St)	4
	SR 313 (SR 312 Extension)	CR 214 (King St)	SR 16	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 Northeast 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 5-4.

Please note that the original behavioral response rates provided by the SRESP in Volume 2 were modified to fit the evacuation zones created by Clay and Putnam Counties. The original rates were based on a five zone system; however, the evacuation zones for those counties range from three to four zones depending upon the county. In addition, a new evacuation zone F was included for Duval, Flagler, Nassau, and St. Johns Counties. Zone F uses the same behavioral response rates as zone A. In most cases, the 'F' zone is located in the inland portions of the County, where there is a specialized flooding risk, such as along the St. Johns River and other water bodies including Crescent Lake in Flagler County. The evacuation zone systems for Duval, Flagler, Nassau, Putnam, and St. Johns are listed below:

- Clay – 3 zones: Zone A, Zone B, Zone C/D/E;
- Duval – 6 zones: Zone A, Zone B, Zone C, Zone D, Zone E, Zone F;
- Flagler – 6 zones: Zone A, Zone B, Zone C, Zone D, Zone E, Zone F;
- Nassau – 5 zones: Zone A/B, Zone C, Zone D, Zone E, Zone F;
- Putnam – 4 zones: Zone A, Zone B, Zone C, Zone D/E; and,
- St. Johns – 6 zones: Zone A, Zone B, Zone C, Zone D, Zone E, Zone 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 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. All together, the 82 primary shelters located within the seven county region can host more than 64,000 persons during an evacuation event.

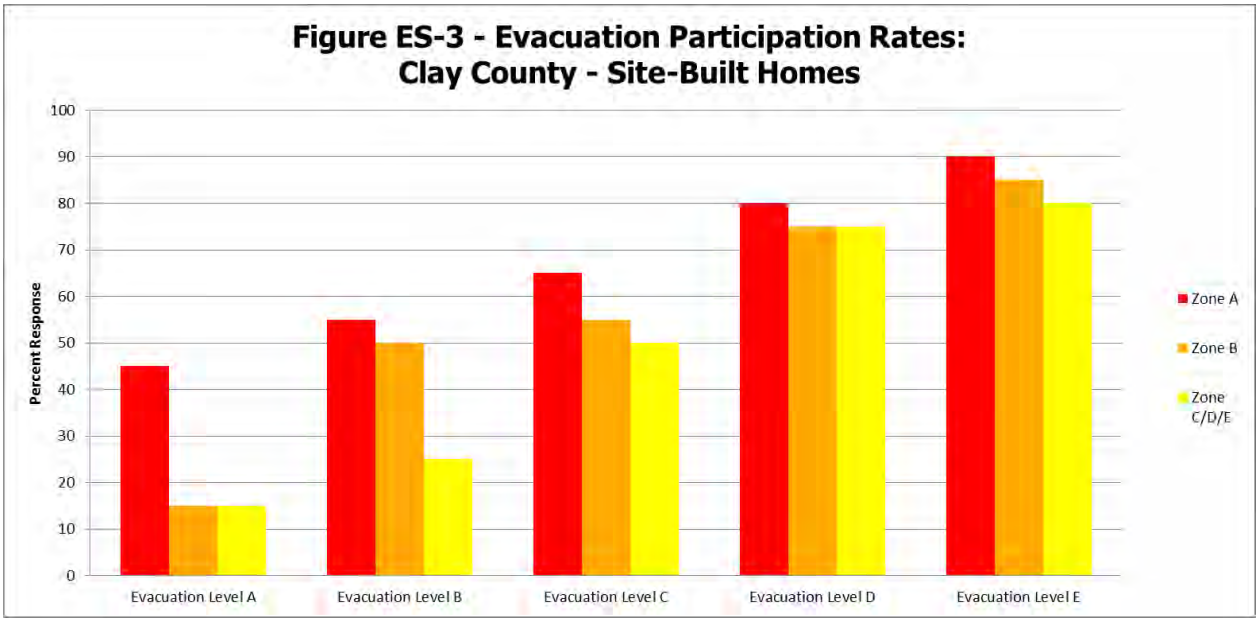


Figure ES-3 - Evacuation Participation Rates:
Clay County - Site-Built Homes
Percent Response
100
90
80
70
60
50
40
30
20
10
0
Evacuation Level A
Evacuation Level B
Evacuation Level C
Evacuation Level D
Evacuation Level E
Zone A
Zone B
Zone C/D/E

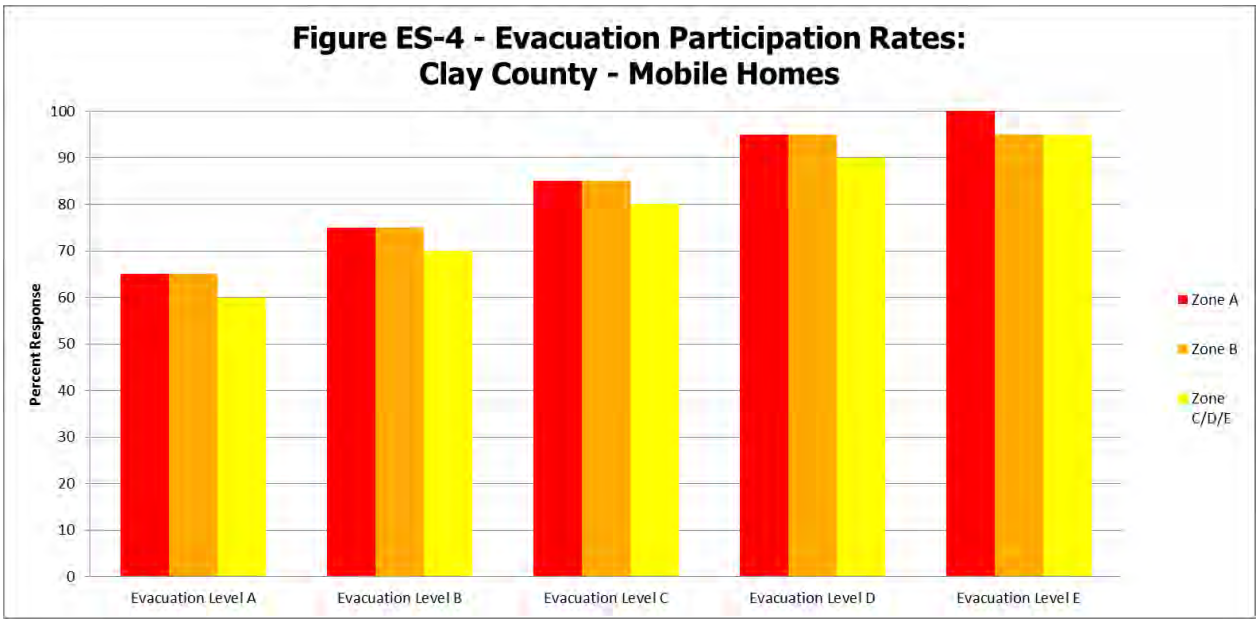


Figure ES-4 - Evacuation Participation Rates:
Clay County - Mobile Homes
Percent Response
100
90
80
70
60
50
40
30
20
10
0
Evacuation Level A
Evacuation Level B
Evacuation Level C
Evacuation Level D
Evacuation Level E
Zone A
Zone B
Zone C/D/E

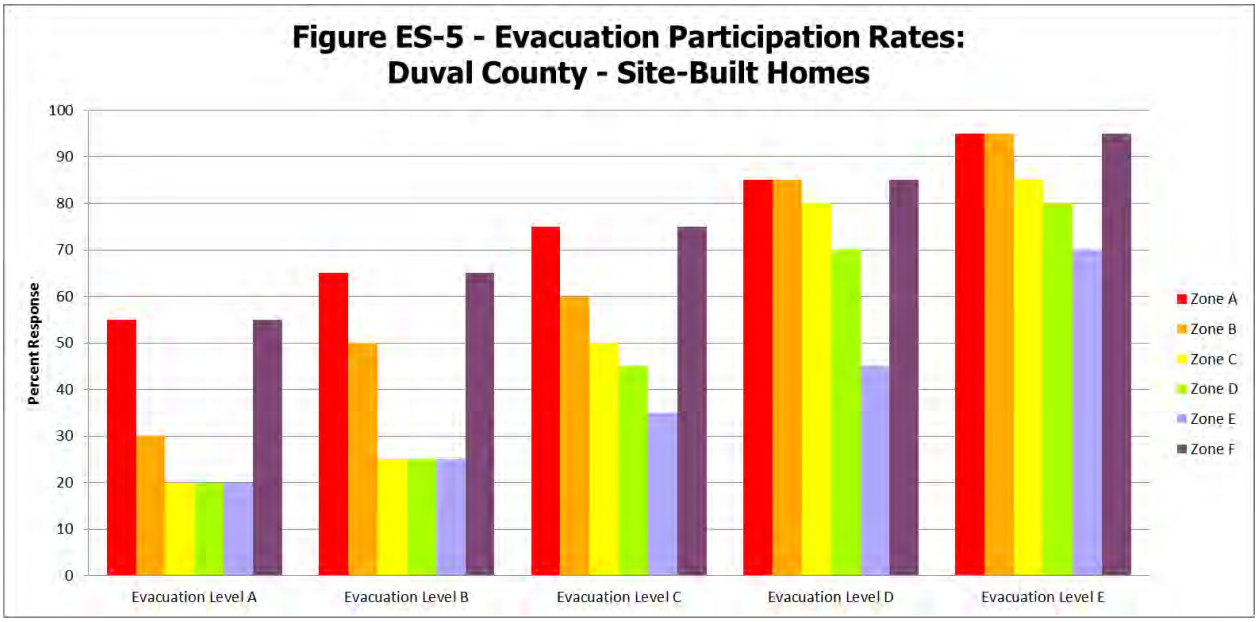


Figure ES-5 - Evacuation Participation Rates:
Duval County - Site-Built Homes
Percent Response
100
90
80
70
60
50
40
30
20
10
0
Evacuation Level A
Evacuation Level B
Evacuation Level C
Evacuation Level D
Evacuation Level E
Zone A
Zone B
Zone C
Zone D
Zone E
Zone F

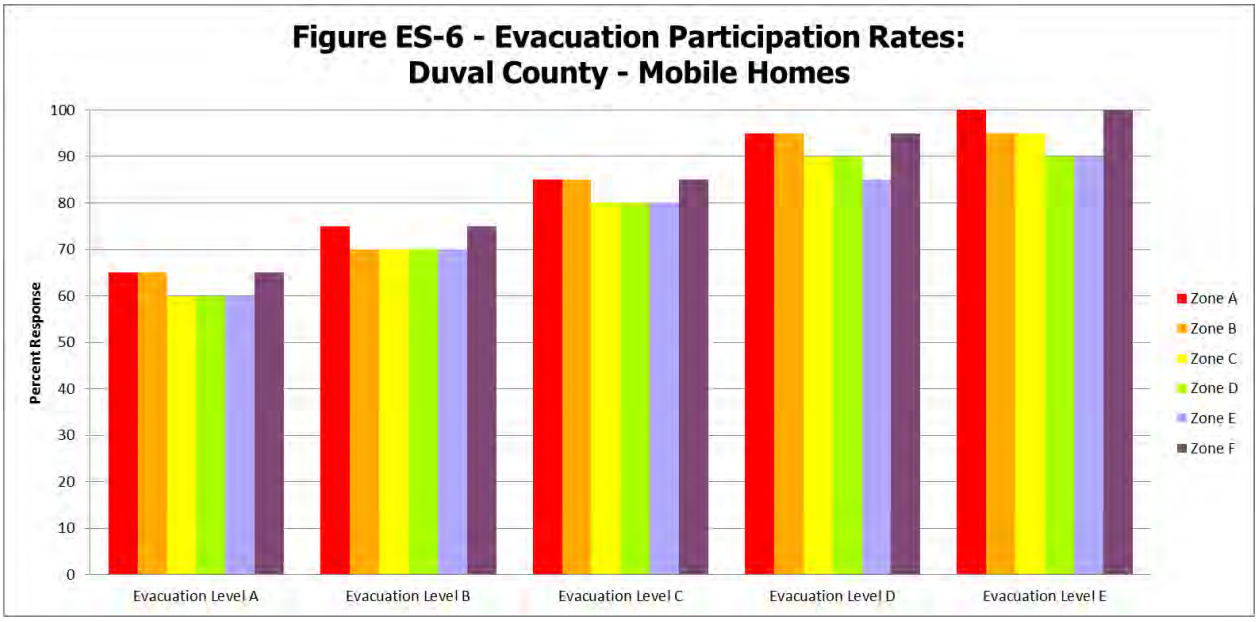


Figure ES-6 - Evacuation Participation Rates:
Duval County - Mobile Homes
Percent Response
100
90
80
70
60
50
40
30
20
10
0
Evacuation Level A
Evacuation Level B
Evacuation Level C
Evacuation Level D
Evacuation Level E
Zone A
Zone B
Zone C
Zone D
Zone E
Zone F

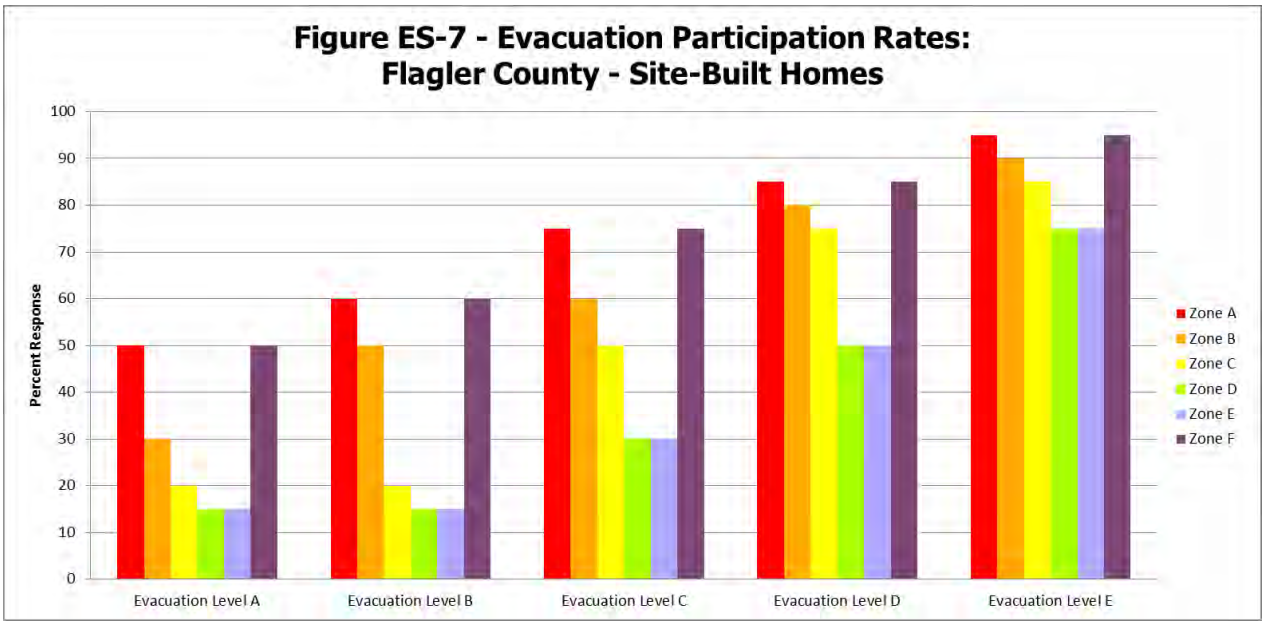


Figure ES-7 - Evacuation Participation Rates:
Flagler County - Site-Built Homes
Percent Response
100
90
80
70
60
50
40
30
20
10
0
Evacuation Level A
Evacuation Level B
Evacuation Level C
Evacuation Level D
Evacuation Level E
Zone A
Zone B
Zone C
Zone D
Zone E
Zone F

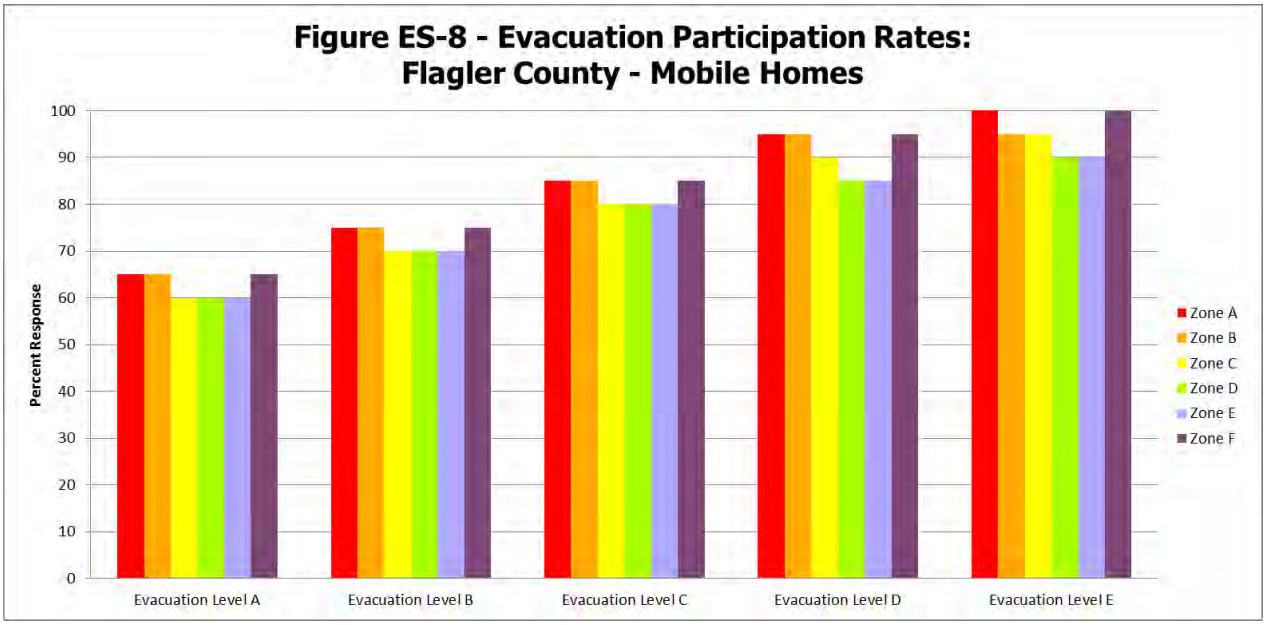


Figure ES-8 - Evacuation Participation Rates:
Flagler County - Mobile Homes
Percent Response
100
90
80
70
60
50
40
30
20
10
0
Evacuation Level A
Evacuation Level B
Evacuation Level C
Evacuation Level D
Evacuation Level E
Zone A
Zone B
Zone C
Zone D
Zone E
Zone F

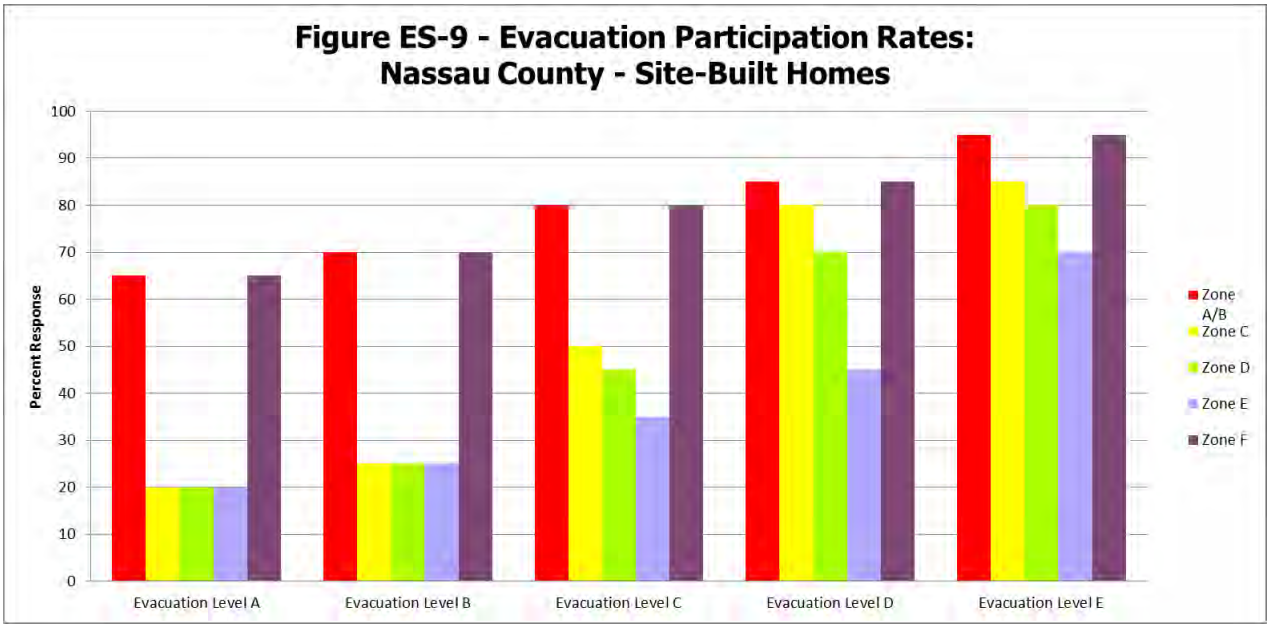


Figure ES-9 - Evacuation Participation Rates:
Nassau County - Site-Built Homes
Percent Response
100
90
80
70
60
50
40
30
20
10
0
Evacuation Level A
Evacuation Level B
Evacuation Level C
Evacuation Level D
Evacuation Level E
Zone A/B
Zone C
Zone D
Zone E
Zone F

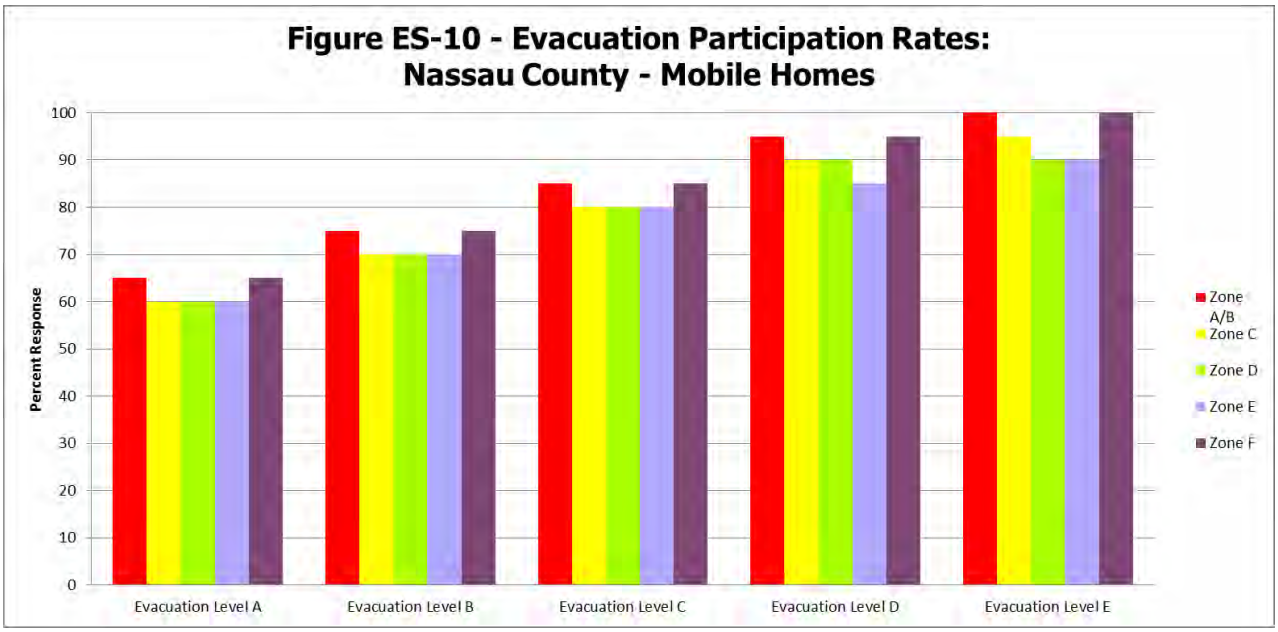


Figure ES-10 - Evacuation Participation Rates:
Nassau County - Mobile Homes
Percent Response
100
90
80
70
60
50
40
30
20
10
0
Evacuation Level A
Evacuation Level B
Evacuation Level C
Evacuation Level D
Evacuation Level E
Zone A/B
Zone C
Zone D
Zone E
Zone F

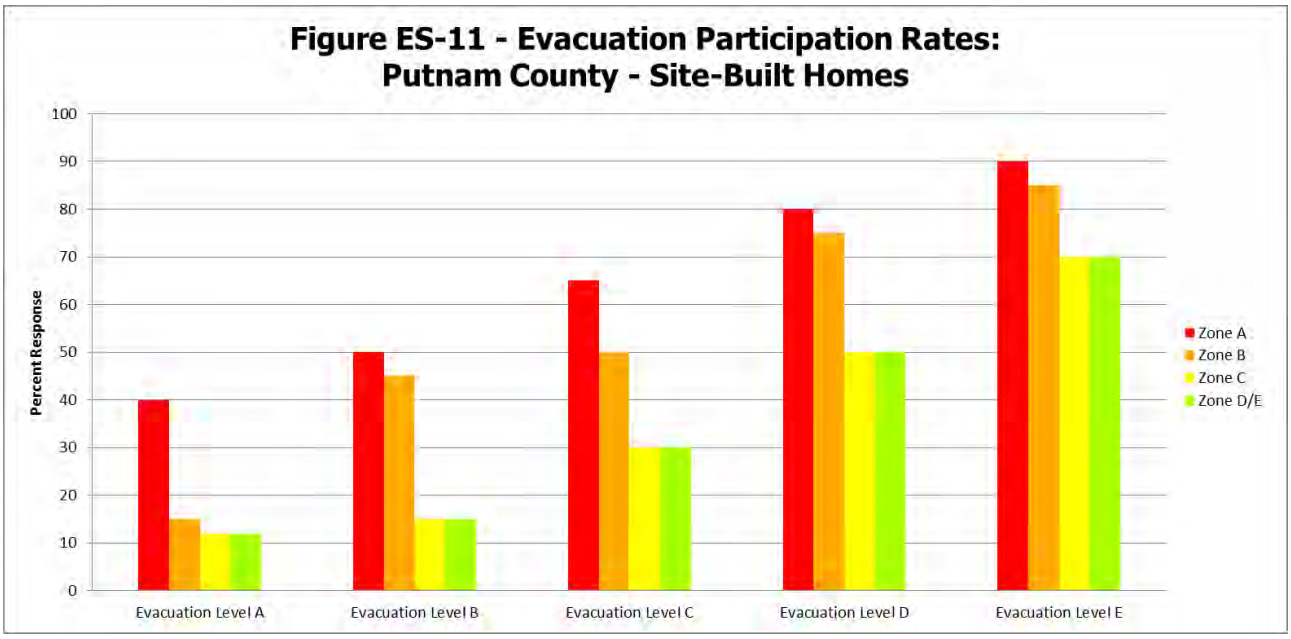


Figure ES-11 - Evacuation Participation Rates:
Putnam County - Site-Built Homes
Percent Response
100
90
80
70
60
50
40
30
20
10
0
Evacuation Level A
Evacuation Level B
Evacuation Level C
Evacuation Level D
Evacuation Level E
Zone A
Zone B
Zone C
Zone D/E

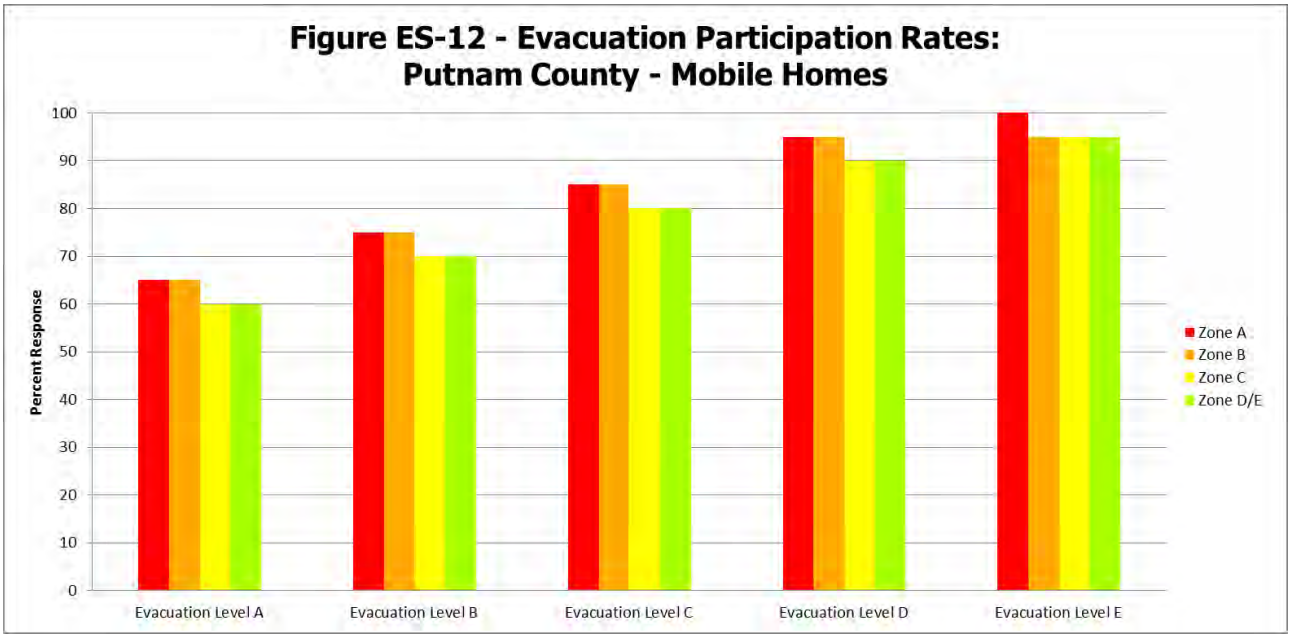


Figure ES-12 - Evacuation Participation Rates:
Putnam County - Mobile Homes
Percent Response
100
90
80
70
60
50
40
30
20
10
0
Evacuation Level A
Evacuation Level B
Evacuation Level C
Evacuation Level D
Evacuation Level E
Zone A
Zone B
Zone C
Zone D/E

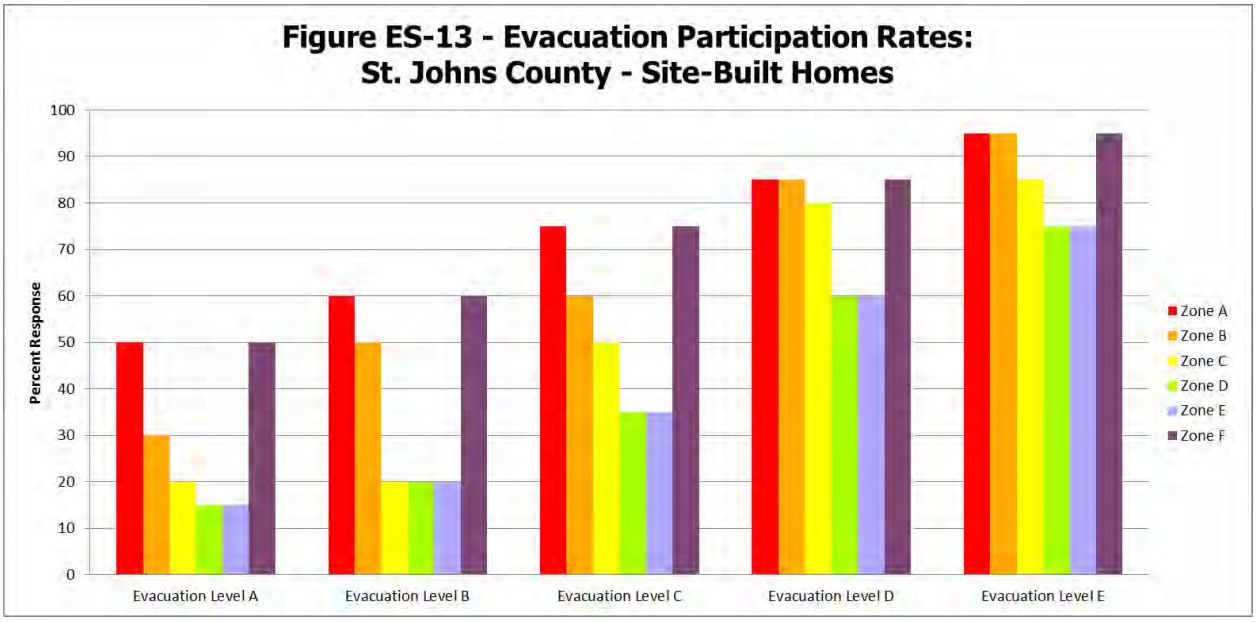


Figure ES-13 - Evacuation Participation Rates:
St. Johns County - Site-Built Homes
Percent Response
100
90
80
70
60
50
40
30
20
10
0
Evacuation Level A
Evacuation Level B
Evacuation Level C
Evacuation Level D
Evacuation Level E
Zone A
Zone B
Zone C
Zone D
Zone E
Zone F

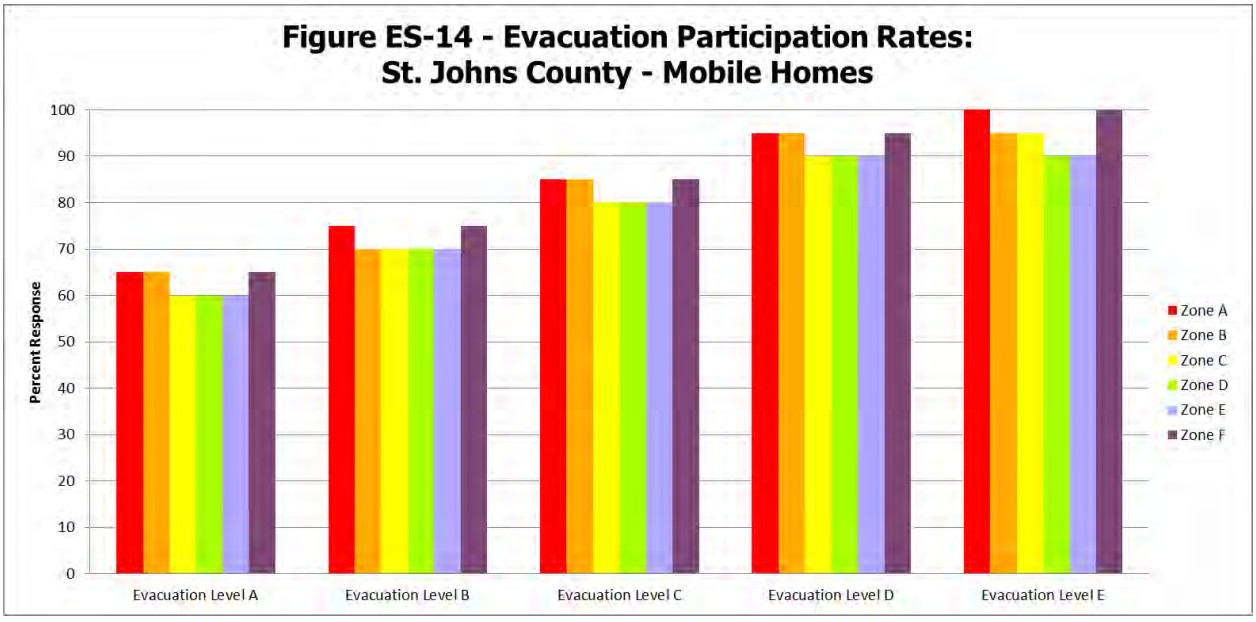


Figure ES-14 - Evacuation Participation Rates:
St. Johns County - Mobile Homes
Percent Response
100
90
80
70
60
50
40
30
20
10
0
Evacuation Level A
Evacuation Level B
Evacuation Level C
Evacuation Level D
Evacuation Level E
Zone A
Zone B
Zone C
Zone D
Zone E
Zone F

- **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 Northeast Florida region, six counties, Clay, Duval, Flagler, Nassau, Putnam, and St. Johns, have updated and established their evacuation zones based on the results of the new data and information collected as part of the SRESP. The four coastal counties in the Northeast Florida Region added an additional 'F' evacuation zone. County level evacuation zones are included in Volume 5-4.

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;
- Evacuation Phasing; and,
- Zone Importer.

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

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

	Evacuation Zone A	Evacuation Zone B	Evacuation Zone C	Evacuation Zone D	Evacuation Zone E	Evacuation Zone F
Clay County*/**						
Site-built Homes	5,864	6,718	45,522			N/A
Mobile/Manuf. Homes	88	396	1,929			
TOTAL	5,951	7,114	47,450			
Duval County						
Site-built Homes	102,801	38,513	108,463	74,327	40,138	10,151
Mobile/Manuf. Homes	4,307	1,659	6,935	5,923	2,151	2,803
TOTAL	107,108	40,171	115,398	80,251	42,289	12,955
Flagler County						
Site-built Homes	8,071	12,675	684	8,751	3,130	388
Mobile/Manuf. Homes	745	418	0	128	30	475
TOTAL	8,816	13,093	684	8,879	3,160	863
Nassau County*						
Site-built Homes	31,269		5,686	2,196	993	1,788
Mobile/Manuf. Homes	3,933		2,736	1,405	863	658
TOTAL	35,202		8,422	3,601	1,856	2,446
Putnam County*/**						
Site-built Homes	5,373	1,418	687	863		N/A
Mobile/Manuf. Homes	3,342	1,293	564	477		
TOTAL	8,715	2,710	1,251	1,340		
St. Johns County						
Site-built Homes	54,902	56,968	3,028	1,743	17	14,287
Mobile/Manuf. Homes	3,078	3,794	813	115	8	2,404
TOTAL	57,980	60,762	3,841	1,858	26	16,691

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

** For the purposes of this study, Clay County has a combined C/D/E zone, Nassau County has a combined A/B zone, and Putnam County has a combined D/E zone.*

***In addition, Clay and Putnam Counties are the only counties within the NEFRC region that did not designate a zone F within their jurisdiction.*

Table ES-5 – Vulnerable Population in the Northeast Florida Region for 2020

	Evacuation Zone A	Evacuation Zone B	Evacuation Zone C	Evacuation Zone D	Evacuation Zone E	Evacuation Zone F
Clay County*/**						
Site-built Homes	6,533	7,485	50,697			N/A
Mobile/Manuf. Homes	98	443	2,156			
TOTAL	6,631	7,929	52,853			
Duval County						
Site-built Homes	107,495	40,278	113,415	77,714	41,973	10,619
Mobile/Manuf. Homes	4,523	1,746	7,265	6,217	2,261	2,931
TOTAL	112,019	42,024	120,680	83,931	44,234	13,550
Flagler County						
Site-built Homes	9,632	15,120	816	10,438	3,733	465
Mobile/Manuf. Homes	887	503	0	153	36	565
TOTAL	10,519	15,623	816	10,590	3,769	1,029
Nassau County*						
Site-built Homes	33,203		6,082	2,334	1,049	1,832
Mobile/Manuf. Homes	4,243		2,945	1,493	907	685
TOTAL	37,446		9,027	3,827	1,956	2,517
Putnam County*/**						
Site-built Homes	5,435	1,434	694	871		N/A
Mobile/Manuf. Homes	3,379	1,308	571	483		
TOTAL	8,815	2,742	1,265	1,354		
St. Johns County						
Site-built Homes	63,670	66,012	3,506	2,021	20	16,562
Mobile/Manuf. Homes	3,559	4,408	950	132	10	2,791
TOTAL	67,229	70,420	4,455	2,154	30	19,353

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

** For the purposes of this study, Clay County has a combined C/D/E zone, Nassau County has a combined A/B zone, and Putnam County has a combined D/E zone.*

***In addition, Clay and Putnam Counties are the only counties within the NEFRC region that did not designate a zone F within their jurisdiction.*

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 Northeast Florida Region are identified in **Table ES-6** for 2015 and in **Table ES-7** for 2020.

Table ES-6 – Vulnerable Population by Destination for 2015

	Evacuation Zone A	Evacuation Zone B	Evacuation Zone C	Evacuation Zone D	Evacuation Zone E	Evacuation Zone F
Clay County*/**						
To Friends and Family	3,571	4,268	28,470			N/A
To Hotel/ Motel	1,479	1,739	11,670			
To Public Shelter	304	383	3,873			
To Other Destination	598	723	3,437			
Duval County						
To Friends and Family	64,265	24,103	69,239	48,150	25,373	7,773
To Hotel/ Motel	16,066	6,026	17,310	12,038	6,343	1,943
To Public Shelter	5,485	2,125	9,509	8,144	4,272	732
To Other Destination	21,292	7,918	19,340	11,919	6,300	2,507
Flagler County*						
To Friends and Family	5,289	7,856	410	5,327	1,896	518
To Hotel/ Motel	1,726	2,598	137	1,769	630	149
To Public Shelter	463	1,064	68	890	317	57
To Other Destination	1,337	1,575	68	892	317	139
Nassau County*						
To Friends and Family	21,318		5,190	2,231	1,157	1,501
To Hotel/ Motel	8,407		1,832	760	378	546
To Public Shelter	1,957		613	278	153	155
To Other Destination	3,520		788	332	168	245

	Evacuation Zone A	Evacuation Zone B	Evacuation Zone C	Evacuation Zone D	Evacuation Zone E	Evacuation Zone F
Putnam County*/**						
To Friends and Family	5,229	1,626	750		804	N/A
To Hotel/ Motel	1,576	477	222		244	
To Public Shelter	831	269	123		126	
To Other Destination	1,079	338	156		166	
St. Johns County*						
To Friends and Family	31,889	33,419	2,113	1,022	14	9,180
To Hotel/ Motel	14,341	15,001	920	459	6	4,053
To Public Shelter	2,991	3,304	249	153	2	907
To Other Destination	8,758	9,038	560	224	3	2,552

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

** For the purposes of this study, Clay County has a combined C/D/E zone, Nassau County has a combined A/B zone, and Putnam County has a combined D/E zone.*

***In addition, Clay and Putnam Counties are the only counties within the NEFRC region that did not designate a zone F within their jurisdiction.*

Table ES-7 – Vulnerable Population by Destination for 2020

	Evacuation Zone A	Evacuation Zone B	Evacuation Zone C	Evacuation Zone D	Evacuation Zone E	Evacuation Zone F
Clay County*/**						
To Friends and Family	3,979	4,757	31,712			N/A
To Hotel/ Motel	1,648	1,938	12,998			
To Public Shelter	338	427	4,314			
To Other Destination	666	806	3,829			
Duval County						
To Friends and Family	67,211	25,215	72,408	50,359	26,541	8,130
To Hotel/ Motel	16,803	6,304	18,102	12,590	6,635	2,032
To Public Shelter	5,737	2,223	9,945	8,517	4,469	765
To Other Destination	22,268	8,283	20,225	12,465	6,590	2,622
Flagler County						
To Friends and Family	6,312	9,374	490	6,354	2,261	617
To Hotel/ Motel	2,060	3,099	163	2,110	752	178
To Public Shelter	553	1,270	82	1,062	378	68
To Other Destination	1,596	1,880	82	1,064	378	166
Nassau County*						
To Friends and Family	22,680		5,563	2,371	1,219	1,545
To Hotel/ Motel	8,937		1,962	807	398	561
To Public Shelter	2,084		657	296	161	160
To Other Destination	3,745		844	353	177	252

	Evacuation Zone A	Evacuation Zone B	Evacuation Zone C	Evacuation Zone D	Evacuation Zone E	Evacuation Zone F
Putnam County*/**						
To Friends and Family	5,289	1,645	759	812		N/A
To Hotel/ Motel	1,594	483	224	247		
To Public Shelter	840	272	124	128		
To Other Destination	1,092	342	157	167		
St. Johns County						
To Friends and Family	36,976	38,731	2,450	1,185	16	10,644
To Hotel/ Motel	16,629	17,385	1,066	532	7	4,699
To Public Shelter	3,468	3,830	289	178	3	1,051
To Other Destination	10,156	10,475	649	260	4	2,959

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

** For the purposes of this study, Clay County has a combined C/D/E zone, Nassau County has a combined A/B zone, and Putnam County has a combined D/E zone.*

***In addition, Clay and Putnam Counties are the only counties within the NEFRC region that did not designate a zone F within their jurisdiction.*

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

Table ES-8 – Vulnerable Shadow Evacuation Population

	Evacuation Level A	Evacuation Level B	Evacuation Level C	Evacuation Level D	Evacuation Level E
2015					
Baker County	12,572	13,385	14,198	15,011	15,824
Clay County	45,187	52,345	48,614	60,292	66,131
Duval County	173,117	195,880	206,063	195,822	223,686
Flagler County	16,843	16,758	22,154	25,581	30,900
Nassau County	22,259	23,610	20,933	19,676	20,202
Putnam County	30,422	28,967	31,951	33,030	36,561
St. Johns County	45,655	29,752	32,510	39,381	47,048
2020					
Baker County	13,528	14,405	15,282	16,158	17,035
Clay County	50,340	58,321	54,105	67,116	73,621
Duval County	181,062	204,779	215,341	204,522	233,611
Flagler County	20,090	19,915	26,318	30,422	36,766
Nassau County	23,928	25,376	22,499	21,167	21,759
Putnam County	30,764	29,292	32,314	33,412	36,986
St. Johns County	52,794	34,250	37,450	45,381	54,239

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

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

Calculated clearance times are used by county emergency managers as one input to determine when to recommend an evacuation order. This calculation can include the population-at-risk, shadow evacuees, as well as evacuees from other counties anticipated to pass through the county. Clearance time is developed to include the time required for evacuees to secure their homes and prepare to leave, the time spent by all vehicles traveling along the evacuation route network, and the additional time spent on the road caused by traffic and road congestion. Clearance time does not relate to the time any one vehicle spends traveling along the evacuation route network, nor does it guarantee vehicles will safely reach their destination once outside the County. The four clearance times that are calculated as part of the evacuation transportation analysis include: 1) Clearance Time to Shelter, 2) In-County Clearance Time, 3) Out of County Clearance Time, and 4) Regional Clearance Time. Definitions for these clearance times are found in Chapter IV of this volume.

