# 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 East Central Florida Region, the regional model network includes the seven counties within the East Central Florida Regional Council area plus 17 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 East Central Florida Region. It is important to note that the input data discussed in this chapter is included only for the counties within the East Central Florida RPC, as these are the counties that the East Central Florida RPC has direct responsibility for the data. Data for the adjacent counties included in the East 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 RC designated evacuation routes as well as a supporting roadway network that facilitates movement of evacuation traffic. The 2005 Florida Department of Transportation (FDOT) Statewide Model Network (the latest model available) was used as a basis for developing the regional model network, while the evacuation routes were obtained from the East 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 2017 conditions and is referred to as the base model network. **Figure III-2** identifies the model network and evacuation routes for the ECFRPC. County level details of the regional model network are provided in the Volume 5 report. The regional model network for the East Central Florida region includes key roadways within the seven county region, including I-95, I-4, Florida's Turnpike, US 441, US 27, US 192, SR 50, SR 528, SR 44, SR 40, SR 46, and SR 520.

# Figure III-1

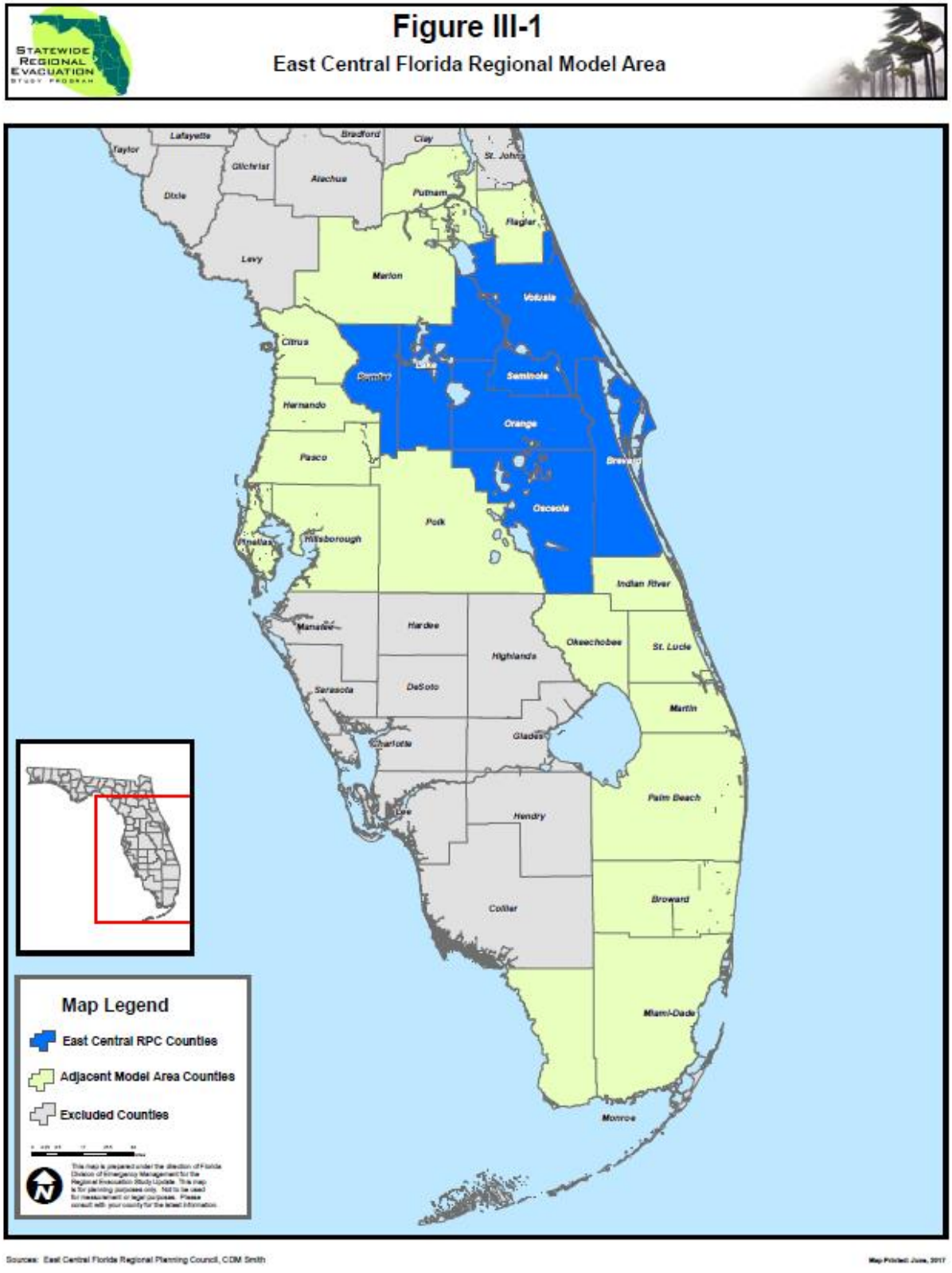


Figure III-1
East Central Florida Regional Model Area
Taylor
Lafayette
Bradford
Clay
St. Johns
Gilchrist
Alachua
Dixie
Putnam
Flagler
Levy
Marion
Volusia
Citrus
Sumter
Lake
Seminole
Hernando
Orange
Pasco
Brevard
Osceola
Polk
Pinellas
Hillsborough
Indian River
Manatee
Hardee
Okeechobee
St. Lucie
Highlands
Sarasota
DeSoto
Martin
Charlotte
Glades
Palm Beach
Lee
Hendry
Broward
Collier
Miami-Dade
Monroe
Map Legend
East Central RPC Counties
Adjacent Model Area Counties
Excluded Counties
Sources: East Central Florida Regional Planning Council, CDM Smith

