Hurricane Evacuation Behavioral Assumptions for Connecticut

Appendix to
Hurricane Evacuation Behavior in the Middle Atlantic and Northeast States

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Preface

This document is accompanied by a lengthier report titled *Hurricane Evacuation Behavior in the Middle Atlantic and Northeast States*, referred to hereafter as the "Main Report". That volume provides background information relevant to understanding the following discussion. In particular the Main Report describes methodology and data which form the basis for many of the recommendations included in this volume. On occasion this report will make reference to "MR-Fig. *x*", meaning a particular figure in the Main Report.

Sample survey results for two Connecticut locations are reported in this document, but the reader should be aware that they are included as "tests" of the general response model's applicability to Connecticut rather than to provide actual figures for evacuation planning. Even for the two sites themselves response in future hurricanes could be considerably different than that observed in Gloria.

Evacuation Rates Among Residents

The percentage of respondents in our sample who evacuated in Gloria varied little between interview sites. Forty-three percent left from Groton and 38% from Fairfield (MR-Fig. 8). This does not necessarily mean, however, that more should have left. Substantially more of the Groton sample lived within a block of water (69% to 25%) (MR-Fig. 7).

Although more Groton area respondents (33%) than Fairfield (27%) said they were told to evacuate, the differences are not great enough to infer that they are indicative of the entire populations in the two areas (MR-Fig. 10). In both locations people hearing that they should leave were twice as likely to do so (66% vs 28%) (MR-Fig. 11). Respondents in both locations were far more likely to interpret the evacuation notice as advisory than mandatory (MR-Fig. 12). Overall all in the northern sampling region, people believing the notice to be mandatory were more likely to evacuate (MR-Fig. 13).

Slightly less than half those who didn't leave said they felt safe staying where they were (MR-Fig. 18). Over 60% in both locations perceived their houses to be safe in hurricanes (MR-Fig. 15).

Response in Gloria in both interview locations conforms to patterns predicted by the general response model. Table 1 summarizes the general guidelines for use in assigning evacuation rates to specific locations elsewhere in Connecticut. The table varies response on the basis of four variables.

	Severe Storm Evacuation Ordered in High/Mod. Risk Areas, and Mobile Homes			Weak Storm Evacuation Ordered in High Risk Areas Only, and Mobile Homes		
	Risk Area					
	High	*Mod*	*Low*	*High*	*Mod*	*Low*
	Housing Other Than Mobile Homes					
	90%	70%	30%	80%	40%	20%
	Mobile Homes					
	90%	85%	60%	90%	70%	55%

Note:

Figures will be lower if officials are not successful in communicating orders.

Table 1. Evacuation rates to be used for planning in Connecticut.

Storm Severity

The table addresses two storm scenarios. The first is a strong storm, a category 3 or worse. The second storm is weaker. The difference obviously is that more people are at risk in the more severe storm, and evacuation will be greater from moderate-risk and low-risk locations.

Action by Officials

It is assumed that officials will tell people to leave from high-risk and moderate-risk locations and tell all mobile home dwellers in coastal counties to evacuate in the severe storm. In the weaker storm only mobile home residents and people who live in high-risk locations are told to leave.

It is also assumed that officials are successful at communicating the evacuation notices to residents. The Gloria data attests to the greater likelihood of people leaving if they believe officials have told them to. The only way to ensure that everyone will hear the notice is to have it disseminated door-to-door. If that is not possible, vehicles with loudspeakers are the second best method. If officials cannot disseminate the evacuation notices in either of those manners, evacuation rates will be 25% lower in high-risk areas and 50% lower in moderate-risk and low-risk areas.

Risk Area

High-risk areas refer primarily to barrier islands and other land areas exposed to the open ocean where wave battering and scour are major hazards in addition to flooding. Moderate-risk areas are subject to flooding in moderate to strong storms but do not experience significant battering and scour. Low-risk areas are subject only to wind and are adjacent to moderate-risk locations. Most of the

sample households in the two areas are located in high-risk to moderate-risk locations.

