Florida Statewide Regional Evacuation Study Program

Evacuation Transportation Analysis

Volume 4-3

Florida Division of Emergency Management

North Central Florida Regional Planning Council

North Central Florida Region

Includes Hurricane Evacuation Study

2015

Statewide Regional Evacuation Study Program

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EXECUTIVE SUMMARY

The evacuation transportation analysis discussed in this volume documents the methodology, analysis, and results of the transportation component of the Statewide Regional Evacuation Study Program (SRESP). 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 eleven county North Central Florida Regional Planning Council area. The transportation modeling methodology includes some processes that are performed at the statewide level, in order to determine the impacts of evacuations from other regions impacting the evacuation clearance times in the North Central Florida region. While the impact of other regions is included in the North Central Florida analysis, it is important to note that the results of the transportation analysis presented in this document are only reported for the eleven counties included in the North Central Florida RPC. Transportation analysis results for other regions and counties are reported in the corresponding Volume 4 report for those regions.

C. Input and Coordination

The development of the transportation methodology and framework required coordination and input from all eleven regional planning councils in Florida, along with the Division of Emergency Management, Department of Transportation, Department of Community Affairs, and local county emergency management teams. At the statewide level, the transportation consultant, Wilbur Smith Associates, participated in SRESP Work Group Meetings which were typically held on a monthly basis to discuss the development of the transportation methodology and receive feedback and input from the State agencies and RPCs.

At the local and regional level, Wilbur Smith Associates conducted a series of four regional meetings to coordinate with and receive input from local county emergency management, the regional planning council, local transportation planning agencies and groups, as well as other interested agencies.

D. Evacuation Modeling Methodology and Framework

The evacuation modeling methodology and framework was developed during 2008 and 2009 in coordination with all eleven Regional Planning Councils and the Division of Emergency Management. The methodology used in the North Central Florida RPC Evacuation Transportation Analysis is identical to the methodology used for all eleven Regional Planning Councils and includes the following components:

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

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

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

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

- **Zone System and Highway Network** - The SRESP evacuation model relies upon data that covers the entire State of Florida as well as areas covering the States of Georgia, Alabama, Mississippi, South Carolina, North Carolina, and Tennessee. While the primary focus of the model is with evacuation behavior within Florida, areas outside of the state

had to be considered in order to allow a more precise routing of evacuation traffic. This allows the model to measure the flow of traffic across the state line if needed.

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

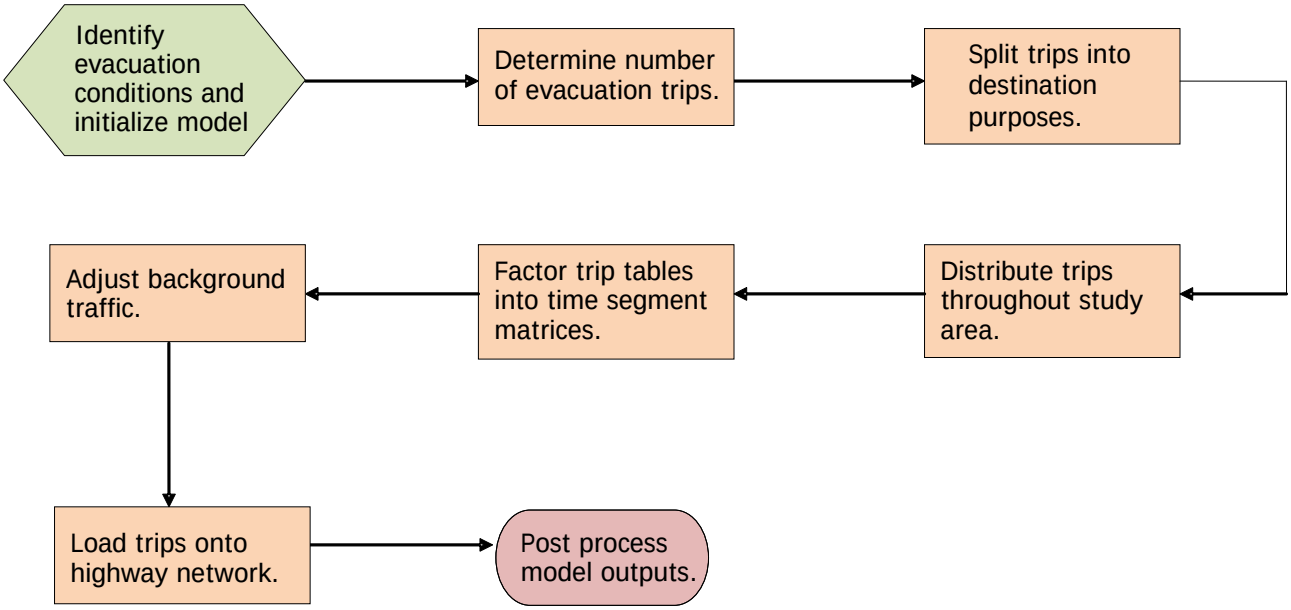
- **Background Traffic** - The traffic that consumes the roadway capacity of a transportation system during an evacuation can be divided into two groups. The first group is the evacuation traffic itself. Once the evacuation demand is determined, this information is converted into a number of vehicles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

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

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

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

Figure ES-1 - General Model Flow



- **Dynamic Traffic Assignment** - Dynamic traffic assignment (DTA) was utilized in the evacuation methodology because it is sensitive to individual time increments. DTA works by assigning a certain number of vehicles to the highway network in a given interval of time. The model then tracks the progress of these trips through the network over the interval. Another set of vehicles is assigned during the following time interval. The model then tracks the progress of these trips through the network along with the progress of the trips loaded in the previous time interval. As vehicles begin to arrive at the same segments of roadway, they interact with one another to create congestion. When vehicles that were loaded to the network in subsequent intervals of time arrive at the congested links, they contribute to the congestion as well. This results in a slowing down of the traffic and eventually spill-backs and queuing delays. It is this time dependent feature of DTA that makes it well suited to evacuation modeling. By dynamically adjusting the travel times and speeds of the vehicles moving through the network as they respond to congestion the model is able to do the following:

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

- **Prototype Model Development** - Wilbur Smith Associates developed a prototype model to test the modeling methodology used to calculate evacuation clearance times.

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

E. Regional Model Implementation

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

- **Regional Model Network** - The regional model network consists of the RPC designated evacuation routes as well as a supporting roadway network that facilitates movement of evacuation traffic. The 2005 Florida Department of Transportation (FDOT) Statewide Model Network was used as a basis for developing the regional model network, while the evacuation routes were obtained from the North Central Florida RPC. The RPC relied on the emergency managers of its constituent counties to provide it with information on which roads were to be included as evacuation routes. The resulting model network was updated to 2006 conditions and is referred to as the base model network. **Figure ES-2** identifies the model network and evacuation routes for the NCFRPC. County level details of the regional model network are provided in the Volume 5-3 report. The regional model network for the North Central Florida region includes key roadways within the eleven county region, including I-75, I-10, US 19, US 27, US 90, US 441, US 41, US 301, SR 100, SR 26 and SR 6.

- **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 255 zones located within the eleven county North Central Florida region, as illustrated in **Figure III-3**. In the North Central Florida region, Alachua County has the largest number of TEZs with 113; Columbia follows with 30 TEZs. Lafayette and Union Counties have the lowest number of TEZs within the RPC, having 6 and 7 zones, respectively. The larger number of TEZs generally reflect counties with dense urban structure and higher population densities.

- **Regional Demographic Characteristics** - Demographic data were developed for the following years: 2006, 2010, and 2015. A snapshot of the key demographic data for each county in the North Central Florida RPC for 2006, 2010 and 2015 is summarized in **Table ES-1**. The tables list the number of occupied dwelling units for site built homes, the permanent population in site-built homes, as well as the number of occupied dwelling units for mobile homes and the permanent population in mobile homes. The mobile home category includes RVs and boats and the permanent population in those housing options. The demographic characteristics summary also includes hotels and motels because many of these units are in vulnerable areas, and the proportion of seasonal units and hotel/motel units that are occupied at any point in time will have an important impact on the total population that may participate in an evacuation.

Figure ES-2 - North Central Regional Model Network

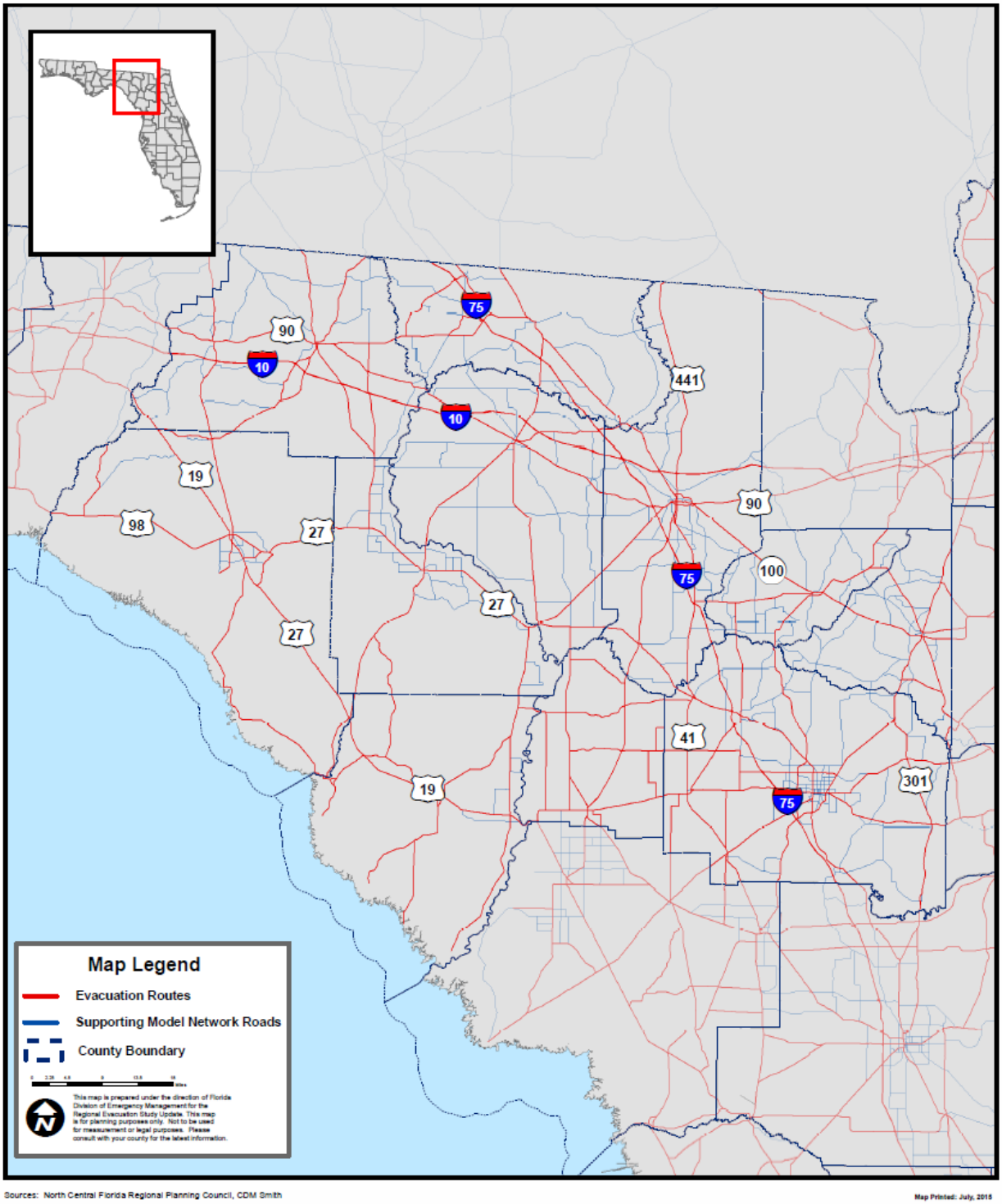
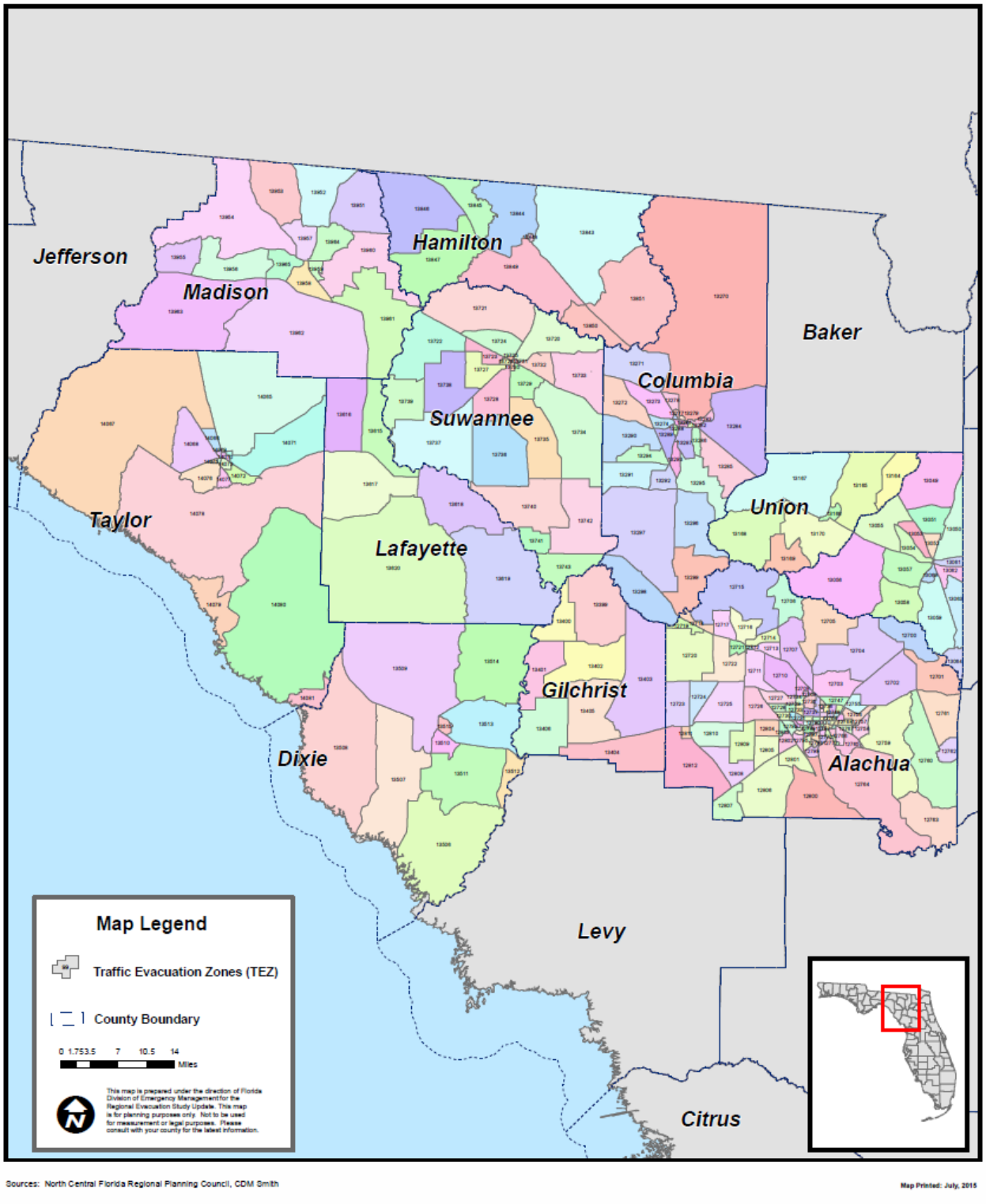


Figure ES-3 - North Central Regional Model Transportation Evacuation Zone System



Alachua County has the largest population in the region during all three time periods. The county is expected to reach over 250,000 people by 2015. Columbia County has the second largest population in the region and is projected to have almost 75,000 people by 2015. Suwannee and Gilchrist Counties are both estimated to grow by more than 20% between 2006 and 2015; conversely, Hamilton County is expected to have a nominal 7% increase.

Table ES-1 – North Central Florida Demographic Characteristic Summary

County	Characteristic	2010	Year 2015	2020
Alachua	Occupied site-built homes	92,122	94,225	99,023
	Population in site-built homes	213,941	218,816	229,936
	Occupied mobile homes	8,394	8,582	9,024
	Population in mobile homes	19,475	19,921	20,952
	Hotel/motel units	9,264	9,264	9,264
Bradford	Occupied site-built homes	6,785	6,644	6,834
	Population in site-built homes	16,052	15,720	16,171
	Occupied mobile homes	2,694	2,653	2,726
	Population in mobile homes	7,976	7,858	8,075
	Hotel/motel units	624	624	624
Columbia	Occupied site-built homes	15,397	15,931	16,972
	Population in site-built homes	38,647	39,963	42,535
	Occupied mobile homes	9,544	9,864	10,511
	Population in mobile homes	24,278	25,117	26,807
	Hotel/motel units	2,677	2,677	2,677
Dixie	Occupied site-built homes	3,226	3,380	3,583
	Population in site-built homes	6,308	6,542	6,845

County	Characteristic	Year 2010	2015	2020
	Occupied mobile homes	3,090	3,238	3,434
	Population in mobile homes	8,684	9,170	9,805
	Hotel/motel units	233	233	233
Gilchrist	Occupied site-built homes	2,812	2,911	3,104
	Population in site-built homes	6,743	6,983	7,443
	Occupied mobile homes	3,309	3,422	3,653
	Population in mobile homes	9,068	9,374	10,005
	Hotel/motel units	119	119	119
Hamilton	Occupied site-built homes	2,578	2,625	2,707
	Population in site-built homes	6,061	6,163	6,346
	Occupied mobile homes	2,039	2,074	2,140
	Population in mobile homes	5,674	5,782	5,975
	Hotel/motel units	474	474	474
Lafayette	Occupied site-built homes	1,674	1,668	1,756
	Population in site-built homes	3,989	3,971	4,166
	Occupied mobile homes	906	906	952
	Population in mobile homes	2,787	2,787	2,944
	Hotel/motel units	66	66	66
Madison	Occupied site-built homes	4,580	4,596	4,630
	Population in site-built homes	10,674	10,711	10,783
	Occupied mobile homes	2,405	2,414	2,428
	Population in mobile homes	6,617	6,643	6,680

County	Characteristic	Year 2010	2015	2020
	Hotel/motel units	492	492	492
Suwannee	Occupied site-built homes	8,328	9,049	9,642
	Population in site-built homes	19,389	21,057	22,430
	Occupied mobile homes	7,625	8,282	8,829
	Population in mobile homes	20,769	22,567	24,067
	Hotel/motel units	558	558	558
Taylor	Occupied site-built homes	5,271	5,418	5,555
	Population in site-built homes	12,647	12,991	13,319
	Occupied mobile homes	2,649	2,722	2,790
	Population in mobile homes	6,669	6,861	7,035
	Hotel/motel units	744	744	744
Union	Occupied site-built homes	2,663	2,711	2,821
	Population in site-built homes	6,453	6,572	6,834
	Occupied mobile homes	1,385	1,410	1,470
	Population in mobile homes	4,304	4,382	4,569
	Hotel/motel units	80	80	80

Source: North Central Florida Regional Planning Council

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

  The planned roadway improvements that were added to the network generally include only capacity improvement projects such as additional through lanes. **Table ES-2** identifies capacity improvement projects completed between 2006 and 2010 that were included in the 2010 network. There were no capacity improvement projects planned for implementation between 2011 and 2015. The table identifies each roadway that will be improved as well as the extent of the improvement. In the North Central Florida region, one project was identified in Columbia County: by the end of 2010, SR 47 from I-75 to SR 25/US 41 will be widened to 4 lanes.

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

- **Behavioral Assumptions** - For the North Central Florida Region, two of the counties within the region have evacuation zones corresponding to five categories of storm surge. Evacuation rates for site-built homes and mobile/manufactured homes are provided by county and summarized in **Figure ES-4** through **Figure ES-7**. 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 5-3.

  A review of the evacuation rates for the North Central Florida region illustrates that evacuation participation rates increase as the evacuation level increases, and participation rates for persons living in mobile/manufactured homes are generally higher than for persons living in site-built homes. It should be noted that a certain percentage of the population evacuates, even when they are not living in an area that is ordered to evacuate. These people are commonly referred to as shadow evacuees. Shadow evacuation rates are also included in Figure ES-4 through Figure ES-7.

- **Shelters** - In order for the transportation model to accurately assign public shelter trips to the correct location, a complete list of available public shelters needs to be available. The shelters were categorized as either primary or other, with primary indicating that the shelter is compliant with American Red Cross standards for a shelter and other indicating all other shelters. In the eleven county region there is a total of 164 shelters, including 45 in Alachua County, 29 in Columbia County, 22 in Suwannee County, 14 in Madison County, 12 in Taylor County, and 42 in the remaining counties in the region. All together, the 164 shelters located within the eleven county region can host more than 24,000 persons during an evacuation event.

Table ES-2 – North Central Florida Roadway Improvements, 2010 – 2015

County	Roadway	From	To	Number of Lanes
		None		

Sources: FDOT SIS First Five Year Plan, FDOT SIS Second Five Year Plan, North Central Florida Regional Planning Council
Note: Projects included in this table are roadway improvement projects completed between 2010 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 – North Central Florida Roadway Improvements, 2015 – 2030

North Central Florida Region Roadway Improvements, 2020				
County	Roadway	From	To	Number of Lanes
Alachua	SR 20 (SE Hawthorne Rd)	E of US 301	Putnam County Line	4
Bradford	SR 200 (US 301)	SR 200 (US 301)	SR 100 (Bypass)	4
	SR 200 (US 301)	SR 100	SR 16	4
	SR 200 (US 301)	SR 16	SR 200 (Bypass)	4

Sources: FDOT SIS First Five Year Plan, FDOT SIS Second Five Year Plan, North Central Florida Regional Planning Council
Note: Projects included in this table are roadway improvement projects completed between 2015 and 2020 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.

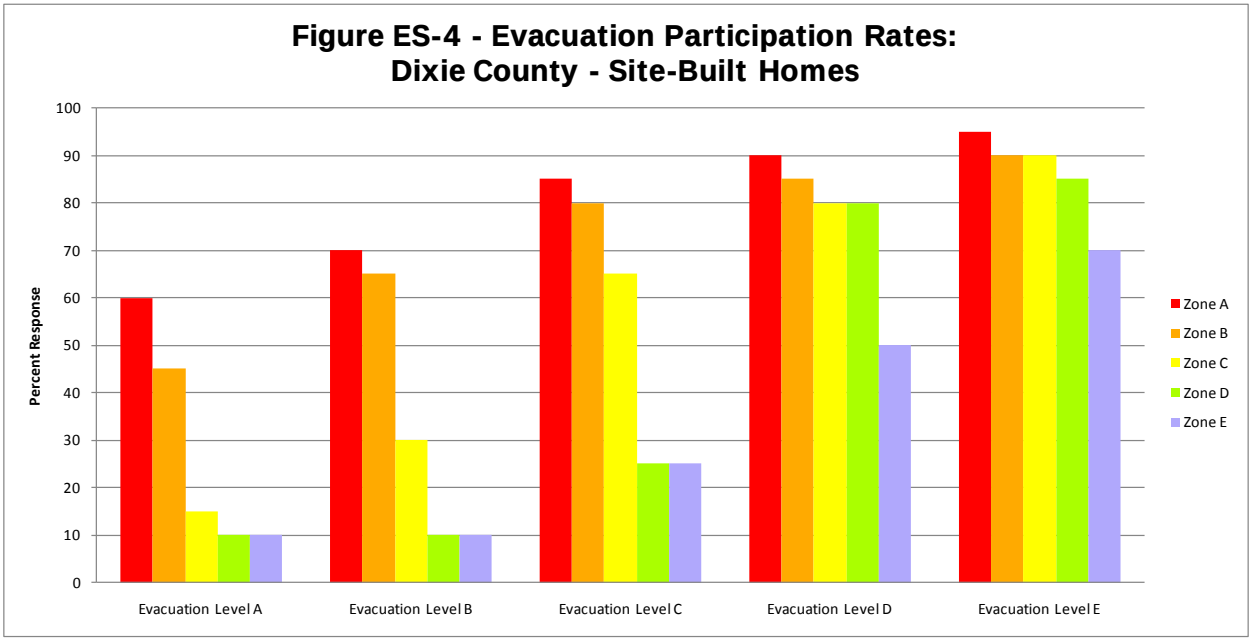


Figure ES-4 - Evacuation Participation Rates:
Dixie County - Site-Built Homes
Percent Response
100
90
80
70
60
50
40
30
20
10
0
Evacuation Level A
Evacuation Level B
Evacuation Level C
Evacuation Level D
Evacuation Level E
Zone A
Zone B
Zone C
Zone D
Zone E

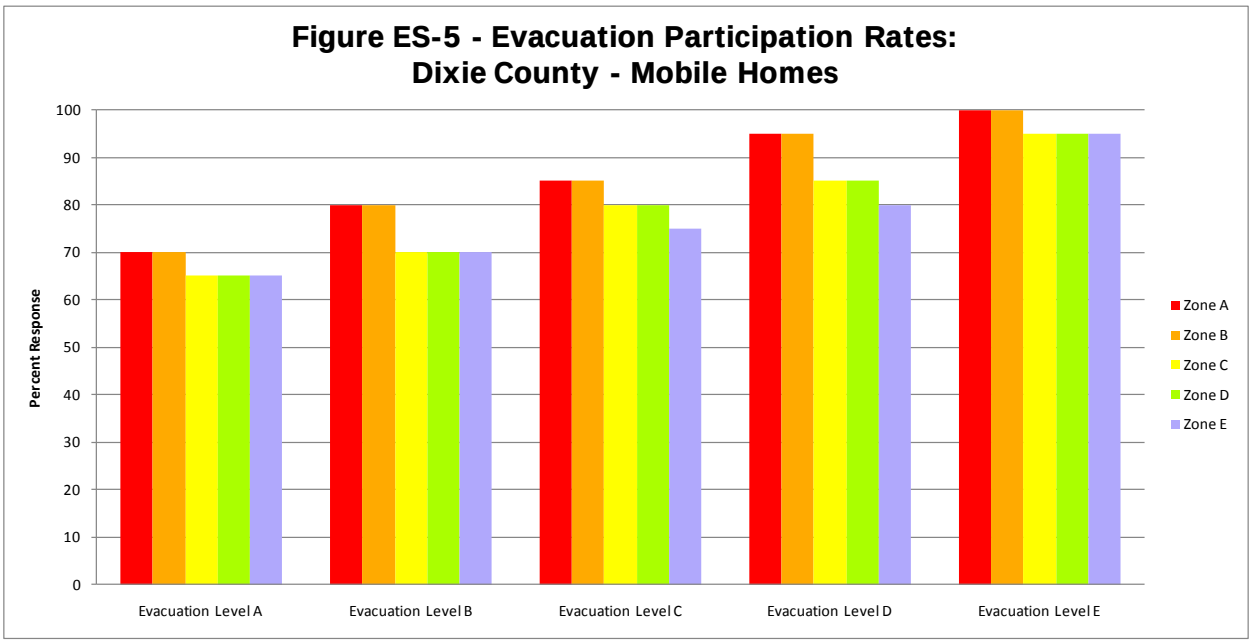


Figure ES-5 - Evacuation Participation Rates:
Dixie County - Mobile Homes
Percent Response
100
90
80
70
60
50
40
30
20
10
0
Evacuation Level A
Evacuation Level B
Evacuation Level C
Evacuation Level D
Evacuation Level E
Zone A
Zone B
Zone C
Zone D
Zone E

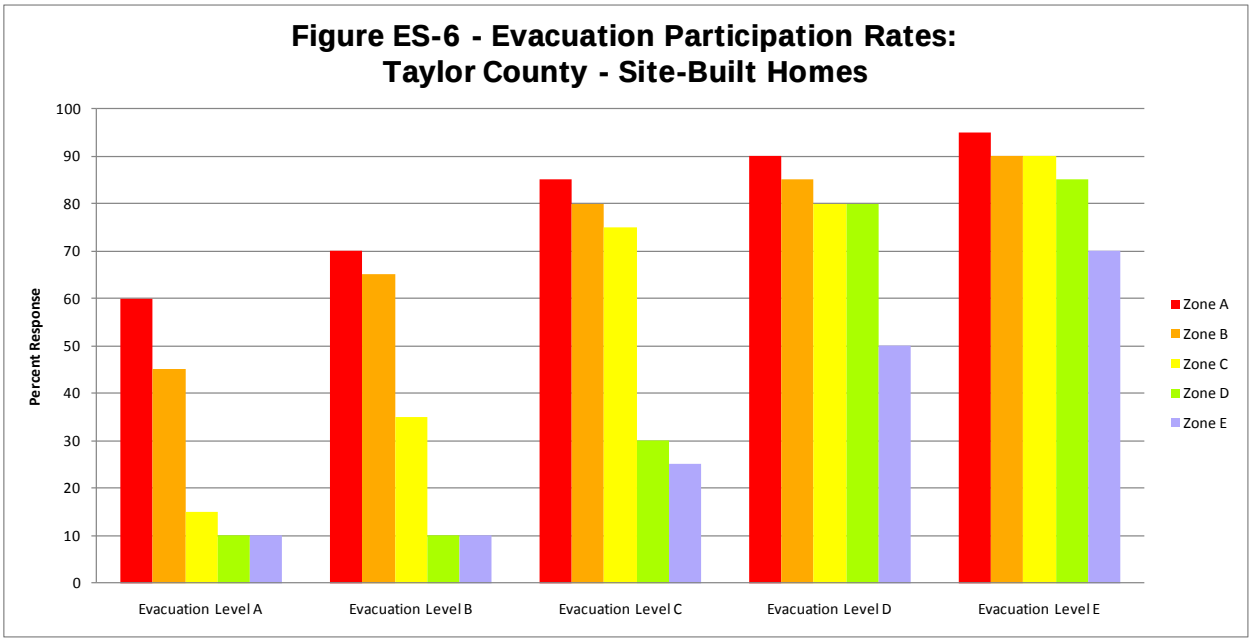


Figure ES-6 - Evacuation Participation Rates:
Taylor County - Site-Built Homes
Percent Response
100
90
80
70
60
50
40
30
20
10
0
Evacuation Level A
Evacuation Level B
Evacuation Level C
Evacuation Level D
Evacuation Level E
Zone A
Zone B
Zone C
Zone D
Zone E

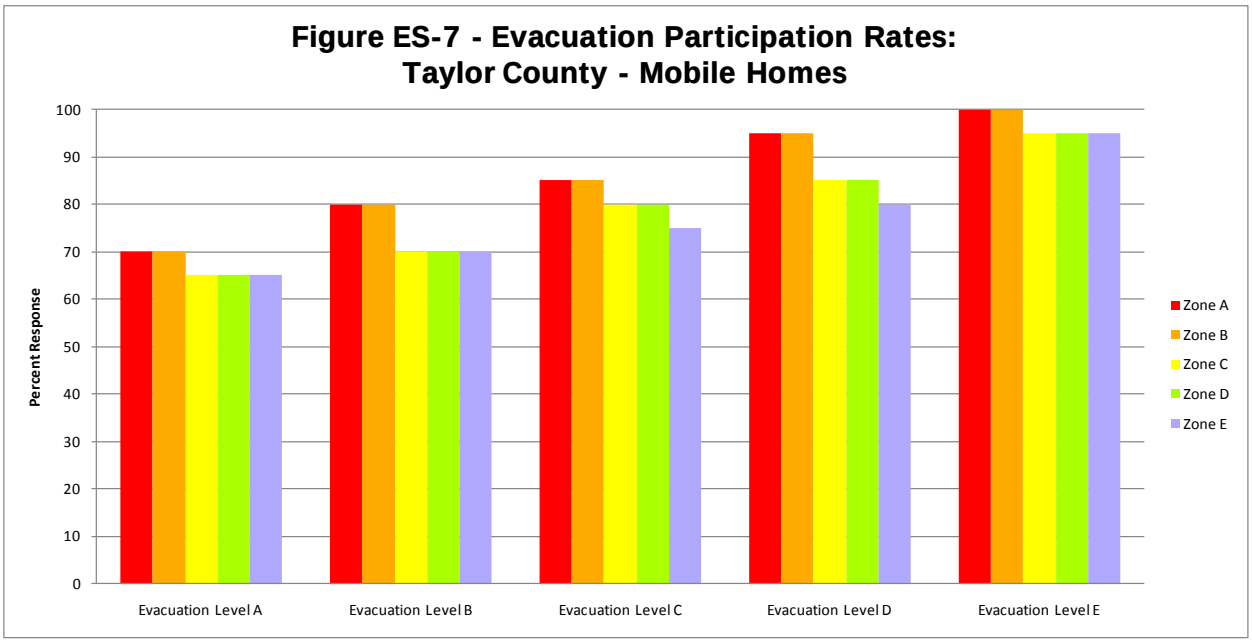


Figure ES-7 - Evacuation Participation Rates:
Taylor County - Mobile Homes
Percent Response
100
90
80
70
60
50
40
30
20
10
0
Evacuation Level A
Evacuation Level B
Evacuation Level C
Evacuation Level D
Evacuation Level E
Zone A
Zone B
Zone C
Zone D
Zone E

- **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. Dixie and Taylor Counties within the North Central Florida region have updated and established their evacuation zones based on the results of the new data and information collected as part of the SRESP. County level evacuation zones are included in Volume 5-3.

F. TIME User Interface

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

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

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

G. Vulnerable Population

Using a combination of the demographic data, behavioral assumptions, and evacuation zones, the vulnerable population in each county could be determined by evacuation level. For the purposes of the transportation analysis, the vulnerable population, or population-at-risk, is defined as the total population living within the county designated evacuation zones for each evacuation level. This population is living in an area that is at risk for severe flooding during a storm event. The vulnerable population for the North Central Florida Region for 2010 is identified in **Table ES-3**, summarized by evacuation zone and split between site-built homes and mobile/manufactured homes. Vulnerable population for 2015 is summarized in **Table ES-4**.

Table ES-3 – Vulnerable Population in the North Central Region for 2015

	Evacuation Zone A	Evacuation Zone B	Evacuation Zone C	Evacuation Zone D	Evacuation Zone E
Dixie County					
Site-built Homes	971	356	37	1377	1027
Mobile/Manuf. Homes	638	573	28	2309	1609
TOTAL	1,608	928	66	3685	2636
Taylor County					
Site-built Homes	1,077	62	112	707	736
Mobile/Manuf. Homes	655	52	117	494	706
TOTAL	1,732	115	229	1201	1,441

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

Table ES-4 – Vulnerable Population in the North Central Region for 2020

	Evacuation Zone A	Evacuation Zone B	Evacuation Zone C	Evacuation Zone D	Evacuation Zone E
Dixie County					
Site-built Homes	1,026	376	39	1431	1048
Mobile/Manuf. Homes	678	608	31	2474	1746
TOTAL	1,705	984	70	3906	2794
Taylor County					
Site-built Homes	1,104	64	115	725	754
Mobile/Manuf. Homes	671	54	120	506	724
TOTAL	1,775	118	234	1232	1478

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

In addition, based again on the demographic data, behavioral assumptions, and evacuation zones, the planned destinations of vulnerable population in each county could be determined by evacuation level. Destinations include friends and family, hotel/motel, public shelter, and other locations. Vulnerable population destinations for the North Central Florida Region are identified in **Table ES-5** for 2010 and in **Table ES-6** for 2015.

The vulnerable shadow population is provided in **Table ES-7** for both 2010 and 2015. The vulnerable shadow population was determined using the behavioral assumptions for evacuating shadow population and is based on evacuation level (storm category), not evacuation zone.