# Figure III-2

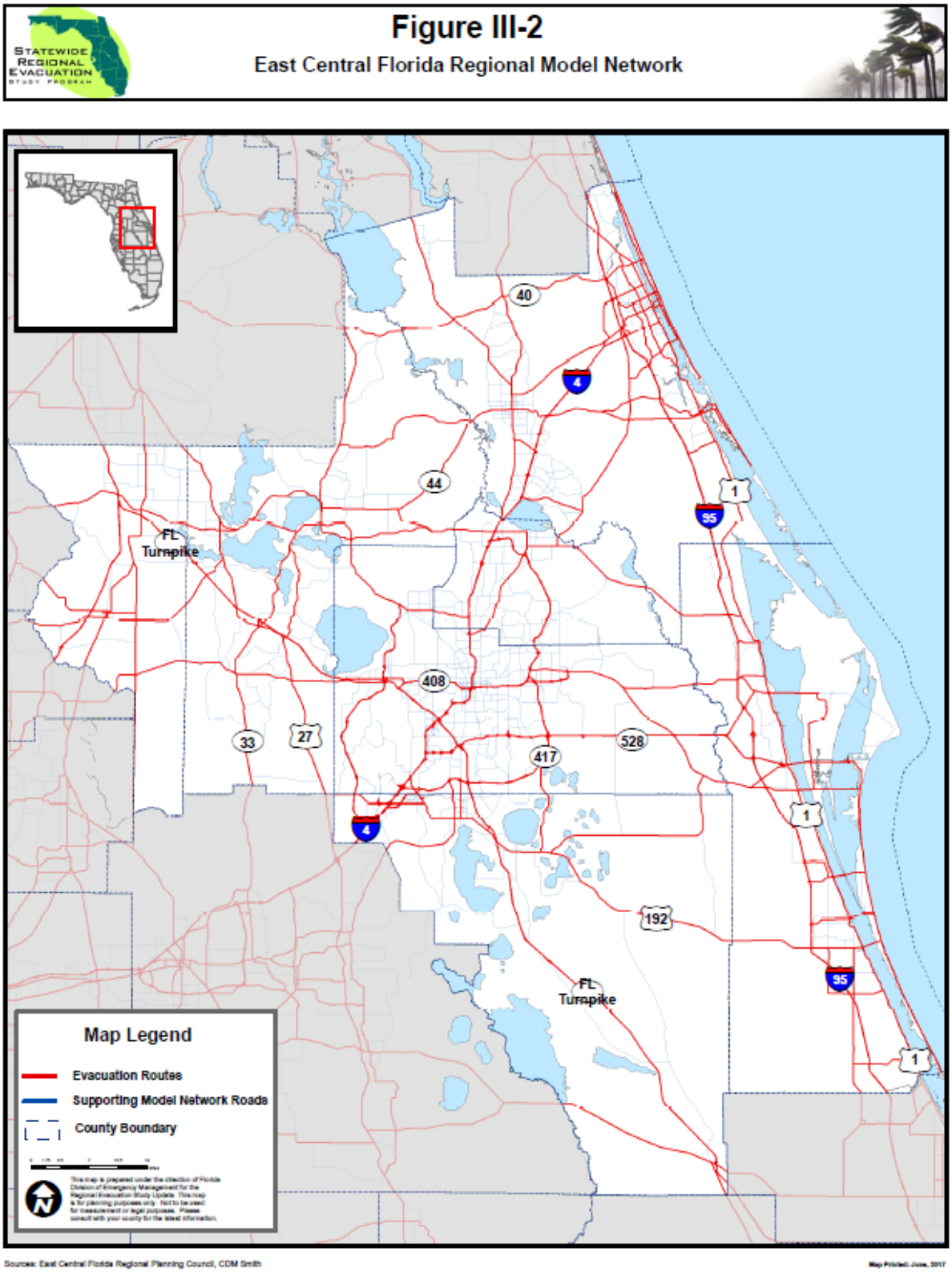


Figure III-2
East Central Florida Regional Model Network
40
4
44
1
95
FL Turnpike
408
33
27
417
528
192
Map Legend
Evacuation Routes
Supporting Model Network Roads
County Boundary
Sources: East Central Florida Regional Planning Council, CDM Smith

## 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 RC. Each traffic evacuation zone has a unique identification number that is used by the model to connect evacuation trip generation to the evacuation highway network. There is a buffer in zone numbering between counties to allow for future growth in each county.

