

PUBLIC RESPONSE TO HURRICANE OPAL:

SUMMARY OF FINDINGS¹

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Hurricane Opal prompted an extensive and rapid evacuation in Alabama and the Florida Panhandle on October 3rd and 4th, 1995, severely taxing evacuation routes and other resources. A telephone survey was conducted in January 1996 with residents of the region to document how they responded during the threat.

Background

Storm History

At 4 AM on Tuesday, October 3rd a Hurricane Watch was issued for Hurricane Opal from Morgan City, Louisiana to just west of Pensacola, Florida. At 10 AM that day the Watch was extended eastward to the mouth of the Suwanee River. Throughout most of the rest of Tuesday, landfall was anticipated someplace from Alabama to Panama City, Florida on the morning of Thursday, October 5th. Tuesday evening, however, the storm began to increase forward speed and intensity, and by 10 PM a Hurricane Warning was issued for Alabama and the Florida Panhandle, with eye landfall expected by Wednesday evening and tropical storm force winds by Wednesday morning. Opal continued to strengthen overnight and the next morning. At 4 AM Wednesday, Opal was forecast to be a category 4 storm (132 MPH) at landfall by 10 AM had already reached almost 150 MPH. From that time on Opal weakened, although forecasts indicated that it was possible that the storm might intensify again before landfall. When

¹This summary is based on a survey conducted as part of a Behavioral Analysis performed for the Mobile District of the U.S. Army Corps of Engineers in support of the Tri-State Hurricane Evacuation Study Update. Additional details of the Behavioral Analysis may be obtained from the author.

landfall occurred between Pensacola and Fort Walton Beach at 5 PM, the storm had weakened considerably, with maximum sustained winds between 105 and 115 MPH. Severe damage was caused by storm surge and wave scour in a narrow band along the shoreline extending as much as 150 miles east of the eye landfall location. Wind damage was relatively slight near the coast, but tornadoes and winds caused widespread damage and power outages at scattered locations well inland along the storm's track stretching into North Carolina.

Evacuation Notices

Alabama and Florida coastal counties took a variety of actions in response to Opal. At 5 PM on Tuesday, Escambia County began announcing that an evacuation order would probably be issued at 10 PM. Okaloosa County issued an evacuation order at 6 PM. Escambia and Santa Rosa Counties issued evacuation orders at 10 PM, and Bay County announced that an evacuation order would be issued at 6 AM Wednesday, but recommended that those planning to leave do so before morning. Walton County issued an evacuation order at 11 PM. Mobile and Baldwin Counties in Alabama ordered evacuation Wednesday morning at 6 AM. Some of the counties cancelled the evacuations late Wednesday morning and advised people to take refuge nearby, due to fear that people would be caught in congested traffic as Opal arrived.

Survey Methods

In January 1996 a total of 800 residents of the area threatened by Opal were interviewed by telephone. The sample was divided into four groups of roughly 200 interviews each: Mobile and Baldwin Counties in Alabama, Escambia and Santa Rosa Counties, Okaloosa and Walton Counties, and Bay County in Florida. In each of the four groups approximately half the interviews were conducted in beach locations, a fourth in

mainland surge areas, and a fourth in areas inland of storm surge but within the coastal counties listed above.

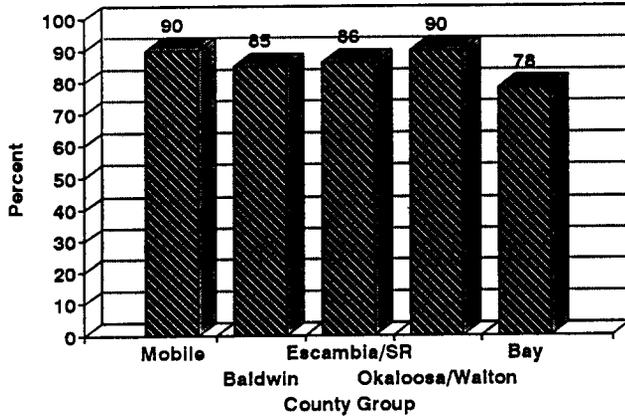
Figures reported in surveys cited in this report are based upon samples taken from larger populations. The sample values provide estimates of the values of the larger populations from which they were selected, but are usually not precisely the same as the true population values. In general, the larger the number of people in the sample, the closer the sample value will be to the true population value. A sample of 200 will provide estimates which one can be 90% confident are within 4 to 6 percentage points of the true population values, whereas a sample of 100 will provide the same degree of confidence within 5 to 8 percentage points of the true population values. With a sample of 50, one can be 90% "confident" of being within 7 to 11 percentage points of the actual population value, and a sample of 25 is 90% "accurate" only within 10 to 17 percentage points.