Table ES-5 – Vulnerable Population by Destination for 2015

	Evacuation Zone A	Evacuation Zone B	Evacuation Zone C	Evacuation Zone D	Evacuation Zone E
Dixie County					
To Friends and Family	1,062	593	43	2,349	1,684
To Hotel/ Motel	161	93	7	369	264
To Public Shelter	125	86	11	668	476
To Other Destination	260	156	5	300	212
Taylor County					
To Friends and Family	1,060	69	137	731	866
To Hotel/ Motel	206	14	29	145	179
To Public Shelter	119	8	29	145	179
To Other Destination	346	23	34	180	216

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

Table ES-6 – Vulnerable Population by Destination for 2020

	Evacuation Zone A	Evacuation Zone B	Evacuation Zone C	Evacuation Zone D	Evacuation Zone E
Dixie County					
To Friends and Family	1,125	628	46	2,486	1,781
To Hotel/ Motel	170	98	7	391	279
To Public Shelter	133	92	12	710	506
To Other Destination	276	166	5	319	227
Taylor County					
To Friends and Family	1,087	71	140	750	888
To Hotel/ Motel	211	14	29	148	184
To Public Shelter	122	9	29	148	184
To Other Destination	355	24	35	185	222

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

Table ES-7 – Vulnerable Shadow Evacuation Population

	Evacuation Level A	Evacuation Level B	Evacuation Level C	Evacuation Level D	Evacuation Level E
2015					
Alachua County	30,983	42,043	64,160	75,219	86,279
Bradford County	8,641	9,429	10,216	11,791	12,579
Columbia County	27,098	29,097	33,093	35,091	37,090
Dixie County	9,343	8,630	9,089	6,967	5,315
Gilchrist County	9,742	10,092	10,441	10,791	11,140
Hamilton County	6,405	6,713	7,021	7,329	7,637
Lafayette County	3,197	3,197	3,395	3,791	3,989
Madison County	7,722	8,257	8,792	9,328	9,863
Suwannee county	23,584	24,638	25,059	26,744	27,798
Taylor County	7,663	7,605	8,729	9,233	9,186
Union County	4,712	5,041	5,369	6,026	6,354
2020					
Alachua County	32,550	44,167	67,399	79,016	90,633
Bradford County	8,881	9,690	10,500	12,118	12,927
Columbia County	28,924	31,052	35,308	37,437	39,565
Dixie County	9,972	9,217	9,691	7,410	5,634
Gilchrist County	10,409	10,782	11,154	11,527	11,899
Hamilton County	6,611	6,928	7,246	7,563	7,880
Lafayette County	3,352	3,352	3,561	3,978	4,187
Madison County	7,756	8,295	8,834	9,373	9,911
Suwannee county	25,171	26,292	26,741	28,535	29,656
Taylor County	7,855	7,796	8,950	9,469	9,424
Union County	4,925	5,266	5,608	6,290	6,631

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

H. Evacuation Model Scenarios

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

- **Base Scenarios** – The base scenarios were developed to estimate a series of worst case scenarios and are identical for all eleven RPCs across the State. These scenarios assume 100 percent of the vulnerable population evacuates and includes impacts from counties outside of the RPC area. These scenarios are generally designed for growth management purposes, in order to ensure that all residents that choose to evacuate during an event are able to do so. The base scenarios for the North Central region are identified in **Table ES-8**; and,

- **Operational Scenarios** – The operational scenarios were developed by the RPCs in coordination with local county emergency managers and are designed to provide important information to emergency management personnel to plan for different storm events. These scenarios are different from region to region and vary for each evacuation level. The operational scenarios for the North Central region are identified in **Table ES-9**.

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

I. Clearance Time Results

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

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

Table ES-8 – Base Scenarios

	Scenario 1 Level A 2010	Scenario 2 Level B 2010	Scenario 3 Level C 2010	Scenario 4 Level D 2010	Scenario 5 Level E 2010
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	Alachua Bradford Columbia Dixie Gilchrist Hamilton Lafayette Madison Suwannee Taylor Union Levy Jefferson	Alachua Bradford Columbia Dixie Gilchrist Hamilton Lafayette Madison Suwannee Taylor Union Levy Jefferson	Alachua Bradford Columbia Dixie Gilchrist Hamilton Lafayette Madison Suwannee Taylor Union Levy Jefferson	Alachua Bradford Columbia Dixie Gilchrist Hamilton Lafayette Madison Suwannee Taylor Union Levy Jefferson	Alachua Bradford Columbia Dixie Gilchrist Hamilton Lafayette Madison Suwannee Taylor Union Levy Jefferson
	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	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	Alachua Bradford Columbia Dixie Gilchrist Hamilton Lafayette Madison Suwannee Taylor Union Levy Jefferson	Alachua Bradford Columbia Dixie Gilchrist Hamilton Lafayette Madison Suwannee Taylor Union Levy Jefferson	Alachua Bradford Columbia Dixie Gilchrist Hamilton Lafayette Madison Suwannee Taylor Union Levy Jefferson	Alachua Bradford Columbia Dixie Gilchrist Hamilton Lafayette Madison Suwannee Taylor Union Levy Jefferson	Alachua Bradford Columbia Dixie Gilchrist Hamilton Lafayette Madison Suwannee Taylor Union Levy Jefferson

Table ES-9 – Operational Scenarios

	Scenario 1 Level A 2010	Scenario 2 Level B 2010	Scenario 3 Level C 2010	Scenario 4 Level D 2010	Scenario 5 Level E 2010
Demographic Data	2015	2015	2015	2015	2015
Highway Network	2015	2015	2015	2015	2015
One-Way Operations	None	None	None	None	None
University Population	Default	Default	Default	Default	Default
Tourist Rate	Default	Default	Default	Default	Default
Shelters Open	Primary	Primary	Primary	Primary	Primary
Response Curve	12-hour	12-hour	12-hour	12-hour	9-hour
Evacuation Phasing	None	None	None	None	None
Behavioral Response	Planning	Planning	Planning	Planning	Planning
Evacuation Zone	A	B except as noted below	C except as noted below	D except as noted below	E except as noted below
Counties Evacuating	Hillsborough Pasco Pinellas Levy Hernando Citrus Dixie Taylor Gilchrist Lafayette Madison Jefferson	Wakulla Leon Jefferson Taylor Dixie Madison Lafayette (A) Gilchrist (A) Hamilton (A) Suwannee (A)	Duval St. Johns Flagler Volusia Nassau Clay (B) Putnam (B) Baker (A) Union (A) Bradford (A) Alachua (A) Columbia (A)	Hillsborough Pasco Pinellas Hernando (C) Citrus (C) Sumter (B) Polk (B) Marion (B) Levy (B) Dixie (A) Taylor (A) Gilchrist (A) Lafayette (A) Alachua (A) Suwannee (A) Hamilton (A) Columbia (A)	Dixie Taylor Levy Citrus Jefferson (C) Wakulla (C) Hernando (D) Pasco (C) Pinellas (B) Hillsborough (B) Sumter (B) Marion (C) Alachua (C) Gilchrist (C) Lafayette (D) Madison (A) Hamilton (A) Suwannee (A) Columbia (A) Union (A) Leon (B) Bradford (A) Baker (A)

Table ES-9 – Operational Scenarios

	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	2020	2020	2020	2020	2020
Highway Network	2020	2020	2020	2020	2020
One-Way Operations	None	None	None	None	None
University Population	Default	Default	Default	Default	Default
Tourist Rate	Default	Default	Default	Default	Default
Shelters Open	Primary	Primary	Primary	Primary	Primary
Response Curve	12-hour	12-hour	12-hour	12-hour	18-hour
Evacuation Phasing	None	None	None	None	None
Behavioral Response	Planning	Planning	Planning	Planning	Planning
Evacuation Zone	A	B except as noted below	C except as noted below	D except as noted below	E except as noted below
Counties Evacuating	Duval St. Johns Flagler Volusia Nassau Clay Putnam Baker Union Bradford Alachua	Hillsborough Pasco Pinellas Hernando (A) Citrus (A) Levy (A) Dixie (A) Taylor (A)	Wakulla Leon Jefferson Taylor Dixie Madison Lafayette (B) Gilchrist (B) Hamilton (B) Suwannee (B) Levy (A)	Duval St. Johns Flagler Volusia Nassau Clay (C) Putnam (C) Baker (B) Union (B) Bradford (B) Alachua (B) Columbia (A) Hamilton (A) Suwannee (A) Gilchrist (A) Dixie (A) Lafayette (A) Taylor (A) Madison (A)	Dixie Taylor Levy Citrus Jefferson (C) Wakulla (C) Hernando (D) Pasco (C) Pinellas (B) Hillsborough (B) Sumter (B) Marion (C) Alachua (C) Gilchrist (C) Lafayette (D) Madison (A) Hamilton (A) Suwannee (A) Columbia (A) Union (A) Leon (B) Bradford (A) Baker (A)

- **Clearance Time to Shelter** - The time necessary to safely evacuate vulnerable residents and visitors to a "point of safety" within the county based on a specific hazard, behavioral assumptions and evacuation scenario. Calculated from the point in time when the evacuation order is given to the point in time when the last vehicle reaches a point of safety within the county. Key points to remember for clearance time to shelter include:
  - All in-county trips reach their destination within the county; and,
  - This definition does not include any out of county trips.

- **In-County Clearance Time** - The time required from the point an evacuation order is given until the last evacuee can either leave the evacuation zone or arrive at safe shelter within the county. This does not include those evacuees leaving the county on their own. Key points to remember for in-county clearance time include:
  - All in-county trips reach their destination within the county;
  - All out of county trips exit the evacuation zone, but may still be located in the county; and,
  - This definition does not include out-of-county pass-through trips from adjacent counties, unless they evacuate through an evacuation zone.

- **Out of County Clearance Time** - The time necessary to safely evacuate vulnerable residents and visitors to a "point of safety" within the county based on a specific hazard, behavioral assumptions and evacuation scenario. Calculated from the point an evacuation order is given to the point in time when the last vehicle assigned an external destination exits the county. Key points to remember for out of county clearance time include:
  - The roadway network within the county is clear;
  - All out of county trips exit the county, including out of county pass-through trips from adjacent counties; and,
  - All in-county trips reach their destination.

- **Regional Clearance Time** - The time necessary to safely evacuate vulnerable residents and visitors to a "point of safety" within the (RPC) region based on a specific hazard, behavioral assumptions and evacuation scenario. Calculated from last vehicle assigned an external destination exits the region. Key points to remember for regional clearance time include:
  - The roadway network within the RPC is clear;
  - All out of county trips exit the RPC, including out of county pass-through trips from adjacent counties;
  - All in-county trips reach their destination; and,
  - Regional clearance time is equal to the largest out of county clearance time for a given scenario for any of the counties within the RPC, since the out of county clearance time includes out of county pass through trips from adjacent counties.

Calculated clearance times are used by county emergency managers as one input to determine when to recommend an evacuation order. Clearance times for each of the base scenarios are summarized in **Table ES-10** and **ES-11**, while clearance times for each of the operational scenarios are summarized in **Table ES-12** and **Table ES-13.** Clearance time includes several components, including the mobilization time for the evacuating population to prepare for an evacuation (pack supplies and personal belongs, load their vehicle, etc.), the actual time spent traveling on the roadway network, and the delay time caused by traffic congestion.

Base Scenarios

In-county clearance times for the base scenarios range from 11 hours to 13 hours depending upon the evacuation level. Clearance Time to Shelter varies a little more, with clearance times for the base scenarios ranging from 6.5 hours to 12.5 hours.

In 2015, in-county clearance times for the base scenarios remain fairly constant, with clearance times again ranging from 11 hours to 13 hours. 2015 Clearance Time to Shelter shows a similar pattern to 2010, with clearance times for the base scenarios ranging from 7.0 hours to 13 hours depending upon the scenario.

Out of county clearance times for the base scenarios range from 11.5 hours to 14 hours, depending on the scenario. Out of county clearance times remain fairly constant in 2015, with out of county clearance times again ranging from 11.5 to 14 hours.

Regional clearance time for the eleven county North Central Florida region remains constant at 14 hours for all base scenarios for both 2010 and 2015.

Operational Scenarios

In-county clearance times for the 2010 operational scenarios range from 0 hours to 22 hours depending upon the scenario. Counties that were not included in the evacuation scenario will have an in-county clearance time of 0 since no one within the county is evacuating. Clearance Time to Shelter shows a similar pattern, with clearance times for the operational scenarios ranging from 0 hours to 12 hours depending upon the county and the scenario.

In 2015, in-county clearance times for the operational scenarios vary from 0 hours to 21.5 hours for the level E evacuation in Taylor County. The 2015 level E evacuation includes vehicle trips evacuating from most of the Gulf Coast, which cause a large increase in clearance times. Clearance Time to Shelter shows a similar pattern to the 2010 scenarios, with clearance times for the base scenarios ranging from 0 hours to 18.5 hours depending upon the scenario.

Out of county clearance times for the 2010 operational scenarios range from 0.5 hours to 35 hours for the evacuation level D scenario. Out of county clearance times have a similar pattern for all counties in 2015 to between 0.5 and 35.5 hours depending upon the scenario. Regional clearance time for the eleven county NCFRPC region ranges from 13 hours to 35 hours in 2010. This time increases to between 14 and 35.5 hours in 2015.

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					
Alachua County	12.5	12.5	12.5	12.5	12.5
Bradford County	12.5	12.5	12.5	12.5	12.5
Columbia County	12.5	12.5	12.5	12.5	12.5
Dixie County	13.0	13.0	13.0	13.0	13.0
Gilchrist County	12.5	12.5	12.5	12.5	12.5
Hamilton County	12.5	12.5	12.5	12.5	12.5
Lafayette County	12.5	12.5	12.5	12.5	12.5
Madison County	12.5	12.5	12.5	12.5	12.5
Suwannee county	13.0	13.0	13.0	13.0	13.0
Taylor County	13.0	13.0	13.0	13.0	13.0
Union County	12.5	12.5	12.5	12.5	12.5
In-County Clearance Time					
Alachua County	13.0	13.0	13.0	13.0	13.0
Bradford County	13.0	13.0	13.0	13.0	13.0
Columbia County	13.0	13.0	13.0	13.0	13.0
Dixie County	13.0	13.0	13.0	13.0	13.0
Gilchrist County	13.0	13.0	13.0	13.0	13.0
Hamilton County	13.0	13.0	13.0	13.0	13.0
Lafayette County	13.0	13.0	13.0	13.0	13.0
Madison County	13.0	13.0	13.0	13.0	14.0
Suwannee county	13.5	13.5	13.5	13.5	13.5
Taylor County	13.0	13.0	13.0	13.0	14.5
Union County	13.0	13.0	13.0	13.0	13.0
Out of County Clearance Time					
Alachua County	14.0	14.5	14.0	14.0	14.0
Bradford County	13.5	13.5	14.0	14.0	14.0
Columbia County	14.0	14.0	14.0	14.0	14.0
Dixie County	13.0	13.0	13.0	13.0	13.0
Gilchrist County	13.5	13.5	13.5	13.5	13.5
Hamilton County	14.5	14.5	14.5	14.5	14.5
Lafayette County	13.0	13.5	13.5	13.5	14.0
Madison County	14.0	14.0	14.0	14.0	14.0
Suwannee county	14.0	14.0	14.0	14.0	14.0
Taylor County	14.0	14.0	14.0	14.0	14.5
Union County	13.0	13.0	13.5	13.5	13.5
Regional Clearance Time					
North Central	14.5	14.5	14.5	14.5	14.5

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					
Alachua County	12.5	12.5	12.5	12.5	12.5
Bradford County	11.0	11.5	11.5	11.0	11.5
Columbia County	12.0	12.0	12.0	12.0	12.0
Dixie County	11.0	11.0	11.5	11.5	12.0
Gilchrist County	11.0	11.0	11.0	11.0	11.0
Hamilton County	7.0	10.0	9.5	9.5	7.0
Lafayette County	10.5	10.0	9.0	10.5	9.0
Madison County	11.0	10.0	11.0	11.0	11.0
Suwannee county	12.0	12.0	12.0	12.0	12.0
Taylor County	12.5	12.5	12.0	12.5	13.0
Union County	11.0	11.0	11.0	11.0	11.0
In-County Clearance Time					
Alachua County	13.0	13.0	13.0	13.0	13.0
Bradford County	12.5	12.5	12.5	12.5	12.5
Columbia County	13.0	13.0	13.0	13.0	13.0
Dixie County	11.5	11.5	11.5	11.5	12.5
Gilchrist County	12.5	12.5	12.5	12.5	12.5
Hamilton County	11.0	12.0	11.5	11.5	10.5
Lafayette County	12.5	12.5	11.5	12.5	11.0
Madison County	12.0	11.5	12.5	12.5	12.5
Suwannee county	13.0	13.0	13.0	13.0	13.0
Taylor County	13.0	13.0	12.5	13.0	13.0
Union County	12.5	12.5	12.5	12.5	12.5
Out of County Clearance Time					
Alachua County	13.5	13.5	13.5	13.5	14.0
Bradford County	12.5	13.0	12.5	13.5	13.5
Columbia County	13.5	13.5	13.5	13.5	13.5
Dixie County	12.0	12.0	12.5	12.5	13.0
Gilchrist County	12.5	13.0	13.0	13.0	13.0
Hamilton County	13.5	13.5	13.5	13.5	13.5
Lafayette County	12.5	12.0	12.5	12.5	12.5
Madison County	13.5	13.5	13.5	13.5	13.5
Suwannee county	13.5	13.5	13.5	13.5	13.5
Taylor County	13.5	13.5	13.5	13.5	13.5
Union County	11.5	11.5	12.0	12.5	12.5
Regional Clearance Time					
North Central	14.0	14.0	14.0	14.0	14.0

Table ES-12 – 2015 Clearance Times for Operational Scenarios

	Evacuation Level A Operational Scenario 1	Evacuation Level B Operational Scenario 2	Evacuation Level C Operational Scenario 3	Evacuation Level D Operational Scenario 4	Evacuation Level E Operational Scenario 5
Clearance Time to Shelter					
Alachua County	0.0	0.0	13.5	12.5	10.0
Bradford County	0.0	0.0	12.5	0.0	9.5
Columbia County	0.0	0.0	12.5	13.5	12.5
Dixie County	12.5	12.5	0.0	12.5	10.0
Gilchrist County	12.5	12.5	0.0	12.5	9.5
Hamilton County	0.0	12.5	0.0	12.5	9.5
Lafayette County	12.5	12.5	0.0	12.5	9.5
Madison County	12.5	12.5	0.0	0.0	9.5
Suwannee county	0.0	12.5	0.0	12.5	10.0
Taylor County	13.0	13.0	0.0	13.0	10.0
Union County	0.0	0.0	12.5	0.0	9.5
In-County Clearance Time					
Alachua County	0.0	0.0	14.0	13.0	10.5
Bradford County	0.0	0.0	13.0	0.0	10.0
Columbia County	0.0	0.0	13.0	14.0	13.0
Dixie County	16.0	14.5	0.0	27.5	20.5
Gilchrist County	13.0	13.0	0.0	13.0	10.0
Hamilton County	0.0	13.0	0.0	13.0	10.0
Lafayette County	13.0	13.0	0.0	13.0	10.0
Madison County	13.0	13.0	0.0	0.0	10.0
Suwannee county	0.0	13.0	0.0	13.0	10.5
Taylor County	16.5	13.0	0.0	26.0	20.5
Union County	0.0	0.0	13.0	0.0	10.0
Out of County Clearance Time					
Alachua County	19.5	15.0	24.5	38.5	26.5
Bradford County	19.5	11.5	24.0	39.0	27.0
Columbia County	20.0	14.5	24.0	39.0	27.5
Dixie County	16.5	14.5	15.5	28.5	20.5
Gilchrist County	15.5	13.0	18.5	32.5	20.5
Hamilton County	20.5	14.0	24.5	39.0	27.5
Lafayette County	18.0	14.0	20.0	28.5	20.5
Madison County	20.5	13.5	24.5	38.5	27.5
Suwannee county	20.5	14.0	24.5	38.5	27.0
Taylor County	17.0	13.5	19.5	29.5	21.5
Union County	16.5	12.5	24.0	38.5	26.5
Regional Clearance Time					
North Central	20.5	15.0	25.0	39.0	27.5

Table ES-13 – 2020 Clearance Times for Operational Scenarios

	Evacuation Level A Operational Scenario 6	Evacuation Level B Operational Scenario 7	Evacuation Level C Operational Scenario 8	Evacuation Level D Operational Scenario 9	Evacuation Level E Operational Scenario 10
Clearance Time to Shelter					
Alachua County	13.5	0.0	12.5	13.5	18.5
Bradford County	12.5	0.0	12.5	12.5	18.5
Columbia County	0.0	0.0	12.5	12.5	18.5
Dixie County	0.0	12.5	13.0	12.5	18.5
Gilchrist County	0.0	0.0	12.5	12.5	18.5
Hamilton County	0.0	0.0	12.5	12.5	18.5
Lafayette County	0.0	0.0	12.5	12.5	18.5
Madison County	0.0	0.0	12.5	12.5	18.0
Suwannee county	0.0	0.0	13.0	12.5	18.5
Taylor County	0.0	13.0	13.0	13.0	19.0
Union County	12.5	0.0	12.5	12.5	18.0
In-County Clearance Time					
Alachua County	14.0	0.0	13.0	14.0	19.0
Bradford County	13.0	0.0	13.0	13.0	19.0
Columbia County	0.0	0.0	13.0	13.0	19.0
Dixie County	0.0	16.0	13.0	16.5	25.0
Gilchrist County	0.0	0.0	13.0	13.0	19.0
Hamilton County	0.0	0.0	13.0	13.0	19.0
Lafayette County	0.0	0.0	13.0	13.0	19.0
Madison County	0.0	0.0	13.0	13.0	18.5
Suwannee county	0.0	0.0	13.5	13.0	19.0
Taylor County	0.0	17.0	14.0	13.0	25.0
Union County	13.0	0.0	13.0	13.0	18.5
Out of County Clearance Time					
Alachua County	15.0	23.0	14.0	31.0	33.5
Bradford County	14.5	23.0	14.0	30.0	34.0
Columbia County	15.5	23.0	14.0	30.5	34.0
Dixie County	13.0	16.5	13.0	20.0	25.0
Gilchrist County	13.0	20.0	13.5	29.0	24.5
Hamilton County	15.5	23.0	14.5	30.5	34.5
Lafayette County	14.0	16.0	13.5	31.0	25.5
Madison County	15.0	24.0	14.0	31.0	31.0
Suwannee county	15.0	23.5	14.0	31.0	34.0
Taylor County	14.0	17.5	14.0	31.5	26.0
Union County	14.0	20.0	13.5	30.0	27.0
Regional Clearance Time					
North Central	16.0	24.0	14.5	31.5	34.5

J. Maximum Evacuating Population Clearances

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

Using the base scenarios, which assume 100% of the vulnerable population is evacuating, along with shadow evacuations and evacuations from adjacent counties, an estimate was made of the evacuating population actually able to evacuate out of each county by the time intervals of 12, 18, 24, and 36 hours. The estimated maximum evacuating population by time interval for 2010 is identified in **Table ES-14** and for 2015 in **Table ES-15**.

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

K. Sensitivity Analysis

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

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

- For low evacuation levels A and B, clearance time will vary by as much as 40 percent depending on the response curve. Low evacuation levels A and B have fewer evacuating vehicles that can be accommodated more easily on the transportation network. In most cases, clearance times typically exceed the response curve by one to two hours. Thus, a 12 hour response curve may yield a clearance time of 13 or 14 hours while an 18 hour response curve may yield a clearance time of 19 or 20 hours. This leads to a higher level of variability than larger evacuations;

Table ES-14 – 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 Alachua County					
12-Hour	26,557	34,794	54,994	64,473	73,953
18-Hour	30,983	42,043	64,160	75,219	86,279
24-Hour					
36-Hour					
Estimated Evacuating Population Clearing Bradford County					
12-Hour	7,681	8,381	8,757	10,107	10,782
18-Hour	8,641	9,429	10,216	11,791	12,579
24-Hour					
36-Hour					
Estimated Evacuating Population Clearing Columbia County					
12-Hour	23,227	24,940	28,365	30,078	31,791
18-Hour	27,098	29,097	33,093	35,091	37,090
24-Hour					
36-Hour					
Estimated Evacuating Population Clearing Dixie County					
12-Hour	1,280	1,313	1,998	2,871	3,587
18-Hour	1,387	1,422	2,165	3,110	3,886
24-Hour					
36-Hour					
Estimated Evacuating Population Clearing Gilchrist County					
12-Hour	8,660	8,971	9,281	9,592	9,902
18-Hour	9,742	10,092	10,441	10,791	11,140
24-Hour					
36-Hour					
Estimated Evacuating Population Clearing Hamilton County					
12-Hour	5,301	5,556	5,810	6,065	6,320
18-Hour	6,405	6,713	7,021	7,329	7,637
24-Hour					
36-Hour					
Estimated Evacuating Population Clearing Lafayette County					
12-Hour	2,951	2,842	3,018	3,370	3,419
18-Hour	3,197	3,197	3,395	3,791	3,989
24-Hour					
36-Hour					
Estimated Evacuating Population Clearing Madison County					
12-Hour	6,619	7,077	7,536	7,995	8,454
18-Hour	7,722	8,257	8,792	9,328	9,863
24-Hour					
36-Hour					

Table ES-14 – 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 Suwannee County					
12-Hour	20,215	21,118	21,479	22,923	23,827
18-Hour	23,584	24,638	25,059	26,744	27,798
24-Hour					
36-Hour					
Estimated Evacuating Population Clearing Taylor County					
12-Hour	8,053	8,102	9,261	10,722	11,507
18-Hour	9,395	9,452	10,804	12,509	13,904
24-Hour					
36-Hour					
Estimated Evacuating Population Clearing Union County					
12-Hour	4,350	4,653	4,772	5,356	5,648
18-Hour	4,712	5,041	5,369	6,026	6,354
24-Hour					
36-Hour					

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

Table ES-15 – 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 Alachua County					
12-Hour	26,938	36,552	57,771	65,393	75,007
18-Hour	32,550	44,167	67,399	79,016	90,633
24-Hour					
36-Hour					
Estimated Evacuating Population Clearing Bradford County					
12-Hour	7,612	8,306	9,000	10,387	11,080
18-Hour	8,881	9,690	10,500	12,118	12,927
24-Hour					
36-Hour					
Estimated Evacuating Population Clearing Columbia County					
12-Hour	24,792	26,616	30,264	32,089	33,913
18-Hour	28,924	31,052	35,308	37,437	39,565
24-Hour					
36-Hour					
Estimated Evacuating Population Clearing Dixie County					
12-Hour	1,313	1,346	2,049	2,946	3,680
18-Hour	1,422	1,458	2,220	3,191	3,987
24-Hour					
36-Hour					
Estimated Evacuating Population Clearing Gilchrist County					
12-Hour	9,252	9,584	9,915	10,246	10,577
18-Hour	10,409	10,782	11,154	11,527	11,899
24-Hour					
36-Hour					
Estimated Evacuating Population Clearing Hamilton County					
12-Hour	5,471	5,734	5,997	6,259	6,521
18-Hour	6,611	6,928	7,246	7,563	7,880
24-Hour					
36-Hour					
Estimated Evacuating Population Clearing Lafayette County					
12-Hour	2,980	2,980	3,165	3,536	3,589
18-Hour	3,352	3,352	3,561	3,978	4,187
24-Hour					
36-Hour					
Estimated Evacuating Population Clearing Madison County					
12-Hour	6,648	7,110	7,572	7,757	8,202
18-Hour	7,756	8,295	8,834	9,373	9,911
24-Hour					
36-Hour					

Table ES-15 – 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 Suwannee County					
12-Hour	21,575	22,536	22,921	24,459	25,419
18-Hour	25,171	26,292	26,741	28,535	29,656
24-Hour					
36-Hour					
Estimated Evacuating Population Clearing Taylor County					
12-Hour	8,254	8,305	9,495	10,995	11,802
18-Hour	9,630	9,689	11,077	12,828	14,261
24-Hour					
36-Hour					
Estimated Evacuating Population Clearing Union County					
12-Hour	4,546	4,681	4,985	5,591	5,894
18-Hour	4,925	5,266	5,608	6,290	6,631
24-Hour					
36-Hour					

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

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

L. Summary and Conclusions

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

- Critical transportation facilities within the NCFRPC region include US 19, I-75, I-10, and US 47. For large storm events, such as level D and E evacuations, other State facilities also play an important role in evacuations, such as US 301;

- Given the rural nature of many of the counties within the NCFRPC, many two-lane state and US highways play a major role during the evacuation process. State and County officials should coordinate personnel resources to provide sufficient traffic control at major intersections along these routes;

- NCFRPC counties play a major role even when evacuations occur in other parts of the State, as seen in operational scenarios that assumed either Tampa Bay area storm events or Jacksonville area storm events. For example, evacuation traffic from the Tampa Bay area travels along US 19 in Dixie and Taylor Counties and along I-75 through Alachua, Columbia, Suwannee, and Hamilton Counties. In addition, evacuation traffic from Jacksonville travels along I-10, US 301, and SR 20 in Alachua County. NCFRPC counties should continue their coordination efforts with the State and provide assistance even when NCFRPC counties are not evacuating;

- 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 5-3) to estimate fuel and supply requirements along major evacuation routes to aid motorists during the evacuation process;

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

- The counties within the North Central 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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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.

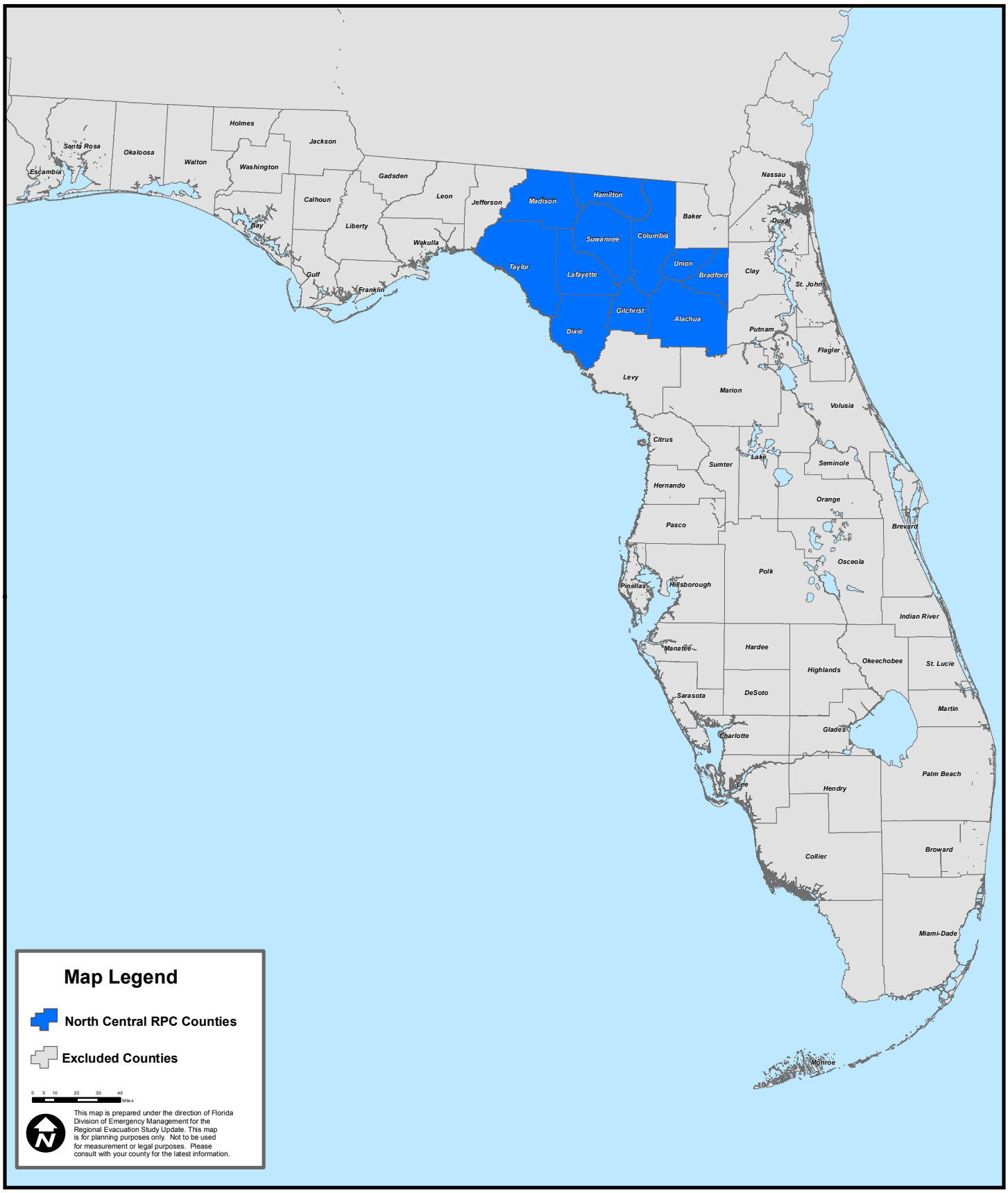
One of the objectives of the SRESP is to create consistent and integrated regional evacuation data and mapping, and by doing so, to facilitate knowledge sharing between state, regional, county, and local partners. To achieve this objective, it is important for all Regional Planning Councils to adopt 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 eleven county North Central Florida Regional Planning Council area, as illustrated in **Figure I-1**. The transportation modeling methodology includes some processes that are performed at the statewide level, in order to determine the impacts of evacuations from other regions impacting the evacuation clearance times in the North Central Florida region. While the impact of other regions is included in the North Central Florida analysis, it is important to note that the results of the transportation analysis presented in this document are only reported for the six counties included in the North Central Florida RPC. Transportation analysis results for other regions and counties are reported in the corresponding Volume 4 report for those regions.

Figure I-1

North Central Florida Regional Planning Council



Sources: North Central Florida Regional Planning Council, CDM Smith

Map Printed: July, 2015

C. Input and Coordination

The development of the transportation methodology and framework required coordination and input from all eleven regional planning councils in Florida, along with the Division of Emergency Management, Department of Transportation, and local county emergency management teams. At the statewide level, the transportation consultant, Wilbur Smith Associates, participated in SRESP Work Group Meetings which were typically held on a monthly basis to discuss the development of the transportation methodology and receive feedback and input from the State agencies and RPCs.

At the local and regional level, Wilbur Smith Associates conducted a series of four regional meetings to coordinate with and receive input from local county emergency management, the regional planning council, local transportation planning agencies and groups, as well as other interested agencies. The four meetings held in the North Central Florida region included the following:

Regional Meeting No. 1 – Model Development Meeting
The first regional meeting for the North Central Florida region was held on November 17, 2008 at 10:00 AM. The purpose of the model development meeting was to introduce the transportation model development process. Feedback received through this process was used and incorporated into the development of the evacuation transportation methodology and framework.

Regional Meeting No. 2 – Model Implementation Meeting
The second regional meeting for the North Central Florida region was held on April 8, 2009 at 10:00 AM. The purpose of the model implementation meeting was to discuss the evacuation modeling methodology, present the evacuation networks and small area data summaries, and obtain input from local county emergency management staff regarding county level traffic management plans, model input assumptions, and the geographic extents of the regional model. Feedback received through this process was used and incorporated into the development of the North Central Florida regional model.

Regional Meeting No. 3 – Scenario Development Meeting
The third regional meeting for the North Central Florida region was held on November 4, 2009 at 1:30 PM. The purpose of the scenario development meeting was to discuss the final evacuation methodology and framework, review the North Central Florida regional model network, discuss the base scenarios for the region for growth management purposes, and discuss and receive input on the operational scenarios to be evaluated for emergency management purposes.

Regional Meeting No. 4 – Transportation Analysis Meeting
The fourth and final regional meeting for the North Central Florida region was held on July 6, 2010 at 1:30 PM. The purpose of the transportation analysis meeting was to review the draft results of the transportation analysis and receive feedback on the draft final report.

Regional Meeting No. 5 – Transportation Analysis Update

It was decided that no changes were needed to the operational scenarios since the largest impact to evacuation clearance times comes from evacuees outside the region evacuating into or through north central Florida. The consultant was supplied with this information on March 31, 2015.

This topic was discussed during the February 19, 2015, District 3 Local Emergency Planning Committee meeting, as well as at the March 12, 2015, Florida Division of Emergency Management Region 3 meeting held in Union County. A series of individual meetings were held to discuss the changes to operational scenarios, road network, evacuation zones, and shelter inventories. These occurred with the original coastal counties while conducting hazards analysis update visits in Dixie County on March 17, 2015 and in Taylor County on March 17, 2015.

The update to the transportation network was limited to four road segment, of which only two are currently constructed. The changes were discussed with Alachua and Bradford County emergency management during at the March 12, 2015, Florida Division of Emergency Management Region 3 meeting held in Union County. The regional Florida Department of Transportation emergency management contact was asked if there are any road network changes that could impact road capacity and the evacuation model. The consultant was supplied with this information on March 31, 2015.

The regional shelter list was reviewed and updated and distributed to all eleven county emergency management directors for review and approval. The review included an initial update and a final update based upon comment received back from the counties. This information was supplied to the consultant on April 17, 2015, for the original north central Florida counties.

Regional Meeting No. 6 – Scenario Development Meeting

All of the project overview information was also reviewed during a May 7, 2015, conference call with Dixie, Taylor, Gilchrist and Lafayette Counties to present the results Directional Atlas updates. For the combined Withlacoochee and North Central Florida counties, a conference call was conducted on June 17, 2015, to review the update process of the 2015-2020 Transportation Update of the Statewide Regional Evacuation Study. This call included the counties which were previously part of the Withlacoochee Regional Planning Council. Counties invited to this call included: Citrus, Levy, Hernando, Marion and Sumter Counties.

Regional Meeting No. 7 – Transportation Update Final Meeting

The final regional meeting for the North Central Florida region was held on August 24, 2015 via a conference call. The purpose of the transportation update final meeting was to review the results of the transportation analysis and receive feedback on the draft final report.

