

ANNEX 3 TO BASIC PLAN

EVACUATION TIMING

I. INTRODUCTION

A. General

As mentioned in paragraph III. H, page 3 of the Basic Plan, a transportation analysis was conducted. The principal purpose of this analysis was to determine the time required to evacuate the threatened population (clearance times) under a variety of hurricane situations and to evaluate traffic control measures that could improve the flow of evacuating traffic. Transportation computer modeling techniques developed to simulate hurricane evacuation traffic patterns were used to conduct this analysis. To provide a better estimate of where these people would go, the behavioral studies included work to estimate what portion of the evacuees would go to other inland counties or seek safe haven in other states.

1. Estimated Evacuation Clearance Times.

- a. A HES tool describing the time required to clear the roadway of all vehicles evacuating in response to a hurricane situation. Clearance time is one of two major considerations involved in issuing an evacuation order or advisory. The other time is the arrival of sustained tropical storm winds. The clearance times were developed by storm scenario and by behavioral characteristics for each conglomerate.
- b. Clearance time begins when the first evacuating vehicle enters the road network and ends when the last evacuating vehicle reaches an assumed point of safety. As determined during the post-Floyd Hurricane Evacuation Studies, I-95 is the Clearance Time cutoff point for the Northern and Central Conglomerates. The Allendale/Hampton County line is the Clearance Time cutoff point for the Southern Conglomerate. Clearance time includes the time required by evacuees to enter the road network (referred to as mobilization time) and the time spent by evacuees traveling along the road network due to traffic congestion (referred to as queuing delay time). Clearance time does not relate to the time any one vehicle spends traveling on the road network and does not include time needed for local officials to assemble and make a decision.
- c. Several hundred clearance time runs were done based on differing intensities of hurricanes, evacuation area assumptions, rapidity of evacuees' response, and differing tourist seasons. Clearance times generally fall below 24 hours for most of the scenarios. However, due to the limited road network and large numbers of tourists and permanent residents who would have to evacuate in the Northern Conglomerate, times could potentially exceed 26 hours for a Category 4-5 hurricane, high tourist occupancy scenario.

- d. Clearance times for normal and reverse / counter flow use have been calculated. Times are shown in the chart on page 6 and in each conglomerate appendix of Annex 2. While the I-26 Reversal Plan is anticipated to significantly reduce conglomerate clearance times, the counter flow plans for US 278, US 501, and US 17 may not produce the desired conglomerate time reductions due to controlling traffic bottlenecks. The bottleneck in the Southern Conglomerate is the merge intersection of US 278 and SC 68 in Hampton County. The US 278 counter flow road segment is upstream of this bottleneck and will not influence the clearance time. However, it may reduce clearance times for the US 278 road segment, thus enabling traffic to more quickly exit Hilton Head Island. The controlling bottleneck in the Northern Conglomerate is US 501 between US 17 Bypass and Conway. The US 17 counter flow road segment is in Georgetown County and will not influence the controlling bottleneck clearance time. However, a clearance time reduction for that road segment is possible, thus enabling traffic to more quickly exit the US 17 area north of Georgetown. Horry County and Conway city officials request their concurrence prior to the implementation of the US 501 Counter Flow plan.
- e. The clearance time calculated for each scenario (category of storm) was based on three criteria: evacuation zone participation rates, population response rate, and level of tourist occupancy.

2. Evacuation Zone Participation Rates.

- a. Participation rates assumed by zones within a county, and for each scenario, are part of the clearance time model. Key factors behind the participation assumptions are as follows:
- b. Zones to be evacuated for storm surge were assumed to have a 100% participation rate. Even though in actuality these rates will be lower, as a matter of public safety the clearance times calculated in this study should allow those who are vulnerable to storm surge the opportunity to evacuate whether they choose to or not.
- c. All mobile home residents in conglomerate counties are assumed to evacuate.
- d. A portion of the theoretically non-vulnerable population was also assumed to evacuate in the modeling. This percentage could be higher than what was used particularly for more intense hurricanes (1%-15%), but will be balanced out with the less than 100% of surge residents who will participate in an actual event.

3. Response Rate.

A critical behavioral aspect considered for the transportation analysis was the rapidity of evacuation response of the evacuating population. Behavioral data from past hurricane evacuations shows that mobilization and actual departures of the evacuating population can occur over a period of many hours or over a very brief time. In the Hurricanes Bertha and Fran evacuations, evacuees loaded the road network over a long period due to the meteorology and path of the storm. In Hurricane Floyd, traffic loaded the road network very quickly.