Evacuation Rates

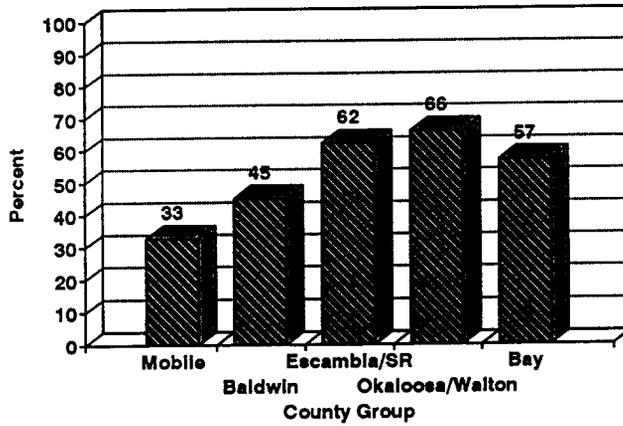
Location

Respondents were asked whether they left their homes to go someplace safer in Opal, and the results appear in Figures 1-3. In the beach areas at least 85% of the respondents said they evacuated in all locations except Bay County, where parts of Panama City Beach are farther from the Gulf and higher in elevation than in beach areas of other counties. In the mainland surge areas there was more variation. In the Florida counties evacuation rates varied between 57% and 66%, but in Alabama the rates were below 50%. In the non-surge areas, roughly a third evacuated in Florida, compared to 15% in Alabama. Overall 85% evacuated from beach areas, compared to 57% in the mainland surge locations and 30% in non-surge locations (Figure 4).

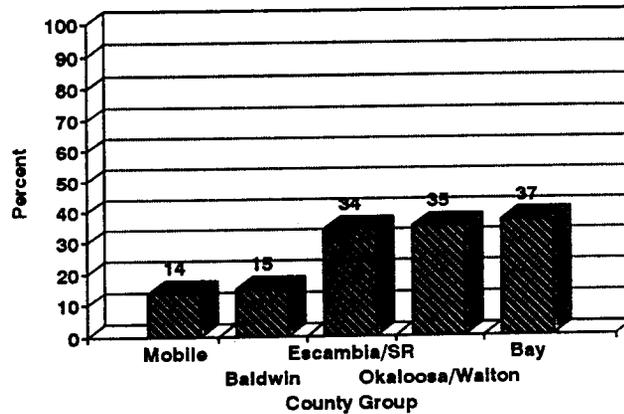
**Fig. 1. Evacuation in Opal
Beaches**



**Fig. 2. Evacuation in Opal
Mainland Surge**



**Fig. 3. Evacuation in Opal
Non-Surge**



Evacuation Notices

Most residents of the beach areas (74%) said they heard from officials that they should evacuate. In the mainland surge areas only 52% said they heard officials say they should evacuate, and in the non-surge areas only 28% said they heard official notices. Another 10% in each location said they heard from other people (second hand) that officials had said they were to evacuate. Figure 5 depicts the effect of perceived evacuation notices on evacuation. Three-fourths of the people in beach locations said they evacuated, even if they didn't hear evacuation notices from officials, although slightly more (87%) left if they did hear. The effect in the mainland surge areas was much more pronounced. Of those who said they heard directly from officials that they should evacuate, 75% left, compared to only 29% of those who did not hear. A similar effect was observed in the non-surge locations.

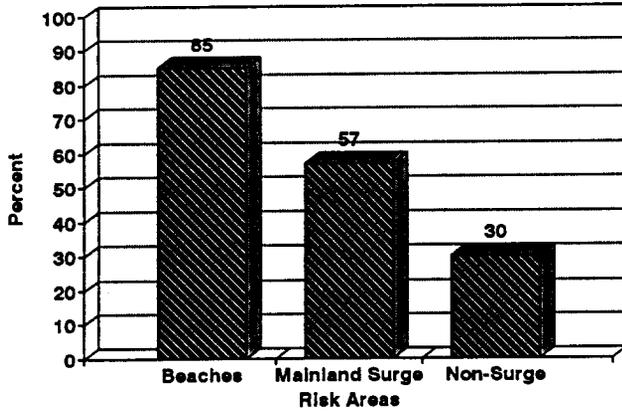
In the beach areas most people who heard official evacuation notices thought the notices were mandatory. In the mainland surge areas people were evenly divided among those who thought the messages were mandatory and those who thought they were recommendations. In the non-surge areas few people believed the notices were mandatory.

