CHAPTER I

INTRODUCTION

1.0 General

- In the case of a major hurricane, the time required to evacuate vulnerable populations from coastal areas will increase dramatically as coastal populations grow. Forecast lead times have not significantly improved, making prediction of a specific landfall location more than 12 hours before its occurrence difficult. It is, therefore, important that vulnerable populations that are unable to evacuate in a timely manner be sheltered initially in or as close to their communities as possible.

- Emergency Management Agencies of both state and local jurisdictions generally are charged with safeguarding the lives and property of citizens. This responsibility also includes the task of selecting buildings that can serve as Hurricane Evacuation Shelters (HES). This manual explains a simple procedure for collecting data on and then evaluating potential HES buildings.

1.1 Purpose of Student Manual

Two technical documents establish the criteria for selecting buildings to serve as HESs:

(1) MASS CARE -- Preparedness and Operations (ARC 3031)
   - Focuses on mass care considerations

(2) Guidelines for Hurricane Evacuation Shelter Selection (ARC 4496)
   - Contains the requirements relating to storm surge, rainfall flooding, wind hazards, and hazardous materials considerations

- ARC 4496 lists the requirements in a generic form. This provides little help to an emergency management official who is responsible for applying the guidelines to a particular building.

- This student manual has been prepared to provide training in the application of the procedures established in the Model Hurricane Evacuation Shelter Selection Guidance Manual.

- Information regarding principles of building construction, wind effects, storm surge, rainfall flooding, hazardous materials considerations, and a least-risk decision making procedure are included.
• A survey checklist and its relationship to the least-risk decision making table are explained.

• This manual can be used for formal training and self-help programs to assist local officials in selecting buildings that may be used as HESs.

• The guidelines provided in ARC 4496 were prepared by an interagency group and:

  • Reflect the application of technical data compiled in:

    • Hurricane Evacuation Studies,
    • research findings related to wind loads and structural problems,
    • and other hazard information that may affect the suitability of a building as an HES.

• The risk assessment procedure outlined in this manual:

  • Is based upon a qualitative evaluation procedure that does not include detailed structural analysis or destructive testing.

  • Does not guarantee that a specific building will survive the associated risks of a hurricane. The wind design and construction practices of many local communities are frequently inadequate to resist the effects of a major hurricane.

  • Only provides a mechanism for selecting the least vulnerable areas within suitable buildings.

• The planning assumptions used in preparation of this manual can be found below in Figure 1.1.
Planning Assumptions Used In Preparation Of This Manual

For the purposes of this manual, the following planning assumptions were used:

a. In the absence of known structural deficiencies, buildings are assumed to provide adequate protection for storm conditions up to the level they were designed to (e.g., 110 mph windloads). Safety procedures similar to those recommended for the general population should be followed in selecting shelter space (e.g., avoiding areas adjacent to glass, etc.), if storm conditions are not expected to exceed local code requirements.

b. The potential HES buildings will be selected from locally available building stocks that are unlikely to have received special hurricane resistance attention in design and construction.

c. The guidelines established in this manual assume that storm conditions (wind, flood, etc.) will exceed local code requirements, therefore extraordinary procedures must be followed to identify suitable shelter areas within existing buildings. This must be done to significantly reduce the risks to those seeking shelter in an HES.

d. Once designated as an HES, the building will be utilized by local emergency management officials and other sheltering agencies regardless of the projected intensity of a hurricane event.

Figure 1.1 Planning Assumptions

• The Student Manual:
  • Is intended for an audience including HES surveyors and public safety officials involved in the actual shelter selection process.
  • Has been specifically designed in a low-tech format to meet the needs of an audience with a limited knowledge of hurricane effects and building wind design principals.
  • Focuses on the hazards and risks associated with the use of a building as an HES.
  • Uses procedures based upon currently available technical information (SLOSH, FIRM, etc.), historical wind performance data, and sound engineering judgement.
  • Is intended to enable HES surveyors and public safety officials to approach the selection process in an informed manner and to reach logical and consistent conclusions.

1.2 Development of a Comprehensive Shelter Strategy

• The development of a comprehensive shelter strategy is an essential component of disaster preparedness planning for a community. All communities should have a comprehensive long-range strategy and continuously strive to achieve these goals. The process of selecting HES buildings can help in developing such a comprehensive strategy.
This section provides a basic description of the strategic planning process and describes how to incorporate the data from hurricane evacuation shelter studies into a planning process.

