

SCOPE OF WORK

CITY OF CAPE CORAL HURRICANE EVACUATION STUDY

I. SCOPE OF WORK - STUDY PURPOSE

The purpose of this project is the development of a City of Cape Coral Hurricane Evacuation Study. Cape Coral is and will be at buildout the largest City between Tampa and Miami. A Category 3 hurricane threat would require a large portion of the City to evacuate. The total amount of time to evacuate all the residents in the City must be under an established time to ensure safe evacuation out of the storm surge vulnerable areas during a major hurricane. Such a major hurricane threat would also require many other areas in Lee County and other south Florida counties to evacuate. Such scenarios create hundreds of thousands of trips on area regional hurricane evacuation roadways. A primary purpose of the study is to determine if regional roadway improvements can maintain or reduce the out of city, county and regional evacuation times.

The evacuation study will consist of a Demographic and Land Use Analysis, a Hazard Analysis for hurricane storm surge, a review of the Behavioral Analysis being done as part of the current ongoing Statewide Regional Evacuation Study as well as collecting Cape Coral specific survey data, Shelter Analysis and, City and County/Regional Evacuation Transportation Networks, Evacuation and Population Vulnerability Analysis, and a Transportation Analysis. The study will delineate the storm tide limits and the evacuation zones, identification of population-at-risk and evacuation populations, storm surge analysis of selected critical facilities and the evacuation transportation analysis. The Southwest Florida Regional Evacuation Study that is currently being updated can be used as a guide for the City specific Evacuation Study. Products will include printed documents and digital data, including GIS products.

A. DEMOGRAPHIC/SOCIO-ECONOMIC PROFILE AND LAND USE ANALYSIS

1. Demographic projections and socio-economic profiles shall be developed for the City (with vulnerable zone generally comparisons) to support overall evacuation analysis. Use best available data to determine the following.
 - a) EDR/BEBR Age distribution, 2020 and City Buildout or 2045
 - b) EDR/BEBR Race/ethnic distribution, 2020 and City Buildout or 2045
 - Elderly living alone
 - Speaks English less than “very well”
 - Population below poverty level
 - Households with no vehicles
 - Housing units by vacancy status, including seasonal
 - Disability Trends
 - c) Product will be in a digital format.
2. Small area dwelling unit and population data shall be developed for the City to support traffic modeling. The data shall be based on Traffic Analysis Zones (TAZ) and shall be used. Data will include:

- a) 2020 number of dwelling units by type (single-family, multi-family and mobile home), by occupancy status
 - b) 2020 number of people for each type of occupied dwelling unit
 - c) 2020 number of people in group quarters
 - d) 2020 estimates of licensed hotels/motels, by type, with number of rooms (available from DBPR);
 - e) 2020 number of vehicles for each type of occupied dwelling unit
 - f) Buildout estimates or 2045 for each of the above, making use of City planning data, Lee MPO transportation models, and DBPR licenses for mobile home/RV parks, hotels/motels, by type, with number of rooms and other sources;
3. Land Use Analysis - Provide a description of the City Land Use. Based on consistent and generalized land use categories, provide a future land use map for the City.

B. HAZARDS ANALYSIS FOR HURRICANE STORM SURGE

1. The hurricane storm surge hazards analysis will use the most current Sea, Lake and Overland Surges from Hurricane (SLOSH) model to identify the potential storm surge threat to the entire City, and shall include investigations of
 - a. History of hurricane activity in the region;
 - b. Local and out of city regional roadway flooding by freshwater flooding based on 100- and 500- year flood plains and local historic hurricane storm surge information;
 - c. Hazardous sites, i.e., 302 sites, etc., as listed in HMIS; propane storage facilities, natural gas pipeline terminals, fuel storage facilities, tank farms. These facilities will be geo-coded, to the extent possible, so they can be displayed on a map which shows their proximity to major evacuation routes, shelters and critical facilities.
2. Levels of Vulnerability - Levels of vulnerability shall be identified and related to Tropical Storm and the five hurricane intensity categories of the Saffir/Simpson scale. The levels of vulnerability shall be determined based on worst case hurricane track (maximum of the maximum MOM) of the most recent computer runs and/or maps/atlasses produced from the most current SLOSH Models, FIRMs and past freshwater flood experiences for the region. This will provide the basis for the development of the various regional transportation/evacuation scenarios.
 - a. Surge zones will be the primary vulnerability assessment overlay tool and can be download at (<https://floridadisaster.maps.arcgis.com>). These polygon files can be overlaid on point data (shelters, critical facilities) and polygon area data (demographics and population).
 - b. Freshwater flooding (historical and repetitive) and FEMA FIRM data can also be used in the GIS overlay process for determining rain event and non-tidal water inundation (as in evacuation route flooding and ground saturation potential with soil data)

