

# ALABAMA HURRICANE EVACUATION STUDY TECHNICAL DATA REPORT

## BEHAVIORAL ANALYSIS

### PURPOSE

The behavioral analysis is conducted to provide estimates of public response to a variety of hurricane threats. These estimates are used in the shelter analysis and transportation analysis, and as guidance in emergency decision-making and public awareness efforts.



### OBJECTIVES

The specific objective of the behavioral analysis is to answer the following questions:

- a. What percentage of the population will evacuate under a range of hurricane threat situations or in response to evacuation advisories?
- b. When will the evacuating population leave in response to an evacuation order given by local officials?
- c. How many vehicles will the evacuating population use during a hurricane evacuation?
- d. How many evacuating vehicles will be towing boats, camper trailers, or other vehicular equipment?
  - a. What are the destinations of the evacuees and what type shelter will they be heading for?
  - e. How will the threatened population respond based upon forecasts of hurricane intensity or other information provided during a hurricane emergency.

## METHODOLOGY

Every evacuation plan must contain estimates and assumptions about how people will react when a hurricane evacuation is implemented. Behavioral assumptions for the Alabama coastal counties were developed by statistical analysis of data gathered from telephone interviews and actual response data from previous hurricane evacuations.

Actual behavior in a single event can be documented and compared to estimated behavioral characteristics for a specific location. It is tempting to over generalize from a single evacuation, however, we know that people will respond differently in different sets of circumstances and at different points in time. Hypothetical response data was collected for Alabama in 1983 and included questions about intended responses to hypothetical hurricane threats. Little additional hypothetical data were collected as part of this present update.

During January 1996 about 196 telephone interviews were conducted with residents of Mobile and Baldwin Counties. Respondents were asked a series of detailed questions about their experiences in Hurricanes Opal and Erin.



The sample was designed to provide statistically reliable data for three categories of risk areas in the region. The three risk areas were; the beach area, the mainland surge area and the non-surge areas. Non-surge areas included locations adjacent to surge areas.

Table 1 summarizes the number of interviews completed for each risk area. The size of samples varies in each risk area because of the differences in population.

**TABLE 1  
NUMBER OF BEHAVIORAL SAMPLES**

	Beaches	Mainland Surge area	Non-surge Area	Total
Mobile/Baldwin	86	61	49	196

## ANALYSIS OF SURVEYS

Behavioral studies are statistical. In general, the larger the number of people in the sample, the closer the sample value will be to the true value. A sample of 100 will provide estimates which one can be 90 percent "confident" that they are within 5 to 8 percentage points of the true values. With a sample of 50, one can be 90 percent "confident" of being within 7 to 11 percentage points of the actual population value. Therefore in many of the following tables showing responses by risk area an additional 600 surveys from coastal counties in the panhandle of Florida were used to increase confidence limits.

### a. Evacuation Participation Rates

Participation rate refers to the percentage of the population that will leave their homes to go someplace they believe to be safer when a hurricane threatens. Most of this chapter will describe evacuation participation during Hurricanes Opal and Erin in 1995.

### b. Participation Rate During Hurricane Opal

Evacuation participation rates in Hurricane Opal varied much more from one risk zone to another than from one county to another, as shown in Table 2 below. Alabama mainland surge and non-surge areas responded at lower rates than Florida probably because most of Hurricane Opal's forecast track was east of Alabama putting Alabama on the weaker side of the storm. The 1986 behavioral studies showed that 90-95 percent of the high-risk areas, 60-80 percent of moderate risk areas and 20-40 percent of low risk areas would evacuate. Higher percentage rates would result during Category 3 or higher storms.

**TABLE 2**  
**PARTICIPATION RATE DURING HURRICANE OPAL (PERCENT)**

	Beaches	Mainland Surge	Non-Surge
Mobile/Baldwin	88	39	15
Escambia/Santa Rosa	86	62	34
Okaloosa/Walton	90	66	35
Bay	78	57	37
Average	85	57	30

### c. Who Heard The Evacuation Notice

Table 3 below shows the percent of the sample population that heard the Hurricane Opal evacuation notice directly or from others and the percent that didn't hear the notice. Table 4 shows the evacuation participation rate (percent) for the same groups of people in Table 3.

