STATEWIDE REGIONAL EVACUATION STUDY PROGRAM

Volume 1-3

North Central Florida Region Technical Data Report 2015 Update

CHAPTER VI

EVACUATION TRANSPORTATION ANALYSIS 2015 Update

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CHAPTER VI

EVACUATION TRANSPORTATION ANALYSIS

The evacuation transportation analysis discussed in this chapter 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) as in the 2015 North Central Florida Study Update. 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 four 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

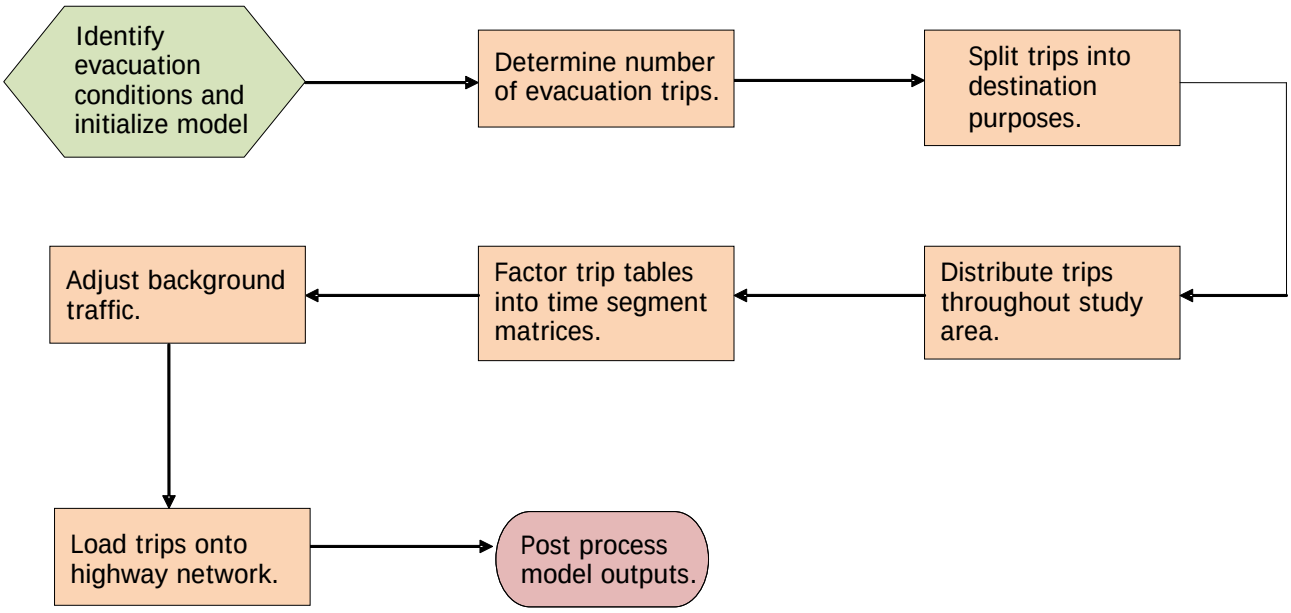
highway network by a model. The model determines the speed at which these trips can move and proceeds to move the evacuation trips accordingly. The result is a set of clearance times.

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 VI-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 VI-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 2015 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 2015 conditions and is referred to as the base model network. **Figure VI-2** identifies the model network and evacuation routes for the TBRPC. County level details of the regional model network are provided in the Volume 5-8 report. The regional model network for the North Central Florida region includes key roadways within the eleven county region, including I-10, I-75, US 301, US 19, US 441, US 41 and US 27.

- **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: 2010, 2015, and 2020. A snapshot of the key demographic data for each county in the North Central Florida RPC for 2010, 2015 and 2020 is summarized in **Table VI-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 VI-2 North Central Florida Regional Model Network