For effective hurricane evacuation planning, it is essential to create a survivable operations capability for immediate needs. This process is called Survivable Crisis Management (SCM). People, plans, facilities, and equipment are four essential components of the SCM infrastructure. The following steps are required to develop an effective SCM infrastructure.

Step 1-Assess hurricane hazards, risks, and vulnerabilities of a community
Step 2-Define requirements for the community
Step 3-Assess existing capabilities against requirements
Step 4-Identify shelter deficiencies
Step 5-Develop a comprehensive plan to correct deficiencies and meet requirements
Step 6-Develop contingency plans to work around deficiencies until they are corrected
Step 7-Develop and conduct exercises to evaluate capabilities

*Figure 1.2, SCM Development Process Flowchart* illustrates the activities necessary to develop SCM capability. The individual steps in this process also must focus on four principal components; people, plan, facilities, and equipment.

1.2.1 Steps for Developing a Comprehensive Shelter Strategy

**Step 1:** This step begins with an assessment of the hurricane hazards and risks facing a community. The specific hazards associated with hurricanes are well documented in this manual and can be generalized into four categories: storm surge, rainfall flooding, wind hazards, and hazardous materials considerations. Identifying the hazards must be accompanied by a determination of the risk each hazard poses for that community. For example, coastal communities are more vulnerable to storm surge compared to inland communities. The actual threat from hurricane-related hazards depends upon the location, topography, geography, and industry.
Figure 1.2 SCM Development Process Flowchart
The assessment of the vulnerability of a community must also include an analysis of the effects of simultaneous emergency events, such as flooding and windborne debris, which can lead to hazardous materials risks.

**Step 2:** The next step is to define what is required to manage these hazards and risks adequately, and to assess the shelter requirements of the community. For example, a complete evacuation plan may be required for a barrier island, whereas inland communities with few evacuation routes may simply need adequate shelter spaces within the community. With respect to hurricane shelter planning, the objective is to provide a suitable space for an evacuated population. This population is defined as a summation of residents from mobile homes and substandard housing, those evacuated from storm surge risk and flood-prone low-lying areas, nonresident tourists and visitors, and, in some cases, overflow evacuees from other jurisdictions.

**Step 3:** The next step focuses on the evaluation of existing shelter facility capabilities within the community, both current facilities and potential new facilities. The approach to be used is:

1) Evaluate existing shelter facilities to determine their status with respect to established guidelines;

2) Determine actual shelter space capacity in existing facilities and identify unutilized space; and

3) Evaluate new facilities with respect to the established guidelines to provide options for increasing local shelter space capacity.

The evaluation process used for each individual facility includes a risk analysis with respect to the four major hazards, shelter space capacity evaluation, assessment of features conducive to mass care operations, and infrastructure and emergency power assessments. This information will provide emergency management officials with a snapshot of actual capabilities and associated risks of each facility with respect to the established guidelines.

The qualitative risk analysis performed during this study provides the following type(s) of information:

- Storm Surge Inundation - Refer to Chapter III, Section 3.4.2
- Rainfall Flooding/Dam Considerations - Refer to Chapter III, Section 3.4.3
- HAZMAT & Nuclear Power Plant Considerations - Refer to Chapter III, Section 3.4.4
- Wind and Debris Exposure - Refer to Chapter IV, Section 4.3.1.3
Based on shelter demand, existing capacity, and risks known for each facility, and a composite profile of the community-at-large available, emergency management officials and other agencies with mass care responsibilities can determine whether there is sufficient shelter capacity to meet its needs. When anticipated demand exceeds existing capacity, as established in the evaluation criteria, a least-risk decision making process needs to be developed and marginal facilities utilized.

**Step 4:** With the requirements and existing capabilities clearly understood, the community can identify its deficiencies and develop a comprehensive plan to remedy them. This shelter study has to be formatted specifically to provide a list of deficiencies and, where feasible, recommend mitigation/retrofit options to alleviate the deficiencies. In situations where a shelter deficit does exist, a comprehensive shelter strategic plan should be prepared to address all aspects of shelter deficit reduction. This plan should include, but not be limited to, shelter demand reduction (which should receive high priority), identification of nontraditional shelter facilities (shopping malls common areas, public hearing facilities, community or civic centers, fraternal organizations, funeral homes, etc.), and mutual aid agreements with neighboring jurisdictions that have shelter surplus.

The deficiencies also should be ranked, or prioritized, for retrofit. The ranking process should include considerations for both the impact the deficiencies have upon the use of the individual facility and the overall impact upon the community's shelter strategy. Some deficiencies, such as lack of feeding capabilities, may have an impact upon short term operations. Further, a weak long span roof over the shelter area or unreinforced masonry walls may pose a serious threat to occupant safety in a severe hurricane.