**TABLE 3  
POPULATION HEARING EVACUATION NOTICE (PERCENT)**

	Beaches	Mainland Surge	Non-Surge
Heard Directly	74	52	28
Heard from Others	10	11	11
Didn't Hear or Didn't Know	16	37	61

**TABLE 4  
EVACUATION BY HEARING NOTICE GROUPS (PERCENT)**

	Beaches	Mainland Surge	Non-Surge
Heard Directly	87	75	46
Heard from Others	86	67	54
Didn't Hear or Didn't Know	74	29	18

Based on Tables 3 and 4 people on the beaches were more likely to evacuate whether they heard the notice or not. Whereas the people in the mainland surge and non-surge areas had significantly lower participation rates for those that didn't hear vs. those that did hear the notice. The figures show that there is a much greater response for those hearing an evacuation order. This determination was not made in the 1986 behavioral studies.

### d. Evacuation Notice Interpretation

How the public interprets an evacuation notice is also a critical aspect of response to the notice. Table 5 shows the percent of the sample population that interpreted the notice as being mandatory versus recommended and those that didn't hear or didn't know. Table 6 shows the evacuation participation of those same groups. It is apparent that the participation rate drops if the notice is thought to be recommended and not mandatory. The figures show that there is a

much greater response with a mandatory evacuation order. This analysis was not made in the 1986 behavioral study.

**TABLE 5  
HURRICANE OPAL NOTICE INTERPRETATION (PERCENT)**

	Beaches	Mainland Surge	Non-Surge
Mandatory	46	27	8
Recommended	30	27	23
Didn't Hear or Didn't Know	24	46	69

**TABLE 6  
HURRICANE OPAL PARTICIPATION RATES BY NOTICE INTERPRETATION**

	Beaches	Mainland Surge	Non-Surge
Mandatory	91	87	50
Recommended	79	62	48
Didn't Hear or Didn't Know	74	29	18

**e. Automated Telephone Notification**

In some counties an automated telephone notification system is used to phone thousands of households in the surge-prone areas. Table 7 shows that more people receiving such calls evacuated than those who did not receive calls. This behavioral parameter was not evaluated in the 1986-study effort.

**TABLE 7  
TELEPHONE NOTIFICATION EVACUATION RATES**

	Beaches	Mainland Surge	Non-Surge
Received Telephone Notification	91	90	NA
Heard about Evacuation other ways	84	72	NA
Didn't Hear or Didn't Know	74	29	NA

## f. Perception of Vulnerability

Likelihood of evacuating is often a product of how coastal residents perceive their personal vulnerability to hurricanes. A series of questions was asked to assess those perceptions. Respondents were reminded by interviewers that Hurricane Opal's winds had at one time been 125 mph or greater and were asked the following questions:

*1. Did they believe their home would be at risk to dangerous flooding from storm surge or waves?*

*2. Did they believe that it would be safe to stay in their home, considering both the wind and water?*

The results of the answers to these questions are shown in Tables 8 through 11. Table 8 shows that fewer than half of respondents in the beach and mainland surge area felt that their homes would have flooded dangerously. Table 9 shows that those who believed their home would flood were more likely to evacuate than those who thought their home would not flood.

**TABLE 8  
BELIEF HOME WOULD BE AT RISK TO FLOODING (PERCENT)**

	Beaches	Mainland Surge	Non-Surge
Home would flood in Category 3 Storm	49	46	22
Home would not flood in Category 3 Storm	45	51	72
Didn't Know	6	4	7

**TABLE 9  
HURRICANE OPAL EVACUATION RATES  
BASED ON BELIEF HOME WOULD FLOOD**

	Beaches	Mainland Surge	Non-Surge
Home would flood in Category 3 Storm	91	75	42
Home would not flood in Category 3 Storm	78	43	27

Most beach residents and half the mainland surge residents thought their home would have been unsafe in 125-mph winds as shown in Table 10. It should also be noted that almost as many non-surge residents (44 percent) felt that their homes were also unsafe in 125-mph winds. Table 11 shows that those believing their homes were unsafe in 125-mph winds were more likely to evacuate than others. The differences in these participation rates are greater in mainland surge and non-surge areas than in beach areas.