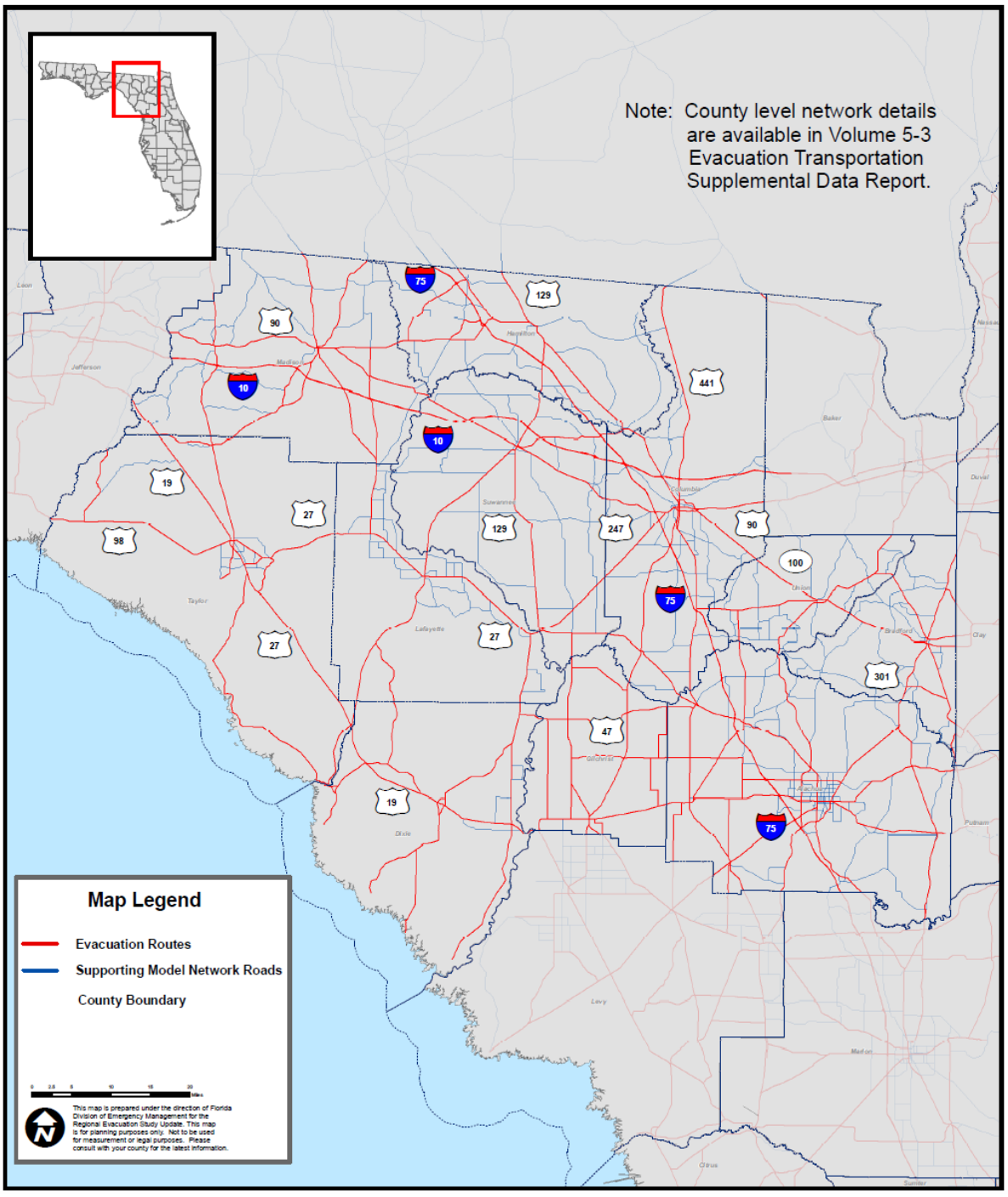
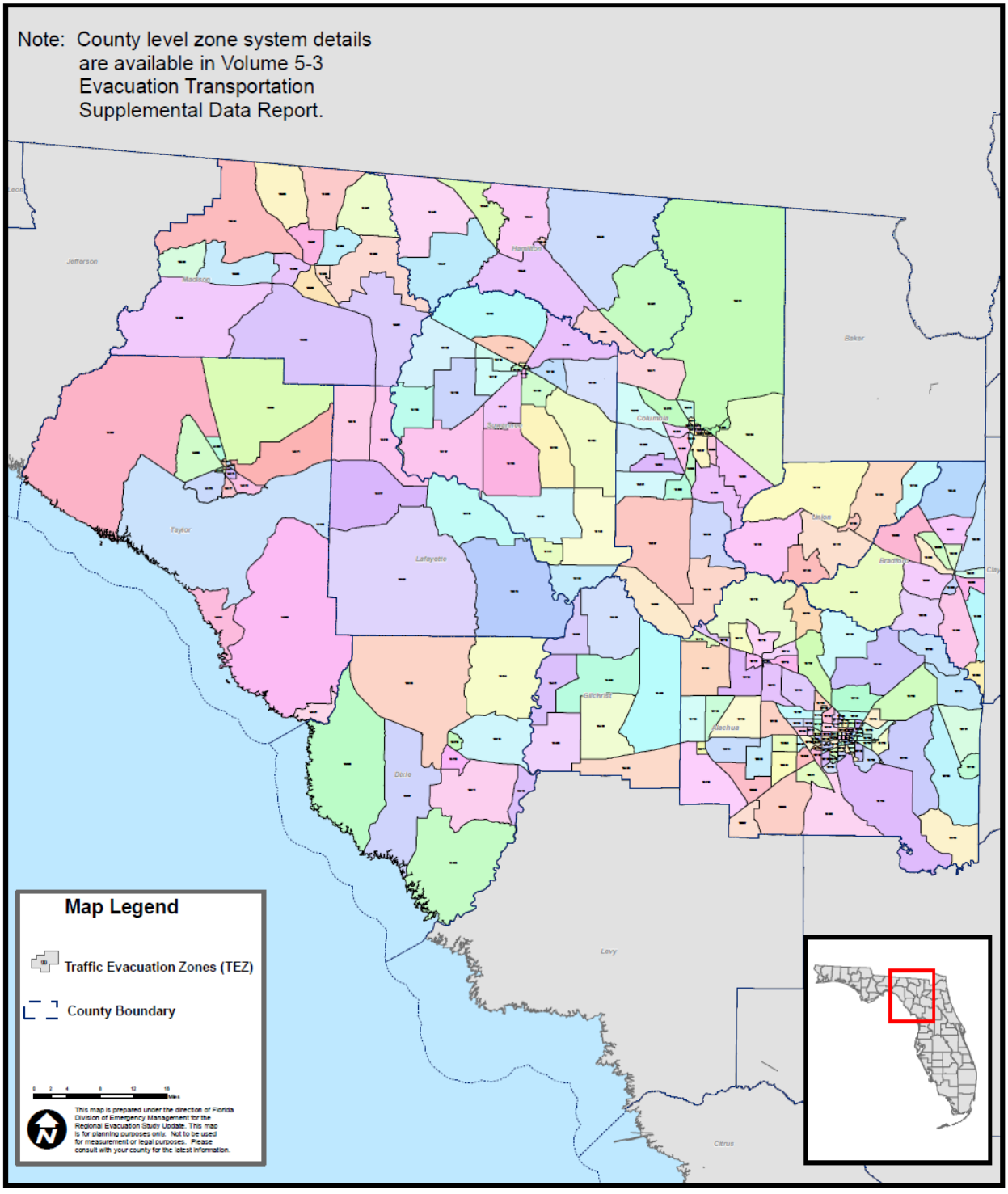