The final TEZ system for the State of Florida has 8,829 zones. Of the total number of zones in Florida, 1,455 of the zones are located within the seven-county East Central Florida region, as illustrated in **Figure III-3**. In the East Central Florida region, Volusia County has the largest number of TEZs with 482, and Orange County follows with 316 TEZs. Seminole and Sumter Counties have the lowest number of TEZs within the RPC with 91 and 60 TEZs, respectively. The larger number of TEZs generally reflects counties with denser urban form and higher population densities. The number of TEZs for each county in the region is listed below:

- Brevard – 300
- Lake – 108
- Orange – 316
- Osceola – 98
- Seminole – 91
- Sumter – 60
- Volusia – 482

## Figure III-3

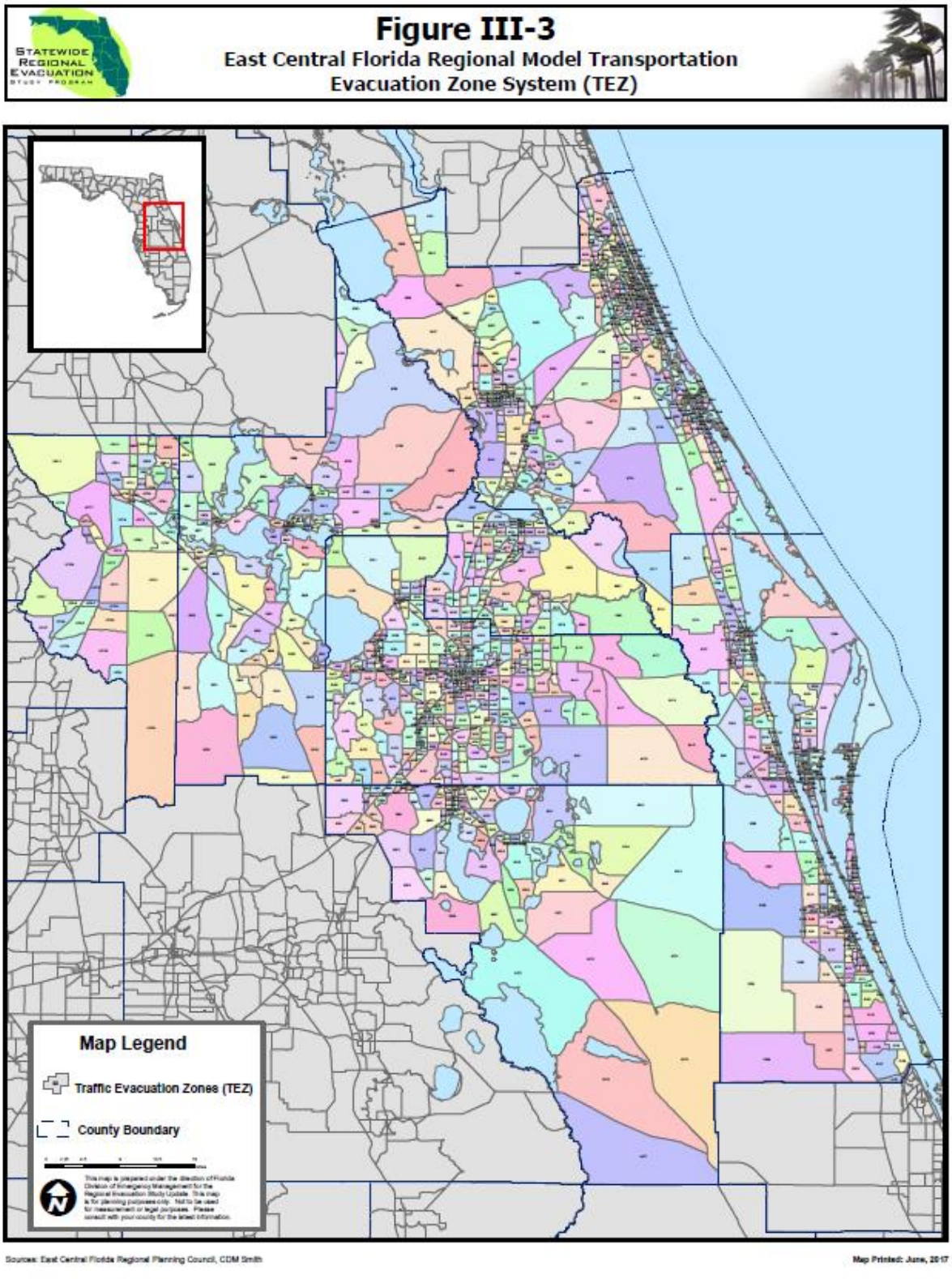


Figure III-3
East Central Florida Regional Model Transportation
Evacuation Zone System (TEZ)
Map Legend
Traffic Evacuation Zones (TEZ)
County Boundary

## C. Regional Demographic Characteristics

As discussed in Chapter II, the evacuation model uses the demographic information as input for generating a set of evacuation trips. The demographic data were developed for the following years: 2010, 2015, and 2020.

A snapshot of the key demographic data for each county in the East Central Florida RPC for 2015 and 2020 is summarized in **Table III-1**. The tables list the number of occupied dwelling units for site built homes, the permanent population in site-built homes, as well as the number of occupied dwelling units for mobile homes and the permanent population in mobile homes. The mobile home category includes RVs and boats and the permanent population in those housing options. The demographic characteristics summary also includes hotels and motels because many of these units are in vulnerable areas and the proportion of seasonal units and hotel/motel units that are occupied at any point in time will have an important impact on the total population that may participate in an evacuation. Detailed demographic data for each individual TEZ within the region is included in Volume 5.