Figure 6 indicates that those who believed the evacuation notices were mandatory were more likely to evacuate than those who believed they were recommendations. This was particularly true in the mainland surge area.

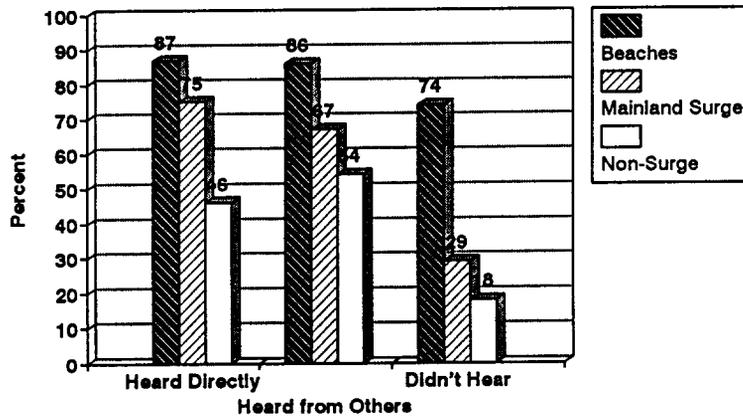
Other Factors

In some of the counties (Escambia and Santa Rosa in particular), many residents were contacted by a computerized telephone notification system and advised or ordered to evacuate. In both the beach and mainland surge areas, 90% of those receiving calls said they evacuated, significantly more than those who did not receive calls.

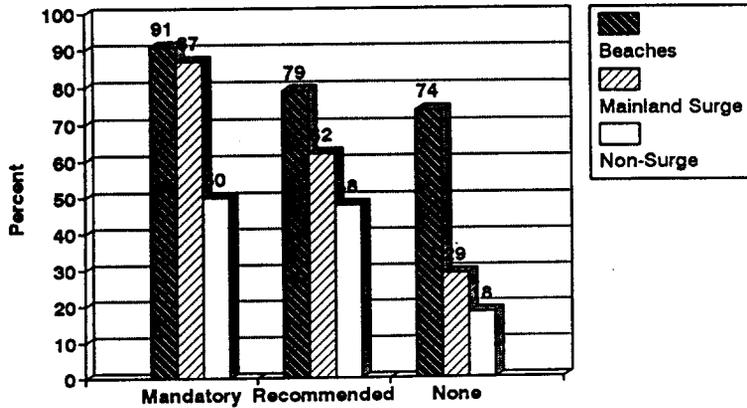
**Fig. 4. Evacuation in Opal
by Risk Area**



**Fig. 5. Evacuation in Opal
Heard Official Evacuation Notices**



**Fig. 6. Evacuation in Opal
Heard Official Evacuation Notices**



People were asked whether they believed their homes would have experienced dangerous flooding had Opal struck their location with 125 MPH winds. Those who said yes were more likely than others to evacuate in each of the three risk areas (79% vs. 50% overall). Almost identical differences were found among people who felt their homes would not be safe versus those who thought their homes would be safe, if Opal had struck their location with 125 MPH winds, considering both wind and water.

People who evacuated in Erin earlier in 1995 were more likely than others to evacuate in Opal (91% vs. 56% overall). Mobile home residents were more likely than others to evacuate (83% vs. 60%). People who had lived in their own homes or in the region fewer than five years were slightly more likely than others to evacuate.

There were no differences in evacuation rates with respect to age, income, race, number of people in the household, number of children in the household, or pet ownership.