Figure VI-3 North Central Florida Regional Model Traffic Evacuation Zone Map



Alachua County has the largest population in the region during all three time periods.

Table VI-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

County	Characteristic	2010	Year 2015	2020
	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
	Hotel/motel units	492	492	492

County	Characteristic	2010	Year 2015	2020
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

- **Planned Roadway Improvements** - To correspond to the two different sets of demographic data, two model networks were ultimately developed. The base 2015 network was update to include 2020 demographic data and road network.

  The planned roadway improvements that were added to the network generally include only capacity improvement projects such as additional through lanes. **Table VI-2** identifies no improvement projects were completed between 2010 and 2015. Likewise, **Table VI-3** identifies that improvement projects planned for implementation between 2015 and 2020. The tables identify each roadway that will be improved as well as the extent of the improvement.

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

- **Behavioral Assumptions** - For the North Central Florida Region, all eleven 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 VI-4** through **Figure VI-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 5-8.

  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 VI-4 through Figure VI-11.

- 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 that may be available only under site specific scenarios.

- **Evacuation Zones** - The final input variable that is needed to complete the transportation evacuation model is the delineation of evacuation zones for all coastal counties. Local county emergency managers have the responsibility of identifying and defining evacuation zones for their county. All eleven 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 5-8.

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.

Table VI-2 North Central Florida Region Roadway Improvements, 2010-2015

None are scheduled

Table VI-3 North Central Florida Planned Roadway Improvements, 2015-2020

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.
** 10 lanes includes 6 partially controlled lanes w/ 4-lane service roads*