Clearance times for each of the base scenarios are summarized in **Table ES-11** and **ES-12**, while clearance times for each of the operational scenarios are summarized in **Table ES-13** and **Table ES-14.**

Table ES-9 – Base Scenarios

	Scenario 1 Level A 2015	Scenario 2 Level B 2015	Scenario 3 Level C 2015	Scenario 4 Level D 2015	Scenario 5 Level E 2015
Demographic Data	2015	2015	2015	2015	2015
Highway Network	2015	2015	2015	2015	2015
One-Way Operations	None	None	None	None	None
University Population	Fall/Spring	Fall/Spring	Fall/Spring	Fall/Spring	Fall/Spring
Tourist Rate	Default	Default	Default	Default	Default
Shelters Open	Primary	Primary	Primary	Primary	Primary
Response Curve	12-hour	12-hour	12-hour	12-hour	12-hour
Evacuation Phasing	None	None	None	None	None
Behavioral Response	100%	100%	100%	100%	100%
Evacuation Zone	A	B	C	D	E
Counties Evacuating	Baker Clay Duval Flagler Putnam Nassau St. Johns Camden (GA) Volusia	Baker Clay Duval Flagler Putnam Nassau St. Johns Camden (GA) Volusia	Baker Clay Duval Flagler Putnam Nassau St. Johns Camden (GA) Volusia	Baker Clay Duval Flagler Putnam Nassau St. Johns Camden (GA) Volusia	Baker Clay Duval Flagler Putnam Nassau St. Johns Camden (GA) Volusia
	Scenario 6 Level A 2015	**Scenario 7 Level B 2015**	**Scenario 8 Level C 2015**	**Scenario 9 Level D 2015**	**Scenario 10 Level E 2015**
Demographic Data	2015	2015	2015	2015	2015
Highway Network	2015	2015	2015	2015	2015
One-Way Operations	None	None	None	None	None
University Population	Fall/Spring	Fall/Spring	Fall/Spring	Fall/Spring	Fall/Spring
Tourist Rate	Default	Default	Default	Default	Default
Shelters Open	Primary	Primary	Primary	Primary	Primary
Response Curve	12-hour	12-hour	12-hour	12-hour	12-hour
Evacuation Phasing	None	None	None	None	None
Behavioral Response	100%	100%	100%	100%	100%
Evacuation Zone	A	B	C	D	E
Counties Evacuating	Baker Clay Duval Flagler Putnam Nassau St. Johns Camden (GA) Volusia	Baker Clay Duval Flagler Putnam Nassau St. Johns Camden (GA) Volusia	Baker Clay Duval Flagler Putnam Nassau St. Johns Camden (GA) Volusia	Baker Clay Duval Flagler Putnam Nassau St. Johns Camden (GA) Volusia	Baker Clay Duval Flagler Putnam Nassau St. Johns Camden (GA) Volusia

Table ES-10 – 2015 Clearance Times for Base Scenario

	Evacuation Level A Base Scenario	Evacuation Level B Base Scenario	Evacuation Level C Base Scenario	Evacuation Level D Base Scenario	Evacuation Level E Base Scenario
Clearance Time to Shelter					
Baker County	13.0	14.0	14.0	14.0	15.0
Clay County	14.0	15.5	17.0	17.0	20.0
Duval County	14.0	17.0	18.5	23.0	34.0
Flagler County	12.5	12.5	12.5	12.5	12.5
Nassau County	17.0	20.0	21.0	27.0	34.5
Putnam County	13.5	14.0	15.0	16.0	17.5
St. Johns County	14.0	17.5	17.5	18.0	18.0
In-County Clearance Time					
Baker County	13.5	14.5	14.5	14.5	15.5
Clay County	14.0	17.0	18.5	24.5	26.0
Duval County	14.5	17.0	18.5	24.0	34.0
Flagler County	14.5	17.5	19.0	22.0	25.5
Nassau County	17.0	20.5	21.0	28.5	34.5
Putnam County	14.0	18.0	18.5	25.5	26.0
St. Johns County	14.5	17.5	19.0	21.5	25.0
Out of County Clearance Time					
Baker County	17.5	20.5	24.0	28.5	35.0
Clay County	14.5	18.0	21.0	27.5	33.0
Duval County	15.0	17.5	21.0	27.5	34.5
Flagler County	14.5	17.5	19.5	22.0	25.5
Nassau County	18.0	21.5	22.0	28.5	35.5
Putnam County	15.0	18.0	19.0	26.0	27.0
St. Johns County	14.5	17.5	19.0	21.5	25.0
Regional Clearance Time					
Northeast Florida	18.0	21.5	24.0	28.5	35.5

Table ES-11 – 2020 Clearance Times for Base Scenario

	Evacuation Level A Base Scenario	Evacuation Level B Base Scenario	Evacuation Level C Base Scenario	Evacuation Level D Base Scenario	Evacuation Level E Base Scenario
Clearance Time to Shelter					
Baker County	13.0	14.0	14.0	14.0	15.5
Clay County	14.0	16.5	17.0	18.5	21.5
Duval County	14.0	18.0	18.5	25.0	30.0
Flagler County	12.5	12.5	12.5	12.5	12.5
Nassau County	20.0	20.0	24.0	26.5	33.5
Putnam County	14.0	14.5	16.5	18.0	18.5
St. Johns County	14.5	18.5	19.0	19.0	19.0
In-County Clearance Time					
Baker County	13.5	14.5	14.5	14.5	16.0
Clay County	14.5	18.5	23.0	23.5	26.5
Duval County	15.0	18.5	19.0	25.0	30.0
Flagler County	15.0	18.5	20.5	21.0	27.0
Nassau County	20.0	21.0	26.0	32.5	37.0
Putnam County	14.5	19.0	20.5	21.5	25.5
St. Johns County	15.0	18.5	20.0	21.0	26.5
Out of County Clearance Time					
Baker County	19.5	21.5	25.5	31.0	37.5
Clay County	15.5	19.5	23.5	25.5	31.5
Duval County	15.0	20.5	22.5	25.5	33.0
Flagler County	15.5	19.0	20.5	21.5	27.0
Nassau County	21.0	22.0	28.0	34.5	38.5
Putnam County	15.0	19.5	23.5	24.5	27.5
St. Johns County	15.0	18.5	20.0	21.0	26.5
Regional Clearance Time					
Northeast Florida	21.0	22.0	28.0	34.5	38.5

Table ES-12 – Operational Scenarios

	Scenario 1 Level A 2015	Scenario 2 Level B 2015	Scenario 3 Level C w/ 1way 2015	Scenario 4 Level C 2015	Scenario 5 Level D 2015	Scenario 6 Level E 2015	Scenario 7 Level C+F 2015
Demographic Data	2015	2015	2015	2015	2015	2015	2015
Highway Network	2015	2015	2015	2015	2015	2015	2015
One-Way Operations	None	None	I-10	None	None	None	None
University Population	Fall/Spring	Fall/Spring	Fall/Spring	Fall/Spring	Fall/Spring	Fall/Spring	Fall/Spring
Tourist Rate	Default	Default	Default	Default	Default	Default	Default
Shelters Open	Primary	Primary	Primary	Primary	Primary	Primary	Primary
Response Curve	12-hour	12-hour	12-hour	12-hour	12-hour	12-hour	12-hour
Evacuation Phasing	None	None	None	None	None	None	None
Behavioral Response	Planning	Planning	Planning	Planning	Planning	Planning	Planning
Evacuation Zone	A	B	C	C	D	E	C + F
Counties Evacuating	Baker Clay Duval Flagler Putnam Nassau St. Johns Camden (GA) Volusia	Baker Clay Duval Flagler Putnam Nassau St. Johns Camden (GA) Volusia	Baker Clay Duval Flagler Putnam Nassau St. Johns Camden (GA) Volusia	Baker Clay Duval Flagler Putnam Nassau St. Johns Camden (GA) Volusia	Baker Clay Duval Flagler Putnam Nassau St. Johns Camden (GA) Volusia	Baker Clay Duval Flagler Putnam Nassau St. Johns Camden (GA) Volusia	Baker Clay Duval Flagler Putnam Nassau St. Johns Camden (GA) Volusia
	Scenario 8 Level A 2020	**Scenario 9 Level B 2020**	**Scenario 10 Level C 2020**	**Scenario 11 Level D 2020**	**Scenario 12 Level E w/ 1way 2020**	**Scenario 13 Level E 2020**	**Scenario 14 Level C+F 2020**
Demographic Data	2020	2020	2020	2020	2020	2020	2020
Highway Network	2020	2020	2020	2020	2020	2020	2020
One-Way Operations	None	None	None	None	I-10	None	None
University Population	Fall/Spring	Fall/Spring	Fall/Spring	Fall/Spring	Fall/Spring	Fall/Spring	Fall/Spring
Tourist Rate	Default	Default	Default	Default	Default	Default	Default
Shelters Open	Primary	Primary	Primary	Primary	Primary	Primary	Primary
Response Curve	12-hour	12-hour	12-hour	12-hour	12-hour	12-hour	12-hour
Evacuation Phasing	None	None	None	None	None	None	None
Behavioral Response	Planning	Planning	Planning	Planning	Planning	Planning	Planning
Evacuation Zone	A	B	C	D	E	E	C + F
Counties Evacuating	Baker Clay Duval Flagler Putnam Nassau St. Johns Camden (GA) Volusia	Baker Clay Duval Flagler Putnam Nassau St. Johns Camden (GA) Volusia	Baker Clay Duval Flagler Putnam Nassau St. Johns Camden (GA) Volusia	Baker Clay Duval Flagler Putnam Nassau St. Johns Camden (GA) Volusia	Baker Clay Duval Flagler Putnam Nassau St. Johns Camden (GA) Volusia	Baker Clay Duval Flagler Putnam Nassau St. Johns Camden (GA) Volusia	Baker Clay Duval Flagler Putnam Nassau St. Johns Camden (GA) Volusia

Table ES-13 – 2015 Clearance Times for Operational Scenarios

	Scenario 1 Level A 2015	Scenario 2 Level B 2015	Scenario 3 Level C w/ 1way 2015	Scenario 4 Level C 2015	Scenario 5 Level D 2015	Scenario 6 Level E 2015	Scenario 7 Level C+F 2015
Clearance Time to Shelter							
Baker County	13.0	13.5	13.5	13.5	13.5	14.0	13.5
Clay County	12.5	13.0	14.5	15.5	17.5	18.0	15.5
Duval County	12.5	13.0	14.0	14.0	18.0	20.5	15.0
Flagler County	12.5	12.5	12.5	12.5	12.5	12.5	12.5
Nassau County	14.0	16.5	17.0	18.0	20.5	24.5	18.0
Putnam County	13.0	13.0	13.5	14.0	15.5	16.5	14.0
St. Johns County	13.0	13.5	14.5	14.5	16.5	17.5	14.5
In-County Clearance Time							
Baker County	13.5	14.0	14.0	14.0	14.0	14.5	14.0
Clay County	13.5	13.5	14.5	15.5	17.5	21.5	15.5
Duval County	14.5	14.5	14.5	15.0	18.0	22.0	15.0
Flagler County	13.5	14.0	14.5	14.5	18.0	22.0	15.0
Nassau County	15.0	16.5	17.5	18.5	21.0	26.5	18.5
Putnam County	13.0	13.5	14.0	14.5	17.5	22.0	14.5
St. Johns County	13.5	13.5	14.5	14.5	18.0	21.5	15.0
Out of County Clearance Time							
Baker County	16.5	16.5	17.5	18.5	23.5	26.0	19.5
Clay County	13.5	14.0	15.5	17.5	19.0	23.5	18.0
Duval County	14.5	14.5	14.5	16.0	21.5	24.0	18.5
Flagler County	14.0	14.0	15.0	15.0	18.5	22.0	15.5
Nassau County	15.5	18.0	18.5	20.0	22.0	28.5	20.0
Putnam County	14.0	14.0	15.0	16.0	18.5	22.5	16.0
St. Johns County	13.5	13.5	14.5	14.5	18.0	21.5	15.0
Regional Clearance Time							
Northeast Florida	16.5	18.0	18.5	20.0	23.5	28.5	20.0

Table ES-14 – 2020 Clearance Times for Operational Scenarios

	Scenario 8 Level A 2020	Scenario 9 Level B 2020	Scenario 10 Level C 2020	Scenario 11 Level D 2020	Scenario 12 Level E w/ 1way 2020	Scenario 13 Level E 2020	Scenario 14 Level C + F 2020
Clearance Time to Shelter							
Baker County	13.0	14.0	14.0	14.0	13.0	15.0	14.0
Clay County	13.0	13.5	16.5	18.0	17.5	19.0	16.5
Duval County	12.5	16.5	19.0	19.0	28.5	24.5	19.5
Flagler County	12.5	12.5	12.5	12.5	12.5	12.5	12.5
Nassau County	14.5	16.5	20.5	25.5	30.0	30.0	20.5
Putnam County	13.0	13.5	14.5	16.0	18.0	18.0	14.5
St. Johns County	13.0	14.0	15.0	17.5	18.5	19.0	15.0
In-County Clearance Time							
Baker County	13.5	14.5	14.5	14.5	13.5	15.5	14.5
Clay County	13.5	14.0	17.5	22.5	28.0	24.5	17.5
Duval County	14.5	16.5	19.0	22.5	28.5	24.5	19.5
Flagler County	13.5	14.0	16.5	23.0	27.5	23.0	18.0
Nassau County	15.0	17.0	21.0	26.0	30.0	30.0	21.0
Putnam County	13.5	14.5	17.0	22.5	28.0	22.5	18.5
St. Johns County	14.0	14.0	16.5	23.0	27.5	23.0	18.0
Out of County Clearance Time							
Baker County	16.5	17.5	23.0	23.0	33.0	36.0	25.5
Clay County	13.5	16.0	20.5	22.5	31.0	25.0	22.5
Duval County	14.5	17.0	21.5	22.5	32.0	26.5	22.5
Flagler County	14.0	14.5	16.5	23.0	27.5	23.0	18.5
Nassau County	16.5	18.0	22.5	26.0	32.0	32.5	22.5
Putnam County	14.0	15.0	17.0	23.0	28.5	25.0	18.5
St. Johns County	14.0	14.0	16.5	23.0	27.5	23.0	18.0
Regional Clearance Time							
Northeast Florida	16.5	18.0	23.0	26.0	33.0	36.0	25.5

Clearance times reported for all scenarios reflect impacts from changes in population from the 2000 and 2010 U.S. Census. The 2010 SRESP study used 2000 U.S. Census data for its base and forecasts using characteristics from American Community Survey for 2006, 2010, and 2015. For the 2013 update to the SRESP, data from the 2010 U.S. Census indicate a decrease in population for the Region as compared to the previous study's 2010 and 2015 population projections. In addition to this decrease, the distribution of the population in the NEFRC 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 NEFRC region. County emergency managers also submitted revised evacuation zones for the six counties within the Region. These changes have impacts on the resulting clearance times reported for 2015 and 2020 of this study update and generally results in lower clearance times as compared to the previous 2010 study. Since the methodology and approach differs in major input variables (a decrease in regional population, re-defined evacuation zones, additional roadway and shelter capacity), SRESP users should be mindful when comparing results from the previous study and the updated study.

Base Scenarios

In-county clearance times for the base scenarios range from 13.5 hours for the evacuation level A scenarios to 34.5 hours in Nassau County for evacuation level E scenario in 2015. Clearance Time to Shelter clearance times for the base scenarios ranging from 12.5 hours for the evacuation level A scenarios to 34.5 hours in Nassau County for evacuation level E scenario in 2015.

In 2020, in-county clearance times for the base scenarios range from 13.5 hours for the evacuation level A scenarios to 37 hours for the evacuation level E scenario. Clearance Time to Shelter clearance times for the base scenarios ranging from 12.5 hours for the evacuation level A scenarios to 33.5 hours for evacuation level E scenario in 2020.

Out of county clearance times for the base scenarios range from 14.5 hours for the base evacuation level A scenario to 35.5 hours for the evacuation level E scenario in 2015. Out of county clearance times range from 15.0 hours for the base evacuation level A scenario to 38.5 hours in 2020.

Regional clearance time for the seven county NEFRC region ranges from 18 hours to 35.5 hours in 2015 and from 21 and 38.5 hours in 2020. Overall, when clearance times between years 2015 and 2020 are compared, there are decreases in clearance times in response to changes in the evacuation roadway network from roadway improvements located in Clay, Duval, Nassau, and St. Johns Counties.

Operational Scenarios

In-county clearance times for the 2015 operational scenarios range from 13.0 hours to 26.5 hours depending upon the scenario. Clearance Time to Shelter shows a similar pattern, with clearance times for the operational scenarios ranging from 12.5 hours to 24.5 hours depending upon the county and the scenario.

In 2020, in-county clearance times for the operational scenarios vary from 13.5 hours to 30 hours depending upon the scenario. Clearance Time to Shelter shows a similar pattern, with

clearance times for the base scenarios ranging from 12.5 hours to 30 hours depending upon the scenario.

Out of county clearance times for the 2015 operational scenarios range from 13.5 hours to 28.5 hours for the evacuation level E scenario. Out of county clearance times range from 13.5 hours to 36 hours in 2020 depending upon the scenario. Regional clearance time for the seven county NEFRC region ranges from 16.5 hours to 28.5 hours in 2015. This time ranges from 16.5 to 36 hours in 2020.

Two scenarios, one in 2015 and one in 2020, investigated the impacts of implementing the one-way flow plan for I-10. In 2015, the one-way flow plan provided a reduction of 1.5 hours during a level C evacuation, decreasing regional clearance time from 20.5 hours in Scenario 4 to 18.5 hours in Scenario 3. In 2020, implementation of the one-way flow plan provided mixed results due to the significant levels of congestion. On a regional basis, the regional clearance time was reduced by 3 hours to 33 hours in Scenario 12 compared to 36 hours in Scenario 13. However, the regional clearance time is based on the out-of-county clearance time for Baker County which is the only county to see improvements to their out-of-county clearance time with implementation of the one-way flow plan for I-10. Clay, Duval, Flagler, Putnam, and St. Johns counties saw significant increases from 4.5 to 6 hours to their out-of-county clearance times, indicating adverse impacts from the high congestion caused by the implementation of the I-10 one-way flow plan.

Two scenarios, one in 2015 and one in 2020, investigated the impacts of evacuating populations and their vehicles from areas designated as zone F during a level C evacuation. In 2015, evacuating vehicles from zone F areas did not significantly impact the overall regional clearance time for the region. However, there are clearance time impacts on the out-of-county clearance times for several counties within the region. In 2015, Baker, Clay, Duval, Flagler, and St. Johns saw out-of-county clearance time increase from 0.5 to 2.5 hours in Scenario 7 compared to Scenario 4.

In 2020, addition of the F zone on the operational C scenario resulted in increases in both the regional and out-of-county clearance times. The regional clearance time for Scenario 14 increased by 2.5 hours compared to Scenario 10, with several counties seeing increases from 1 to 2.5 hours in regards to out-of-county clearance times. Some county clearance times were either unchanged or had small decreases, which is a result of changes in evacuating vehicle roadway choice between Level C scenarios with and without evacuating zone F areas. This underscores the importance of the concentration and distribution of the NEFRC region's population within areas designated as zone F. The origin of zone F evacuees influences the location and intensity of congestion along the evacuation roadway network.

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 2015 is identified in **Table ES-15** and for 2020 in **Table ES-16**.

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

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

	Evacuation Level A	Evacuation Level B	Evacuation Level C	Evacuation Level D	Evacuation Level E
Estimated Evacuating Population Clearing Baker County					
12-Hour	8,621	7,835	7,099	6,320	5,425
18-Hour	12,572	11,753	10,649	9,481	8,138
24-Hour		13,385	14,198	12,641	10,851
36-Hour				15,011	15,824
Estimated Evacuating Population Clearing Clay County					
12-Hour	42,321	43,607	62,359	52,716	46,053
18-Hour	51,138	65,410	93,539	79,074	69,080
24-Hour			109,129	105,432	92,106
36-Hour				120,807	126,646
Estimated Evacuating Population Clearing Duval County					
12-Hour	224,180	235,309	267,851	235,091	211,792
18-Hour	280,225	343,159	401,777	352,636	317,689
24-Hour			468,740	470,182	423,585
36-Hour				538,750	608,903
Estimated Evacuating Population Clearing Flagler County					
12-Hour	21,235	26,515	27,537	31,120	30,839
18-Hour	25,659	38,667	41,305	46,680	46,258
24-Hour			44,747	57,053	61,677
36-Hour					65,532
Estimated Evacuating Population Clearing Nassau County					
12-Hour	38,307	32,825	35,213	28,169	23,420
18-Hour	57,461	49,238	52,819	42,253	35,129
24-Hour		58,812	64,557	56,338	46,839
36-Hour				66,901	69,283
Estimated Evacuating Population Clearing Putnam County					
12-Hour	31,310	26,928	28,185	21,714	22,479
18-Hour	39,137	40,392	42,278	32,570	33,718
24-Hour			44,627	43,427	44,957
36-Hour				47,046	50,577
Estimated Evacuating Population Clearing St. Johns County					
12-Hour	85,767	101,824	97,953	91,436	82,327
18-Hour	103,635	148,494	146,930	137,153	123,491
24-Hour			155,093	163,822	164,654
36-Hour					171,515

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 Baker County					
12-Hour	8,325	8,040	7,192	6,255	5,451
18-Hour	12,487	12,060	10,787	9,382	8,177
24-Hour	13,528	14,405	14,383	12,509	10,902
36-Hour			15,282	16,158	17,035
Estimated Evacuating Population Clearing Clay County					
12-Hour	44,107	44,850	62,052	63,308	53,727
18-Hour	56,971	67,275	93,078	94,962	80,591
24-Hour		72,881	121,518	126,616	107,454
36-Hour				134,529	141,034
Estimated Evacuating Population Clearing Duval County					
12-Hour	234,465	210,042	261,367	265,024	231,454
18-Hour	293,081	315,063	392,051	397,536	347,181
24-Hour		358,822	490,064	530,048	462,908
36-Hour				563,176	636,499
Estimated Evacuating Population Clearing Flagler County					
12-Hour	23,697	29,089	31,186	37,937	34,704
18-Hour	30,609	43,633	46,779	56,905	52,055
24-Hour		46,057	53,276	67,970	69,407
36-Hour					78,083
Estimated Evacuating Population Clearing Nassau County					
12-Hour	35,071	34,267	29,559	24,858	23,070
18-Hour	52,606	51,400	44,339	37,287	34,604
24-Hour	61,374	62,822	59,119	49,716	46,139
36-Hour			68,972	71,467	74,015
Estimated Evacuating Population Clearing Putnam County					
12-Hour	31,663	25,138	23,048	23,308	22,325
18-Hour	39,579	37,707	34,572	34,963	33,488
24-Hour		40,849	45,136	46,617	44,650
36-Hour				47,588	51,162
Estimated Evacuating Population Clearing St. Johns County					
12-Hour	96,018	111,502	107,732	108,365	89,899
18-Hour	120,023	167,253	161,599	162,548	134,849
24-Hour		171,899	179,554	189,639	179,798
36-Hour					198,527

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 24 different scenarios (10 base and 14 operational), several conclusions could be reached including the following:

- Critical transportation facilities within the NEFRC region include I-10, I-95, SR 9A, SR 2, SR 16, SR 228, US 17, US 301, US 90, and CR 127. During the level A evacuation scenarios, the roadway segments with the highest vehicle queues are primarily concentrated along major Interstate and State Highway system. In contrast, for the level E evacuation scenarios, the roadway segments with the highest vehicle queues include other roadways, such as SR 23, SR 21, SR 100, US 1, and several county roads. Outside the region, US 301, I-95, and US 17 are also critical facilities in Georgia;

- 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 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 5-4) to estimate fuel and supply requirements along major evacuation routes to aid motorists during the evacuation process;

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

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

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

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CHAPTER I
INTRODUCTION

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

A. Background and Purpose

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

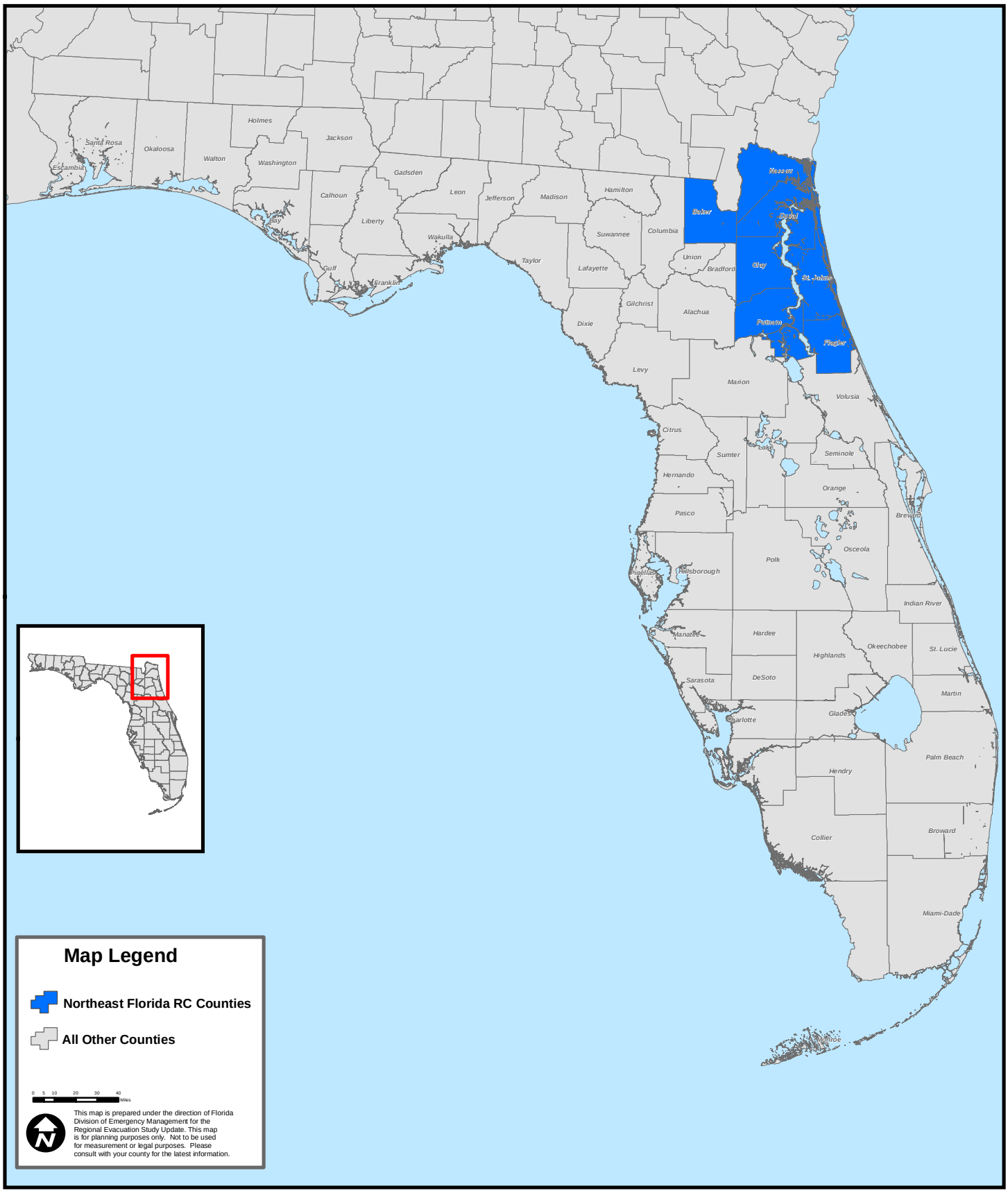
One of the objectives of the SRESP is to create consistent and integrated regional evacuation data and mapping, and by doing so, to facilitate knowledge sharing between state, regional, county, and local partners. To achieve this objective, it is important for all Regional Planning Councils to adopt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

B. Study Area

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

Figure I-1

Northeast Florida Regional Council



Map Legend

Northeast Florida RC Counties

All Other Counties

0 5 10 20 30 40 Miles

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

Sources: Northeast Florida Regional Council, CDM Smith

Map Printed: April, 2014

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 this SRESP Northeast Florida Regional Study completed in 2012 and 2014, four meetings were held at the local and regional level to receive updated input from local county emergency management and the regional planning council. The four meetings held in the Northeast Florida region included the following:

Regional Meeting No. 1 – Scenario Development Update Meeting
The first meeting for the Northeast Florida region was held on December 7, 2012 at 1:00 PM. The purpose of the scenario development update meeting was to review the Northeast 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 regional meeting was held on June 28, 2013 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 report.

Regional Meeting No. 3 – Transportation Analysis Update Meeting
The third regional meeting for the Northeast Florida region was held on August 28, 2013 at 1:30 PM. The purpose of the transportation analysis meeting was to review the revised draft results of the transportation analysis and receive any additional feedback on the draft report.

Regional Meeting No. 4 – Transportation Analysis Update Meeting
The fourth and final regional meeting for the Northeast Florida region was held on March 26, 2014 at 10:00 AM. The purpose of the transportation analysis meeting was to review the revised draft results of the transportation analysis and receive any additional feedback on the draft final report.

D. Study Comparisons

It is important to note that the 2013 Northeast Florida Regional Evacuation Study contains significant updates and revisions in comparison to the 2010 Regional Evacuation Study for the Northeast Florida region. These revisions include updates to population projections based on the 2010 census, new evacuation zones based on updated storm surge 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 2010 Northeast Florida Regional Evacuation Study difficult.

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CHAPTER II
EVACUATION MODELING METHODOLOGY AND FRAMEWORK

The evacuation modeling methodology and framework was developed during 2008 and 2009 in coordination with all eleven Regional Planning Councils and the Division of Emergency Management, and updated in 2012 to incorporate F evacuation zones. The methodology used in this Northeast Florida Region Evacuation Transportation Analysis was updated to accommodate new versions of Cube Voyager and Cube Avenue software and is summarized in the following sections.

A. Behavioral Assumptions

In 2008, the Statewide Regional Evacuation Study Program (SRESP) commissioned a survey of Florida residents. The purpose of this survey was to develop an understanding of the behavior of individuals when faced with the prospect of an impending evacuation. These data were used to develop a set of "planning assumptions" that describe the way people respond to an order to evacuate and are an important input to the SRESP Evacuation Model. The behavioral data provides insights into how people respond to the changing conditions leading up to and during an evacuation.

The primary application of the survey data was to help anticipate how people would respond with respect to five behaviors:

- How many people would evacuate?
- When they would leave?
- What type of refuge they would seek?
- Where they would travel for refuge?
- How many vehicles would they use?

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

- Type of dwelling unit (site-built home versus mobile home);
- The evacuation zone in which the evacuee reside; and,
- The intensity of the evacuation that has been ordered.

How many people?

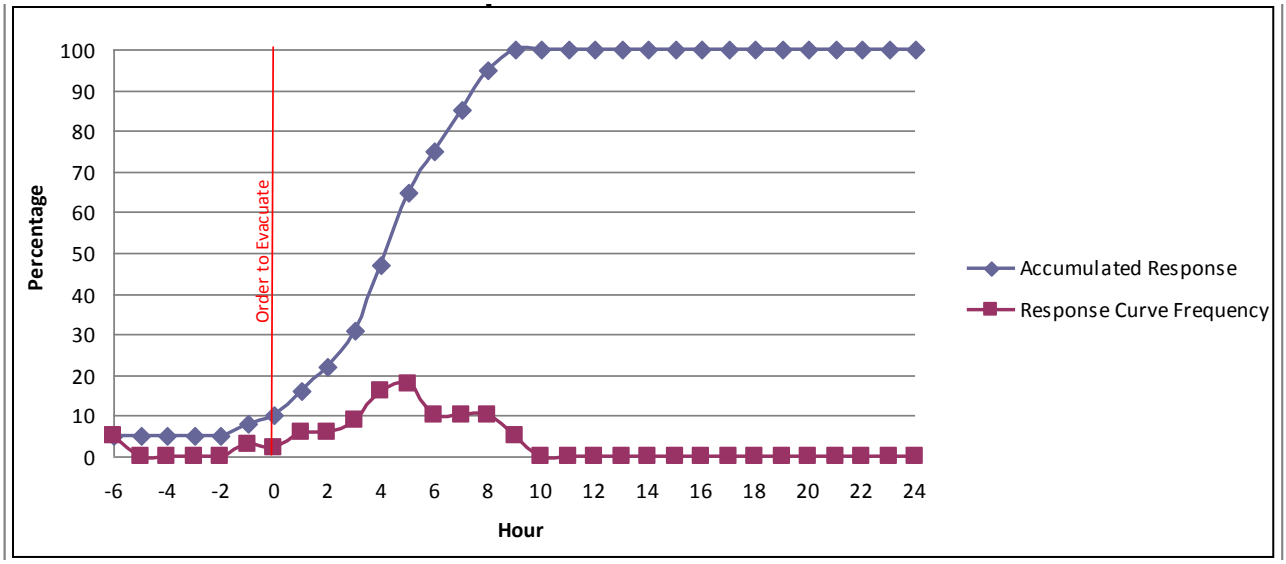
The evacuation rate indicates the percent of residents who will leave their homes to go someplace safer in each storm threat scenario. The evacuation rates are based on the following assumptions: that the storm track passes very close to the area being evacuated; and officials order evacuation for surge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

When will they leave?

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

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

Figure II-1 – Nine Hour Response Curve



What type of refuge would be sought?

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

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

Where will they travel?

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

How many vehicles are used?

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

B. Zone System and Highway Network

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

Zone System

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

The Northeast Florida Regional Council developed their small area data by utilizing Census 2010 geography. Data were developed for the following years: 2010, 2015, and 2020.

Traffic Evacuation Zones (TEZ)

Small area data geographies were aggregated into larger units known as Traffic Evacuation Zones (TEZ). These TEZ form the basic unit of analysis in the evacuation model similar to how traffic analysis zones form the basic unit of analysis in a standard travel demand model. The TEZ system was developed so that the small area geographies will nest completely within one TEZ or another. This eliminates any potential for split data and will ensure that data in the TEZ

system can always be updated with relative ease.

The final TEZ system for the State of Florida has 8,829 zones. This number provides sufficient detail to accurately accommodate the assignment of evacuation trips onto an evacuation network. Furthermore, additional roadway segments have been included in the model's highway network to facilitate the movement of evacuation trips onto and off of the evacuation network. Each TEZ has a unique identification number that will be used by the model to connect evacuation trip generation to the evacuation highway network.

Highway Network

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

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

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

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

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

- Microsoft and Google aerials and maps – These aerial maps were used to identify and clarify roadway alignments. Whenever questions concerning the existence of particular facilities, their characteristics, or their alignments arose, aerials were referenced.

Changes to the Florida Statewide Model Network

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

- The original database, which was coded for a 2005 base year, was updated to 2010 conditions to correspond to the SRESP base year;
- Additional facilities had to be added to the network to accommodate evacuation traffic behavior;
- Many attributes from the original data set were removed and new ones were added specifically tailored for trip activity for evacuation modeling purposes;

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

Capacities

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

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

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

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

Speeds

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

Roadway Attributes

The roadway attributes contain the highway characteristics for each link in the highway

network. Some of the attributes like DISTANCE, FTYPE, ATYPE, etc., were retained from the highway network database and other attributes like DENSITY and EVAC_RTE are specific to the evacuation modeling and were included in the network.

Reverse Lane Operations

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

C. Background Traffic

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

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

Methodology used to Account for Background Traffic

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

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

throughout the state. These characteristics were analyzed to determine how much capacity is available throughout a given day during an evacuation.

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

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

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

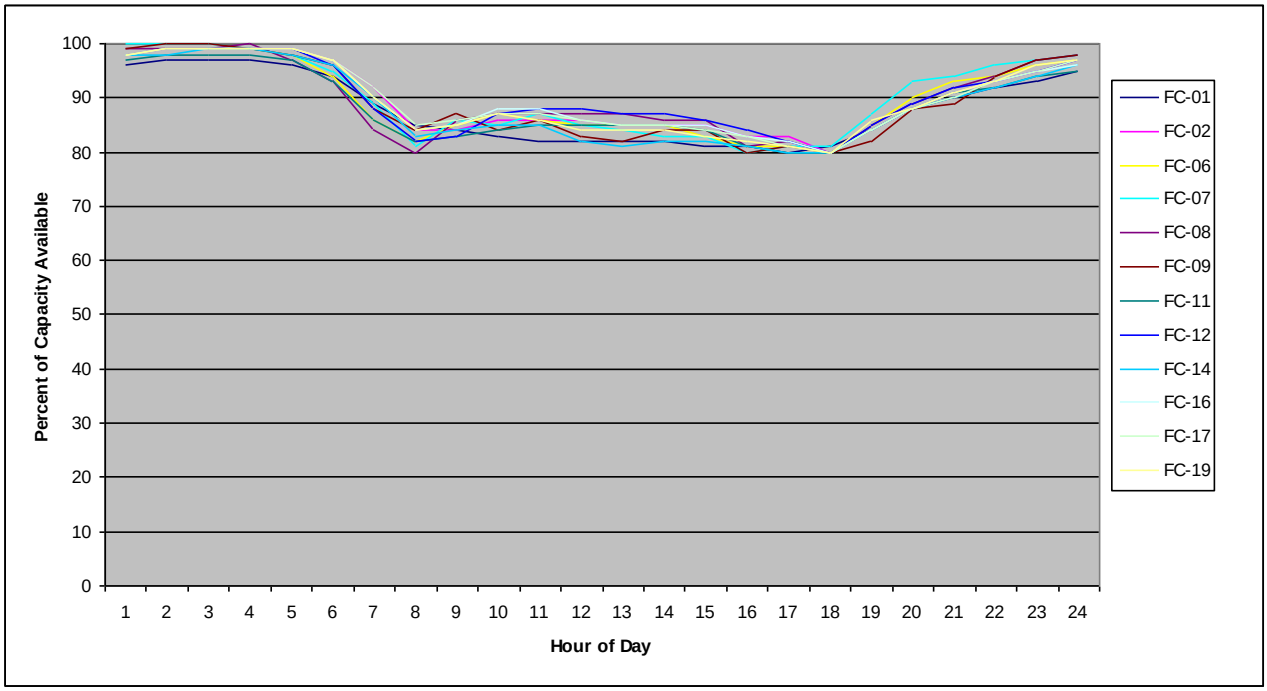
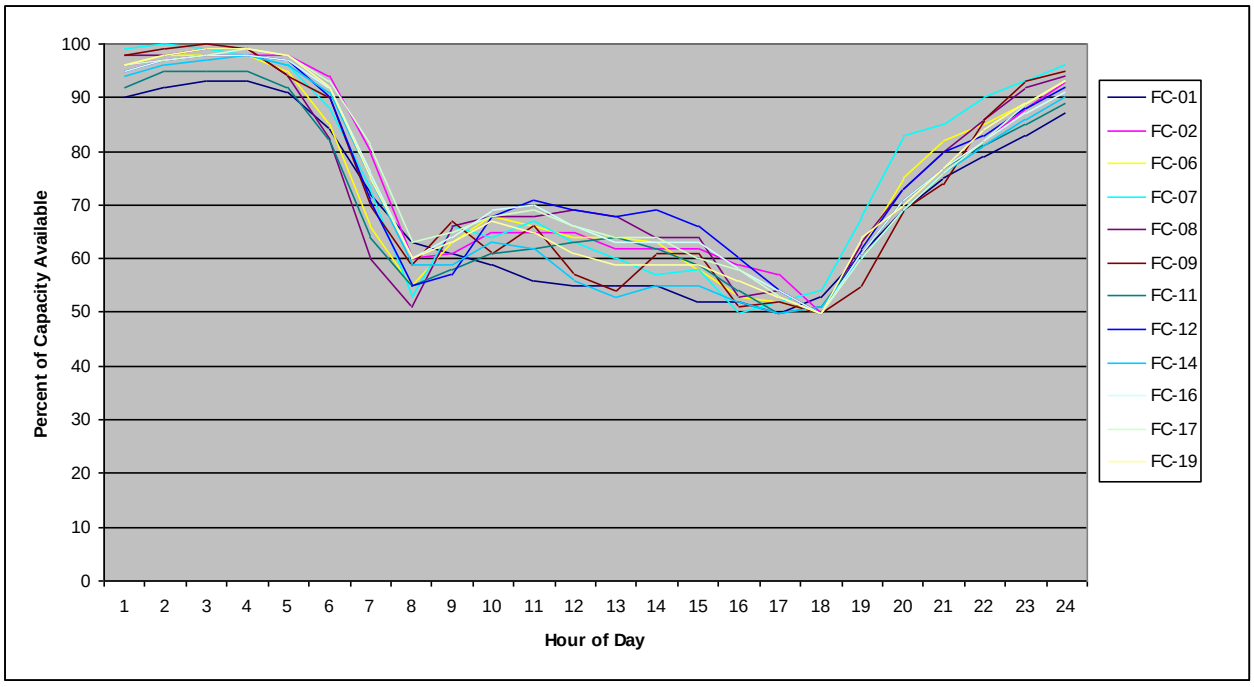


Figure II-3 – Percent of Available Capacity for Other Counties

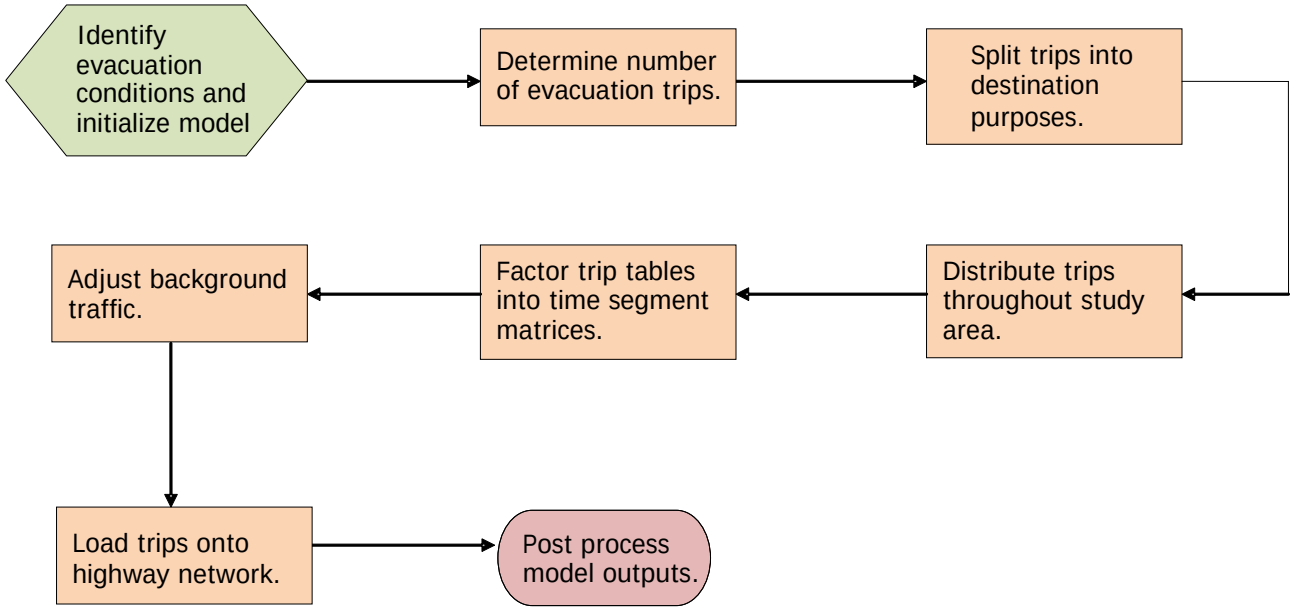


D. Evacuation Traffic

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

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

Figure II-4 - General Model Flow



Initializing the Model

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

Number of Evacuating Trips

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

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

Production Ends

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

Attraction Ends

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

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

Splitting Trips into Destination Purposes

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

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

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

Trip End Balancing

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

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

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

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

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

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

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

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

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

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

CHAPTER III
REGIONAL MODEL IMPLEMENTATION

The evacuation transportation model discussed in Chapter II includes several components that are completed using a statewide dataset (determine number of evacuation trips, split trips into destination purposes, and distribute trips throughout state) and several components that can only be completed at the regional level (factor trip tables into time segment matrices, adjust background traffic, and load trips onto the highway network) due to computer run time limitations with the model software. Thus, for the regional level steps, each RPC throughout the State needed to decide on a regional model network to complete the analysis in their region. For the Northeast Florida region, the regional model network includes the seven counties within the Northeast Florida Regional Council area plus 22 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 Northeast Florida region. It is important to note that the input data discussed in this chapter is included only for the counties within the Northeast Florida region, as these are the counties that the Northeast Florida region has direct responsibility for the data. Data for the adjacent counties included in the Northeast 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

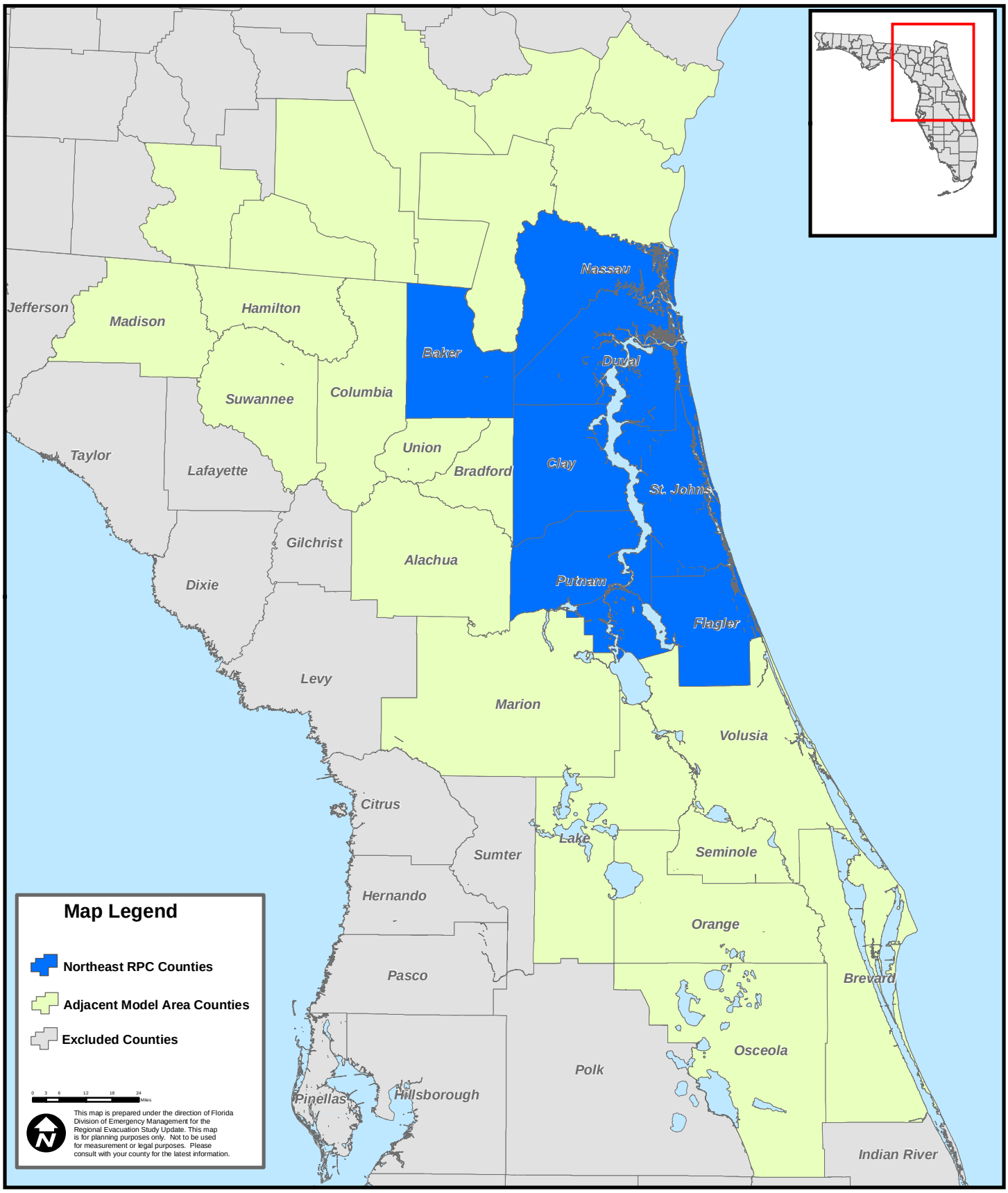
The road network is a key component of the evacuation model. The roadway variables in the network include area type, functional class, number of through lanes, capacity, speed, and several others. The regional model network consists of the NEFRC designated evacuation routes as well as a supporting roadway network that facilitates movement of evacuation traffic. The 2005 Florida Department of Transportation (FDOT) Statewide Model Network (the latest model available) was used as a basis for developing the regional model network, while the evacuation routes were obtained from the Northeast Florida region. The NEFRC relied on the emergency managers of its constituent counties to provide it with information on which roads were to be included as evacuation routes. The resulting model network was updated to 2010 conditions and is referred to as the base model network. **Figure III-2** identifies the model network and evacuation routes for the NEFRC. County level details of the regional model network are provided in the Volume 5 report. The regional model network for the Northeast Florida region includes key roadways within the seven county region, including I-10, I-95, I-295, US 301, US 23, US 17, US 1, SR 228, SR 207, SR 206, SR 200, SR 121, SR 100, SR 20, SR 21, SR 16, SR 2, SR A1A, SR 9A, and SR 11.