3. Evacuation Zones - Finalized evacuation zones based on storm surge shall be established for the City and reviewed for changes with existing zones in the County Evacuation Study.
 - a. The evacuation zone maps shall be provided at a scale that permits a clear and ready identification of geographic and roadway features, thereby permitting a clear differentiation of the zone boundaries.

C. BEHAVIORAL ANALYSIS

1. Evaluate the most recent hurricane behavioral surveys, including the currently ongoing update to the Statewide evacuation study that will include regional survey data, to determine the appropriate planning assumptions regarding evacuation participation rates, perception of risk, destination assignments (in county, out-of-county, out-of region), vehicle usage, obstacles to evacuation, or other issues as identified by city and county emergency managers.
2. Collect survey data from a reasonable sample size of the City of Cape residents to determine how many residents are likely to evacuate in a storm event and where they might go. The survey should include coverage of different evacuation zones within the City as well as different storm scenarios. As part of this task, research and determine if the use of cell phone data from previous evacuation events may provide a better end result for this analysis. This task includes a coordination meeting between the Consultant and the Cape Coral Project Manager to determine how best to proceed.
3. Using the behavioral data collected and the recommended planning assumptions, work with city and county emergency management to develop behavioral scenarios to be incorporated into the evacuation transportation analysis.
4. When possible, graphically depict population behaviors and needs (i.e. persons needing transportation assistance densities)

D. SHELTER ANALYSIS

1. The Hurricane Evacuation Analysis will include a shelter analysis that will provide a shelter inventory based on the most recent Statewide Emergency Shelter plan and City and County emergency management data. The shelter information is currently being updated as part of the Statewide Regional Evacuation Study.
2. Based on the Behavioral Analysis and historical observation, shelter demand assumptions will be applied to determine shelter demand and potential shelter deficits in the city.

E. REGIONAL EVACUATION TRANSPORTATION NETWORKS

1. Identify the existing regional evacuation routes to exit the city and any additional arterials/ collectors in the city and county critical for evacuation.
2. Identify the capacities of the regional evacuation transportation network,

- including identified Contra-flow routes and capacity.
3. Identify the scheduled improvements and capacity increase on the regional evacuation transportation network for the planning year 2020 and 2045.
 4. Acquire, import, or create evacuation network to include in attributes the functional classification, state route number, local road name, completion status, posted speed, and/or approximate average speed.
 5. Provide maps of the existing and projected regional evacuation transportation networks for 2020 and 2045.
 6. Provide a listing of transportation road segments that have ITS capabilities.

F. EVACUATION POPULATION AND VULNERABILITY ANALYSIS

1. The vulnerability analysis shall include a comprehensive evaluation and identification of the levels of vulnerability by hurricane evacuation zones, the population-at-risk, and storm surge effects on institutional/medical and other critical facilities identified in the City.
2. Population Analysis. Using the GIS, determine by evacuation zone, the following for the 2020 and 2045 projection:
 - a. the estimated number of people living in various dwelling unit types by seasonal occupancy rates;
 - b. the number of mobile home residents;
 - c. the estimated tourist population,
 - d. the number of people to be evacuated,
 - e. the number of vehicles to be used in an evacuation, and
 - f. the demographic breakdown based on the socio-economic factors identified in Section A.

G. TRANSPORTATION ANALYSIS

1. The transportation analysis will be a City study including estimates of vehicle movements from the City, as well as the impacts of evacuations within Lee County from adjacent county and regions that includes updates from the ongoing Statewide Regional Evacuation Study. The specific model methodology will be reviewed with and approved by the City of Cape Coral before transportation analysis begins.
2. The study shall utilize professionally accepted transportation models or other appropriate computer analysis systems. The modeling effort will incorporate the use of Geographic Information System (GIS) capabilities into the analysis. General study methods and modeling procedures will be documented.
3. A condensed (end user) transportation model and program shall be provided to the City of Cape Coral and the Lee MPO. The programs will be set up to provide a user friendly means of modifying input variables such as population, housing units, mobile home units, tourist dwelling units, people per unit, vehicles per unit, participation rates, destination distributions, trip routing and road segment capacities that would change clearance times for various evacuation scenarios.