Orange County has the largest population in the region during both time periods. The county is expected to reach over 1.88 million people by 2020. Brevard County has the second largest population for all years and is expected to exceed 831,000 people by 2020. The county with the lowest population in the region is Sumter County, which is projected to have 501,725 people in 2020. Between 2015 and 2020, Brevard, Seminole, and Volusia Counties are also projected to experience the smallest rates of growth. All three counties are estimated to increase by 4%. In contrast, Lake and Osceola Counties are expected to each grow by 11% between 2015 and 2020. Sumter County has just over 130,000 and is expected to grow by almost 50%.

Lake County has the highest number of mobile homes for both time periods. Although Lake County has the most mobile homes, the homes only represent a little more than 5.4% of the total occupied homes. Seminole County has the lowest number of mobile homes. The mobile homes in Seminole County account for .008% of total occupied homes.

## Table III-1 – East Central Florida Demographic Characteristic Summary

| County | Characteristic | Year | |
|---|---|---|---|
| | | 2015 | 2020 |
| Brevard | Occupied site-built homes | 217,097 | 227,868 |
| | Population in site-built homes | 524,363 | 542,997 |
| | Occupied mobile homes | 18,383 | 18,383 |
| | Population in mobile homes | 35,254 | 35,254 |
| | Hotel/motel units | 4,013 | 4,763 |
| | **TOTAL** | **801,125** | **831,284** |
| Lake | Occupied site-built homes | 104,344 | 117,518 |
| | Population in site-built homes | 268,954 | 308,897 |
| | Occupied mobile homes | 24,109 | 24,109 |
| | Population in mobile homes | 49,777 | 49,777 |
| | Hotel/motel units | 1,424 | 1,424 |
| | **TOTAL** | **448,608** | **501,725** |
| Orange | Occupied site-built homes | 419,659 | 459,539 |
| | Population in site-built homes | 1,114,688 | 1,220,997 |
| | Occupied mobile homes | 18,628 | 18,626 |
| | Population in mobile homes | 43,679 | 43,678 |
| | Hotel/motel units | 125,599 | 138,385 |
| | **TOTAL** | **1,722,253** | **1,881,225** |
| Osceola | Occupied site-built homes | 106,730 | 121,500 |
| | Population in site-built homes | 318,419 | 361,246 |
| | Occupied mobile homes | 10,272 | 10,262 |
| | Population in mobile homes | 23,206 | 23,188 |
| | Hotel/motel units | 42,865 | 49,139 |
| | **TOTAL** | **501,492** | **565,335** |
| Seminole | Occupied site-built homes | 162,788 | 169,432 |
| | Population in site-built homes | 419,665 | 437,790 |
| | Occupied mobile homes | 4,823 | 4,821 |
| | Population in mobile homes | 9,359 | 9,353 |
| | Hotel/motel units | 6,076 | 6,432 |
| | **TOTAL** | **602,711** | **627,828** |
| Sumter | Occupied site-built homes | 40,875 | 48,748 |
| | Population in site-built homes | 83,212 | 99,236 |
| | Occupied mobile homes | 8,271 | 9,867 |
| | Population in mobile homes | 17,160 | 20,475 |
| | Hotel/motel units | 1,784 | 1,819 |
| | **TOTAL** | **151,302** | **180,145** |
| Volusia | Occupied site-built homes | 193,280 | 201,353 |
| | Population in site-built homes | 469,977 | 492,792 |
| | Occupied mobile homes | 19,591 | 19,591 |
| | Population in mobile homes | 37,726 | 37,726 |
| | Hotel/motel units | 8,290 | 8,290 |
| | **TOTAL** | **728,864** | **759,752** |

*Source: East Central Florida Regional Council*

## D. Planned Roadway Improvements

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

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

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

## Table III-2 – East Central Florida Region Roadway Improvements, 2015

| County | Roadway | From | To | Number of Lanes |
|---|---|---|---|---|
| Brevard | Barnes Blvd | Murrell Rd | Fiske Blvd (SR 519) | 4 |
| | SR 5 (US 1) | Pine St | Cidco Rd | 6 |
| | I-95 | S. of SR 528 | Port St. John | 6 |
| | I-95 | S. of SR 514 (Malabar) | Palm Bay Rd | 6 |
| Lake | SR 50 | W. of Hancock Rd | Turnpike Ramps | 6 |
| Orange | SR 50 | W. of Hancock Rd | Turnpike Ramps | 6 |
| | SR 530/US 192 | Lake County Line | Osceola County Line | 6 |
| | SR 50 | E. Ramps Turnpike | Avalon Rd. | 6 |
| | SR 528 | I-4 | Florida's Turnpike | 6 |
| | Florida Turnpike | SR 50 | Beulah Rd | 8 |
| Sumter | SR 35 (US 301) | N of CR 466A | CR 214 | 4 |
| | CR 468 | CR 466A | CR 466 | 4 |
| | Turnpike | @CR 468 | | New Interchange |
| Volusia | SR 415 | Reed Ellis Rd | Acorn Lake Rd | 4 |
| | LPGA Blvd | Jimmy Ann Dr. | E. of Derbyshire Rd | 4 |

***Sources: FDOT SIS First Five Year Plan, FDOT SIS Second Five Year Plan, East Central Florida Regional Planning Council***