B. Regional Zone System

The regional zone system is based on Traffic Evacuation Zones (TEZs) 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 individuals in the region reside, as well as where the

Figure III-1

Northeast Florida Regional Model Area

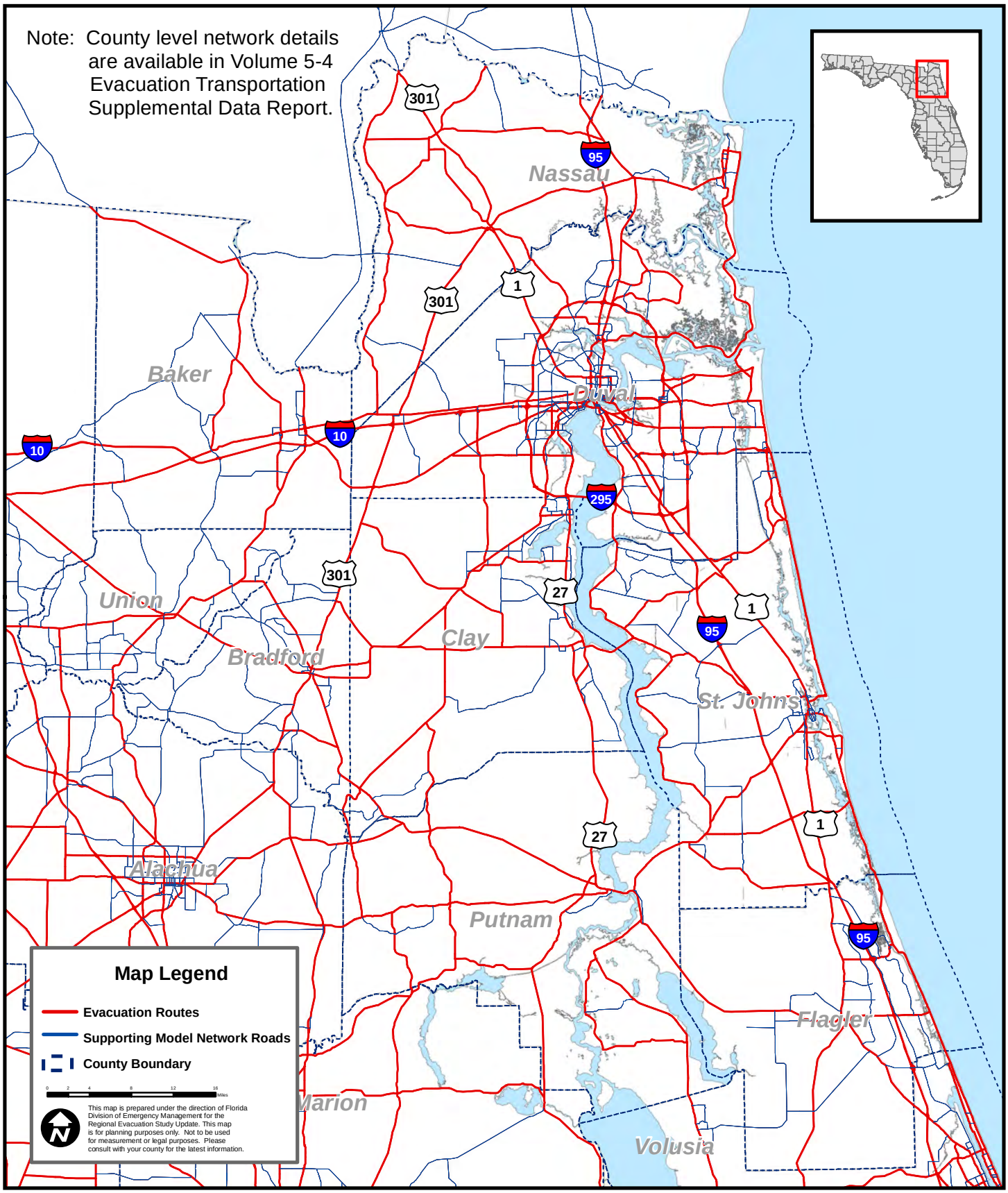


Sources: Northeast Florida Regional Council, CDM Smith

Map Printed: April, 2014

Figure III-2

Northeast Florida Regional Model Network



Sources: Northeast Florida Regional Council, CDM Smith

Map Printed: April, 2014

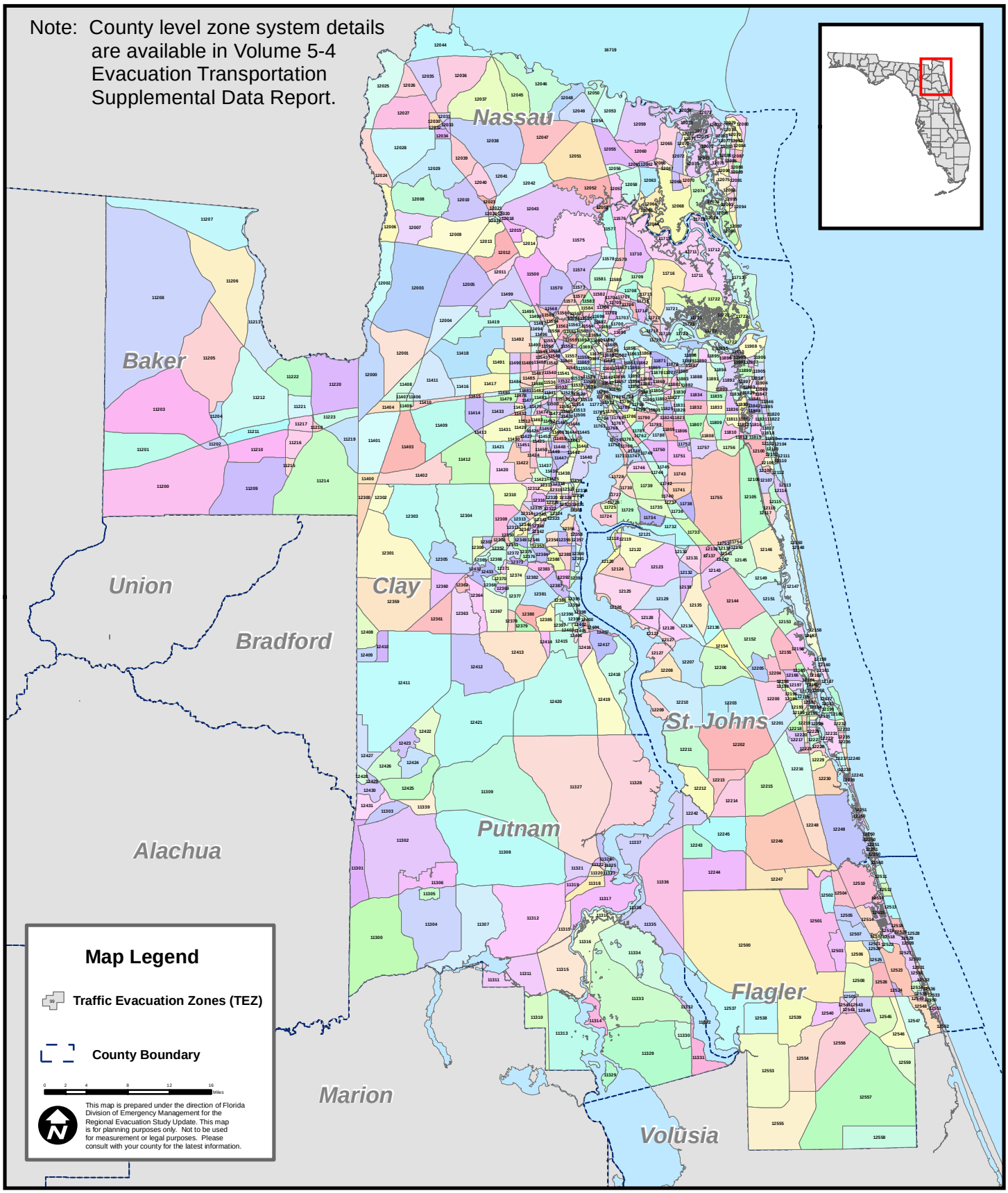
vulnerable populations are located. The TEZs are aggregations of the smaller small area data geographies provided by the NEFRC. Each traffic evacuation zone has a unique identification number that is used by the model to connect evacuation trip generation to the evacuation highway network. There is a 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, 1,025 of the zones are located within the seven county Northeast Florida region, as illustrated in **Figure III-3**, which has not changed since the 2010 SRESP Study. In the Northeast Florida region, Duval County has the largest number of TEZs with 516, and St. Johns County follows with 152 TEZs. Baker and Putnam Counties have the lowest number of TEZs within the region with 24 and 40 TEZs, respectively. The larger number of TEZs generally reflects counties with denser urban form and higher population densities. The number of TEZs for each county in the region is listed below:

- Baker – 24
- Clay – 134
- Duval – 516
- Flagler – 61
- Nassau – 98
- Putnam – 40
- St. Johns – 152

Figure III-3

Northeast Florida Regional Model Transportation Evacuation (TEZ) Zone System



Sources: Northeast Florida Regional Council, CDM Smith

Map Printed: April , 2014

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 Northeast Florida region 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.

Duval County has the largest population in the region during all three time periods. The county is expected to reach over 900,000 people by 2020. Clay County has the second largest population for all years and is expected to exceed 225,000 people by 2020. The county with the lowest population in the region is Baker County, which is projected to have 27,871 people in 2020. Between 2010 and 2020, Duval and Putnam Counties are also projected to experience the smallest rates of growth. Duval County is estimated to increase by 7.7% while Putnam County increased by approximately 19 residents. In contrast, Flagler County is expected to grow by 32.8% between 2010 and 2020.

Duval County has the highest number of mobile homes for all three time periods. Although Duval County has the most mobile homes, the homes only represent a little more than 5.3% of the total occupied homes. Flagler and Baker Counties have the lowest number of mobile homes. The mobile homes in Flagler County account for a little less than 5.1% of total occupied homes; however, in Baker County mobile homes comprise over 43% of the total occupied homes in that county.

Table III-1 - Northeast Florida Demographic Characteristic Summary

County	Characteristic	Year		
		2010	2015	2020
Baker	Occupied site-built homes	5,311	5,512	5,583
	Population in site-built homes	14,536	15,224	16,355
	Occupied mobile homes	3,460	3,628	4,306
	Population in mobile home	10,234	10,655	11,516
	Hotel/motel units	147	147	147
Clay	Occupied site-built homes	59,567	63,775	70,995
	Population in site-built homes	164,093	174,855	194,875
	Occupied mobile homes	9,222	9,838	10,960
	Population in mobile home	25,515	27,299	30,419
	Hotel/motel units	1,416	1,416	1,416
Duval	Occupied site-built homes	324,088	332,957	348,228
	Population in site-built homes	797,528	820,808	858,503
	Occupied mobile homes	18,463	19,012	19,912
	Population in mobile home	46,923	48,757	50,994
	Hotel/motel units	18,017	18,017	18,017
Flagler	Occupied site-built homes	37,165	41,075	49,150
	Population in site-built homes	90,933	101,152	120,547
	Occupied mobile homes	2,023	2,221	2,661
	Population in mobile home	4,739	5,448	6,499
	Hotel/motel units	935	935	935
Nassau	Occupied site-built homes	21,763	22,876	25,291
	Population in site-built homes	53,331	57,740	62,169
	Occupied mobile homes	6,928	7,338	8,105
	Population in mobile home	19,161	20,491	22,349
	Hotel/motel units	1,816	1,816	1,816
Putnam	Occupied site-built homes	17,810	17,614	17,815
	Population in site-built homes	43,311	42,831	43,334
	Occupied mobile homes	11,600	11,459	11,600
	Population in mobile home	29,650	29,303	29,646
	Hotel/motel units	618	618	618
St. Johns	Occupied site-built homes	67,791	76,389	88,900
	Population in site-built homes	168,553	189,387	219,583
	Occupied mobile homes	7,546	8,433	9,839
	Population in mobile home	18,686	20,955	24,301
	Hotel/motel units	5,481	5,481	5,481

Source: Northeast Florida Regional Council

D. Planned Roadway Improvements

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

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

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

Table III-2 - Northeast Florida Region Roadway Improvements, 2011 – 2015

County	Roadway	From	To	Number of Lanes
Duval	Beach Blvd (US 90 / SR 212)	@ ICWW		6
	Hodges Blvd	Atlantic Blvd	Beach Blvd	4
	Kernan Blvd	Matthew Unger Dr	Glen Kerrnan Pkwy	6
	Kernan Blvd	McCormick Rd	Matthew Unger Dr	4
	New World Ave	103rd St	Branan Field/Chaffee Rd	4
	Old St. Augustine Rd	@ I-295		6
	Old St. Augustine Rd	Hood Landing Rd	I-95	5
	Tallulah Ave (SR 111)	68th St	Main St	2
	US 301	(future) Baldwin Bypass	Nassau County Line	4
Nassau	US 301	Duval County Line	South of Callahan	4
St. Johns	CR 210	US 1	CR 210A	4
	CR 210	Russell Sampson Rd	CE Wilson Rd	6
	CR 2209	Racetrack Rd	CR 244	4
	CR 2209	CR 244	CR 210	4
	CR 244	CR 210	SR 16A	2
	International Golf Parkway	Royal Pines Pkwy	SR 16	4
	Pacetti Road	Samara Lakes	SR 16	4
	SR 207	Holmes Blvd	SR 312	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 - Northeast Florida Planned Roadway Improvements, 2016–2020

County	Roadway	From	To	Number of Lanes
Clay	Cheswick Oak Ave Extension	Branan-Field Rd (SR 23)	Cheswick Oak Ave	4
	College Dr. Extension	Blanding Blvd (SR 21)	Cheswick Oak Ave	4
	First Coast Outer Beltway	I-10	Blanding Blvd (SR 21)	6
Duval	Branan-Field/Chaffee Rd (SR 23)	103rd St (SR 134)	New World Ave.	6
	SR 9A (I-295)	Heckscher Dr (SR 105)	I-95 (North)	6
	SR 9B	I-95	US1	4
	First Coast Outer Beltway	I-10	Blanding Blvd (SR 21)	6
Nassau	SR A1A	I-95	Still Quarters Rd	6
	SR A1A	Still Quarters Rd	Ruben Ln	6
	SR A1A	Ruben Ln	Scott Rd	6
	Chester River Rd	SR A1A	Green Pine Rd	4
St. Johns	SR 313 (SR 312 Extension)	SR 207	CR 214 (King St)	4
	SR 313 (SR 312 Extension)	CR 214 (King St)	SR 16	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 Northeast Florida Region, evacuation rates for site-built homes and mobile/manufactured homes are provided by county and summarized in **Figure III-4** through **Figure III-15**. Other rates, such as out of county trip rates, vehicle use rates, public shelter use rates, friend/relative refuge use rates, hotel/motel refuge use rates, and other refuge use rates, are detailed by county, storm threat, and evacuation zone in Volume 5-4.

A review of the evacuation rates for the Northeast 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 Clay County for persons living in evacuation zone A, the county could expect a 45 percent participation rate from persons living in site-built homes in evacuation zone A (Figure III-4) and a 65 percent participation rate from persons living in mobile/manufactured homes in evacuation zone A (Figure III-5). In addition, Clay County can expect shadow evacuations to occur for persons living in site-built homes at a rate of 15 percent from evacuation zone B, and 15 percent from zone C/D/E (Figure III-4). Likewise, for persons living in mobile/manufactured homes, Clay County can expect shadow evacuations to occur at a rate of 65 percent from evacuation zone B and 60 percent from zone C/D/E (Figure III-5).

Please note that the original behavioral response rates provided by the SRESP in Volume 2 were modified to fit the evacuation zones created by Clay, Nassau, and Putnam Counties. The original rates were based on a five zone system; however, the evacuation zones for those counties range from three to five zones depending upon the county. In addition, a new evacuation zone F was included for Duval, Flagler, Nassau, and St. Johns Counties. Zone F uses the same behavioral response rates as zone A. The evacuation zone systems for Duval, Flagler, Nassau, Putnam, and St. Johns are listed below:

- Clay – 3 zones: Zone A, Zone B, Zone C/D/E;
- Duval – 6 zones: Zone A, Zone B, Zone C, Zone D, Zone E, Zone F;
- Flagler – 6 zones: Zone A, Zone B, Zone C, Zone D, Zone E, Zone F;
- Nassau – 5 zones: Zone A/B, Zone C, Zone D, Zone E, Zone F;
- Putnam – 4 zones: Zone A, Zone B, Zone C, Zone D/E; and,
- St. Johns – 6 zones: Zone A, Zone B, Zone C, Zone D, Zone E, Zone F.

A discussion of the newly identified evacuation zone F is included in section G.

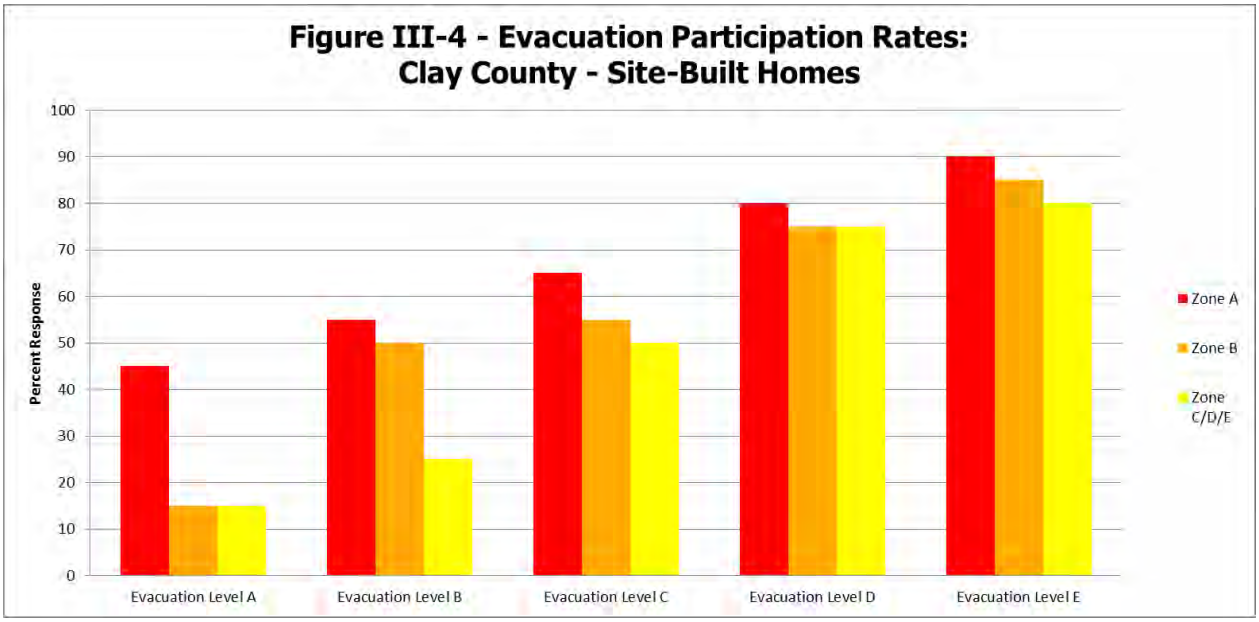


Figure III-4 - Evacuation Participation Rates:
Clay County - Site-Built Homes
Percent Response
100
90
80
70
60
50
40
30
20
10
0
Evacuation Level A
Evacuation Level B
Evacuation Level C
Evacuation Level D
Evacuation Level E
Zone A
Zone B
Zone C/D/E

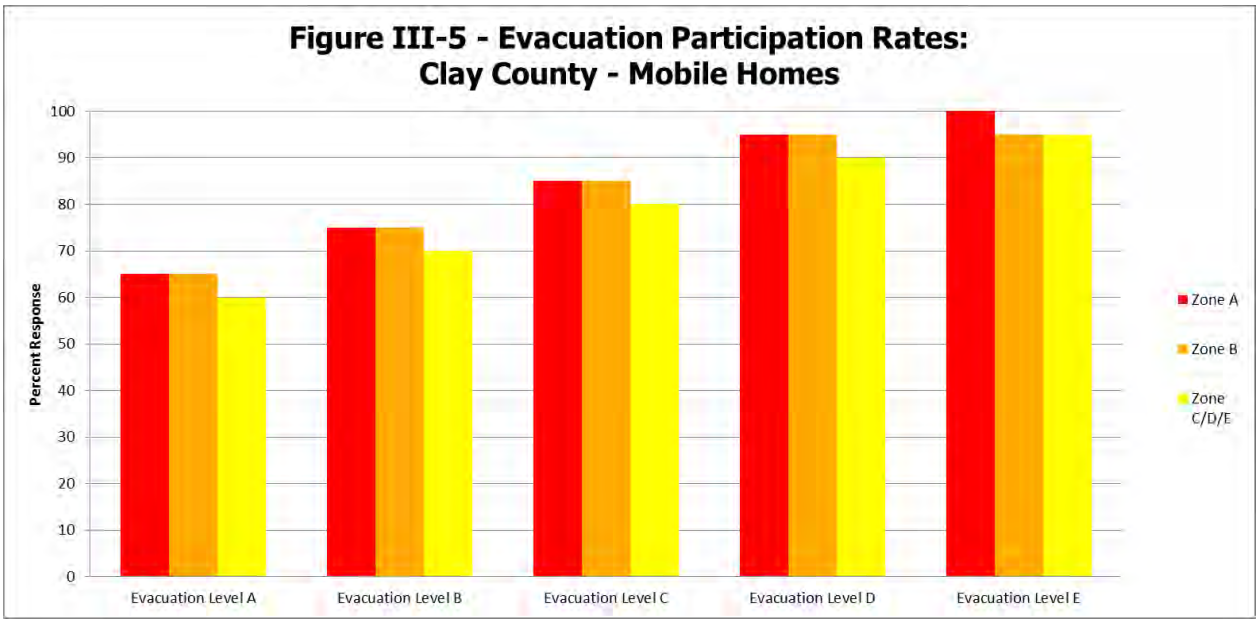


Figure III-5 - Evacuation Participation Rates:
Clay County - Mobile Homes
Percent Response
100
90
80
70
60
50
40
30
20
10
0
Evacuation Level A
Evacuation Level B
Evacuation Level C
Evacuation Level D
Evacuation Level E
Zone A
Zone B
Zone C/D/E

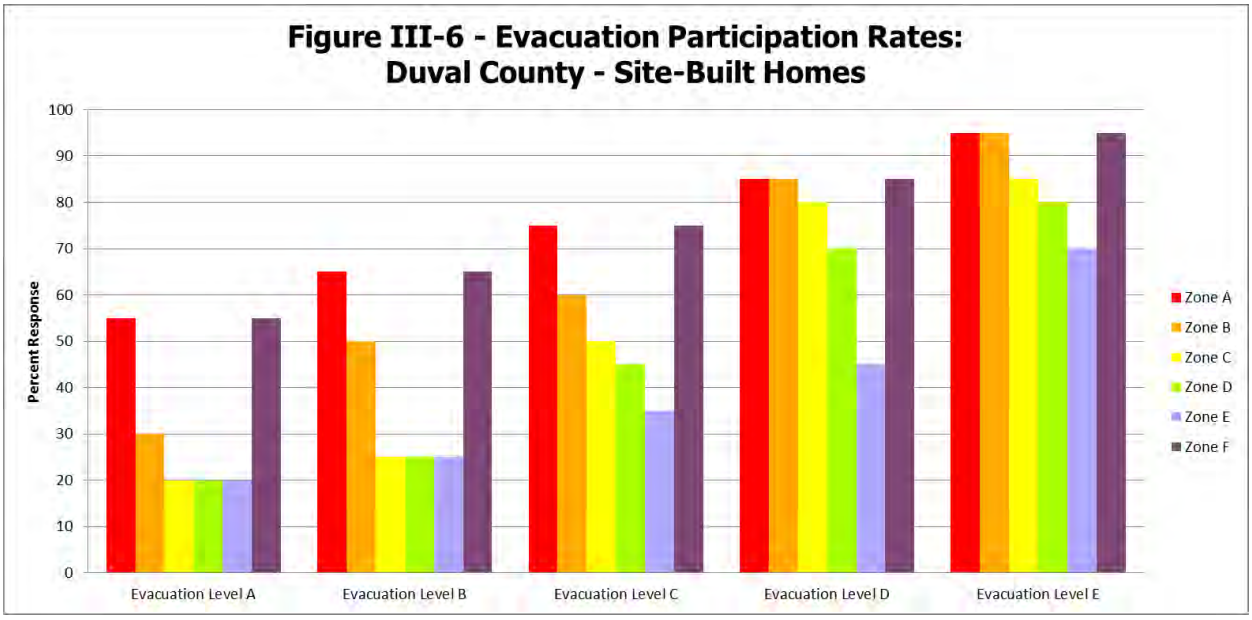


Figure III-6 - Evacuation Participation Rates:
Duval County - Site-Built Homes
Percent Response
100
90
80
70
60
50
40
30
20
10
0
Evacuation Level A
Evacuation Level B
Evacuation Level C
Evacuation Level D
Evacuation Level E
Zone A
Zone B
Zone C
Zone D
Zone E
Zone F

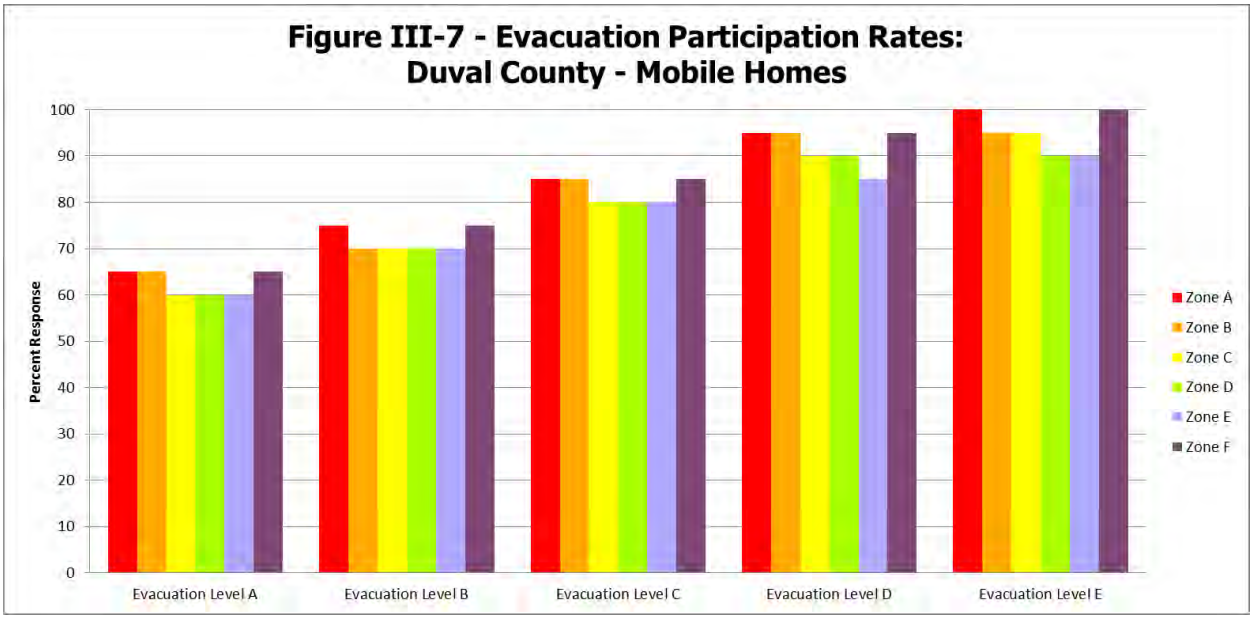


Figure III-7 - Evacuation Participation Rates:
Duval County - Mobile Homes
Percent Response
100
90
80
70
60
50
40
30
20
10
0
Evacuation Level A
Evacuation Level B
Evacuation Level C
Evacuation Level D
Evacuation Level E
Zone A
Zone B
Zone C
Zone D
Zone E
Zone F

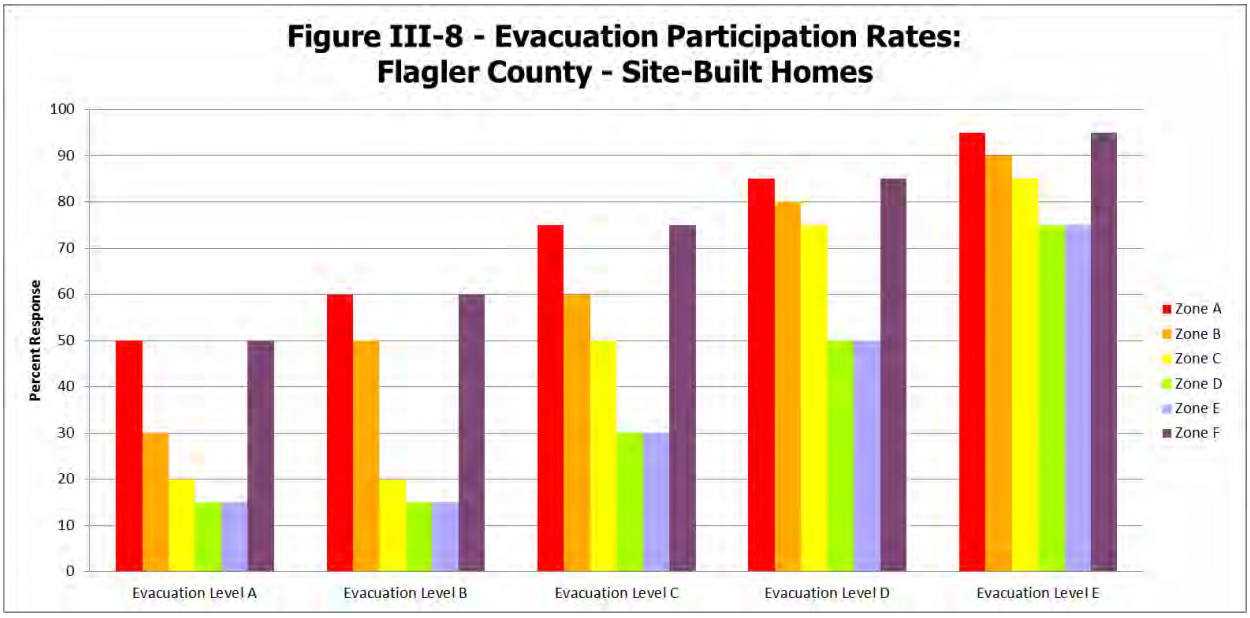


Figure III-8 - Evacuation Participation Rates:
Flagler County - Site-Built Homes
Percent Response
100
90
80
70
60
50
40
30
20
10
0
Evacuation Level A
Evacuation Level B
Evacuation Level C
Evacuation Level D
Evacuation Level E
Zone A
Zone B
Zone C
Zone D
Zone E
Zone F

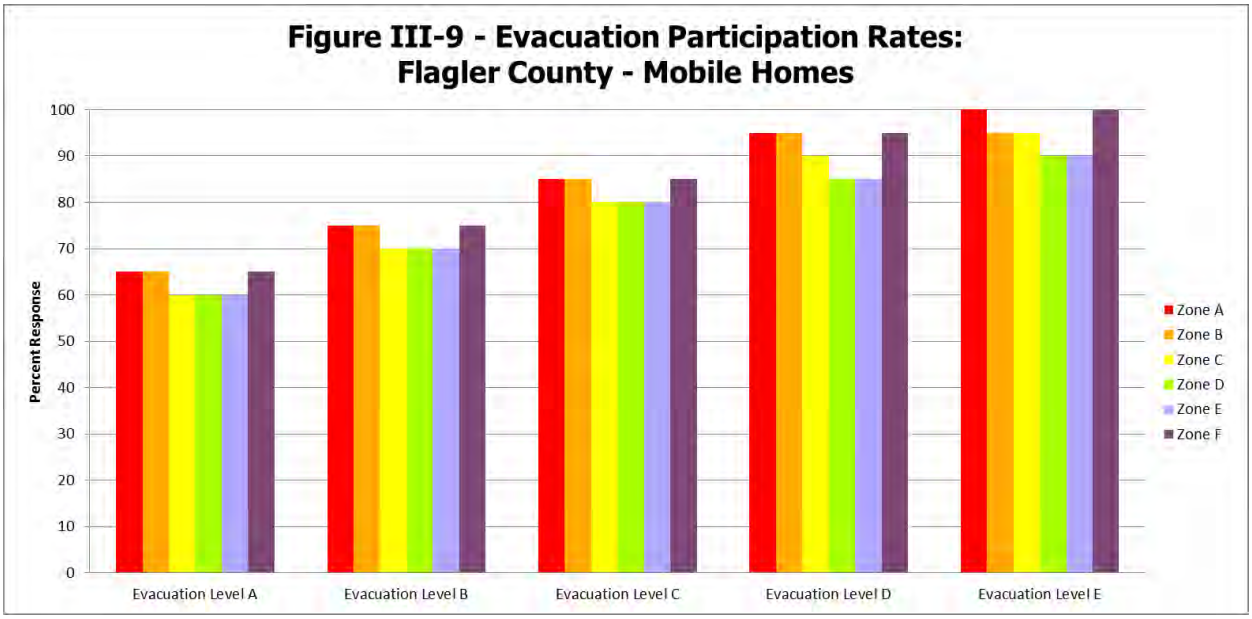


Figure III-9 - Evacuation Participation Rates:
Flagler County - Mobile Homes
Percent Response
100
90
80
70
60
50
40
30
20
10
0
Evacuation Level A
Evacuation Level B
Evacuation Level C
Evacuation Level D
Evacuation Level E
Zone A
Zone B
Zone C
Zone D
Zone E
Zone F

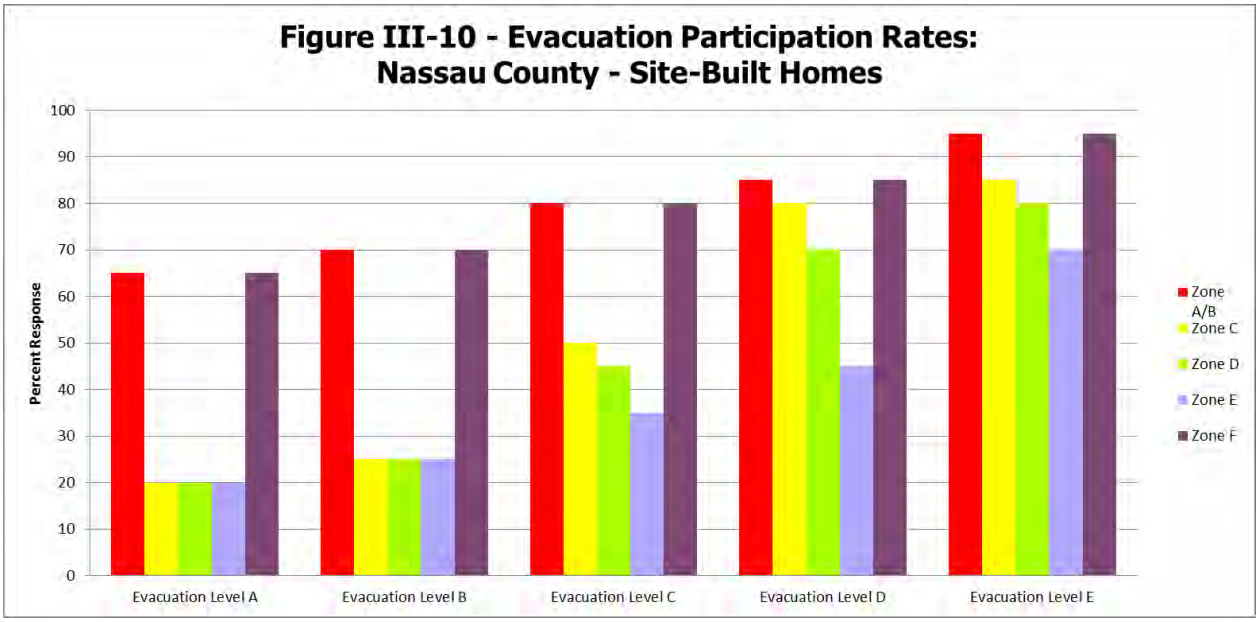


Figure III-10 - Evacuation Participation Rates:
Nassau County - Site-Built Homes
Percent Response
100
90
80
70
60
50
40
30
20
10
0
Evacuation Level A
Evacuation Level B
Evacuation Level C
Evacuation Level D
Evacuation Level E
Zone A/B
Zone C
Zone D
Zone E
Zone F

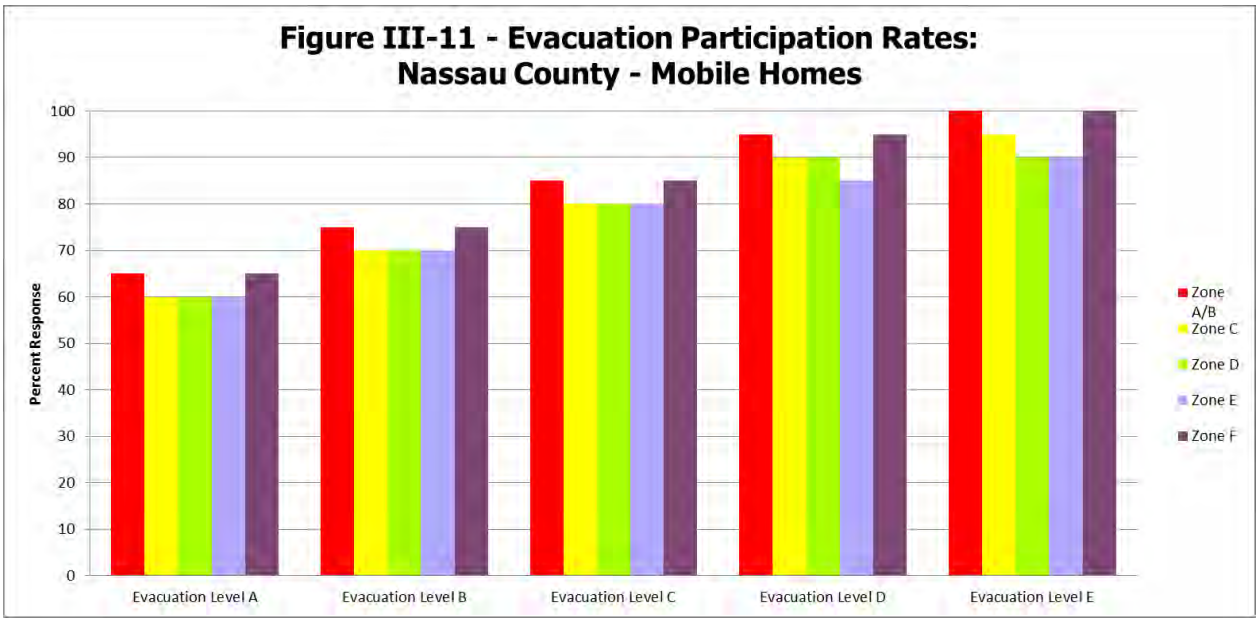


Figure III-11 - Evacuation Participation Rates:
Nassau County - Mobile Homes
Percent Response
100
90
80
70
60
50
40
30
20
10
0
Evacuation Level A
Evacuation Level B
Evacuation Level C
Evacuation Level D
Evacuation Level E
Zone A/B
Zone C
Zone D
Zone E
Zone F

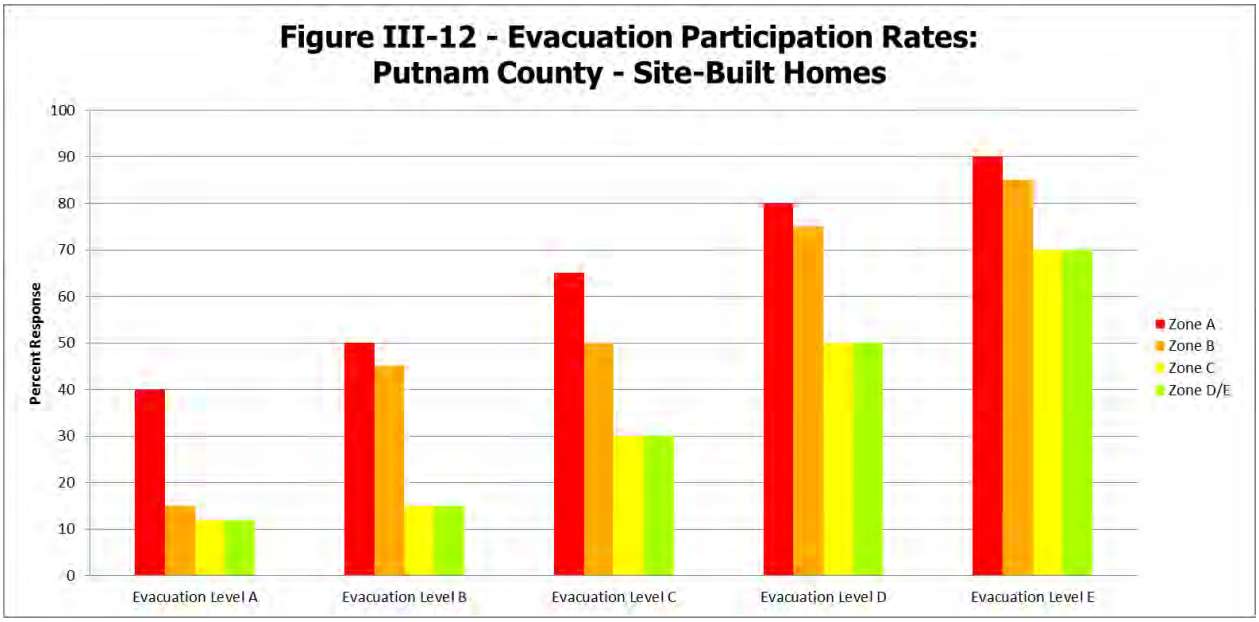


Figure III-12 - Evacuation Participation Rates:
Putnam County - Site-Built Homes
Percent Response
100
90
80
70
60
50
40
30
20
10
0
Evacuation Level A
Evacuation Level B
Evacuation Level C
Evacuation Level D
Evacuation Level E
Zone A
Zone B
Zone C
Zone D/E

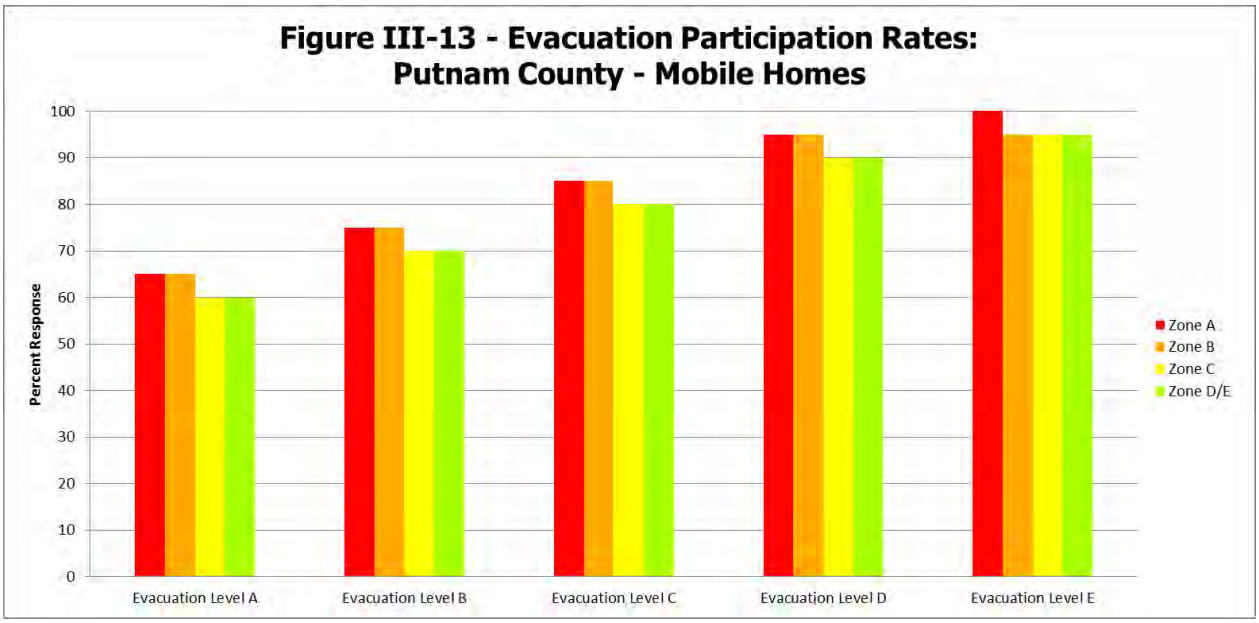


Figure III-13 - Evacuation Participation Rates:
Putnam County - Mobile Homes
Percent Response
100
90
80
70
60
50
40
30
20
10
0
Evacuation Level A
Evacuation Level B
Evacuation Level C
Evacuation Level D
Evacuation Level E
Zone A
Zone B
Zone C
Zone D/E

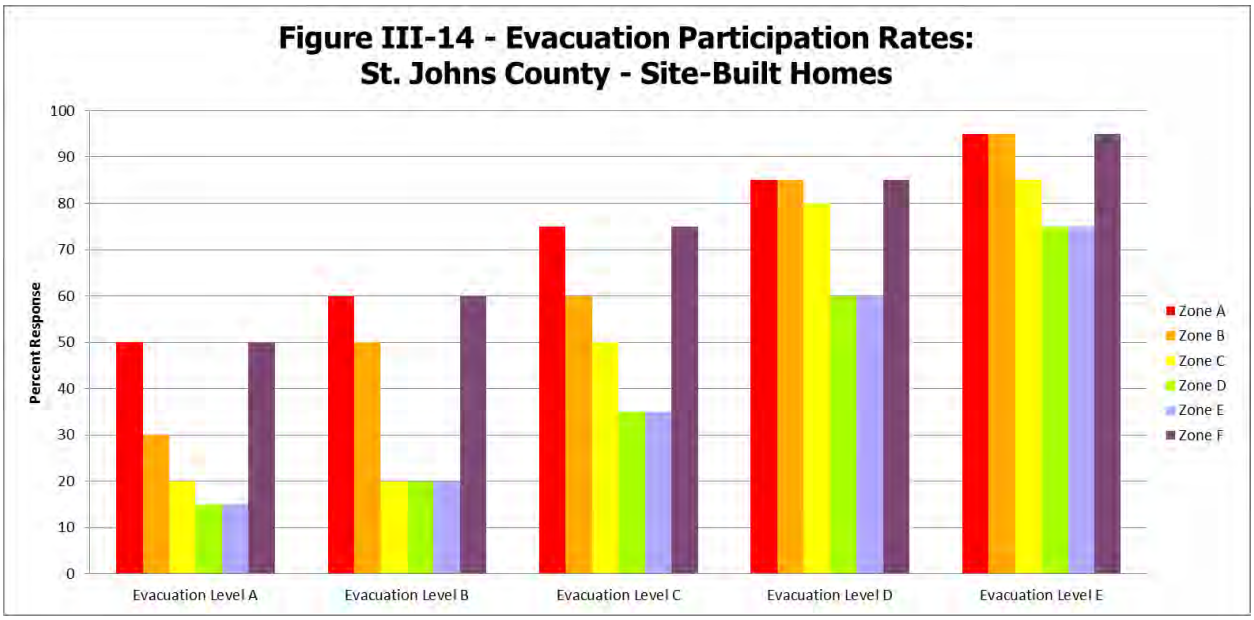


Figure III-14 - Evacuation Participation Rates:
St. Johns County - Site-Built Homes
Percent Response
100
90
80
70
60
50
40
30
20
10
0
Evacuation Level A
Evacuation Level B
Evacuation Level C
Evacuation Level D
Evacuation Level E
Zone A
Zone B
Zone C
Zone D
Zone E
Zone F

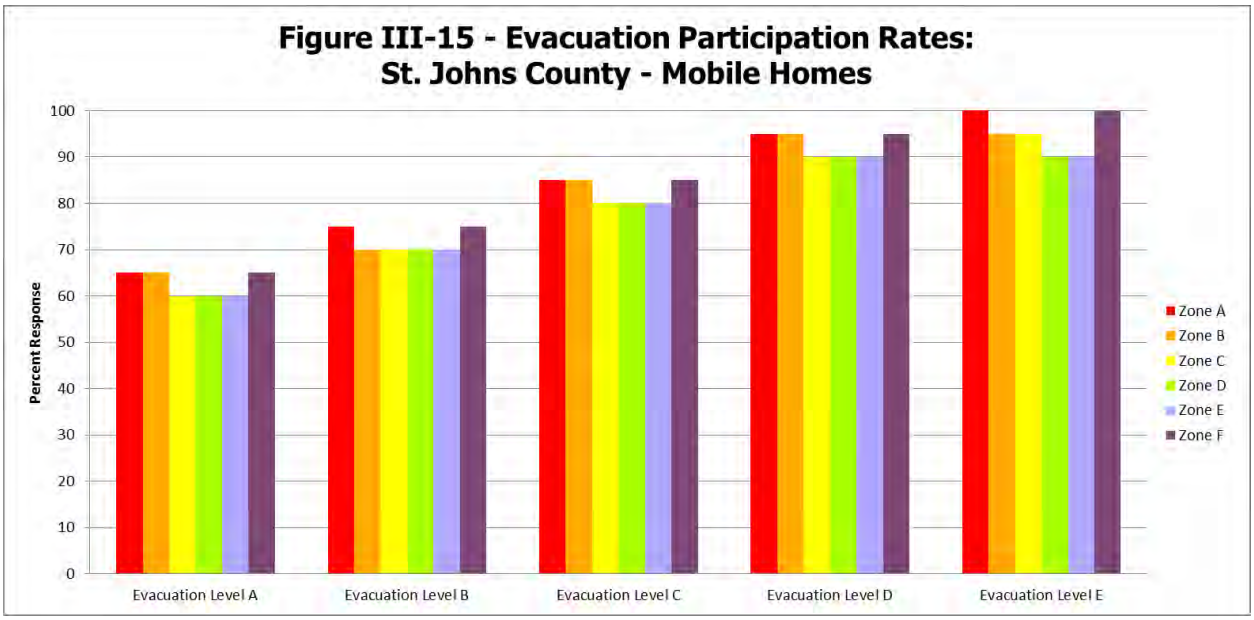


Figure III-15 - Evacuation Participation Rates:
St. Johns County - Mobile Homes
Percent Response
100
90
80
70
60
50
40
30
20
10
0
Evacuation Level A
Evacuation Level B
Evacuation Level C
Evacuation Level D
Evacuation Level E
Zone A
Zone B
Zone C
Zone D
Zone E
Zone F

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 Northeast Florida region compiled the list of available public shelters using information provided by local county emergency managers. The shelters were categorized as either primary or other, with primary indicating that the shelter is compliant with American Red Cross standards for a shelter and other indicating all other shelters.