For retrofit actions that cannot be undertaken immediately, contingency plans must be prepared and implemented. Nature and probability are unlikely to wait until all deficiencies are corrected. The safety of vulnerable citizens of a community must receive priority. Options of space utilization that is not considered convenient (e.g., school classrooms, courtrooms, commercial and public conference centers, etc.) must be inventoried. As a final option, refuge-of-last-resort operational plans should be prepared.

**Step 6:** With the deficiencies identified, cost-effective corrective actions prepared, and projects ranked, then the SCM proposals should be prepared and potential funding sources identified. As with any proposal recommending capital investment, the project(s) must have a demonstrated role within the framework of comprehensive shelter strategy plan. The information obtained during the SCM process can be used to justify the necessity and effectiveness of the project(s).

**Step 7:** The final step of the SCM process is the actual implementation of the comprehensive shelter strategy and periodic evaluation of progress. Shelter planning and
operational preparedness activities are a dynamic process. Changes in shelter demand, renovation activities at a key shelter facility (that temporarily removes it from the inventory), new construction projects at existing campuses, and a host of other factors must be updated constantly. Also periodic inspections of existing shelter facilities to verify the status, with respect to ARC 4496 conformance, and evaluation of new construction projects should be performed.

1.3 Contents and Organization

- For ease of referencing the information found in this manual, it has been organized into chapters, which are further subdivided into sections. As an example, the material you are currently reading is located in Chapter I, Section 1.3; the first digit of the section number indicates the chapter where the corresponding information is found and the "3" indicates the section.

- Chapter I provides introductory information on the purpose of this manual, contents and organization, and basic assumptions about the manual’s target audience. The hurricane environment and its effects on buildings due to winds, storm surge, rainfall flooding, and hazardous materials considerations are described in Chapter II. Pre-site Visit procedures and checklist are discussed in Chapter III. Site Visit procedures and checklist are covered in Chapter IV. Chapter V explains the procedure for completing the Least-Risk Decision Making (LRDM) table and for classifying a building as preferred, marginal or non-compliant. Chapter VI provides recommendations for a sample report.

1.4 Overview of Hurricane Evacuation Shelter Selection Process

- Planning for an HES involves consideration of numerous factors that guide selection.

  - No individual agency is expected, or is likely, to possess all the skills and expertise necessary to implement fully a disaster shelter program. Instead, the implementation of the guidelines and procedures in this manual requires assistance and coordination with other public and private agencies that have the essential expertise and technical backgrounds.

  - As the focus of this manual is HES selection, it is important that individuals involved in this process have a basic understanding of shelter planning. This will assist individuals in seeing how they fit into this overall project. The HES Selection Process flowchart, shown in Figure 1.3, illustrates the activities necessary to identify sufficient HES capacity for a community.

- The first step in the hurricane evacuation shelter planning process is to identify, and quantify, the vulnerable population. This population consists of the following groups:
• Persons living in areas subject to storm surge inundation
• All mobile-home and manufactured-home residents
• Persons living in wind damage-prone housing
• Persons living in the 100-year floodplain, or other special hazard area
• Special needs populations
• Seasonal tourists and visitors and
• Other nonlocal evacuees/regional overflow

• With the vulnerable population identified, evacuation studies are conducted that take into account out-of-area evacuation, evacuation to a friend or relative's home outside of vulnerable areas, those who are likely to use a public shelter, etc. These studies provide information on shelter demand that is used as a planning assumption.

• Sufficient public shelter space that will meet both long-term mass care criteria (72 hours or more), and short-term (+/- eight hours) sheltering during the gale-force wind period of a hurricane must be identified.

• The shelter demand planning assumption and the per-capita square footage are used to determine the quantity of HES floor area needed.

• As an example, recently performed HES demand studies for "Hazard County," indicate that approximately 17 percent of the vulnerable population of 55,000 persons will seek public shelter. Consequently, local public safety officials must plan to provide HES space for 9,350 shelterees. On a short-term basis, ARC guidelines recommend 20 square feet of HES space per shelteree. Therefore, public safety officials must identify at least 187,000 square feet of usable space.

• Once the shelter demand and floor area requirements are known, a sufficient quantity of facilities must be identified that have an aggregate floor area equal to the HES demand.

• Historically, public education facilities are the first buildings considered when identifying potential HESs.

