

## CHAPTER 13

### EVACUATION OF DANGER AREAS

In almost any natural disaster, certainly one which is associated with a tropical cyclone, it becomes necessary to move people from a dangerous area to one that is safe or at least relatively so. It is therefore necessary as part of the disaster-preparedness planning to formulate detailed plans so that people may be moved in good time, smoothly and efficiently. At the threat of an emergency, such as at the time when the warning service indicates the possible approach of a tropical cyclone, one of the questions that will have to be considered by the authorities would be: which areas might have to be evacuated? The resulting decisions, perhaps provisional ones in the first instance, would be largely based on the forecasts of conditions to be expected — strength of the wind and amount of rainfall, areas likely to be flooded and anticipated depth of water, likelihood of storm surge and coastal areas to be affected.

When all these questions have been considered and conclusions reached, the organization for evacuation, already at full readiness, would be called into action. The effectiveness and operational efficiency of this organization can have a decisive influence on the success or failure of the whole system for disaster preparedness in conditions of actual emergency.

The evacuation of people has as its objective the saving of lives and is therefore one of the most crucial elements of disaster mitigation. In moving people, whether in large groups or in small numbers, numerous problems are bound to arise. Evacuation is therefore a facet of disaster preparedness which calls for the most careful and exhaustive planning. Planning of a high standard will go far to ensure that in a disaster situation the management of evacuation can proceed smoothly and, as unforeseen contingencies arise, they are handled knowledgeably and firmly, thus preventing such contingencies reducing the whole operation to chaos.

#### General aspects of evacuation planning

There are three phases of a possible disaster during which the transfer of people to a safer area may take place:

- (a) *In advance of the arrival of the tropical cyclone or other natural phenomenon.* In this phase action would be taken on the basis of the warnings that have been issued and for this reason the control of evacuation should be a part of the whole operational system and in close touch with the warning sources. During this phase weather conditions must be expected to deteriorate rapidly with rising winds and heavy rainfall. Flooding may begin in the most vulnerable areas.
- (b) *During the emergency itself.* This requirement for evacuation could arise if some delays or breakdowns had occurred during the earlier phase discussed in (a) above, or if it were seen that unexpected dangers had presented themselves, e.g. the destruction of buildings thought to be safe, flood water reaching a significantly higher level than forecast, a storm surge occurring farther along the coast than was considered likely, and so on.
- (c) *In the aftermath of the emergency.* In this phase the amount and complexity of the evacuation problem would depend on the severity of the disaster and its impact upon inhabited areas.

It is clear that phase (a) could merge into phase (b), which itself could merge into phase (c). Phase (a) is obviously the most amenable to detailed planning. There can be no doubt that if this planning produces an efficient, keen and well-disciplined organization for evacuation, then evacuation operations during the actual emergency and in its aftermath would have the best prospects of being carried out successfully and free from panic.

In the planning of evacuation reference should be made to the vulnerability studies. These studies should show the hazardous areas and also indicate the conditions when potential dangers become real. For example, the vulnerability analyses would clearly point to the areas which would be inundated in the event of flood waters reaching a given level, the effects of storm surges of given heights on coastal areas would also be available.

In combination with the results of the vulnerability studies there should be a thorough survey of the area for which the concerned authority has responsibility. It would then be feasible to prepare maps and diagrams showing:

- (a) Areas to be evacuated and time required for the operation to be carried out;
- (b) Areas/places/buildings to be used as shelters;
- (c) Assembly points and routes to be used in transferring people from a particular area to the specified safety area or place or building.

In addition, plans should be drawn up to cover the transport arrangements and traffic control. On the welfare side the National Red Cross and other appropriate voluntary agencies should assist in the planning of various aspects including first aid, mass feeding, distribution of food, the special problems associated with the elderly, pregnant women, nursing mothers and their babies. The morale of evacuees should receive special attention. The very fact of having to abandon their homes, especially if this occurs at night, could generate an atmosphere of tension and acute depression among some of the people.

Administrative planning should ensure that records are kept of all people evacuated and their new locations. Records should also be maintained of the assistance provided to individuals, families, etc. It should also be verified and checked at regular intervals that reception areas or places or buildings are able to absorb the proposed number of evacuees.

In the following paragraphs some of the more important aspects of evacuation are discussed separately.