**TABLE 10  
BELIEF HOME WOULD BE AT RISK AT 125 MPH WINDS (PERCENT)**

	Beaches	Mainland Surge	Non-Surge
Home would be Unsafe in 125 mph Winds	61	50	44
Home would be Safe in 125 mph Winds	30	42	44
Didn't Know	9	4	13

**TABLE 11  
EVACUATION RATES BASED ON WIND SAFETY OF HOME**

	Beaches	Mainland Surge	Non-Surge
Home would be Unsafe in 125 mph Winds	92	71	38
Home would be Safe in 125 mph Winds	73	42	25

**g. Hurricane Erin Response Comparison**

People who evacuated in Erin earlier in the 1995 hurricane season were more likely to evacuate for Hurricane Opal than those who did not evacuate for Hurricane Erin. This is shown in the participation rates in.

**TABLE 12  
HURRICANE OPAL EVACUATION RATES  
BASED ON HURRICANE ERIN EVACUATION (PERCENT)**

	Beaches	Mainland Surge	Non-Surge
Respondents who evacuated for Erin	96	77	70
Respondents who did not evacuate for Erin	80	54	26

#### **h. Response Of Mobile Home Residents**

Table 13 shows that mobile home residents in the mainland surge and non-surge areas were more likely to evacuate than people living in single-family site built homes. It must be noted that for each county there were few mobile homes in the beach area. The evacuation rates for people living in multi-family structures were not substantially different from those people living in single-family site built homes. One should also note that there were relatively few multi-story structures outside the beach area.

**TABLE 13  
HURRICANE OPAL EVACUATION RATES  
BASED ON STRUCTURE TYPE (PERCENT)**

	Beaches	Mainland Surge	Non-Surge
Evacuation Rate of Mobile Home Residents	84	81	77
Evacuation Rate of SF Site-built Residents	84	55	27

#### **i. Prior Hurricane Experience**

There is little doubt that past hurricane experiences have an impact on how people react to future hurricane events. This experience with hurricanes is related to the length of time residents have lived in coastal hazard areas. Table 14 shows how respondents reacted to Hurricane Opal based on how long they lived in their current residence. While the effect is not strong, the numbers show that, at least in the beach and mainland surge areas, newcomers were more likely than others to evacuate in Hurricane Opal.

**TABLE 14  
HURRICANE OPAL EVACUATION RATES  
BASED ON LENGTH OF RESIDENCY (PERCENT)**

	Beaches	Mainland Surge	Non-Surge
Lived in Home Less than 5 Years	92	64	27
Lived in Home Over 20 Years	84	50	23

### j. Reasons For Not Evacuating During Hurricane Opal

There are a variety of human characteristics that have been found to cause no differences in evacuation rates in Hurricane Opal. These include age, family size, children, pets, race and income. When people were asked why they did not evacuate during Hurricane Opal, they often tend to overstate some reasons and understate others. Collectively, such responses give an indication of factors that were more or less prominent in people’s minds. Table 15 shows the most common responses to that question. Most people who didn't evacuate in Alabama counties said they felt they were safe. Okaloosa and Walton counties were on the stronger side of the storm which probably is the reason for lower numbers of them feeling their house was safe. The next most common reason for people not evacuating was traffic. Many others said they waited too long to leave or that conditions had become too dangerous to leave. Some said they actually tried to evacuate but gave up and returned home due to traffic. Having a job that required them to stay was the response of a few, with the highest values in Bay County. There were also a few respondents that said they did not evacuate during Hurricane Opal because they had evacuated in other past hurricanes unnecessarily.

**TABLE 15  
REASONS FOR NOT EVACUATING DURING HURRICANE OPAL**

	Mobile/ Baldwin	Escambia/ Santa Rosa	Okaloosa/ Walton	Bay
Felt their house was safe	64	54	27	49
Left unnecessarily in the past	0	2	1	7
Had to stay because of job	8	2	7	16
Waited to long to leave	3	14	10	13
Stayed because of traffic problems	7	24	39	28
Tried to evacuate but returned home	0	13	16	4
Conditions to dangerous to leave	2	11	4	5

When asked an open-ended question whether they would do anything differently next time under the same conditions, only 13 percent of the people who stayed (non evacuees) volunteered that they would leave next time and 12 percent of the evacuees said they would stay next time. It is likely that both responses would be higher if the respondents were asked specifically if they would or would not evacuate in the future.

### k. Participation Rate in Hurricane Erin

Hurricane Erin threatened Alabama and the Florida Panhandle earlier than Hurricane Opal in 1995, and made landfall near Pensacola. The evacuation in Hurricane Erin was much less than in Hurricane Opal but offers a good example of evacuation in a weak storm. Table 16 shows that even in the beach areas, the evacuation participation rate was below a third except for Alabama counties where almost half the respondents evacuated. Evacuation from mainland surge and non-surge locations was generally less than 10 percent, the most notable exception being Escambia and Santa Rosa Counties, where 23 percent left from mainland surge.