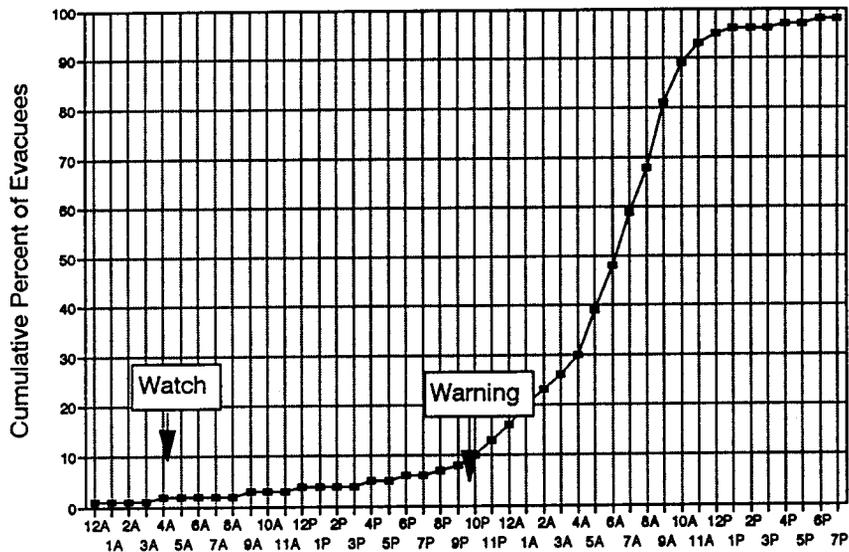
When asked why they did not evacuate, most people who stayed behind said they felt safe where they were. However, 23% said they didn't leave because traffic was too bad, 10% said they waited too long to leave, and 5% said conditions had become too dangerous to leave by the time they decided to do so. Seven percent said they tried to leave but gave up and returned home because of traffic.

Evacuation Timing

One of the most interesting aspects of the Hurricane Opal evacuation was the timing of the evacuation. Traffic counters and observations suggested that few people left their homes before 6 AM Wednesday morning, resulting in a great deal of congestion on evacuation routes. At this writing, the data for building a cumulative response curve is incomplete, but current data suggests the final curve will be similar to the one shown in Figure 7. Although some of the evacuees left during the Hurricane Watch period on Tuesday, the evacuation did not begin in earnest until at least 10 PM Tuesday, and more

likely after daybreak Wednesday. This would help explain the traffic congestion and delays which were widely reported.

Fig. 7. Cumulative Response in Opal
October 3-4



Destinations

Eight percent of the respondents said they went to destinations in their own neighborhoods, and 36% said they went to places within their own county but outside their neighborhood. Twenty-four percent said they went someplace other than their original destinations. However, almost as many said they went farther than originally planned as those who said they didn't go as far. Traffic was the most commonly cited reason for changing destination (48%), but 20% said they had to keep going because motels were full, 19% said the storm had gotten too close, and 16% said the storm had gotten stronger.

Travel

Figure 8 shows how the length of time required for evacuees to reach their destinations. Almost half took more than four hours, and 20% required more than eight hours. More than half the respondents (55%) said their travel took longer than expected, and almost all said heavy traffic was the main reason. Seventeen percent said poor weather played a part, 12% cited poor traffic management, and 11% believed road construction impeded traffic flow.

Fig. 8. Hours to Reach Destination

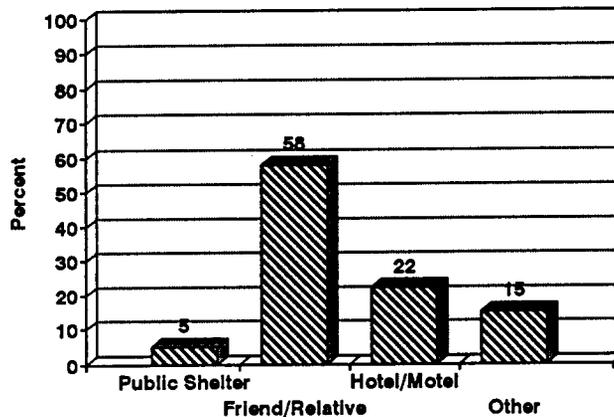


Almost half the evacuees said they heard announcements on radio and television about traffic and road conditions before leaving home, and of those, 28% said they changed their travel plans (e.g., route choice) based on the information. More than half (51%) said they heard such announcements after leaving home, and almost a third changed plans en route. More than half also said they heard announcements about alternative shelter locations after leaving home.

Type of Refuge

As in most evacuations, most evacuees (58%) went to the homes of friends and relatives (Figure 9). Twenty-two percent went to hotels and motel, five percent went to public shelters, and 15% went to other facilities such as churches, hospitals, work places, and second homes.

Fig. 9. Type of Refuge
Combined Sample



Conclusions

Although the loss of life in Opal was low, Opal demonstrated the precariousness of evacuation plans which give insufficient heed to the possibility that storms will accelerate and/or intensify rapidly and unexpectedly. Because Opal lost strength significantly before landfall, residents were spared the more severe part of the lesson.

Opal also demonstrated the importance of official evacuation notices, especially in mainland surge areas, and the effectiveness of automated telephone notification systems was illustrated. Officials should also be encouraged by the large number of people who were reached by announcements concerning traffic and shelter information both before and after leaving home.