### **Safe buildings**

Strongly built multi-storey buildings located in areas where storm waters can drain away rapidly may be used for the reception of evacuees and as shelters. It would be best not to use such buildings if they are built on low ground, i.e. at or near sea-level, or on ground where the drainage is poor and inundation may persist for several days.

### **Evacuation areas, shelters and escape routes**

In each vulnerable area the authorities should carry out a thorough survey and prepare a series of maps showing areas to be evacuated if water-level, whether from flooding or, in the case of a coastal area, from storm surge, is expected to exceed a given height. Past records and the nature of the terrain should be a guide to the limits to be marked on the maps and, as examples, it is suggested that one map should show the areas to be evacuated if the flood level is expected to reach two metres, another map to indicate evacuation areas for floods exceeding two metres and up to a level of three metres, a third map for flood levels greater than three metres but not exceeding four metres and so on.

The maps should also show clearly the various escape routes along which the inhabitants would move or be moved to safety. Assembly points, taking into account the normal day-to-day transportation pattern, should also be marked in order to give information on where buses and other means of transport would be stationed for the collection of evacuees. Shelter or refuge areas should also be shown on the maps. Figure 20 is an example of a storm evacuation map prepared in the U.S.A. by the Emergency Warnings Branch of the National Weather Service. The map gives a wealth of detail which would repay close study



In this sector of disaster preparedness it is absolutely essential that the public should be fully informed of the plans that have been made for their rescue and safety. The authorities should also make inquiries in order to ascertain which families or individuals would travel in private vehicles when the order for evacuation is given. The organization of the whole operation would clearly be highly complex and an adequate number of group leaders should be appointed. Each leader would be responsible for a small number of people, perhaps 10 or 12, and would be in contact with them well before evacuation is ordered and, as soon as the order is announced, would personally shepherd them to safety in accordance with the evacuation plans.

The production of these evacuation and escape-route maps is likely to be expensive and it seems doubtful whether everybody would be prepared to purchase one. Moreover some members of the public might have difficulty in interpreting the maps in a manner that would avoid any possibility of error at vital times. The authorities, therefore, in addition to putting the maps on sale, should arrange for enlarged versions to be on permanent display in prominent places with responsible officials in attendance to explain the arrangements and answer questions. These and other useful steps would assist in meeting the essential requirement that the population should understand and comply with the arrangements made for its safety when evacuation becomes necessary.

In the United States the Department of Commerce has produced for instructional purposes a model community hurricane-preparedness plan for a fictitious city, Homeport, and its vicinity. Homeport represents a coastal community and the preparedness plan deals in a realistic manner with the hazards associated with hurricanes and shows what can be done to minimize death and destruction.

Figure 21 is taken from the Homeport plan and illustrates evacuation plan B for an expected storm tide of 9-12 feet (approximately 3-4 metres) above mean sea-level affecting Homeport and its immediate surroundings. Similar maps were prepared to show evacuation plans for different water-levels, plan A for flood levels of 4-8 feet (approximately 1.3-2.7 metres) and plan C for a flood level or storm tide of a level exceeding 13 feet (4.3 metres).

Among the main features of the map, the following may be mentioned: areas to be evacuated in the conditions specified are shown by shading; the locations of buildings which can be used as shelters are marked; escape routes, i.e. evacuation routes, are clearly indicated; contours give the heights above mean sea-level of the city and its vicinity.

The scale of the map shown in Figure 20 was originally 1:62500, i.e. one inch to the mile or 1 cm to 0.625 km. This scale is quite suitable for those who are accustomed to working with maps but for the information of the general public it would be advisable to produce, in addition, maps on a larger scale such as 1 in 10000 or even 1 in 5000. The main reason for this is that it is essential for all the people, not merely a high percentage of them, to understand without ambiguity the plans prepared for their safety. With very large-scale maps, such as 1 in 5000, all major details can be depicted prominently, the size of the population in each district, as well as traffic lanes on the escape routes and also the nature of the surface, whether it can carry heavy traffic or ought to be restricted to light transport. Moreover, with such a map, an inhabitant would be able to pinpoint the position of his own house and would judge what he needed to do in relation to assembly points, escape routes and shelters.

### **Emergency duty assignments**

As part of the planning for evacuation, a detailed organization structure should be drawn up showing what is expected of all official and voluntary bodies with a role to play in the conduct of evacuation. The chain of control and individual responsibilities should be clearly defined.