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

## Table III-3 – East Central Florida Planned Roadway Improvements, 2020

| County | Roadway | From | To | Number of Lanes |
|---|---|---|---|---|
| **Lake** | SR 25 (US 27) | N of Boggy Marsh Rd | N of Lake Louisa Rd | 6 |
| **Orange** | SR 417 | University Blvd | Michelle hammock Rd | 6 |
| | I-4 | S of US 441 (OBT) | S of Ivanhoe Blvd | 10 |
| | Florida's Turnpike | Osceola County Line | Beachline (SR 528) | 8 |
| | Beachline (SR 528) | MP 4 | MP 8.421 | 8 |
| | I-4 | Kirkman Rd | North County Line | 10 to 14 |
| **Osceola** | Florida's Turnpike | S. of Osceola Pkwy | Osceola County Line | 8 |
| **Sumter** | | | | |
| **Seminole** | SR 429 (Wekiva Pkwy) | Orange Blvd | W. of I-4 | 8 |
| | SR 46 (Wekiva Pkwy) | W. of Center Rd | I-4 | 8 |
| | Seminole Expwy | Aloma Ave | SR 434 | 6 |
| | I-4 | South County Line | SR 434 | 10 to 14 |

***Sources: FDOT SIS First Five Year Plan, FDOT SIS Second Five Year Plan, East Central Florida Regional Planning Council***

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

## E. Behavioral Assumptions

The behavioral assumptions provide important information on the way people respond to an evacuation order and are an important input to the SRESP transportation evacuation model. For the East Central Florida Region, evacuation rates for site-built homes and mobile/manufactured homes are provided by county and summarized in **Figure III-4** through **Figure III-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 5-4.

A review of the evacuation rates for the East 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-7.

For example, if an evacuation order was issued for Brevard 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 a 75 percent participation rate from persons living in mobile/manufactured homes in evacuation zone A (Figure III-5). In addition, Brevard County can expect shadow evacuations to occur for persons living in site-built homes at a rate of 55 percent from evacuation zone B, 35 percent from evacuation zone C, 25 percent from evacuation zone D, and 15 percent from zone E (Figure III-4). Likewise, for persons living in mobile/manufactured homes, Brevard County can expect shadow evacuations to occur at a rate of 75 percent from evacuation zone B and 70 percent from zone C/D/E (Figure III-5).

Please note that the original behavioral response rates provided by SRESP in Volume 2 were modified to fit the evacuation zones created by Brevard and Volusia Counties. The original rates were based on a five zone system.

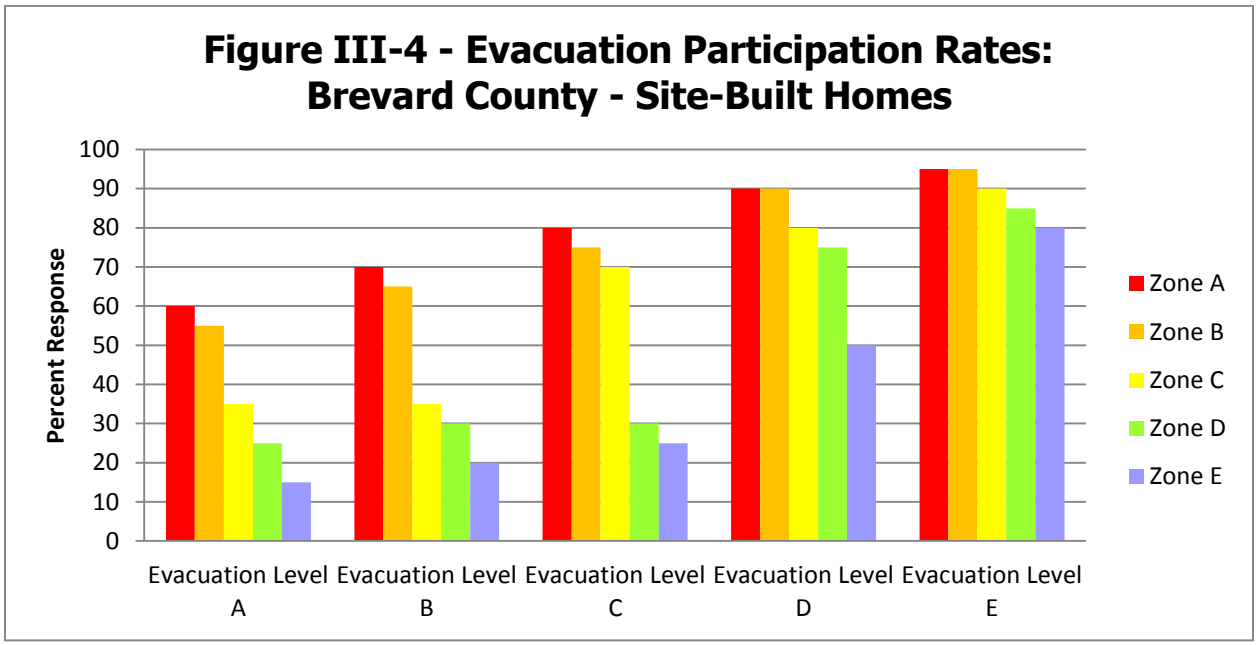


Figure III-4 - Evacuation Participation Rates:
Brevard County - Site-Built Homes
Percent Response
100
90
80
70
60
50
40
30
20
10
0
Evacuation Level A
Evacuation Level B
Evacuation Level C
Evacuation Level D
Evacuation Level E
Zone A
Zone B
Zone C
Zone D
Zone E