CHAPTER II
EVACUATION MODELING METHODOLOGY AND FRAMEWORK

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

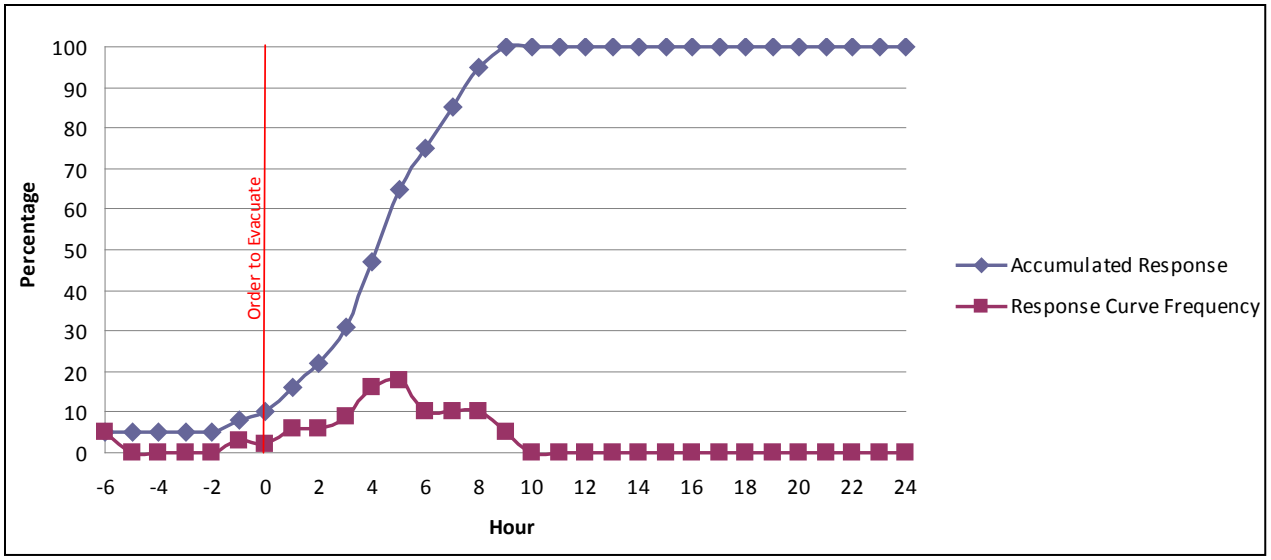
The evacuation rate indicates the percent of residents who will leave their homes to go someplace safer in each storm threat scenario. The evacuation rates are based on the following assumptions: that the storm track passes very close to the area being evacuated; and officials order evacuation for surge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

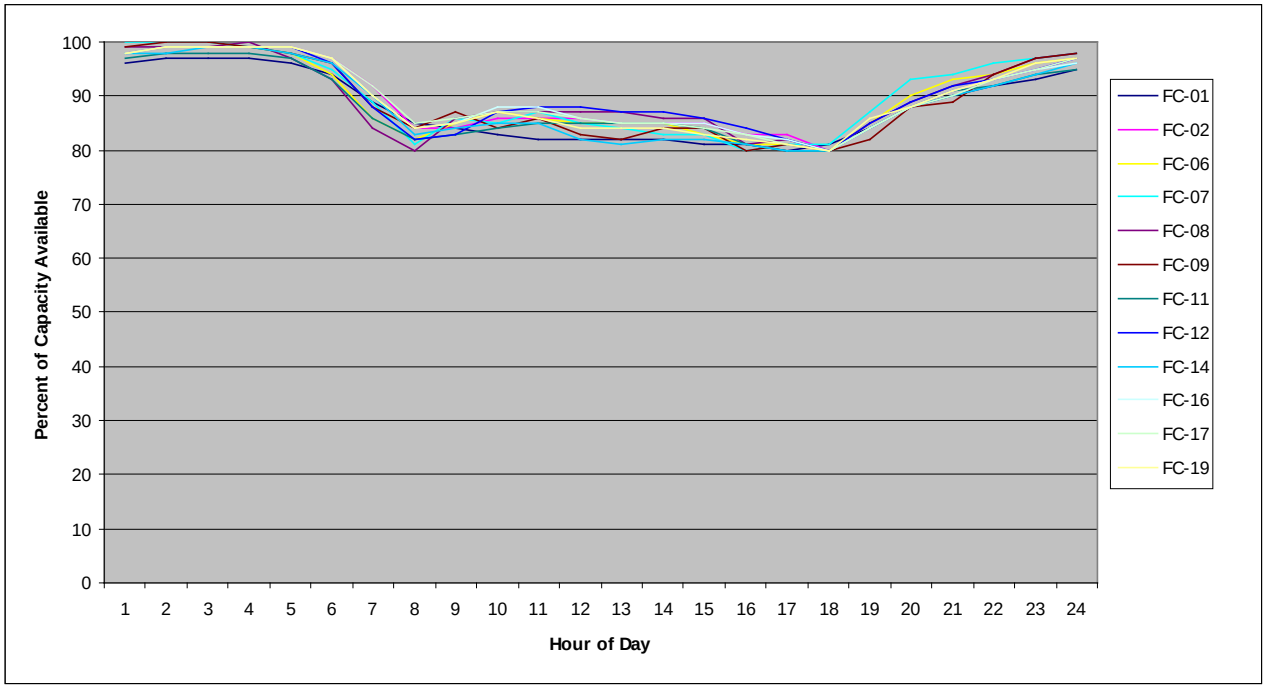
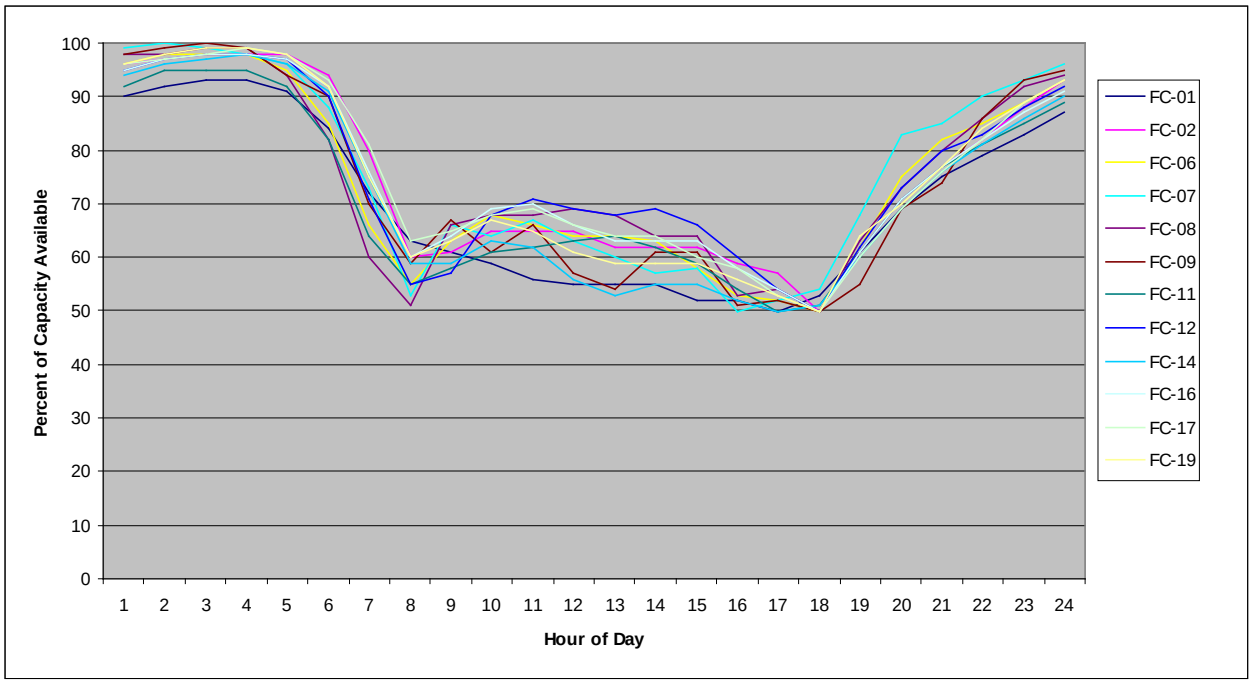


Figure II-3 – Percent of Available Capacity for Other Counties

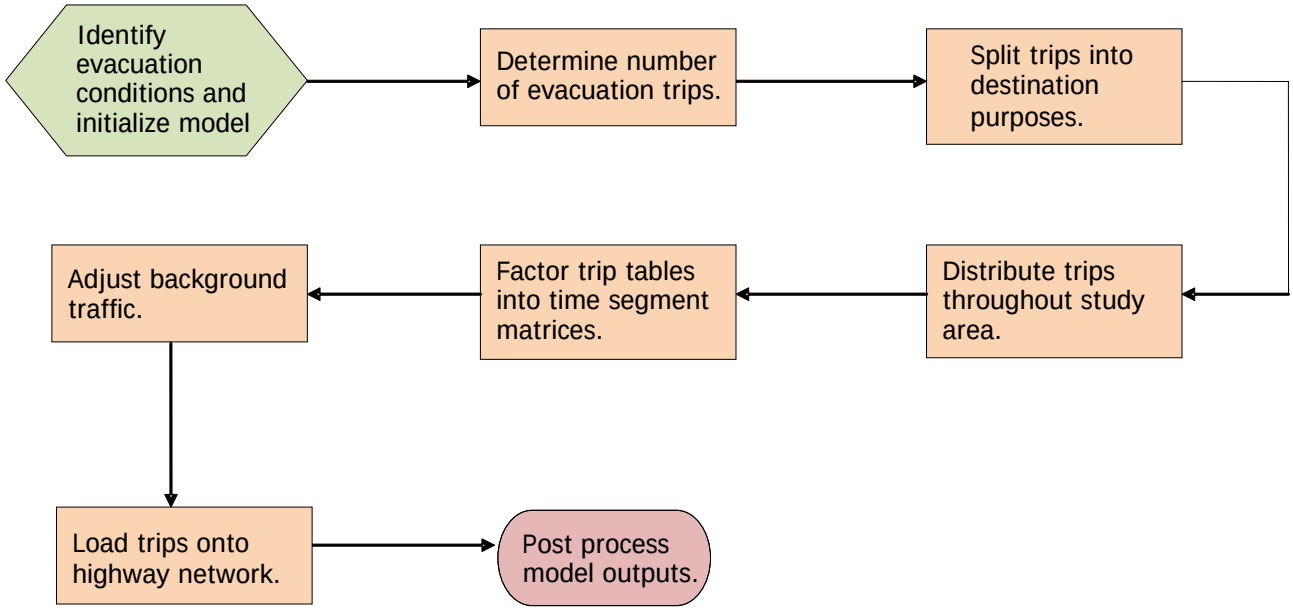


D. Evacuation Traffic

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 North Central Florida Region, the regional model network includes the eleven counties within the RPC plus 31 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 North Central Florida Region. It is important to note that the input data discussed in this chapter is included only for the counties within the North Central Florida RPC, as these are the counties that the North Central Florida RPC has direct responsibility for the data. Data for the adjacent counties included in the North Central Florida Regional model were provided by the corresponding RPC in which the counties belong. The model data for these counties is discussed in the corresponding Volume 4 report for those respective RPCs.

A. Regional Model Network

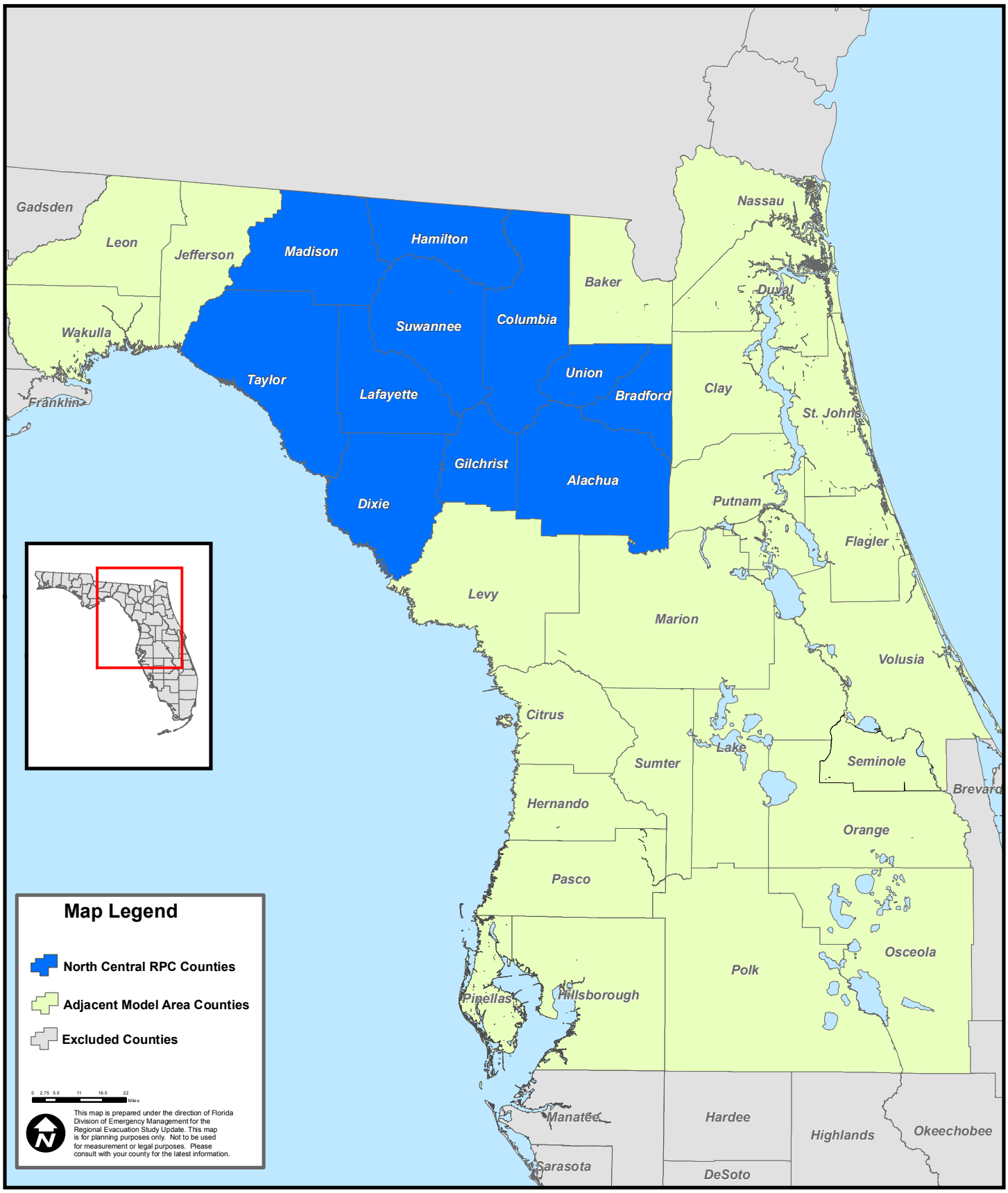
The road network is a key component of the evacuation model. The roadway variables in the network include area type, functional class, number of through lanes, capacity, speed, and several others. The regional model network consists of the RPC designated evacuation routes as well as a supporting roadway network that facilitates movement of evacuation traffic. The 2005 Florida Department of Transportation (FDOT) Statewide Model Network was used as a basis for developing the regional model network, while the evacuation routes were obtained from the North Central Florida RPC. The RPC relied on the emergency managers of its constituent counties to provide it with information on which roads were to be included as evacuation routes. The resulting model network was updated to 2010 conditions and is referred to as the base model network. **Figure III-2** identifies the model network and evacuation routes for the NCFRPC. County level details of the regional model network are provided in the Volume 5 report. The regional model network for the North Central Florida region includes key roadways within the eleven county region, including I-75, I-10, US 19, US 27, US 90, US 441, US 41, US 301, SR 100, SR 26 and SR 6.

B. Regional Zone System

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

Figure III-1

North Central Regional Model Area

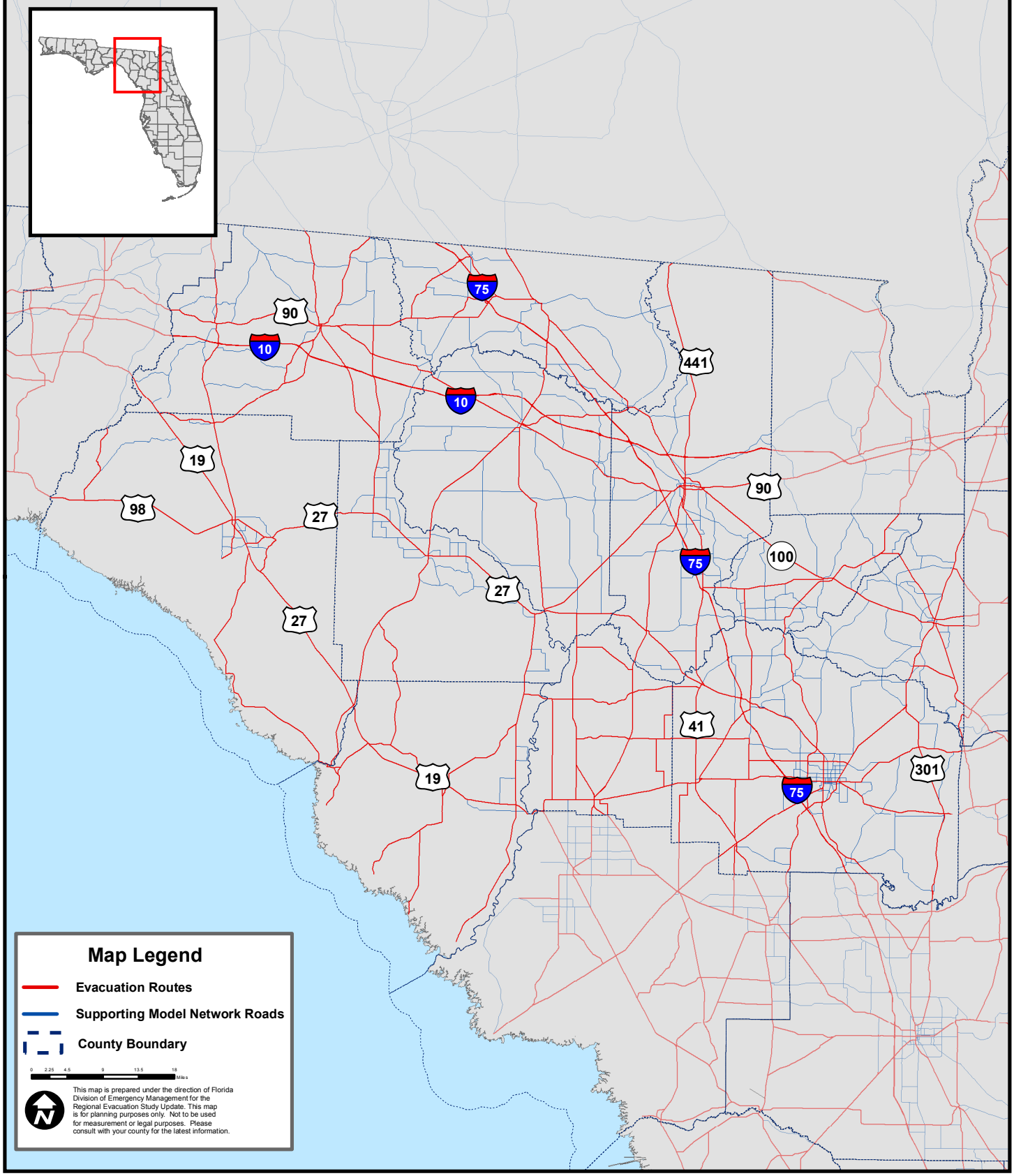


Sources: North Central Florida Regional Planning Council, CDM Smith

Map Printed: July, 2015

Figure III-2

North Central Regional Model Network



Sources: North Central Florida Regional Planning Council, CDM Smith

Map Printed: July, 2015

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, 255 of the zones are located within the eleven county North Central Florida region, as illustrated in **Figure III-3**. In the North Central Florida region, Alachua County has the largest number of TEZs with 113; Columbia follows with 30 TEZs. Lafayette and Union Counties have the lowest number of TEZs within the RPC, having 6 and 7 zones, respectively. The larger number of TEZs generally reflects counties with higher population densities. The number of TEZs for each county in the region is listed below:

- Alachua – 113
- Bradford – 16
- Columbia – 30
- Dixie – 10
- Gilchrist – 8
- Hamilton – 9
- Lafayette – 6
- Madison – 15
- Suwannee – 24
- Taylor – 17
- Union – 7

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: 2020, 2015, and 2020.

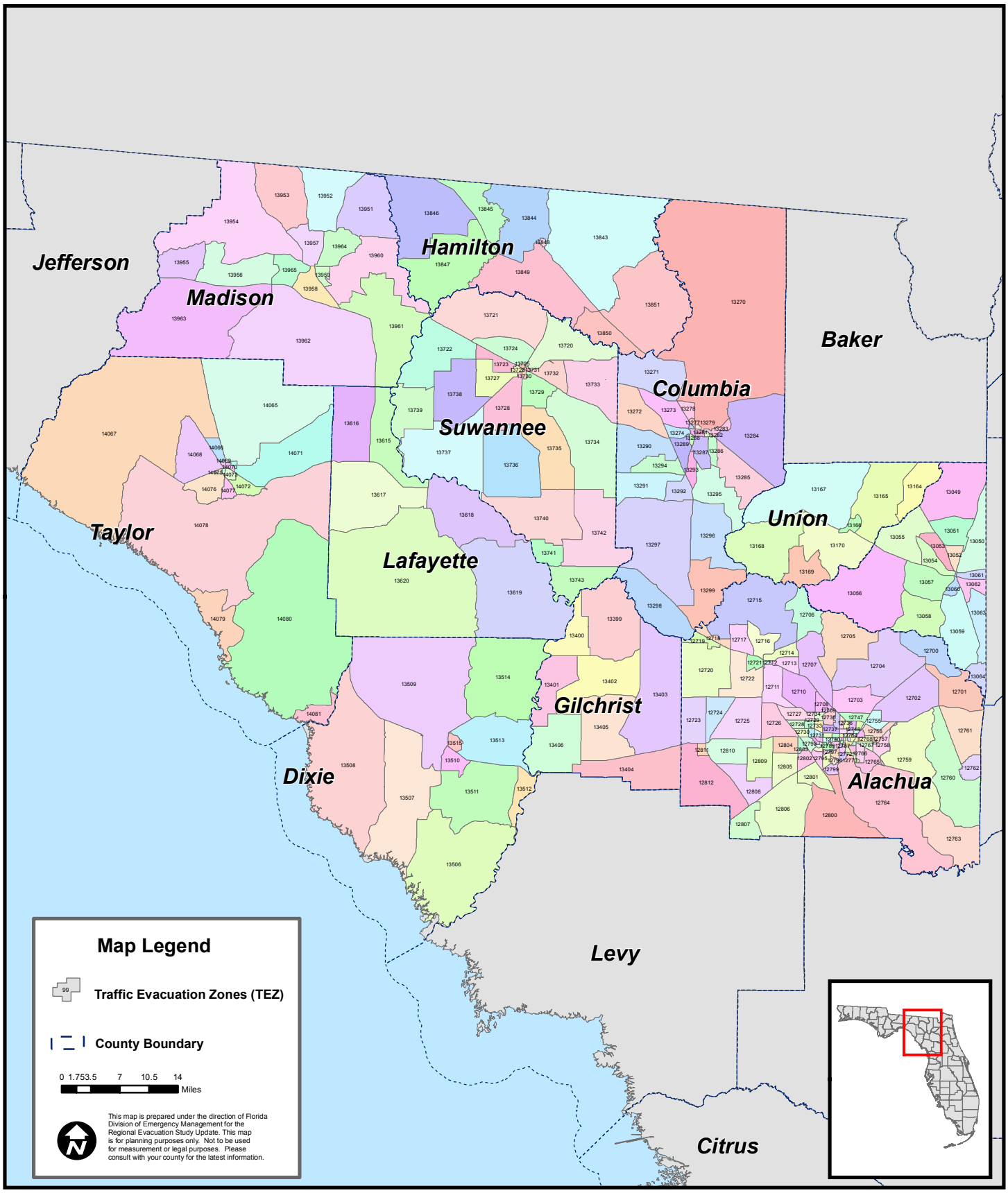
A snapshot of the key demographic data for each county in the North Central Florida RPC for 2020, 2015, and 2020 is summarized in **Table III-1**. The tables list the number of occupied dwelling units for site built homes, the permanent population in site-built homes, as well as the number of occupied 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 a number 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.

Alachua County has the largest population in the region during all three time periods. The county is expected to reach over 250,000 people by 2020. Columbia County has the second largest population in the region and is projected to have almost 75,000 people by 2015. Suwannee and Gilchrist Counties are both estimated to grow by more than 20% between 2010 and 2015; conversely, Hamilton County is expected to have a nominal 7% increase.

For modeling purposes, the RPC kept the number of mobile homes and population in mobile homes static for each of the time horizons with the exception of Alachua County. Alachua County has the highest number of mobile homes followed by Columbia. The coastal counties, Dixie and Taylor, both have just over 3,000 mobile homes.

Figure III-3

North Central Regional Model Transportation Evacuation Zone (TEZ) System



Sources: North Central Florida Regional Planning Council, CDM Smith

Map Printed: July, 2015

Table III-1 - North Central Florida Demographic Characteristic Summary

County	Characteristic	Year 2010	2015	2020
Alachua	Occupied site-built homes	92,122	94,225	99,023
	Population in site-built homes	213,941	218,816	229,936
	Occupied mobile homes	8,394	8,582	9,024
	Population in mobile homes	19,475	19,921	20,952
	Hotel/motel units	9,264	9,264	9,264
Bradford	Occupied site-built homes	6,785	6,644	6,834
	Population in site-built homes	16,052	15,720	16,171
	Occupied mobile homes	2,694	2,653	2,726
	Population in mobile homes	7,976	7,858	8,075
	Hotel/motel units	624	624	624
Columbia	Occupied site-built homes	15,397	15,931	16,972
	Population in site-built homes	38,647	39,963	42,535
	Occupied mobile homes	9,544	9,864	10,511
	Population in mobile homes	24,278	25,117	26,807
	Hotel/motel units	2,677	2,677	2,677
Dixie	Occupied site-built homes	3,226	3,380	3,583
	Population in site-built homes	6,308	6,542	6,845
	Occupied mobile homes	3,090	3,238	3,434
	Population in mobile homes	8,684	9,170	9,805
	Hotel/motel units	233	233	233
Gilchrist	Occupied site-built homes			

County	Characteristic	Year 2010	2015	2020
		2,812	2,911	3,104
	Population in site-built homes	6,743	6,983	7,443
	Occupied mobile homes	3,309	3,422	3,653
	Population in mobile homes	9,068	9,374	10,005
	Hotel/motel units	119	119	119
Hamilton	Occupied site-built homes	2,578	2,625	2,707
	Population in site-built homes	6,061	6,163	6,346
	Occupied mobile homes	2,039	2,074	2,140
	Population in mobile homes	5,674	5,782	5,975
	Hotel/motel units	474	474	474
Lafayette	Occupied site-built homes	1,674	1,668	1,756
	Population in site-built homes	3,989	3,971	4,166
	Occupied mobile homes	906	906	952
	Population in mobile homes	2,787	2,787	2,944
	Hotel/motel units	66	66	66
Madison	Occupied site-built homes	4,580	4,596	4,630
	Population in site-built homes	10,674	10,711	10,783
	Occupied mobile homes	2,405	2,414	2,428
	Population in mobile homes	6,617	6,643	6,680
	Hotel/motel units	492	492	492
Suwannee	Occupied site-built homes	8,328	9,049	9,642
	Population in site-built homes	19,389	21,057	22,430

County	Characteristic	Year 2010	2015	2020
	Occupied mobile homes	7,625	8,282	8,829
	Population in mobile homes	20,769	22,567	24,067
	Hotel/motel units	558	558	558
Taylor	Occupied site-built homes	5,271	5,418	5,555
	Population in site-built homes	12,647	12,991	13,319
	Occupied mobile homes	2,649	2,722	2,790
	Population in mobile homes	6,669	6,861	7,035
	Hotel/motel units	744	744	744
Union	Occupied site-built homes	2,663	2,711	2,821
	Population in site-built homes	6,453	6,572	6,834
	Occupied mobile homes	1,385	1,410	1,470
	Population in mobile homes	4,304	4,382	4,569
	Hotel/motel units	80	80	80

Source: North Central Florida Regional Planning Council

D. Planned Roadway Improvements

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

The planned roadway improvements that were added to the network generally include only capacity improvement projects such as additional through lanes. **Table III-2** identifies capacity improvement projects completed between 2010 and 2020 that were included in the 2020 network. There were no capacity improvement projects planned for implementation between 2011 and 2015. The table identifies each roadway that will be improved as well as the extent of the improvement.

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

Table III-2 - North Central Florida Region Roadway Improvements, 2015

None

Table III-3 - North Central Florida Region Roadway Improvements, 2020

North Central Florida Region Roadway Improvements, 2020				
County	Roadway	From	To	Number of Lanes
Alachua	SR 20 (SE Hawthorne Rd)	E of US 301	Putnam County Line	4
Bradford	SR 200 (US 301)	SR 200 (US 301)	SR 100 (Bypass)	4
	SR 200 (US 301)	SR 100	SR 16	4
	SR 200 (US 301)	SR 16	SR 200 (Bypass)	4

Sources: FDOT SIS First Five Year Plan, FDOT SIS Second Five Year Plan, North Central Florida Regional Planning Council
Note: Projects included in this table are roadway improvement projects completed between 2010 and 2020 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.

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 North Central Florida Region, two counties, Dixie and Taylor, have evacuation zones corresponding to five categories of storm surge. Evacuation rates for site-built homes and mobile/manufactured homes are provided by county and summarized in **Figure III-4** through **Figure III-11**. 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 5-3.

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

For example, if an evacuation order was issued for Dixie County for persons living in evacuation zone A, the county could expect a 60 percent participation rate from persons living in site-built homes in evacuation zone A (Figure III-4) and an 70 percent participation rate from persons living in mobile/manufactured homes in evacuation zone A (Figure III-5). In addition, Dixie County can expect shadow evacuations to occur for persons living in site-built homes at a rate of 45 percent from evacuation zone B, 15 percent from evacuation zone C, 10 percent from evacuation zone D, and 10 percent from evacuation zone E (Figure III-4). Likewise, for persons living in mobile/manufactured homes, Dixie County can expect shadow evacuations to occur at a rate of 70 percent from evacuation zone B, and 65 percent each from evacuation zones C, D, and E (Figure III-5).

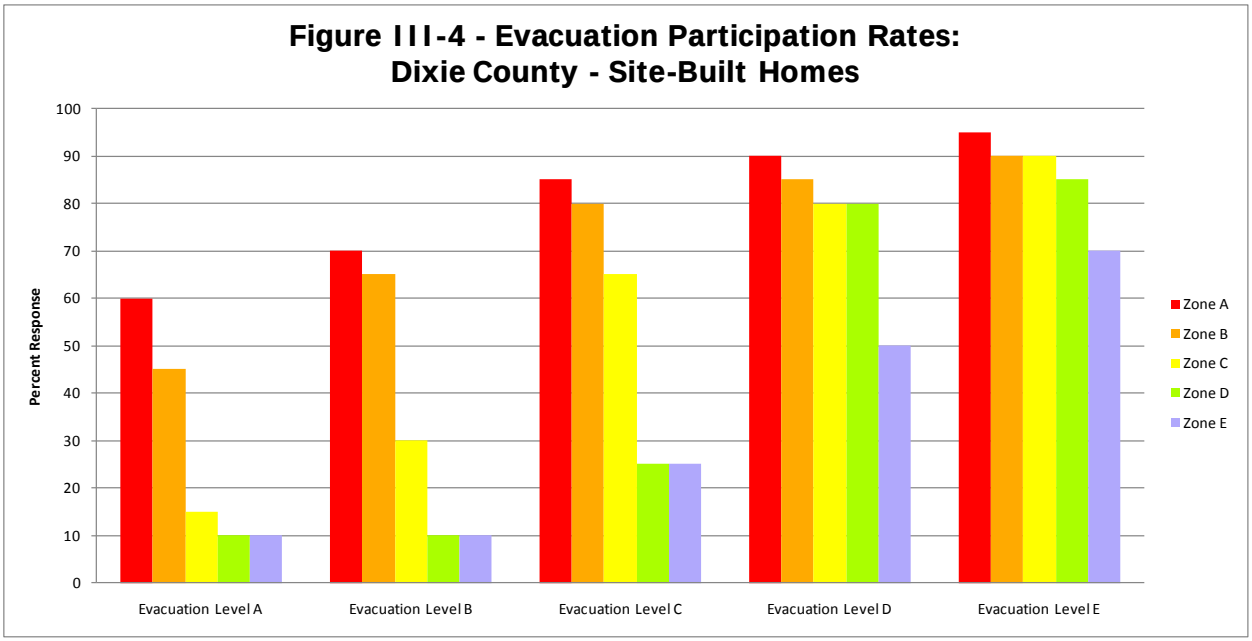


Figure III-4 - Evacuation Participation Rates:
Dixie County - Site-Built Homes
Percent Response
100
90
80
70
60
50
40
30
20
10
0
Evacuation Level A
Evacuation Level B
Evacuation Level C
Evacuation Level D
Evacuation Level E
Zone A
Zone B
Zone C
Zone D
Zone E

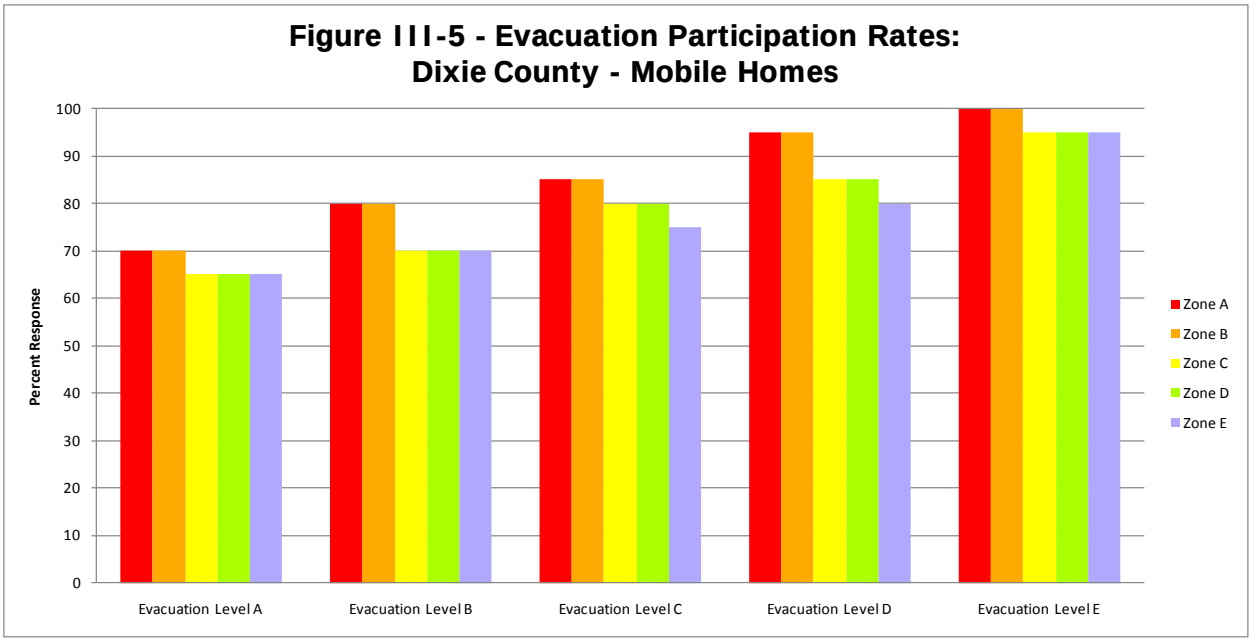


Figure III-5 - Evacuation Participation Rates:
Dixie County - Mobile Homes
Percent Response
100
90
80
70
60
50
40
30
20
10
0
Evacuation Level A
Evacuation Level B
Evacuation Level C
Evacuation Level D
Evacuation Level E
Zone A
Zone B
Zone C
Zone D
Zone E

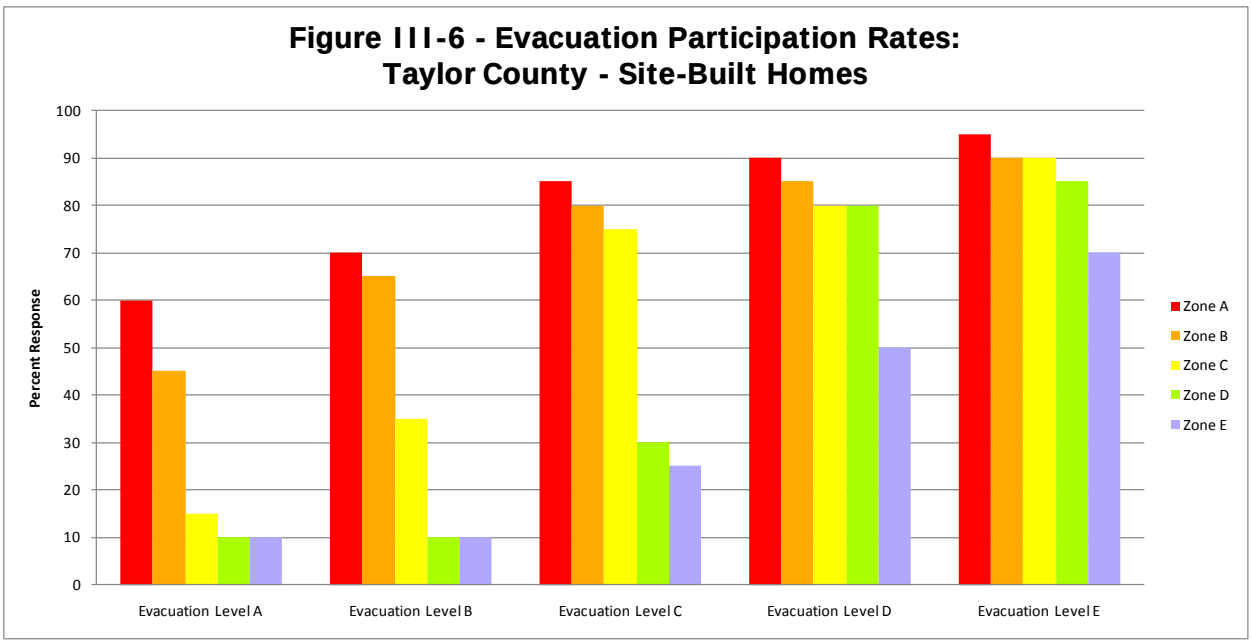


Figure III-6 - Evacuation Participation Rates:
Taylor County - Site-Built Homes
Percent Response
100
90
80
70
60
50
40
30
20
10
0
Evacuation Level A
Evacuation Level B
Evacuation Level C
Evacuation Level D
Evacuation Level E
Zone A
Zone B
Zone C
Zone D
Zone E

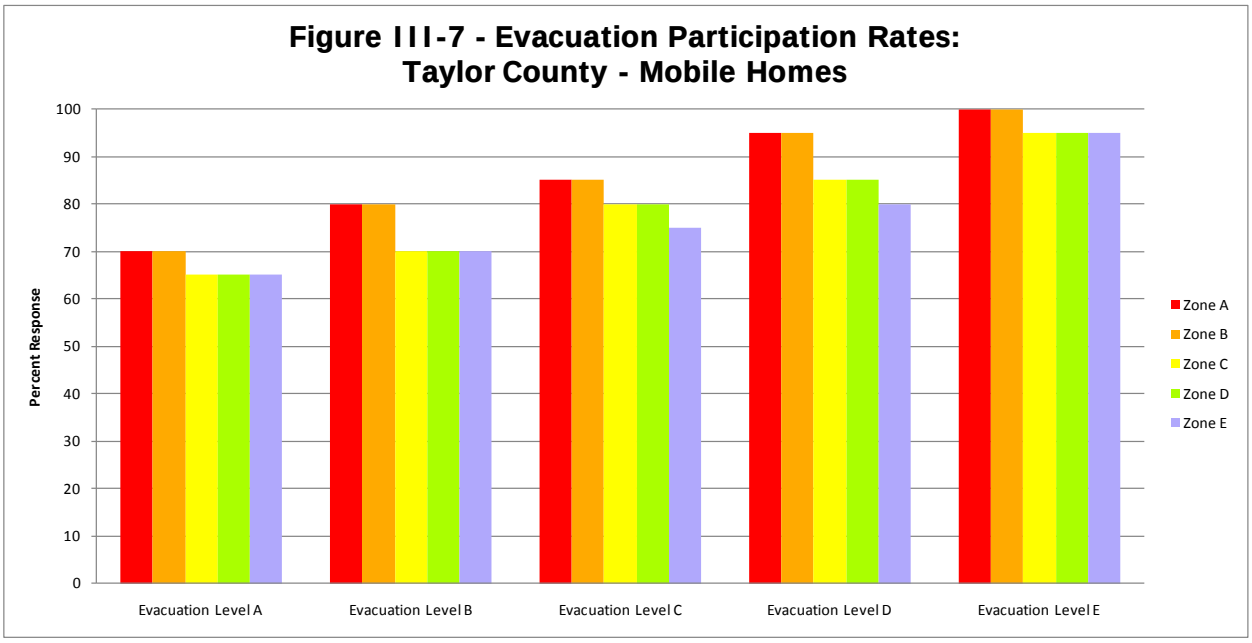


Figure III-7 - Evacuation Participation Rates:
Taylor County - Mobile Homes
Percent Response
100
90
80
70
60
50
40
30
20
10
0
Evacuation Level A
Evacuation Level B
Evacuation Level C
Evacuation Level D
Evacuation Level E
Zone A
Zone B
Zone C
Zone D
Zone E

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

In the eleven county region there are a total of 49 shelters. The number of shelters in each county in the region is listed below:

- Alachua – 15
- Bradford – 5
- Columbia – 7
- Dixie – 1
- Gilchrist – 4
- Hamilton – 5
- Lafayette – 2
- Madison – 3
- Suwannee – 3
- Taylor – 2
- Union – 2

All together, the 49 shelters located within the eleven county region can host 30,722 persons during an evacuation event. Detailed lists of the available public shelters by county are included in Volume 5-3.