Figure VI-4 Evacuation Participation Rates: Dixie County - Site-Built Homes

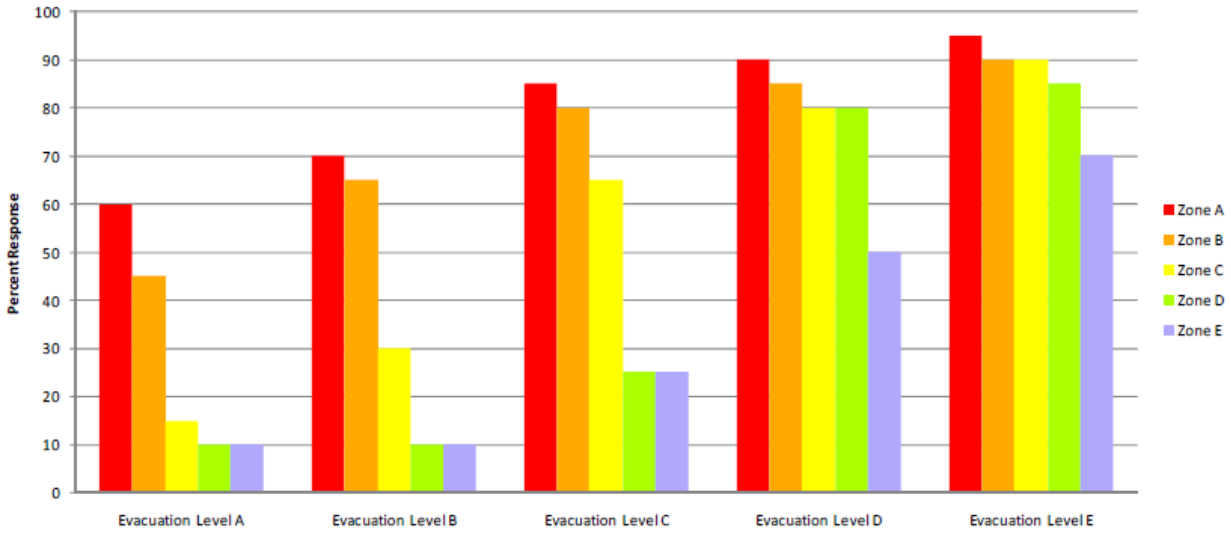


Figure VI-5 Evacuation Participation Rates: Dixie County - Mobile Homes