**TABLE 16  
PARTICIPATION RATE IN HURRICANE ERIN (PERCENT)**

	Beaches	Mainland Surge	Non-Surge
Mobile/Baldwin	47	12	2
Escambia/Santa Rosa	36	23	10
Okaloosa/Walton	6	4	8
Bay	17	2	5
Average	29	8	6

In beach areas (averaging across the region) 37 percent of the beach respondents, and 22 percent of the mainland surge and non-surge respondents said they heard officials say they should evacuate during Hurricane Erin (see Table 17). Even in the beach areas only 11 percent of the residents thought the notices were mandatory.

**TABLE 17  
HURRICANE ERIN NOTICE INTERPRETATION (PERCENT)**

	Beaches	Mainland Surge	Non-Surge
Mandatory	11	4	2
Recommended	26	18	20
Did not Hear or Did not Know	63	78	78

Table 18 shows that in the beach areas, if people thought they heard a mandatory order to evacuate for Hurricane Erin, 63 percent left, compared to 34 percent if they thought the notice was a recommendation, and 21 percent if they heard no evacuation notice. There were too few evacuees in mainland surge and non-surge locations to analyze those areas separately. For the combined sample (beach + mainland surge + non-surge areas) responses were approximately 10 percentage points lower than in beach areas for each group.

**TABLE 18  
HURRICANE ERIN PARTICIPATION RATES BY NOTICE INTERPRETATION**

	Beaches	Combined Sample All Risk Zones
Mandatory	63	56
Recommended	34	23
Did Not Hear or Did Not Know	21	11

Table 19 shows that people who thought their homes would have flooded were more likely than others to evacuate in Hurricane Erin. Other factors such as how long they lived in the area, age, income, family size, number of children, and race were unimportant in distinguishing those who would evacuate for Hurricane Erin from those who would stay.

**TABLE 19  
HURRICANE ERIN EVACUATION RATES (PERCENT)  
BASED ON BELIEF HOME WOULD FLOOD**

	Beaches	Combined Sample All Risk Zones
Believed home would flood in Category 3 Storm	40	26
Believed home would not flood in Category 3 Storm	26	10

## **I. Responses In Other Hurricanes**

The original Tri-state Hurricane Evacuation Study Behavioral Analysis detailed responses in other hurricanes, including Hurricane Eloise in 1975 and Hurricane Frederic in 1979. Every hurricane threat is different, so responses vary from storm to storm. The response patterns that were observed in earlier hurricanes in the region are consistent with those response patterns observed in Hurricanes Opal and Erin.

In Gulf Shores and on Dauphin Island in Alabama more than 90 percent evacuated in Hurricane Frederic. In Mobile in the area advised by officials to leave, 63 percent evacuated, and of those who said they heard officials say to evacuate, 84 percent did so, compared to only 20 percent of those who said they didn't hear. Of those in Mobile who before Hurricane Frederic believed their homes were subject to flooding, 88 percent left in Hurricane Frederic, compared to only eight percent who believed their homes would not flood.

## **PLANNING RECOMMENDATIONS**

The percentage of region residents who will evacuate during hurricane threats will depend upon several factors, but the most important is whether they believe their safety would be at risk if they stayed in their homes during a hurricane. That belief will be affected by the vulnerability of their location, how safe they feel their home is, and what they believe they hear from public officials during an actual threat.

Table 20 presents participation rates for two evacuation scenarios. Scenario 1 is for a strong hurricane in which evacuation is ordered for Category 3 surge areas as well as for all mobile homes. Scenario 2 is for a weak hurricane in which evacuation is ordered only for Category 1 surge areas and for all mobile homes. The rates in Table 20 assume that officials are successful in reaching the public with evacuation notices and strongly advise mobile home residents to leave and go to someplace safer. If they are not successful in reaching the public, the participation rates will be lower. Many surge zone residents believe their homes would not flood in a Category 3 hurricane. This is especially true in mainland surge areas. One way to overcome misperceptions is by ensuring that everyone in areas needing to evacuate receive evacuation notices from public officials.