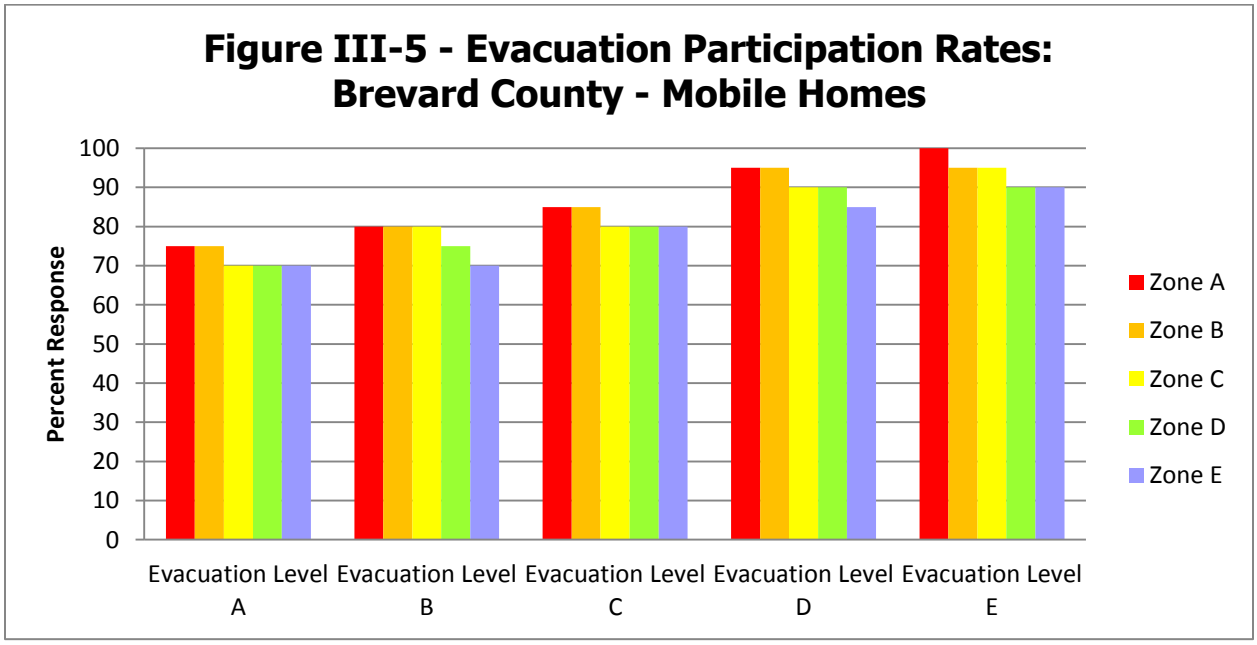


Figure III-5 - Evacuation Participation Rates:
Brevard County - Mobile Homes
Percent Response
100
90
80
70
60
50
40
30
20
10
0
Evacuation Level A
Evacuation Level B
Evacuation Level C
Evacuation Level D
Evacuation Level E
Zone A
Zone B
Zone C
Zone D
Zone E