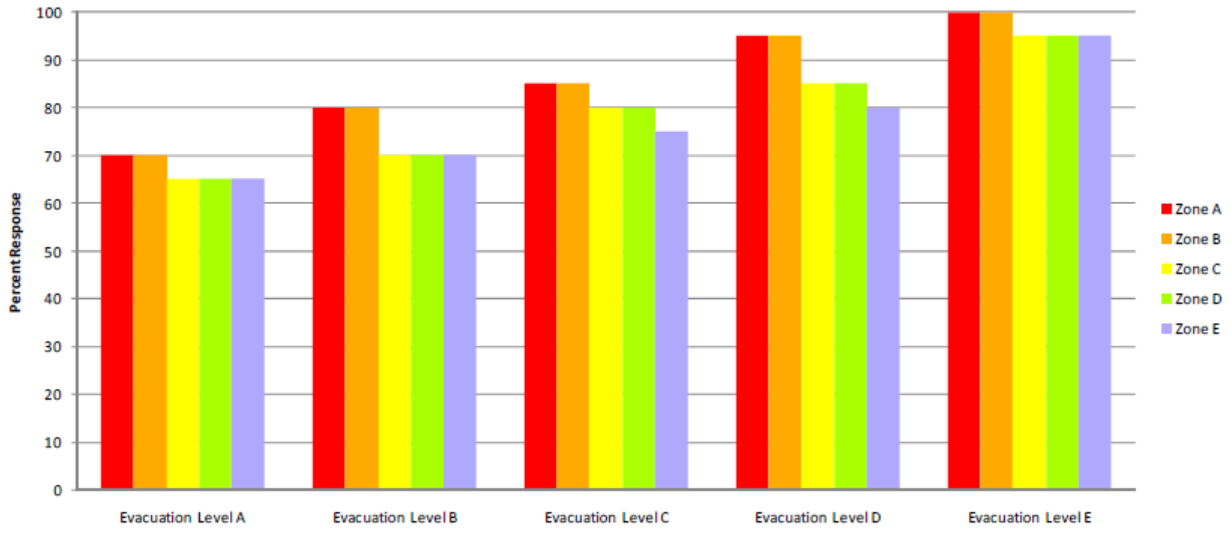


Figure VI-6 Evacuation Participation Rates: Taylor County – Site-Built Homes

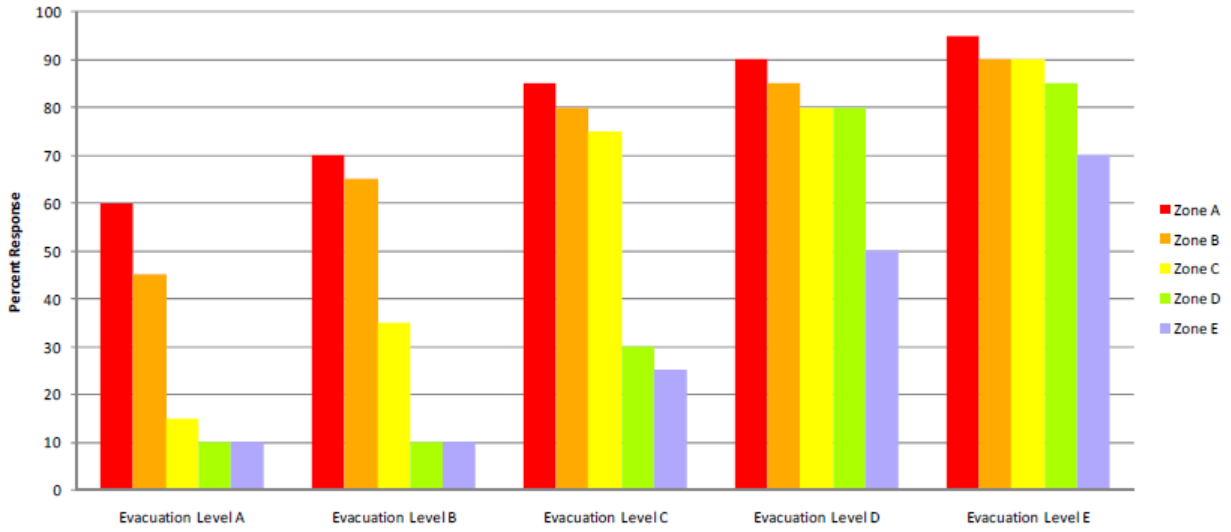
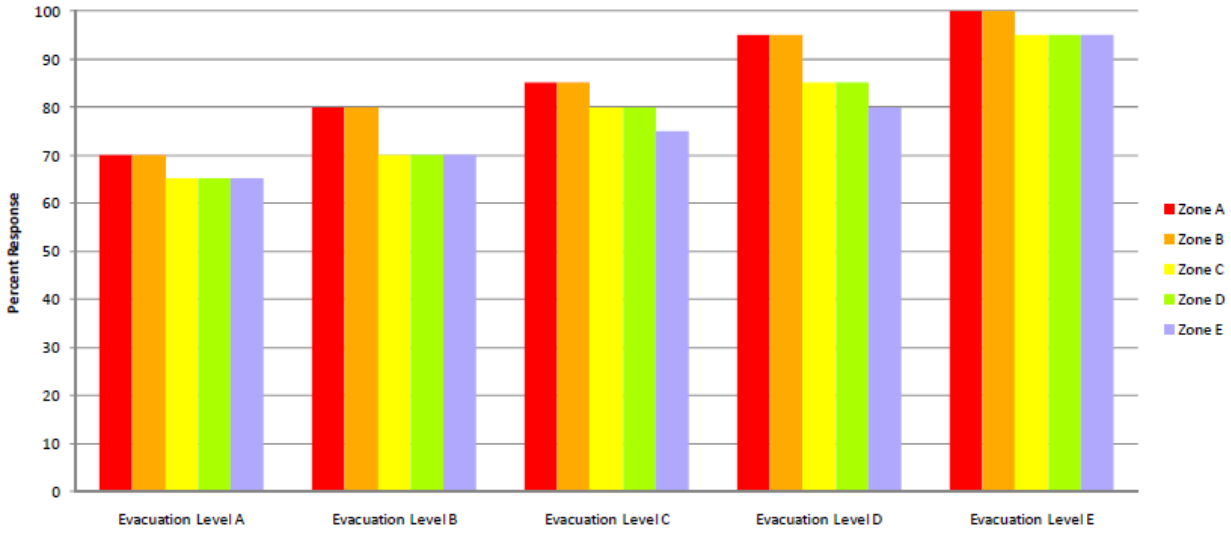