• Other types of facilities that may be included in the list of potential HES buildings are: churches, private schools, fraternal organizations, community centers, public buildings, and occasionally commercial/industrial facilities

• The potential list of HES facilities may be influenced by demographic and area-specific hazard factors.
• For example, public safety officials may place special emphasis on specific school campuses, even though they are in close proximity to each other, due to a large and concentrated mobile-home population neighboring the campuses.
• With the initial list of potential HES buildings prepared, each facility must be evaluated to meet any established mass care and hurricane vulnerability criteria. For the purposes of this manual, the criteria will be assumed to be ARC 3031 for mass care and ARC 4496 for hurricane vulnerability.

• The site-specific evaluation process can be broken down into four major components: mass care requirements, flood inundation hazards, structural integrity and wind resistance, and technological or hazardous materials considerations.

• As each of these components requires expertise in differing fields, each component may be evaluated by a different individual and/or agency. Each, however, is equally important to the decision to designate a building as an HES.

• All the information and recommendations from each of these components must be compiled into a useful format to assist local public safety officials, and other sheltering agencies, with the decision-making process.

• The final step in the selection process is to perform a detailed review of all information pertinent to designating a facility as an HES.

• For buildings that meet or exceed the minimum established criteria, the decision to use the facility as an HES is a simple matter.

• If the buildings that meet the minimum guidelines also provide sufficient usable space to meet the projected shelter demand, the shelter selection process is complete for the approaching hurricane season.
PRIMARY RESPONSIBILITIES
WHO DOES WHAT?

CALCULATE SHELTER DEMAND
Technical Studies
Local Emergency Management
Sheltering Agency

LIST OF ALL POTENTIAL SHELTERS
Local Government
Sheltering Agency

SHELTER SELECTION CRITERIA

SHELTER
SPACE
REQUIREMENTS: e.g. ARC 3031
Sheltering Agency

TIDAL/ RIVERINE
FLOODING/ SLOSH
FEMA
Technical Reports
Local Emer. Mgt.

STRUCTURAL
INTEGRITY/
WIND RESISTANCE
Structural Engineers
Construction Tech.
Building Inspectors
Technical Volunteers

OTHER
HAZARDS AND
FACTORS
e.g. EPZ,
EVACUATION
ROUTING
Technical Reports
Local Government

LEAST RISK DECISION-
MAKING PROCEDURE
Local Government
Sheltering Agency

ESTABLISH / MAINTAIN LIST
Local Government: (Comprehensive)
Sheltering Agency: (Specific)
HES Transportation Analysis

Figure 1.3 HES Shelter Selection Process Flowchart
• However, it is a rare luxury for the majority of communities to find adequate HES space that meets the minimum criteria. Public safety officials often must make a decision that balances the relative risks associated with the use of marginal, and in some cases noncompliant, buildings against the risks associated with other options (i.e., out-of-area evacuation).

** Experts who assisted in the facility evaluation process should be consulted in situations where marginal or noncompliant facilities are considered.

** Every effort should be made to identify a sufficient quantity of facilities that comply with the hazards assessment criteria, as mass care criteria deficiencies often can be overcome through adequate resource planning and management.

• Planning for HES operations is an ongoing activity. Once a facility is designated as an HES, it must be evaluated annually, prior to hurricane season, to reaffirm its status in the local shelter inventory.

• Modifications or additions may enhance the safety and/or shelter capacity of an HES, or they may be a detriment. In situations where there is a question as to the impact of a modification, the facility should be re-evaluated by someone with the appropriate expertise.

• Planned maintenance or remodeling projects undertaken during hurricane season also should be noted, particularly if it temporarily will reduce or eliminate the HES’s shelter capacity from the local inventory.

1.5 Qualifications of Surveyors

• The shelter selection process involves proper understanding of hurricane effects on buildings, flood risk-assessment methods, common construction techniques, construction drawing and specification reading, and structural considerations for hurricane resistance. The process does not require a structural engineer’s level of expertise. Anyone with appropriate technical knowledge and writing skills can survey and assist in the selection of HES buildings.

• The following professionals, with sufficient training, should be able to survey and select public buildings for shelter purposes:
  • Structural engineers,
  • Architects,
  • Construction professionals with four or two-year degrees in civil engineering technology,
• Certified building inspectors,
• Commercial/institutional building construction contractors, and
• Persons with extensive experience in the building construction industry.

• The hazardous materials evaluations, and the fire/life safety requirements require special expertise in evaluating the level of risks at particular buildings.

• Usually this expertise is available from the local fire/life safety inspectors and the Local Emergency Planning Committee (LEPC); they should provide current evaluations for any potential HES buildings.