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 North Central Florida region, Dixie and Taylor Counties have updated and established their evacuation zones based on the results of the new data and information collected as part of the SRESP. Evacuation zones for the North Central Florida Region are illustrated in **Figure III-8**. County level evacuation zones are included in Volume 5-3.

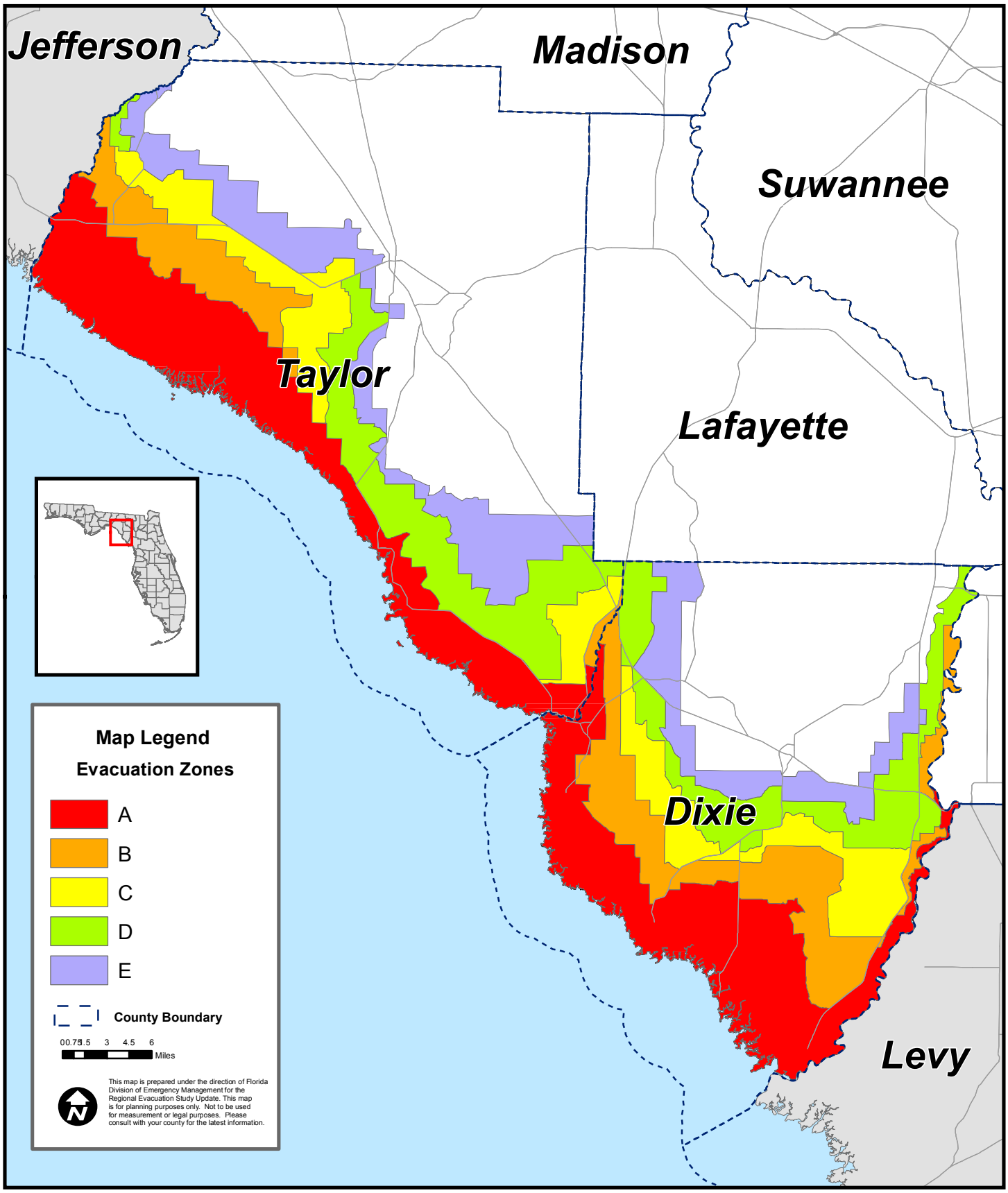
H. TIME User Interface

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

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

Figure III-8

North Central Florida Regional Model Transportation Evacuation Zone System



Sources: North Central Florida Regional Planning Council, CDM Smith

Map Printed: July, 2015

- **Analysis time period -** The first input variable is the evacuation analysis time period. The time period selections include 2010, 2020 and 2015. 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 the user to take into account the FDOT one-way evacuation operations plans for major facilities, including I-4, I-75, and 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 North Central Florida RPC 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 North Central Florida's model network and include both coastal and inland counties. The coastal counties include Dixie and Taylor Counties. The inland counties are Alachua, Bradford, Columbia, Gilchrist, Hamilton, Lafayette, Madison, Suwannee,

and Union Counties. The user has the opportunity to pick which of the counties in the network actually evacuate.

- **Evacuation level -** Once the evacuating counties are chosen, the evacuation level is designated. The evacuation levels range from A to E and represent the evacuation zones that are ordered to evacuate. The user may also select "none", which assumes that no evacuations are made within the selected county; only regular background traffic will occur.

- **Response curve hours –** The user must define which evacuation response curve will be applied to each evacuating county in the area. The evacuation response curves show the proportion of evacuation by increment of time for evacuation orders that were issued. There are six different curves to from which to choose: a 6-hour curve, 9-hour curve, 12-hour curve, 18-hour curve, 24-hour curve, and a 36-hour curve. The faster curves represent more urgent circumstances and slower curves represent less urgent circumstances.

- **Evacuation Phasing –** The phase selection indicates when an evacuation would begin in a given county. There are ten different options beginning in hour 1 and extending to hour 27. After hour 3, the other phasing options follow in 3 hour increments.

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 North Central 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**.

The vulnerable population in the North Central Florida Region includes only Dixie and Taylor Counties, as these are the only two coastal counties in the region. The vulnerable population varies by evacuation zone. Dixie County, for example, has more than 3,200 vulnerable residents in evacuation zone A and only slightly more than 1,000 vulnerable residents in evacuation zone B in 2015. In both coastal counties in the region, the total vulnerable population living in site-built homes slightly exceeds the vulnerable population living in mobile/manufactured homes.

In addition, based again on the demographic data, behavioral assumptions, and evacuation zones, the planned destinations of vulnerable population in each county could be determined by evacuation level. Destinations include friends and family, hotel/motel, public shelter, and other locations. Vulnerable population destinations for the North Central Florida Region are identified in **Table IV-3** for 20105 and in **Table IV-4** for 2020.

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

The vulnerable shadow population is provided in **Table IV-5** for both 20105 and 2020. The vulnerable shadow population was determined using the behavioral assumptions for evacuating shadow population and is based on evacuation level (storm category), not evacuation zone. Vulnerable shadow population for the eleven county region ranges from 136,000 to more than 222,000 persons for 2015, depending upon the evacuation level. For 2020, the range increases to between 140,000 and 233,400 persons.

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

	Evacuation Zone A	Evacuation Zone B	Evacuation Zone C	Evacuation Zone D	Evacuation Zone E
Dixie County					
Site-built Homes	971	356	37	1377	1027
Mobile/Manuf. Homes	638	573	28	2309	1609
TOTAL	1,608	928	66	3685	2636
Taylor County					
Site-built Homes	1,077	62	112	707	736
Mobile/Manuf. Homes	655	52	117	494	706
TOTAL	1,732	115	229	1201	1,441

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

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

	Evacuation Zone A	Evacuation Zone B	Evacuation Zone C	Evacuation Zone D	Evacuation Zone E
Dixie County					
Site-built Homes	1,026	376	39	1431	1048
Mobile/Manuf. Homes	678	608	31	2474	1746
TOTAL	1,705	984	70	3906	2794
Taylor County					
Site-built Homes	1,104	64	115	725	754
Mobile/Manuf. Homes	671	54	120	506	724
TOTAL	1,775	118	234	1232	1478

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

Table IV-3 – Vulnerable Population by Destination for 2015

	Evacuation Zone A	Evacuation Zone B	Evacuation Zone C	Evacuation Zone D	Evacuation Zone E
Dixie County					
To Friends and Family	1,062	593	43	2,349	1,684
To Hotel/ Motel	161	93	7	369	264
To Public Shelter	125	86	11	668	476
To Other Destination	260	156	5	300	212
Taylor County					
To Friends and Family	1,060	69	137	731	866
To Hotel/ Motel	206	14	29	145	179
To Public Shelter	119	8	29	145	179
To Other Destination	346	23	34	180	216

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

Table IV-4 – Vulnerable Population by Destination for 2020

	Evacuation Zone A	Evacuation Zone B	Evacuation Zone C	Evacuation Zone D	Evacuation Zone E
Dixie County					
To Friends and Family	1,125	628	46	2,486	1,781
To Hotel/ Motel	170	98	7	391	279
To Public Shelter	133	92	12	710	506
To Other Destination	276	166	5	319	227
Taylor County					
To Friends and Family	1,087	71	140	750	888
To Hotel/ Motel	211	14	29	148	184
To Public Shelter	122	9	29	148	184
To Other Destination	355	24	35	185	222

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

Table IV-5 – Vulnerable Shadow Evacuation Population

	Evacuation Level A	Evacuation Level B	Evacuation Level C	Evacuation Level D	Evacuation Level E
2015					
Alachua County	30,983	42,043	64,160	75,219	86,279
Bradford County	8,641	9,429	10,216	11,791	12,579
Columbia County	27,098	29,097	33,093	35,091	37,090
Dixie County	9,343	8,630	9,089	6,967	5,315
Gilchrist County	9,742	10,092	10,441	10,791	11,140
Hamilton County	6,405	6,713	7,021	7,329	7,637
Lafayette County	3,197	3,197	3,395	3,791	3,989
Madison County	7,722	8,257	8,792	9,328	9,863
Suwannee county	23,584	24,638	25,059	26,744	27,798
Taylor County	7,663	7,605	8,729	9,233	9,186
Union County	4,712	5,041	5,369	6,026	6,354
2020					
Alachua County	32,550	44,167	67,399	79,016	90,633
Bradford County	8,881	9,690	10,500	12,118	12,927
Columbia County	28,924	31,052	35,308	37,437	39,565
Dixie County	9,972	9,217	9,691	7,410	5,634
Gilchrist County	10,409	10,782	11,154	11,527	11,899
Hamilton County	6,611	6,928	7,246	7,563	7,880
Lafayette County	3,352	3,352	3,561	3,978	4,187
Madison County	7,756	8,295	8,834	9,373	9,911
Suwannee county	25,171	26,292	26,741	28,535	29,656
Taylor County	7,855	7,796	8,950	9,469	9,424
Union County	4,925	5,266	5,608	6,290	6,631

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

B. Clearance Time Definitions

The determination of clearance time is one of the most important outcomes from the evacuation transportation analysis. Calculated clearance times are used by county emergency managers as one input to determine when to recommend an evacuation order. This calculation can include the population-at-risk, shadow evacuees, as well as evacuees from other counties anticipated to pass through the county.

Clearance time is developed to include the time required for evacuees to secure their homes and prepare to leave, the time spent by all vehicles traveling along the evacuation route network, and the additional time spent on the road caused by traffic and road congestion.

Clearance time does not relate to the time any one vehicle spends traveling along the evacuation route network, nor does it guarantee vehicles will safely reach their destination once outside the County. The Glossary of the SRESP contains the agreed upon language of the four clearance times that are calculated as part of the evacuation transportation analysis. Below provides a simplified explanation of these clearance times:

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

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

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

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

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

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

C. Evacuation Model Scenarios

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

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

- **Operational Scenarios** – The operational scenarios were developed by the RPCs in coordination with local county emergency managers and are designed to provide important information to emergency management personnel to plan for different storm events. These scenarios are different from region to region and vary for each evacuation level.

Because of the numerous possible combinations of variables that can be applied in the model, the evacuation transportation model is available for use through the North Central Florida RPC to continue testing combinations of options and provide additional information to emergency managers.

D. Base Scenarios

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

- **Analysis Time Period** – Five scenarios for the 2015 time period and five scenarios for the 2020 time period. The five scenarios for each time period include one for each of the five evacuation levels, A, B, C, D, and E;

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

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

- **University Population** – The base scenarios use the fall/spring semester data to estimate evacuation trips by the student population. This data was provided by each RPC as part of the demographic small area data;

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

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

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

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

- **Behavioral Response** - For all five evacuation levels (A, B, C, D, or E) in both the 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 Dixie, Taylor, Levy, and Jefferson 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 Alachua, Bradford, Columbia, Dixie, Gilchrist, Hamilton, Lafayette, Madison, Taylor, Union, Levy, and Jefferson 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 Alachua, Bradford, Columbia, Dixie, Gilchrist, Hamilton, Lafayette, Madison, Taylor, Union, Levy, and Jefferson Counties); and,
    - For the remaining counties in the North Central 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	Alachua Bradford Columbia Dixie Gilchrist Hamilton Lafayette Madison Suwannee Taylor Union Levy Jefferson	Alachua Bradford Columbia Dixie Gilchrist Hamilton Lafayette Madison Suwannee Taylor Union Levy Jefferson	Alachua Bradford Columbia Dixie Gilchrist Hamilton Lafayette Madison Suwannee Taylor Union Levy Jefferson	Alachua Bradford Columbia Dixie Gilchrist Hamilton Lafayette Madison Suwannee Taylor Union Levy Jefferson	Alachua Bradford Columbia Dixie Gilchrist Hamilton Lafayette Madison Suwannee Taylor Union Levy Jefferson
	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	Alachua Bradford Columbia Dixie Gilchrist Hamilton Lafayette Madison Suwannee Taylor Union Levy Jefferson	Alachua Bradford Columbia Dixie Gilchrist Hamilton Lafayette Madison Suwannee Taylor Union Levy Jefferson	Alachua Bradford Columbia Dixie Gilchrist Hamilton Lafayette Madison Suwannee Taylor Union Levy Jefferson	Alachua Bradford Columbia Dixie Gilchrist Hamilton Lafayette Madison Suwannee Taylor Union Levy Jefferson	Alachua Bradford Columbia Dixie Gilchrist Hamilton Lafayette Madison Suwannee Taylor Union Levy Jefferson

E. Base Scenario Results

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

Evacuating Population

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

Within the eleven county region, total evacuating population ranges from more than 143,000 persons for a base scenario level A evacuation to more than 239,000 persons for a base scenario level E evacuation in 2015. By 2020, this range increases within the eleven counties to more than 147,000 persons for a base scenario level A evacuation and more than 251,000 persons for a base scenario level E evacuation.

Evacuating Vehicles

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

The total number of evacuating vehicles within the eleven county region for the base scenarios also varies by evacuation level. A total of more than 73,300 vehicles evacuate from the eleven county RPC for a base scenario level A evacuation in 2015, and this number increases to more than 119,600 evacuating vehicles from the eleven county region for a base scenario level E evacuation in 2015. By 2030, the number of evacuating vehicles is expected to increase to more than 75,300 vehicles for a base scenario level A evacuation and more than 125,200 evacuating vehicles for a base scenario level E evacuation.

Shelter Demand

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

Public shelter demand in the eleven county region ranges from more than 18,700 persons for the base scenario level A evacuation in 2015 to more than 30,400 persons for the base scenario level E evacuation. By 2020, the public shelter demand is expected to increase to more than 19,200 persons for the level A evacuation and more than 31,800 persons for the 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
Alachua County					
Site-built Homes	11,059	22,119	44,236	55,295	66,355
Mobile/Manuf. Homes	19,924	19,924	19,924	19,924	19,924
Tourists	0	0	0	0	0
TOTAL	30,983	42,043	64,160	75,219	86,279
Bradford County					
Site-built Homes	787	1,575	2,362	3,937	4,725
Mobile/Manuf. Homes	7,854	7,854	7,854	7,854	7,854
Tourists	0	0	0	0	0
TOTAL	8,641	9,429	10,216	11,791	12,579
Columbia County					
Site-built Homes	1,998	3,997	7,993	9,991	11,990
Mobile/Manuf. Homes	25,100	25,100	25,100	25,100	25,100
Tourists	0	0	0	0	0
TOTAL	27,098	29,097	33,093	35,091	37,090
Dixie County					
Site-built Homes	1,650	1,850	2,374	3,938	4,865
Mobile/Manuf. Homes	9,145	9,145	9,145	9,145	9,145
Tourists	156	172	172	172	229
TOTAL	10,951	11,167	11,691	13,255	14,239
Gilchrist County					
Site-built Homes	349	699	1,048	1,398	1,747
Mobile/Manuf. Homes	9,393	9,393	9,393	9,393	9,393
Tourists	0	0	0	0	0
TOTAL	9,742	10,092	10,441	10,791	11,140
Hamilton County					
Site-built Homes	616	924	1,232	1,540	1,848
Mobile/Manuf. Homes	5,789	5,789	5,789	5,789	5,789
Tourists	0	0	0	0	0
TOTAL	6,405	6,713	7,021	7,329	7,637
Lafayette County					
Site-built Homes	396	396	594	990	1,188
Mobile/Manuf. Homes	2,801	2,801	2,801	2,801	2,801
Tourists	0	0	0	0	0
TOTAL	3,197	3,197	3,395	3,791	3,989
Madison County					
Site-built Homes	1,071	1,606	2,141	2,677	3,212
Mobile/Manuf. Homes	6,651	6,651	6,651	6,651	6,651
Tourists	0	0	0	0	0
TOTAL	7,722	8,257	8,792	9,328	9,863

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
Suwannee County					
Site-built Homes	1,053	2,107	2,528	4,213	5,267
Mobile/Manuf. Homes	22,531	22,531	22,531	22,531	22,531
Tourists	0	0	0	0	0
TOTAL	23,584	24,638	25,059	26,744	27,798
Taylor County					
Site-built Homes	2,290	2,347	3,699	5,404	6,799
Mobile/Manuf. Homes	6,859	6,859	6,859	6,859	6,859
Tourists	246	246	246	246	246
TOTAL	9,395	9,452	10,804	12,509	13,904
Union County					
Site-built Homes	328	657	985	1,642	1,970
Mobile/Manuf. Homes	4,384	4,384	4,384	4,384	4,384
Tourists	0	0	0	0	0
TOTAL	4,712	5,041	5,369	6,026	6,354

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
Alachua					
Site-built Homes	11,617	23,234	46,466	58,083	69,700
Mobile/Manuf. Homes	20,933	20,933	20,933	20,933	20,933
Tourists	0	0	0	0	0
TOTAL	32,550	44,167	67,399	79,016	90,633
Bradford					
Site-built Homes	809	1,618	2,428	4,046	4,855
Mobile/Manuf. Homes	8,072	8,072	8,072	8,072	8,072
Tourists	0	0	0	0	0
TOTAL	8,881	9,690	10,500	12,118	12,927
Columbia					
Site-built Homes	2,128	4,256	8,512	10,641	12,769
Mobile/Manuf. Homes	26,796	26,796	26,796	26,796	26,796
Tourists	0	0	0	0	0
TOTAL	28,924	31,052	35,308	37,437	39,565
Dixie					
Site-built Homes	1,739	1,951	2,495	4,120	5,080
Mobile/Manuf. Homes	9,782	9,782	9,782	9,782	9,782
Tourists	156	172	172	172	229
TOTAL	11,677	11,905	12,449	14,074	15,091
Gilchrist					
Site-built Homes	372	745	1,117	1,490	1,862
Mobile/Manuf. Homes	10,037	10,037	10,037	10,037	10,037
Tourists	0	0	0	0	0
TOTAL	10,409	10,782	11,154	11,527	11,899
Hamilton					
Site-built Homes	634	951	1,269	1,586	1,903
Mobile/Manuf. Homes	5,977	5,977	5,977	5,977	5,977
Tourists	0	0	0	0	0
TOTAL	6,611	6,928	7,246	7,563	7,880
Lafayette					
Site-built Homes	418	418	627	1,044	1,253
Mobile/Manuf. Homes	2,934	2,934	2,934	2,934	2,934
Tourists	0	0	0	0	0
TOTAL	3,352	3,352	3,561	3,978	4,187
Madison					
Site-built Homes	1,078	1,617	2,156	2,695	3,233
Mobile/Manuf. Homes	6,678	6,678	6,678	6,678	6,678
Tourists	0	0	0	0	0
TOTAL	7,756	8,295	8,834	9,373	9,911

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
Suwannee County					
Site-built Homes	1,121	2,242	2,691	4,485	5,606
Mobile/Manuf. Homes	24,050	24,050	24,050	24,050	24,050
Tourists	0	0	0	0	0
TOTAL	25,171	26,292	26,741	28,535	29,656
Taylor					
Site-built Homes	2,349	2,408	3,796	5,547	6,980
Mobile/Manuf. Homes	7,035	7,035	7,035	7,035	7,035
Tourists	246	246	246	246	246
TOTAL	9,630	9,689	11,077	12,828	14,261
Union					
Site-built Homes	341	682	1,024	1,706	2,047
Mobile/Manuf. Homes	4,584	4,584	4,584	4,584	4,584
Tourists	0	0	0	0	0
TOTAL	4,925	5,266	5,608	6,290	6,631

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
Alachua County					
Site-built Homes	5,516	11,031	22,061	27,577	33,093
Mobile/Manuf. Homes	11,215	11,215	11,215	11,215	11,215
Tourists	0	0	0	0	0
TOTAL	16,731	22,246	33,276	38,792	44,308
Bradford					
Site-built Homes	463	926	1,389	2,315	2,778
Mobile/Manuf. Homes	4,236	4,236	4,236	4,236	4,236
Tourists	0	0	0	0	0
TOTAL	4,699	5,162	5,625	6,551	7,014
Columbia					
Site-built Homes	941	1,883	3,766	4,707	5,649
Mobile/Manuf. Homes	14,604	14,604	14,604	14,604	14,604
Tourists	0	0	0	0	0
TOTAL	15,545	16,487	18,370	19,311	20,253
Dixie					
Site-built Homes	1,070	1,205	1,554	2,592	3,195
Mobile/Manuf. Homes	4,520	4,520	4,520	4,520	4,520
Tourists	67	75	75	75	100
TOTAL	5,657	5,800	6,149	7,187	7,815
Gilchrist					
Site-built Homes	208	415	623	830	1,038
Mobile/Manuf. Homes	5,447	5,447	5,447	5,447	5,447
Tourists	0	0	0	0	0
TOTAL	5,655	5,862	6,070	6,277	6,485
Hamilton					
Site-built Homes	316	474	632	791	949
Mobile/Manuf. Homes	3,065	3,065	3,065	3,065	3,065
Tourists	0	0	0	0	0
TOTAL	3,381	3,539	3,697	3,856	4,014
Lafayette					
Site-built Homes	252	252	379	631	757
Mobile/Manuf. Homes	1,484	1,484	1,484	1,484	1,484
Tourists	0	0	0	0	0
TOTAL	1,736	1,736	1,863	2,115	2,241
Madison					
Site-built Homes	561	841	1,121	1,401	1,682
Mobile/Manuf. Homes	3,436	3,436	3,436	3,436	3,436
Tourists	0	0	0	0	0
TOTAL	3,997	4,277	4,557	4,837	5,118

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
Suwannee County					
Site-built Homes	574	1,147	1,377	2,294	2,868
Mobile/Manuf. Homes	11,660	11,660	11,660	11,660	11,660
Tourists	0	0	0	0	0
TOTAL	12,234	12,807	13,037	13,954	14,528
Taylor					
Site-built Homes	1,387	1,422	2,165	3,110	3,886
Mobile/Manuf. Homes	3,916	3,916	3,916	3,916	3,916
Tourists	107	107	107	107	107
TOTAL	5,410	5,445	6,188	7,133	7,909
Union					
Site-built Homes	195	391	586	977	1,172
Mobile/Manuf. Homes	2,295	2,295	2,295	2,295	2,295
Tourists	0	0	0	0	0
TOTAL	2,490	2,686	2,881	3,272	3,467

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
Alachua County					
Site-built Homes	5,790	11,579	23,157	28,946	34,736
Mobile/Manuf. Homes	11,782	11,782	11,782	11,782	11,782
Tourists	0	0	0	0	0
TOTAL	17,572	23,361	34,939	40,728	46,518
Bradford					
Site-built Homes	476	952	1,428	2,381	2,857
Mobile/Manuf. Homes	4,352	4,352	4,352	4,352	4,352
Tourists	0	0	0	0	0
TOTAL	4,828	5,304	5,780	6,733	7,209
Columbia					
Site-built Homes	1,003	2,006	4,012	5,015	6,018
Mobile/Manuf. Homes	15,562	15,562	15,562	15,562	15,562
Tourists	0	0	0	0	0
TOTAL	16,565	17,568	19,574	20,577	21,580
Dixie					
Site-built Homes	1,134	1,277	1,647	2,747	3,385
Mobile/Manuf. Homes	4,797	4,797	4,797	4,797	4,797
Tourists	67	75	75	75	100
TOTAL	5,998	6,149	6,519	7,619	8,282
Gilchrist					
Site-built Homes	221	443	664	886	1,107
Mobile/Manuf. Homes	5,823	5,823	5,823	5,823	5,823
Tourists	0	0	0	0	0
TOTAL	6,044	6,266	6,487	6,709	6,930
Hamilton					
Site-built Homes	327	490	653	817	980
Mobile/Manuf. Homes	3,165	3,165	3,165	3,165	3,165
Tourists	0	0	0	0	0
TOTAL	3,492	3,655	3,818	3,982	4,145
Lafayette					
Site-built Homes	267	267	400	666	800
Mobile/Manuf. Homes	1,552	1,552	1,552	1,552	1,552
Tourists	0	0	0	0	0
TOTAL	1,819	1,819	1,952	2,218	2,352
Madison					
Site-built Homes	565	847	1,129	1,412	1,694
Mobile/Manuf. Homes	3,454	3,454	3,454	3,454	3,454
Tourists	0	0	0	0	0
TOTAL	4,019	4,301	4,583	4,866	5,148

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
Suwannee County					
Site-built Homes	611	1,222	1,467	2,444	3,055
Mobile/Manuf. Homes	12,440	12,440	12,440	12,440	12,440
Tourists	0	0	0	0	0
TOTAL	13,051	13,662	13,907	14,884	15,495
Taylor					
Site-built Homes	1,422	1,458	2,220	3,191	3,987
Mobile/Manuf. Homes	4,016	4,016	4,016	4,016	4,016
Tourists	107	107	107	107	107
TOTAL	5,545	5,581	6,343	7,314	8,110
Union					
Site-built Homes	203	406	610	1,016	1,219
Mobile/Manuf. Homes	2,398	2,398	2,398	2,398	2,398
Tourists	0	0	0	0	0
TOTAL	2,601	2,804	3,008	3,414	3,617

Table IV-11 – Shelter Demand by Base Scenario

	Evacuation Level A	Evacuation Level B	Evacuation Level C	Evacuation Level D	Evacuation Level E
2015					
Alachua County	4,642	6,173	9,233	10,765	12,295
Bradford County	1,027	1,112	1,197	1,369	1,454
Columbia County	4,227	4,401	4,749	4,923	5,099
Dixie County	1,452	1,469	1,556	1,828	1,974
Gilchrist County	1,045	1,086	1,123	1,162	1,199
Hamilton County	938	982	1,027	1,069	1,114
Lafayette County	481	481	516	586	622
Madison County	1,079	1,140	1,201	1,264	1,326
Suwannee county	3,363	3,489	3,541	3,746	3,872
Taylor County	1,254	1,258	1,415	1,611	1,776
Union County	479	533	586	696	751
2020					
Alachua County	4,875	6,482	9,696	11,304	12,909
Bradford County	1,053	1,141	1,230	1,406	1,495
Columbia County	4,503	4,690	5,060	5,247	5,432
Dixie County	1,543	1,556	1,652	1,939	2,092
Gilchrist County	1,119	1,158	1,199	1,241	1,282
Hamilton County	968	1,014	1,060	1,104	1,151
Lafayette County	505	505	542	616	653
Madison County	1,084	1,147	1,210	1,271	1,334
Suwannee county	3,589	3,722	3,778	3,994	4,131
Taylor County	1,286	1,291	1,452	1,652	1,822
Union County	500	555	612	725	783

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

Congested Roadways

Another important component of the transportation analysis is the identification of critical roadway segments for evacuation traffic. This analysis includes a review of vehicle flows during the evacuation period, along with excessive vehicle queues. A summary of the total number of evacuating vehicles for each of the base scenarios is presented in **Table IV-12**. It is important to note that the total number of evacuating vehicles in the table below includes vehicles evacuating from the two coastal counties on either side of the RPC, in addition to the eleven counties within the RPC, for a total of thirteen 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	77,535	86,047	101,713	113,285	123,152
2020	81,534	90,470	106,910	119,044	129,386

The identification of critical roadways in the evacuation network is also important to assist emergency managers with identifying roadways that have the greatest impact on clearance times. Critical roadways were identified by reviewing roadways in the model network that have the highest vehicle queues for extended periods of time during an evacuation. Due to the nature of a major evacuation in general, nearly all roadway facilities will have extended vehicle queues at some point during the evacuation process. The point of this analysis is to identify those roadway facilities that have vehicle queues for the longest time periods during each of the evacuation scenarios. Critical roadway segments for the North Central Florida Region are identified in **Figures IV-1** through **IV-10** for each of the base scenarios for 2015 and 2020.

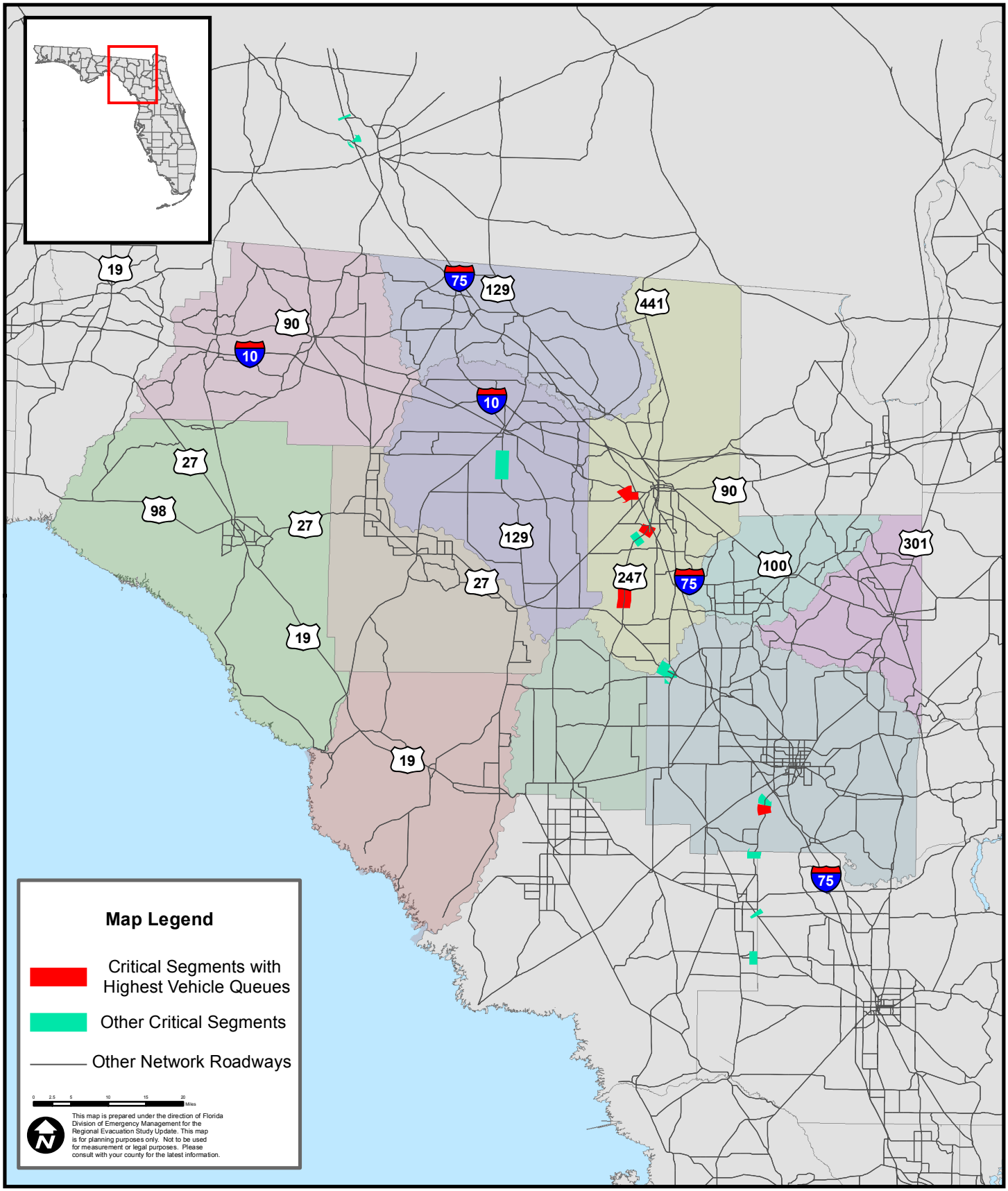
Through a review of the critical roadway segment figures, it is clear that US 47 in Columbia County, US 129 in Suwannee County, I-75 in several locations including south of the I-75 interchange, and several locations in Alachua County are critical facilities for many of the evacuation scenarios. During the level A evacuation scenarios, the heavily traveled roadways are primarily major Interstate and State Highways. In contrast, for the level E evacuation scenarios, heavily traveled roadways include other roadways within the region.