**TABLE 20  
EVACUATION PARTICIPATION RATES (PERCENT)  
TO BE USED FOR PLANNING**

	Category 3 Storm Evacuation Ordered in Beach and Mainland Surge  Areas and All Mobile Homes	Category 1 Storm Evacuation Ordered in Beach and Category 1  Areas and All Mobile Homes	
Surge	RISK AREA	RISK AREA	
	Beach	Mainland Surge	Non-surge
Non-Mobile Homes	90	85	25
Mobile Homes	95	90	70
	Beach	Mainland Surge	Non-surge
Non-Mobile Homes	70	50	10
Mobile Homes	90	70	50

## EVACUATION RESPONSE RATES

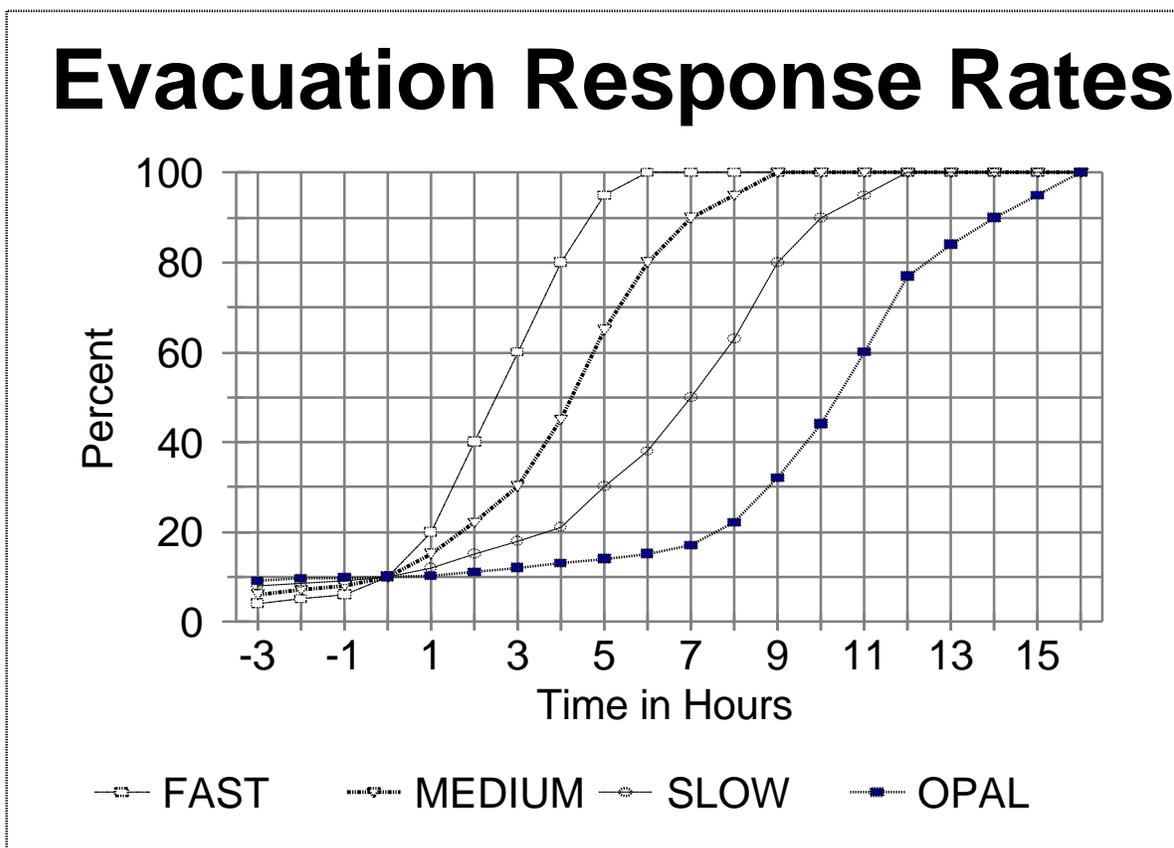
Evacuation response rates refer to how quickly evacuees leave their homes to enter the road network. Everyone does not leave at the same time, nor is it necessarily advisable that they do so. Empirical evidence in evacuation after evacuation demonstrates emphatically that the same people will leave promptly or slowly depending upon the circumstances of the particular threat. When people believe they have the luxury of taking their time to depart, most tend to do so. However, when the urgency of immediate response is communicated to people, they respond very swiftly, even leaving between midnight and daybreak. One other factor is also clear: very few evacuees (less than 20 percent) leave before officials issue an evacuation notice.