4. Tourist Profile.

Tourist population varies throughout the season. Clearance times are estimated for low and high tourist populations. High tourist population uses 90% occupancy rates, and low tourist population is based on 30%.

5. Evacuation routes and lane reversal / counter flow plans.

In addition to dedicated evacuation routes, if conditions require their employment, South Carolina will implement one or more of the following lane reversal (four lanes outbound) or counter flow plans (three of four lanes outbound):

- a. Reversal plans: I-26 from I-526 in Charleston westbound to I-77 / I-26 interchange in Columbia; US 501 in Horry County from SC 22 / US 501 interchange west of Conway to the SC 576 / US 501 and US 501 Bypass in Marion County; US 21 in the City of Beaufort from the US 21 / SC 280 intersection to the US 21 / US 17 intersection in Gardens Corner; and US 278 off of Hilton Head from the Cross Island Expressway to the US 278 / I-95 interchange.
- b. Counter Flow plans: US 501 in Horry County east of Conway from SC 544 / SC 544 Connector to the US 501 / US 378 intersection in Conway; US 17 in Georgetown County from the US 17 / DeBordieu intersection south to the five points intersection in the city of Georgetown; US 21 in the city of Beaufort from the US 21 / SC 280 intersection to the US 21 / US 17 intersection in Gardens Corner; and US 278 off of Hilton Head from Spanish Wells Road to the US 278 / SC 170 interchange.

6. South Carolina Clearance Times.

The summary charts on the next pages illustrate the 2005 South Carolina Hurricane Evacuation Clearance Times for normal and reversed / counter flow lane operations. Times are expressed in hours and are based on 2002 U.S. Census estimates extrapolated to 2007.

2009 South Carolina Hurricane Evacuation Clearance Times (In hours)

Hurricane Category & Evacuation Response	Northern Normal Lane Use		Northern US 17 / US 501 Counter Flow or US 501 Reversal	
	Tourist Low	Occupancy High	Tourist Low	Occupancy High
Category 1-2			For US 501 Counter Flow: There is negligible savings in time as counter flow section is downstream of controlling bottleneck. See note 1.	
Rapid	10.75	18.25		
Medium	11.25	19.25		
Long	11.75	19.75	For US 501 Reversal: Clearance Times not calculated. Potential local savings only. See note 1.	
Category 3-4				
Rapid	20.25	27.75		
Medium	21.00	28.75		
Long	21.25	29.25		
Category 5				
Rapid	20.25	29.00		
Medium	21.00	30.00		
Long	21.25	30.25		

Note 1: Traffic bottleneck restricting Clearance Times is US 501 from US17 Bypass to Conway. Due to the location of both counter flow route segments relative to the bottleneck, no conglomerate clearance time reduction is possible. However, these counter flow/reversal plans may provide a local Clearance Time reduction for those road segments only, meaning that traffic may clear Conway or Georgetown sooner. Therefore, the decision to execute / not execute the US 501 Counter Flow / Reversal, or the US 17 Counter Flow should not be made with the assumption that the overall Conglomerate Clearance Times will be reduced.

2009 South Carolina Hurricane Evacuation Clearance Times (continued)

Hurricane Category & Evacuation Response	Central		Central	
	Normal Lane Use		I-26 Reversed Lane	
	Tourist Occupancy		Tourist Occupancy	
	Low	High	Low	High
Category 1				
Rapid	12.25	14.50	9.50	10.75
Medium	12.50	14.75	12.50	12.75*
Long	14.00	15.00	15.50	15.75
Category 2				
Rapid	16.50	19.50	13.50	14.00
Medium	16.75	19.75	14.00	14.25*
Long	17.00	20.00	15.50	16.25
Category 3				
Rapid	23.75	27.50	15.50	17.50
Medium	24.25	28.00	15.75	17.75
Long	24.50	28.25	16.00	18.00
Category 4-5				
Rapid	27.50	31.00	17.50	19.75
Medium	28.00	31.25	17.75	20.00
Long	28.25	31.50	18.00	20.25

*These times reflect the use of most restrictive times based on Folly Road south of the James Island Connector.