In addition to the identification of critical roadway segments, the total number of evacuating vehicles entering and exiting each county by evacuation scenario was also determined. Evacuating vehicles exiting each county by major evacuation route are identified in **Table IV-13** for 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 North Central Florida Region for each base scenario are included in Volume 5-3.

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

Figure IV-1

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

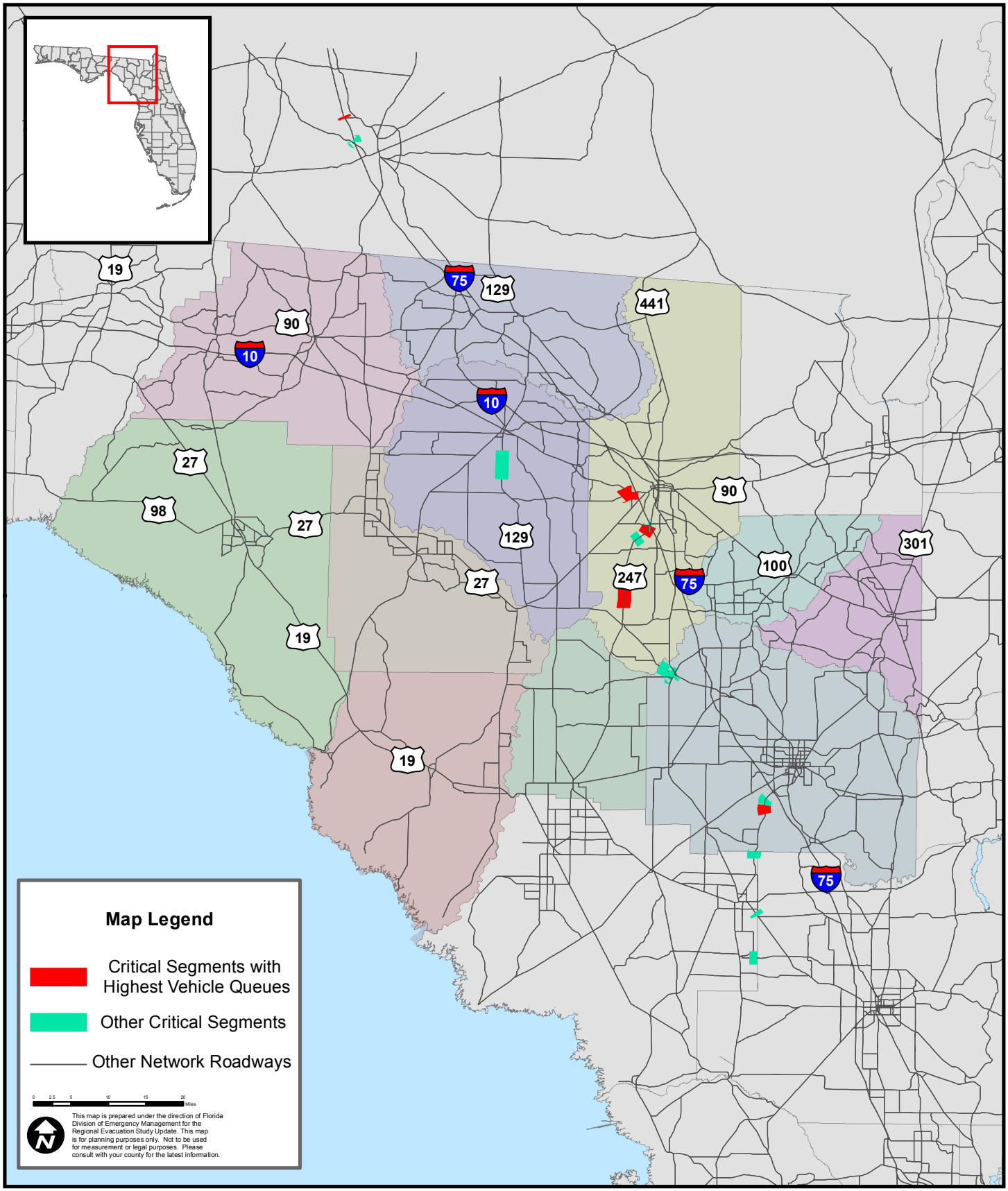


Sources: North Central Florida Regional Planning Council, CDM Smith

Map Printed: June, 2015

Figure IV-2

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

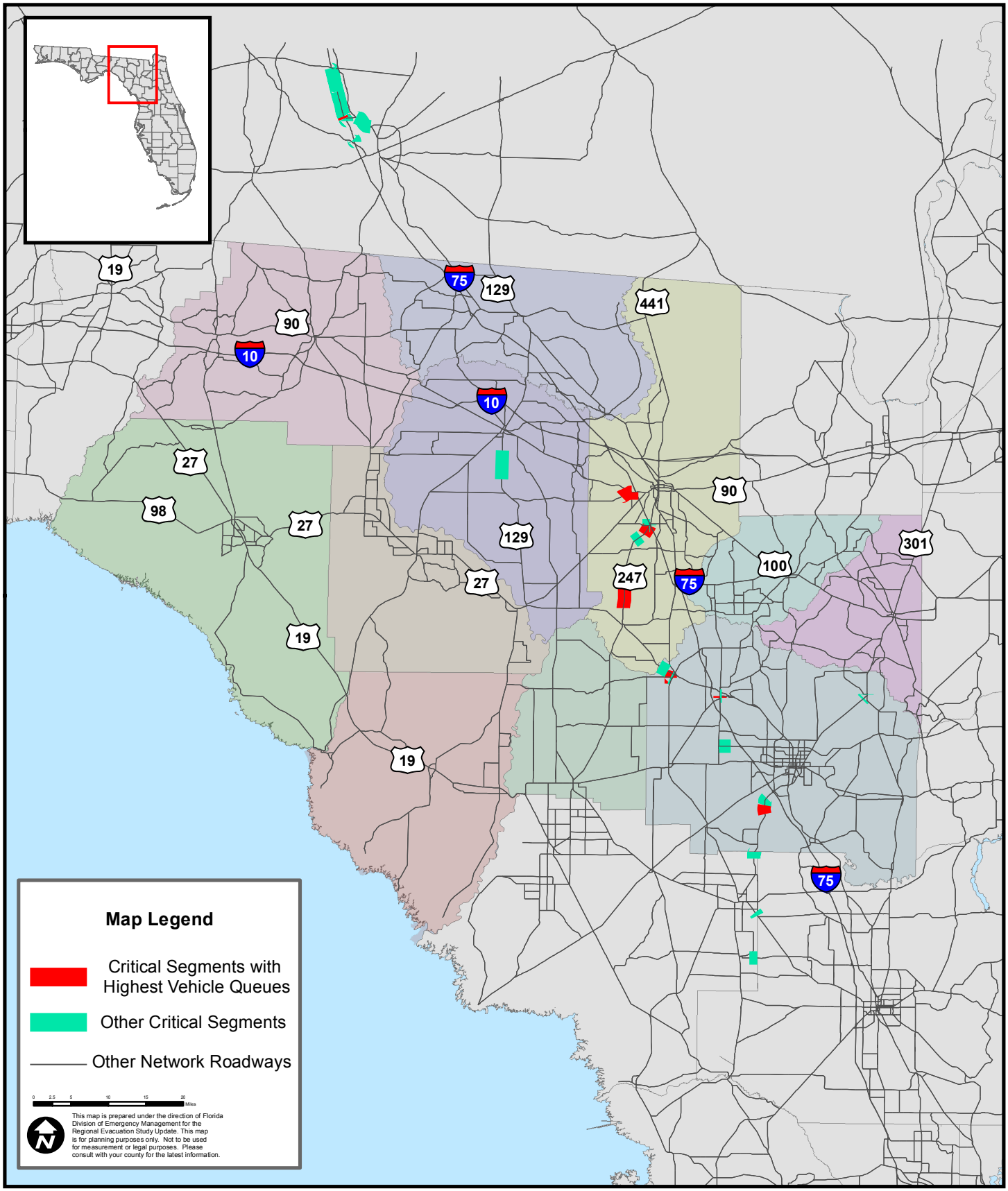


Sources: North Central Florida Regional Planning Council, CDM Smith

Map Printed: June, 2015

Figure IV-3

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

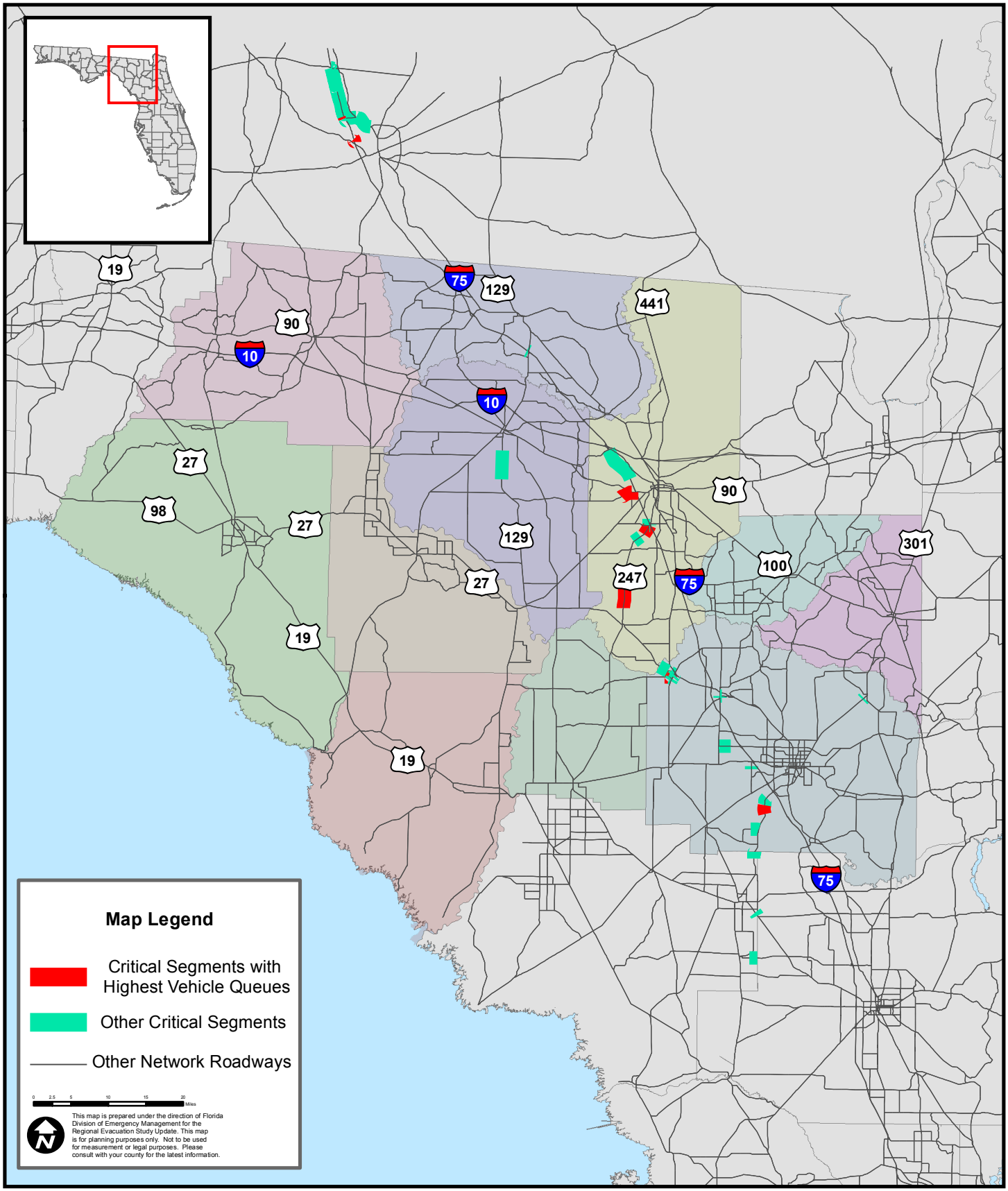


Sources: North Central Florida Regional Planning Council, CDM Smith

Map Printed: June, 2015

Figure IV-4

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

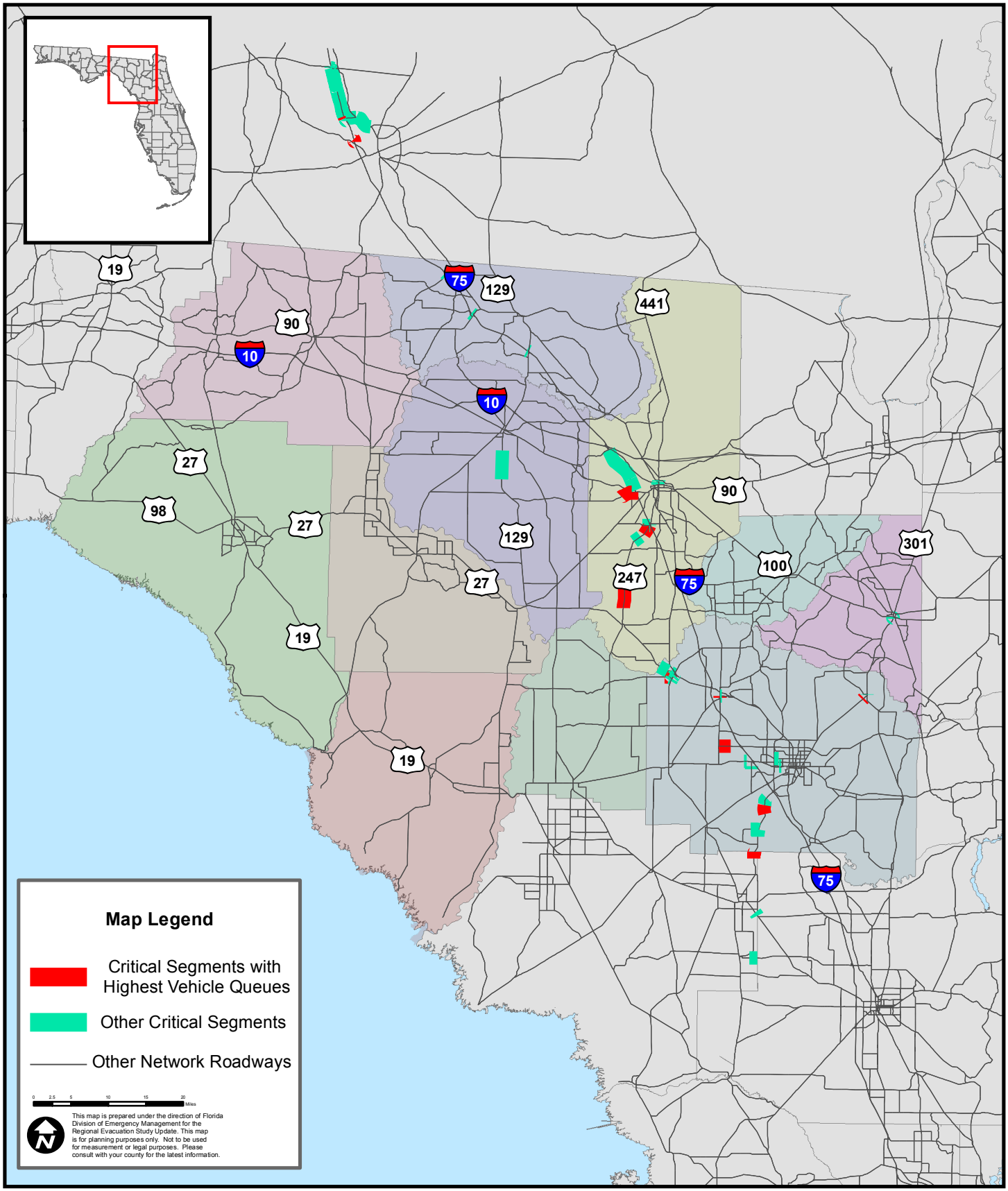


Sources: North Central Florida Regional Planning Council, CDM Smith

Map Printed: June, 2015

Figure IV-5

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

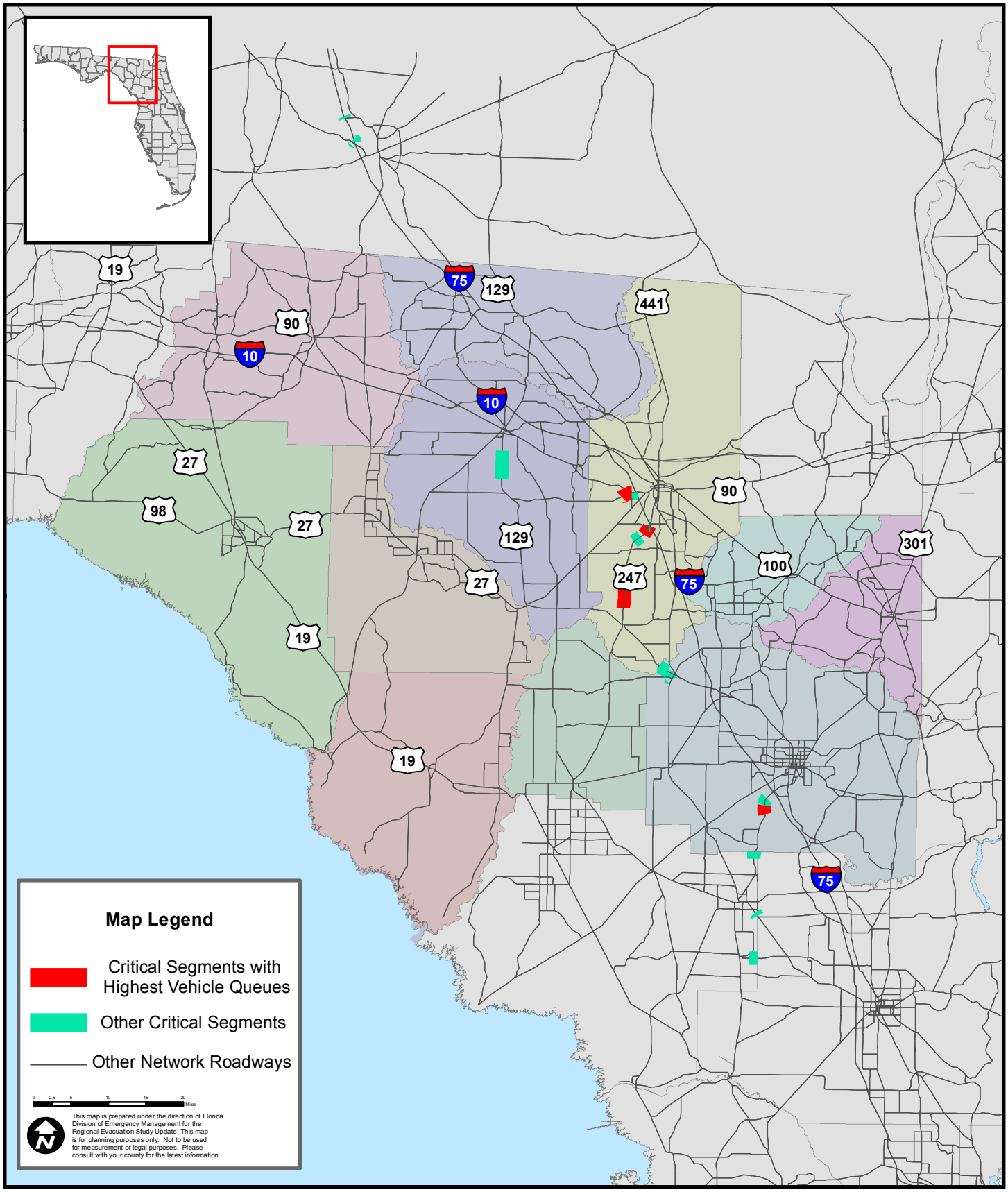


Sources: North Central Florida Regional Planning Council, CDM Smith

Map Printed: June, 2015

Figure IV-6

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

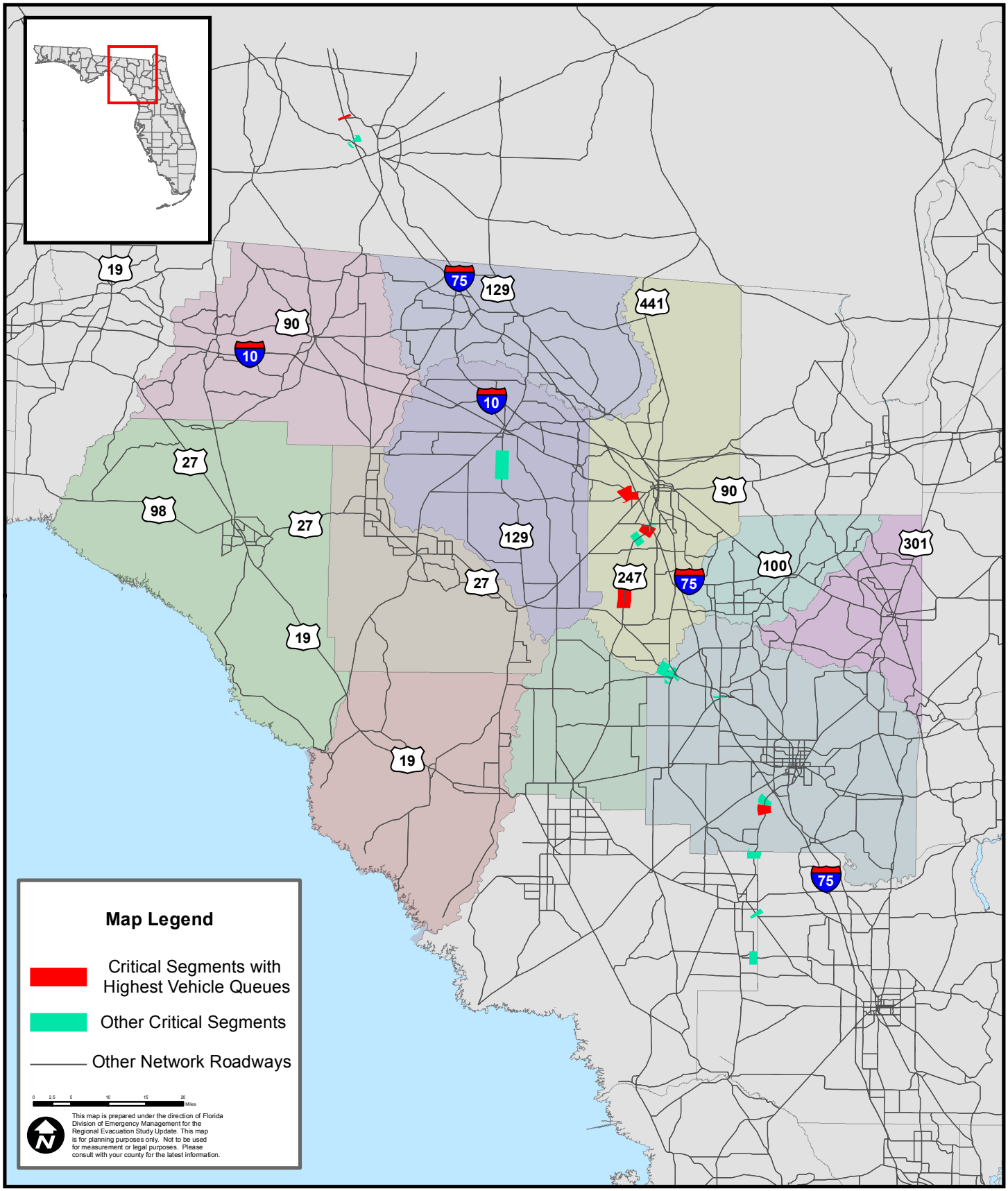


Sources: North Central Florida Regional Planning Council, CDM Smith

Map Printed: June, 2015

Figure IV-7

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

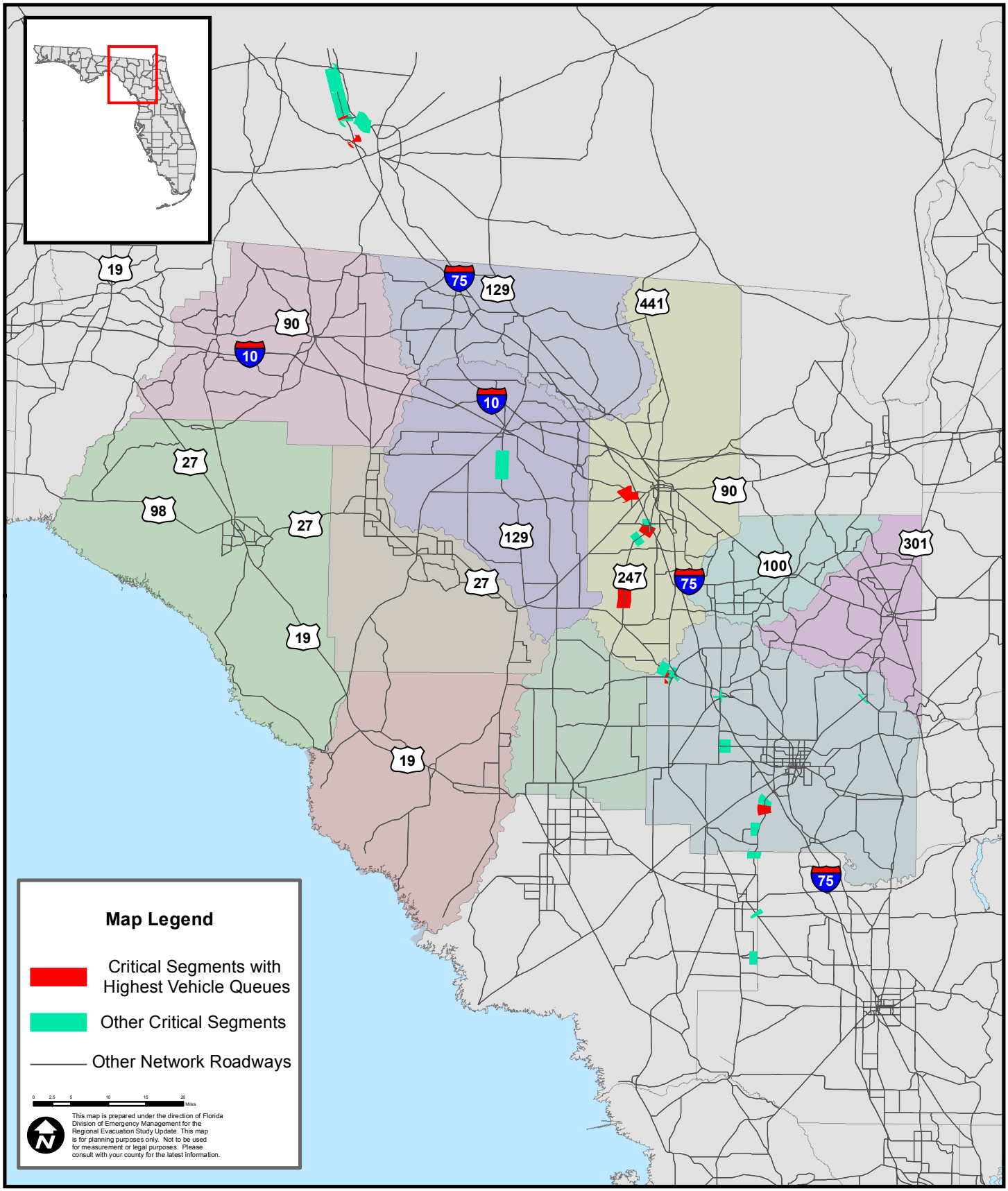


Sources: North Central Florida Regional Planning Council, CDM Smith

Map Printed: June, 2015

Figure IV-8

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

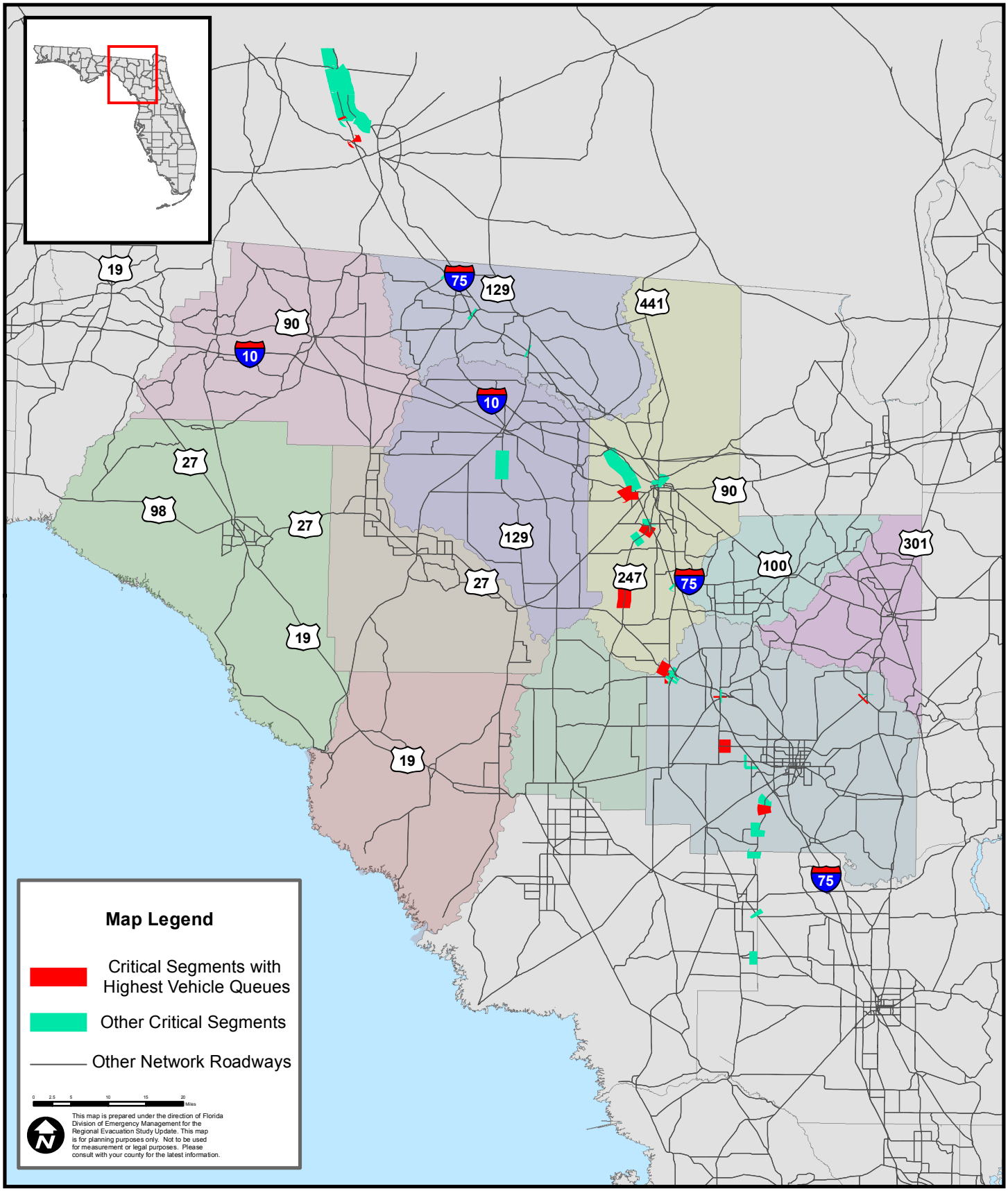


Sources: North Central Florida Regional Planning Council, CDM Smith

Map Printed: June, 2015

Figure IV-10

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

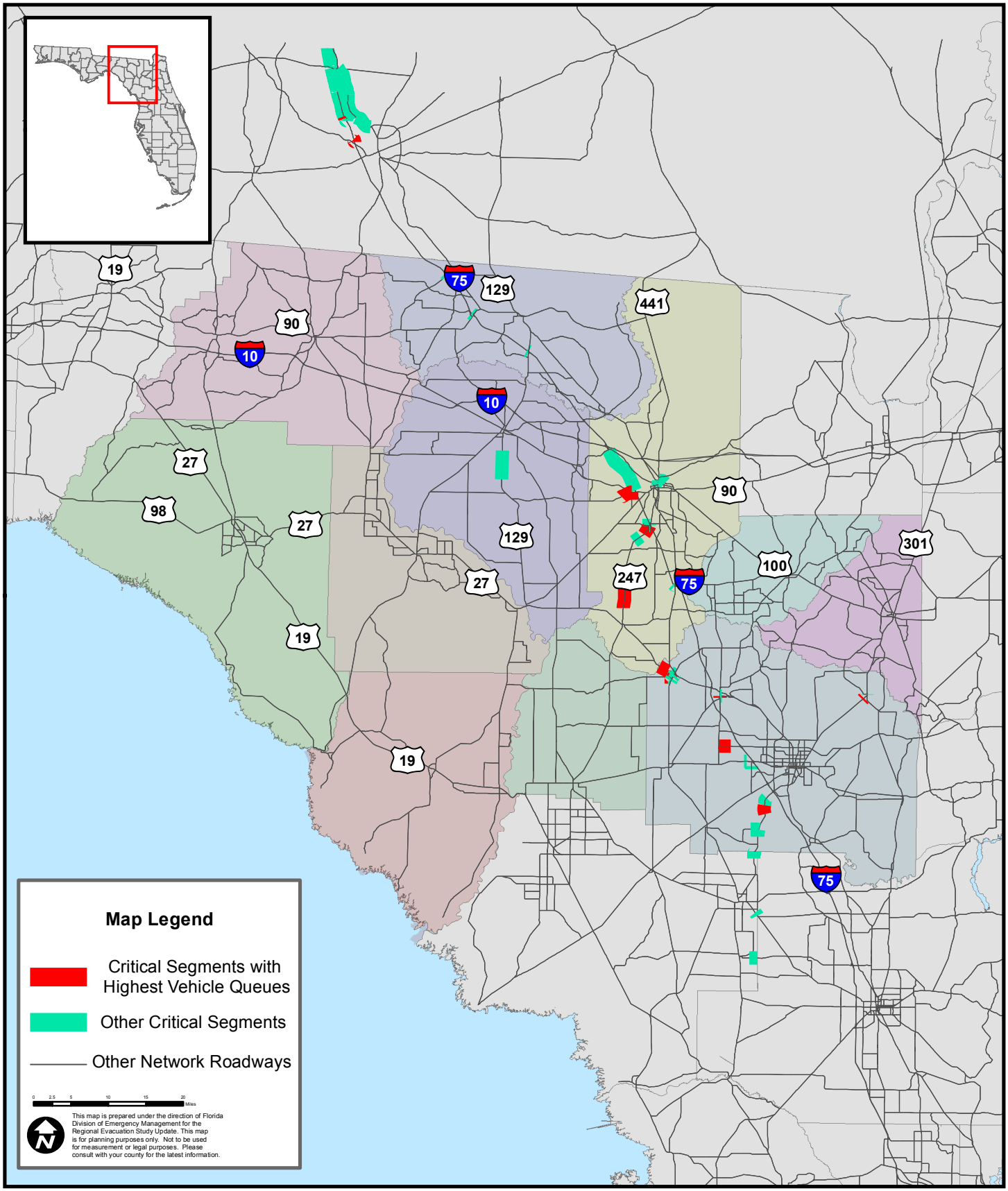


Sources: North Central Florida Regional Planning Council, CDM Smith

Map Printed: June, 2015

Figure IV-10

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



Sources: North Central Florida Regional Planning Council, CDM Smith

Map Printed: June, 2015

Table IV-13 – Evacuating Vehicles Leaving Each County by Evacuation Route for the 2015 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
Alachua County					
I-75 Northbound	6,200	8,100	12,600	14,800	17,000
I-75 Southbound	2,400	2,800	4,400	5,300	6,000
US 301 Northbound	1,300	1,600	2,700	3,200	3,700
US 27 Westbound	100	100	200	300	400
Bradford					
US 301 Southbound	300	400	500	600	700
US 301 Northbound	2,200	2,600	3,800	4,400	5,000
Columbia					
I-75 Northbound	11,400	13,200	16,900	18,800	20,400
I-10 Westbound	1,800	2,300	3,300	4,000	4,800
US 27 Southbound	1,300	1,300	1,600	1,800	2,000
I-75 Southbound	2,800	3,100	3,700	4,100	4,500
I-10 Eastbound	1,600	1,700	1,800	1,900	2,100
US 441 Northbound	300	400	600	1,100	1,500
Dixie					
US 19 Southbound	1,000	1,000	1,200	1,500	1,700
US 19 Northbound	1,000	1,000	1,100	1,500	1,700
Gilchrist					
US 19 Northbound	300	300	400	400	400
US 19 Southbound	400	500	500	600	700
Hamilton					
I-75 Northbound	17,000	18,900	22,700	25,200	27,100
I-75 Southbound	500	600	600	700	700
Lafayette					
US 27 Westbound	100	200	300	400	400
US 27 Eastbound	1,900	2,000	2,200	2,600	2,900
Madison					
US 19 Westbound	2,000	2,000	2,400	2,900	3,300
I-10 Westbound	2,800	3,200	4,100	4,900	5,500
I-10 Eastbound	500	600	700	800	800
Suwannee					
US 27 Westbound	200	200	300	500	500
US 27 Eastbound	700	700	900	1,100	1,200
I-75 Northbound	12,800	14,700	18,600	20,700	22,400
I-75 Southbound	800	900	900	1,000	1,100
I-10 Eastbound	1,400	1,500	1,600	1,800	2,100
I-10 Westbound	2,300	2,800	3,800	4,600	5,400
Taylor					
US 19 Northbound	2,000	2,000	2,400	2,900	3,300
US 27 Eastbound	300	400	500	600	700
Union					
SR 121 Southbound	100	100	100	200	200
SR 121 Northbound	800	900	1,200	1,400	1,600