In the seven county region, there is a total of 82 primary shelters. The number of primary shelters in each county in the region is listed below:

- Baker – 6
- Clay – 17
- Duval – 24
- Flagler– 7
- Nassau – 9
- Putnam – 5
- St. Johns – 14

All together, the 82 primary shelters located within the seven county region can host more than 64,000 persons during an evacuation event. Detailed lists of the available primary shelters by county are included in Volume 5-4.

G. Evacuation Zones

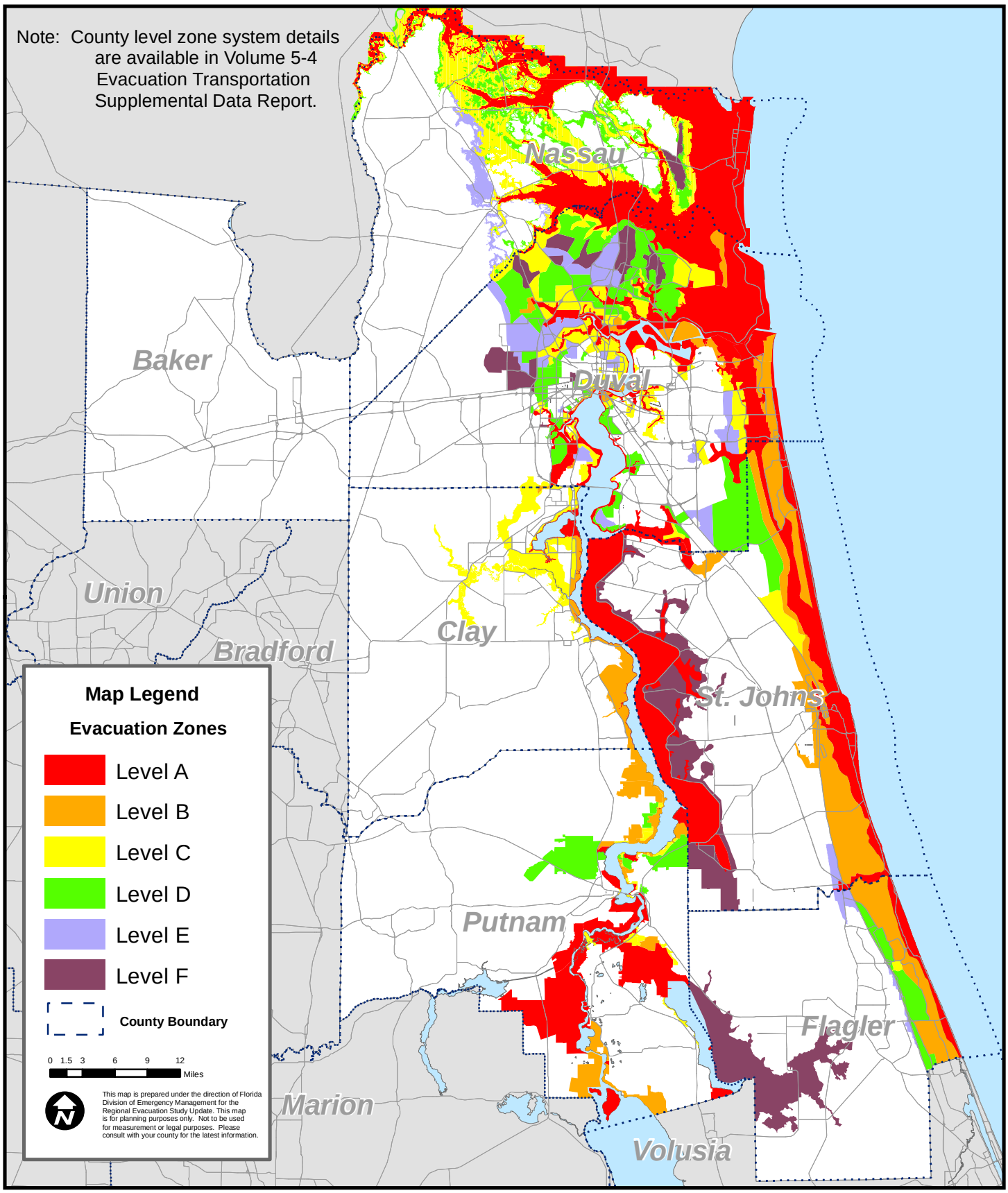
The final input variable that is needed to complete the transportation evacuation model is the delineation of evacuation zones for all coastal counties. Local county emergency managers have the responsibility of identifying and defining evacuation zones for their county. Within the Northeast Florida region, six counties (Clay, Duval, Flagler, Nassau, Putnam, and St. Johns) have updated and established their evacuation zones based on the results of new data and information collected as part of the SRESP in May 2013. Evacuation zones for the Northeast Florida region are illustrated in **Figure III-16**. County level evacuation zone maps are also included in Volume 5-4.

The four coastal counties in the Northeast Florida Region added an additional 'F' evacuation zone. In most cases, the 'F' zone is located in the inland portions of the County, where there is a specialized flooding risk, such as along the St. Johns River and other water bodies including Crescent Lake in Flagler County. It is important to note evacuation zone F operates independently than other zones, while evacuation zones A through E typically include any lower letter zones. For example, an evacuation at level C is inclusive of evacuation zones A, B, and C and an evacuation at level E includes evacuation zones A, B, C, D, and E.

In contrast, an evacuation of evacuation zone F is independent and does not include any of the other evacuation zones unless specifically identified. An evacuation of C+F, for example, includes a normal C evacuation (including zones A, B, and C) plus zone F, but does not include zones D and E.

Figure III-16

Northeast Florida Regional Evacuation Zones



Sources: Northeast Florida Regional Council, CDM Smith

Map Printed: April, 2014

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. The 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 region 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. The user may also import new zones, such as zone F, and identify the corresponding behavioral assumptions. Imported zones can either be analyzed independently of all other zones or in combination with other evacuation zones. 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.

- **Zone Importer** - A feature which allows the user to import a user generated evacuation zone system and apply that evacuation zone system to the model TEZs. These imported evacuation zones must be developed by the user in an external application such as ESRI ArcGIS and imported from a shape file format. These new evacuation zones will override the default evacuation zones for a given scenario allowing the user to create custom scenarios with evacuation patterns representing a variety of storm vectors.

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CHAPTER IV
TRANSPORTATION ANALYSIS

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

A. Vulnerable Population

Using a combination of the demographic data, behavioral assumptions, and evacuation zones, the vulnerable population in each county could be determined by evacuation level. For the purposes of the transportation analysis, the vulnerable population, or population-at-risk, is defined as the total population living within the county designated evacuation zones for each evacuation level. This population is living in an area that is at risk for severe flooding during a storm event. The vulnerable population for the Northeast Florida region for 2015 is identified in **Table IV-1**, summarized by evacuation zone and split between site-built homes and mobile/manufactured homes. Vulnerable population for 2020 is summarized in **Table IV-2**.

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

	Evacuation Zone A	Evacuation Zone B	Evacuation Zone C	Evacuation Zone D	Evacuation Zone E	Evacuation Zone F
Clay County*/**						
Site-built Homes	5,864	6,718	45,522			N/A
Mobile/Manuf. Homes	88	396	1,929			
TOTAL	5,951	7,114	47,450			
Duval County						
Site-built Homes	102,801	38,513	108,463	74,327	40,138	10,151
Mobile/Manuf. Homes	4,307	1,659	6,935	5,923	2,151	2,803
TOTAL	107,108	40,171	115,398	80,251	42,289	12,955
Flagler County						
Site-built Homes	8,071	12,675	684	8,751	3,130	388
Mobile/Manuf. Homes	745	418	0	128	30	475
TOTAL	8,816	13,093	684	8,879	3,160	863
Nassau County*						
Site-built Homes	31,269		5,686	2,196	993	1,788
Mobile/Manuf. Homes	3,933		2,736	1,405	863	658
TOTAL	35,202		8,422	3,601	1,856	2,446
Putnam County*/**						
Site-built Homes	5,373	1,418	687	863		N/A
Mobile/Manuf. Homes	3,342	1,293	564	477		
TOTAL	8,715	2,710	1,251	1,340		
St. Johns County						
Site-built Homes	54,902	56,968	3,028	1,743	17	14,287
Mobile/Manuf. Homes	3,078	3,794	813	115	8	2,404
TOTAL	57,980	60,762	3,841	1,858	26	16,691

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

** For the purposes of this study, Clay County has a combined C/D/E zone, Nassau County has a combined A/B zone, and Putnam County has a combined D/E zone.*

*** In addition, Clay and Putnam Counties are the only counties within the NEFRC region that did not designate a zone F within their jurisdiction.*

Table IV-2 – Vulnerable Population in the Northeast Florida Region for 2020

	Evacuation Zone A	Evacuation Zone B	Evacuation Zone C	Evacuation Zone D	Evacuation Zone E	Evacuation Zone F
Clay County*/**						
Site-built Homes	6,533	7,485	50,697			N/A
Mobile/Manuf. Homes	98	443	2,156			
TOTAL	6,631	7,929	52,853			
Duval County						
Site-built Homes	107,495	40,278	113,415	77,714	41,973	10,619
Mobile/Manuf. Homes	4,523	1,746	7,265	6,217	2,261	2,931
TOTAL	112,019	42,024	120,680	83,931	44,234	13,550
Flagler County						
Site-built Homes	9,632	15,120	816	10,438	3,733	465
Mobile/Manuf. Homes	887	503	0	153	36	565
TOTAL	10,519	15,623	816	10,590	3,769	1,029
Nassau County*						
Site-built Homes	33,203		6,082	2,334	1,049	1,832
Mobile/Manuf. Homes	4,243		2,945	1,493	907	685
TOTAL	37,446		9,027	3,827	1,956	2,517
Putnam County*/**						
Site-built Homes	5,435	1,434	694	871		N/A
Mobile/Manuf. Homes	3,379	1,308	571	483		
TOTAL	8,815	2,742	1,265	1,354		
St. Johns County						
Site-built Homes	63,670	66,012	3,506	2,021	20	16,562
Mobile/Manuf. Homes	3,559	4,408	950	132	10	2,791
TOTAL	67,229	70,420	4,455	2,154	30	19,353

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

** For the purposes of this study, Clay County has a combined C/D/E zone, Nassau County has a combined A/B zone, and Putnam County has a combined D/E zone.*

*** In addition, Clay and Putnam Counties are the only counties within the NEFRC region that did not designate a zone F within their jurisdiction.*

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 Northeast Florida Region are identified in **Table IV-3** for 2015 and in **Table IV-4** for 2020.

Table IV-3 – Vulnerable Population by Destination for 2015

	Evacuation Zone A	Evacuation Zone B	Evacuation Zone C	Evacuation Zone D	Evacuation Zone E	Evacuation Zone F
Clay County*/**						
To Friends and Family	3,571	4,268	28,470			N/A
To Hotel/ Motel	1,479	1,739	11,670			
To Public Shelter	304	383	3,873			
To Other Destination	598	723	3,437			
Duval County						
To Friends and Family	64,265	24,103	69,239	48,150	25,373	7,773
To Hotel/ Motel	16,066	6,026	17,310	12,038	6,343	1,943
To Public Shelter	5,485	2,125	9,509	8,144	4,272	732
To Other Destination	21,292	7,918	19,340	11,919	6,300	2,507
Flagler County*						
To Friends and Family	5,289	7,856	410	5,327	1,896	518
To Hotel/ Motel	1,726	2,598	137	1,769	630	149
To Public Shelter	463	1,064	68	890	317	57
To Other Destination	1,337	1,575	68	892	317	139
Nassau County*						
To Friends and Family	21,318		5,190	2,231	1,157	1,501
To Hotel/ Motel	8,407		1,832	760	378	546
To Public Shelter	1,957		613	278	153	155
To Other Destination	3,520		788	332	168	245

	Evacuation Zone A	Evacuation Zone B	Evacuation Zone C	Evacuation Zone D	Evacuation Zone E	Evacuation Zone F
Putnam County*/**						
To Friends and Family	5,229	1,626	750	804		N/A
To Hotel/ Motel	1,576	477	222	244		
To Public Shelter	831	269	123	126		
To Other Destination	1,079	338	156	166		
St. Johns County*						
To Friends and Family	31,889	33,419	2,113	1,022	14	9,180
To Hotel/ Motel	14,341	15,001	920	459	6	4,053
To Public Shelter	2,991	3,304	249	153	2	907
To Other Destination	8,758	9,038	560	224	3	2,552

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

** For the purposes of this study, Clay County has a combined C/D/E zone, Nassau County has a combined A/B zone, and Putnam County has a combined D/E zone.*

*** In addition, Clay and Putnam Counties are the only counties within the NEFRC region that did not designate a zone F within their jurisdiction.*

Table IV-4 – Vulnerable Population by Destination for 2020

	Evacuation Zone A	Evacuation Zone B	Evacuation Zone C	Evacuation Zone D	Evacuation Zone E	Evacuation Zone F
Clay County*/**						
To Friends and Family	3,979	4,757	31,712			N/A
To Hotel/ Motel	1,648	1,938	12,998			
To Public Shelter	338	427	4,314			
To Other Destination	666	806	3,829			
Duval County						
To Friends and Family	67,211	25,215	72,408	50,359	26,541	8,130
To Hotel/ Motel	16,803	6,304	18,102	12,590	6,635	2,032
To Public Shelter	5,737	2,223	9,945	8,517	4,469	765
To Other Destination	22,268	8,283	20,225	12,465	6,590	2,622
Flagler County						
To Friends and Family	6,312	9,374	490	6,354	2,261	617
To Hotel/ Motel	2,060	3,099	163	2,110	752	178
To Public Shelter	553	1,270	82	1,062	378	68
To Other Destination	1,596	1,880	82	1,064	378	166
Nassau County*						
To Friends and Family	22,680		5,563	2,371	1,219	1,545
To Hotel/ Motel	8,937		1,962	807	398	561
To Public Shelter	2,084		657	296	161	160
To Other Destination	3,745		844	353	177	252

	Evacuation Zone A	Evacuation Zone B	Evacuation Zone C	Evacuation Zone D	Evacuation Zone E	Evacuation Zone F
Putnam County*/**						
To Friends and Family	5,289	1,645	759	812		N/A
To Hotel/ Motel	1,594	483	224	247		
To Public Shelter	840	272	124	128		
To Other Destination	1,092	342	157	167		
St. Johns County						
To Friends and Family	36,976	38,731	2,450	1,185	16	10,644
To Hotel/ Motel	16,629	17,385	1,066	532	7	4,699
To Public Shelter	3,468	3,830	289	178	3	1,051
To Other Destination	10,156	10,475	649	260	4	2,959

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

** For the purposes of this study, Clay County has a combined C/D/E zone, Nassau County has a combined A/B zone, and Putnam County has a combined D/E zone.*

*** In addition, Clay and Putnam Counties are the only counties within the NEFRC region that did not designate a zone F within their jurisdiction.*

The vulnerable shadow population is provided in **Table IV-5** for both 2015 and 2020. The vulnerable shadow population was determined using the behavioral assumptions for evacuating shadow population and is based on evacuation level (storm category), not evacuation zone.

Table IV-5 – Vulnerable Shadow Evacuation Population

	Evacuation Level A	Evacuation Level B	Evacuation Level C	Evacuation Level D	Evacuation Level E
2015					
Baker County	12,572	13,385	14,198	15,011	15,824
Clay County	45,187	52,345	48,614	60,292	66,131
Duval County	173,117	195,880	206,063	195,822	223,686
Flagler County	16,843	16,758	22,154	25,581	30,900
Nassau County	22,259	23,610	20,933	19,676	20,202
Putnam County	30,422	28,967	31,951	33,030	36,561
St. Johns County	45,655	29,752	32,510	39,381	47,048
2020					
Baker County	13,528	14,405	15,282	16,158	17,035
Clay County	50,340	58,321	54,105	67,116	73,621
Duval County	181,062	204,779	215,341	204,522	233,611
Flagler County	20,090	19,915	26,318	30,422	36,766
Nassau County	23,928	25,376	22,499	21,167	21,759
Putnam County	30,764	29,292	32,314	33,412	36,986
St. Johns County	52,794	34,250	37,450	45,381	54,239

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

B. Clearance Time Definitions

The determination of clearance time is one of the most important outcomes from the evacuation transportation analysis. Calculated clearance times are used by county emergency managers as one input to determine when to recommend an evacuation order. This calculation can include the population-at-risk, shadow evacuees, as well as evacuees from other counties anticipated to pass through the county. Clearance time is developed to include the time required for evacuees to secure their homes and prepare to leave, the time spent by all vehicles traveling along the evacuation route network, and the additional time spent on the road caused by traffic and road congestion. Clearance time does not relate to the time any one vehicle spends traveling along the evacuation route network, nor does it guarantee vehicles will safely reach their destination once outside the County. The 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 Northeast Florida region to continue testing combinations of options and provide additional information to emergency managers.

D. Base Scenarios

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

- **Analysis Time Period** – Five scenarios for the 2015 time period and five scenarios for the 2020 time period. The five scenarios for each time period include one for each of the five evacuation levels, A, B, C, D, and E. The base scenarios did not include analysis of evacuation zone F;

- **Highway Network** – The five 2015 scenarios use the 2015 network and the five 2020 scenarios use the 2020 network, which includes planned roadway capacity improvement projects expected to be implemented by 2020;

- **One-Way Evacuation Operations** – The base scenarios do not include implementation of any one-way evacuation operations;

- **University Population** – The base scenarios use the fall/spring semester data to estimate evacuation trips by the student population. This data was provided by each

RPC as part of the demographic small area data;

- **Tourist Occupancy Rates** – The base scenarios use the default hotel/motel occupancy rates to estimate tourist evacuation trips. This data was provided by each RPC as part of the demographic small area data;

- **Shelters** – The base scenarios assume all designated primary shelters within each county in the model network are open. The base scenarios do not include shelters that are designated as other shelters, only primary shelters;

- **Response Curve** – The 12-hour response curve is used for all ten base scenarios;

- **Evacuation Phasing** - All counties that are evacuating begin at same time, within 1 hour of the evacuation order being given;

- **Behavioral Response** - For 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 Baker, Clay, Duval, Flagler, Putnam, Nassau, St. Johns, Camden (GA), and Volusia 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 Baker, Clay, Duval, Flagler, Putnam, Nassau, St. Johns, Camden (GA), and Volusia 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 Baker, Clay, Duval, Flagler, Putnam, Nassau, St. Johns, Camden (GA), and Volusia Counties);
  - Zone F was not included in the base scenarios; and,
  - For the remaining counties in the Northeast Florida model network, no evacuations are assumed, including shadow evacuations.

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

Table IV-6 – Base Scenarios

	Scenario 1 Level A 2015	Scenario 2 Level B 2015	Scenario 3 Level C 2015	Scenario 4 Level D 2015	Scenario 5 Level E 2015
Demographic Data	2015	2015	2015	2015	2015
Highway Network	2015	2015	2015	2015	2015
One-Way Operations	None	None	None	None	None
University Population	Fall/Spring	Fall/Spring	Fall/Spring	Fall/Spring	Fall/Spring
Tourist Rate	Default	Default	Default	Default	Default
Shelters Open	Primary	Primary	Primary	Primary	Primary
Response Curve	12-hour	12-hour	12-hour	12-hour	12-hour
Evacuation Phasing	None	None	None	None	None
Behavioral Response	100%	100%	100%	100%	100%
Evacuation Zone	A	B	C	D	E
Counties Evacuating	Baker Clay Duval Flagler Putnam Nassau St. Johns Camden (GA) Volusia	Baker Clay Duval Flagler Putnam Nassau St. Johns Camden (GA) Volusia	Baker Clay Duval Flagler Putnam Nassau St. Johns Camden (GA) Volusia	Baker Clay Duval Flagler Putnam Nassau St. Johns Camden (GA) Volusia	Baker Clay Duval Flagler Putnam Nassau St. Johns Camden (GA) Volusia
	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	Baker Clay Duval Flagler Putnam Nassau St. Johns Camden (GA) Volusia	Baker Clay Duval Flagler Putnam Nassau St. Johns Camden (GA) Volusia	Baker Clay Duval Flagler Putnam Nassau St. Johns Camden (GA) Volusia	Baker Clay Duval Flagler Putnam Nassau St. Johns Camden (GA) Volusia	Baker Clay Duval Flagler Putnam Nassau St. Johns Camden (GA) Volusia

E. Base Scenario Results

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

Evacuating Population

It is important to determine the evacuating population for each of the base scenarios in order to understand the magnitude of the evacuation effort, including estimated population that is evacuating and the county level shelter demand. Evacuating population as reported from the modeling results for the base scenarios is summarized by county for 2015 in **Table IV-7** and for 2020 in **Table IV-8**.

Within the seven county region, total evacuating population ranges from almost 570,000 persons for a base scenario level A evacuation to more than 1,108,000 for a base scenario level E evacuation in 2015. By 2020, this range increases within the seven counties to more than 615,000 persons for a base scenario level A evacuation and more than 1,196,000 for a base scenario level E evacuation.

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

	Evacuation Level A Base Scenario	Evacuation Level B Base Scenario	Evacuation Level C Base Scenario	Evacuation Level D Base Scenario	Evacuation Level E Base Scenario
Baker County					
Site-built Homes	813	1,626	2,439	3,252	4,065
Mobile/Manuf. Homes	11,759	11,759	11,759	11,759	11,759
Tourists	0	0	0	0	0
TOTAL	12,572	13,385	14,198	15,011	15,824
Clay County					
Site-built Homes	24,004	38,276	81,441	93,119	98,958
Mobile/Manuf. Homes	27,128	27,128	27,128	27,128	27,128
Tourists	6	6	560	560	560
TOTAL	51,138	65,410	109,129	120,807	126,646
Duval County					
Site-built Homes	229,702	291,391	415,198	483,695	552,973
Mobile/Manuf. Homes	49,163	49,163	49,163	49,163	49,163
Tourists	1,360	2,605	4,379	5,892	6,767
TOTAL	280,225	343,159	468,740	538,750	608,903
Flagler County					
Site-built Homes	20,209	32,963	38,869	51,173	59,652
Mobile/Manuf. Homes	5,379	5,379	5,379	5,379	5,379
Tourists	71	325	499	501	501
TOTAL	25,659	38,667	44,747	57,053	65,532
Nassau County					
Site-built Homes	35,731	37,082	42,786	44,999	47,360
Mobile/Manuf. Homes	20,689	20,689	20,689	20,689	20,689
Tourists	1,041	1,041	1,082	1,213	1,234
TOTAL	57,461	58,812	64,557	66,901	69,283
Putnam County					
Site-built Homes	9,315	10,555	14,790	17,174	20,705
Mobile/Manuf. Homes	29,688	29,688	29,688	29,688	29,688
Tourists	134	149	149	184	184
TOTAL	39,137	40,392	44,627	47,046	50,577
St. Johns County					
Site-built Homes	80,451	124,239	130,838	139,567	147,260
Mobile/Manuf. Homes	21,392	21,392	21,392	21,392	21,392
Tourists	1,792	2,863	2,863	2,863	2,863
TOTAL	103,635	148,494	155,093	163,822	171,515

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

	Evacuation Level A Base Scenario	Evacuation Level B Base Scenario	Evacuation Level C Base Scenario	Evacuation Level D Base Scenario	Evacuation Level E Base Scenario
Baker County					
Site-built Homes	877	1,754	2,631	3,507	4,384
Mobile/Manuf. Homes	12,651	12,651	12,651	12,651	12,651
Tourists	0	0	0	0	0
TOTAL	13,528	14,405	15,282	16,158	17,035
Clay County					
Site-built Homes	26,763	42,673	90,756	103,767	110,272
Mobile/Manuf. Homes	30,202	30,202	30,202	30,202	30,202
Tourists	6	6	560	560	560
TOTAL	56,971	72,881	121,518	134,529	141,034
Duval County					
Site-built Homes	240,158	304,654	434,122	505,721	578,169
Mobile/Manuf. Homes	51,563	51,563	51,563	51,563	51,563
Tourists	1,360	2,605	4,379	5,892	6,767
TOTAL	293,081	358,822	490,064	563,176	636,499
Flagler County					
Site-built Homes	24,123	39,317	46,362	61,054	71,167
Mobile/Manuf. Homes	6,415	6,415	6,415	6,415	6,415
Tourists	71	325	499	501	501
TOTAL	30,609	46,057	53,276	67,970	78,083
Nassau County					
Site-built Homes	38,013	39,461	45,570	47,934	50,461
Mobile/Manuf. Homes	22,320	22,320	22,320	22,320	22,320
Tourists	1,041	1,041	1,082	1,213	1,234
TOTAL	61,374	62,822	68,972	71,467	74,015
Putnam County					
Site-built Homes	9,426	10,681	14,968	17,385	20,959
Mobile/Manuf. Homes	30,019	30,019	30,019	30,019	30,019
Tourists	134	149	149	184	184
TOTAL	39,579	40,849	45,136	47,588	51,162
St. Johns County					
Site-built Homes	93,415	144,220	151,875	161,960	170,848
Mobile/Manuf. Homes	24,816	24,816	24,816	24,816	24,816
Tourists	1,792	2,863	2,863	2,863	2,863
TOTAL	120,023	171,899	179,554	189,639	198,527

Evacuating Vehicles

From a transportation standpoint, the number of evacuating vehicles is more important than the evacuating population. Evacuating vehicles for the base scenarios is summarized by county for 2015 in **Table IV-9** and for 2020 in **Table IV-10**.

The total number of evacuating vehicles within the seven county region for the base scenarios also varies by evacuation level. A total of more than 294,000 vehicles evacuate from the seven county region for a base scenario level A evacuation in 2015, and this number increases to almost 563,000 evacuating vehicles from the seven county region for a base scenario level E evacuation in 2015. By 2020, the number of evacuating vehicles is expected to increase to more than 320,000 vehicles for a base scenario level A evacuation and more than 610,000 evacuating vehicles for a base scenario level E evacuation.

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

	Evacuation Level A Base Scenario	Evacuation Level B Base Scenario	Evacuation Level C Base Scenario	Evacuation Level D Base Scenario	Evacuation Level E Base Scenario
Baker County					
Site-built Homes	402	804	1,207	1,609	2,011
Mobile/Manuf. Homes	5,779	5,779	5,779	5,779	5,779
Tourists	0	0	0	0	0
TOTAL	6,181	6,583	6,986	7,388	7,790
Clay County					
Site-built Homes	11,800	19,012	39,889	45,531	48,352
Mobile/Manuf. Homes	14,188	14,188	14,188	14,188	14,188
Tourists	5	5	466	466	466
TOTAL	25,993	33,205	54,543	60,185	63,006
Duval County					
Site-built Homes	114,479	145,834	205,215	239,041	272,506
Mobile/Manuf. Homes	24,813	24,813	24,813	24,813	24,813
Tourists	1,134	2,171	3,649	4,910	5,639
TOTAL	140,426	172,818	233,677	268,764	302,958
Flagler County					
Site-built Homes	11,799	18,675	21,689	28,017	32,298
Mobile/Manuf. Homes	3,203	3,203	3,203	3,203	3,203
Tourists	60	271	416	418	418
TOTAL	15,062	22,149	25,308	31,638	35,919
Nassau County					
Site-built Homes	20,931	21,649	24,848	26,045	27,285
Mobile/Manuf. Homes	11,796	11,796	11,796	11,796	11,796
Tourists	867	867	902	1,010	1,028
TOTAL	33,594	34,312	37,546	38,851	40,109
Putnam County					
Site-built Homes	3,972	4,551	6,485	7,566	9,169
Mobile/Manuf. Homes	12,769	12,769	12,769	12,769	12,769
Tourists	111	124	124	153	153
TOTAL	16,852	17,444	19,378	20,488	22,091
St. Johns County					
Site-built Homes	42,108	64,712	68,011	72,434	76,342
Mobile/Manuf. Homes	12,351	12,351	12,351	12,351	12,351
Tourists	1,495	2,388	2,388	2,388	2,388
TOTAL	55,954	79,451	82,750	87,173	91,081

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

	Evacuation Level A Base Scenario	Evacuation Level B Base Scenario	Evacuation Level C Base Scenario	Evacuation Level D Base Scenario	Evacuation Level E Base Scenario
Baker County					
Site-built Homes	479	958	1,437	1,916	2,394
Mobile/Manuf. Homes	8,326	8,326	8,326	8,326	8,326
Tourists	0	0	0	0	0
TOTAL	8,805	9,284	9,763	10,242	10,720
Clay County					
Site-built Homes	13,143	21,180	44,405	50,686	53,827
Mobile/Manuf. Homes	15,810	15,810	15,810	15,810	15,810
Tourists	5	5	466	466	466
TOTAL	28,958	36,995	60,681	66,962	70,103
Duval County					
Site-built Homes	119,732	152,531	214,644	250,010	285,007
Mobile/Manuf. Homes	26,015	26,015	26,015	26,015	26,015
Tourists	1,134	2,171	3,649	4,910	5,639
TOTAL	146,881	180,717	244,308	280,935	316,661
Flagler County					
Site-built Homes	14,115	22,334	25,938	33,515	38,629
Mobile/Manuf. Homes	3,835	3,835	3,835	3,835	3,835
Tourists	60	271	416	418	418
TOTAL	18,010	26,440	30,189	37,768	42,882
Nassau County					
Site-built Homes	22,430	23,199	26,629	27,910	29,240
Mobile/Manuf. Homes	12,623	12,623	12,623	12,623	12,623
Tourists	867	867	902	1,010	1,028
TOTAL	35,920	36,689	40,154	41,543	42,891
Putnam County					
Site-built Homes	4,019	4,607	6,564	7,661	9,283
Mobile/Manuf. Homes	12,883	12,883	12,883	12,883	12,883
Tourists	111	124	124	153	153
TOTAL	17,013	17,614	19,571	20,697	22,319
St. Johns County					
Site-built Homes	48,891	75,158	78,995	84,117	88,646
Mobile/Manuf. Homes	14,365	14,365	14,365	14,365	14,365
Tourists	1,495	2,388	2,388	2,388	2,388
TOTAL	64,751	91,911	95,748	100,870	105,399

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 from each county who will seek public shelter during their evacuation, either at an in-county shelter or an out of county shelter.

Public shelter demand in the seven county region ranges from 46,010 persons for the base scenario level A evacuation in 2015 to 87,966 persons for the base scenario level E evacuation. By 2020, the public shelter demand is expected to increase to 50,529 persons for the level A evacuation and 95,952 persons for the level E evacuation.

Table IV-11 – Shelter Demand by Base Scenario

	Evacuation Level A	Evacuation Level B	Evacuation Level C	Evacuation Level D	Evacuation Level E
2015					
Baker County	2,251	2,362	2,473	2,584	2,697
Clay County	4,910	5,911	9,152	11,009	11,531
Duval County	20,378	24,418	33,696	39,651	45,064
Flagler County	2,533	3,707	4,342	5,637	6,555
Nassau County	4,923	4,989	5,289	5,409	5,526
Putnam County	3,552	3,639	4,044	4,397	4,753
St. Johns County	7,463	9,824	10,319	11,119	11,840
2020					
Baker County	3,213	3,347	3,480	3,613	3,744
Clay County	5,470	6,586	10,184	12,253	12,833
Duval County	21,319	25,545	35,241	41,462	47,118
Flagler County	3,030	4,429	5,186	6,738	7,833
Nassau County	5,267	5,337	5,657	5,787	5,913
Putnam County	3,585	3,674	4,083	4,442	4,803
St. Johns County	8,643	11,370	11,945	12,870	13,709

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

Congested Roadways

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

Table IV-12 – Total Evacuating Vehicles for Base Scenarios

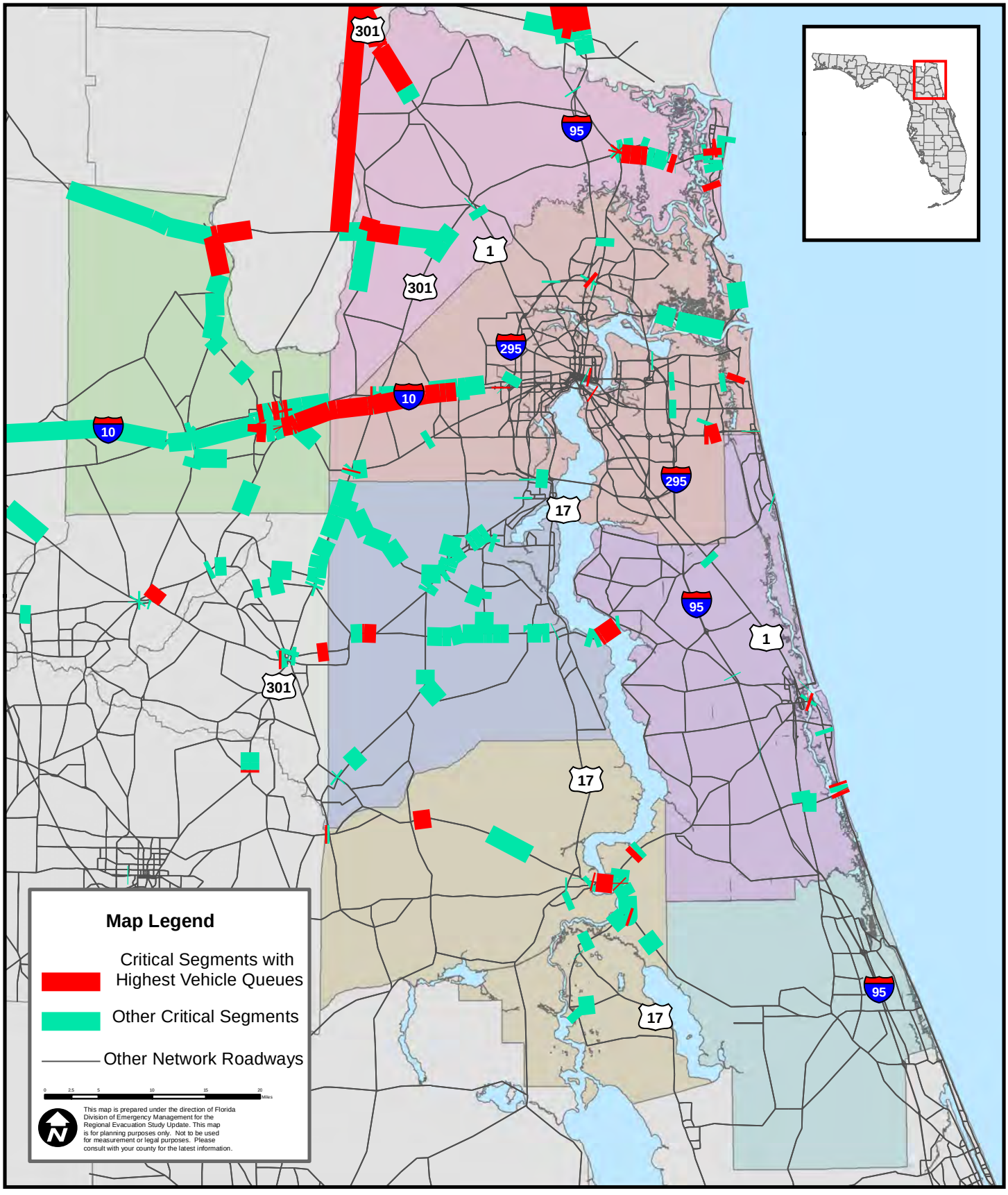
	Evacuation Level A Base Scenario	Evacuation Level B Base Scenario	Evacuation Level C Base Scenario	Evacuation Level D Base Scenario	Evacuation Level E Base Scenario
2015	352,338	435,699	546,912	624,071	711,552
2020	382,109	473,683	593,255	676,294	769,014

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, from a regional perspective, that have vehicle queues for the longest time periods during each of the evacuation scenarios. It is important to note this analysis was conducted on a regional basis and critical roadways at the individual county level may include additional roadways not identified through this analysis. Regional critical roadway segments for the Northeast Florida Region are identified in **Figures IV-1** through **IV-10** for each of the base scenarios for 2015 and 2020.

Through a review of the regional critical roadway segment figures and vehicle flows, it is clear that I-10, I-95, SR 9A, SR 16, SR 2, US 17, US 301, US 90, and CR 127 are critical facilities for the evacuation scenarios. During the level A evacuation scenarios, the roadway segments with the highest vehicle queues are primarily concentrated along major Interstate and State Highway system. In contrast, for the level E evacuation scenarios, the roadway segments with the highest vehicle queues include other roadways, such as CR 215, SR 23, SR 21, SR 100, US 1, and several county roads. Outside the region, US 301 and I-95 are also critical facilities in Georgia.