Housing

Table 1 distinguishes between mobile homes and other housing. Neither of the survey locations contained a large percentage of mobile homes, but they should be considered separately for planning. Evacuation will be greater from mobile homes than from other housing, all other factors being the same.

Evacuation Timing By Residents

With so few evacuees in the two samples, it's difficult to make very confident statements about the exact time evacuees left. The matter is further complicated by the fact that interviewees were being asked to recall fairly precise information from something that occurred two years previously. It appears, however, that evacuees began to leave somewhat earlier from the Groton area than from the Fairfield area (MR-Fig. 23). (Figure 23 in the *Main Report* is in error. Fifty-five percent of the Groton evacuees said they left on the 26th, not 21% as reported in the figure.) This probably reflects differences in the timing of actions taken by local officials.

Evacuation timing, however, will vary greatly from storm to storm, and little can be generalized from Gloria. For planning purposes three different sets of assumptions depicted in Figure 1 should be analyzed. The three curves in Figure 1 reflect three different rates at which evacuees leave, reflecting in turn three different levels of urgency.

The left-most curve represents response when forecasts are early and residents are told to evacuate with plenty of warning. That scenario should probably be called optimistic. The middle curve is probably more typical. Warning is not quite so early in relation to landfall. Finally, the right-hand curve will pertain when a storm accelerates, intensifies, or changes course unexpectedly. People will leave very promptly if it is made clear to them that they must. All three curves should be used for planning because all three will occur eventually.

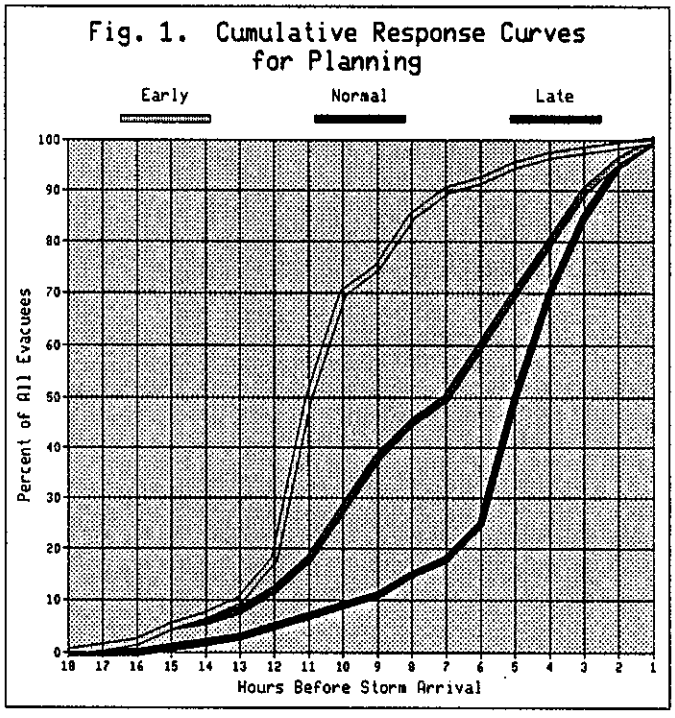

Fig. 1. Cumulative Response Curves for Planning

Fewer than 20% of eventual evacuees will leave before being told to leave. When told, however, people will leave as promptly as they believe they must. Given the luxury of time, most people will not evacuate late at night and will wait until morning if they haven't left by 11 pm or midnight. People will leave in the middle of the night if officials make it clear that circumstances make it imperative that they do so. People from high-risk locations (barrier islands) tend to leave earlier than other evacuees.

Demand for Public Shelters by Residents

Few evacuees in either survey area used public shelters: 23% of the Groton evacuees said they went to public shelters compared to 11% of the Fairfield evacuees (MR-Fig. 25). Due to the sample sizes, however, both figures are subject to enough uncertainty to prevent the conclusion that there were overall differences in shelter use among all evacuees from the two areas. It's likely that overall differences were smaller than those found in the samples. Such figures are normal for high-risk and moderate-risk locations. Residents of beach communities usually have higher incomes and choose not to stay at public shelters and can afford motels if arrangements can't be made with friends and relatives. They also tend to leave earlier and go farther.