4. The study shall include an inventory of all new roads, all roadway improvements that resulted in increased capacity, bridges and scheduled roadways and improvements that impact the evacuation route network.
5. A constraints analysis that will, at a minimum examine roadway elevations and actual experiences to identify roadways that have historically experienced flooding due to rainfall and which should be monitored for vehicle distress during evacuation times.
6. The transportation documentation will provide data on evacuation route assignments and clearance time estimates for 2020 and 2045 to exit the City, County and Region. Using a professionally accepted transportation model or other appropriate technique and methodology, vehicle travel time associated with moving threatened population to areas of safety. Based on the results of the hazard analysis and behavioral data identifying desired shelter destinations of City evacuees, evacuating vehicles will be re-assigned to the quickest and safest evacuation routes consistent with operational considerations.
7. Tabular data will be supported by maps identifying, at a minimum:
 - a. route loading nodes from evacuation zones,
 - b. evacuation zones,
 - c. evacuation routes, and
 - d. potential traffic control points.
6. Maps of evacuation routes and traffic evacuation zones shall be provided at a scale that permits easy identification of pertinent roadways and geographical features.
7. The results of the transportation analysis shall be based upon the pre-constructed evacuation scenarios to be determined by the City of Cape Coral and the Statewide Regional Evacuation Study Updates and the response curves developed from historical and behavioral analysis data.
8. Evacuation Route Assignments. Necessary investigations will be conducted to select evacuation routes that offer the shortest and most direct access from each of the evacuation zones. The assignment of traffic volumes to specific routes will be a product of repeated testing of the evacuation roadway network to minimize impacts to adjoining zones, and to achieve the shortest possible clearance times for the threatened areas.
9. The information will be based on changes in population and vehicular usage, revised behavioral tendencies, historical participation rates, and changes in both shelter assignments and the evacuation route networks.
10. The analysis shall consider a wide variety and complexity of multiple county and regions and multiple scenario evacuations, which will be determined by the City of Cape Coral and the Statewide Regional Evacuation Study Updates. Base scenarios will be developed to estimate a series of worst-case scenarios.

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 can do so. The modeling shall test various evacuation routes, timing strategies, shelter/refuge strategies, and traffic control measures in order to minimize clearance times.

11. A sensitivity analysis shall be conducted to calculate the impacts of the following on clearance times:

- a. Mobilization response curves simulating a quick, medium, and slow response to the hurricane threat;
- b. Based on the FDOT Work Program and the Capital Improvements Plan (CIP) for the local area, increases in highway capacity due to roadway widening, new construction and public safety policies, or any other factors that would affect highway capacity;
- c. Reduction in highway capacities based on ambient weather conditions;
- d. Tendency of roadway segments to flood, based on category of hurricane;
- e. Creation of new or improved roadways, such as the Del Prado Extension, and their capacity for “critical” or longest time route movement. This analysis should include what roadways are included within the MPO’s Long range Plan;
- f. Drawbridge operations;
- g. Percent of vehicles pulling trailers, commercial and other background;
- h. When and how tourists and seasonal population will evacuate;
- i. R.V. park resident’s evacuation response; and
- j. Toll booth operations.

12. The following shall also be provided:

- a. An estimate of clearance times for 2020 and 2045 from specific vulnerable evacuation zones to specific destination;
- b. Estimate the number of evacuees and vehicles leaving the City, the exiting routes, which they would use, and the exiting route clearance times by category;
- c. Estimate the number of evacuees and vehicles entering the City and the entering routes they would use and what they would add to clearance times by category of storm;
- d. A discussion, with appropriate tables, of the 12, 18, 24, and 36 hour maximums of the number of people that can be evacuated verses the number that need to evacuate, as well as maps which depict what links will still be loaded at those intervals;
- e. A map which clearly identifies evacuation routes;
- f. An elevation map and a map depicting the 100-year flood plain area;
- g. A table that identifies the number of vulnerable populations, the vulnerable population components (surge, mobile home/wind,