Figure IV-1

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

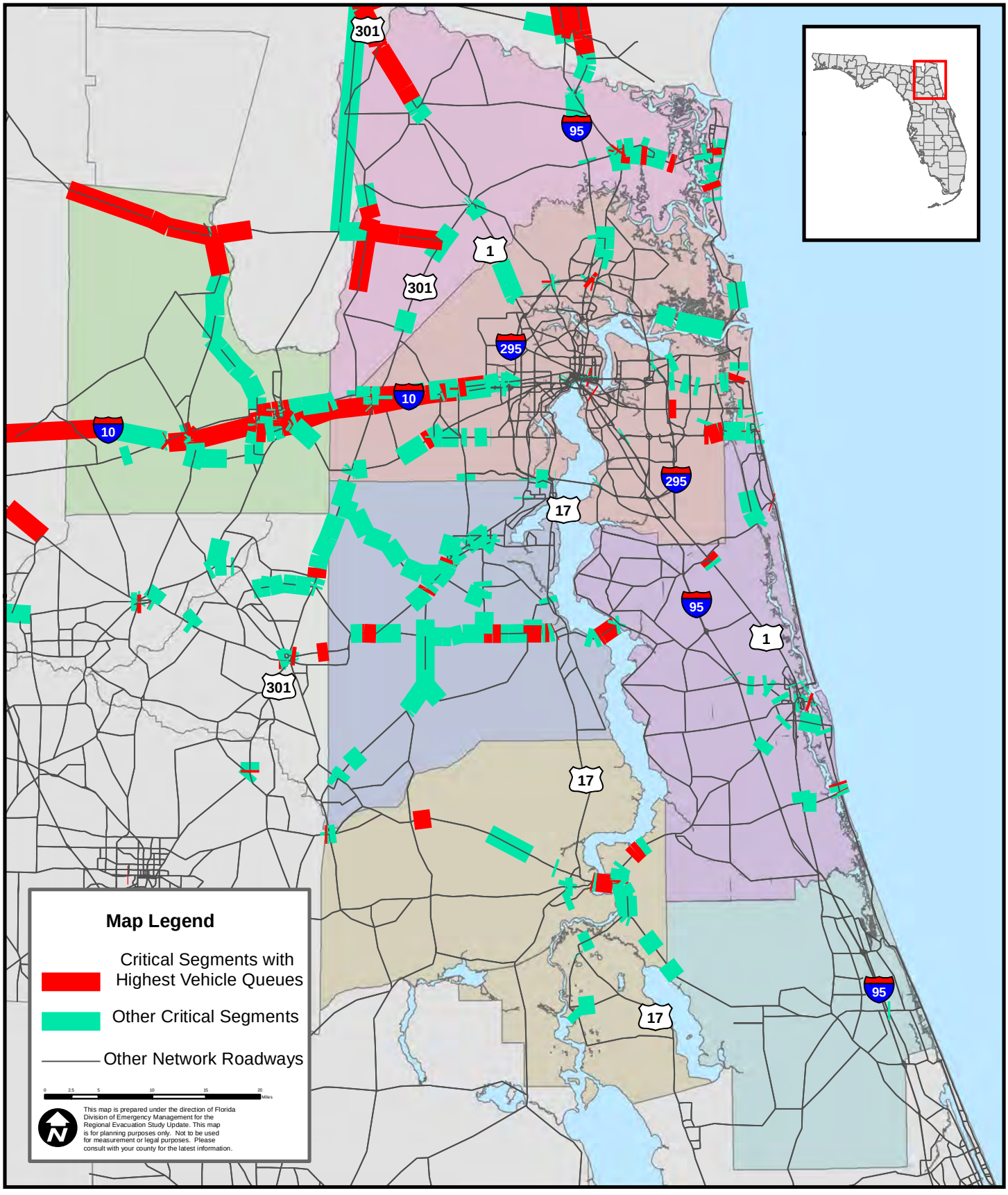


Sources: Northeast Florida Regional Council, CDM Smith

Map Printed: April, 2014

Figure IV-2

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

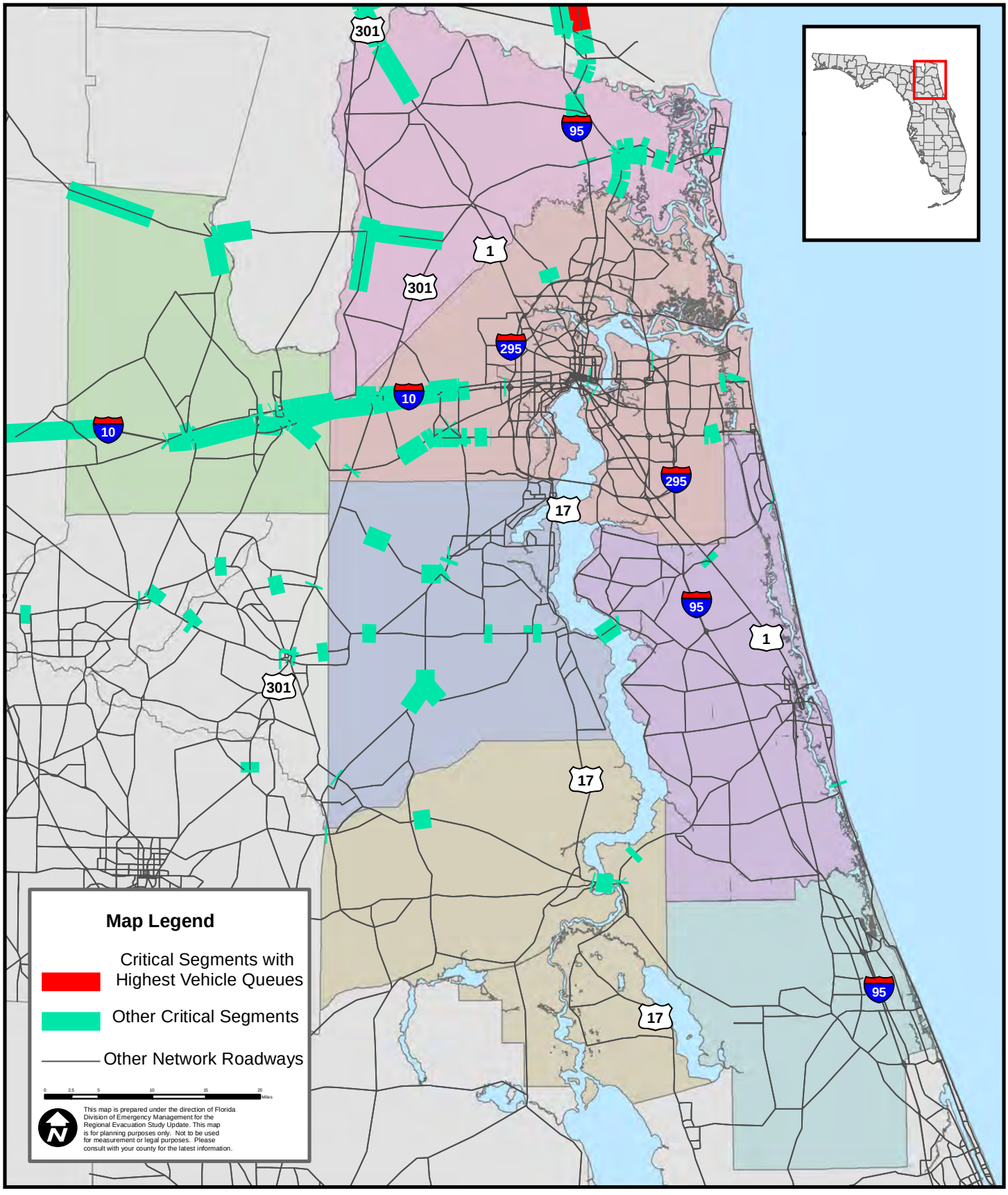


Sources: Northeast Florida Regional Council, CDM Smith

Map Printed: April, 2014

Figure IV-3

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

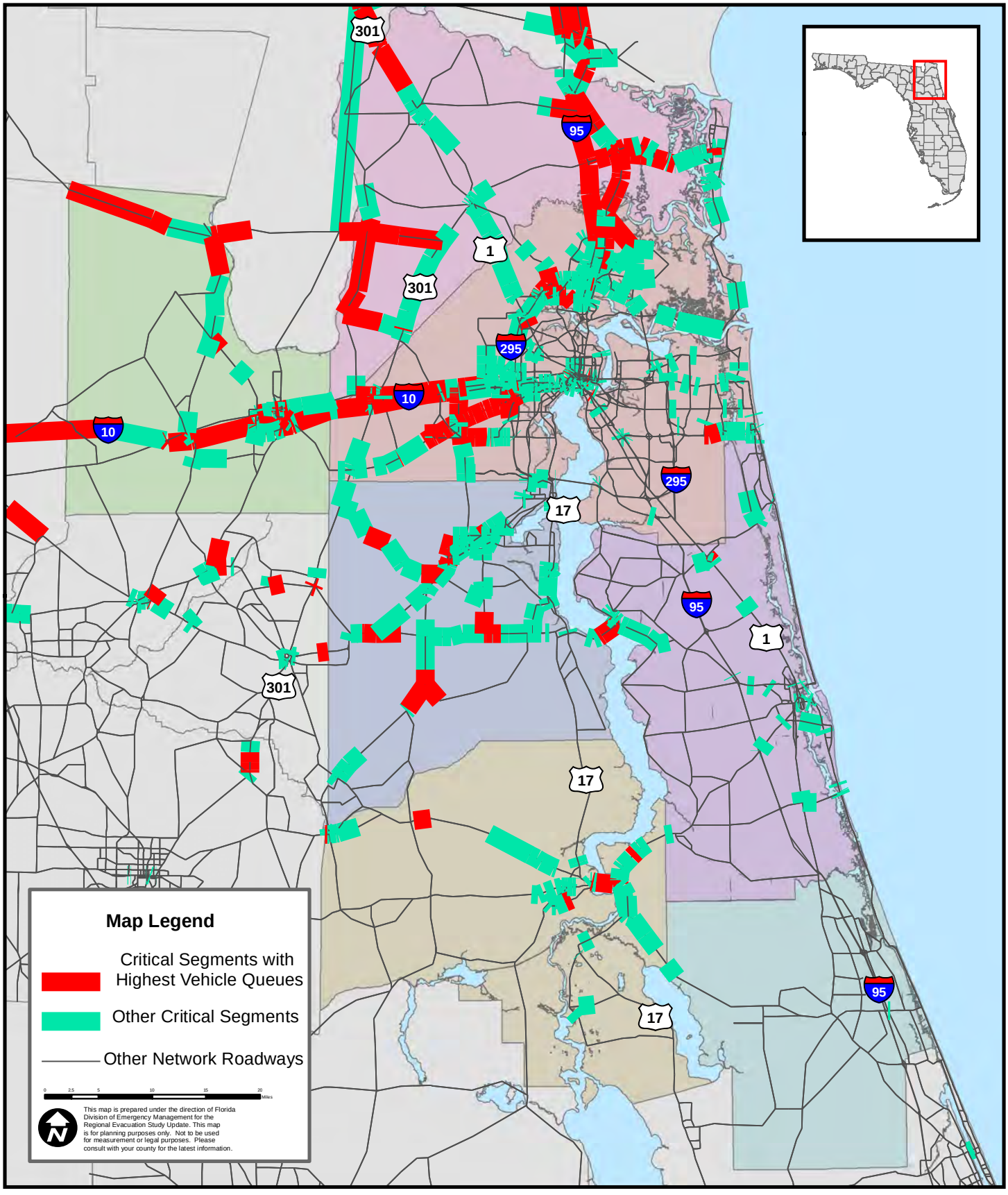


Sources: Northeast Florida Regional Council, CDM Smith

Map Printed: April, 2014

Figure IV-4

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

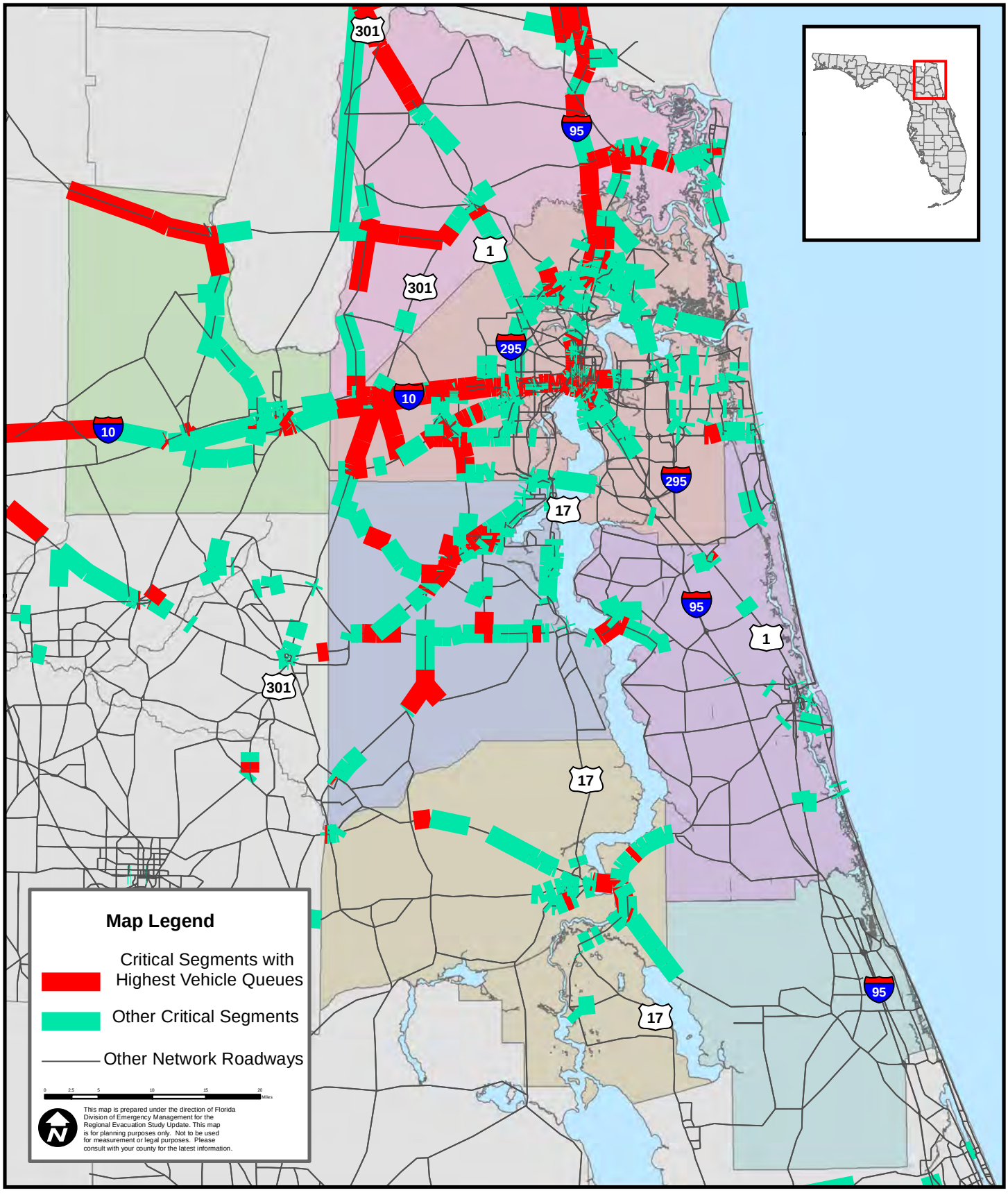


Sources: Northeast Florida Regional Council, CDM Smith

Map Printed: April, 2014

Figure IV-5

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

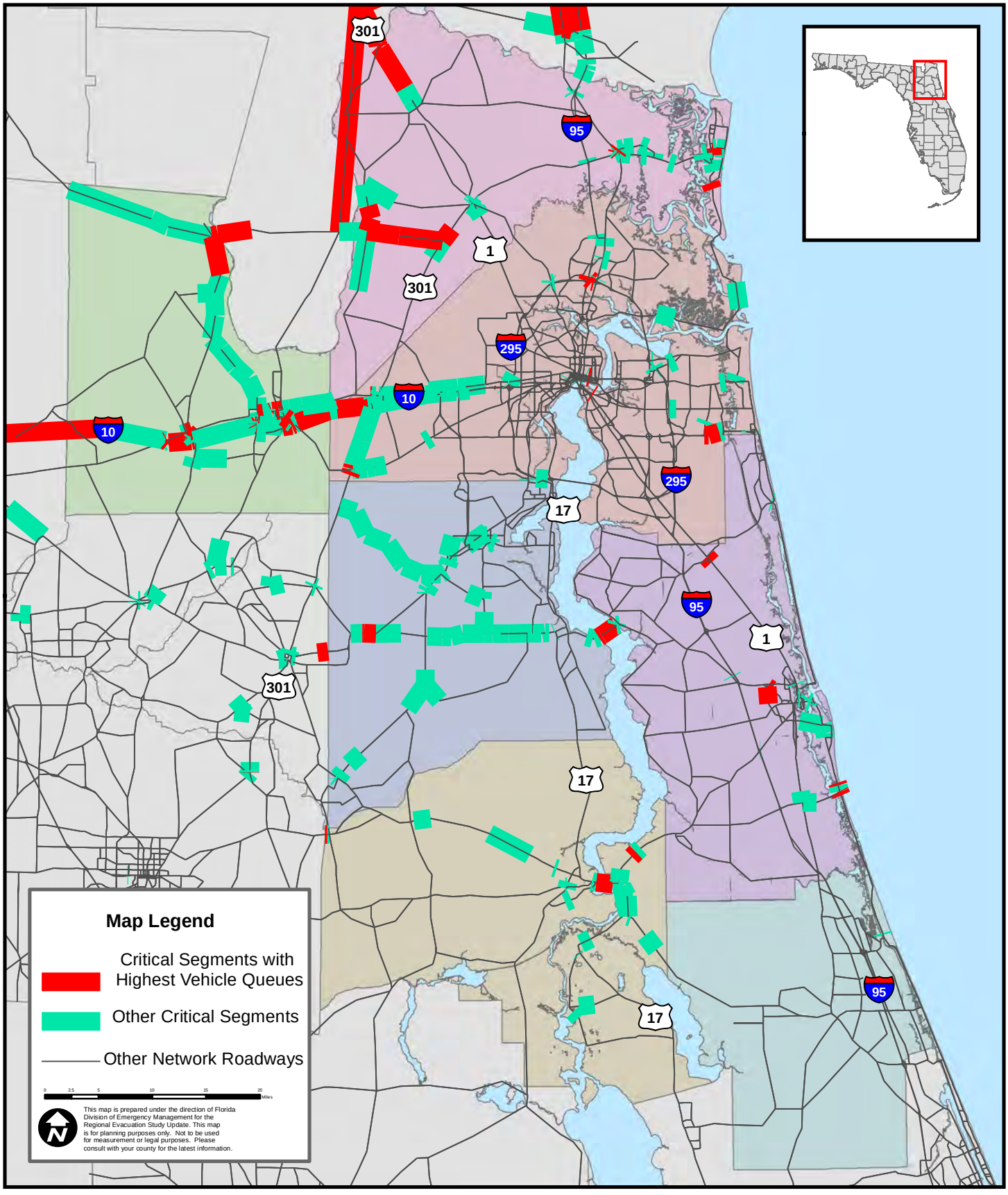


Sources: Northeast Florida Regional Council, CDM Smith

Map Printed: April, 2014

Figure IV-6

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

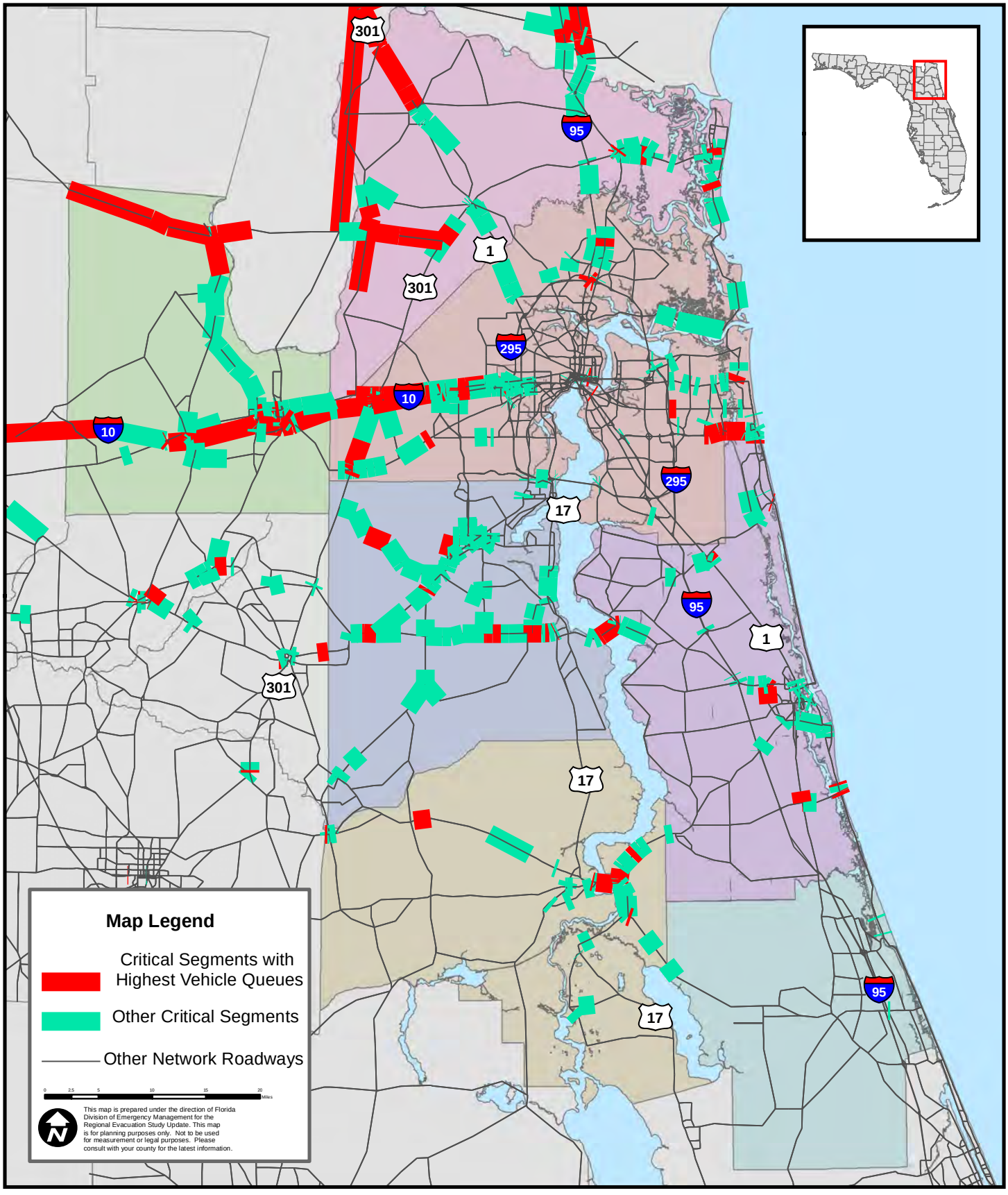


Sources: Northeast Florida Regional Council, CDM Smith

Map Printed: April, 2014

Figure IV-7

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

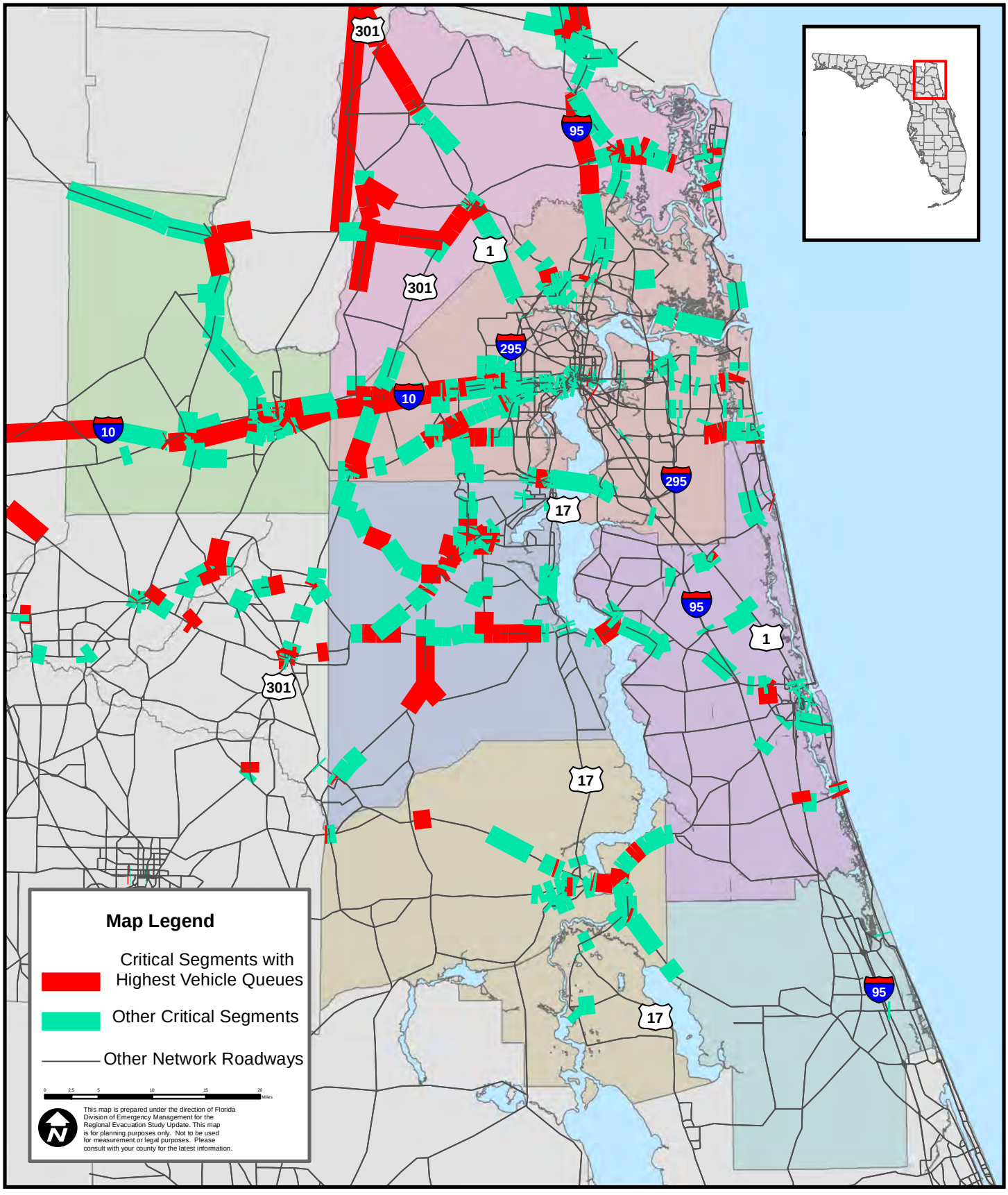


Sources: Northeast Florida Regional Council, CDM Smith

Map Printed: April, 2014

Figure IV-8

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

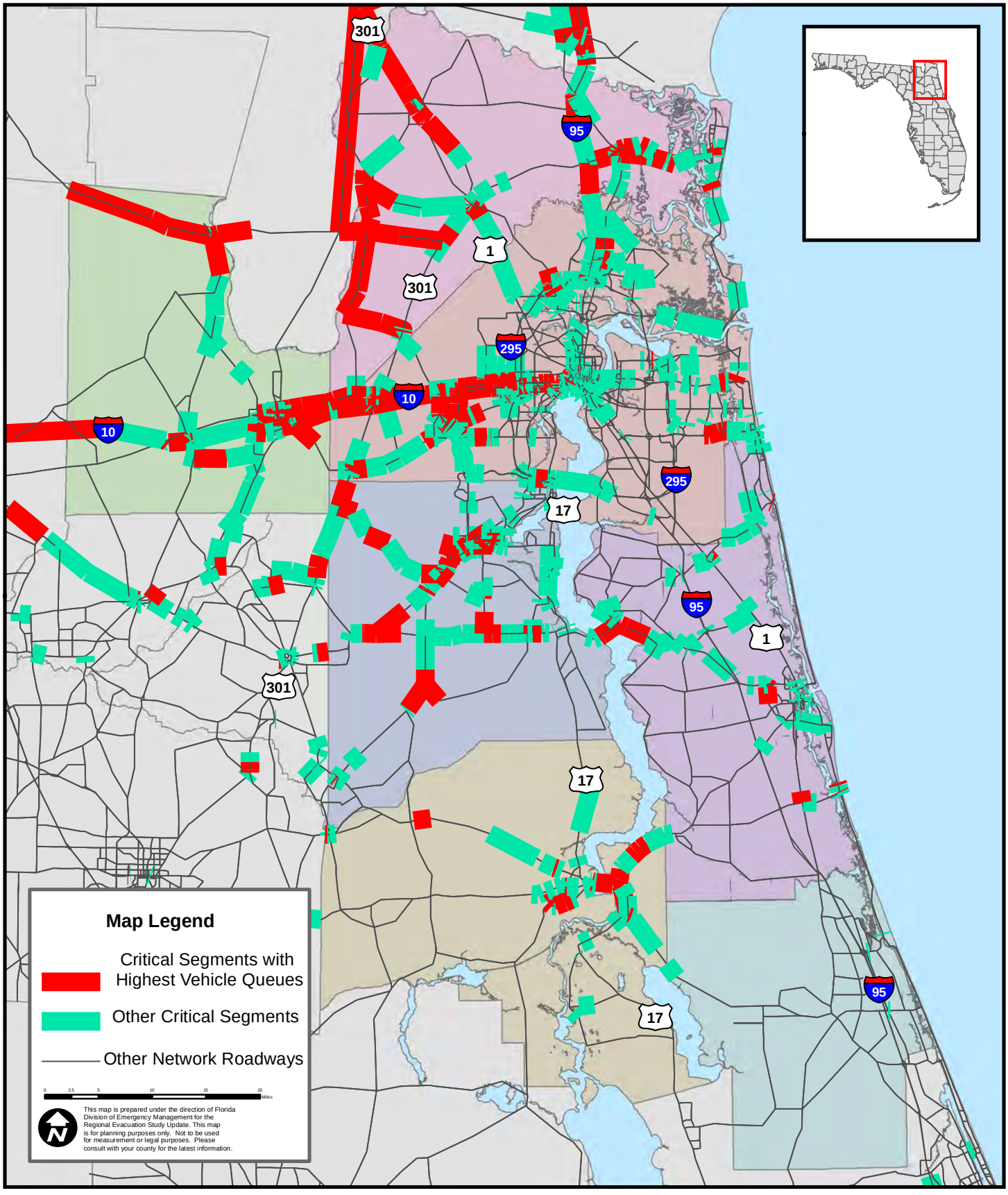


Sources: Northeast Florida Regional Council, CDM Smith

Map Printed: April, 2014

Figure IV-9

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

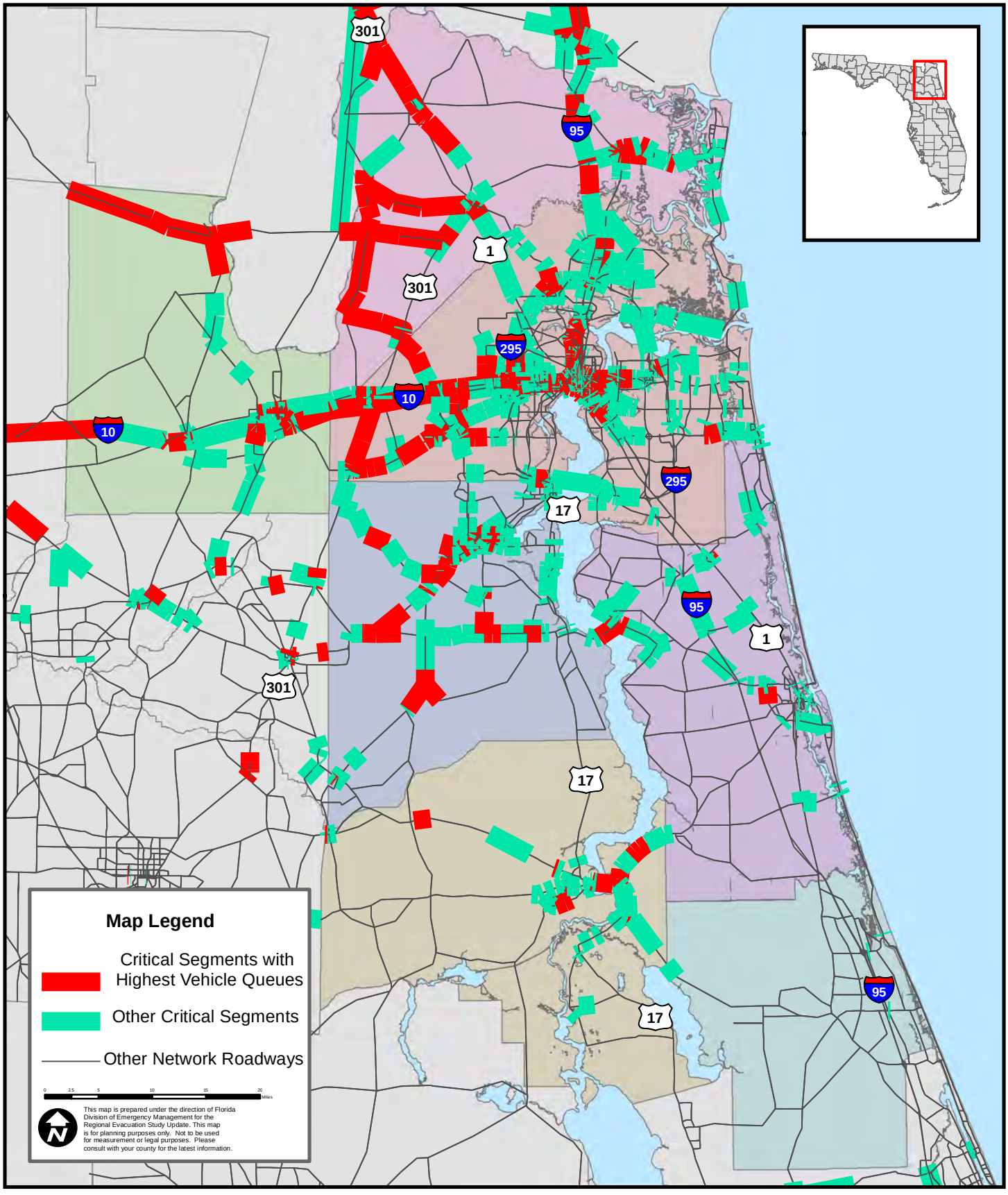


Sources: Northeast Florida Regional Council, CDM Smith

Map Printed: April, 2014

Figure IV-10

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



Sources: Northeast Florida Regional Council, CDM Smith

Map Printed: April, 2014

In addition to the identification of critical roadway segments, the total number of evacuating vehicles entering and exiting each county by evacuation scenario was also determined. Evacuating vehicles exiting each county by major evacuation route are identified in **Table IV-13** for 2015 and **Table IV-14** for 2020. In addition, evacuating vehicles entering each county by major evacuation route are identified in **Table IV-15** for 2015 and **Table IV-16** for 2020. Detailed volume figures for all evacuation routes in the Northeast Florida region for each base scenario are included in Volume 5-4.

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

Table IV-13 – Evacuating Vehicles Leaving Each County by Evacuation Route for the 2015 Base Scenario

	Evacuation Level A Scenario	Evacuation Level B Scenario	Evacuation Level C Scenario	Evacuation Level D Scenario	Evacuation Level E Scenario
Baker County					
SR 2 Westbound	9,900	10,500	13,500	16,900	18,200
US 90 Westbound	4,200	6,700	7,500	6,600	7,700
I-10 Westbound	28,300	36,000	49,300	52,300	63,000
SR 121 Southbound	800	1,000	1,700	2,000	2,100
I-10 Eastbound	400	400	500	600	600
Clay County					
US 301 Northbound	1,600	1,700	2,200	2,500	5,400
US 301 Southbound	11,700	17,200	23,300	31,000	28,300
SR 16 Westbound	4,700	6,300	5,900	7,300	8,100
SR 230 Westbound	800	1,200	700	1,000	1,000
SR 100 Northbound	3,200	5,000	6,400	6,000	8,300
SR 21 Southbound	1,900	2,800	4,200	4,600	4,800
SR 100 Southbound	100	100	100	200	200
US 17 Southbound	700	2,200	5,100	7,200	8,200
SR 16 Eastbound	300	500	900	1,200	1,300
US 17 Northbound	1,000	1,200	1,700	2,100	2,500
SR 21 Northbound	3,700	4,700	8,600	9,400	9,500
Duval County					
I-95 Southbound	9,500	11,700	17,000	20,900	24,600
SR 13 Southbound	100	100	100	200	400
US 17 Southbound	1,000	4,500	5,900	7,900	11,800
SR 21 Southbound	6,800	8,100	8,100	10,900	12,900
US 301 Southbound	8,300	11,900	15,300	20,600	16,100
I-10 Westbound	24,300	31,000	43,300	33,300	41,400
US 90 Westbound	5,100	6,900	10,000	13,500	19,700
US 301 Northbound	100	100	100	200	800
US 1 Northbound	11,000	13,900	16,200	15,400	15,100
I-95 Northbound	36,000	45,000	50,900	60,100	72,100
US 17 Northbound	1,000	1,200	3,700	4,400	2,800
Flagler County					
I-95 Southbound	9,600	13,000	18,000	22,600	26,100
US 1 Southbound	300	300	400	600	700
SR 11 Southbound	300	900	1,800	2,300	2,600
SR 20 Westbound	2,000	3,000	3,900	4,600	5,800
US 1 Northbound	2,000	3,300	3,200	3,700	4,600
I-95 Northbound	7,100	8,900	9,200	11,100	13,900

Table IV-13 – Evacuating Vehicles Leaving Each County by Evacuation Route for the 2015 Base Scenario

	Evacuation Level A Scenario	Evacuation Level B Scenario	Evacuation Level C Scenario	Evacuation Level D Scenario	Evacuation Level E Scenario
Nassau County					
US 17 Southbound	500	600	800	1,000	1,000
I-95 Southbound	11,100	11,500	13,800	14,300	13,700
US 1 Southbound	500	500	700	700	700
US 301 Southbound	1,200	2,200	3,700	2,300	4,200
US 90 Westbound	5,100	6,900	10,000	13,500	19,700
US 1 Northbound	11,600	12,600	14,800	16,200	17,400
US 17 Northbound	5,300	9,200	13,300	21,600	15,800
I-95 Northbound	38,200	42,100	48,600	49,900	58,300
Putnam County					
US 17 Southbound	300	400	600	600	600
SR 19 Southbound	500	700	900	1,100	1,300
SR 20 Westbound	5,200	7,100	10,100	12,500	14,400
SR 21 Northbound	100	100	100	100	100
SR 100 Northbound	1,100	1,200	1,900	2,100	3,300
US 17 Northbound	800	1,000	800	900	900
SR 20 Eastbound	300	300	500	600	600
St. Johns County					
I-95 Southbound	9,500	12,800	17,700	21,800	25,300
US 1 Southbound	1,000	1,300	2,800	3,500	4,800
SR 207 Westbound	3,600	4,300	4,500	4,700	4,900
SR 16 Westbound	3,700	4,300	5,500	6,700	7,600
SR 13 Northbound	2,800	3,600	3,800	4,800	6,500
I-95 Northbound	21,600	30,100	28,900	31,500	33,800
US 1 Northbound	2,400	3,700	5,100	5,400	6,000

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

	Evacuation Level A Scenario	Evacuation Level B Scenario	Evacuation Level C Scenario	Evacuation Level D Scenario	Evacuation Level E Scenario
Baker County					
SR 2 Westbound	8,700	12,300	13,900	18,000	24,800
US 90 Westbound	5,400	8,700	9,700	11,800	10,700
I-10 Westbound	28,800	40,100	48,700	57,900	63,700
SR 121 Southbound	800	1,100	2,300	2,400	2,500
I-10 Eastbound	700	800	900	1,100	1,100
Clay County					
US 301 Northbound	1,800	2,700	2,200	3,400	4,500
US 301 Southbound	10,300	13,700	28,100	34,800	37,000
SR 16 Westbound	5,400	7,300	7,700	8,900	10,200
SR 230 Westbound	500	1,200	1,400	2,500	1,600
SR 100 Northbound	3,900	5,000	7,400	8,000	10,600
SR 21 Southbound	2,000	2,900	4,400	4,900	5,800
SR 100 Southbound	100	100	200	200	200
US 17 Southbound	1,700	3,100	8,500	10,200	10,200
SR 16 Eastbound	400	700	1,200	1,400	1,300
US 17 Northbound	900	1,200	1,500	1,700	1,800
SR 21 Northbound	3,000	5,500	8,600	9,300	10,700
Duval County					
I-95 Southbound	11,000	13,900	20,300	24,600	26,100
SR 13 Southbound	100	100	200	500	800
US 17 Southbound	2,700	7,600	11,600	12,300	15,700
SR 21 Southbound	7,200	7,900	9,400	10,400	12,600
US 301 Southbound	6,200	8,900	16,000	23,300	22,900
I-10 Westbound	25,200	33,100	38,700	45,900	42,200
US 90 Westbound	5,400	11,000	12,700	9,500	11,100
US 301 Northbound	500	200	900	800	2,800
US 1 Northbound	11,700	13,500	14,400	14,000	16,400
I-95 Northbound	38,300	46,700	47,400	57,300	61,600
US 17 Northbound	900	1,200	2,300	2,600	3,400
Flagler County					
I-95 Southbound	10,800	15,000	22,500	28,300	30,300
US 1 Southbound	300	300	500	700	800
SR 11 Southbound	700	1,300	2,600	3,600	4,900
SR 20 Westbound	2,500	3,800	4,500	5,000	5,800
US 1 Northbound	2,200	3,800	3,500	4,000	5,300
I-95 Northbound	7,500	9,500	9,100	10,500	14,300
Nassau County					
US 17 Southbound	600	600	900	900	1,200
I-95 Southbound	12,400	13,000	14,900	15,800	15,000
US 1 Southbound	300	400	500	500	600

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

	Evacuation Level A Scenario	Evacuation Level B Scenario	Evacuation Level C Scenario	Evacuation Level D Scenario	Evacuation Level E Scenario
US 301 Southbound	1,300	1,900	3,600	2,900	2,800
US 90 Westbound	5,400	11,000	12,700	9,500	11,100
US 1 Northbound	11,800	13,400	15,400	17,200	20,800
US 17 Northbound	6,000	6,300	13,900	15,800	12,400
I-95 Northbound	39,500	47,100	41,300	47,100	58,100
Putnam County					
US 17 Southbound	400	400	600	600	500
SR 19 Southbound	800	1,000	1,200	1,600	1,900
SR 20 Westbound	6,100	8,000	12,400	14,200	16,000
SR 21 Northbound	100	100	100	100	200
SR 100 Northbound	1,200	1,600	3,100	3,600	4,100
US 17 Northbound	900	900	700	800	1,000
SR 20 Eastbound	300	400	600	700	500
St. Johns County					
I-95 Southbound	10,900	14,700	21,800	26,600	27,300
US 1 Southbound	1,300	1,700	3,900	5,300	4,600
SR 207 Westbound	3,900	4,800	5,200	5,600	6,100
SR 16 Westbound	4,000	5,000	7,200	7,600	8,200
SR 13 Northbound	4,500	6,200	6,200	6,300	7,800
I-95 Northbound	25,400	35,200	32,200	34,700	40,900
US 1 Northbound	1,900	3,100	2,800	2,900	4,100

Table IV-15 – Evacuating Vehicles Entering Each County by Evacuation Route for the 2015 Base Scenario

	Evacuation Level A Scenario	Evacuation Level B Scenario	Evacuation Level C Scenario	Evacuation Level D Scenario	Evacuation Level E Scenario
Baker County					
SR 2 Westbound	1,800	1,400	1,700	2,100	3,100
SR 121 Northbound	3,500	5,500	3,300	9,200	6,300
I-10 Westbound	24,300	31,000	43,300	33,300	41,400
US 90 Westbound	5,100	6,900	10,000	13,500	19,700
Clay County					
US 17 Southbound	1,000	4,500	5,900	7,900	11,800
SR 21 Southbound	6,800	8,100	8,100	10,900	12,900
US 301 Southbound	8,300	11,900	15,300	20,600	16,100
SR 100 Northbound	1,100	1,200	1,900	2,100	3,300
US 17 Northbound	800	1,000	800	900	900
SR 16 Westbound	3,700	4,300	5,500	6,700	7,600
Duval County					
I-10 Eastbound	400	400	500	600	600
US 301 Northbound	1,600	1,700	2,200	2,500	5,400
US 17 Northbound	1,000	1,200	1,700	2,100	2,500
SR 21 Northbound	3,700	4,700	8,600	9,400	9,500
US 17 Southbound	500	600	800	1,000	1,000
I-95 Southbound	11,100	11,500	13,800	14,300	13,700
US 1 Southbound	500	500	700	700	700
US 301 Southbound	1,200	2,200	3,700	2,300	4,200
SR 13 Northbound	2,800	3,600	3,800	4,800	6,500
I-95 Northbound	21,600	30,100	28,900	31,500	33,800
US 1 Northbound	2,400	3,700	5,100	5,400	6,000
Flagler County					
I-95 Southbound	9,500	12,800	17,700	21,800	25,300
US 1 Southbound	1,000	1,300	2,800	3,500	4,800
SR 11 Northbound	200	200	200	200	300
US 1 Northbound	300	400	600	1,000	1,900
I-95 Northbound	3,800	4,300	4,600	5,700	8,300
Nassau County					
US 90 Westbound	5,100	6,900	10,000	13,500	19,700
US 301 Northbound	100	100	100	200	800
US 1 Northbound	11,000	13,900	16,200	15,400	15,100
I-95 Northbound	36,000	45,000	50,900	60,100	72,100
US 17 Northbound	1,000	1,200	3,700	4,400	2,800
Putnam County					

Table IV-15 – Evacuating Vehicles Entering Each County by Evacuation Route for the 2015 Base Scenario

	Evacuation Level A Scenario	Evacuation Level B Scenario	Evacuation Level C Scenario	Evacuation Level D Scenario	Evacuation Level E Scenario
SR 21 Southbound	1,900	2,700	3,900	4,600	4,700
SR 100 Southbound	100	100	100	200	200
US 17 Southbound	700	2,200	5,100	7,200	8,200
SR 20 Westbound	2,000	3,000	3,900	4,600	5,800
SR 207 Westbound	3,600	4,300	4,500	4,700	4,900
St. Johns County					
SR 16 Eastbound	300	500	900	1,200	1,300
I-95 Southbound	9,500	11,700	17,000	20,900	24,600
SR 13 Southbound	100	100	100	200	400
US 1 Northbound	2,000	3,300	3,200	3,700	4,600
I-95 Northbound	7,100	8,900	9,200	11,100	13,900

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

	Evacuation Level A Scenario	Evacuation Level B Scenario	Evacuation Level C Scenario	Evacuation Level D Scenario	Evacuation Level E Scenario
Baker County					
SR 2 Westbound	1,400	1,900	1,900	2,700	8,600
SR 121 Northbound	600	700	4,200	12,000	11,300
I-10 Westbound	25,200	33,100	38,700	45,900	42,200
US 90 Westbound	5,400	11,000	12,700	9,500	11,100
Clay County					
US 17 Southbound	2,700	7,600	11,600	12,300	15,700
SR 21 Southbound	7,200	7,900	9,400	10,400	12,600
US 301 Southbound	6,200	8,900	16,000	23,300	22,900
SR 100 Northbound	1,200	1,600	3,100	3,600	4,100
US 17 Northbound	900	900	700	800	1,000
SR 16 Westbound	4,000	5,000	7,200	7,600	8,200
Duval County					
I-10 Eastbound	700	800	900	1,100	1,100
US 301 Northbound	1,800	2,700	2,200	3,400	4,500
US 17 Northbound	900	1,200	1,500	1,700	1,800
SR 21 Northbound	3,000	5,500	8,600	9,300	10,700
US 17 Southbound	600	600	900	900	1,200
I-95 Southbound	12,400	13,000	14,900	15,800	15,000
US 1 Southbound	300	400	500	500	600
US 301 Southbound	1,300	1,900	3,600	2,900	2,800
SR 13 Northbound	4,500	6,200	6,200	6,300	7,800
I-95 Northbound	25,400	35,200	32,200	34,700	40,900
US 1 Northbound	1,900	3,100	2,800	2,900	4,100
Flagler County					
I-95 Southbound	10,900	14,700	21,800	26,600	27,300
US 1 Southbound	1,300	1,700	3,900	5,300	4,600
SR 11 Northbound	100	100	200	200	300
US 1 Northbound	300	500	800	900	1,600
I-95 Northbound	3,600	4,100	4,100	5,000	7,600
Nassau County					
US 90 Westbound	5,400	11,000	12,700	9,500	11,100
US 301 Northbound	500	200	900	800	2,800
US 1 Northbound	11,700	13,500	14,400	14,000	16,400
I-95 Northbound	38,300	46,700	47,400	57,300	61,600
US 17 Northbound	900	1,200	2,300	2,600	3,400
Putnam County					

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

	Evacuation Level A Scenario	Evacuation Level B Scenario	Evacuation Level C Scenario	Evacuation Level D Scenario	Evacuation Level E Scenario
SR 21 Southbound	2,000	2,900	4,300	4,900	5,800
SR 100 Southbound	100	100	200	200	200
US 17 Southbound	1,700	3,100	8,500	10,200	10,200
SR 20 Westbound	2,500	3,800	4,500	5,000	5,800
SR 207 Westbound	3,900	4,800	5,200	5,600	6,100
St. Johns County					
SR 16 Eastbound	400	700	1,200	1,400	1,300
I-95 Southbound	11,000	13,900	20,300	24,600	26,100
SR 13 Southbound	100	100	200	500	800
US 1 Northbound	2,200	3,800	3,500	4,000	5,300
I-95 Northbound	7,500	9,500	9,100	10,500	14,300

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, IV-13, IV-14, IV-15,** and **IV-16**. Clearance time includes several components, including the mobilization time for the evacuating population to prepare for an evacuation (pack supplies and personal belongs, load their vehicle, etc.), the actual time spent traveling on the roadway network, and the delay time caused by traffic congestion.

In-county clearance times for the base scenarios range from 13.5 hours for the evacuation level A scenarios to 34.5 hours in Nassau County for evacuation level E scenario in 2015. Clearance Time to Shelter clearance times for the base scenarios ranging from 12.5 hours for the evacuation level A scenarios to 34.5 hours in Nassau County for evacuation level E scenario in 2015.

In 2020, in-county clearance times for the base scenarios range from 13.5 hours for the evacuation level A scenarios to 37 hours for the evacuation level E scenario. Clearance Time to Shelter clearance times for the base scenarios ranging from 12.5 hours for the evacuation level A scenarios to 33.5 hours for evacuation level E scenario in 2020.

Out of county clearance times for the base scenarios range from 14.5 hours for the base evacuation level A scenario to 35.5 hours for the evacuation level E scenario in 2015. Out of county clearance times range from 15.0 hours for the base evacuation level A scenario to 38.5 hours in 2020.

Regional clearance time for the seven county NEFRC region ranges from 18 hours to 35.5 hours in 2015 and from 21 and 38.5 hours in 2020. Overall, when clearance times between years 2015 and 2020 are compared, there are some instances of decreases in clearance times in response to changes in the evacuation roadway network from roadway improvements located in Clay, Duval, Nassau, and St. Johns Counties. These improvements were previously identified in Table III-3, located in Chapter 3.

Table IV-17 – 2015 Clearance Times for Base Scenario

	Evacuation Level A Base Scenario	Evacuation Level B Base Scenario	Evacuation Level C Base Scenario	Evacuation Level D Base Scenario	Evacuation Level E Base Scenario
Clearance Time to Shelter					
Baker County	13.0	14.0	14.0	14.0	15.0
Clay County	14.0	15.5	17.0	17.0	20.0
Duval County	14.0	17.0	18.5	23.0	34.0
Flagler County	12.5	12.5	12.5	12.5	12.5
Nassau County	17.0	20.0	21.0	27.0	34.5
Putnam County	13.5	14.0	15.0	16.0	17.5
St. Johns County	14.0	17.5	17.5	18.0	18.0
In-County Clearance Time					
Baker County	13.5	14.5	14.5	14.5	15.5
Clay County	14.0	17.0	18.5	24.5	26.0
Duval County	14.5	17.0	18.5	24.0	34.0
Flagler County	14.5	17.5	19.0	22.0	25.5
Nassau County	17.0	20.5	21.0	28.5	34.5
Putnam County	14.0	18.0	18.5	25.5	26.0
St. Johns County	14.5	17.5	19.0	21.5	25.0
Out of County Clearance Time					
Baker County	17.5	20.5	24.0	28.5	35.0
Clay County	14.5	18.0	21.0	27.5	33.0
Duval County	15.0	17.5	21.0	27.5	34.5
Flagler County	14.5	17.5	19.5	22.0	25.5
Nassau County	18.0	21.5	22.0	28.5	35.5
Putnam County	15.0	18.0	19.0	26.0	27.0
St. Johns County	14.5	17.5	19.0	21.5	25.0
Regional Clearance Time					
Northeast Florida	18.0	21.5	24.0	28.5	35.5

Table IV-18 – 2020 Clearance Times for Base Scenario

	Evacuation Level A Base Scenario	Evacuation Level B Base Scenario	Evacuation Level C Base Scenario	Evacuation Level D Base Scenario	Evacuation Level E Base Scenario
Clearance Time to Shelter					
Baker County	13.0	14.0	14.0	14.0	15.5
Clay County	14.0	16.5	17.0	18.5	21.5
Duval County	14.0	18.0	18.5	25.0	30.0
Flagler County	12.5	12.5	12.5	12.5	12.5
Nassau County	20.0	20.0	24.0	26.5	33.5
Putnam County	14.0	14.5	16.5	18.0	18.5
St. Johns County	14.5	18.5	19.0	19.0	19.0
In-County Clearance Time					
Baker County	13.5	14.5	14.5	14.5	16.0
Clay County	14.5	18.5	23.0	23.5	26.5
Duval County	15.0	18.5	19.0	25.0	30.0
Flagler County	15.0	18.5	20.5	21.0	27.0
Nassau County	20.0	21.0	26.0	32.5	37.0
Putnam County	14.5	19.0	20.5	21.5	25.5
St. Johns County	15.0	18.5	20.0	21.0	26.5
Out of County Clearance Time					
Baker County	19.5	21.5	25.5	31.0	37.5
Clay County	15.5	19.5	23.5	25.5	31.5
Duval County	15.0	20.5	22.5	25.5	33.0
Flagler County	15.5	19.0	20.5	21.5	27.0
Nassau County	21.0	22.0	28.0	34.5	38.5
Putnam County	15.0	19.5	23.5	24.5	27.5
St. Johns County	15.0	18.5	20.0	21.0	26.5
Regional Clearance Time					
Northeast Florida	21.0	22.0	28.0	34.5	38.5

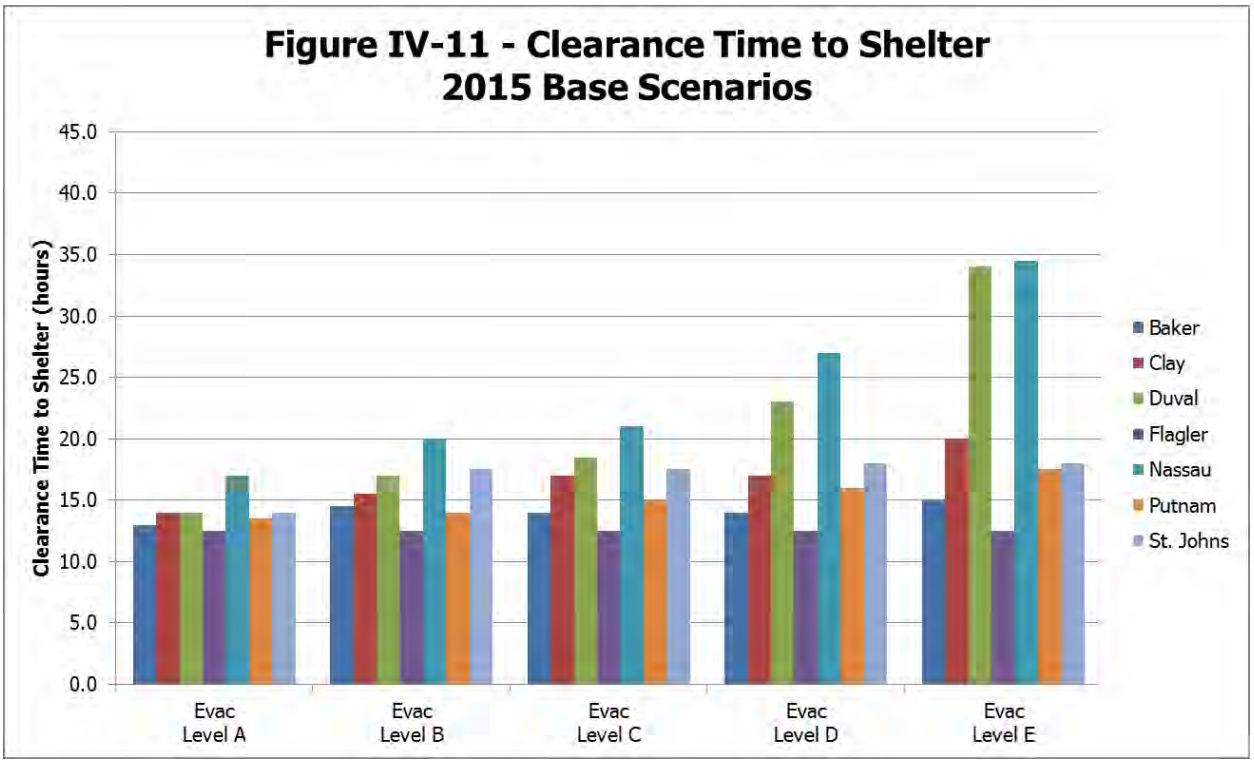


Figure IV-11 - Clearance Time to Shelter
2015 Base Scenarios
Clearance Time to Shelter (hours)
45.0
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
Evac Level A
Evac Level B
Evac Level C
Evac Level D
Evac Level E
Baker
Clay
Duval
Flagler
Nassau
Putnam
St. Johns