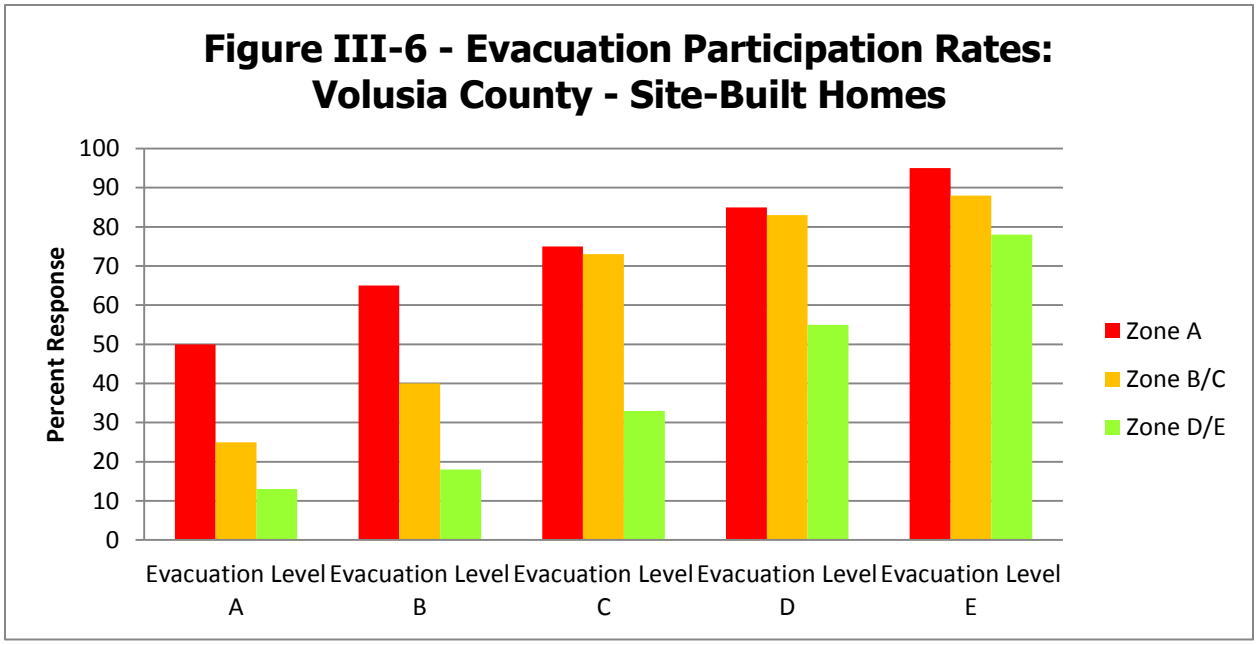


Figure III-6 - Evacuation Participation Rates:
Volusia County - Site-Built Homes
Percent Response
100
90
80
70
60
50
40
30
20
10
0
Evacuation Level A
Evacuation Level B
Evacuation Level C
Evacuation Level D
Evacuation Level E
Zone A
Zone B/C
Zone D/E

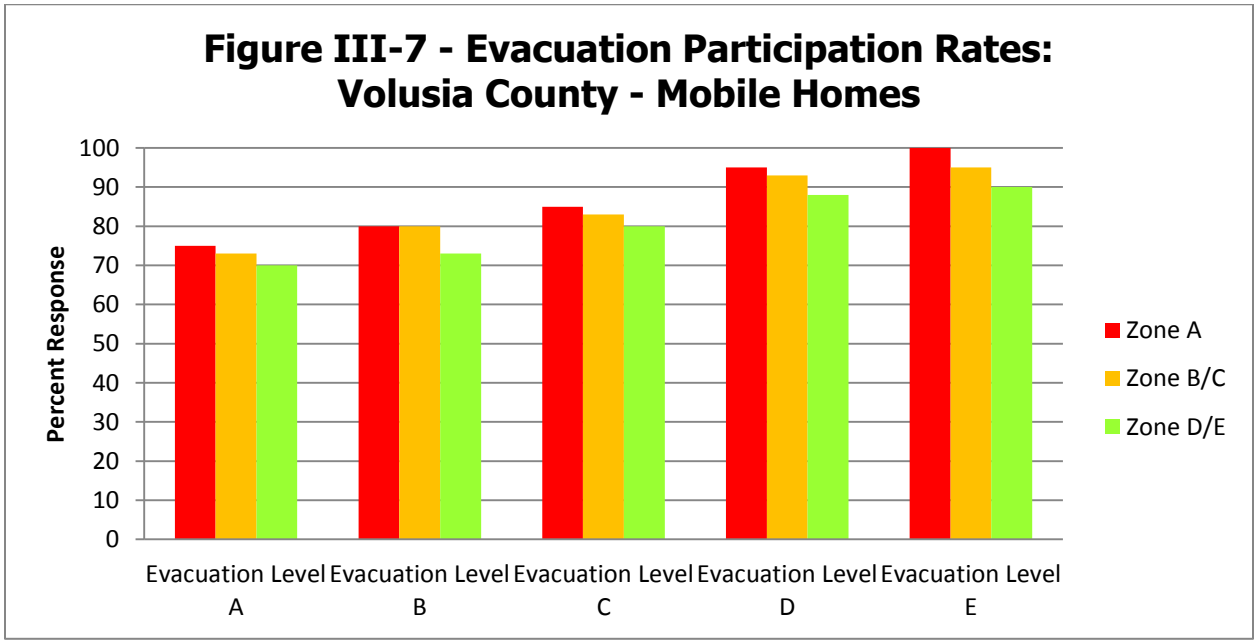


Figure III-7 - Evacuation Participation Rates:
Volusia County - Mobile Homes
Percent Response
100
90
80
70
60
50
40
30
20
10
0
Evacuation Level A
Evacuation Level B
Evacuation Level C
Evacuation Level D
Evacuation Level E
Zone A
Zone B/C
Zone D/E

## 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 East 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 seven-county region, there are a total of 385 primary and other shelters. The number of primary and other shelters in each county in the region is listed below:

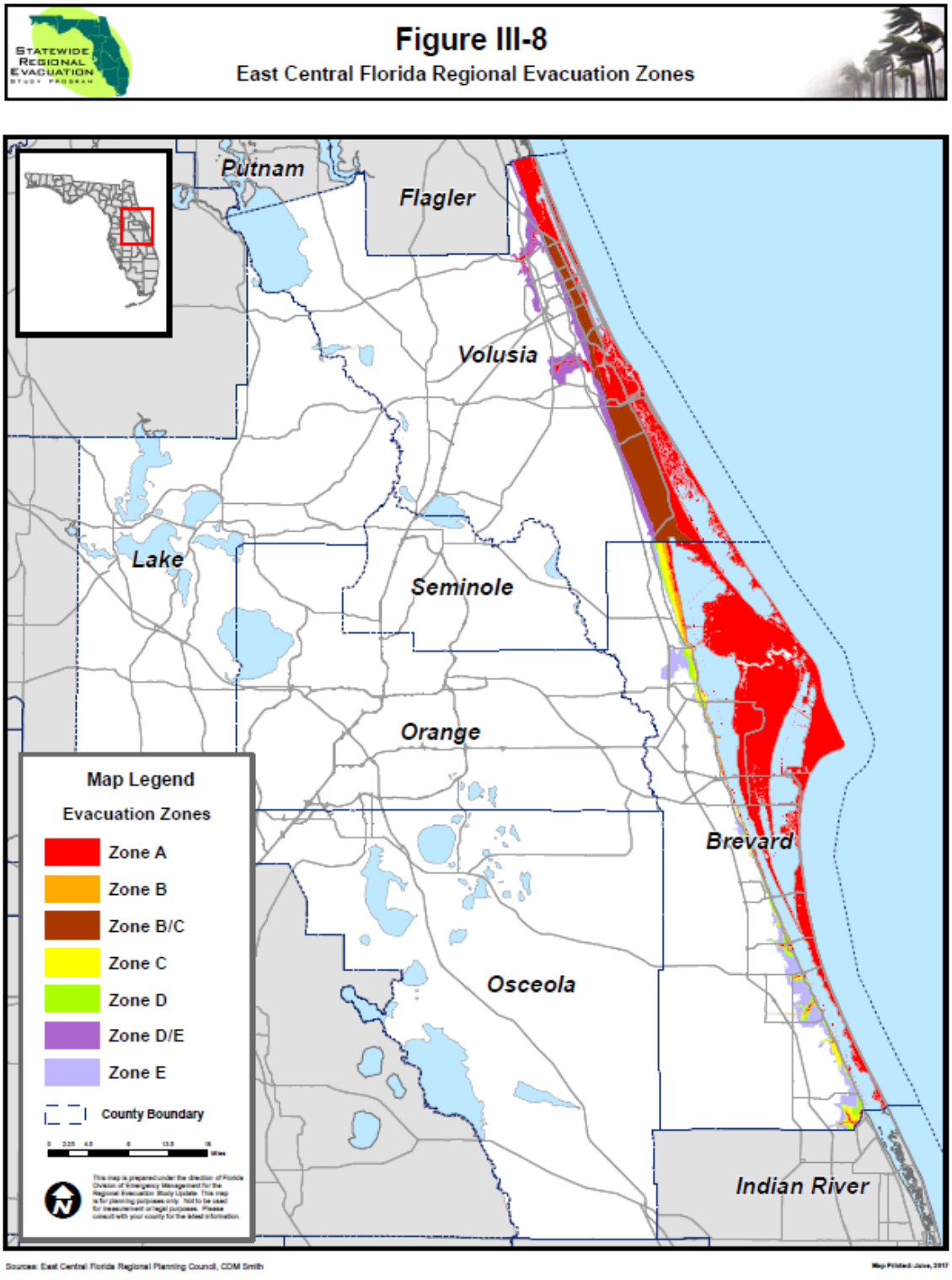
- Brevard – 37
- Lake – 26
- Orange – 145
- Osceola – 50
- Seminole – 62
- Sumter - 22
- Volusia – 43

All together, the 385 shelters located within the seven-county region can host more than 122,364 persons during an evacuation event. Detailed lists of the available public shelters by county are included in Volume 5-4.

## G. Evacuation Zones

The final input variable that is needed to complete the transportation evacuation model is the delineation of evacuation zones for all coastal counties. Local county emergency managers have the responsibility of identifying and defining evacuation zones for their county. Within the East Central Florida region, Volusia updated their evacuation zones based on the results of the new data and information collected as part of the SRESP in 2017 and included a D/E zone. Some counties added an additional F zone, as discussed previously. Evacuation zones for the East Central Florida Region are illustrated in **Figure III-8**. County level evacuation zone maps are also included in Volume 5-4.

## Figure III-8 – Regional Evacuation Zone Map



## H. TIME User Interface

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

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

- **Analysis time period -** The first input variable is the evacuation analysis time period. The time period selections include 2010, 2015 and 2020. The time period determines which set of demographic data and which version of the model network will be used.

- **Highway network -** Once the time period is selected, the user must pick either the default highway network or a modified network. The default includes the network corresponding to the selected time period and also incorporates planned highway improvement projects from the Florida Department of Transportation Work Program. In the case that there are any new projects or changes need to be taken into account, the modified network would be chosen. These changes could include possible road or bridge closures because of storm conditions or any managed traffic diversions or traffic control measures.

- **Behavioral response -** The next variable is behavioral response, which is a set of "planning assumptions" that describe the way people respond to an order to evacuate and are an important input to the SRESP Evacuation Model. A user may choose 100% or the survey response. The 100% response indicates that 100% of people in evacuation zones will evacuate, while the survey response uses the percentage of people from the behavioral planning assumptions corresponding to the evacuation level for each county.

- **One-way evacuation operations -** Another variable for consideration is whether to allow one-way evacuation operations or not. One-way evacuation operations take into account the FDOT one-way evacuation operations plans for major facilities, including I-95, I-75 northbound from Tampa, and I-4.

- **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 East 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 East Central Florida's model network and include both coastal and inland counties. The coastal counties in Florida include Nassau, Duval, Flagler, St. Johns, Volusia, and Brevard Counties; Georgia coastal counties include Camden and Glynn. The inland counties in Florida are Baker, Clay, Putnam, Madison, Suwannee, Lafayette, Columbia, Union, Bradford, Alachua, Marion, Lake, Seminole, Sumter, Orange, and Osceola Counties. The inland counties in Georgia are Brantley, Charlton, Ware, Clinch, Echols, and Lowndes Counties. The user has the opportunity to pick which of the counties in the network actually evacuate.

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

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

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

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