- shadow) and evacuation destination (friends/family, hotel/motel, public shelter, out of county, etc.) by evacuation zone; and
- h. A table/matrix, which shows the anticipated number of vehicles and evacuees leaving the city, by evacuation route and by category of hurricane.
 - i. Table/matrix which shows the number of vehicles and evacuees entering the county/region by category of storm during multi-county/regional evacuations.
13. Overall travel patterns shall account for the following:
- a. In-city origins to out-of-city destinations;
 - b. Out-of-city origins to out-of-city destinations, known as “through” trips;
14. Recommendations - Provide recommendations that would assist in the lowering of identified clearance times including use of alternate evacuation routes, phased evacuation, specific major or intra-county traffic control, security, and blockade points and route capacity improvements. Also, identify points along critical evacuation routes where resources are necessary to keep these routes open for evacuation and post storm recovery purposes.
15. Methodology - Provide a clear and concise discussion of the transportation methodology used. At a minimum this should include a discussion of the model, the assumptions used in the modeling process, data collection techniques, information and data sources, as well as specific categorizations and enumerations of data sub-components (e.g., vulnerable population (123,456) = tourist population (12,345) + surge population (98,765) + etc.), participation rates used, evacuation destination percentages, definitions and terminology, and evacuation scenarios.
18. Regional and Multi-Regional Analysis - The impacts from the region and multiple regions should be done and provided to the City. Impacts on City, county and regional shelter supply, and the City, county and regional exiting evacuation routes clearance times, shall be determined based on scenarios, which affect part of the region, the entire region, and multiple regions. This analysis will address how the evacuation shall be handled for multiple regions evacuating at the same time. Different transportation strategies will be called for depending on which multiple regions are evacuating.
19. The last major Regional Evacuation Transportation Study Update in 2017 was conducted by CDM Smith which developed the Transportation Interface for Modeling Evacuations (TIME) to make it easier for transportation planners to use their model and implement the evacuation methodology. The current Statewide Regional Evacuation Study is also using TIME model. 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. If (TIME) is applicable for the Cape Coral Hurricane Evacuation Study, it could

use as comparison to model results developed for this transportation analysis. These following variables may be selected using the TIME interface and allow the user to retrieve the best results from various evacuation alternatives:

- a. Analysis time period;
- b. Highway network;
- c. Behavioral response;
- d. One-way evacuation operations;
- e. University population;
- f. Tourist occupancy rates;
- g. Shelters;
- h. Counties evacuating;
- i. Evacuation level;
- j. Response curve hours; and,
- k. Evacuation Phasing.

H. STUDY MANAGEMENT AND COORDINATION

The city of Cape Coral staff will manage the evacuation study and assign a Project Manager to oversee the project. The MPO staff will provide support and be responsible for procurement and processing the invoices.

1. The Recipient will be responsible for study management, coordination and documentation of the Cape Coral Hurricane Evacuation Study. This effort will include work item tracking, funds management and accounting, submitting study monthly status reports, any formal meetings necessary, and report documentation. Coordination with appropriate local, county and any interested state interests will be maintained during the development of all study products. Meetings will be held at key intervals of the study process to keep all parties informed and to gather necessary input data. The Consultant shall plan to attend up to ten Cape Coral (Council or TAC) and/or MPO (Board or Committees) meetings to present progress and the final results of the study.
2. All draft documents and products will be submitted to the City of Cape Coral and the Lee MPO for review and comment prior to finalization. Meetings virtually or in person with staff will be held as appropriate to review and discuss the draft documents.

I. SCHEDULE OF WORK AND PAYMENTS

- A. The Recipient will submit to the City of Cape Coral and the Lee MPO specified documents as described when completed. The project should be completed within one year. Monthly reports will be submitted with the invoices and must demonstrate substantial progress toward the completion of each phase. The anticipated phases for completion by sections in this scope are as follows.

Phase I - Sections A - B
Phase II - Sections C - F
Phase III and IV – Section G

- B. The Recipient will provide in each monthly report an updated timeline that identifies

all sections completed, dates of completion and anticipated dates for completion.

- C. A total of ten printed copies of the City of Cape Coral Hurricane Evacuation Study along with digital files to be provided electronically for reproduction, as needed.