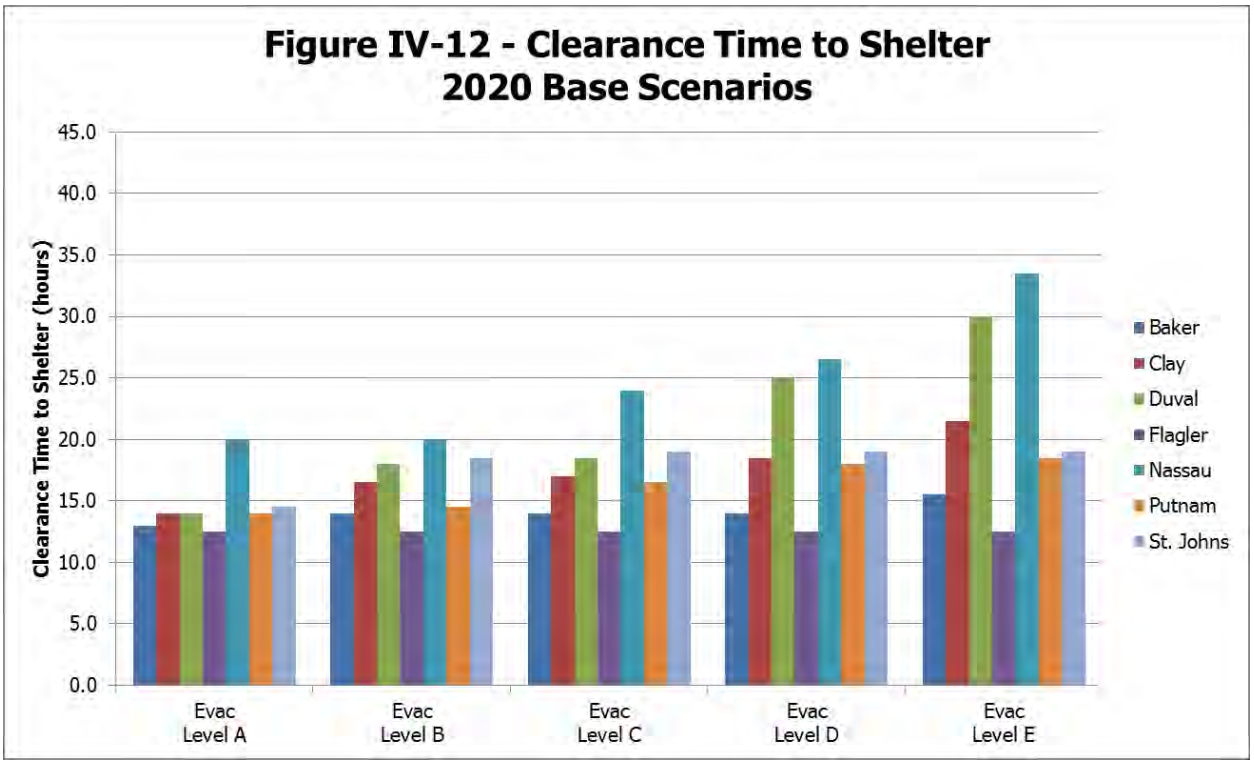


Figure IV-12 - Clearance Time to Shelter
2020 Base Scenarios
Clearance Time to Shelter (hours)
45.0
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
Evac Level A
Evac Level B
Evac Level C
Evac Level D
Evac Level E
Baker
Clay
Duval
Flagler
Nassau
Putnam
St. Johns

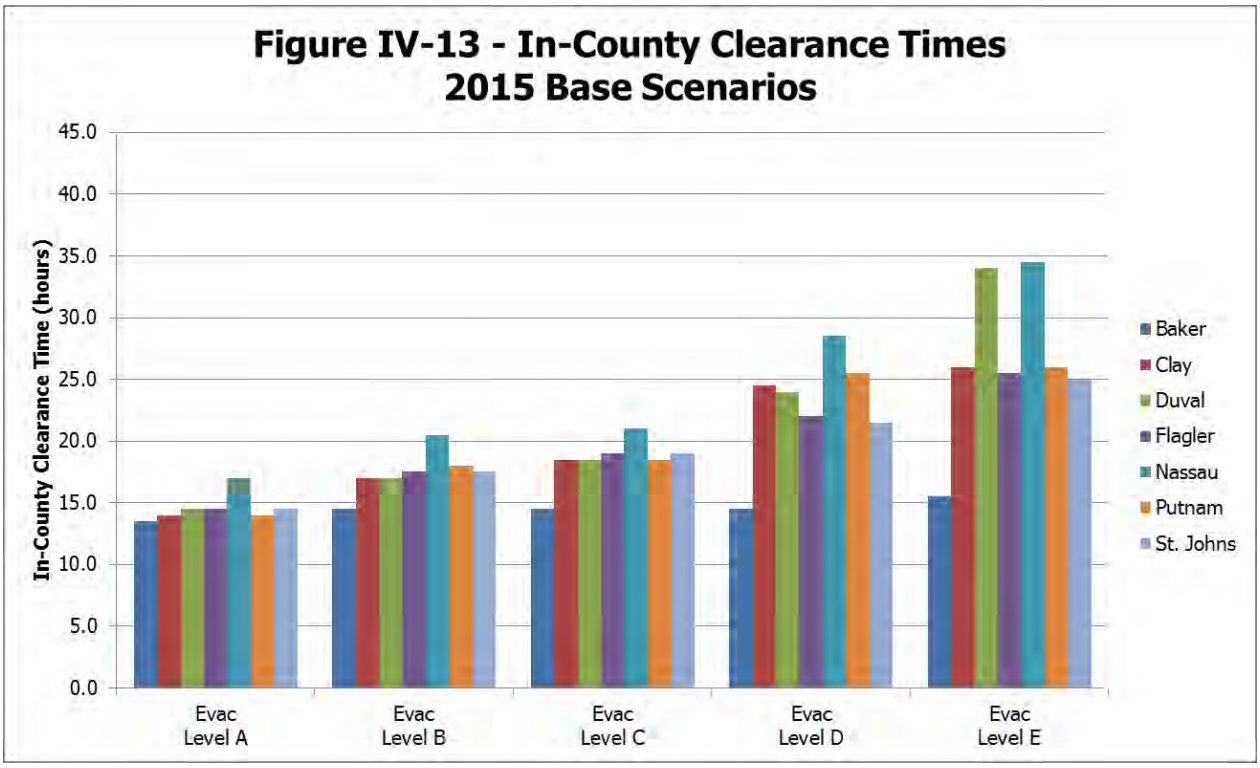


Figure IV-13 - In-County Clearance Times
2015 Base Scenarios
In-County Clearance Time (hours)
45.0
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
Evac Level A
Evac Level B
Evac Level C
Evac Level D
Evac Level E
Baker
Clay
Duval
Flagler
Nassau
Putnam
St. Johns

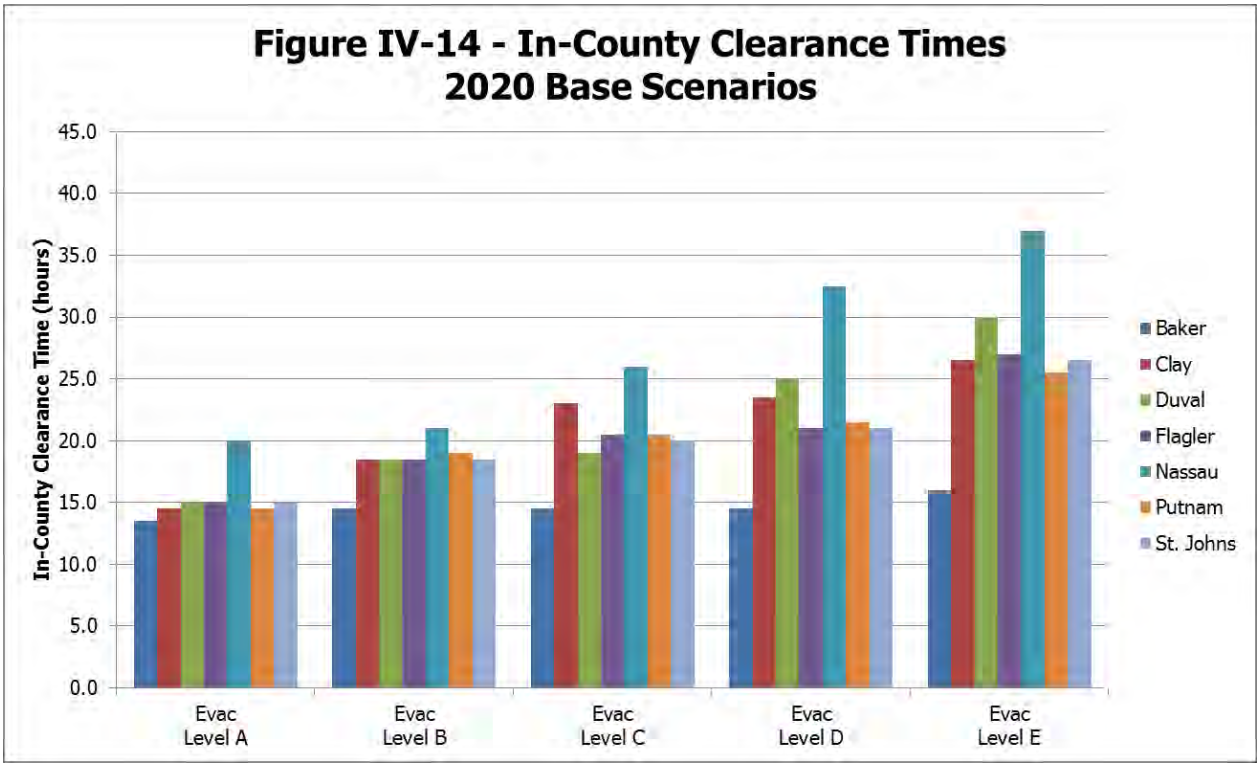


Figure IV-14 - In-County Clearance Times
2020 Base Scenarios
In-County Clearance Time (hours)
45.0
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
Evac Level A
Evac Level B
Evac Level C
Evac Level D
Evac Level E
Baker
Clay
Duval
Flagler
Nassau
Putnam
St. Johns

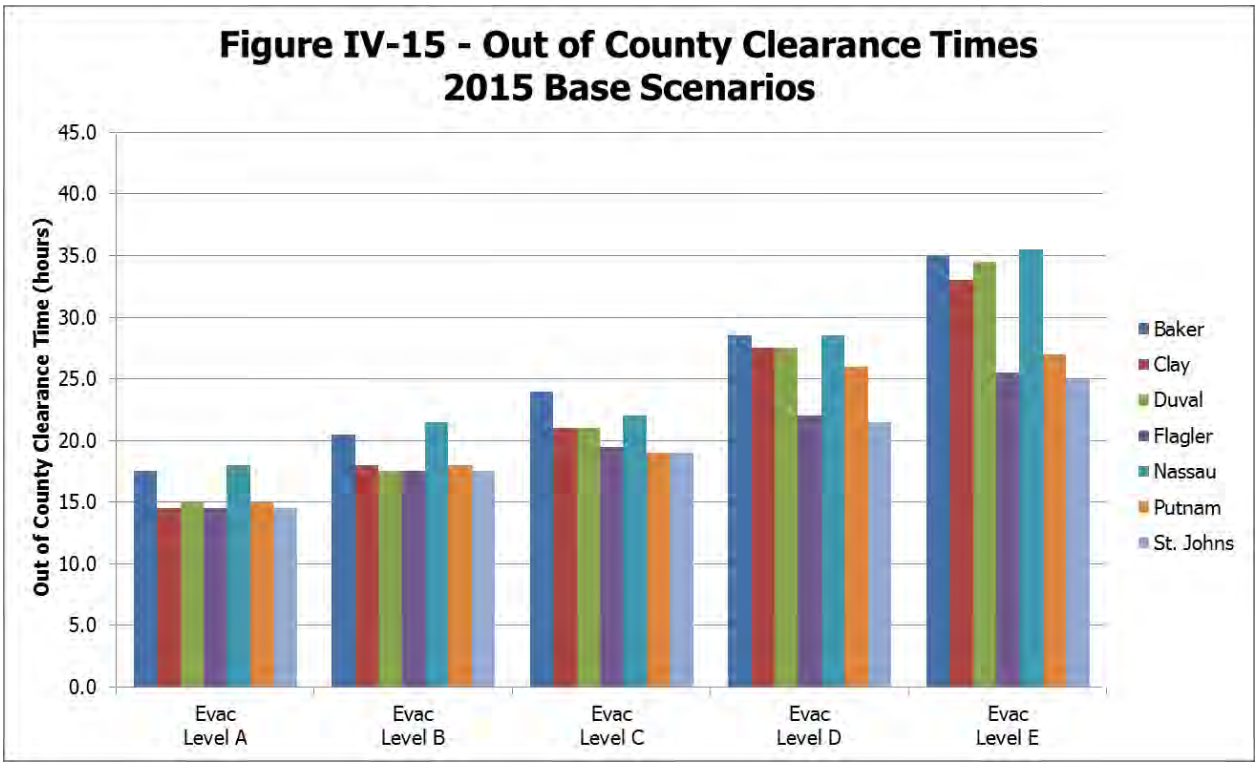


Figure IV-15 - Out of County Clearance Times
2015 Base Scenarios
Out of County Clearance Time (hours)
45.0
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
Evac Level A
Evac Level B
Evac Level C
Evac Level D
Evac Level E
Baker
Clay
Duval
Flagler
Nassau
Putnam
St. Johns

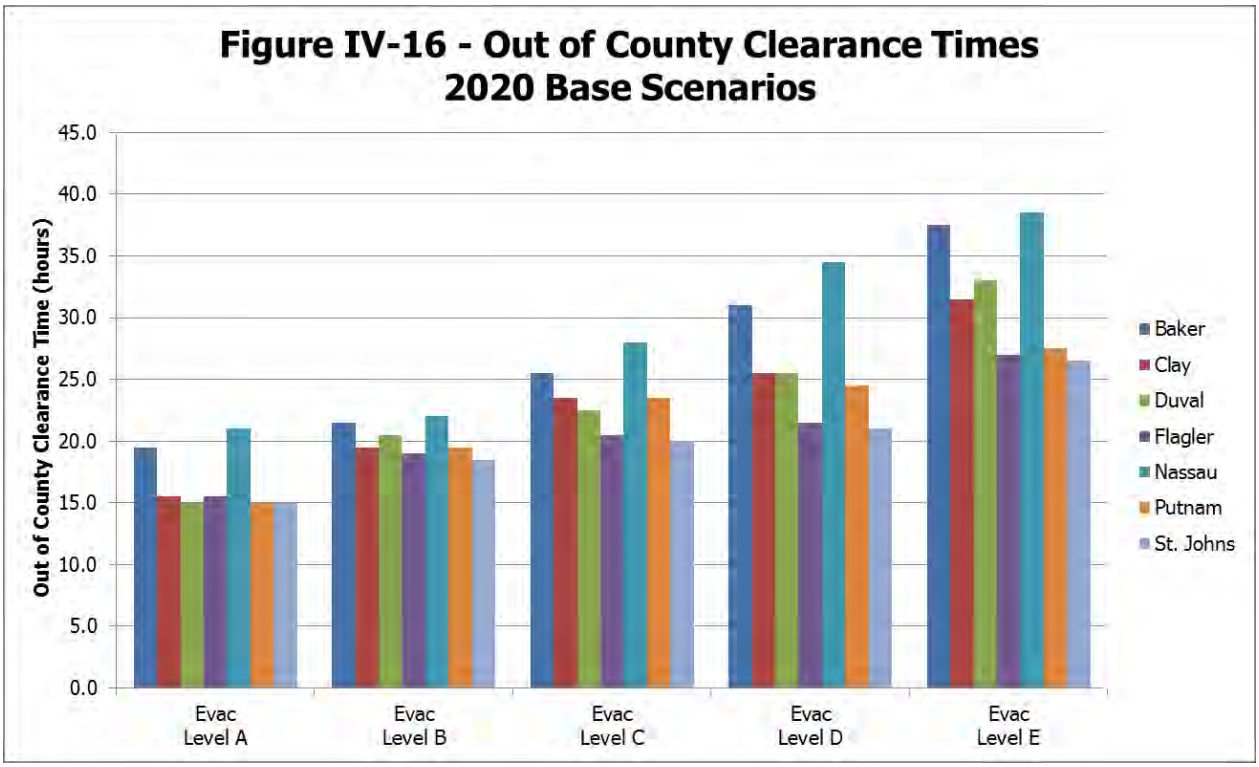


Figure IV-16 - Out of County Clearance Times
2020 Base Scenarios
Out of County Clearance Time (hours)
45.0
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
Evac Level A
Evac Level B
Evac Level C
Evac Level D
Evac Level E
Baker
Clay
Duval
Flagler
Nassau
Putnam
St. Johns

F. Operational Scenarios

The transportation analysis also included fourteen region wide operational scenarios selected by the county emergency managers and NEFRC staff for the Northeast Florida Region. While the base scenarios required that the basic assumptions were consistent between scenarios except for the year and the evacuation level, this is not the case for the operational scenarios. The only requirement for each region is that two operational scenarios are developed for each evacuation level (two for Level A, two for Level B, etc.). Operational Scenarios 1 through 7 are for year 2015 while Scenarios 8 through 14 are for year 2020. Otherwise, the assumptions and characteristics between the fourteen operational scenarios can be different for each scenario.

The fourteen operational scenarios selected for analysis in the Northeast Florida Region are illustrated in **Table IV-19**. Due to its geographic location, the Northeast Florida region is not greatly impacted by evacuations in other parts of the State, with the exception of some impacts from the East Central region immediately to the south. For this reason, the NEFRC and local county emergency managers selected operational scenarios similar to the base scenarios, with the only exceptions being the use of the behavioral planning assumptions instead of the 100 percent behavioral assumptions, the testing of one-way flow for certain scenarios along I-10, and the inclusion of a new evacuation zone F for two of the scenarios.

All fourteen operational scenarios used the default tourist and university population rates, along with the 12-hour response curve. Counties evacuating also were identical to the base scenarios and included the seven counties within the region plus one coastal county on either side of the region (Volusia County and Camden County, GA).

Table IV-19 – Operational Scenarios

	Scenario 1 Level A 2015	Scenario 2 Level B 2015	Scenario 3 Level C w/ 1way 2015	Scenario 4 Level C 2015	Scenario 5 Level D 2015	Scenario 6 Level E 2015	Scenario 7 Level C+F 2015
Demographic Data	2015	2015	2015	2015	2015	2015	2015
Highway Network	2015	2015	2015	2015	2015	2015	2015
One-Way Operations	None	None	I-10	None	None	None	None
University Population	Fall/Spring	Fall/Spring	Fall/Spring	Fall/Spring	Fall/Spring	Fall/Spring	Fall/Spring
Tourist Rate	Default	Default	Default	Default	Default	Default	Default
Shelters Open	Primary	Primary	Primary	Primary	Primary	Primary	Primary
Response Curve	12-hour	12-hour	12-hour	12-hour	12-hour	12-hour	12-hour
Evacuation Phasing	None	None	None	None	None	None	None
Behavioral Response	Planning	Planning	Planning	Planning	Planning	Planning	Planning
Evacuation Zone	A	B	C	C	D	E	C + F
Counties Evacuating	Baker Clay Duval Flagler Putnam Nassau St. Johns Camden (GA) Volusia	Baker Clay Duval Flagler Putnam Nassau St. Johns Camden (GA) Volusia	Baker Clay Duval Flagler Putnam Nassau St. Johns Camden (GA) Volusia	Baker Clay Duval Flagler Putnam Nassau St. Johns Camden (GA) Volusia	Baker Clay Duval Flagler Putnam Nassau St. Johns Camden (GA) Volusia	Baker Clay Duval Flagler Putnam Nassau St. Johns Camden (GA) Volusia	Baker Clay Duval Flagler Putnam Nassau St. Johns Camden (GA) Volusia
	Scenario 8 Level A 2020	**Scenario 9 Level B 2020**	**Scenario 10 Level C 2020**	**Scenario 11 Level D 2020**	**Scenario 12 Level E w/ 1way 2020**	**Scenario 13 Level E 2020**	**Scenario 14 Level C+F 2020**
Demographic Data	2020	2020	2020	2020	2020	2020	2020
Highway Network	2020	2020	2020	2020	2020	2020	2020
One-Way Operations	None	None	None	None	I-10	None	None
University Population	Fall/Spring	Fall/Spring	Fall/Spring	Fall/Spring	Fall/Spring	Fall/Spring	Fall/Spring
Tourist Rate	Default	Default	Default	Default	Default	Default	Default
Shelters Open	Primary	Primary	Primary	Primary	Primary	Primary	Primary
Response Curve	12-hour	12-hour	12-hour	12-hour	12-hour	12-hour	12-hour
Evacuation Phasing	None	None	None	None	None	None	None
Behavioral Response	Planning	Planning	Planning	Planning	Planning	Planning	Planning
Evacuation Zone	A	B	C	D	E	E	C + F
Counties Evacuating	Baker Clay Duval Flagler Putnam Nassau St. Johns Camden (GA) Volusia	Baker Clay Duval Flagler Putnam Nassau St. Johns Camden (GA) Volusia	Baker Clay Duval Flagler Putnam Nassau St. Johns Camden (GA) Volusia	Baker Clay Duval Flagler Putnam Nassau St. Johns Camden (GA) Volusia	Baker Clay Duval Flagler Putnam Nassau St. Johns Camden (GA) Volusia	Baker Clay Duval Flagler Putnam Nassau St. Johns Camden (GA) Volusia	Baker Clay Duval Flagler Putnam Nassau St. Johns Camden (GA) Volusia

G. Operational Scenario Results

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

Evacuating Population

Similar to the base scenarios, the evacuating population was estimated for the seven county region. Evacuating population as reported from the modeling results for the operational scenarios is summarized by county for 2015 in **Table IV-20** and for 2020 in **Table IV-21**.

Within the seven county region, total evacuating population ranges from more than 399,000 persons for the operational scenario level A evacuation to more than 1 million persons for the operational scenario level E evacuation in 2015. By 2020, this range increases within the seven counties to more than 430,000 persons for the operational scenario level A evacuation to almost 1.1 million persons for the operational scenario level E evacuation.

The F zone evacuation adds more than 13,800 persons to the level C evacuation in 2015, and adds more than 15,100 persons to the level C evacuation in 2020.

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

	Scenario 1 Level A 2015	Scenario 2 Level B 2015	Scenario 3 Level C w/ 1way 2015	Scenario 4 Level C 2015	Scenario 5 Level D 2015	Scenario 6 Level E 2015	Scenario 7 Level C+F 2015
Baker County							
Site-built Homes	813	1,626	2,439	2,439	3,252	4,065	2,439
Mobile/Manuf. Homes	7,056	7,644	8,820	8,820	9,408	10,583	8,820
Tourists	0	0	0	0	0	0	0
TOTAL	7,869	9,270	11,259	11,259	12,660	14,648	11,259
Clay County							
Site-built Homes	20,783	32,286	47,695	47,695	71,153	85,076	47,695
Mobile/Manuf. Homes	15,065	16,542	21,726	21,726	23,165	24,482	21,726
Tourists	6	6	560	560	560	560	560
TOTAL	35,854	48,834	69,981	69,981	94,878	110,118	69,981
Duval County							
Site-built Homes	183,462	236,187	319,903	319,903	418,528	502,752	325,004
Mobile/Manuf. Homes	28,385	31,808	39,628	39,628	43,026	45,106	39,786
Tourists	1,360	2,605	4,379	4,379	5,892	6,767	5,374
TOTAL	213,207	270,600	363,910	363,910	467,446	554,625	370,164
Flagler County							
Site-built Homes	16,183	23,413	31,450	31,450	44,646	55,198	31,664
Mobile/Manuf. Homes	3,083	3,418	4,362	4,362	4,695	4,937	4,385
Tourists	71	325	499	499	501	501	499
TOTAL	19,337	27,156	36,311	36,311	49,842	60,636	36,548
Nassau County							
Site-built Homes	19,488	24,587	31,513	31,513	38,520	44,210	32,374
Mobile/Manuf. Homes	12,022	13,424	16,747	16,747	18,185	19,071	16,787
Tourists	1,041	1,041	1,082	1,082	1,213	1,234	1,082
TOTAL	32,551	39,052	49,342	49,342	57,918	64,515	50,243
Putnam County							
Site-built Homes	6,086	7,084	11,820	11,820	15,108	19,559	11,820
Mobile/Manuf. Homes	16,844	18,613	23,982	23,982	25,741	27,147	23,982
Tourists	134	149	149	149	184	184	149
TOTAL	23,064	25,846	35,951	35,951	41,033	46,890	35,951
St. Johns County							
Site-built Homes	53,040	73,840	92,851	92,851	121,679	140,867	99,181
Mobile/Manuf. Homes	12,500	13,770	17,457	17,457	18,917	19,791	17,569
Tourists	1,792	2,863	2,863	2,863	2,863	2,863	2,892
TOTAL	67,332	90,473	113,171	113,171	143,459	163,521	119,642

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

	Scenario 8 Level A 2020	Scenario 9 Level B 2020	Scenario 10 Level C 2020	Scenario 11 Level D 2020	Scenario 12 Level E w/ 1way 2020	Scenario 13 Level E 2020	Scenario 14 Level C + F 2020
Baker County							
Site-built Homes	877	1,754	2,631	3,507	4,384	4,384	2,631
Mobile/Manuf. Homes	7,590	8,223	9,488	10,120	11,385	11,385	9,488
Tourists	0	0	0	0	0	0	0
TOTAL	8,467	9,977	12,119	13,627	15,769	15,769	12,119
Clay County							
Site-built Homes	23,164	35,985	53,153	79,291	94,805	94,805	53,153
Mobile/Manuf. Homes	16,773	18,418	24,189	25,790	27,257	27,257	24,189
Tourists	6	6	560	560	560	560	560
TOTAL	39,943	54,409	77,902	105,641	122,622	122,622	77,902
Duval County							
Site-built Homes	191,812	246,936	334,468	437,588	525,648	525,648	339,797
Mobile/Manuf. Homes	29,774	33,367	41,564	45,130	47,310	47,310	41,729
Tourists	1,360	2,605	4,379	5,892	6,767	6,767	5,374
TOTAL	222,946	282,908	380,411	488,610	579,725	579,725	386,900
Flagler County							
Site-built Homes	19,310	27,932	37,523	53,266	65,854	65,854	37,778
Mobile/Manuf. Homes	3,676	4,076	5,201	5,599	5,887	5,887	5,230
Tourists	71	325	499	501	501	501	499
TOTAL	23,057	32,333	43,223	59,366	72,242	72,242	43,507
Nassau County							
Site-built Homes	20,751	26,182	33,565	41,038	47,106	47,106	34,455
Mobile/Manuf. Homes	12,966	14,476	18,067	19,617	20,574	20,574	18,108
Tourists	1,041	1,041	1,082	1,213	1,234	1,234	1,082
TOTAL	34,758	41,699	52,714	61,868	68,914	68,914	53,645
Putnam County							
Site-built Homes	6,159	7,169	11,962	15,291	19,798	19,798	11,962
Mobile/Manuf. Homes	17,033	18,822	24,250	26,029	27,450	27,450	24,250
Tourists	134	149	149	184	184	184	149
TOTAL	23,326	26,140	36,361	41,504	47,432	47,432	36,361
St. Johns County							
Site-built Homes	61,563	85,691	107,753	141,184	163,422	163,422	115,062
Mobile/Manuf. Homes	14,500	15,974	20,251	21,945	22,958	22,958	20,381
Tourists	1,792	2,863	2,863	2,863	2,863	2,863	2,892
TOTAL	77,855	104,528	130,867	165,992	189,243	189,243	138,335

Evacuating Vehicles

From a transportation standpoint, the number of evacuating vehicles is more important than the evacuating population. Evacuating vehicles for the operational scenarios are summarized by county for 2015 in **Table IV-22** and for 2020 in **Table IV-23**.

The total number of evacuating vehicles within the seven county region for the operational scenarios also varies by evacuation level. A total of more than 204,700 vehicles evacuated from the seven county region for the operational scenario level A evacuation in 2015, which increases to slightly more than 516,400 evacuating vehicles from the seven county region for the operational scenario level E evacuation in 2015. By 2020, the number of evacuating vehicles is expected to increase to almost 222,400 vehicles for the operational scenario level A evacuation and slightly more than 560,600 evacuating vehicles for the operational scenario level E evacuation.

The F zone evacuation adds a total of more than 7,000 vehicles to the level C evacuation in 2015, and adds a total of more than 7,600 vehicles to the level C evacuation in 2020.

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

	Scenario 1 Level A 2015	Scenario 2 Level B 2015	Scenario 3 Level C w/ 1way 2015	Scenario 4 Level C 2015	Scenario 5 Level D 2015	Scenario 6 Level E 2015	Scenario 7 Level C+F 2015
Baker County							
Site-built Homes	402	804	1,207	1,207	1,609	2,011	1,207
Mobile/Manuf. Homes	3,468	3,756	4,334	4,334	4,623	5,201	4,334
Tourists	0	0	0	0	0	0	0
TOTAL	3,870	4,560	5,541	5,541	6,232	7,212	5,541
Clay County							
Site-built Homes	10,164	15,868	23,351	23,351	34,785	41,568	23,351
Mobile/Manuf. Homes	7,887	8,666	11,364	11,364	12,121	12,807	11,364
Tourists	5	5	466	466	466	466	466
TOTAL	18,056	24,539	35,181	35,181	47,372	54,841	35,181
Duval County							
Site-built Homes	90,954	117,190	158,165	158,165	206,670	247,998	160,625
Mobile/Manuf. Homes	14,305	16,024	19,995	19,995	21,694	22,743	20,081
Tourists	1,134	2,171	3,649	3,649	4,910	5,639	4,478
TOTAL	106,393	135,385	181,809	181,809	233,274	276,380	185,184
Flagler County							
Site-built Homes	9,085	13,015	17,375	17,375	24,363	29,921	17,508
Mobile/Manuf. Homes	1,846	2,051	2,602	2,602	2,806	2,949	2,615
Tourists	60	271	416	416	418	418	416
TOTAL	10,991	15,337	20,393	20,393	27,587	33,288	20,539
Nassau County							
Site-built Homes	11,298	14,239	18,226	18,226	22,250	25,461	18,730
Mobile/Manuf. Homes	6,859	7,661	9,551	9,551	10,376	10,880	9,574
Tourists	867	867	902	902	1,010	1,028	902
TOTAL	19,024	22,767	28,679	28,679	33,636	37,369	29,206
Putnam County							
Site-built Homes	2,663	3,096	5,211	5,211	6,672	8,670	5,211
Mobile/Manuf. Homes	7,264	8,035	10,323	10,323	11,090	11,693	10,323
Tourists	111	124	124	124	153	153	124
TOTAL	10,038	11,255	15,658	15,658	17,915	20,516	15,658
St. Johns County							
Site-built Homes	27,634	38,412	48,264	48,264	63,123	73,027	51,149
Mobile/Manuf. Homes	7,205	7,938	10,073	10,073	10,910	11,419	10,141
Tourists	1,495	2,388	2,388	2,388	2,388	2,388	2,411
TOTAL	36,334	48,738	60,725	60,725	76,421	86,834	63,701

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

	Scenario 8 Level A 2020	Scenario 9 Level B 2020	Scenario 10 Level C 2020	Scenario 11 Level D 2020	Scenario 12 Level E w/ 1way 2020	Scenario 13 Level E 2020	Scenario 14 Level C + F 2020
Baker County							
Site-built Homes	479	958	1,437	1,916	2,394	2,394	1,437
Mobile/Manuf. Homes	4,996	5,412	6,244	6,661	7,493	7,493	6,244
Tourists	0	0	0	0	0	0	0
TOTAL	5,475	6,370	7,681	8,577	9,887	9,887	7,681
Clay County							
Site-built Homes	11,318	17,671	25,999	38,727	46,277	46,277	25,999
Mobile/Manuf. Homes	8,788	9,656	12,664	13,507	14,272	14,272	12,664
Tourists	5	5	466	466	466	466	466
TOTAL	20,111	27,332	39,129	52,700	61,015	61,015	39,129
Duval County							
Site-built Homes	95,127	122,569	165,423	216,156	259,377	259,377	167,997
Mobile/Manuf. Homes	14,999	16,802	20,964	22,745	23,844	23,844	21,053
Tourists	1,134	2,171	3,649	4,910	5,639	5,639	4,478
TOTAL	111,260	141,542	190,036	243,811	288,860	288,860	193,528
Flagler County							
Site-built Homes	10,866	15,566	20,781	29,141	35,786	35,786	20,941
Mobile/Manuf. Homes	2,210	2,455	3,115	3,359	3,530	3,530	3,131
Tourists	60	271	416	418	418	418	416
TOTAL	13,136	18,292	24,312	32,918	39,734	39,734	24,488
Nassau County							
Site-built Homes	12,107	15,258	19,531	23,844	27,284	27,284	20,073
Mobile/Manuf. Homes	7,340	8,198	10,220	11,103	11,642	11,642	10,245
Tourists	867	867	902	1,010	1,028	1,028	902
TOTAL	20,314	24,323	30,653	35,957	39,954	39,954	31,220
Putnam County							
Site-built Homes	2,695	3,134	5,275	6,755	8,777	8,777	5,275
Mobile/Manuf. Homes	7,330	8,108	10,416	11,191	11,799	11,799	10,416
Tourists	111	124	124	153	153	153	124
TOTAL	10,136	11,366	15,815	18,099	20,729	20,729	15,815
St. Johns County							
Site-built Homes	32,087	44,604	56,045	73,300	84,794	84,794	59,386
Mobile/Manuf. Homes	8,382	9,237	11,716	12,691	13,284	13,284	11,795
Tourists	1,495	2,388	2,388	2,388	2,388	2,388	2,411
TOTAL	41,964	56,229	70,149	88,379	100,466	100,466	73,592

Shelter Demand

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

Public shelter demand in the seven county region ranges from more than 32,000 persons for the operational scenario level A evacuation in 2015 to more than 80,000 persons for the operational scenario level E evacuation. By 2020, the public shelter demand is expected to increase to more than 35,000 persons for the level A evacuation and more than 87,300 persons for the level E evacuation.

Table IV-24 – Shelter Demand by Operational Scenario

	Scenario 1 Level A 2015	Scenario 2 Level B 2015	Scenario 3 Level C w/ 1way 2015	Scenario 4 Level C 2015	Scenario 5 Level D 2015	Scenario 6 Level E 2015	Scenario 7 Level C+F 2015
2015							
Baker County	1,395	1,613	1,937	1,937	2,157	2,483	1,937
Clay County	3,360	4,394	6,223	6,223	8,701	10,047	6,233
Duval County	15,560	19,534	26,710	26,710	34,251	40,611	26,808
Flagler County	1,939	2,694	3,620	3,620	4,984	6,098	3,600
Nassau County	2,801	3,263	4,118	4,118	4,693	5,119	4,137
Putnam County	2,137	2,372	3,312	3,312	3,859	4,422	3,313
St. Johns County	4,829	6,268	7,918	7,918	9,862	11,274	7,994
	Scenario 8 Level A 2020	**Scenario 9 Level B 2020**	**Scenario 10 Level C 2020**	**Scenario 11 Level D 2020**	**Scenario 12 Level E w/ 1way 2020**	**Scenario 13 Level E 2020**	**Scenario 14 Level C + F 2020**
2020							
Baker County	1,981	2,268	2,710	2,997	3,437	3,437	2,710
Clay County	3,743	4,895	6,926	9,683	11,183	11,183	6,926
Duval County	16,278	20,431	27,931	35,812	42,463	42,463	28,029
Flagler County	2,316	3,217	4,322	5,953	7,285	7,285	4,299
Nassau County	2,991	3,487	4,401	5,019	5,476	5,476	4,427
Putnam County	2,157	2,396	3,345	3,898	4,468	4,468	3,345
St. Johns County	5,583	7,241	9,156	11,413	13,050	13,050	9,191

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

Congested Roadways

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

Table IV-25 – Total Evacuating Vehicles for Operational Scenarios

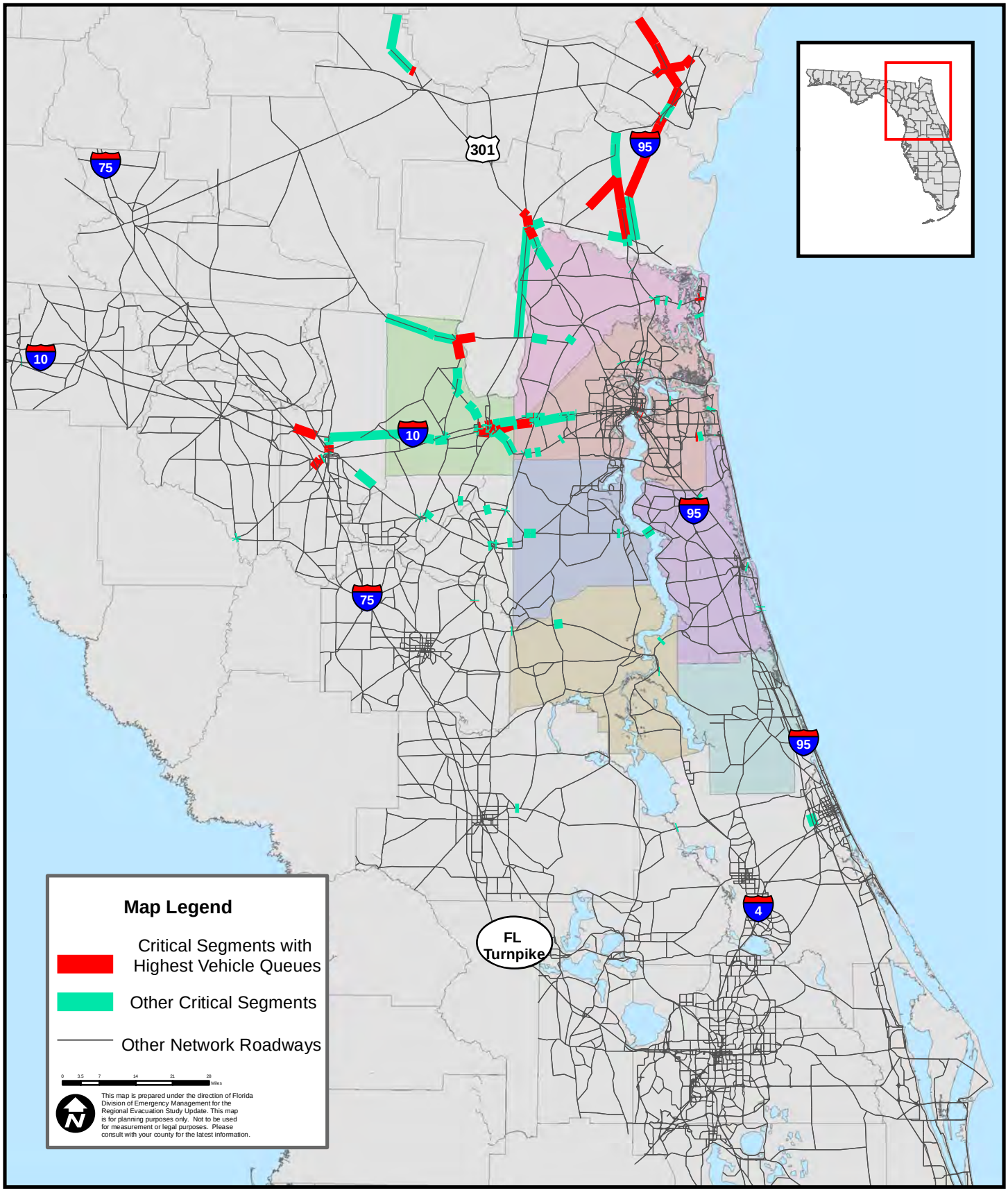
	Scenario 1 Level A 2015	Scenario 2 Level B 2015	Scenario 3 Level C w/ 1way 2015	Scenario 4 Level C 2015	Scenario 5 Level D 2015	Scenario 6 Level E 2015	Scenario 7 Level C+F 2015
2015	252,378	323,730	427,026	427,026	544,641	660,182	434,053
	Scenario 8 Level A 2020	**Scenario 9 Level B 2020**	**Scenario 10 Level C 2020**	**Scenario 11 Level D 2020**	**Scenario 12 Level E w/ 1way 2020**	**Scenario 13 Level E 2020**	**Scenario 14 Level C + F 2020**
2020	273,129	350,602	462,312	589,547	713,301	713,301	469,992

Similar to the base scenarios, regional 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, from a regional perspective, that have vehicle queues for the longest time periods during each of the evacuation scenarios. It is important to note this analysis was conducted on a regional basis and critical roadways at the individual county level may include additional roadways not identified through this analysis. Regional critical roadway segments for the Northeast Florida region are identified in **Figures IV-17** through **IV-30** for each of the operational scenarios for 2015 and 2020.

I-10, I-95, US 90, US 301, SR 2, SR 16, SR 228, and CR 127 are critical facilities for all operational scenarios. During the level A evacuation scenarios, the roadway segments with the highest vehicle queues are primarily concentrated along the major Interstate and State Highway system. In contrast, for the level E evacuation scenarios, the roadway segments with the highest vehicle queues include other roadways within the region, such as SR 23 and several county roads. Outside the region, US 301, US 17, and I-95 are also critical facilities in Georgia.

Figure IV-14

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

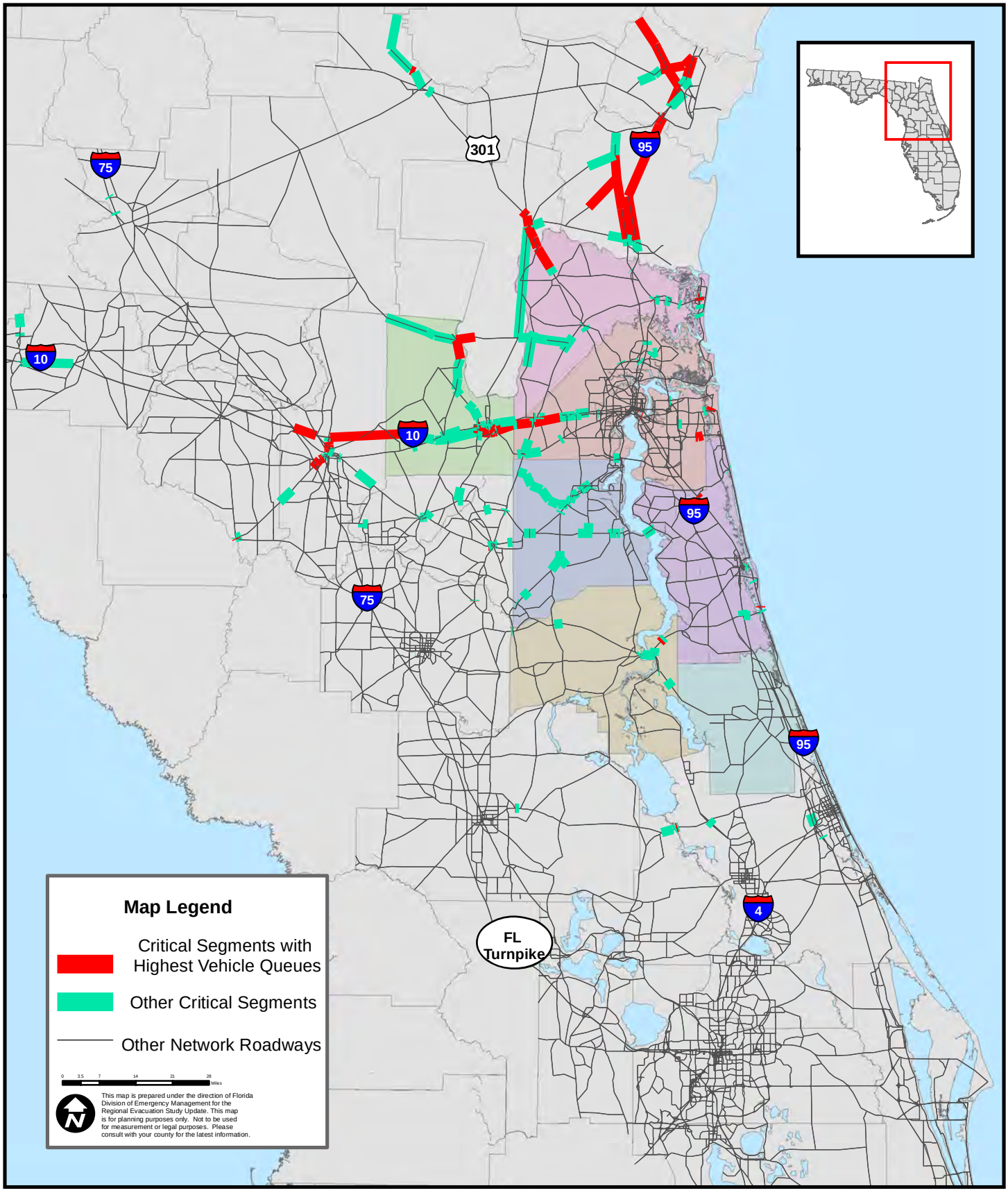


Sources: Northeast Florida Regional Council, CDM Smith

Map Printed: April, 2014

Figure IV-15

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

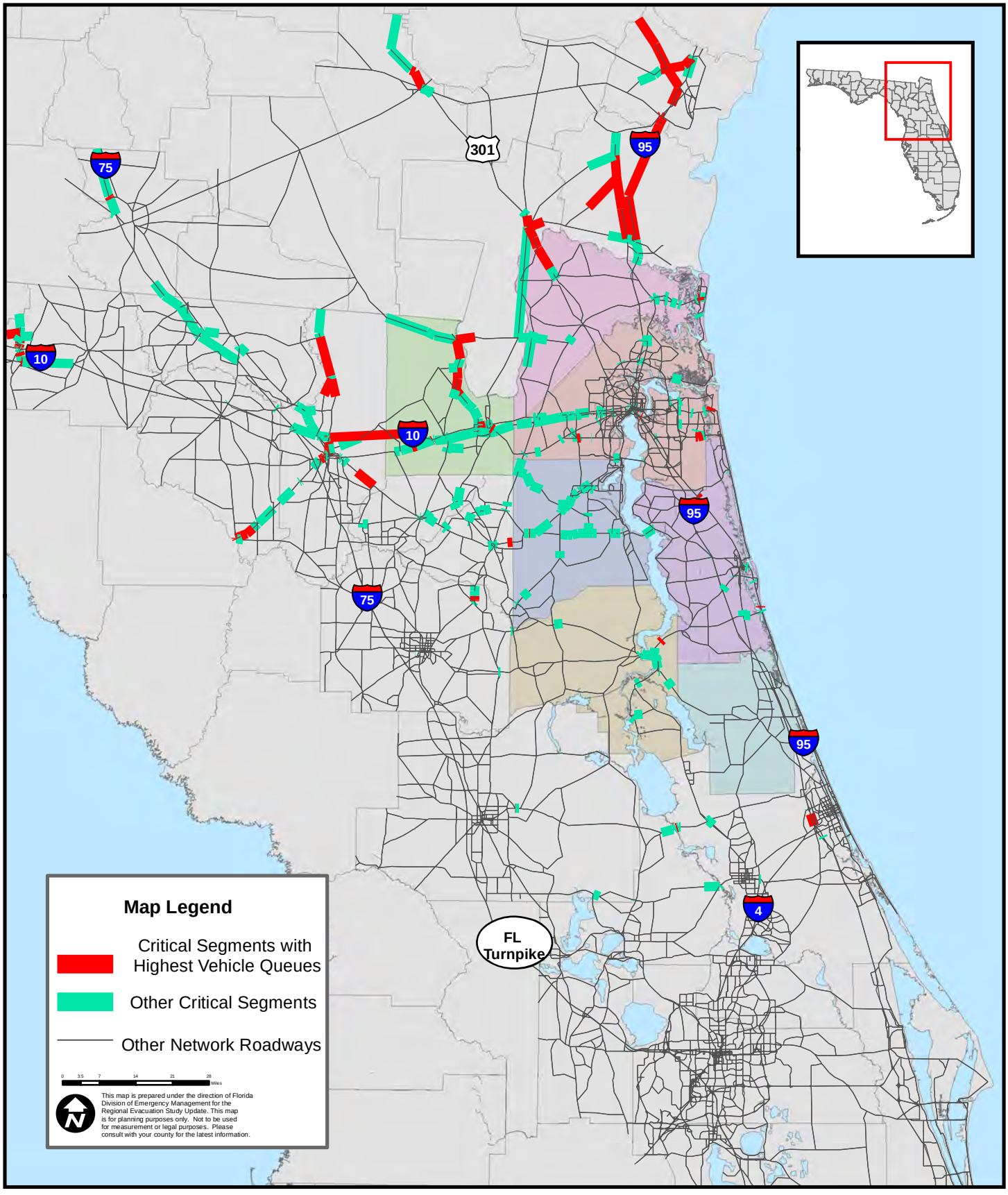


Sources: Northeast Florida Regional Council, CDM Smith

Map Printed: April, 2014

Figure IV-16

Critical Roadway Segments with Excessive Vehicle Queues for 2015 Operational Scenario Evacuation Level C Scenario 3