Table IV-14 – Evacuating Vehicles Leaving Each County by Evacuation Route for the 2020 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
Alachua County					
I-75 Northbound	6,600	8,500	13,300	15,600	17,600
I-75 Southbound	2,600	3,200	4,700	5,700	6,600
US 301 Northbound	1,300	1,700	2,900	3,500	4,100
US 27 Westbound	100	100	200	300	400
Bradford					
US 301 Southbound	300	400	500	600	700
US 301 Northbound	2,200	2,700	3,900	4,700	5,400
Columbia					
I-75 Northbound	12,100	13,800	17,400	19,500	20,900
I-10 Westbound	2,000	2,400	3,800	4,300	5,000
US 27 Southbound	1,400	1,500	1,700	2,000	2,200
I-75 Southbound	3,000	3,400	3,900	4,400	4,800
I-10 Eastbound	1,700	1,700	1,800	2,100	2,400
US 441 Northbound	300	400	800	1,300	1,900
Dixie					
US 19 Southbound	1,000	1,100	1,300	1,700	1,900
US 19 Northbound	1,000	1,100	1,200	1,500	1,800
Gilchrist					
US 19 Northbound	300	300	300	400	500
US 19 Southbound	500	500	500	700	800
Hamilton					
I-75 Northbound	17,900	20,000	23,700	26,300	28,000
I-75 Southbound	600	600	700	700	700
Lafayette					
US 27 Westbound	100	200	300	400	400
US 27 Eastbound	2,000	2,000	2,300	2,700	3,000
Madison					
US 19 Westbound	2,100	2,200	2,500	3,100	3,500
I-10 Westbound	2,900	3,300	4,500	5,100	5,700
I-10 Eastbound	500	600	700	800	800
Suwannee					
US 27 Westbound	200	200	300	500	400
US 27 Eastbound	700	800	900	1,100	1,300
I-75 Northbound	13,600	15,500	19,300	21,500	23,100
I-75 Southbound	900	900	1,000	1,100	1,100
I-10 Eastbound	1,300	1,500	1,700	2,000	2,200
I-10 Westbound	2,500	2,900	4,300	4,900	5,600
Taylor					
US 19 Northbound	2,100	2,200	2,500	3,100	3,500
US 27 Eastbound	400	400	500	600	700
Union					
SR 121 Southbound	100	100	100	200	200
SR 121 Northbound	900	1,000	1,300	1,500	1,800

Table IV-15 – Evacuating Vehicles Entering Each County by Evacuation Route for the 2015 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
Alachua County					
US 27 Southbound	1,300	1,300	1,600	1,800	2,000
I-75 Southbound	2,800	3,100	3,700	4,100	4,500
I-75 Northbound	-	-	-	-	-
US 301 Southbound	300	400	500	600	700
Bradford					
US 301 Northbound	1,300	1,600	2,700	3,200	3,700
Columbia					
I-75 Northbound	6,200	8,100	12,600	14,800	17,000
Dixie					
US 19 Northbound	300	300	400	400	400
Gilchrist					
US 19 Southbound	1,000	1,000	1,100	1,500	1,700
Hamilton					
I-75 Northbound	12,800	14,700	18,600	20,700	22,400
Lafayette					
US 27 Westbound	200	200	300	500	500
US 27 Eastbound	300	400	500	600	700
Madison					
US 19 Northbound	2,000	2,000	2,400	2,900	3,300
I-10 Eastbound	100	100	100	100	200
I-10 Westbound	2,300	2,800	3,800	4,600	5,400
Suwannee					
I-10 Eastbound	500	600	700	800	800
US 27 Eastbound	1,900	2,000	2,200	2,600	2,900
I-75 Southbound	500	600	600	700	700
I-75 Northbound	11,400	13,200	16,900	18,800	20,400
I-10 Westbound	1,800	2,300	3,300	4,000	4,800
Taylor					
US 27 Westbound	100	200	300	400	400
US 19 Northbound	1,000	1,000	1,200	1,500	1,700
Union					
SR 121 Northbound	200	300	500	500	600

Table IV-16 – Evacuating Vehicles Entering Each County by Evacuation Route for the 2020 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
Alachua County					
US 27 Southbound	1,400	1,500	1,700	2,000	2,200
I-75 Southbound	3,000	3,400	3,900	4,400	4,800
I-75 Northbound	-	-	-	-	-
US 301 Southbound	300	400	500	600	700
Bradford					
US 301 Northbound	1,300	1,700	2,900	3,500	4,100
Columbia					
I-75 Northbound	6,600	8,500	13,300	15,600	17,600
Dixie					
US 19 Northbound	300	300	300	400	500
Gilchrist					
US 19 Southbound	1,000	1,100	1,200	1,500	1,800
Hamilton					
I-75 Northbound	13,600	15,500	19,300	21,500	23,100
Lafayette					
US 27 Westbound	200	200	300	500	400
US 27 Eastbound	400	400	500	600	700
Madison					
US 19 Northbound	2,100	2,200	2,500	3,100	3,500
I-10 Eastbound	100	100	100	200	200
I-10 Westbound	2,500	2,900	4,300	4,900	5,600
Suwannee					
I-10 Eastbound	500	600	700	800	800
US 27 Eastbound	2,000	2,000	2,300	2,700	3,000
I-75 Southbound	600	600	700	700	700
I-75 Northbound	12,100	13,800	17,400	19,500	20,900
I-10 Westbound	2,000	2,400	3,800	4,300	5,000
Taylor					
US 27 Westbound	100	200	300	400	400
US 19 Northbound	1,000	1,100	1,300	1,700	1,900
Union					
SR 121 Northbound	300	300	600	600	800

Clearance Times

Calculated clearance times are used by county emergency managers as one input to determine when to recommend an evacuation order. Clearance times for each of the base scenarios are summarized in **Table IV-17** and **IV-18**, as well as **Figures IV-11, IV-12,** and **IV-13**. Clearance time includes several components, including the mobilization time for the evacuating population to prepare for an evacuation (pack supplies and personal belongs, load their vehicle, etc.), the actual time spent traveling on the roadway network, and the delay time caused by traffic congestion.

In-county clearance times for the base scenarios range from 11 hours to 13 hours depending upon the evacuation level. Clearance Time to Shelter varies a little more, with clearance times for the base scenarios ranging from 6.5 hours to 12.5 hours.

In 2020, in-county clearance times for the base scenarios remain fairly constant, with clearance times again ranging from 11 hours to 13 hours. 2020 Clearance Time to Shelter shows a similar pattern to 2015, with clearance times for the base scenarios ranging from 7.0 hours to 13 hours depending upon the scenario.

Out of county clearance times for the base scenarios range from 11.5 hours to 14 hours for the various scenarios. Out of county clearance times remain fairly constant in 2020, with out of county clearance times again ranging from 11.5 to 14 hours.

Regional clearance time for the eleven county North Central Florida region remains constant at 14 hours for all base scenarios for both 2015 and 2020.

Table IV-17 – 2015 Clearance Times for Base Scenario

	Evacuation Level A Base Scenario	Evacuation Level B Base Scenario	Evacuation Level C Base Scenario	Evacuation Level D Base Scenario	Evacuation Level E Base Scenario
Clearance Time to Shelter					
Alachua County	12.5	12.5	12.5	12.5	12.5
Bradford County	12.5	12.5	12.5	12.5	12.5
Columbia County	12.5	12.5	12.5	12.5	12.5
Dixie County	13.0	13.0	13.0	13.0	13.0
Gilchrist County	12.5	12.5	12.5	12.5	12.5
Hamilton County	12.5	12.5	12.5	12.5	12.5
Lafayette County	12.5	12.5	12.5	12.5	12.5
Madison County	12.5	12.5	12.5	12.5	12.5
Suwannee county	13.0	13.0	13.0	13.0	13.0
Taylor County	13.0	13.0	13.0	13.0	13.0
Union County	12.5	12.5	12.5	12.5	12.5
In-County Clearance Time					
Alachua County	13.0	13.0	13.0	13.0	13.0
Bradford County	13.0	13.0	13.0	13.0	13.0
Columbia County	13.0	13.0	13.0	13.0	13.0
Dixie County	13.0	13.0	13.0	13.0	13.0
Gilchrist County	13.0	13.0	13.0	13.0	13.0
Hamilton County	13.0	13.0	13.0	13.0	13.0
Lafayette County	13.0	13.0	13.0	13.0	13.0
Madison County	13.0	13.0	13.0	13.0	14.0
Suwannee county	13.5	13.5	13.5	13.5	13.5
Taylor County	13.0	13.0	13.0	13.0	14.5
Union County	13.0	13.0	13.0	13.0	13.0
Out of County Clearance Time					
Alachua County	14.0	14.5	14.0	14.0	14.0
Bradford County	13.5	13.5	14.0	14.0	14.0
Columbia County	14.0	14.0	14.0	14.0	14.0
Dixie County	13.0	13.0	13.0	13.0	13.0
Gilchrist County	13.5	13.5	13.5	13.5	13.5
Hamilton County	14.5	14.5	14.5	14.5	14.5
Lafayette County	13.0	13.5	13.5	13.5	14.0
Madison County	14.0	14.0	14.0	14.0	14.0
Suwannee county	14.0	14.0	14.0	14.0	14.0
Taylor County	14.0	14.0	14.0	14.0	14.5
Union County	13.0	13.0	13.5	13.5	13.5
Regional Clearance Time					
North Central	14.5	14.5	14.5	14.5	14.5

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					
Alachua County	12.5	12.5	12.5	12.5	12.5
Bradford County	11.0	11.5	11.5	11.0	11.5
Columbia County	12.0	12.0	12.0	12.0	12.0
Dixie County	11.0	11.0	11.5	11.5	12.0
Gilchrist County	11.0	11.0	11.0	11.0	11.0
Hamilton County	7.0	10.0	9.5	9.5	7.0
Lafayette County	10.5	10.0	9.0	10.5	9.0
Madison County	11.0	10.0	11.0	11.0	11.0
Suwannee county	12.0	12.0	12.0	12.0	12.0
Taylor County	12.5	12.5	12.0	12.5	13.0
Union County	11.0	11.0	11.0	11.0	11.0
In-County Clearance Time					
Alachua County	13.0	13.0	13.0	13.0	13.0
Bradford County	12.5	12.5	12.5	12.5	12.5
Columbia County	13.0	13.0	13.0	13.0	13.0
Dixie County	11.5	11.5	11.5	11.5	12.5
Gilchrist County	12.5	12.5	12.5	12.5	12.5
Hamilton County	11.0	12.0	11.5	11.5	10.5
Lafayette County	12.5	12.5	11.5	12.5	11.0
Madison County	12.0	11.5	12.5	12.5	12.5
Suwannee county	13.0	13.0	13.0	13.0	13.0
Taylor County	13.0	13.0	12.5	13.0	13.0
Union County	12.5	12.5	12.5	12.5	12.5
Out of County Clearance Time					
Alachua County	13.5	13.5	13.5	13.5	14.0
Bradford County	12.5	13.0	12.5	13.5	13.5
Columbia County	13.5	13.5	13.5	13.5	13.5
Dixie County	12.0	12.0	12.5	12.5	13.0
Gilchrist County	12.5	13.0	13.0	13.0	13.0
Hamilton County	13.5	13.5	13.5	13.5	13.5
Lafayette County	12.5	12.0	12.5	12.5	12.5
Madison County	13.5	13.5	13.5	13.5	13.5
Suwannee county	13.5	13.5	13.5	13.5	13.5
Taylor County	13.5	13.5	13.5	13.5	13.5
Union County	11.5	11.5	12.0	12.5	12.5
Regional Clearance Time					
North Central	14.0	14.0	14.0	14.0	14.0

Figure IV-11 - Clearance Time to Shelter Base Scenarios

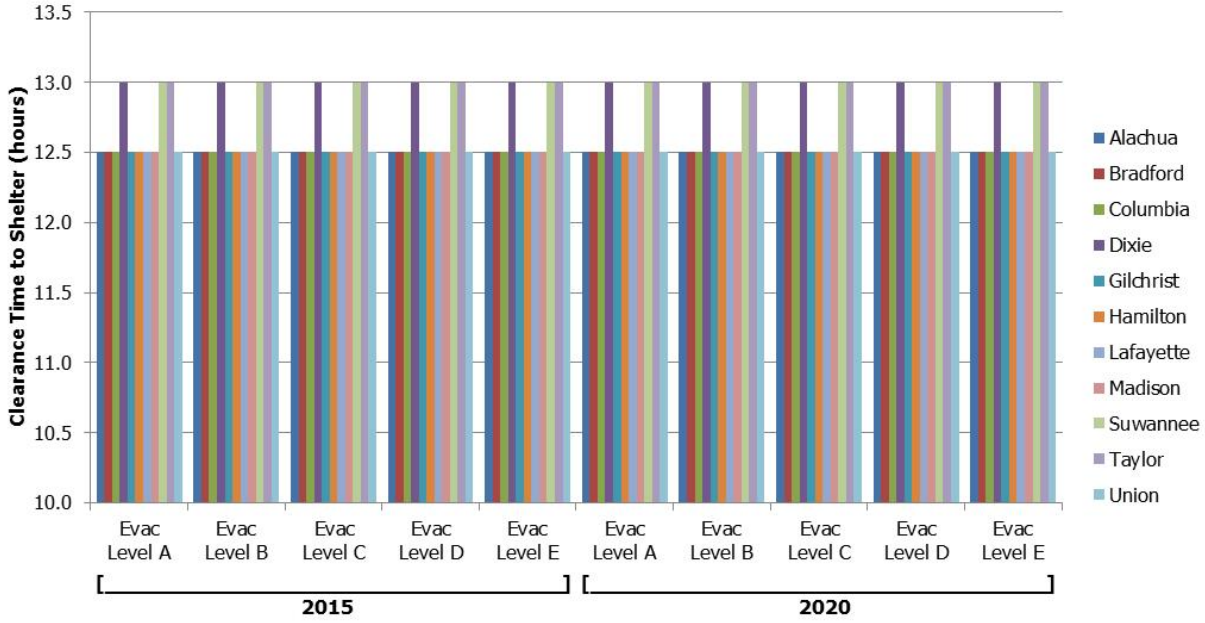
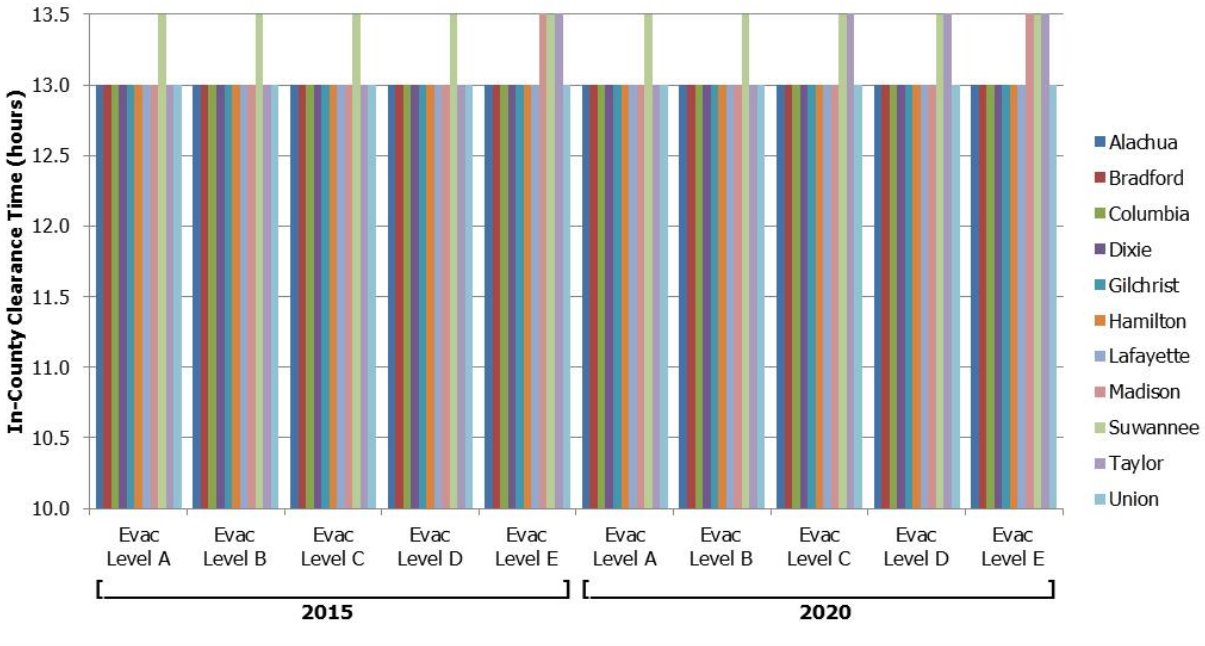


Figure IV-12 - In-County Clearance Times Base Scenarios



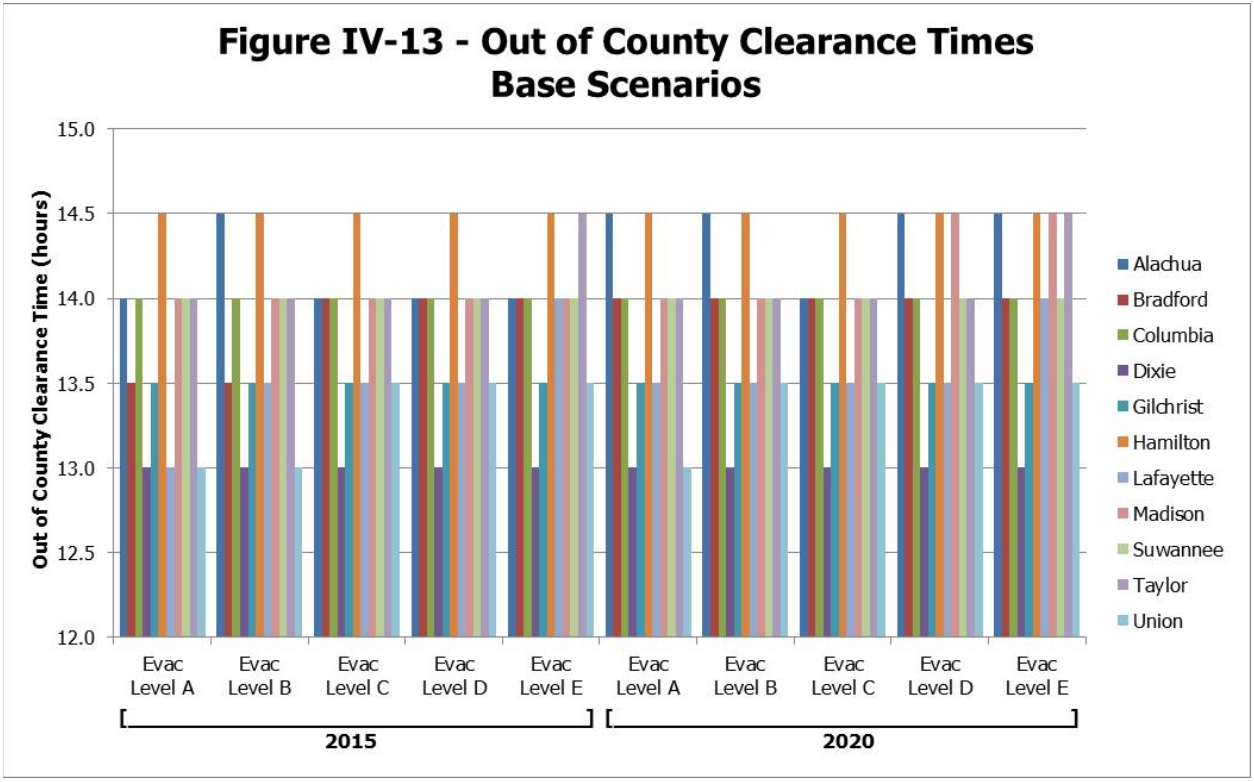


Figure IV-13 - Out of County Clearance Times
Base Scenarios
Out of County Clearance Time (hours)
15.0
14.5
14.0
13.5
13.0
12.5
12.0
Evac Level A
Evac Level B
Evac Level C
Evac Level D
Evac Level E
Evac Level A
Evac Level B
Evac Level C
Evac Level D
Evac Level E
2015
2020
Alachua
Bradford
Columbia
Dixie
Gilchrist
Hamilton
Lafayette
Madison
Suwannee
Taylor
Union

F. Operational Scenarios

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

The ten operational scenarios selected for analysis in the North Central Florida Region are illustrated in **Table IV-19**. All ten operational scenarios used the default tourist and university population rates, along with the planning assumption behavioral response rates. The North Florida Region's largest issues in terms of evacuation response typically come from major evacuations in other areas of the state, such as Tampa or Jacksonville. The ten operational scenarios were developed to estimate response and evacuation conditions for a variety of storms approaching Florida from different directions and include the following:

- Scenario 1 – 2015 Level A - storm approaching Florida from the southwest (Tampa)
- Scenario 2 – 2015 Level B - storm approaching Florida Panhandle from the south
- Scenario 3 – 2015 Level C - storm approaching Florida from the east (Jacksonville)
- Scenario 4 – 2015 Level D - storm approaching Florida from the southwest (Tampa)
- Scenario 5 – 2015 Level E - storm approaching Florida at the mouth of the Suwannee River
- Scenario 6 – 2020 Level A - storm approaching Florida from the east (Jacksonville)
- Scenario 7 – 2020 Level B - storm approaching Florida from the southwest (Tampa)
- Scenario 8 – 2020 Level C - storm approaching Florida Panhandle from the south
- Scenario 9 – 2020 Level D - storm approaching Florida from the east (Jacksonville)
- Scenario 10 – 2020 Level E - storm approaching Florida at the mouth of the Suwannee River

Table IV-19 – Operational Scenarios

	Scenario 1 Level A 2015	Scenario 2 Level B 2015	Scenario 3 Level C 2015	Scenario 4 Level D 2015	Scenario 5 Level E 2015
Demographic Data	2015	2015	2015	2015	2015
Highway Network	2015	2015	2015	2015	2015
One-Way Operations	None	None	None	None	None
University Population	Default	Default	Default	Default	Default
Tourist Rate	Default	Default	Default	Default	Default
Shelters Open	Primary	Primary	Primary	Primary	Primary
Response Curve	12-hour	12-hour	12-hour	12-hour	9-hour
Evacuation Phasing	None	None	None	None	None
Behavioral Response	Planning	Planning	Planning	Planning	Planning
Evacuation Zone	A	B except as noted below	C except as noted below	D except as noted below	E except as noted below
Counties Evacuating	Hillsborough Pasco Pinellas Levy Hernando Citrus Dixie Taylor Gilchrist Lafayette Madison Jefferson	Wakulla Leon Jefferson Taylor Dixie Madison Lafayette (A) Gilchrist (A) Hamilton (A) Suwannee (A)	Duval St. Johns Flagler Volusia Nassau Clay (B) Putnam (B) Baker (A) Union (A) Bradford (A) Alachua (A) Columbia (A)	Hillsborough Pasco Pinellas Hernando (C) Citrus (C) Sumter (B) Polk (B) Marion (B) Levy (B) Dixie (A) Taylor (A) Gilchrist (A) Lafayette (A) Alachua (A) Suwannee (A) Hamilton (A) Columbia (A)	Dixie Taylor Levy Citrus Jefferson (C) Wakulla (C) Hernando (D) Pasco (C) Pinellas (B) Hillsborough (B) Sumter (B) Marion (C) Alachua (C) Gilchrist (C) Lafayette (D) Madison (A) Hamilton (A) Suwannee (A) Columbia (A) Union (A) Leon (B) Bradford (A) Baker (A)

Table IV-19 – Operational Scenarios

	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	Default	Default	Default	Default	Default
Tourist Rate	Default	Default	Default	Default	Default
Shelters Open	Primary	Primary	Primary	Primary	Primary
Response Curve	12-hour	12-hour	12-hour	12-hour	18-hour
Evacuation Phasing	None	None	None	None	None
Behavioral Response	Planning	Planning	Planning	Planning	Planning
Evacuation Zone	A	B except as noted below	C except as noted below	D except as noted below	E except as noted below
Counties Evacuating	Duval St. Johns Flagler Volusia Nassau Clay Putnam Baker Union Bradford Alachua	Hillsborough Pasco Pinellas Hernando (A) Citrus (A) Levy (A) Dixie (A) Taylor (A)	Wakulla Leon Jefferson Taylor Dixie Madison Lafayette (B) Gilchrist (B) Hamilton (B) Suwannee (B) Levy (A)	Duval St. Johns Flagler Volusia Nassau Clay (C) Putnam (C) Baker (B) Union (B) Bradford (B) Alachua (B) Columbia (A) Hamilton (A) Suwannee (A) Gilchrist (A) Dixie (A) Lafayette (A) Taylor (A) Madison (A)	Dixie Taylor Levy Citrus Jefferson (C) Wakulla (C) Hernando (D) Pasco (C) Pinellas (B) Hillsborough (B) Sumter (B) Marion (C) Alachua (C) Gilchrist (C) Lafayette (D) Madison (A) Hamilton (A) Suwannee (A) Columbia (A) Union (A) Leon (B) Bradford (A) Baker (A)

G. Operational Scenario Results

Each of the ten operational scenarios were modeled for the North Central 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 eleven county region. Evacuating population for the operational scenarios is summarized by county for 2015 in **Table IV-20** and for 2020 in **Table IV-21**.

Within the eleven county region, total evacuating population ranges from more than 26,300 persons for the operational scenario level A evacuation to nearly 147,000 persons for the operational scenario level E evacuation in 2015. By 2020, this range increases within the eleven counties to more than 15,100 persons for the operational scenario level B evacuation and more than 153,700 persons for the operational scenario level E evacuation. The level B evacuation includes fewer evacuating population from the eleven county region since it tests the effect of a southwest Florida (Tampa) evacuation on the NCFRPC.

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 eleven county region for the operational scenarios also varies by evacuation level. A total of more than 13,000 vehicles evacuate from the eleven county RPC for the operational scenario level A evacuation in 2015, and this number increases to more than 74,500 evacuating vehicles from the eleven county region for the operational scenario level E evacuation in 2015. By 2020, the number of evacuating vehicles is expected to increase to nearly 20,300 vehicles for the operational scenario level A evacuation and more than 77,700 evacuating vehicles for the operational scenario level E evacuation.

Shelter Demand

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

Public shelter demand in the eleven county region ranges from only 3,000 persons for the operational scenario level A evacuation in 2015 to more than 19,000 persons for the operational scenario level E evacuation. By 2020, the public shelter demand ranges from more than 1,600 persons for the level B evacuation to more than 20,000 persons for the level E evacuation.

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

	Evacuation Level A Operational Scenario 1	Evacuation Level B Operational Scenario 2	Evacuation Level C Operational Scenario 3	Evacuation Level D Operational Scenario 4	Evacuation Level E Operational Scenario 5
Alachua County					
Site-built Homes	0	0	10,948	10,948	43,793
Mobile/Manuf. Homes	0	0	11,954	11,954	14,943
Tourists	0	0	0	0	0
TOTAL	0	0	22,902	22,902	58,736
Bradford County					
Site-built Homes	0	0	787	0	787
Mobile/Manuf. Homes	0	0	3,927	0	3,927
Tourists	0	0	0	0	0
TOTAL	0	0	4,714	0	4,714
Columbia County					
Site-built Homes	0	0	1,998	1,998	1,998
Mobile/Manuf. Homes	0	0	15,060	15,060	15,060
Tourists	0	0	0	0	0
TOTAL	0	0	17,058	17,058	17,058
Dixie County					
Site-built Homes	1,262	1,436	0	1,262	4,264
Mobile/Manuf. Homes	5,804	6,322	0	5,804	8,548
Tourists	156	172	0	156	229
TOTAL	7,222	7,930	0	7,222	13,041
Gilchrist County					
Site-built Homes	349	349	0	349	1,048
Mobile/Manuf. Homes	5,166	5,166	0	5,166	7,045
Tourists	0	0	0	0	0
TOTAL	5,515	5,515	0	5,515	8,093
Hamilton County					
Site-built Homes	0	616	0	616	616
Mobile/Manuf. Homes	0	3,184	0	3,184	3,184
Tourists	0	0	0	0	0
TOTAL	0	3,800	0	3,800	3,800
Lafayette County					
Site-built Homes	396	396	0	396	990
Mobile/Manuf. Homes	1,540	1,540	0	1,540	2,380
Tourists	0	0	0	0	0
TOTAL	1,936	1,936	0	1,936	3,370
Madison County					
Site-built Homes	1,071	1,606	0	0	1,071
Mobile/Manuf. Homes	3,658	3,991	0	0	3,658
Tourists	0	0	0	0	0
TOTAL	4,729	5,597	0	0	4,729

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

	Evacuation Level A Operational Scenario 1	Evacuation Level B Operational Scenario 2	Evacuation Level C Operational Scenario 3	Evacuation Level D Operational Scenario 4	Evacuation Level E Operational Scenario 5
Suwannee County					
Site-built Homes	0	1,053	0	1,053	1,053
Mobile/Manuf. Homes	0	12,392	0	12,392	12,392
Tourists	0	0	0	0	0
TOTAL	0	13,445	0	13,445	13,445
Taylor County					
Site-built Homes	1,861	2,003	0	1,861	6,403
Mobile/Manuf. Homes	4,252	4,630	0	4,252	6,310
Tourists	246	246	0	246	246
TOTAL	6,359	6,879	0	6,359	12,959
Union County					
Site-built Homes	0	0	328	0	328
Mobile/Manuf. Homes	0	0	2,630	0	2,630
Tourists	0	0	0	0	0
TOTAL	0	0	2,958	0	2,958

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

	Evacuation Level A Operational Scenario 6	Evacuation Level B Operational Scenario 7	Evacuation Level C Operational Scenario 8	Evacuation Level D Operational Scenario 9	Evacuation Level E Operational Scenario 10
Alachua County					
Site-built Homes	11,506	0	46,466	23,012	46,023
Mobile/Manuf. Homes	12,560	0	20,933	13,606	15,699
Tourists	0	0	0	0	0
TOTAL	24,066	0	67,399	36,618	61,722
Bradford County					
Site-built Homes	809	0	2,428	1,618	809
Mobile/Manuf. Homes	4,036	0	8,072	4,036	4,036
Tourists	0	0	0	0	0
TOTAL	4,845	0	10,500	5,654	4,845
Columbia County					
Site-built Homes	0	0	8,512	2,128	2,128
Mobile/Manuf. Homes	0	0	26,796	16,078	16,078
Tourists	0	0	0	0	0
TOTAL	0	0	35,308	18,206	18,206
Dixie County					
Site-built Homes	0	1,329	2,495	1,329	4,459
Mobile/Manuf. Homes	0	6,209	9,782	6,209	9,144
Tourists	0	156	172	156	229
TOTAL	0	7,694	12,449	7,694	13,832
Gilchrist County					
Site-built Homes	0	0	1,117	372	1,117
Mobile/Manuf. Homes	0	0	10,037	5,520	7,528
Tourists	0	0	0	0	0
TOTAL	0	0	11,154	5,892	8,645
Hamilton County					
Site-built Homes	0	0	1,269	634	634
Mobile/Manuf. Homes	0	0	5,977	3,287	3,287
Tourists	0	0	0	0	0
TOTAL	0	0	7,246	3,921	3,921
Lafayette County					
Site-built Homes	0	0	627	418	1,044
Mobile/Manuf. Homes	0	0	2,934	1,614	2,494
Tourists	0	0	0	0	0
TOTAL	0	0	3,561	2,032	3,538
Madison County					
Site-built Homes	0	0	2,156	1,078	1,078
Mobile/Manuf. Homes	0	0	6,678	3,673	3,673
Tourists	0	0	0	0	0
TOTAL	0	0	8,834	4,751	4,751

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

	Evacuation Level A Operational Scenario 6	Evacuation Level B Operational Scenario 7	Evacuation Level C Operational Scenario 8	Evacuation Level D Operational Scenario 9	Evacuation Level E Operational Scenario 10
Suwannee County					
Site-built Homes	0	0	2,691	1,121	1,121
Mobile/Manuf. Homes	0	0	24,050	13,227	13,227
Tourists	0	0	0	0	0
TOTAL	0	0	26,741	14,348	14,348
Taylor County					
Site-built Homes	0	1,909	3,796	1,909	6,572
Mobile/Manuf. Homes	0	4,361	7,035	4,361	6,472
Tourists	0	246	246	246	246
TOTAL	0	6,516	11,077	6,516	13,290
Union County					
Site-built Homes	341	0	1,024	682	341
Mobile/Manuf. Homes	2,750	0	4,584	2,980	2,750
Tourists	0	0	0	0	0
TOTAL	3,091	0	5,608	3,662	3,091

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

	Evacuation Level A Operational Scenario 1	Evacuation Level B Operational Scenario 2	Evacuation Level C Operational Scenario 3	Evacuation Level D Operational Scenario 4	Evacuation Level E Operational Scenario 5
Alachua County					
Site-built Homes	0	0	5,405	5,405	21,618
Mobile/Manuf. Homes	0	0	6,729	6,729	8,412
Tourists	0	0	0	0	0
TOTAL	0	0	12,134	12,134	30,030
Bradford County					
Site-built Homes	0	0	463	0	463
Mobile/Manuf. Homes	0	0	2,118	0	2,118
Tourists	0	0	0	0	0
TOTAL	0	0	2,581	0	2,581
Columbia County					
Site-built Homes	0	0	941	941	941
Mobile/Manuf. Homes	0	0	8,762	8,762	8,762
Tourists	0	0	0	0	0
TOTAL	0	0	9,703	9,703	9,703
Dixie County					
Site-built Homes	821	935	0	821	2,794
Mobile/Manuf. Homes	2,867	3,120	0	2,867	4,223
Tourists	67	75	0	67	100
TOTAL	3,755	4,130	0	3,755	7,117
Gilchrist County					
Site-built Homes	208	208	0	208	623
Mobile/Manuf. Homes	2,996	2,996	0	2,996	4,085
Tourists	0	0	0	0	0
TOTAL	3,204	3,204	0	3,204	4,708
Hamilton County					
Site-built Homes	0	316	0	316	316
Mobile/Manuf. Homes	0	1,686	0	1,686	1,686
Tourists	0	0	0	0	0
TOTAL	0	2,002	0	2,002	2,002
Lafayette County					
Site-built Homes	252	252	0	252	631
Mobile/Manuf. Homes	816	816	0	816	1,262
Tourists	0	0	0	0	0
TOTAL	1,068	1,068	0	1,068	1,893
Madison County					
Site-built Homes	561	841	0	0	561
Mobile/Manuf. Homes	1,890	2,061	0	0	1,890
Tourists	0	0	0	0	0
TOTAL	2,451	2,902	0	0	2,451

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

	Evacuation Level A Operational Scenario 1	Evacuation Level B Operational Scenario 2	Evacuation Level C Operational Scenario 3	Evacuation Level D Operational Scenario 4	Evacuation Level E Operational Scenario 5
Suwannee County					
Site-built Homes	0	574	0	574	574
Mobile/Manuf. Homes	0	6,413	0	6,413	6,413
Tourists	0	0	0	0	0
TOTAL	0	6,987	0	6,987	6,987
Taylor County					
Site-built Homes	1,097	1,191	0	1,097	3,643
Mobile/Manuf. Homes	2,445	2,668	0	2,445	3,620
Tourists	107	107	0	107	107
TOTAL	3,649	3,966	0	3,649	7,370
Union County					
Site-built Homes	0	0	195	0	195
Mobile/Manuf. Homes	0	0	1,377	0	1,377
Tourists	0	0	0	0	0
TOTAL	0	0	1,572	0	1,572