Therefore, people are not going to leave in substantial numbers until someone in a position of authority tells them to and then they will leave as promptly as they are told they must. The urgency of evacuations varies because of the error inherent in hurricane forecasting. If a storm intensifies, increases forward speed, or changes course unexpectedly, it usually becomes more necessary for evacuees to leave quickly, as in Hurricanes Eloise and Opal.

When planning for an evacuation, the three different timing response curves shown in Figure 1 should be evaluated, because every region will eventually experience all three. In each threat scenario occupants of non-surge areas will tend to wait longer to evacuate than those living in surge-prone locations.

Figure 1 also shows the response curve for Hurricane Opal. Approximately ten percent of the evacuees said they left before the evacuation order was issued.

Few evacuees left during the night after the evacuation order. Seventy percent of the evacuees left between 5 AM and 11 AM on Wednesday, October 4. Looking at the response curve for Hurricane Opal helps explain the traffic congestion that occurred. Too many people left at the same time. Most people (67 percent) said they made up their minds to evacuate when they heard the notice. Most people also felt that the evacuation notice meant that they should leave immediately. The others interpreted the notice to mean that they should leave in a range of 6-24 hours. Beach residents were more likely than others to believe the notices meant to leave immediately.



**FIGURE 1 BEHAVIORAL RESPONSE CURVE**

## TYPE OF REFUGE

Type of refuge refers to whether evacuees go to public shelters, the home of a friend or relatives, hotels, motels or elsewhere.

The majority of evacuees during Hurricane Opal stayed with friends and relatives as shown in Table 21 for all counties. Few evacuees went to public shelters during Hurricane Opal, ranging from two percent to seven percent. Table 22 shows that more than half of the evacuees in all risk zones said they would stay with friends and relatives.

The most notable variation among risk zones is that more evacuees from beach areas went to hotels and motels than evacuees from other risk areas. Generally we have found that more respondents say they will use public shelters than actually do in real evacuations. Most of those saying they would go to public shelters said they had friends and relatives in safe locations where they could stay. The "other" category includes locations such as churches, workplaces and homes (for those being interviewed at vacation residences). It should be noted that behavioral data indicates that almost none of the out of county evacuees will seek public shelter unless they can't find a motel or if there are no shelters provided in their home county and they are instructed to use out of county shelters.



**TABLE 21  
TYPE OF REFUGE DURING HURRICANE OPAL BY PERCENT**

	Mobile/ Baldwin	Escambia/ Santa Rosa	Okaloosa/ Walton	Bay
Evacuate to Public Shelter	2	5	7	6
Stay with Friend or Relatives	64	61	57	51
Go to a Hotel or Motel	21	22	21	27
Other (such as churches or work place)	13	12	15	16

**TABLE 22  
TYPE OF REFUGE DURING HURRICANE OPAL BY RISK AREA (PERCENT)**

	Beaches	Mainland Surge	Non-Surge
Evacuate to Public Shelter	4	8	3
Stay with Friend or Relatives	58	55	68
Go to a Hotel or Motel	26	18	17
Other (such as churches or work place)	12	20	12

Based on available data, estimates of the percent of evacuees that will seek public shelter are shown in Table 23. The two most consistent predictors of shelter demand are risk area and income. Evacuees from more hazardous locations tend to use public shelters less than those from inland areas. Poorer people tend to use shelters more than wealthier people.

**TABLE 23  
PUBLIC SHELTER USE RATES FOR EVACUATION PLANNING (PERCENT)**

Income	Beaches	Mainland Surge	Non-Surge
High Income	5	5	5
Medium Income	5	10	15
Low Income	10	15	25

During Hurricanes Erin and Opal few people in any group used public shelters. The low shelter use rates in Hurricane Opal probably occurred in part because so many evacuees left the local area. In Hurricane Erin the low use rates probably were due to the low overall participation rates.

## EVACUATION DESTINATIONS

### a. Refuge Locations

In Hurricane Opal most evacuees left their own county as shown in Table 24. Table 25 shows that the evacuees by risk area going out of county were very similar to each other and to the county percentages. State destinations of evacuees leaving their own county are shown in Table 26. Almost all the Alabama evacuees leaving their county went elsewhere in Alabama or to Mississippi. Escambia and Santa Rosa evacuees were about evenly divided between Florida and Alabama with a few going to Mississippi and Georgia. This pattern was similar for Okaloosa and Walton Counties.