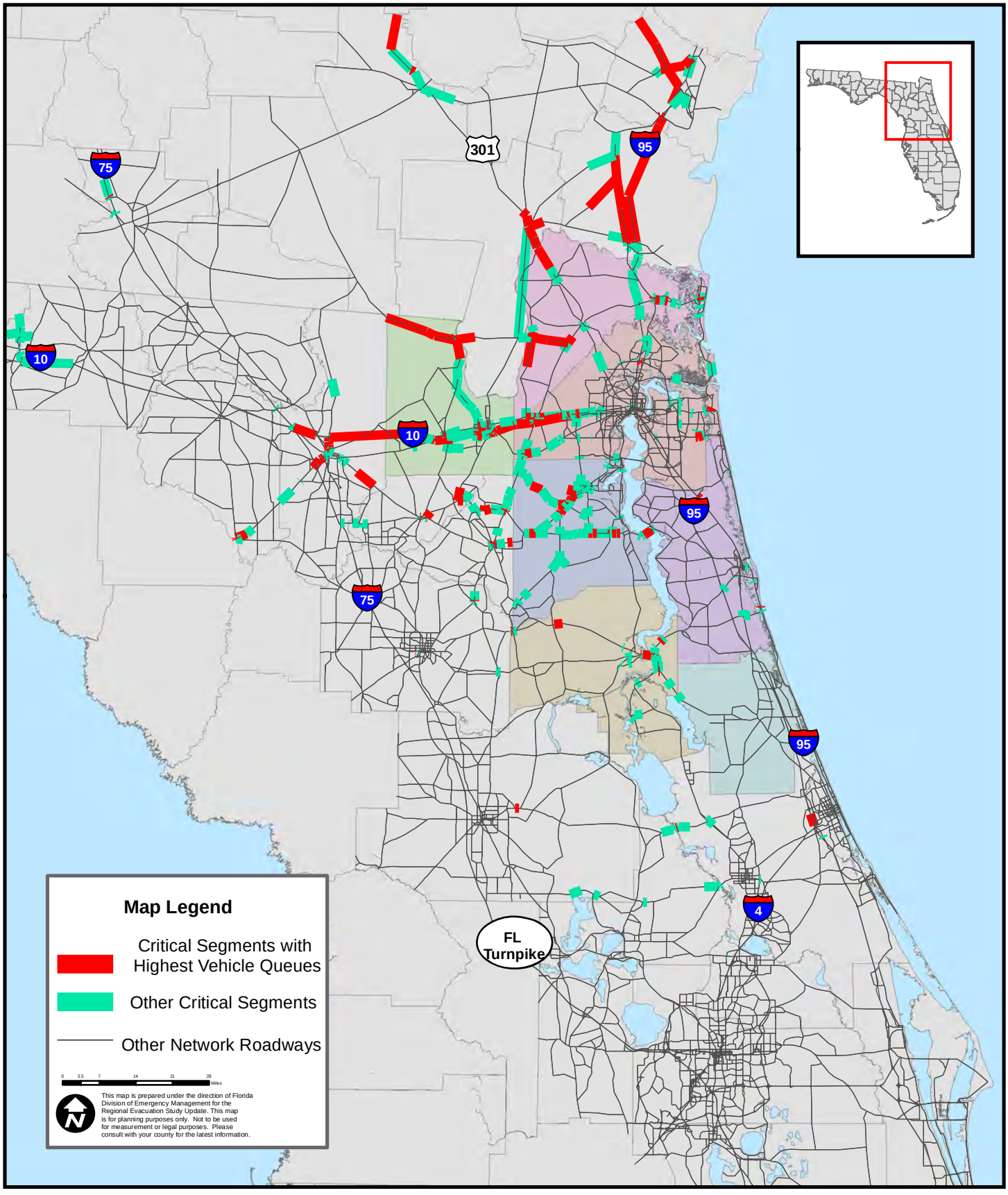


Sources: Northeast Florida Regional Council, CDM Smith

Map Printed: April, 2014

Figure IV-17

Critical Roadway Segments with Excessive Vehicle Queues for 2015 Operational Scenario Evacuation Level C Scenario 4

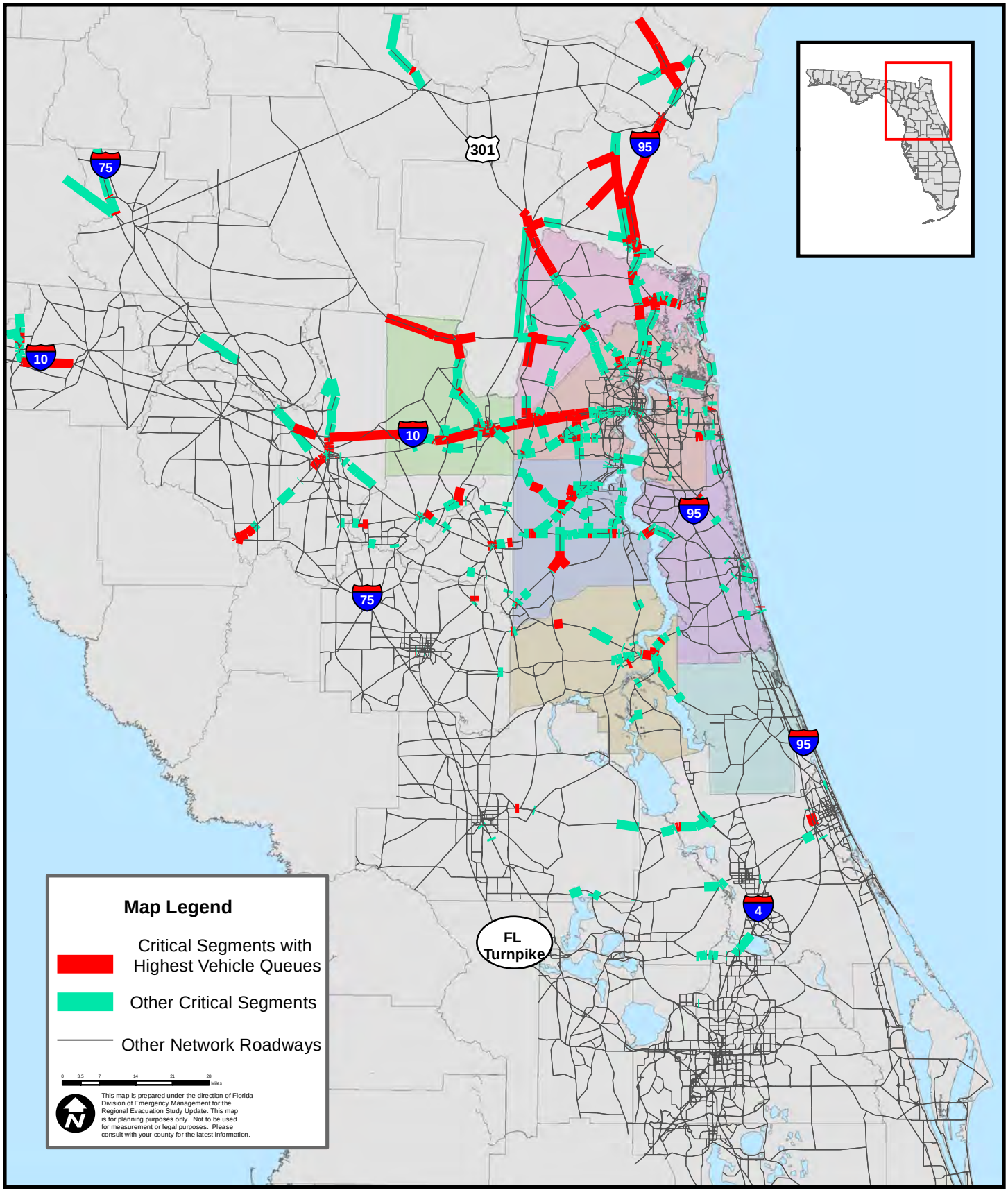


Sources: Northeast Florida Regional Council, CDM Smith

Map Printed: April, 2014

Figure IV-18

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

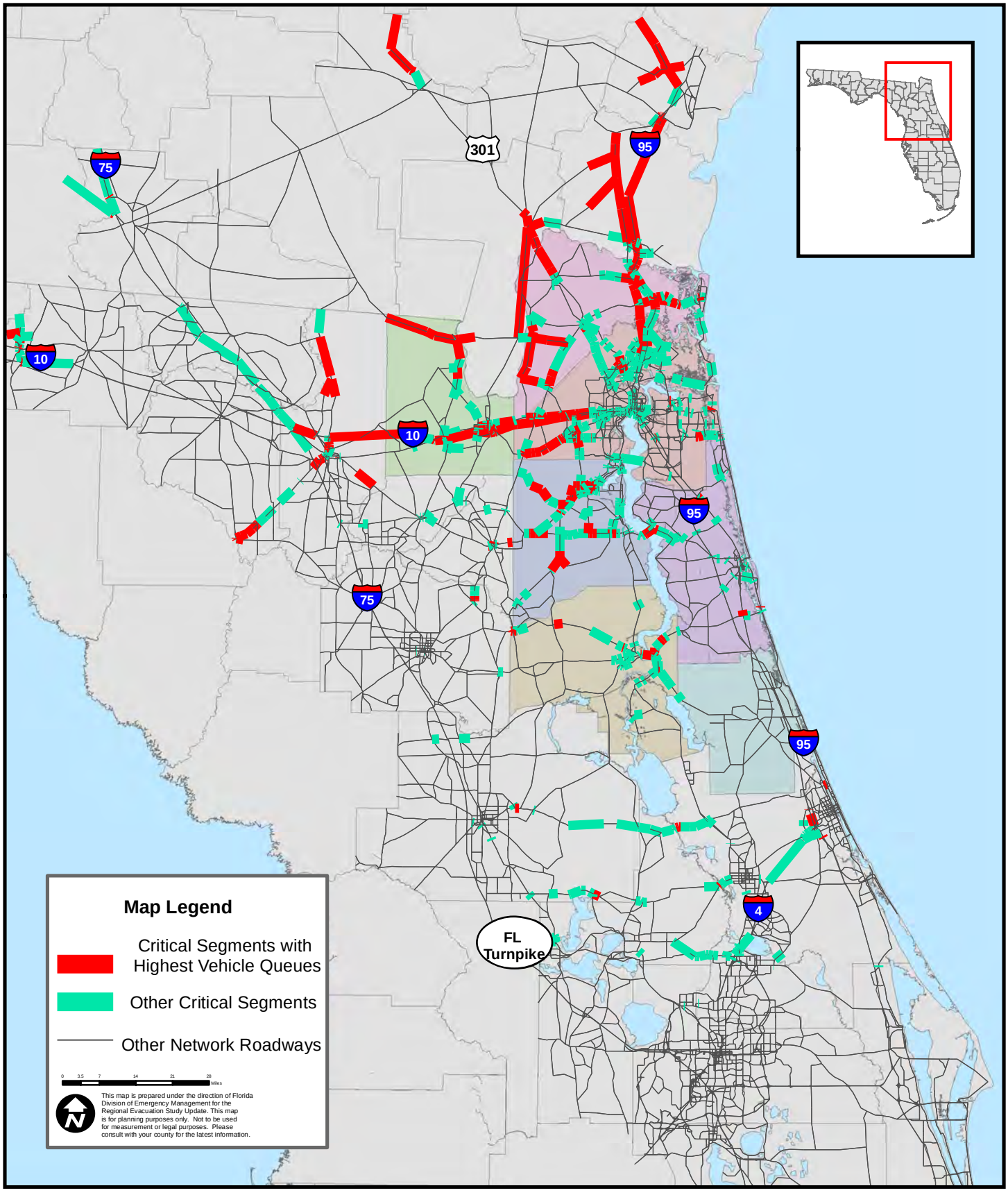


Sources: Northeast Florida Regional Council, CDM Smith

Map Printed: April, 2014

Figure IV-19

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

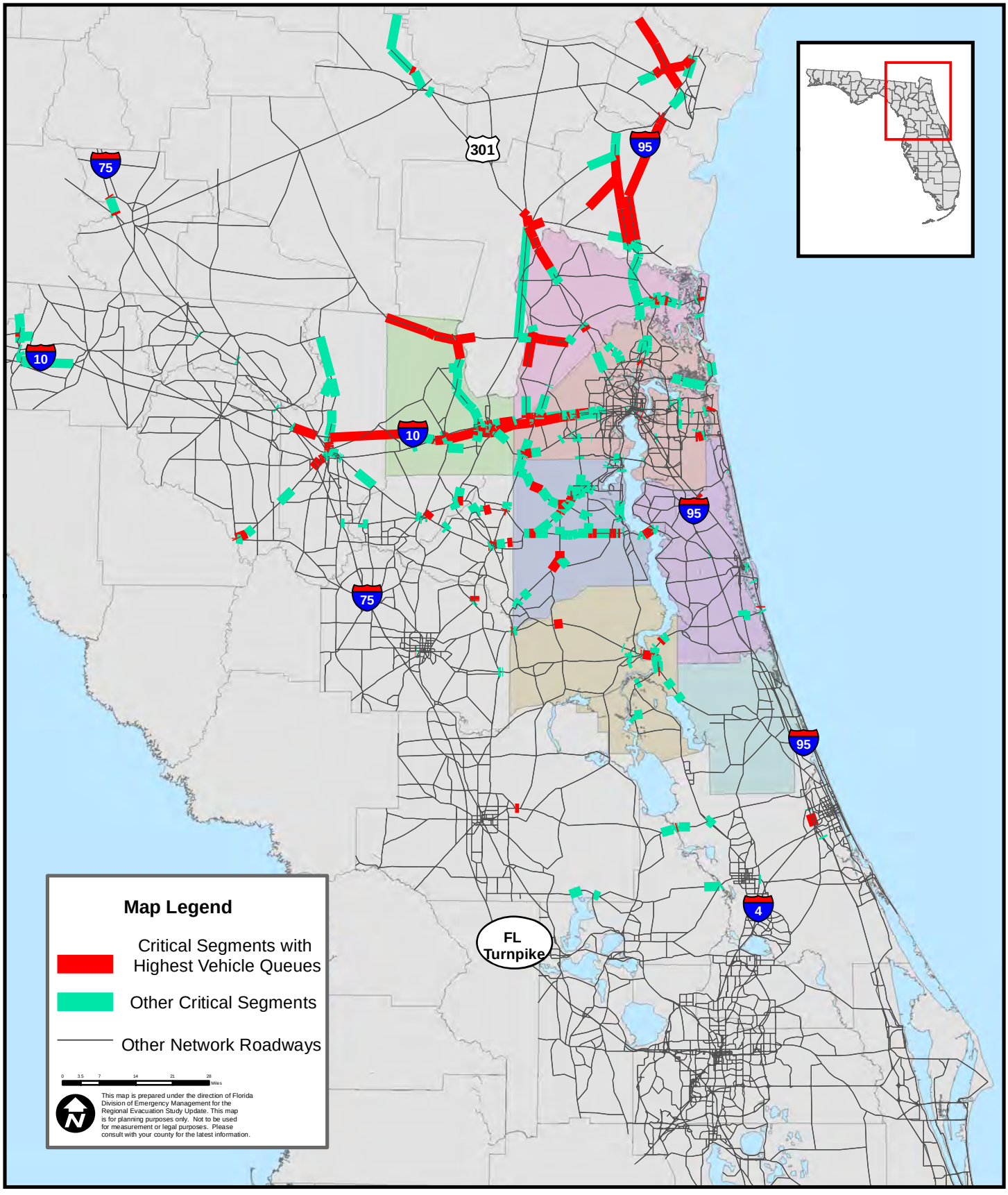


Sources: Northeast Florida Regional Council, CDM Smith

Map Printed: April, 2014

Figure IV-20

Critical Roadway Segments with Excessive Vehicle Queues for 2015 Operational Scenario Evacuation Level C Scenario 7

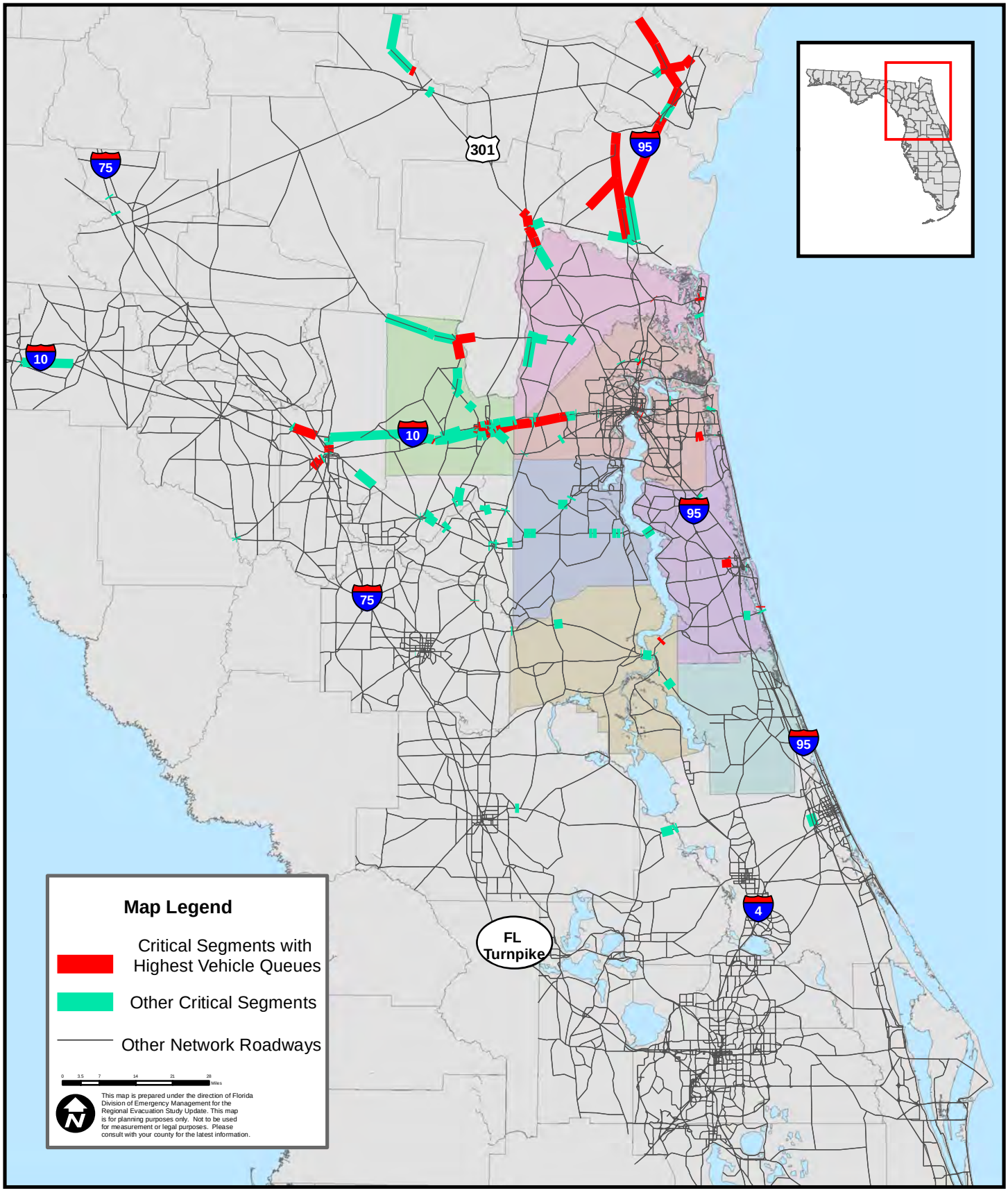


Sources: Northeast Florida Regional Council, CDM Smith

Map Printed: April, 2014

Figure IV-21

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

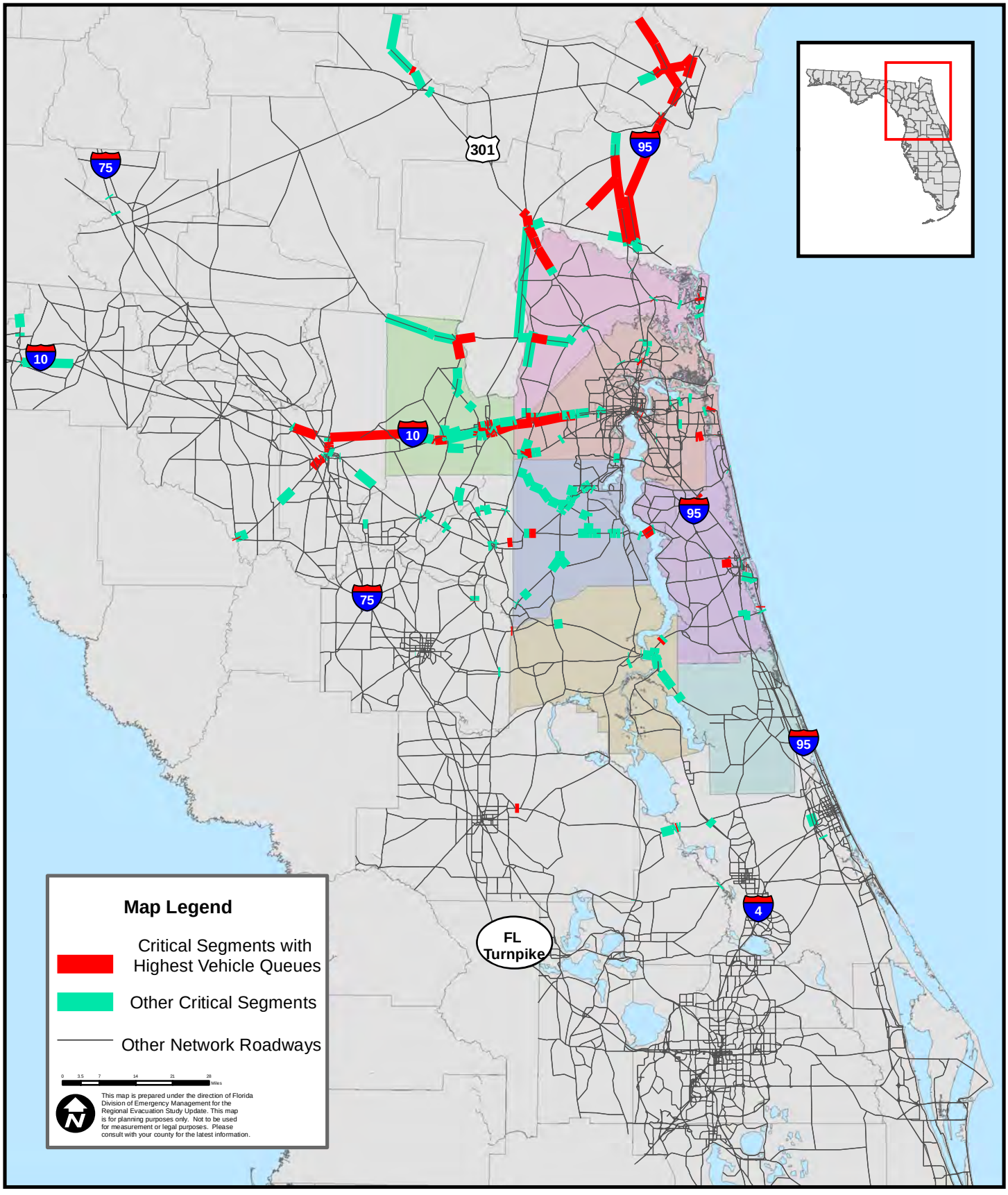


Sources: Northeast Florida Regional Council, CDM Smith

Map Printed: April, 2014

Figure IV-22

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

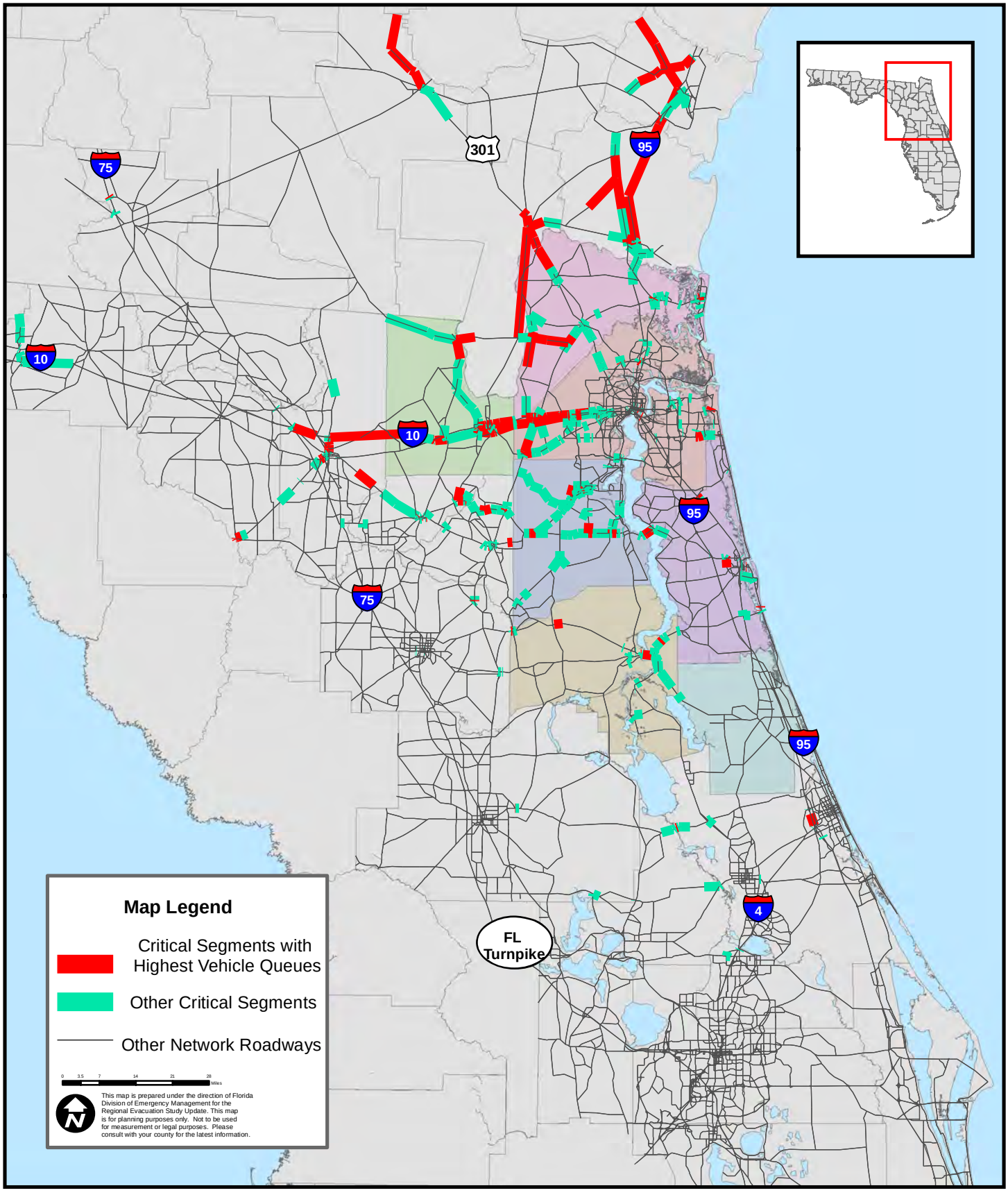


Sources: Northeast Florida Regional Council, CDM Smith

Map Printed: April, 2014

Figure IV-23

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

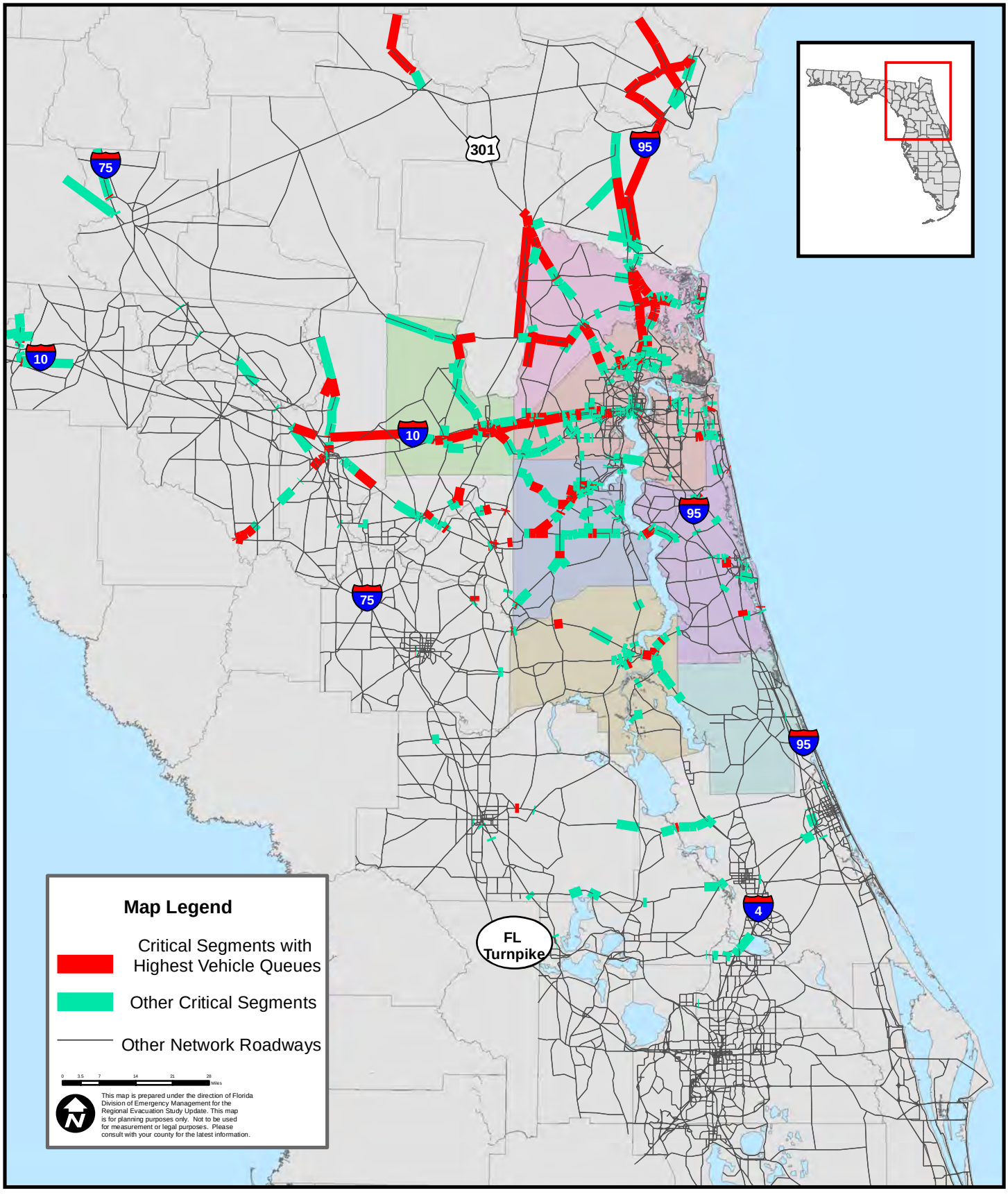


Sources: Northeast Florida Regional Council, CDM Smith

Map Printed: April, 2014

Figure IV-24

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

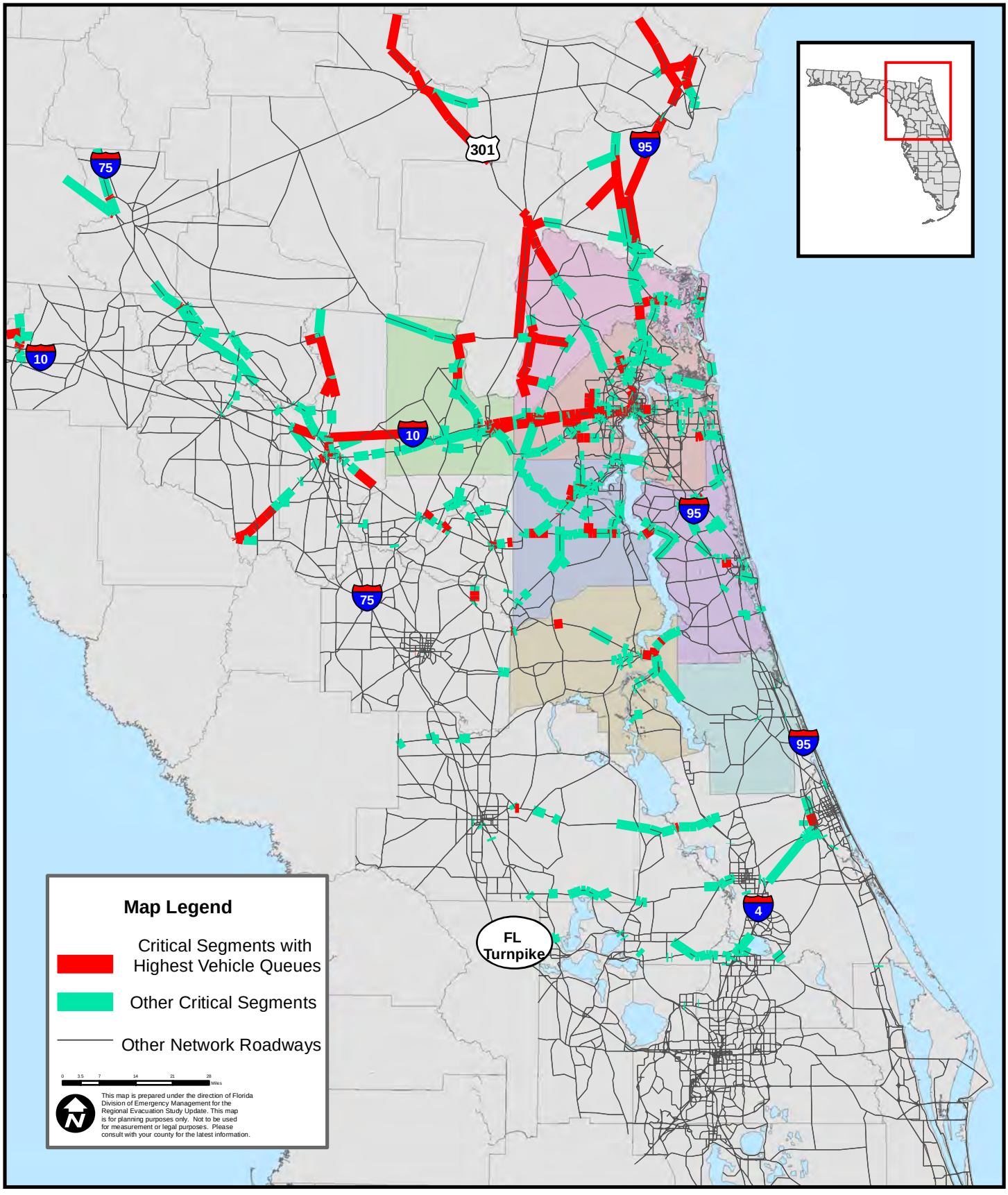


Sources: Northeast Florida Regional Council, CDM Smith

Map Printed: April, 2014

Figure IV-25

Critical Roadway Segments with Excessive Vehicle Queues for 2020 Operational Scenario Evacuation Level E12

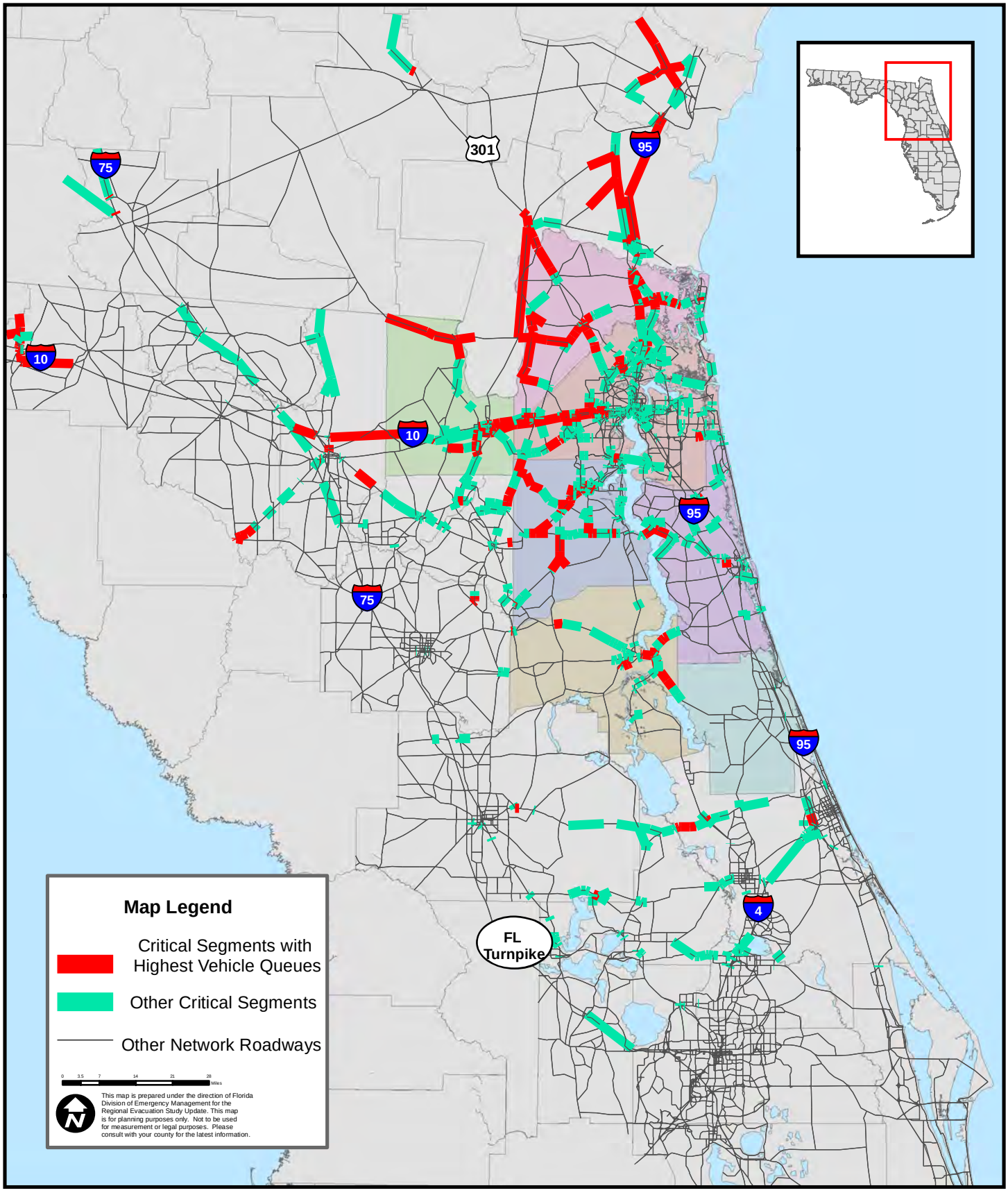


Sources: Northeast Florida Regional Council, CDM Smith

Map Printed: April, 2014

Figure IV-26

Critical Roadway Segments with Excessive Vehicle Queues for 2020 Operational Scenario Evacuation Level E13

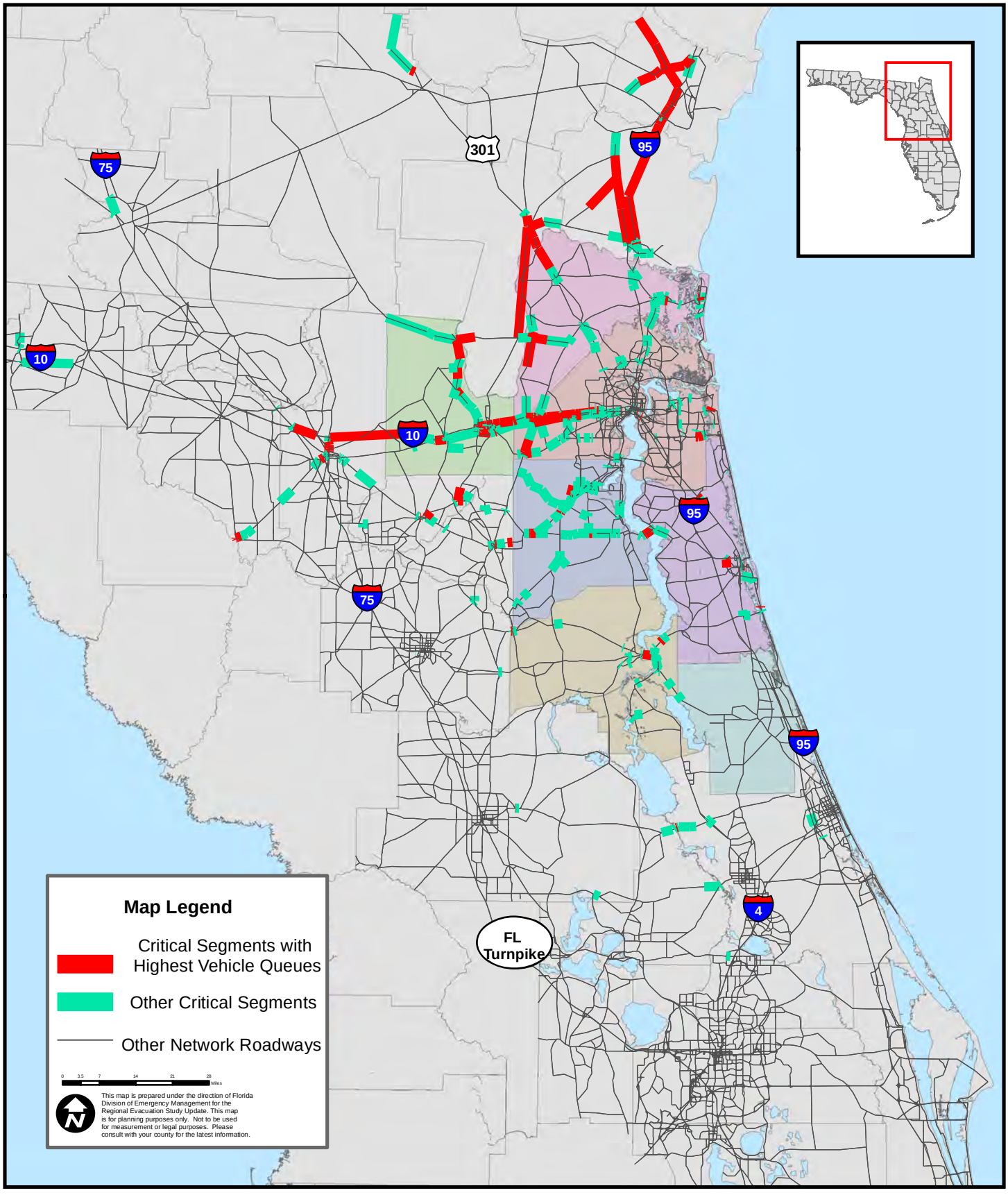


Sources: Northeast Florida Regional Council, CDM Smith

Map Printed: April, 2014

Figure IV-27

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



Sources: Northeast Florida Regional Council, CDM Smith

Map Printed: April, 2014

In addition to the identification of critical roadway segments, the total number of evacuating vehicles entering and exiting each county by evacuation scenario was also determined. Evacuating vehicles exiting each county by major evacuation route are identified in **Table IV-26** for 2015 and **Table IV-27** for 2020. In addition, evacuating vehicles entering each county by major evacuation route are identified in **Table IV-28** for 2015 and **Table IV-29** for 2020. Detailed volume figures for all evacuation routes in the Northeast Florida Region for each operational scenario are included in Volume 5-4.