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

	Evacuation Level A Operational Scenario 6	Evacuation Level B Operational Scenario 7	Evacuation Level C Operational Scenario 8	Evacuation Level D Operational Scenario 9	Evacuation Level E Operational Scenario 10
Alachua County					
Site-built Homes	5,679	0	23,157	11,357	22,714
Mobile/Manuf. Homes	7,069	0	11,782	7,658	8,836
Tourists	0	0	0	0	0
TOTAL	12,748	0	34,939	19,015	31,550
Bradford County					
Site-built Homes	476	0	1,428	952	476
Mobile/Manuf. Homes	2,176	0	4,352	2,176	2,176
Tourists	0	0	0	0	0
TOTAL	2,652	0	5,780	3,128	2,652
Columbia County					
Site-built Homes	0	0	4,012	1,003	1,003
Mobile/Manuf. Homes	0	0	15,562	9,337	9,337
Tourists	0	0	0	0	0
TOTAL	0	0	19,574	10,340	10,340
Dixie County					
Site-built Homes	0	870	1,647	870	2,961
Mobile/Manuf. Homes	0	3,042	4,797	3,042	4,481
Tourists	0	67	75	67	100
TOTAL	0	3,979	6,519	3,979	7,542
Gilchrist County					
Site-built Homes	0	0	664	221	664
Mobile/Manuf. Homes	0	0	5,823	3,202	4,367
Tourists	0	0	0	0	0
TOTAL	0	0	6,487	3,423	5,031
Hamilton County					
Site-built Homes	0	0	653	327	327
Mobile/Manuf. Homes	0	0	3,165	1,740	1,740
Tourists	0	0	0	0	0
TOTAL	0	0	3,818	2,067	2,067
Lafayette County					
Site-built Homes	0	0	400	267	666
Mobile/Manuf. Homes	0	0	1,552	854	1,319
Tourists	0	0	0	0	0
TOTAL	0	0	1,952	1,121	1,985
Madison County					
Site-built Homes	0	0	1,129	565	565
Mobile/Manuf. Homes	0	0	3,454	1,900	1,900
Tourists	0	0	0	0	0
TOTAL	0	0	4,583	2,465	2,465

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

	Evacuation Level A Operational Scenario 6	Evacuation Level B Operational Scenario 7	Evacuation Level C Operational Scenario 8	Evacuation Level D Operational Scenario 9	Evacuation Level E Operational Scenario 10
Suwannee County					
Site-built Homes	0	0	1,467	611	611
Mobile/Manuf. Homes	0	0	12,440	6,842	6,842
Tourists	0	0	0	0	0
TOTAL	0	0	13,907	7,453	7,453
Taylor County					
Site-built Homes	0	1,125	2,220	1,125	3,737
Mobile/Manuf. Homes	0	2,508	4,016	2,508	3,713
Tourists	0	107	107	107	107
TOTAL	0	3,740	6,343	3,740	7,557
Union County					
Site-built Homes	203	0	610	406	203
Mobile/Manuf. Homes	1,439	0	2,398	1,558	1,439
Tourists	0	0	0	0	0
TOTAL	1,642	0	3,008	1,964	1,642

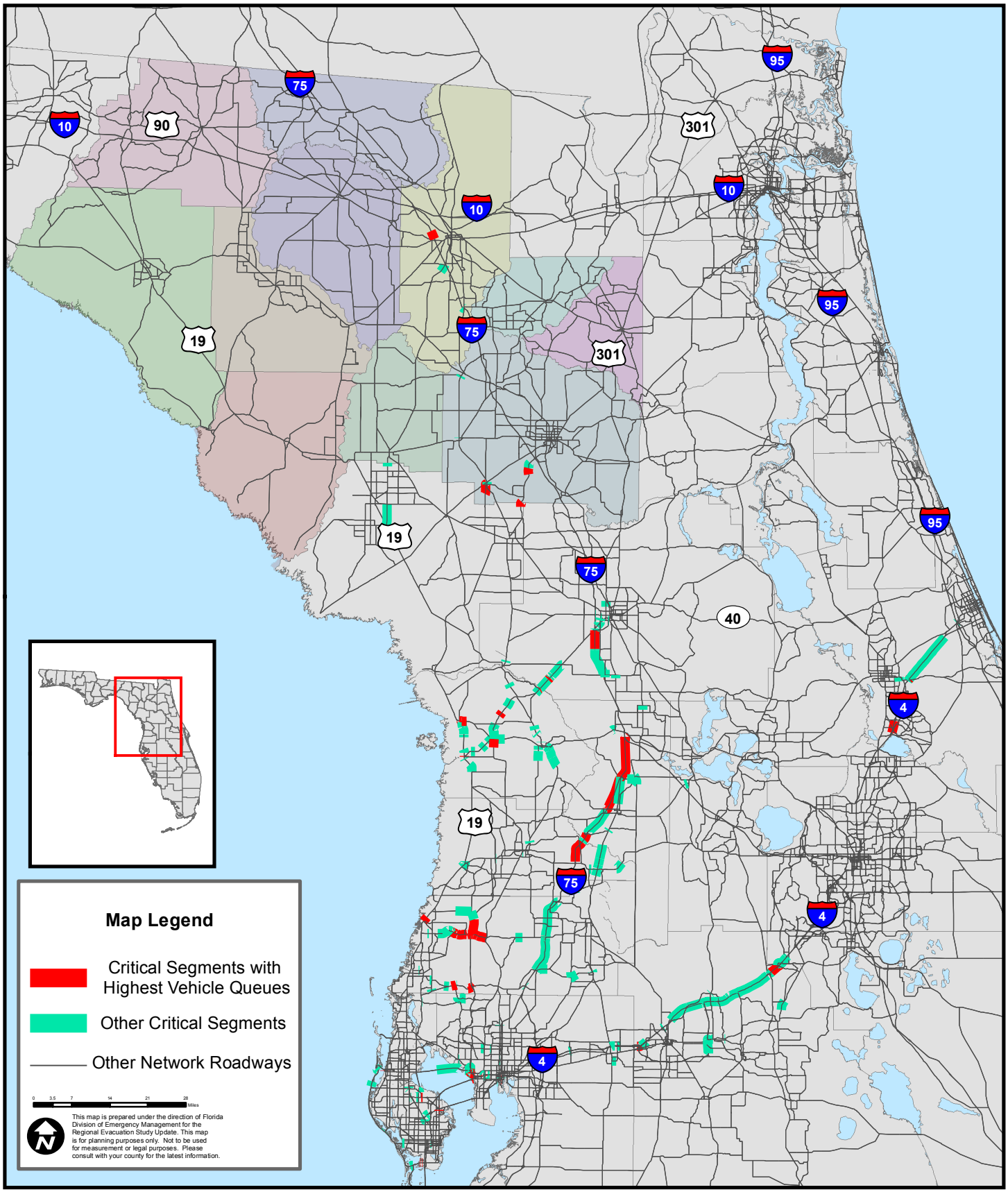
Table IV-24 – Shelter Demand by Operational Scenario

	Evacuation Level A Operational Scenario 1	Evacuation Level B Operational Scenario 2	Evacuation Level C Operational Scenario 3	Evacuation Level D Operational Scenario 4	Evacuation Level E Operational Scenario 5
2015					
Alachua County	0	0	3,367	3,367	8,334
Bradford County	0	0	555	0	555
Columbia County	0	0	2,607	2,607	2,607
Dixie County	960	1,042	0	960	1,793
Gilchrist County	592	592	0	592	871
Hamilton County	0	555	0	555	555
Lafayette County	296	296	0	296	525
Madison County	648	759	0	0	648
Suwannee county	0	1,907	0	1,907	1,907
Taylor County	834	903	0	834	1,652
Union County	0	0	309	0	309
	Evacuation Level A Operational Scenario 6	**Evacuation Level B Operational Scenario 7**	**Evacuation Level C Operational Scenario 8**	**Evacuation Level D Operational Scenario 9**	**Evacuation Level E Operational Scenario 10**
2020					
Alachua County	3,537	0	9,696	5,278	8,756
Bradford County	572	0	1,230	659	572
Columbia County	0	0	5,060	2,777	2,777
Dixie County	0	1,018	1,652	1,018	1,900
Gilchrist County	0	0	1,199	633	931
Hamilton County	0	0	1,060	575	575
Lafayette County	0	0	542	311	551
Madison County	0	0	1,210	653	653
Suwannee county	0	0	3,778	2,033	2,033
Taylor County	0	857	1,452	857	1,695
Union County	322	0	612	400	322

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

Figure IV-14

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



Sources: North Central Florida Regional Planning Council, CDM Smith

Map Printed: June, 2015

Congested Roadways

A summary of the total number of evacuating vehicles for each of the operational scenarios is presented in **Table IV-25**. It is important to note that the total number of evacuating vehicles in the table below includes vehicles evacuating from all of the counties included in the operational scenario, as identified in Table IV-19. The number of counties varies by scenario, with the 2020 Level E scenario including 23 counties stretching throughout the northern and central portions of Florida.

Table IV-25 – Total Evacuating Vehicles for Operational Scenarios

	Evacuation Level A Operational Scenario 1	Evacuation Level B Operational Scenario 2	Evacuation Level C Operational Scenario 3	Evacuation Level D Operational Scenario 4	Evacuation Level E Operational Scenario 5
2015	347,348	42,466	488,771	880,853	688,568
2020	346,344	431,047	72,065	749,940	731,708

Similar to the base scenarios, critical roadways were identified by reviewing roadways in the model network that have the highest vehicle queues for extended periods of time during an evacuation. Due to the nature of a major evacuation in general, nearly all roadway facilities will have extended vehicle queues at some point during the evacuation process. The point of this analysis is to identify those roadway facilities that have vehicle queues for the longest time periods during each of the evacuation scenarios. Critical roadway segments for the North Central Florida region are identified in **Figures IV-14** through **IV-23** for each of the operational scenarios for 2015 and 2020.

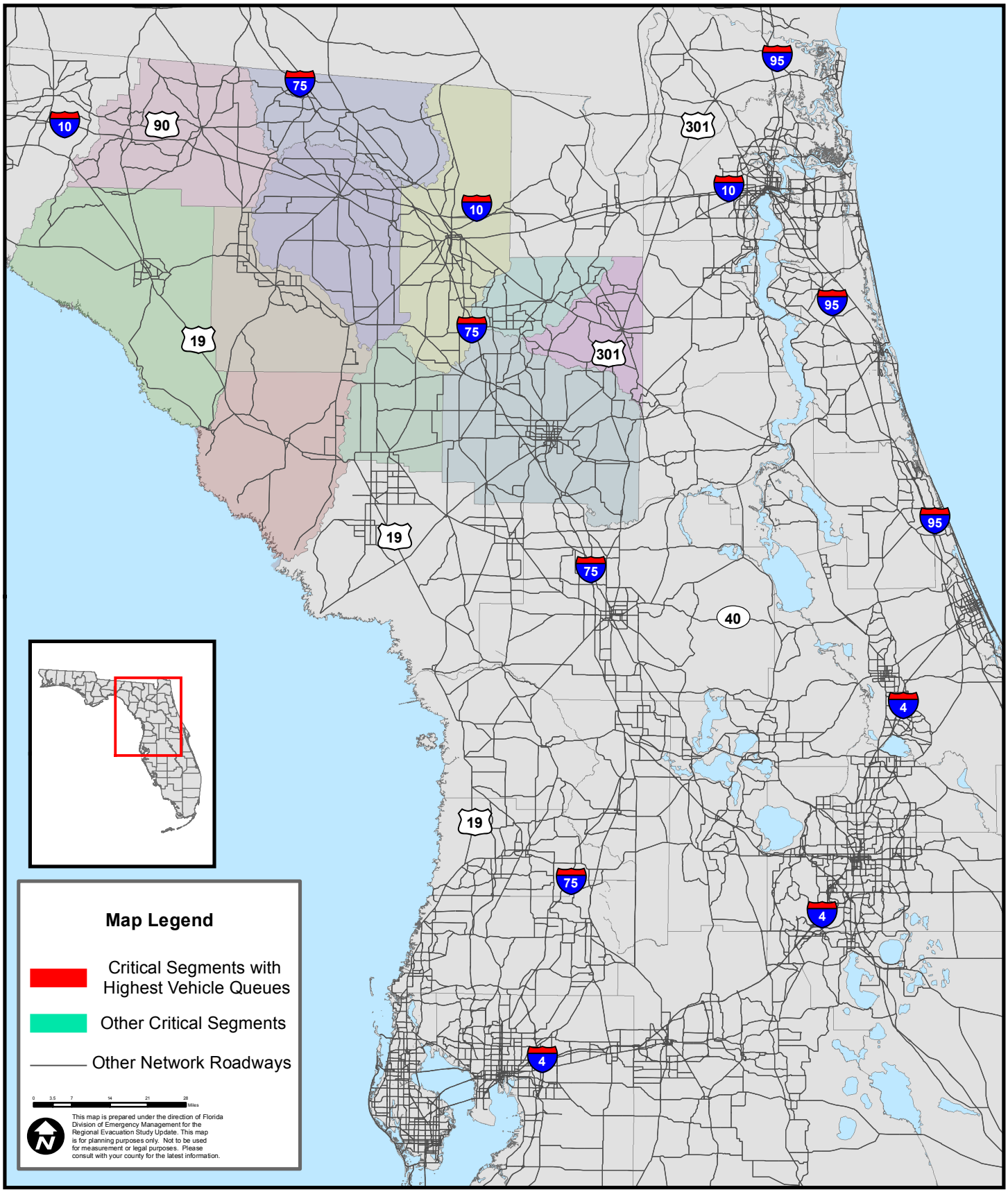
Critical segments vary by scenario as the location of the evacuation event determines which portions of the region experience congestion and queuing. For example, for the level D operational scenario for 2015 where the Tampa Bay region is evacuating, I-75 near the Turnpike and in Alachua and Columbia Counties experience higher queuing than elsewhere in the region. Likewise, for the level D operational scenario for 2020 where Jacksonville is evacuating, I-10 and portions of I-75 experience higher queuing levels.

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 North Central Florida Region for each operational scenario are included in Volume 5-3.