Late night evacuation tends to maximize shelter use, primarily because it is occurring with a sense of urgency, leaving no time to make alternative arrangements with friends, relatives, and motels or leaving too little time to travel the distance necessary to go out-of-town, particularly at night.

Hypothetical shelter use among non-evacuees was greater than actual use among evacuees (37% in Groton and 25% in Fairfield) (MR-Fig. 27). These hypothetical responses are typical of the 100% overestimation normally observed when comparing intended to actual shelter use. It does, however, tend to reinforce the notion that dependence upon public shelters will be greater in Groton.

Table 2, showing guidelines for projecting normal shelter demand, reflects these patterns. Late, urgent evacuations, which will roughly double normal shelter demand, are not a function of location. It should also be noted that emergency management officials in some communities encourage shelter use more than others,

and such policies should be taken into account in planning, because officials can take actions which either increase or decrease shelter use. Other factors to note are that retirees living in "retirement areas" are more likely to use public shelters than other groups, some communities have churches and other organizations which reduce "public" shelter use by being more active than normal in providing their own shelters, and some housing developments and mobile home parks provide onsite shelter which will alleviate demand for public shelter.

	Risk Area		
	High	*Mod*	*Low*
Income			
High	5%	10%	10%
Med.	10%	20%	30%
Low	-	40%	40%

Note:

Figures will be higher if officials encourage use of public shelters.
Figures will be lower for developments with on-site shelters (e.g., clubhouses).
Figures will be lower where churches and other organizations shelter members.

Table 2. Evacuees going to public shelters: planning assumptions for Connecticut.

Evacuation Out-of-Town by Residents

Less than half the people evacuating from both survey areas went out-of-town: 45% in Groton and 35% in Fairfield (MR-Fig. 30). Almost everyone in both locations said they required 30 minutes or less to reach their destinations, however, suggesting that evacuees travelled very short distances (MR-Fig. 31).

Differences are accounted for primarily by income (low income residents don't go as far), evacuation timing (late night, urgent evacuees don't go as far), and risk area (evacuees from high-risk beach areas go farther). Table 3 reflects these generalizations. Note too, that emergency management officials can influence this response. In some locations agencies have policies to discourage evacuees from staying in the local area. Communities which aggressively provide and publicize public shelters will have fewer evacuees leaving the local area.

Very Strong Storm, Early Evacuation			Weak Storm Typical Timing		
Risk Area			Risk Area		
High	*Mod*	*Low*	*High*	*Mod*	*Low*
75%	45%	25%	50%	30%	20%

Note:

Figures will be lower for low income and elderly retired evacuees.

Figures will be lower for last minute evacuations.

Figures will be higher if officials encourage evacuees to leave area.

Table 3. Percent of evacuees leaving local area: planning assumptions for Connecticut.

Vehicle Use by Residents

The average number of vehicles used per evacuating household in Gloria was greater for Fairfield (1.5) than Groton (1.2) (MR-Fig. 37). More people in Fairfield used no vehicles at all, probably walking short distances to friends or to shelters or riding with someone else (MR-Fig. 36).

Normally 65% to 75% of the vehicles available to a household are used in evacuations, and both Connecticut survey locations fell within that range in Gloria (72% and 73%). For planning purposes it would be reasonable to assume that approximately 70% to 75% of available vehicles will be used in most evacuations.

No one in either sample said they required assistance from public agencies in evacuating (MR-Fig. 41), and no one said they used public transportation (MR-Fig. 38). Of those respondents who did *not* evacuate in Gloria, approximately 5% in both areas said they would have needed agency assistance if they had evacuated (MR Fig. 42). Even in communities where agencies prepare lists of people and addresses needing evacuation assistance, it is common to find that those people have already been provided for by friends and relatives when public vehicles arrive to collect them. No one in Groton and 7% of the stayers in Fairfield said they would use public transportation if they evacuated (MR-Fig. 40). Three percent of the stayers in Groton and 8% in Fairfield said they had no cars of their own available (MR-Fig. 39).