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

Table IV-26 – Evacuating Vehicles Leaving Each County by Evacuation Route for the 2015 Operational Scenarios

	Scenario 1 Level A 2015	Scenario 2 Level B 2015	Scenario 3 Level C w/ 1way 2015	Scenario 4 Level C 2015	Scenario 5 Level D 2015	Scenario 6 Level E 2015	Scenario 7 Level C+F 2015
Baker County							
SR 2 Westbound	8,300	9,100	10,000	10,700	16,600	17,200	11,500
US 90 Westbound	2,000	5,200	8,200	7,000	9,100	10,800	8,300
I-10 Westbound	23,100	25,200	46,500	32,100	44,000	49,700	35,900
SR 121 Southbound	500	800	1,100	1,000	1,700	1,600	900
I-10 Eastbound	200	300	0	400	500	600	300
US 90 Eastbound	0	0	200	0	0	0	0
Clay County							
US 301 Northbound	1,300	1,500	2,100	1,700	2,100	4,200	1,700
US 301 Southbound	5,000	7,500	11,600	13,900	21,000	21,600	14,300
SR 16 Westbound	2,900	3,600	5,400	6,400	6,100	8,500	6,300
SR 230 Westbound	100	500	600	700	1,700	1,200	900
SR 100 Northbound	1,400	2,700	3,800	4,300	7,100	7,200	4,600
SR 21 Southbound	1,000	1,600	2,400	2,600	4,200	4,500	2,700
SR 100 Southbound	0	0	100	100	100	200	100
US 17 Southbound	200	400	1,000	2,200	5,800	7,800	2,300
SR 16 Eastbound	200	300	500	500	800	1,000	400
US 17 Northbound	700	800	1,300	1,300	1,500	1,800	1,300
SR 21 Northbound	3,500	4,000	6,800	5,400	7,400	8,500	5,800
Duval County							
US 1 Southbound	0	0	0	0	0	100	0
I-95 Southbound	6,400	8,500	11,800	11,800	16,100	20,800	12,100
SR 13 Southbound	100	100	100	100	200	300	100
US 17 Southbound	400	600	2,600	4,100	7,200	11,600	4,300
SR 21 Southbound	2,500	5,200	6,100	8,500	9,800	10,300	8,000
US 301 Southbound	4,100	4,700	8,500	8,000	13,100	11,800	8,800
I-10 Westbound	21,100	24,700	53,800	28,600	41,400	41,500	31,900
US 90 Westbound	5,500	5,400	4,600	7,500	10,900	12,000	9,600
US 301 Northbound	100	100	100	500	100	2,000	100
US 1 Northbound	8,400	11,000	10,500	13,300	15,700	17,900	13,800
I-95 Northbound	26,300	33,200	38,100	44,900	52,400	61,400	44,800
US 17 Northbound	300	1,000	800	1,600	2,800	3,600	1,100
Flagler County							
I-95 Southbound	6,100	8,500	11,800	11,900	17,000	21,600	12,400
US 1 Southbound	100	100	300	300	400	700	300
SR 11 Southbound	200	300	600	700	1,800	1,600	800
SR 20 Westbound	1,000	2,300	2,600	3,200	4,500	5,300	3,200
US 1 Northbound	2,000	2,500	3,400	3,100	3,700	5,100	3,100
I-95 Northbound	6,500	7,600	10,600	9,000	10,600	14,600	9,000

Table IV-26 – Evacuating Vehicles Leaving Each County by Evacuation Route for the 2015 Operational Scenarios

	Scenario 1 Level A 2015	Scenario 2 Level B 2015	Scenario 3 Level C w/ 1way 2015	Scenario 4 Level C 2015	Scenario 5 Level D 2015	Scenario 6 Level E 2015	Scenario 7 Level C+F 2015
Nassau County							
US 17 Southbound	200	300	500	500	800	900	500
I-95 Southbound	7,700	9,200	11,900	11,700	12,800	13,100	12,000
US 1 Southbound	300	300	400	400	500	600	500
US 301 Southbound	500	700	1,200	1,400	2,900	2,100	2,900
US 90 Eastbound	0	0	200	0	0	0	0
US 90 Westbound	5,500	5,400	4,600	7,500	10,900	12,100	9,700
US 1 Northbound	10,800	11,300	12,400	12,400	14,600	16,500	12,700
US 17 Northbound	4,300	5,700	6,500	9,100	11,400	20,700	8,600
I-95 Northbound	26,100	33,300	37,000	41,700	47,400	52,100	41,400
Putnam County							
US 17 Southbound	100	200	300	300	400	400	300
SR 19 Southbound	200	400	500	500	800	1,000	600
SR 20 Westbound	1,800	3,800	4,900	6,700	10,900	13,300	6,800
SR 21 Northbound	0	0	100	100	100	200	100
SR 100 Northbound	900	900	1,600	1,300	2,200	2,400	1,200
US 17 Northbound	700	700	900	900	900	900	900
SR 20 Eastbound	100	100	200	200	500	600	300
St. Johns County							
I-95 Southbound	6,100	8,400	11,800	11,800	16,500	21,000	12,400
US 1 Southbound	600	900	1,300	1,300	2,100	2,900	1,300
SR 207 Westbound	2,000	3,200	3,100	3,700	4,300	4,800	3,800
SR 16 Westbound	2,100	3,100	3,000	4,000	5,800	7,600	4,300
SR 13 Northbound	1,600	2,200	3,200	3,100	3,900	5,800	3,800
I-95 Northbound	16,900	20,600	28,100	24,800	29,500	35,300	25,500
US 1 Northbound	1,400	1,900	2,900	2,900	4,500	5,600	3,000

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

	Scenario 8 Level A 2020	Scenario 9 Level B 2020	Scenario 10 Level C 2020	Scenario 11 Level D 2020	Scenario 12 Level E w/ 1way 2020	Scenario 13 Level E 2020	Scenario 14 Level C + F 2020
Baker County							
SR 2 Eastbound	0	0	0	0	100	0	0
SR 2 Westbound	8,700	10,300	12,800	14,300	16,700	24,100	14,600
US 90 Westbound	2,700	5,000	6,700	6,400	12,100	9,900	10,400
I-10 Westbound	23,800	27,900	41,000	51,200	70,100	59,600	37,200
SR 121 Southbound	600	900	1,100	2,400	3,400	2,500	1,800
I-10 Eastbound	300	400	500	900	0	900	500
US 90 Eastbound	0	0	0	0	300	0	0
Clay County							
US 301 Northbound	1,000	1,100	2,000	2,500	3,300	3,700	1,600
US 301 Southbound	7,600	8,900	17,000	21,200	23,400	34,900	15,700
SR 16 Westbound	2,900	4,300	6,100	7,100	9,300	8,800	6,800
SR 230 Westbound	100	700	300	600	2,300	1,700	600
SR 100 Northbound	1,800	3,000	5,200	6,600	7,400	9,400	4,700
SR 21 Southbound	1,200	1,800	2,900	4,700	5,600	5,500	3,300
SR 100 Southbound	100	100	100	200	200	200	100
US 17 Southbound	200	900	3,100	6,400	6,600	10,000	3,800
SR 16 Eastbound	200	400	600	900	1,100	1,000	600
US 17 Northbound	600	800	1,100	1,400	1,800	1,800	1,100
SR 21 Northbound	2,600	3,300	5,300	6,500	8,600	8,100	5,700
Duval County							
US 1 Southbound	0	0	0	0	100	100	100
I-95 Southbound	7,400	9,700	13,600	19,200	22,600	22,700	13,700
SR 13 Southbound	100	100	100	200	400	600	100
US 17 Southbound	400	1,700	6,800	10,200	11,400	13,500	7,400
SR 21 Southbound	2,700	5,500	7,700	8,300	8,500	13,100	8,100
US 301 Southbound	6,100	5,200	10,400	11,300	14,300	20,600	8,900
I-10 Westbound	23,000	24,000	29,900	43,200	72,700	46,500	30,300
US 90 Westbound	4,000	7,900	11,800	10,900	15,500	10,700	12,000
US 301 Northbound	100	100	400	300	1,300	1,400	200
US 1 Northbound	8,900	10,800	14,000	16,400	14,400	15,200	13,100
I-95 Northbound	27,500	36,400	39,600	53,400	56,100	60,900	40,900
US 17 Northbound	100	300	1,600	3,400	2,600	2,800	2,600
Flagler County							
I-95 Southbound	6,800	9,500	13,600	19,800	24,200	26,000	14,000
US 1 Southbound	100	200	300	600	700	700	300
SR 11 Southbound	300	400	1,100	1,900	2,400	3,200	1,400
SR 20 Westbound	1,400	2,800	3,700	5,100	6,100	6,100	3,500
US 1 Northbound	2,200	2,900	3,400	4,200	6,000	5,200	3,400
I-95 Northbound	6,800	8,100	9,700	11,300	16,300	14,400	9,600

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

	Scenario 8 Level A 2020	Scenario 9 Level B 2020	Scenario 10 Level C 2020	Scenario 11 Level D 2020	Scenario 12 Level E w/ 1way 2020	Scenario 13 Level E 2020	Scenario 14 Level C + F 2020
Nassau County							
US 17 Southbound	200	300	400	600	900	800	500
I-95 Southbound	8,700	10,200	13,100	14,100	15,200	14,000	13,100
US 1 Southbound	300	200	400	400	500	500	400
US 301 Southbound	800	1,500	1,600	2,800	5,100	3,000	2,700
US 90 Eastbound	0	0	0	0	300	0	0
US 90 Westbound	4,000	7,900	11,800	11,000	15,500	10,700	12,100
US 1 Northbound	10,900	11,500	12,900	14,900	16,700	17,400	13,100
US 17 Northbound	3,300	5,100	7,900	17,800	17,400	20,000	9,900
I-95 Northbound	28,300	36,600	37,200	46,200	46,700	47,900	37,700
Putnam County							
US 17 Southbound	100	200	300	400	400	500	300
SR 19 Southbound	400	500	700	1,200	1,800	1,800	800
SR 20 Westbound	2,400	4,500	7,600	11,400	13,200	15,400	7,900
SR 21 Northbound	0	100	100	100	100	100	100
SR 100 Northbound	800	900	1,600	3,000	3,600	3,600	1,500
US 17 Northbound	600	700	900	800	900	900	800
SR 20 Eastbound	100	100	300	500	500	500	300
St. Johns County							
I-95 Southbound	6,800	9,400	13,300	19,200	23,000	23,700	13,700
US 1 Southbound	800	1,000	1,600	3,100	2,900	3,100	1,700
SR 207 Westbound	2,700	3,500	4,200	4,900	5,400	5,900	4,400
SR 16 Westbound	2,600	3,500	4,600	6,400	7,300	8,700	5,200
SR 13 Northbound	2,600	3,800	5,100	6,400	7,600	6,900	5,700
I-95 Northbound	18,400	23,400	29,400	34,600	44,700	40,700	29,800
US 1 Northbound	1,000	1,700	2,500	2,900	4,000	3,300	2,500

Table IV-28 – Evacuating Vehicles Entering Each County by Evacuation Route for the 2015 Operational Scenarios

	Scenario 1 Level A 2015	Scenario 2 Level B 2015	Scenario 3 Level C w/ 1way 2015	Scenario 4 Level C 2015	Scenario 5 Level D 2015	Scenario 6 Level E 2015	Scenario 7 Level C+F 2015
Baker County							
SR 2 Westbound	1,500	1,900	1,300	1,500	2,600	1,500	1,400
SR 121 Northbound	0	300	1,200	2,000	4,800	4,900	2,100
I-10 Westbound	21,100	24,700	53,800	28,600	41,400	41,500	31,900
US 90 Westbound	5,500	5,400	4,600	7,500	10,900	12,100	9,700
Clay County							
US 17 Southbound	400	600	2,600	4,100	7,200	11,600	4,300
SR 21 Southbound	2,500	5,200	6,100	8,500	9,800	10,300	8,000
US 301 Southbound	4,100	4,700	8,500	8,000	13,100	11,800	8,800
SR 100 Northbound	900	900	1,600	1,300	2,200	2,400	1,200
US 17 Northbound	700	700	900	900	900	900	900
SR 16 Westbound	2,100	3,100	3,000	4,000	5,800	7,600	4,300
Duval County							
US 90 Eastbound	0	0	200	0	0	0	0
I-10 Eastbound	200	300	0	400	500	600	300
US 301 Northbound	1,300	1,500	2,100	1,700	2,100	4,200	1,700
US 17 Northbound	700	800	1,300	1,300	1,500	1,800	1,300
SR 21 Northbound	3,500	4,000	6,800	5,400	7,400	8,500	5,800
US 17 Southbound	200	300	500	500	800	900	500
I-95 Southbound	7,700	9,200	11,900	11,700	12,800	13,100	12,000
US 1 Southbound	300	300	400	400	500	600	500
US 301 Southbound	500	700	1,200	1,400	2,900	2,100	2,900
SR 13 Northbound	1,600	2,200	3,200	3,100	3,900	5,800	3,800
I-95 Northbound	16,900	20,600	28,100	24,800	29,500	35,300	25,500
US 1 Northbound	1,400	1,900	2,900	2,900	4,500	5,600	3,000
Flagler County							
I-95 Southbound	6,100	8,400	11,800	11,800	16,500	21,000	12,400
US 1 Southbound	600	900	1,300	1,300	2,100	2,900	1,300
SR 11 Northbound	200	100	200	200	200	300	200
US 1 Northbound	400	600	600	700	1,100	2,100	700
I-95 Northbound	3,800	4,300	6,000	4,800	5,800	8,700	4,800
Nassau County							
US 90 Westbound	5,500	5,400	4,600	7,500	10,900	12,000	9,600
US 301 Northbound	100	100	100	500	100	2,000	100
US 1 Northbound	8,400	11,000	10,500	13,300	15,700	17,900	13,800
I-95 Northbound	26,300	33,200	38,100	44,900	52,400	61,400	44,800
US 17 Northbound	300	1,000	800	1,600	2,800	3,600	1,100

Table IV-28 – Evacuating Vehicles Entering Each County by Evacuation Route for the 2015 Operational Scenarios

	Scenario 1 Level A 2015	Scenario 2 Level B 2015	Scenario 3 Level C w/ 1way 2015	Scenario 4 Level C 2015	Scenario 5 Level D 2015	Scenario 6 Level E 2015	Scenario 7 Level C+F 2015
Putnam County							
SR 21 Southbound	1,000	1,600	2,400	2,500	4,000	4,400	2,600
SR 100 Southbound	0	0	100	100	100	200	100
US 17 Southbound	200	400	1,000	2,200	5,800	7,800	2,300
SR 20 Westbound	1,000	2,300	2,600	3,200	4,500	5,300	3,200
SR 207 Westbound	2,000	3,200	3,100	3,700	4,300	4,800	3,800
St. Johns County							
SR 16 Eastbound	200	300	500	500	800	1,000	400
US 1 Southbound	0	0	0	0	0	100	0
I-95 Southbound	6,400	8,500	11,800	11,800	16,100	20,800	12,100
SR 13 Southbound	100	100	100	100	200	300	100
US 1 Northbound	2,000	2,500	3,400	3,100	3,700	5,100	3,100
I-95 Northbound	6,500	7,600	10,600	9,000	10,600	14,600	9,000

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

	Scenario 8 Level A 2020	Scenario 9 Level B 2020	Scenario 10 Level C 2020	Scenario 11 Level D 2020	Scenario 12 Level E w/ 1way 2020	Scenario 13 Level E 2020	Scenario 14 Level C + F 2020
Baker County							
SR 2 Westbound	1,700	2,000	1,700	1,600	3,700	3,500	1,600
SR 121 Northbound	700	700	1,800	3,400	2,300	13,500	2,400
I-10 Westbound	23,000	24,000	29,900	43,200	72,700	46,500	30,300
US 90 Westbound	4,000	7,900	11,800	11,000	15,500	10,700	12,100
Clay County							
US 17 Southbound	400	1,700	6,800	10,200	11,400	13,500	7,400
SR 21 Southbound	2,700	5,500	7,700	8,300	8,500	13,100	8,100
US 301 Southbound	6,100	5,200	10,400	11,300	14,300	20,600	8,900
SR 100 Northbound	800	900	1,600	3,000	3,600	3,600	1,500
US 17 Northbound	600	700	900	800	900	900	800
SR 16 Westbound	2,600	3,500	4,600	6,400	7,300	8,700	5,200
Duval County							
US 90 Eastbound	0	0	0	0	300	0	0
I-10 Eastbound	300	400	500	900	0	900	500
US 301 Northbound	1,000	1,100	2,000	2,500	3,300	3,700	1,600
US 17 Northbound	600	800	1,100	1,400	1,800	1,800	1,100
SR 21 Northbound	2,600	3,300	5,300	6,500	8,600	8,100	5,700
US 17 Southbound	200	300	400	600	900	800	500
I-95 Southbound	8,700	10,200	13,100	14,100	15,200	14,000	13,100
US 1 Southbound	300	200	400	400	500	500	400
US 301 Southbound	800	1,500	1,600	2,800	5,100	3,000	2,700
SR 13 Northbound	2,600	3,800	5,100	6,400	7,600	6,900	5,700
I-95 Northbound	18,400	23,400	29,400	34,600	44,700	40,700	29,800
US 1 Northbound	1,000	1,700	2,500	2,900	4,000	3,300	2,500
Flagler County							
I-95 Southbound	6,800	9,400	13,300	19,200	23,000	23,700	13,700
US 1 Southbound	800	1,000	1,600	3,100	2,900	3,100	1,700
SR 11 Northbound	100	100	200	200	300	300	200
US 1 Northbound	400	500	800	1,000	1,800	1,800	700
I-95 Northbound	3,700	4,300	4,900	5,600	8,700	8,000	4,800
Nassau County							
US 90 Westbound	4,000	7,900	11,800	10,900	15,500	10,700	12,000
US 301 Northbound	100	100	400	300	1,300	1,400	200
US 1 Northbound	8,900	10,800	14,000	16,400	14,400	15,200	13,100
I-95 Northbound	27,500	36,400	39,600	53,400	56,100	60,900	40,900
US 17 Northbound	100	300	1,600	3,400	2,600	2,800	2,600

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

	Scenario 8 Level A 2020	Scenario 9 Level B 2020	Scenario 10 Level C 2020	Scenario 11 Level D 2020	Scenario 12 Level E w/ 1way 2020	Scenario 13 Level E 2020	Scenario 14 Level C + F 2020
Putnam County							
SR 21 Southbound	1,200	1,800	2,900	4,600	5,400	5,500	2,900
SR 100 Southbound	100	100	100	200	200	200	100
US 17 Southbound	200	900	3,100	6,400	6,600	10,000	3,800
SR 20 Westbound	1,400	2,800	3,700	5,100	6,100	6,100	3,500
SR 207 Westbound	2,700	3,500	4,200	4,900	5,400	5,900	4,400
St. Johns County							
SR 16 Eastbound	200	400	600	900	1,100	1,000	600
US 1 Southbound	0	0	0	0	100	100	100
I-95 Southbound	7,400	9,700	13,600	19,200	22,600	22,700	13,700
SR 13 Southbound	100	100	100	200	400	600	100
US 1 Northbound	2,200	2,900	3,400	4,200	6,000	5,200	3,400
I-95 Northbound	6,800	8,100	9,700	11,300	16,300	14,400	9,600

Clearance Times

Clearance times for each of the operational scenarios are summarized in **Table IV-30** and **IV-31**, as well as **Figures IV-31, IV-32, IV-33, IV-34, IV-35** and **IV-36**. Clearance time includes several components, including the mobilization time for the evacuating population to prepare for an evacuation (pack supplies and personal belongs, load their vehicle, etc.), the actual time spent traveling on the roadway network, and the delay time caused by traffic congestion.

In-county clearance times for the 2015 operational scenarios range from 13.0 hours to 26.5 hours depending upon the scenario. Clearance Time to Shelter shows a similar pattern, with clearance times for the operational scenarios ranging from 12.5 hours to 24.5 hours depending upon the county and the scenario.

In 2020, in-county clearance times for the operational scenarios vary from 13.5 hours to 30 hours depending upon the scenario. Clearance Time to Shelter shows a similar pattern, with clearance times for the base scenarios ranging from 12.5 hours to 30 hours depending upon the scenario.

Out of county clearance times for the 2015 operational scenarios range from 13.5 hours to 28.5 hours for the evacuation level E scenario. Out of county clearance times range from 13.5 hours to 36 hours in 2020 depending upon the scenario. Regional clearance time for the seven county NEFRC region ranges from 16.5 hours to 28.5 hours in 2015. This time ranges from 16.5 to 36 hours in 2020.

Two scenarios, one in 2015 and one in 2020, investigated the impacts of implementing the one-way flow plan for I-10. In 2015, the one-way flow plan provided a reduction of 1.5 hours during a level C evacuation, decreasing regional clearance time from 20.5 hours in Scenario 4 to 18.5 hours in Scenario 3. In 2020, implementation of the one-way flow plan provided mixed results due to the significant levels of congestion. On a regional basis, the regional clearance time was reduced by 3 hours to 33 hours in Scenario 12 compared to 36 hours in Scenario 13. However, the regional clearance time is based on the out-of-county clearance time for Baker County which is the only county to see improvements to their out-of-county clearance time with implementation of the one-way flow plan for I-10. Clay, Duval, Flagler, Putnam, and St. Johns counties saw significant increases from 4.5 to 6 hours to their out-of-county clearance times, indicating adverse impacts from the high congestion caused by the implementation of the I-10 one-way flow plan.

Two scenarios, one in 2015 and one in 2020, investigated the impacts of evacuating populations and their vehicles from areas designated as zone F during a level C evacuation. In 2015, evacuating vehicles from zone F areas did not significantly impact the overall regional clearance time for the region. However, there are clearance time impacts on the out-of-county clearance times for several counties within the region. In 2015, Baker, Clay, Duval, Flagler, and St. Johns saw out-of-county clearance time increase from 0.5 to 2.5 hours in Scenario 7 compared to Scenario 4.

In 2020, addition of the F zone on the operational C scenario resulted in increases in both the regional and out-of-county clearance times. The regional clearance time for Scenario 14 increased by 2.5 hours compared to Scenario 10, with several counties seeing increases from 1 to 2.5 hours in regards to out-of-county clearance times. Some county clearance times were

Table IV-30 – 2015 Clearance Times for Operational Scenarios

	Scenario 1 Level A 2015	Scenario 2 Level B 2015	Scenario 3 Level C w/ 1way 2015	Scenario 4 Level C 2015	Scenario 5 Level D 2015	Scenario 6 Level E 2015	Scenario 7 Level C+F 2015
Clearance Time to Shelter							
Baker County	13.0	13.5	13.5	13.5	13.5	14.0	13.5
Clay County	12.5	13.0	14.5	15.5	17.5	18.0	15.5
Duval County	12.5	13.0	14.0	14.0	18.0	20.5	15.0
Flagler County	12.5	12.5	12.5	12.5	12.5	12.5	12.5
Nassau County	14.0	16.5	17.0	18.0	20.5	24.5	18.0
Putnam County	13.0	13.0	13.5	14.0	15.5	16.5	14.0
St. Johns County	13.0	13.5	14.5	14.5	16.5	17.5	14.5
In-County Clearance Time							
Baker County	13.5	14.0	14.0	14.0	14.0	14.5	14.0
Clay County	13.5	13.5	14.5	15.5	17.5	21.5	15.5
Duval County	14.5	14.5	14.5	15.0	18.0	22.0	15.0
Flagler County	13.5	14.0	14.5	14.5	18.0	22.0	15.0
Nassau County	15.0	16.5	17.5	18.5	21.0	26.5	18.5
Putnam County	13.0	13.5	14.0	14.5	17.5	22.0	14.5
St. Johns County	13.5	13.5	14.5	14.5	18.0	21.5	15.0
Out of County Clearance Time							
Baker County	16.5	16.5	17.5	18.5	23.5	26.0	19.5
Clay County	13.5	14.0	15.5	17.5	19.0	23.5	18.0
Duval County	14.5	14.5	14.5	16.0	21.5	24.0	18.5
Flagler County	14.0	14.0	15.0	15.0	18.5	22.0	15.5
Nassau County	15.5	18.0	18.5	20.0	22.0	28.5	20.0
Putnam County	14.0	14.0	15.0	16.0	18.5	22.5	16.0
St. Johns County	13.5	13.5	14.5	14.5	18.0	21.5	15.0
Regional Clearance Time							
Northeast Florida	16.5	18.0	18.5	20.0	23.5	28.5	20.0

Table IV-31 – 2020 Clearance Times for Operational Scenarios

	Scenario 8 Level A 2020	Scenario 9 Level B 2020	Scenario 10 Level C 2020	Scenario 11 Level D 2020	Scenario 12 Level E w/ 1way 2020	Scenario 13 Level E 2020	Scenario 14 Level C + F 2020
Clearance Time to Shelter							
Baker County	13.0	14.0	14.0	14.0	13.0	15.0	14.0
Clay County	13.0	13.5	16.5	18.0	17.5	19.0	16.5
Duval County	12.5	16.5	19.0	19.0	28.5	24.5	19.5
Flagler County	12.5	12.5	12.5	12.5	12.5	12.5	12.5
Nassau County	14.5	16.5	20.5	25.5	30.0	30.0	20.5
Putnam County	13.0	13.5	14.5	16.0	18.0	18.0	14.5
St. Johns County	13.0	14.0	15.0	17.5	18.5	19.0	15.0
In-County Clearance Time							
Baker County	13.5	14.5	14.5	14.5	13.5	15.5	14.5
Clay County	13.5	14.0	17.5	22.5	28.0	24.5	17.5
Duval County	14.5	16.5	19.0	22.5	28.5	24.5	19.5
Flagler County	13.5	14.0	16.5	23.0	27.5	23.0	18.0
Nassau County	15.0	17.0	21.0	26.0	30.0	30.0	21.0
Putnam County	13.5	14.5	17.0	22.5	28.0	22.5	18.5
St. Johns County	14.0	14.0	16.5	23.0	27.5	23.0	18.0
Out of County Clearance Time							
Baker County	16.5	17.5	23.0	23.0	33.0	36.0	25.5
Clay County	13.5	16.0	20.5	22.5	31.0	25.0	22.5
Duval County	14.5	17.0	21.5	22.5	32.0	26.5	22.5
Flagler County	14.0	14.5	16.5	23.0	27.5	23.0	18.5
Nassau County	16.5	18.0	22.5	26.0	32.0	32.5	22.5
Putnam County	14.0	15.0	17.0	23.0	28.5	25.0	18.5
St. Johns County	14.0	14.0	16.5	23.0	27.5	23.0	18.0
Regional Clearance Time							
Northeast Florida	16.5	18.0	23.0	26.0	33.0	36.0	25.5

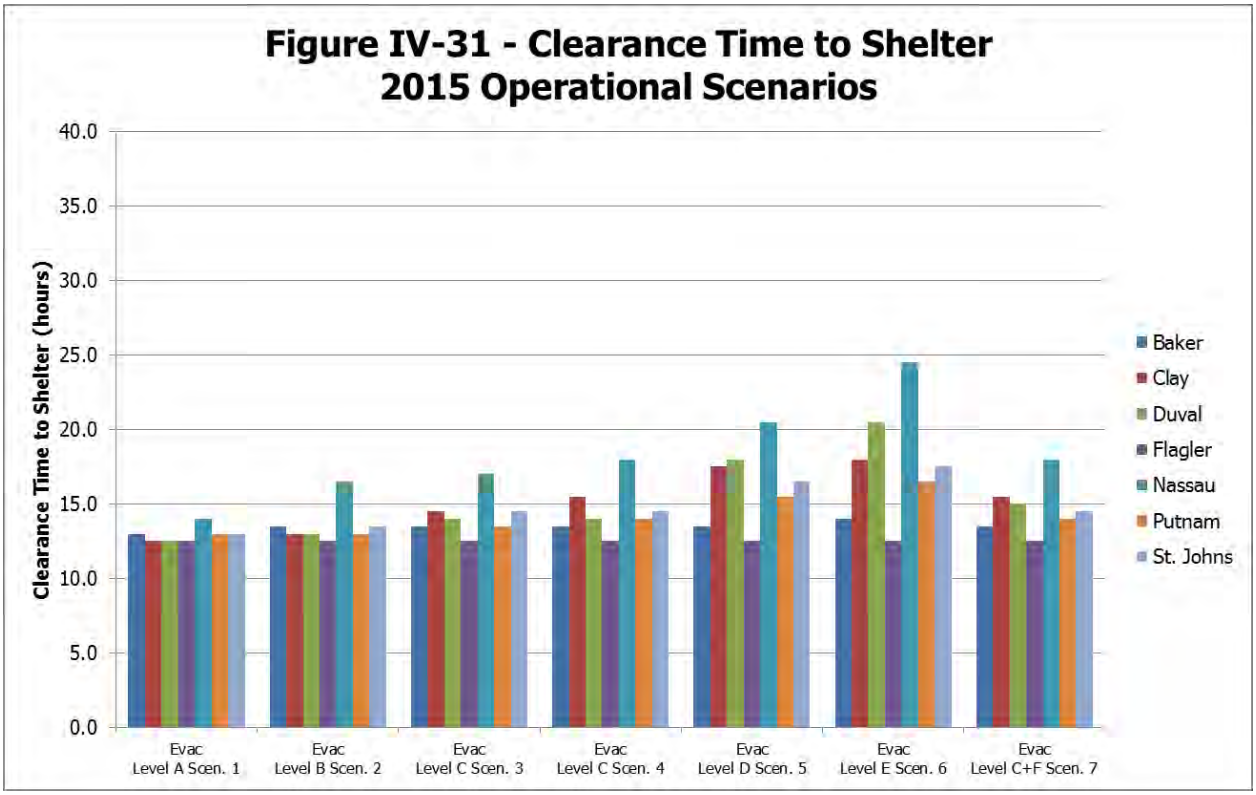


Figure IV-31 - Clearance Time to Shelter
2015 Operational Scenarios
Clearance Time to Shelter (hours)
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
Evac Level A Scen. 1
Evac Level B Scen. 2
Evac Level C Scen. 3
Evac Level C Scen. 4
Evac Level D Scen. 5
Evac Level E Scen. 6
Evac Level C+F Scen. 7
Baker
Clay
Duval
Flagler
Nassau
Putnam
St. Johns

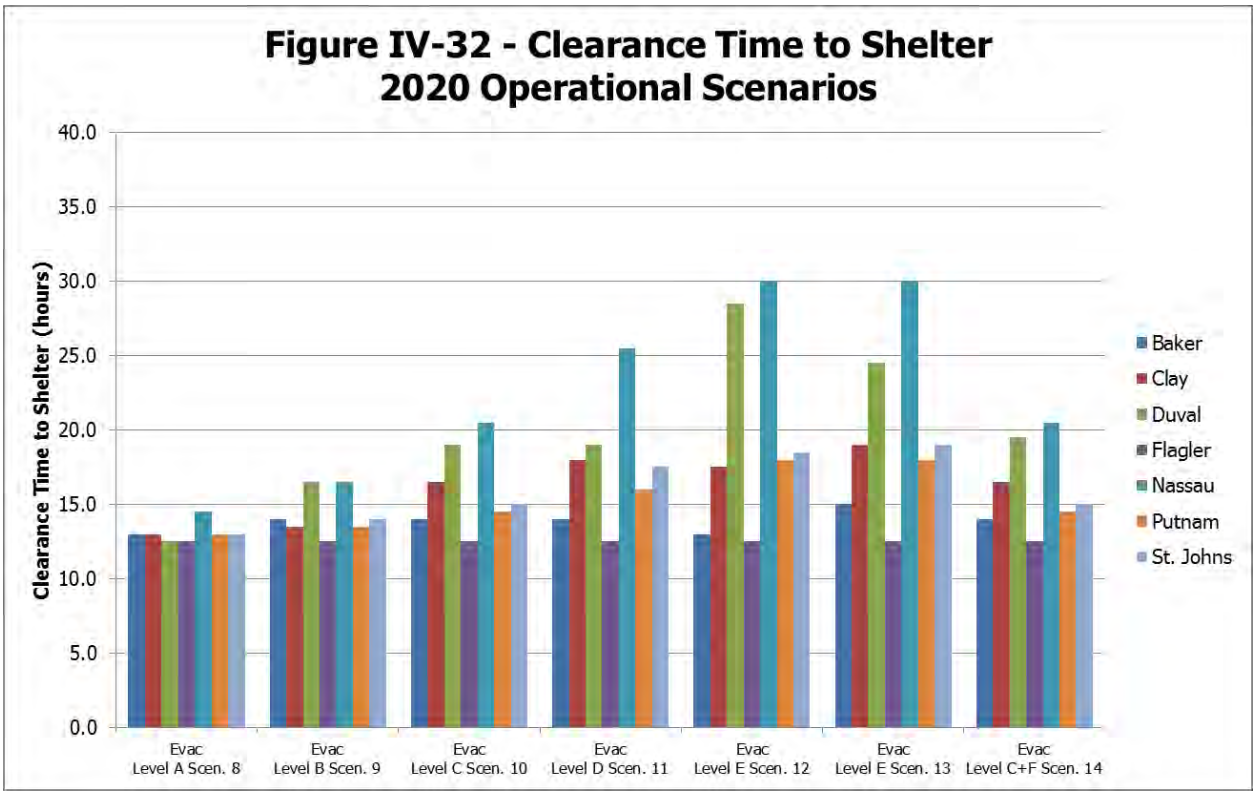


Figure IV-32 - Clearance Time to Shelter
2020 Operational Scenarios
Clearance Time to Shelter (hours)
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
Evac Level A Scen. 8
Evac Level B Scen. 9
Evac Level C Scen. 10
Evac Level D Scen. 11
Evac Level E Scen. 12
Evac Level E Scen. 13
Evac Level C+F Scen. 14
Baker
Clay
Duval
Flagler
Nassau
Putnam
St. Johns

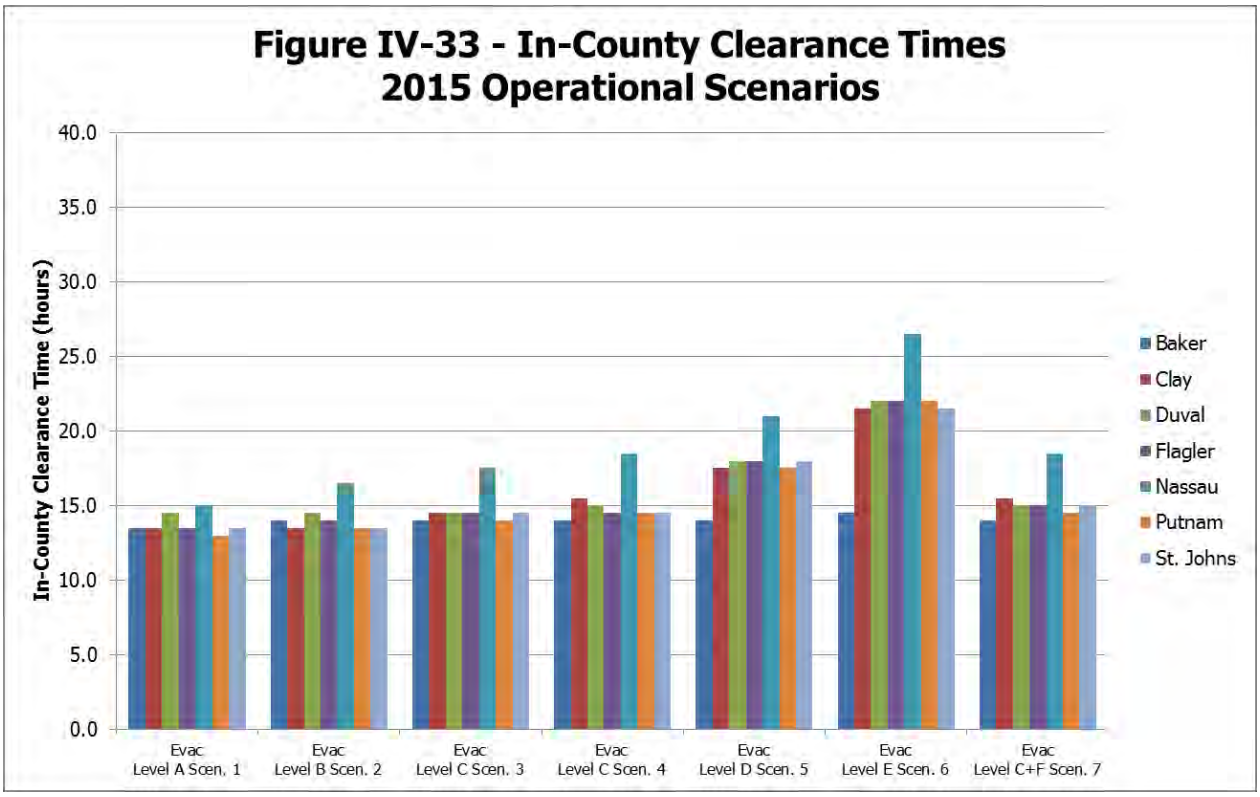


Figure IV-33 - In-County Clearance Times
2015 Operational Scenarios
In-County Clearance Time (hours)
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
Evac Level A Scen. 1
Evac Level B Scen. 2
Evac Level C Scen. 3
Evac Level C Scen. 4
Evac Level D Scen. 5
Evac Level E Scen. 6
Evac Level C+F Scen. 7
Baker
Clay
Duval
Flagler
Nassau
Putnam
St. Johns

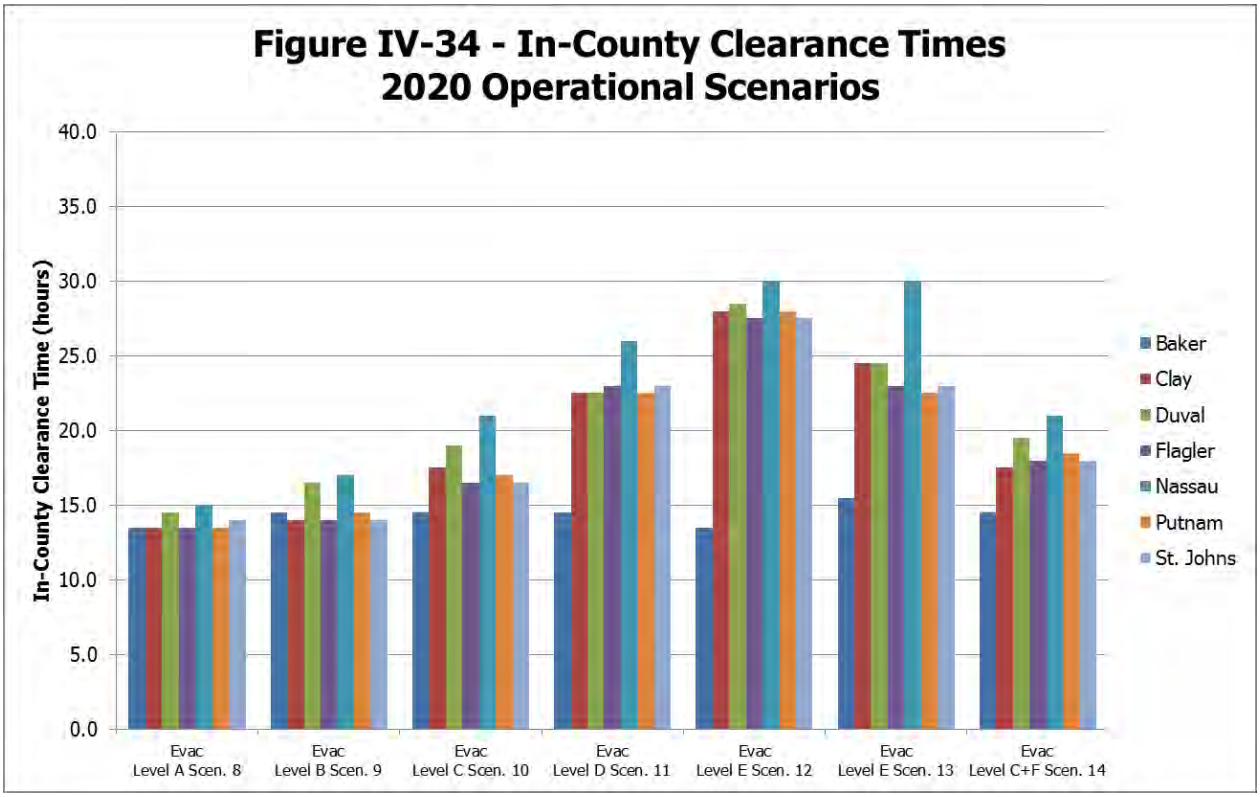


Figure IV-34 - In-County Clearance Times
2020 Operational Scenarios
In-County Clearance Time (hours)
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
Evac Level A Scen. 8
Evac Level B Scen. 9
Evac Level C Scen. 10
Evac Level D Scen. 11
Evac Level E Scen. 12
Evac Level E Scen. 13
Evac Level C+F Scen. 14
Baker
Clay
Duval
Flagler
Nassau
Putnam
St. Johns

Figure IV-35 - Out of County Clearance Times 2015 Operational Scenarios

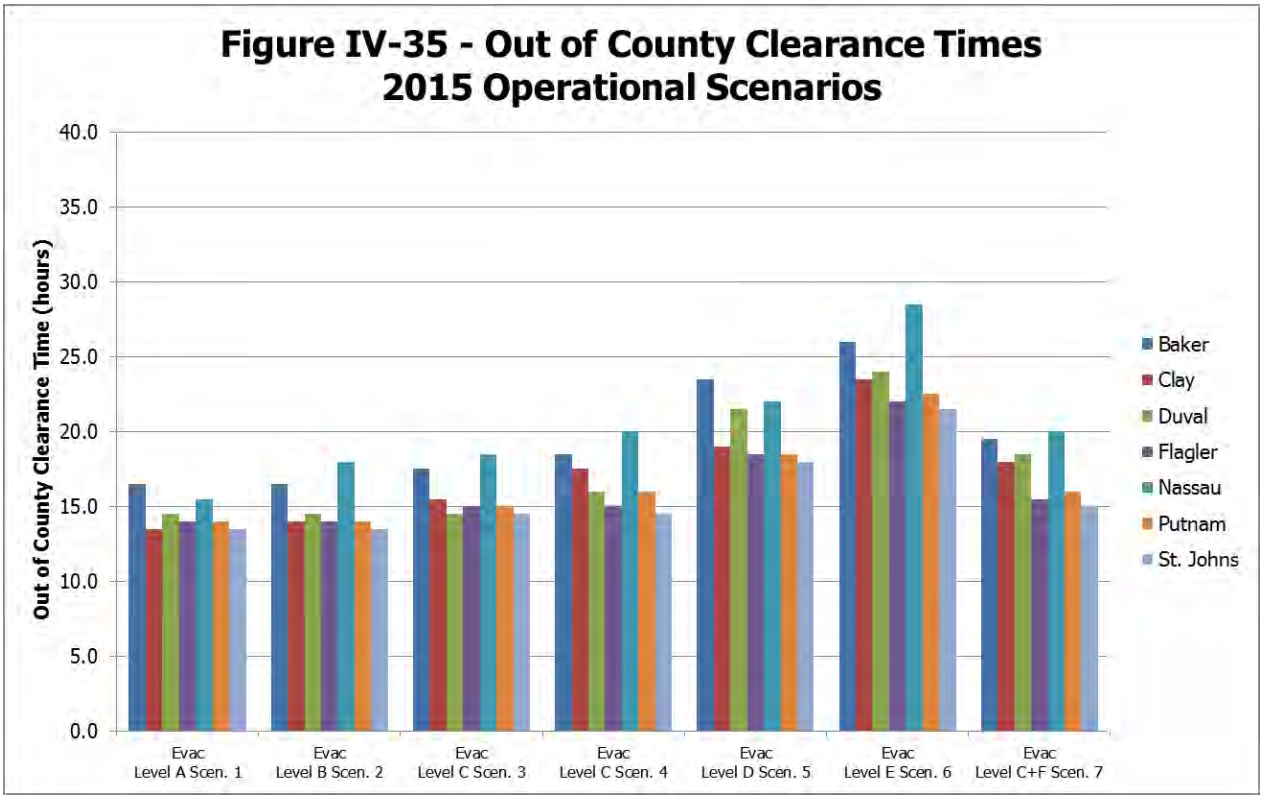
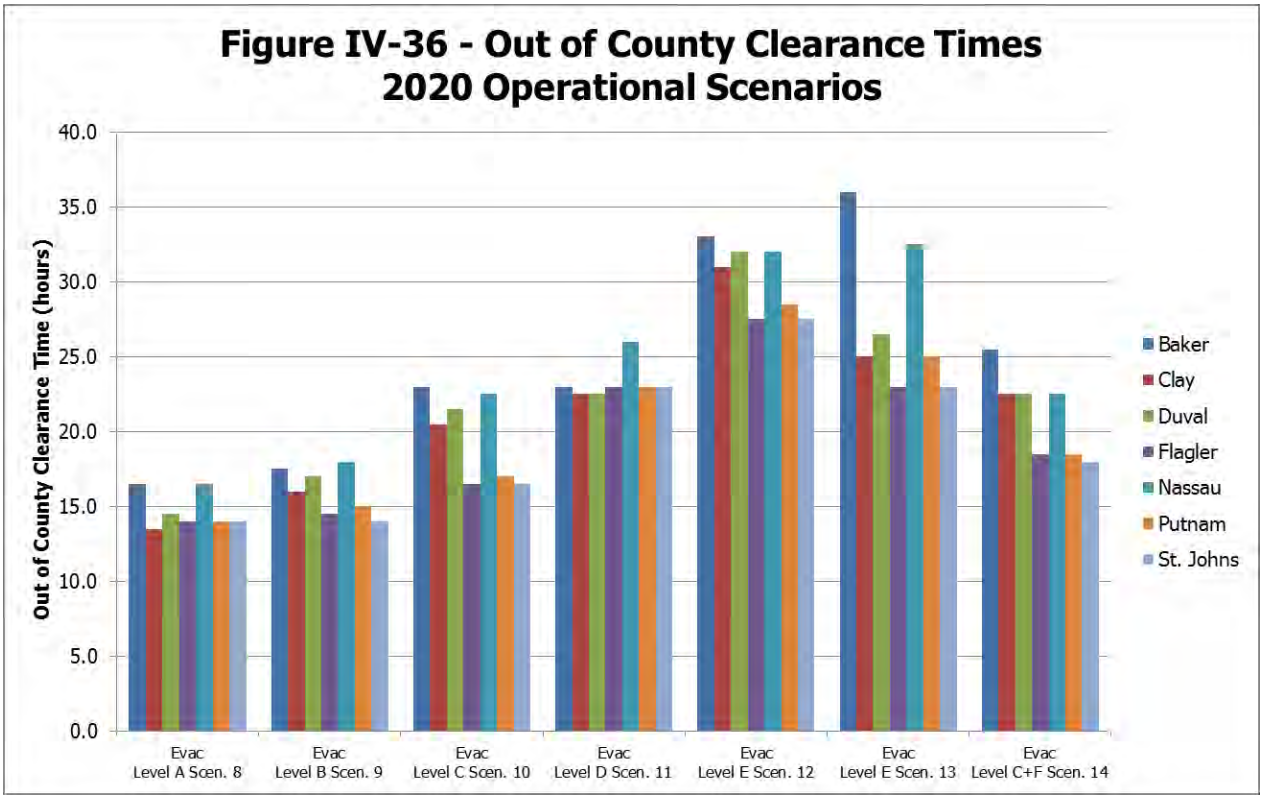


Figure IV-36 - Out of County Clearance Times 2020 Operational Scenarios



either unchanged or had small decreases, which is a result of changes in evacuating vehicle roadway choice between Level C scenarios with and without evacuating zone F areas. This underscores the importance of the concentration and distribution of the NEFRC region's population within areas designated as zone F. The origin of zone F evacuees influences the location and intensity of congestion along the evacuation roadway network.

H. Maximum Evacuating Population Clearances

From an emergency management standpoint, it is important to get an understanding of the maximum proportion of the evacuating population that can be expected to evacuate at various time intervals during an evacuation. Should storm conditions change during an evacuation, emergency managers will need to be able to estimate what portion of the evacuating population is estimated to still remain within the county trying to evacuate.

Using the base scenarios, which assume 100% of the vulnerable population is evacuating, along with shadow evacuations and evacuations from adjacent counties, an estimate was made of the evacuating population actually able to evacuate out of each county by the time intervals of 12, 18, 24, and 36 hours. The estimated maximum evacuating population by time interval for 2015 is identified in **Table IV-32** and for 2020 in **Table IV-33**.

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

I. Sensitivity Analysis

As discussed previously, there are literally thousands of possible combinations of variables that can be applied using the evacuation transportation model, which will result in thousands of possible outcomes. As part of the analysis process, a sensitivity analysis was conducted using the prototype model to evaluate the effect of different response curves on the calculated evacuation clearance times. Calculated clearance times will never be lower than the designated response time, since some evacuating residents will wait to evacuate until near the end of the response time window. For example, using a 12-hour response curve in the analysis means that all residents will begin their evacuation process within 12-hours, and some residents will choose to wait and begin evacuating more than 11.5 hours from when the evacuation was ordered. This will generate a clearance time of more than 12 hours.

The sensitivity analysis identified that clearance times will vary by scenario and by any of the numerous parameters that can be chosen in a particular scenario model run (demographics, student population, tourist population, different counties that are evacuating, response curve, phasing, shadow evacuations, etc.). A few general rules of thumb did emerge from the sensitivity analysis that can provide some guidance to the region regarding the sensitivity of the response curve to the calculated clearance times:

- For low evacuation levels A and B, clearance time will vary by as much as 40 percent depending on the response curve. Low evacuation levels A and B have fewer evacuating vehicles that can be accommodated more easily on the transportation network. In most cases, clearance times typically exceed the response curve by one to two hours. Thus, a

Table IV-32 – Maximum Evacuating Population by Time Interval for 2015

	Evacuation Level A	Evacuation Level B	Evacuation Level C	Evacuation Level D	Evacuation Level E
Estimated Evacuating Population Clearing Baker County					
12-Hour	8,621	7,835	7,099	6,320	5,425
18-Hour	12,572	11,753	10,649	9,481	8,138
24-Hour		13,385	14,198	12,641	10,851
36-Hour				15,011	15,824
Estimated Evacuating Population Clearing Clay County					
12-Hour	42,321	43,607	62,359	52,716	46,053
18-Hour	51,138	65,410	93,539	79,074	69,080
24-Hour			109,129	105,432	92,106
36-Hour				120,807	126,646
Estimated Evacuating Population Clearing Duval County					
12-Hour	224,180	235,309	267,851	235,091	211,792
18-Hour	280,225	343,159	401,777	352,636	317,689
24-Hour			468,740	470,182	423,585
36-Hour				538,750	608,903
Estimated Evacuating Population Clearing Flagler County					
12-Hour	21,235	26,515	27,537	31,120	30,839
18-Hour	25,659	38,667	41,305	46,680	46,258
24-Hour			44,747	57,053	61,677
36-Hour					65,532
Estimated Evacuating Population Clearing Nassau County					
12-Hour	38,307	32,825	35,213	28,169	23,420
18-Hour	57,461	49,238	52,819	42,253	35,129
24-Hour		58,812	64,557	56,338	46,839
36-Hour				66,901	69,283
Estimated Evacuating Population Clearing Putnam County					
12-Hour	31,310	26,928	28,185	21,714	22,479
18-Hour	39,137	40,392	42,278	32,570	33,718
24-Hour			44,627	43,427	44,957
36-Hour				47,046	50,577
Estimated Evacuating Population Clearing St. Johns County					
12-Hour	85,767	101,824	97,953	91,436	82,327
18-Hour	103,635	148,494	146,930	137,153	123,491
24-Hour			155,093	163,822	164,654
36-Hour					171,515

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

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

	Evacuation Level A	Evacuation Level B	Evacuation Level C	Evacuation Level D	Evacuation Level E
Estimated Evacuating Population Clearing Baker County					
12-Hour	8,325	8,040	7,192	6,255	5,451
18-Hour	12,487	12,060	10,787	9,382	8,177
24-Hour	13,528	14,405	14,383	12,509	10,902
36-Hour			15,282	16,158	17,035
Estimated Evacuating Population Clearing Clay County					
12-Hour	44,107	44,850	62,052	63,308	53,727
18-Hour	56,971	67,275	93,078	94,962	80,591
24-Hour		72,881	121,518	126,616	107,454
36-Hour				134,529	141,034
Estimated Evacuating Population Clearing Duval County					
12-Hour	234,465	210,042	261,367	265,024	231,454
18-Hour	293,081	315,063	392,051	397,536	347,181
24-Hour		358,822	490,064	530,048	462,908
36-Hour				563,176	636,499
Estimated Evacuating Population Clearing Flagler County					
12-Hour	23,697	29,089	31,186	37,937	34,704
18-Hour	30,609	43,633	46,779	56,905	52,055
24-Hour		46,057	53,276	67,970	69,407
36-Hour					78,083
Estimated Evacuating Population Clearing Nassau County					
12-Hour	35,071	34,267	29,559	24,858	23,070
18-Hour	52,606	51,400	44,339	37,287	34,604
24-Hour	61,374	62,822	59,119	49,716	46,139
36-Hour			68,972	71,467	74,015
Estimated Evacuating Population Clearing Putnam County					
12-Hour	31,663	25,138	23,048	23,308	22,325
18-Hour	39,579	37,707	34,572	34,963	33,488
24-Hour		40,849	45,136	46,617	44,650
36-Hour				47,588	51,162
Estimated Evacuating Population Clearing St. Johns County					
12-Hour	96,018	111,502	107,732	108,365	89,899
18-Hour	120,023	167,253	161,599	162,548	134,849
24-Hour		171,899	179,554	189,639	179,798
36-Hour					198,527

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.

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;

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

J. Summary and Conclusions

Through a review of the results of the 24 different scenarios (10 base and 14 operational), several conclusions could be reached regarding the transportation analysis, including the following:

- Critical transportation facilities within the NEFRC region include I-10, I-95, SR 9A, SR 2, SR 16, SR 228, US 17, US 301, US 90, and CR 127. During the level A evacuation scenarios, the roadway segments with the highest vehicle queues are primarily concentrated along major Interstate and State Highway system. In contrast, for the level E evacuation scenarios, the roadway segments with the highest vehicle queues include other roadways, such as SR 23, SR 21, SR 100, US 1, and several county roads. Outside the region, US 301, I-95, and US 17 are also critical facilities in Georgia;

- 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 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 5-4) to estimate fuel and supply requirements along major evacuation routes to aid motorists during the evacuation process;

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

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

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

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