2009 South Carolina Hurricane Evacuation Clearance Times (continued)

Hurricane Category & Evacuation Response	South		South	
	Normal Lane Use		US 278 Reversal	
	Tourist Occupancy		Tourist Occupancy	
	Low	High	Low	High
Category 1				
Rapid	12.00	17.50	8.25	11.50
Medium	12.50	18.50	8.75	12.50
Long	13.00	19.50	9.00	13.25
Category 2				
Rapid	16.50	22.50	11.00	15.25
Medium	17.00	23.50	12.00	16.25
Long	17.50	24.50	12.50	17.00
Category 3-5				
Rapid	20.00	25.25	14.00	17.25
Medium	20.50	27.00	14.50	18.50
Long	21.00	27.25	15.00	19.00

Note: Controlling traffic bottleneck is the road segment US 278 from Burnt Church Road to Buckwalter Parkway. Times reflect 2007 estimated census figures and a 2007 localized traffic study for specific routes in Beaufort County. Clearance Times not displaced for US 21 reversal or US 21 counter flow. Potential local savings only.

7. Executive Level Decision Briefings.

After analyzing and interpreting the impacts of the NHC's forecast and the local NWS statements, the SCEMD Director or SEOC Chief of Operations will brief the Governor's Office. Briefings will be held as requested by the Governor. The formal briefing format is:

- a. The NWS representative will discuss the forecast, and the State Climatologist's Office will provide input.
- b. The SCEMD Director or SEOC Chief of Operations will review issues to be addressed and provide a SEOC status update.
- c. The state agency directors will provide status of agency operations.
- d. The SCEMD Director or SEOC Chief of Operations makes recommendations to the Governor with concurrence from State agency directors.
- e. Decision will be made on recommendations presented, and if need be further coordination with county EOCs prior to press conference or press release.

8. Regional Coordination.

- a. The SEOC Chief of Operations will coordinate with SEOCs in neighboring states to include, Georgia, North Carolina, and Florida. With assistance from the FEMA Agencies' Region IV Regional Response Coordination Center (RRCC) in Atlanta, Georgia, the regional traffic flow will be monitored. Whenever a major hurricane, potentially requiring a large multi-state evacuation, threatens the United States, the federally coordinated Evacuation Liaison Team (ELT) will operate from the RRCC on a 24-hour basis until the threat is past.
- b. The ELT supports regional hurricane response efforts by facilitating rapid, efficient, and safe evacuation of threatened populations. The ELT will accomplish this support by providing federal and State emergency management officials with timely and accurate traffic/evacuation related information during multi-state hurricane threats. The ELT assembles the needed information through communication with appropriate SEOCs, other RRCC locations, the FEMA Emergency Support Team (EST) and the Hurricane Liaison Team (HLT) at the National Hurricane Center in Miami, Florida. ESF-5 (Information and Planning) will collect traffic and evacuation related information from ESF-16 (Emergency Traffic Management) and ESF-1 (Transportation) and, with the approval of the SEOC Chief of Operations, release the information to the FEMA liaisons for forwarding to the appropriate location.

Phased Evacuation and Lane Reversal.

1. The size and intensity of a hurricane may necessitate the use of a phased evacuation of threatened areas. The phased evacuation recommendation to the Governor will include an initial Voluntary Evacuation phase followed by a Mandatory Evacuation phase of those areas deemed appropriate based on the current forecast and other operational factors. The Mandatory Evacuation phase may be conducted with or without a lane reversal/counter flow along specific evacuation routes based on the current situation and the lane reversal decision factors. A phased evacuation will be considered for any hurricane of Category 2, 3, 4, or 5. A Category 1 hurricane will normally only require the voluntary evacuation or mandatory evacuation phase. Refer to the respective Conglomerate Annex Introduction Section for phased evacuation recommendations.
2. Evacuation activities will be a joint effort of state and local agencies communicating/coordinating through emergency operations centers. Emergency Traffic Management Emergency Support Function ESF-16 located in the SEOC will provide overall coordination, monitor evacuation status, and prepare recommendations for actions regarding evacuation.
3. The reversal of traffic lanes on specific highways to increase the evacuating traffic flow is an unusual event requiring extensive coordination and commitment of resources. Due to the notification/lead times necessary to have resources in place, State and local authorities must be prepared to stage resources to support lane reversals whenever a hurricane threatens regardless of the strength. The following lane reversal decision factors and indicators will be considered in the process of preparing recommendations regarding lane reversal:
4. Lane Reversal/Counter Flow Indicators:

Lane Reversal/Counter Flow Indicators	
Decision Factor	Indicator
a. The storm's current/ projected intensity and the public perception of the threat to their safety.	Category 3 or greater storm that is portrayed through the media as a significant threat will probably require the use of lane reversal.
b. Tourism occupancy: High tourist occupancy greatly increases evacuating population and thereby increases traffic congestion.	For a Category 1 or 2 storms, monitor traffic flow and have lane reversal ready. A Category 3 or greater storm will indicate the need for reversal. (Note: Beaufort County <u>requires</u> highway 278 counter flow during tourist season at 85% tourist occupancy.)
c. The safety of personnel deploying in support of lane reversal and the current weather must be considered regarding day or night initiation of lane reversal.	Whenever possible, start the lane reversal during daylight hours for the safety of all involved.
d. The traffic volumes observed during the voluntary evacuation phase can be viewed as a predictor of the traffic volumes anticipated coming during the subsequent mandatory evacuation phase.	Low traffic volumes during the voluntary evacuation phase may indicate that large volumes are to be expected later during mandatory and therefore lane reversal may be advisable.
e. If there is no lane reversal at the outset of the mandatory evacuation phase, then the early detection of high traffic counts and/or slowed traffic flow will be critical.	SCDOT must have monitored traffic counts and average vehicle speed indicators ready to provide timely warning that lane reversal should be implemented.
f. The monitoring of regional traffic flow and information from the regional Evacuation Liaison Team will be required to provide early warning of factors impacting SC from Georgia, Florida, or North Carolina.	If the South Carolina traffic/storm related situation is marginal and potential exists for significant traffic problems, then a large regional evacuation situation may indicate that lane reversal is advisable.

Note: Refer to the respective Conglomerate Appendix for the lane reversal/ counter flow implementation recommendations. Also note that the decision to execute the US 501 Counter Flow or Reversal, US 17 Counter Flow, the US 278 Counter Flow or Reversal, or the US 21 Counter Flow or Reversal plans may not result in an overall conglomerate clearance time reduction due to the controlling traffic bottlenecks. However, some reduction in clearance times for those specific road segments may take place.

d. Procedural Agreements.

Conglomerate Evacuations. If the Governor determines the situation requires a mandatory evacuation, the SCEMD Director will recommend that the order be based on conglomerates, not on individual counties. The SCEMD Director will recommend the Governor order the evacuation of one, two, or all coastal conglomerates. In addition, all conglomerate counties agree to participate in their conglomerate evacuation if it is ordered. This agreement is critical to the successful development and implementation of the South Carolina Hurricane Plan.

- e. Operating Condition Levels. The counties within each conglomerate will function as a team. When one member county moves to a higher OPCON, all counties within the conglomerate will consider moving to the higher level. The SEOC will assess the situation and consider moving to a higher OPCON level if a county moves to one. The SEOC and county EOCs are not required to remain at the same OPCON. Operational considerations inherent in state-level evacuation preparations often require the state to move to a higher OPCON level earlier than county EOCs.
- f. Communications and Information. Within each conglomerate, one county has been designated as the lead county. This designation is based primarily on the county with the longest evacuation time within each conglomerate. During hurricane operations, the lead county should inform all other conglomerate counties and the SEOC of their current status. If this notification is not feasible, the conglomerate county EOCs should refer to SEOC situation reports and the Web EOC for county status. The SEOC will consider providing a Liaison Officer to each conglomerate lead county EOC to assist in disseminating information among the conglomerate counties and to serve as a conglomerate point of contact to the SEOC.
- g. During OPCON 4 and higher, the SEOC will schedule conference calls with the coastal county EOCs. County EOCs to be included are Jasper, Beaufort, Hampton, Colleton, Charleston, Dorchester, Berkeley, Georgetown, and Horry. The format for these calls is first the latest hurricane forecast will be reported by the National Weather Service (NWS), SEOC Chief of Operations will report SEOC status, county directors will report local operational status and raise concerns/issues regarding hurricane operations, and the Director will discuss executive level evacuation decision or reentry status. Once the area to be evacuated is determined, the SEOC will schedule a conglomerate conference call to discuss evacuation operations.

B. Operational Area Liaisons

- 1. The primary need after a significant hurricane impact will be to obtain immediate disaster intelligence in order to assess the scope or scale of the disaster, and develop an initial assessment of immediate needs. Operational Area Liaisons will fill that need through their deployment into the impacted area and provision of immediate needs assessments to county and state officials.
- 2. Operational Area Liaisons will be sourced from state government, will train and deploy to the affected Operational Areas as a result of catastrophic event (natural or manmade), conduct emergency operations and damage assessment of the affected area, provide immediate assessments results to the local/county EOC and the State EOC and assist the local/county government with identifying basic needs and coordinating state response assistance.

3. The Operational Area Liaison program continues in development and continued planning and training will ensure full program implementation. See Conglomerate annexes for descriptions of areas where Operational Area Liaisons will be employed.