Figure VI-7 Evacuation Participation Rates: Taylor County - Mobile Homes



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

Table VI-4 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 VI-5 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.

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 VI-6** for 2015 and in **Table VI-7** for 2020.

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

Table VI-6 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 VI-7 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 VI-8 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 Florida region are identified in **Table VI-9**; and,

- **Operational Scenarios** – The operational scenarios were developed by the RPCs in coordination with local county emergency managers and are designed to provide important information to emergency management personnel to plan for different storm events. These scenarios are different from region to region and vary for each evacuation level. The operational scenarios for the North Central Florida region are identified in **Table VI-10**.

Because of the numerous possible combinations of variables that can be applied in the model, the evacuation transportation model is available for use through the 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 VI-9 Base Scenarios

	Scenario 1 Level A 2020	Scenario 2 Level B 2020	Scenario 3 Level C 2020	Scenario 4 Level D 2020	Scenario 5 Level E 2020
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 VI-10 Operational Scenarios

	Scenario 1 Level A 2020	Scenario 2 Level B 2020	Scenario 3 Level C 2020	Scenario 4 Level D 2020	Scenario 5 Level E 2020
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 VI-10 Operational Scenarios (Continued)

	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)

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.

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

Base Scenarios

In-county clearance times for the base scenarios range from 13 hours to 14.5 hours depending upon the evacuation level. Clearance Time to Shelter varies a little more, with clearance times for the base scenarios ranging from 12.5 hours to 13 hours.

Out of county clearance times for the 2015 base scenarios range from 13 hours to 14.5 hours, depending on the scenario. 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 is estimated to be for base scenarios for both 2020 and 2015 as 14.5 and 14 hours.

Operational Scenarios

In-county clearance times for the 2015 operational scenarios range from 0 hours to 27.5 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 13 hours depending upon the county and the scenario.

In 2020, in-county clearance times for the operational scenarios vary from 0 hours to 26 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 2020 scenarios, with clearance times for the base scenarios ranging from 0 hours to 25 hours depending upon the scenario.

Out of county clearance times for the 2020 operational scenarios range from 13 hours to 34 hours for the evacuation level D scenario. Regional clearance time for the eleven county NCFRPC region ranges from 15 hours to 39 hours in 2015. This time changes to between 14.5 and 34.5 hours in 2020. Different scenarios were selected for 2015 and 2020 so a direct comparison does not apply.

Table VI-11 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 VI-12 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 VI-13 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 VI-14 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 2015 is identified in **Table VI-15** and for 2020 in **Table VI-16**.

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

K. Sensitivity Analysis

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

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

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

Table VI-15 Maximum Evacuating Population by Time Interval for 2015

	Evacuation Level A	Evacuation Level B	Evacuation Level C	Evacuation Level D	Evacuation Level E
Estimated Evacuating Population Clearing 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

	Evacuation Level A	Evacuation Level B	Evacuation Level C	Evacuation Level D	Evacuation Level E
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					
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 VI-16 Maximum Evacuating Population by Time Interval for 2020

	Evacuation Level A	Evacuation Level B	Evacuation Level C	Evacuation Level D	Evacuation Level E
Estimated Evacuating Population Clearing 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

	Evacuation Level A	Evacuation Level B	Evacuation Level C	Evacuation Level D	Evacuation Level E
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					
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 North Central Florida area storm events or Jacksonville area storm events. For example,

evacuation traffic from the North Central Florida 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.