**TABLE 24  
LOCATION OF REFUGE IN HURRICANE OPAL BY COUNTY (PERCENT)**

	Mobile/ Baldwin	Escambia/ Santa Rosa	Okaloosa/ Walton	Bay
Stayed in their own Neighborhood	5	7	15	6
Stayed within their own County	33	29	20	21
Left their own County for shelter	62	64	65	73

**TABLE 25  
LOCATION OF REFUGE IN HURRICANE OPAL BY RISK AREA (PERCENT)**

	Beaches	Mainland Surge	Non-Surge
Stayed in their own Neighborhood	5	10	18
Stayed within their own County	27	24	25
Left their own County for shelter	68	66	57

**TABLE 26  
STATE DESTINATIONS DURING HURRICANE OPAL BY COUNTY  
(PERCENT)**

Destination	Mobile/ Baldwin	Escambia/ Santa Rosa	Okaloosa/ Walton	Bay
Evacuated to Florida	6	39	34	47
Evacuated to Alabama	57	37	44	34
Evacuated to Georgia	0	6	5	18
Evacuated to Mississippi	30	10	9	0
Evacuated to Other State	8	8	7	0
Did not Know	0	0	1	1

**b. Destination Changes During Hurricane Opal**

Due to the traffic congestion during the Hurricane Opal evacuation some evacuees changed their destination after leaving. In Alabama 16 percent changed their destination and in Bay County Florida 34 percent of evacuees changed their destination. Table 27 shows the top four reasons why people changed their destination while evacuating in Hurricane Opal by county and Table 28 shows the same information by risk zone. Traffic congestion was the primary reason for changing destinations.

**TABLE 27  
REASONS FOR CHANGING DESTINATION  
DURING HURRICANE OPAL BY COUNTY (PERCENT)**

Destination	Mobile/ Baldwin	Escambia/ Santa Rosa	Okaloosa/ Walton	Bay
Traffic Congestion	53	67	41	35
Storm getting to close	12	31	19	13
Storm getting to strong	12	14	26	13
Motels were full	24	11	7	33

**TABLE 28  
REASONS FOR CHANGING DESTINATION  
DURING HURRICANE OPAL BY RISK ZONE (PERCENT)**

Destination	Beach	Mainland Surge	Non-Surge
Traffic Congestion	53	42	33
Storm getting to close	16	25	22
Storm getting to strong	17	17	0
Motels were full	23	14	11

**c. Destination Travel Times During Hurricane Opal**

Table 29 shows the times it took evacuees to get to their destinations. Time required to reach eventual destinations was shortest in Alabama, where 48 percent reached refuge in an hour or less. In Escambia and Santa Rosa 39 percent took an hour or less, but in the other Florida locations only 21 percent (Okaloosa/Walton) and 27 percent (Bay) consumed such short travel times. In Florida more than 20 percent of all evacuees required at least eight hours to reach their destinations. Mainland surge area evacuees took longer than both beach and non-surge evacuees to reach their destinations as shown in Table 30.

**TABLE 29  
TIME REQUIRED TO REACH DESTINATION  
DURING HURRICANE OPAL BY COUNTY (PERCENT)**

Destination	Mobile/ Baldwin	Escambia/ Santa Rosa	Okaloosa/ Walton	Bay
Less than 1 hour	48	39	21	27
1 hour to 4 hours	25	19	19	25
4 hours to 8 hours	16	20	39	24
More than 8 hours	11	21	21	24

**TABLE 30  
TIME REQUIRED TO REACH DESTINATION  
DURING HURRICANE OPAL BY RISK ZONE (PERCENT)**

Destination	Beach	Mainland Surge	Non-Surge
Less than 1 hour	53	42	33
1 hour to 4 hours	16	25	22
4 hours to 8 hours	17	17	0
More than 8 hours	23	14	11

Approximately half of all evacuees said their evacuation required more time than anticipated, ranging from a low of 46 percent in Alabama to a high of 60 percent in Okaloosa/Walton. Mainland surge respondents were more likely than others to say their trips took longer than expected.

The vast majority (88 percent to 97 percent) of evacuees who said their evacuation took longer than expected attributed the delay to heavy traffic (Table 31). Some also mentioned that too many people left at the same time, which is a way of explaining the traffic congestion. Weather, highway construction, and poor traffic management were also mentioned more frequently than other factors. There was substantial variation among responses from one jurisdiction to another. Traffic was also cited overwhelmingly by respondents in all risk areas (Table 32).