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

Figure IV-15

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

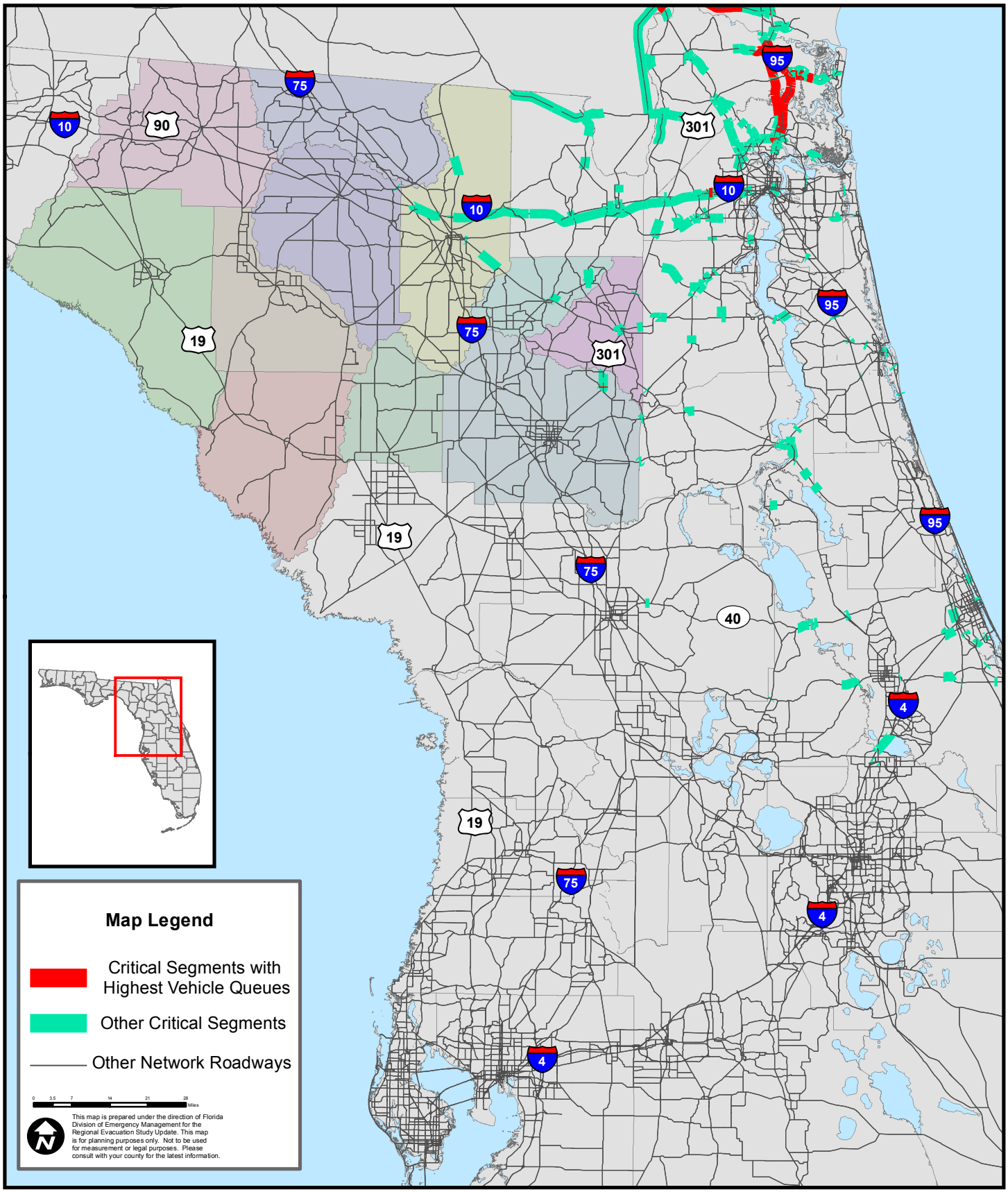


Sources: North Central Florida Regional Planning Council, CDM Smith

Map Printed: June, 2015

Figure IV-16

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

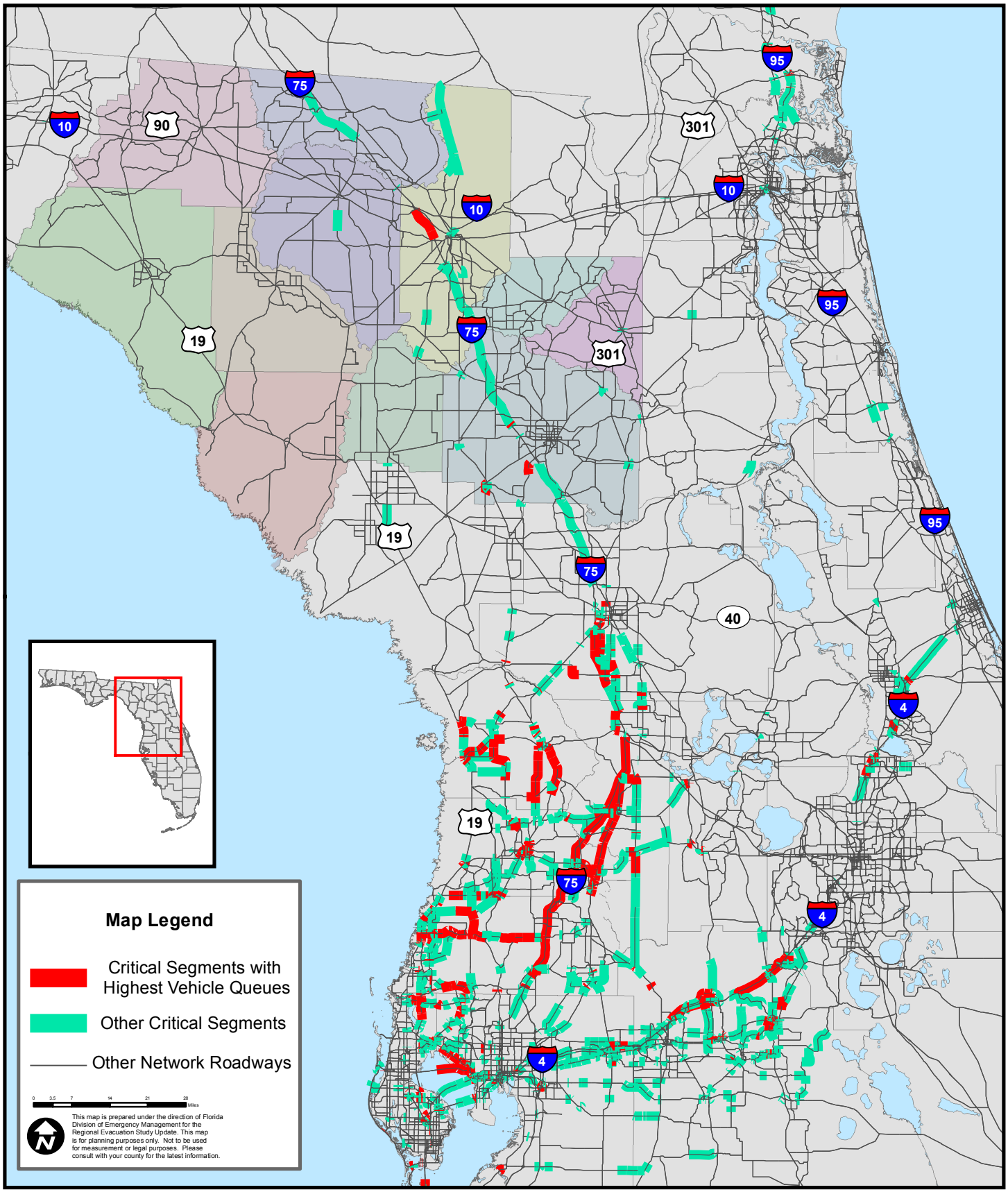


Sources: North Central Florida Regional Planning Council, CDM Smith

Map Printed: June, 2015

Figure IV-17

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

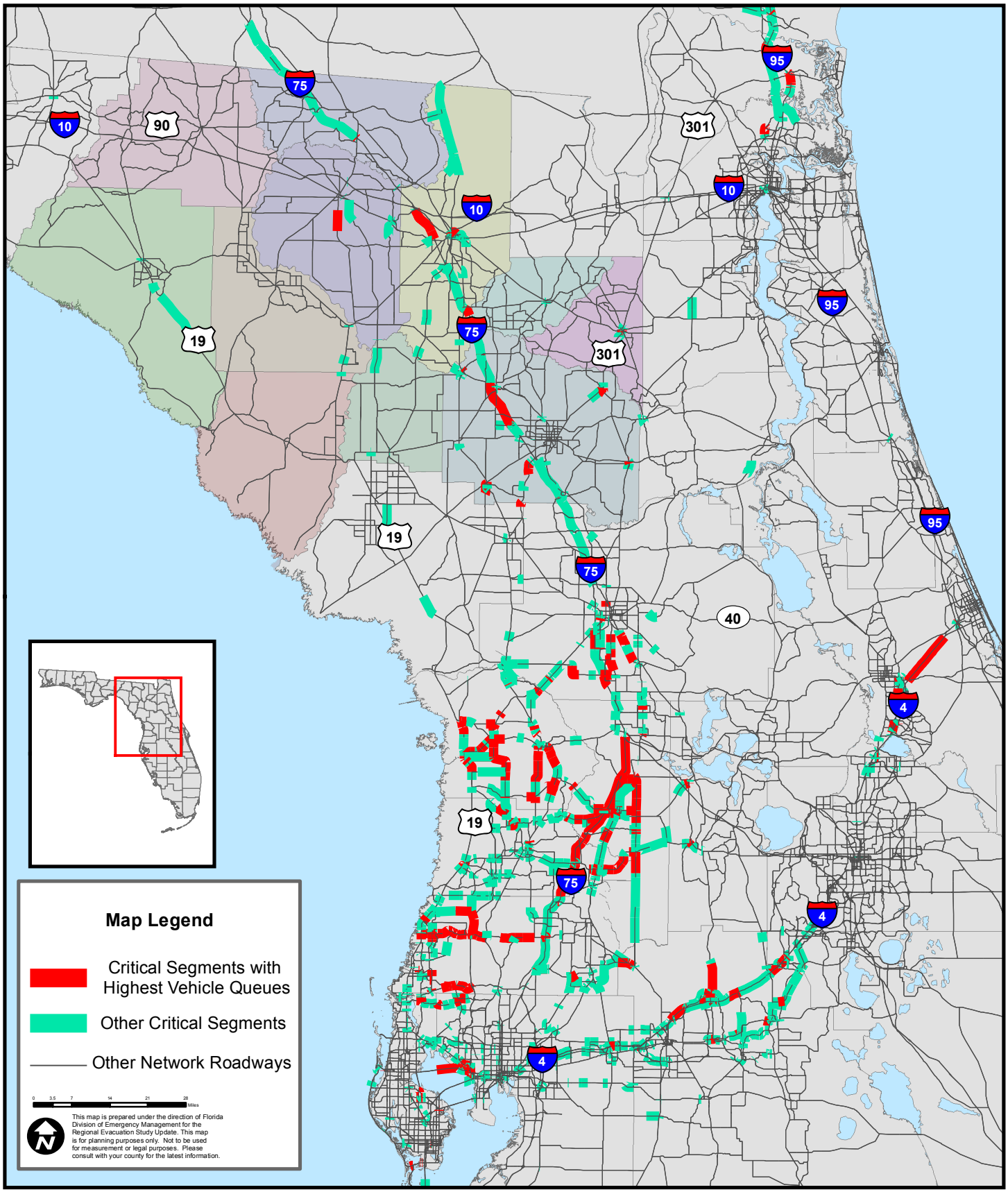


Sources: North Central Florida Regional Planning Council, CDM Smith

Map Printed: June, 2015

Figure IV-18

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

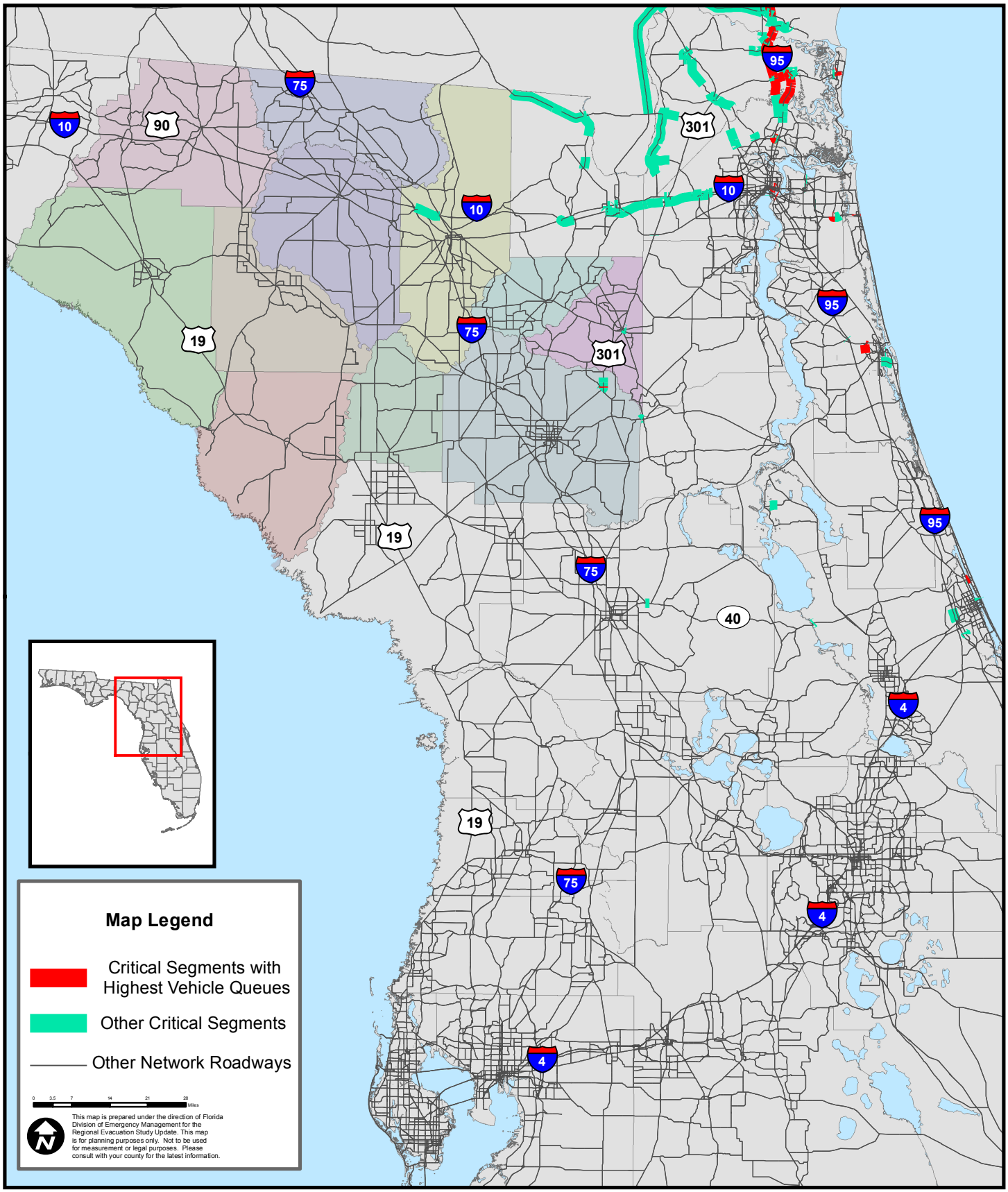


Sources: North Central Florida Regional Planning Council, CDM Smith

Map Printed: June, 2015

Figure IV-19

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

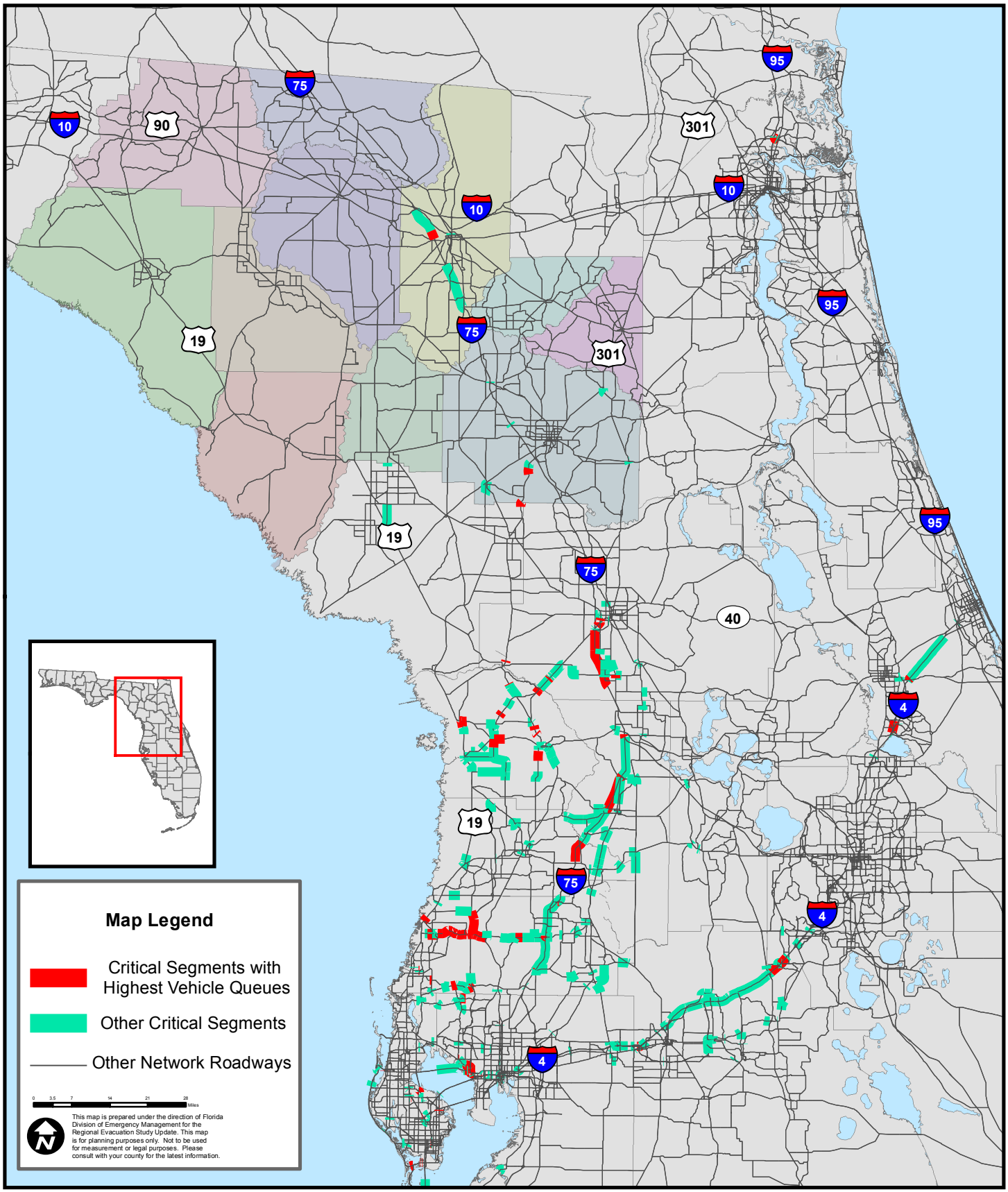


Sources: North Central Florida Regional Planning Council, CDM Smith

Map Printed: June, 2015

Figure IV-20

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

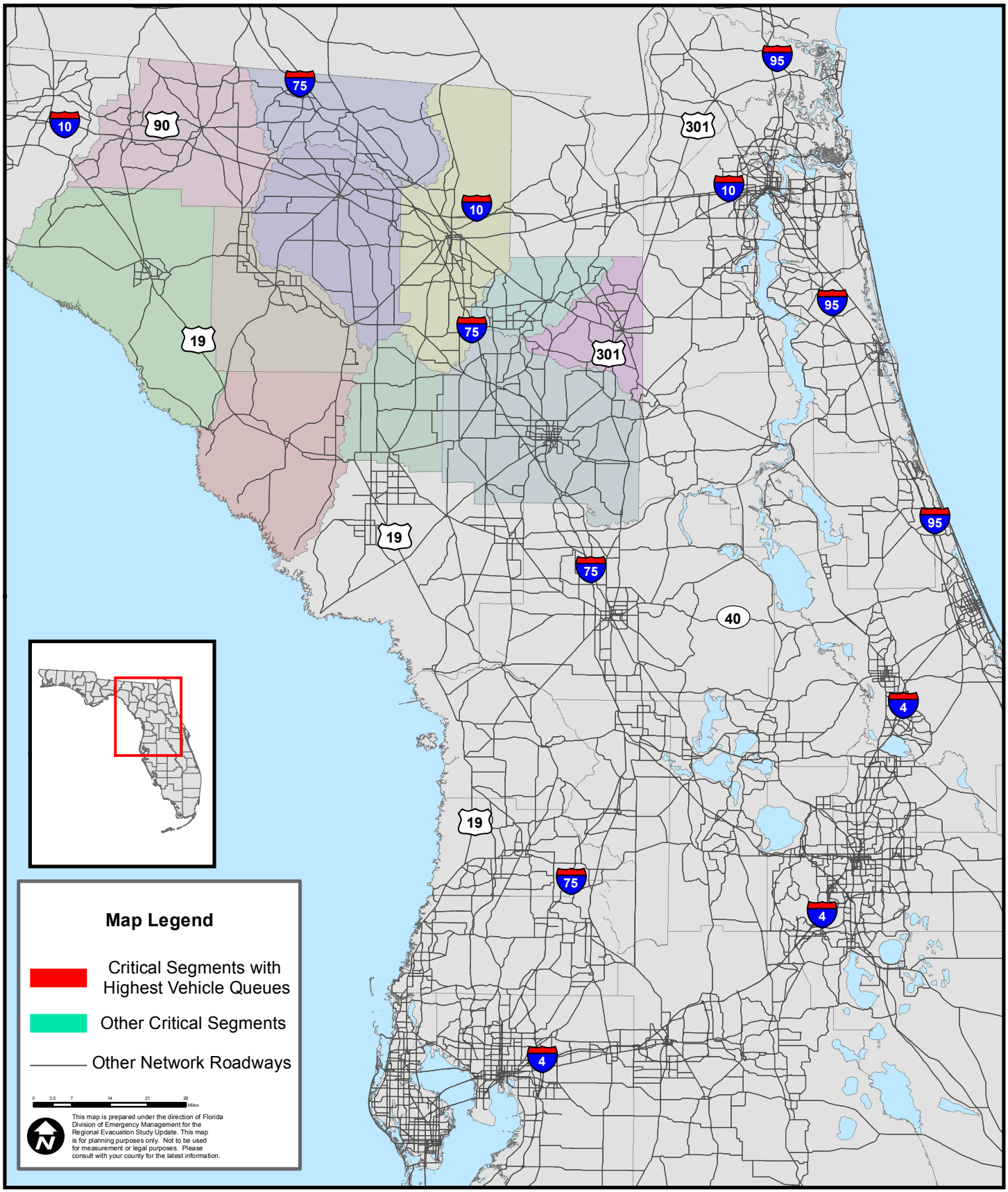


Sources: North Central Florida Regional Planning Council, CDM Smith

Map Printed: June, 2015

Figure IV-21

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

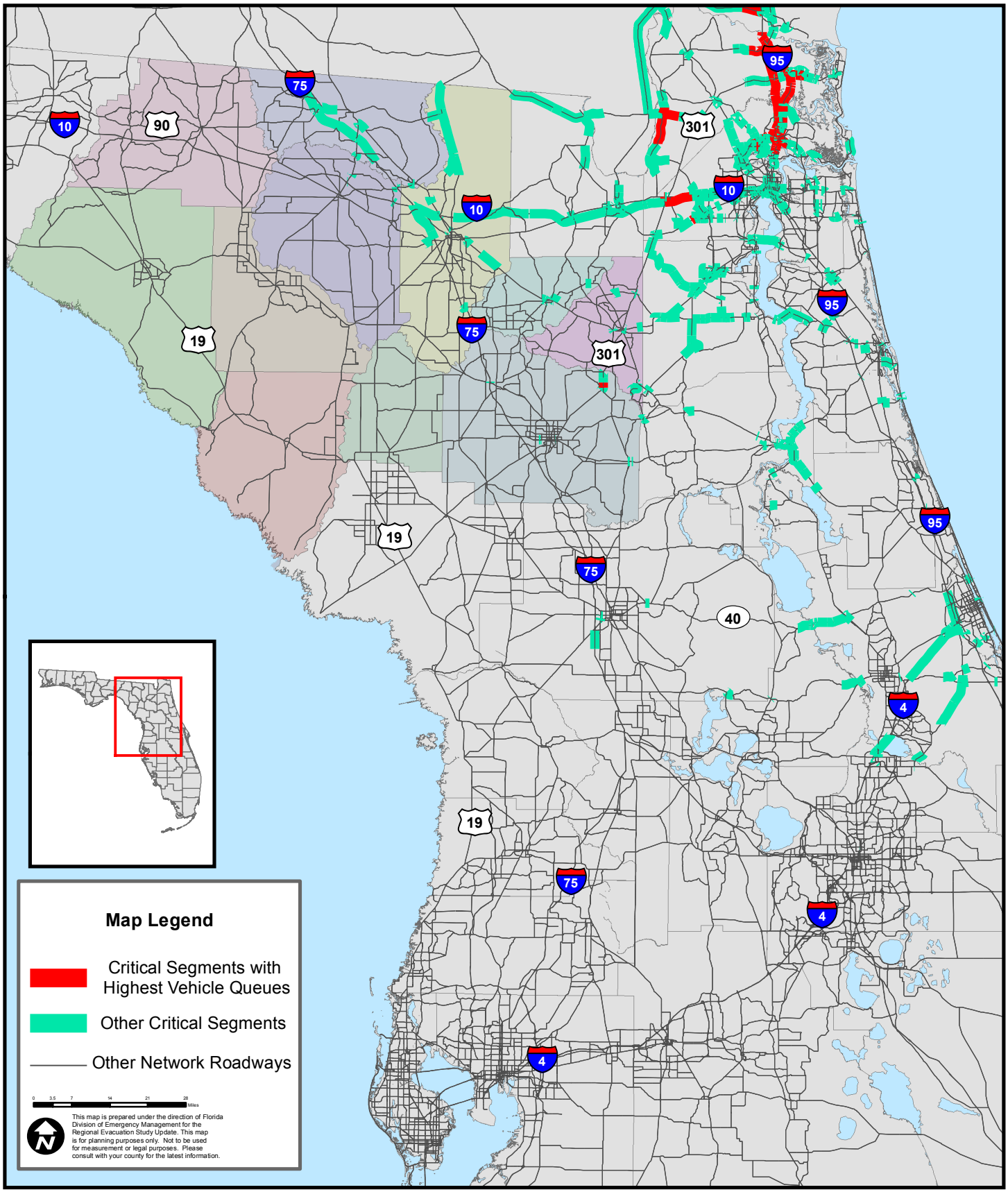


Sources: North Central Florida Regional Planning Council, CDM Smith

Map Printed: June, 2015

Figure IV-22

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

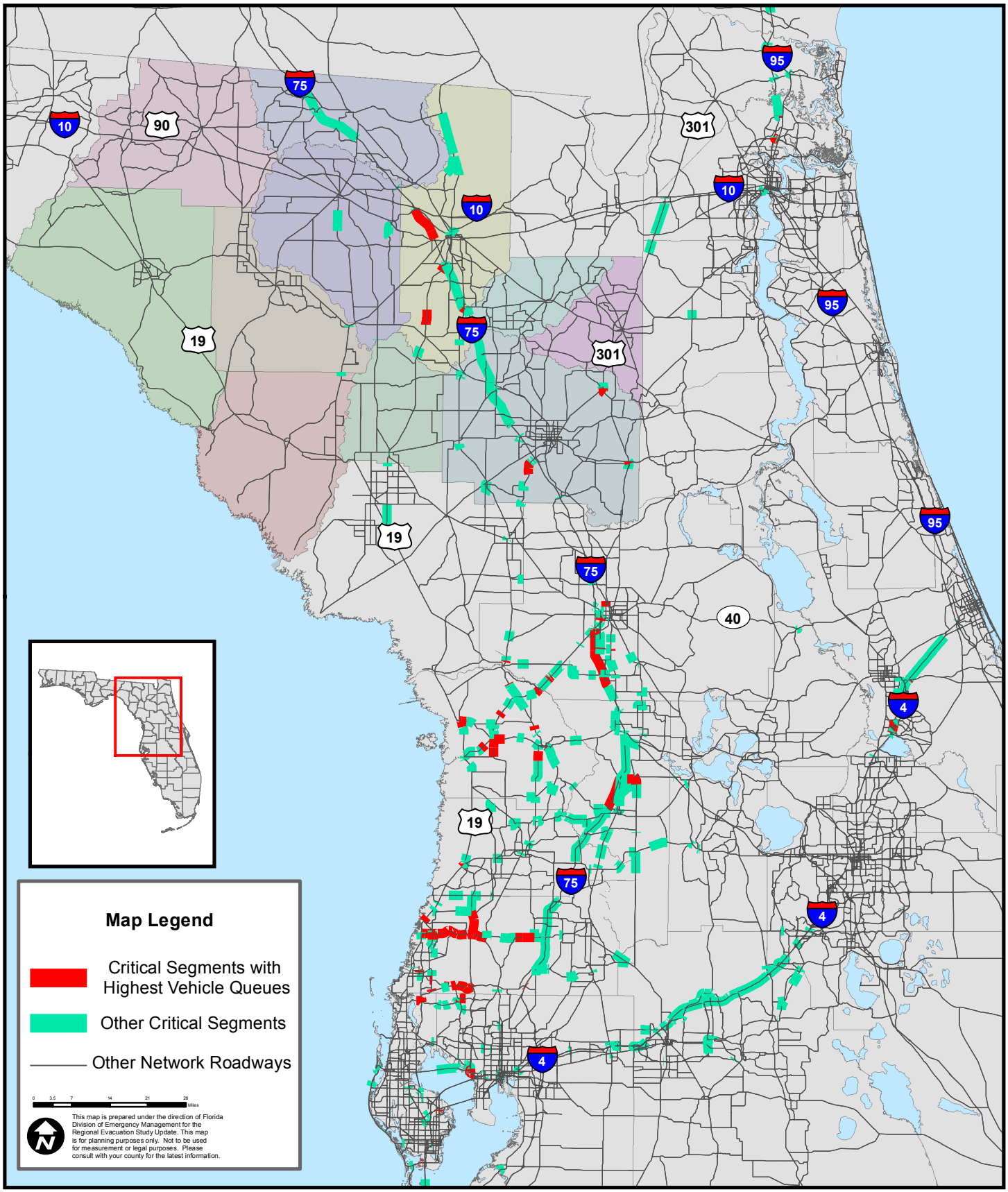


Sources: North Central Florida Regional Planning Council, CDM Smith

Map Printed: June, 2015

Figure IV-23

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



Sources: North Central Florida Regional Planning Council, CDM Smith

Map Printed: June, 2015

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

	Evacuation Level A Operational Scenario	Evacuation Level B Operational Scenario	Evacuation Level C Operational Scenario	Evacuation Level D Operational Scenario	Evacuation Level E Operational Scenario
Alachua County					
I-75 Northbound	36,800	100	16,600	97,800	62,700
I-75 Southbound	200	700	2,200	1,100	2,900
US 301 Northbound	5,800	-	300	14,900	11,900
US 27 Westbound	100	-	100	700	1,500
Bradford					
US 301 Southbound	-	-	7,700	-	200
US 301 Northbound	5,500	-	1,000	15,900	13,500
Columbia					
I-75 Northbound	36,500	1,100	34,100	80,700	54,700
I-10 Westbound	5,700	-	20,100	18,000	13,300
US 27 Southbound	200	400	300	700	1,300
I-75 Southbound	200	1,200	800	1,300	2,300
I-10 Eastbound	400	1,000	200	800	1,500
US 441 Northbound	900	-	4,700	7,800	6,500
Dixie					
US 19 Southbound	2,800	400	-	9,900	12,700
US 19 Northbound	500	600	-	600	1,600
Gilchrist					
US 19 Northbound	2,700	-	100	10,800	15,000
US 19 Southbound	200	300	-	200	600
Hamilton					
I-75 Northbound	37,800	4,300	36,000	86,300	62,400
I-75 Southbound	100	300	-	200	300
Lafayette					
US 27 Westbound	-	-	300	200	300
US 27 Eastbound	1,300	1,400	-	2,500	4,500
Madison					
US 19 Westbound	3,300	1,300	-	10,000	11,700
I-10 Westbound	5,700	700	17,200	17,600	12,500
I-10 Eastbound	300	1,100	-	-	1,300
Suwannee					
US 27 Westbound	-	-	200	300	400
US 27 Eastbound	200	300	-	400	900
I-75 Northbound	36,700	1,500	35,900	82,900	58,200
I-75 Southbound	100	400	-	400	500
I-10 Eastbound	300	1,500	-	500	2,000
I-10 Westbound	5,600	300	17,900	17,900	13,400
Taylor					
US 19 Northbound	3,300	1,300	-	10,000	11,700
US 27 Eastbound	200	200	-	200	700
Union					
SR 121 Southbound	-	-	900	-	100
SR 121 Northbound	100	-	2,000	1,100	3,500

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

	Evacuation Level A Operational Scenario	Evacuation Level B Operational Scenario	Evacuation Level C Operational Scenario	Evacuation Level D Operational Scenario	Evacuation Level E Operational Scenario
Alachua County					
I-75 Northbound	6,100	47,400	1,300	32,900	74,200
I-75 Southbound	1,100	100	1,200	3,700	3,200
US 301 Northbound	400	8,200	300	600	17,700
US 27 Westbound	100	100	-	300	900
Bradford					
US 301 Southbound	5,000	-	-	10,600	200
US 301 Northbound	1,000	8,100	100	1,500	18,500
Columbia					
I-75 Northbound	14,700	44,700	3,300	48,300	64,400
I-10 Westbound	11,700	7,200	200	33,800	15,400
US 27 Southbound	-	100	500	800	1,300
I-75 Southbound	-	-	1,800	1,700	2,400
I-10 Eastbound	-	200	1,400	800	1,500
US 441 Northbound	-	1,900	-	7,800	6,700
Dixie					
US 19 Southbound	-	3,900	600	400	8,000
US 19 Northbound	-	500	900	600	1,700
Gilchrist					
US 19 Northbound	-	3,900	200	-	8,700
US 19 Southbound	-	300	500	300	700
Hamilton					
I-75 Northbound	15,200	46,100	7,400	54,000	71,400
I-75 Southbound	-	-	400	300	300
Lafayette					
US 27 Westbound	200	-	-	600	300
US 27 Eastbound	-	1,400	1,800	1,300	4,300
Madison					
US 19 Westbound	-	4,300	1,700	1,200	9,000
I-10 Westbound	10,800	6,800	1,000	25,500	14,400
I-10 Eastbound	-	-	2,000	300	1,400
Suwannee					
US 27 Westbound	200	-	-	400	400
US 27 Eastbound	-	100	500	400	900
I-75 Northbound	15,400	45,100	3,800	49,600	67,300
I-75 Southbound	-	-	500	500	500
I-10 Eastbound	-	100	2,500	800	2,000
I-10 Westbound	11,100	7,000	500	28,700	15,300
Taylor					
US 19 Northbound	-	4,300	1,700	1,200	9,000
US 27 Eastbound	-	200	400	200	600
Union					
SR 121 Southbound	600	-	-	1,200	100
SR 121 Northbound	300	100	-	4,800	1,800

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

	Evacuation Level A Operational Scenario	Evacuation Level B Operational Scenario	Evacuation Level C Operational Scenario	Evacuation Level D Operational Scenario	Evacuation Level E Operational Scenario
Alachua County					
US 27 Southbound	200	400	300	700	1,300
I-75 Southbound	200	1,200	800	1,300	2,300
I-75 Northbound	30,300	-	9,700	93,500	57,900
US 301 Southbound	-	-	7,700	-	200
Bradford					
US 301 Northbound	5,800	-	300	14,900	11,900
Columbia					
I-75 Northbound	36,800	100	16,600	97,800	62,700
Dixie					
US 19 Northbound	2,700	-	100	10,800	15,000
Gilchrist					
US 19 Southbound	500	600	-	600	1,600
Hamilton					
I-75 Northbound	36,700	1,500	35,900	82,900	58,200
Lafayette					
US 27 Westbound	-	-	200	300	400
US 27 Eastbound	200	200	-	200	700
Madison					
US 19 Northbound	3,300	1,300	-	10,000	11,700
I-10 Eastbound	100	900	-	-	1,100
I-10 Westbound	5,600	300	17,900	17,900	13,400
Suwannee					
I-10 Eastbound	300	1,100	-	-	1,300
US 27 Eastbound	1,300	1,400	-	2,500	4,500
I-75 Southbound	100	300	-	200	300
I-75 Northbound	36,500	1,100	34,100	80,700	54,700
I-10 Westbound	5,700	-	20,100	18,000	13,300
Taylor					
US 27 Westbound	-	-	300	200	300
US 19 Northbound	2,800	400	-	9,900	12,700
Union					
SR 121 Northbound	-	-	-	-	-

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

	Evacuation Level A Operational Scenario	Evacuation Level B Operational Scenario	Evacuation Level C Operational Scenario	Evacuation Level D Operational Scenario	Evacuation Level E Operational Scenario
Alachua County					
US 27 Southbound	-	100	500	800	1,300
I-75 Southbound	-	-	1,800	1,700	2,400
I-75 Northbound	2,300	41,500	-	20,100	62,400
US 301 Southbound	5,000	-	-	10,600	200
Bradford					
US 301 Northbound	400	8,200	300	600	17,700
Columbia					
I-75 Northbound	6,100	47,400	1,300	32,900	74,200
Dixie					
US 19 Northbound	-	3,900	200	-	8,700
Gilchrist					
US 19 Southbound	-	900	900	600	1,700
Hamilton					
I-75 Northbound	15,400	45,100	3,800	49,600	67,300
Lafayette					
US 27 Westbound	200	-	-	400	400
US 27 Eastbound	-	200	400	200	600
Madison					
US 19 Northbound	-	4,300	1,700	1,200	9,000
I-10 Eastbound	-	-	1,700	-	1,100
I-10 Westbound	11,100	7,000	500	28,700	15,300
Suwannee					
I-10 Eastbound	-	-	2,000	300	1,400
US 27 Eastbound	-	1,400	1,800	1,300	4,300
I-75 Southbound	-	-	400	300	300
I-75 Northbound	14,700	44,700	3,300	48,300	64,400
I-10 Westbound	11,700	7,200	200	33,800	15,400
Taylor					
US 27 Westbound	200	-	-	600	300
US 19 Northbound	-	3,900	600	400	8,000
Union					
SR 121 Northbound	-	-	-	-	-

Clearance Times

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

In-county clearance times for the 2015 operational scenarios range from 0 hours to 22 hours depending upon the scenario. Counties that were not included in the evacuation scenario will have an in-county clearance time of 0 since no one within the county is evacuating. Clearance Time to Shelter shows a similar pattern, with clearance times for the operational scenarios ranging from 0 hours to 12 hours depending upon the county and the scenario.

In 2020, in-county clearance times for the operational scenarios vary from 0 hours to 21.5 hours for the level E evacuation in Taylor County. The 2020 level E evacuation includes vehicle trips evacuating from most of the Gulf Coast, which cause a large increase in clearance times. Clearance Time to Shelter shows a similar pattern to the 2015 scenarios, with clearance times for the base scenarios ranging from 0 hours to 18.5 hours depending upon the scenario.

Out of county clearance times for the 2015 operational scenarios range from 0.5 hours to 35 hours. Out of county clearance times have a similar pattern for all counties in 2020 to between 0.5 and 35.5 hours depending upon the scenario. Regional clearance time for the eleven county NCFRPC region ranges from 13 hours to 35 hours in 2015. This time increases to between 14 and 35.5 hours in 2020.

Table IV-30 – 2015 Clearance Times for Operational Scenarios

	Evacuation Level A Operational Scenario	Evacuation Level B Operational Scenario	Evacuation Level C Operational Scenario	Evacuation Level D Operational Scenario	Evacuation Level E Operational Scenario
Clearance Time to Shelter					
Alachua County	0.0	0.0	13.5	12.5	10.0
Bradford County	0.0	0.0	12.5	0.0	9.5
Columbia County	0.0	0.0	12.5	13.5	12.5
Dixie County	12.5	12.5	0.0	12.5	10.0
Gilchrist County	12.5	12.5	0.0	12.5	9.5
Hamilton County	0.0	12.5	0.0	12.5	9.5
Lafayette County	12.5	12.5	0.0	12.5	9.5
Madison County	12.5	12.5	0.0	0.0	9.5
Suwannee county	0.0	12.5	0.0	12.5	10.0
Taylor County	13.0	13.0	0.0	13.0	10.0
Union County	0.0	0.0	12.5	0.0	9.5
In-County Clearance Time					
Alachua County	0.0	0.0	14.0	13.0	10.5
Bradford County	0.0	0.0	13.0	0.0	10.0
Columbia County	0.0	0.0	13.0	14.0	13.0
Dixie County	16.0	14.5	0.0	27.5	20.5
Gilchrist County	13.0	13.0	0.0	13.0	10.0
Hamilton County	0.0	13.0	0.0	13.0	10.0
Lafayette County	13.0	13.0	0.0	13.0	10.0
Madison County	13.0	13.0	0.0	0.0	10.0
Suwannee county	0.0	13.0	0.0	13.0	10.5
Taylor County	16.5	13.0	0.0	26.0	20.5
Union County	0.0	0.0	13.0	0.0	10.0
Out of County Clearance Time					
Alachua County	19.5	15.0	24.5	38.5	26.5
Bradford County	19.5	11.5	24.0	39.0	27.0
Columbia County	20.0	14.5	24.0	39.0	27.5
Dixie County	16.5	14.5	15.5	28.5	20.5
Gilchrist County	15.5	13.0	18.5	32.5	20.5
Hamilton County	20.5	14.0	24.5	39.0	27.5
Lafayette County	18.0	14.0	20.0	28.5	20.5
Madison County	20.5	13.5	24.5	38.5	27.5
Suwannee county	20.5	14.0	24.5	38.5	27.0
Taylor County	17.0	13.5	19.5	29.5	21.5
Union County	16.5	12.5	24.0	38.5	26.5
Regional Clearance Time					
North Central	20.5	15.0	25.0	39.0	27.5

Table IV-31 – 2020 Clearance Times for Operational Scenarios

	Evacuation Level A Operational Scenario	Evacuation Level B Operational Scenario	Evacuation Level C Operational Scenario	Evacuation Level D Operational Scenario	Evacuation Level E Operational Scenario
Clearance Time to Shelter					
Alachua County	13.5	0.0	12.5	13.5	18.5
Bradford County	12.5	0.0	12.5	12.5	18.5
Columbia County	0.0	0.0	12.5	12.5	18.5
Dixie County	0.0	12.5	13.0	12.5	18.5
Gilchrist County	0.0	0.0	12.5	12.5	18.5
Hamilton County	0.0	0.0	12.5	12.5	18.5
Lafayette County	0.0	0.0	12.5	12.5	18.5
Madison County	0.0	0.0	12.5	12.5	18.0
Suwannee county	0.0	0.0	13.0	12.5	18.5
Taylor County	0.0	13.0	13.0	13.0	19.0
Union County	12.5	0.0	12.5	12.5	18.0
In-County Clearance Time					
Alachua County	14.0	0.0	13.0	14.0	19.0
Bradford County	13.0	0.0	13.0	13.0	19.0
Columbia County	0.0	0.0	13.0	13.0	19.0
Dixie County	0.0	16.0	13.0	16.5	25.0
Gilchrist County	0.0	0.0	13.0	13.0	19.0
Hamilton County	0.0	0.0	13.0	13.0	19.0
Lafayette County	0.0	0.0	13.0	13.0	19.0
Madison County	0.0	0.0	13.0	13.0	18.5
Suwannee county	0.0	0.0	13.5	13.0	19.0
Taylor County	0.0	17.0	14.0	13.0	25.0
Union County	13.0	0.0	13.0	13.0	18.5
Out of County Clearance Time					
Alachua County	15.0	23.0	14.0	31.0	33.5
Bradford County	14.5	23.0	14.0	30.0	34.0
Columbia County	15.5	23.0	14.0	30.5	34.0
Dixie County	13.0	16.5	13.0	20.0	25.0
Gilchrist County	13.0	20.0	13.5	29.0	24.5
Hamilton County	15.5	23.0	14.5	30.5	34.5
Lafayette County	14.0	16.0	13.5	31.0	25.5
Madison County	15.0	24.0	14.0	31.0	31.0
Suwannee county	15.0	23.5	14.0	31.0	34.0
Taylor County	14.0	17.5	14.0	31.5	26.0
Union County	14.0	20.0	13.5	30.0	27.0
Regional Clearance Time					
North Central	16.0	24.0	14.5	31.5	34.5

Figure IV-24 - Clearance Time to Shelter Operational Scenarios

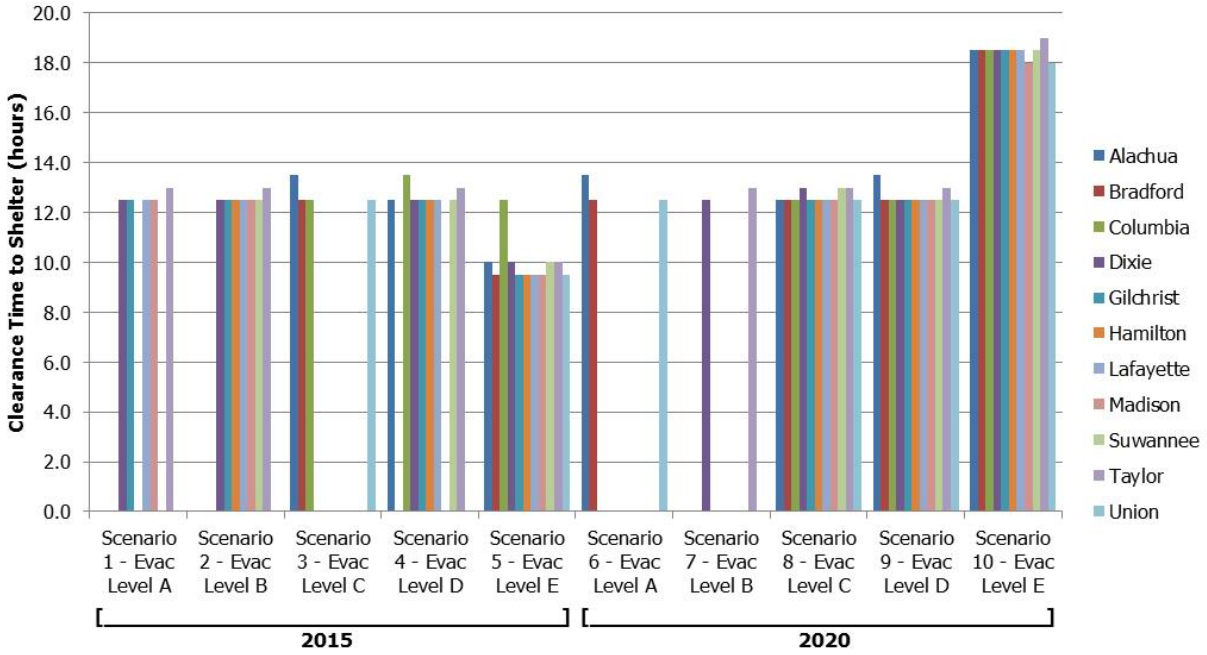


Figure IV-25 - In-County Clearance Times Operational Scenarios

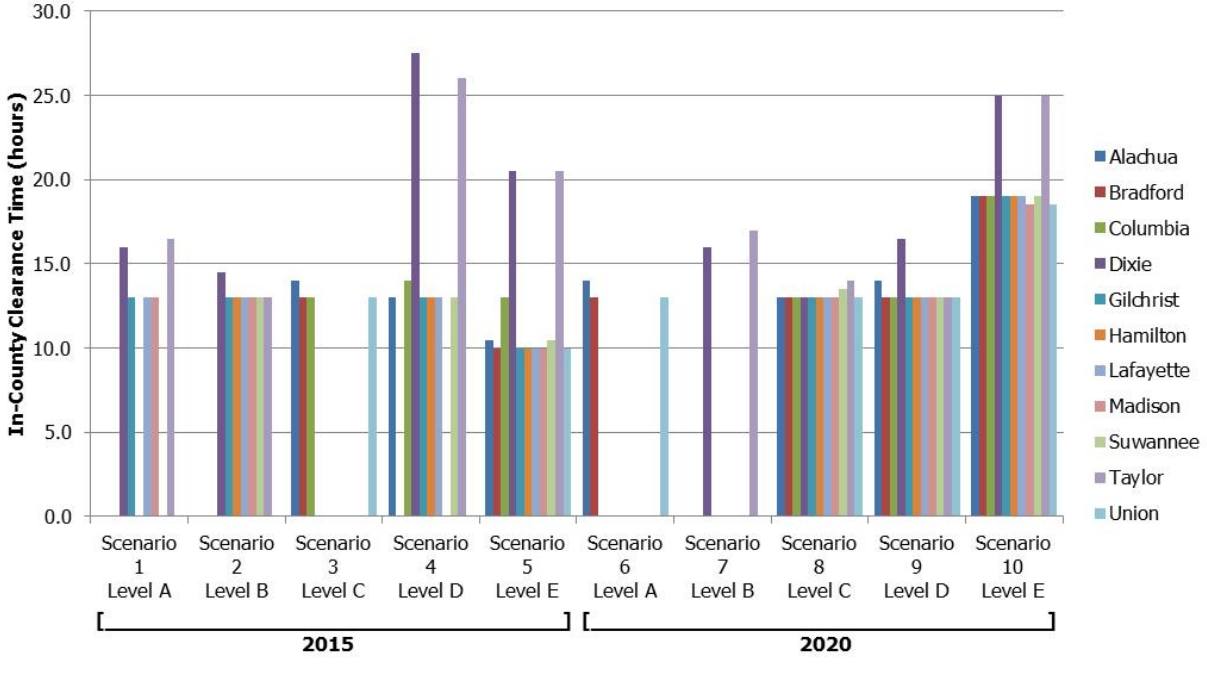
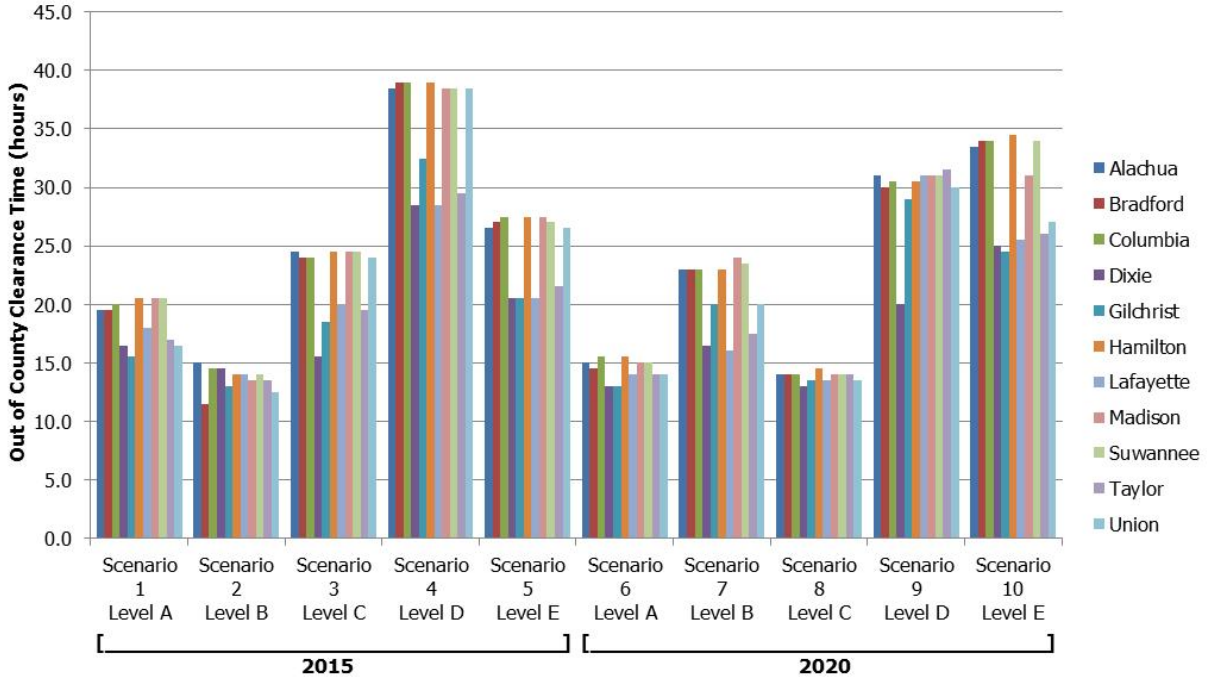


Figure IV-26 - Out of County Clearance Times Operational Scenarios



H. Maximum Evacuating Population Clearances

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

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

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

I. Sensitivity Analysis

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

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

- For low evacuation levels A and B, clearance time will vary by as much as 40 percent depending on the response curve. Low evacuation levels A and B have fewer evacuating vehicles that can be accommodated more easily on the transportation network. In most cases, clearance times typically exceed the response curve by one to two hours. Thus, a 12 hour response curve may yield a clearance time of 13 or 14 hours while an 18 hour response curve may yield a clearance time of 19 or 20 hours. This leads to a higher level of variability than larger evacuations;

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

	Evacuation Level A	Evacuation Level B	Evacuation Level C	Evacuation Level D	Evacuation Level E
Estimated Evacuating Population Clearing Alachua County					
12-Hour	26,557	34,794	54,994	64,473	73,953
18-Hour	30,983	42,043	64,160	75,219	86,279
24-Hour					
36-Hour					
Estimated Evacuating Population Clearing Bradford County					
12-Hour	7,681	8,381	8,757	10,107	10,782
18-Hour	8,641	9,429	10,216	11,791	12,579
24-Hour					
36-Hour					
Estimated Evacuating Population Clearing Columbia County					
12-Hour	23,227	24,940	28,365	30,078	31,791
18-Hour	27,098	29,097	33,093	35,091	37,090
24-Hour					
36-Hour					
Estimated Evacuating Population Clearing Dixie County					
12-Hour	1,280	1,313	1,998	2,871	3,587
18-Hour	1,387	1,422	2,165	3,110	3,886
24-Hour					
36-Hour					
Estimated Evacuating Population Clearing Gilchrist County					
12-Hour	8,660	8,971	9,281	9,592	9,902
18-Hour	9,742	10,092	10,441	10,791	11,140
24-Hour					
36-Hour					
Estimated Evacuating Population Clearing Hamilton County					
12-Hour	5,301	5,556	5,810	6,065	6,320
18-Hour	6,405	6,713	7,021	7,329	7,637
24-Hour					
36-Hour					
Estimated Evacuating Population Clearing Lafayette County					
12-Hour	2,951	2,842	3,018	3,370	3,419
18-Hour	3,197	3,197	3,395	3,791	3,989
24-Hour					
36-Hour					
Estimated Evacuating Population Clearing Madison County					
12-Hour	6,619	7,077	7,536	7,995	8,454
18-Hour	7,722	8,257	8,792	9,328	9,863
24-Hour					
36-Hour					

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 Suwannee County					
12-Hour	20,215	21,118	21,479	22,923	23,827
18-Hour	23,584	24,638	25,059	26,744	27,798
24-Hour					
36-Hour					
Estimated Evacuating Population Clearing Taylor County					
12-Hour	8,053	8,102	9,261	10,722	11,507
18-Hour	9,395	9,452	10,804	12,509	13,904
24-Hour					
36-Hour					
Estimated Evacuating Population Clearing Union County					
12-Hour	4,350	4,653	4,772	5,356	5,648
18-Hour	4,712	5,041	5,369	6,026	6,354
24-Hour					
36-Hour					

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

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

	Evacuation Level A	Evacuation Level B	Evacuation Level C	Evacuation Level D	Evacuation Level E
Estimated Evacuating Population Clearing Alachua County					
12-Hour	26,938	36,552	57,771	65,393	75,007
18-Hour	32,550	44,167	67,399	79,016	90,633
24-Hour					
36-Hour					
Estimated Evacuating Population Clearing Bradford County					
12-Hour	7,612	8,306	9,000	10,387	11,080
18-Hour	8,881	9,690	10,500	12,118	12,927
24-Hour					
36-Hour					
Estimated Evacuating Population Clearing Columbia County					
12-Hour	24,792	26,616	30,264	32,089	33,913
18-Hour	28,924	31,052	35,308	37,437	39,565
24-Hour					
36-Hour					
Estimated Evacuating Population Clearing Dixie County					
12-Hour	1,313	1,346	2,049	2,946	3,680
18-Hour	1,422	1,458	2,220	3,191	3,987
24-Hour					
36-Hour					
Estimated Evacuating Population Clearing Gilchrist County					
12-Hour	9,252	9,584	9,915	10,246	10,577
18-Hour	10,409	10,782	11,154	11,527	11,899
24-Hour					
36-Hour					
Estimated Evacuating Population Clearing Hamilton County					
12-Hour	5,471	5,734	5,997	6,259	6,521
18-Hour	6,611	6,928	7,246	7,563	7,880
24-Hour					
36-Hour					
Estimated Evacuating Population Clearing Lafayette County					
12-Hour	2,980	2,980	3,165	3,536	3,589
18-Hour	3,352	3,352	3,561	3,978	4,187
24-Hour					
36-Hour					
Estimated Evacuating Population Clearing Madison County					
12-Hour	6,648	7,110	7,572	7,757	8,202
18-Hour	7,756	8,295	8,834	9,373	9,911
24-Hour					
36-Hour					

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 Suwannee County					
12-Hour	21,575	22,536	22,921	24,459	25,419
18-Hour	25,171	26,292	26,741	28,535	29,656
24-Hour					
36-Hour					
Estimated Evacuating Population Clearing Taylor County					
12-Hour	8,254	8,305	9,495	10,995	11,802
18-Hour	9,630	9,689	11,077	12,828	14,261
24-Hour					
36-Hour					
Estimated Evacuating Population Clearing Union County					
12-Hour	4,546	4,681	4,985	5,591	5,894
18-Hour	4,925	5,266	5,608	6,290	6,631
24-Hour					
36-Hour					

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

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

J. Summary and Conclusions

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

- Critical transportation facilities within the NCFRPC region include US 19, I-75, I-10, and US 47. For large storm events, such as level D and E evacuations, other State facilities also play an important role in evacuations, such as US 301;

- Given the rural nature of many of the counties within the NCFRPC, many two-lane state and US highways play a major role during the evacuation process. State and County officials should coordinate personnel resources to provide sufficient traffic control at major intersections along these routes;

- NCFRPC counties play a major role even when evacuations occur in other parts of the State, as seen in operational scenarios that assumed either Tampa Bay area storm events or Jacksonville area storm events. For example, evacuation traffic from the Tampa Bay area travels along US 19 in Dixie and Taylor Counties and along I-75 through Alachua, Columbia, Suwannee, and Hamilton Counties. In addition, evacuation traffic from Jacksonville travels along I-10, US 301, and SR 20 in Alachua County. NCFRPC counties should continue their coordination efforts with the State and provide assistance even when NCFRPC counties are not evacuating;

- 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 5-3) to estimate fuel and supply requirements along major evacuation routes to aid motorists during the evacuation process;

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

- The counties within the North Central 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.

North Central Florida Regional Planning Council

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