When the order to evacuate is given and made known to the people by radio, television, sirens, etc., team leaders and wardens should take action that will ensure that everyone concerned is aware of the order, and should marshal their charges in accordance with the plans. If special arrangements are required, e.g. ambulance service for anyone who is incapacitated, these should be made by team leaders or wardens. In this sector of the work the resources of the National Red Cross can be of great benefit.

The plans should also include full descriptions of the responsibilities to be undertaken by the police, fire service, public transport and other utilities and, if the area is a coastal one, by the coast guards. An air patrol operated with helicopters would be extremely valuable in all phases of an evacuation operation.

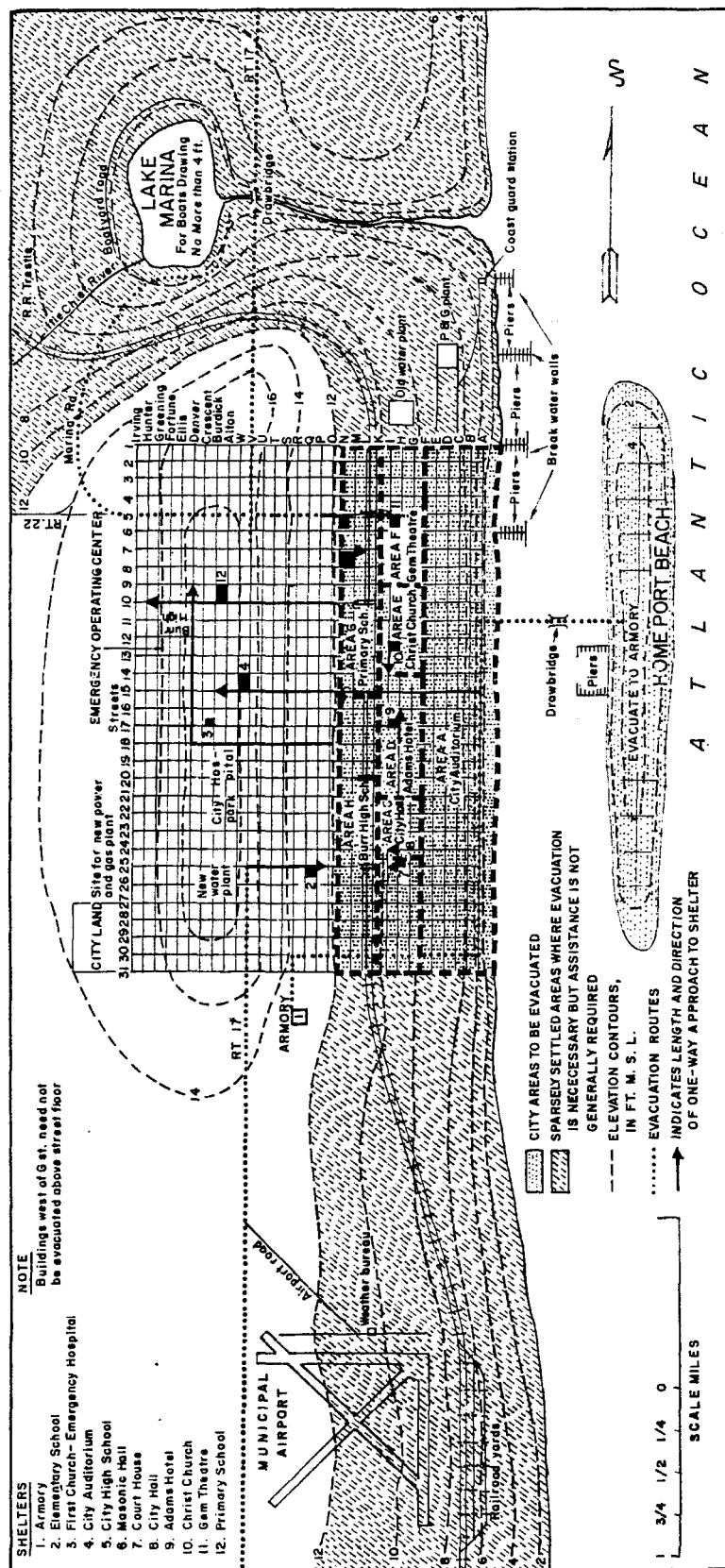


Figure 21 -- Evacuation plan B for expected storm tide of 9-12 ft, MSL, Homeport and vicinity (Reprinted from "A Model Hurricane Plan for a Coastal Community", published by U.S. Department of Commerce, Environmental Sciences Services Administration, 1966)