**TABLE 31  
REASON TRIP TOOK LONGER  
DURING HURRICANE OPAL BY COUNTY (PERCENT)**

Reason	Mobile/ Baldwin	Escambia/ Santa Rosa	Okaloosa/ Walton	Bay
Traffic congestion	88	97	96	93
Too many people left at the same time	16	10	9	25
Roadway construction	2	20	14	4
Bad weather	33	11	19	11
Poor Management	6	12	12	16

**TABLE 32  
REASON TRIP TOOK LONGER DURING HURRICANE OPAL  
BY RISK ZONE (PERCENT)**

Reason	Beach	Mainland Surge	Non-Surge
Traffic congestion	93	95	97
Too many people left at the same time	16	10	23
Roadway construction	11	12	7
Bad weather	13	26	37
Poor Management	8	10	11

In Hurricane Erin evacuees traveled much shorter distances than in Hurricane Opal. Two-thirds of all Hurricane Erin evacuees went to destinations within their own county, and 30 percent went someplace in their own neighborhood.

**d. Destination Assumptions For Use In Planning**

Out-of-county evacuation behavior is highly variable from one location to the next, although there appears to be much consistency within the Tri-state study area. Alabama beach areas in particular appear more likely to go out-of-county than other locations, due to a relative absence of safe refuge options within their counties. It is normal for more evacuees from high-risk locations to go out of county than from moderate-risk locations and more from moderate-risk location than from inland locations. Evacuees in higher risk locations tend to leave earlier and tend to be wealthier (therefore being more able to afford hotels and motels).

**TABLE 33  
PERCENTAGE OF EVACUEES GOING OUT-OF-COUNTY FOR USE IN  
PLANNING**

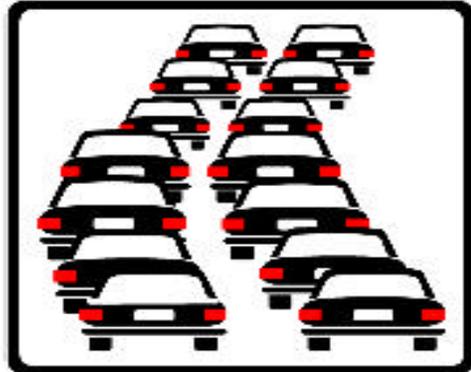
RISK AREA	<u>Cat 3 Storm</u>	<u>Cat 1 Storm</u>
Beaches	65	50
Mainland Surge	55	35
Non-surge	40	15

These figures should not be confused with participation rates. The percent of residents evacuating from each of the areas will vary. To each of the participation rates indicated earlier, the out-of-county destination rate should be applied. It should also be noted that when a large Category 4 or 5 storm is

threatening much higher participation rates might occur as recorded for Hurricane Floyd in 1999.

## **VEHICLE USAGE**

Transportation modeling requires knowledge of the number of vehicles evacuating, more than the number of people. Also some vehicles such as trailers and motor homes impact traffic flow more than other vehicles. Finally emergency management officials need to anticipate the number of people who will need their assistance in order to evacuate.



Not all-available vehicles are used in evacuations, in part because households prefer not to separate their family. The percentage of available vehicles used in Hurricane Opal varied between 62 percent and 68 percent across county groups. A slightly greater percentage of available vehicles were taken from beach areas (70 percent) than other risk areas. The number of vehicles per evacuating household ranged from 1.16 to 1.36. The 1986 behavioral study done for the Tri-State study showed that of the vehicles available to evacuees, 73 percent would be used in Alabama and 61 percent would be used in Florida.

Few evacuees pulled trailers or took motor homes. In Bay County 7.5 percent took such vehicles, and in Okaloosa/Walton only 2.5 percent did so. There was no discernible pattern of variation across risk zones. Pulling trailers (usually for boats) and taking motor homes can vary widely from place to place. A five-percent rate is the lowest, which should probably be used for planning, due to the fact that more evacuees would probably have taken their boats if they had more time to prepare for the evacuation in Hurricane Opal.

Approximately six percent of surveyed households said someone required assistance evacuating. In almost all cases respondents said the assistance was provided by friends or relatives.

Vehicle use figures vary little from place to place or from evacuation to evacuation. Moreover, vehicles use is one of the few behaviors that can be predicted accurately solely with hypothetical response data. For planning purposes it should be assumed that between 65 percent and 75 percent of the available vehicles will be used throughout the study area.