SurvivalRing

Study Yesterday . . Prepare Today . . Live Tomorrow

This digital document created and presented by Richard Fleetwood. He is the founder, author, producer, and webmaster of the **SurvivalRing** *(http://www.survivalring.org)* and **Civil Defense Now!** *(http://www.survivalring.org/cd-main.htm)* websites.

SurvivalRing has as its goal the ideal of being the leading source of survival, preparedness, and self reliance information on the Internet. Linkage, assistance, and creation of digital content in areas that until now have only been hinted at or impossible to find, is being added to everyday via the Survival-Ring website and email lists.

Thousands of hours of searching, writing, and communications have been spent collecting over 2 gigabytes of digital content, as well as tens of thousands of pages of hard copy original public domain material in the areas of civil defense, survival, training, and preparedness, from all over the globe. As much as possible is being put online at his website at

http://www.survivalring.org

Civil Defense Now!

Part of The SurvivalRing website

The content of THIS file, while created from PUBLIC DOMAIN material, produced by the U.S. (or other) Government at taxpayer expense, is presented in THIS digital format, produced from the ORIGINAL hardcopy document, for the benefit of all mankind, in hoping to help spread the idea of PREPAREDNESS for any and all threats that may come from either natural, extraterrestrial (space based), or manmade sources.

There are too many situations and incidents that can come to pass in everyday life, that when time is taken to learn and skills obtained, can mean the difference between life and death. Sept. 11, 2001 proved to the world that no matter how safe a person thinks they may be, death and injury can come from the most UN-LIKELY place, at any time. The documents presented in this series of digitized works, can help the average person with the knowledge within, to know how to save those persons closest to them in REAL disaster. Help spread this idea of sharing SURVIVAL INFORMATION.

If you have documents from any era, on any disaster or civil defense area, PLEASE contact Richard at his email address of **RAFLEET@AOL.COM**. Check the website for the LATEST additions to the CIVIL DEFENSE NOW online library archive. All data online, and much more, is also available on CD-ROM. Information is available at the website on how to obtain it. Thanks for your support, and enjoy the information contained on the following pages. Share them with those who will learn from them and teach what they know to others.

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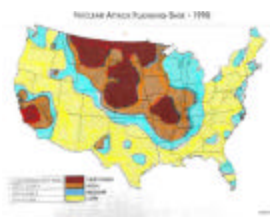
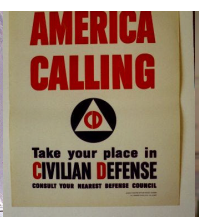




Appendix C
Case Study I – Stand-Alone Community Shelter (North Carolina)

Overview

The severe flooding in the state of North Carolina produced by Hurricane Floyd caused substantial property damage leaving many residents homeless. Temporary housing was provided by the Federal Emergency Management Agency (FEMA) for the victims of the floods. Temporary manufactured home communities were set up to house those left homeless until such time that permanent homes would be available.

Conventional stick-built houses and manufactured homes are typically not designed to resist design wind speeds associated with tornadoes. In areas where extreme winds are common, community shelters are needed to protect the great numbers of people living in FEMA-provided housing. A project for the design of dual-use shelters intended to function as both community centers and shelters for residential neighborhoods was initiated to meet this need. The shelter design drawings and specifications for this project were also intended for use as case studies to provide guidance for design professionals.

Efforts were made to involve design professionals from areas that experience high-wind events and require tornado shelters. The shelters were required to provide near-absolute protection from extreme winds, comply with local building codes, and serve as a community center. Design guidance from ASCE7-98 was used for the structural design. Site evaluations were performed to assess natural hazard risks, parking capacity, and to ensure proper access. In addition, an operations plan was developed specifying procedures, public education, and signage. The wind load analysis on which the designs were based, the operations plan, and the design drawings are provided in this appendix. A summary of design parameters is presented on Sheet S-1 of the plans.

NOTE

To design reinforced concrete shelters, designers may use either the main body of ACI 318 *Building Code Requirements for Structural Concrete* or the Alternate Design Method, Appendix A of ACI 318. For this case study, the designer chose to use the Alternate Design Method.

ASCE 7-98 Wind Load Analysis for Community Shelter in North Carolina

Using Exposure C

General Data

$K_z = 0.85$	Velocity Pressure Exposure Coefficient (Table 6-5 of ASCE 7-98)
$I = 1.00$	Importance Factor (see Chapter 5 of this manual)
$V = 200$	Wind Speed (mph) from FEMA Wind Zone Map (Figure 2-2 in this manual)
$K_{zt} = 1$	Topographic Factor (Figure 6-2 of ASCE 7-98)
$K_d = 1.00$	Wind Directionality Factor (Table 6-6 of ASCE 7-98)
$h = 11.75$	Building Height (ft)
$L = 72$	Building Length (ft)
$B = 50$	Building Width (ft)

Velocity Pressure (Section 6.5.10 of ASCE 7-98)

$q_z = (0.00256)(K_z)(K_{zt})(K_d)(V^2I)$ $q_z = 87.04$ psf

$q_h = qz$

$q_h = 87.04$ psf

External Pressure Coefficients for Walls (Figure 6-3 in ASCE 7-98)

L/B = 1.44	$C_{p1} = 0.8$	windward wall	B/L = 0.69	$C_{p1} = 0.8$	windward wall
	$C_{p2a} = -0.412$	leeward wall		$C_{p2b} = -0.5$	leeward wall
	$C_{p3} = -0.7$	side wall		$C_{p3} = -0.7$	side wall

Roof Pressure Coefficients (Figure 6-3 in ASCE 7-98)

h/L = 0.16	$C_{p4a} = -0.9$	from 0–5.9 ft from windward edge
	$C_{p4b} = -0.9$	from 5.9–11.75 ft from windward edge
	$C_{p5} = -0.5$	from 11.75–23.5 ft from windward edge
	$C_{p6} = -0.3$	more than 23.5 ft from windward edge

(**Note:** Let $C_{p4} = C_{p4a} = C_{p4b}$ due to roof geometry)

Gust Factor

G = 0.85

Internal Pressure Coefficients for Buildings (Table 6-7 in ASCE 7-98)

GC_{pipos} = 0.55 for partially enclosed buildings

GC_{pineg} = -0.55for partially enclosed buildings

Design Wind Pressure for Rigid Buildings of All Heights (Section 6.5.12.2.1 of ASCE 7-98)

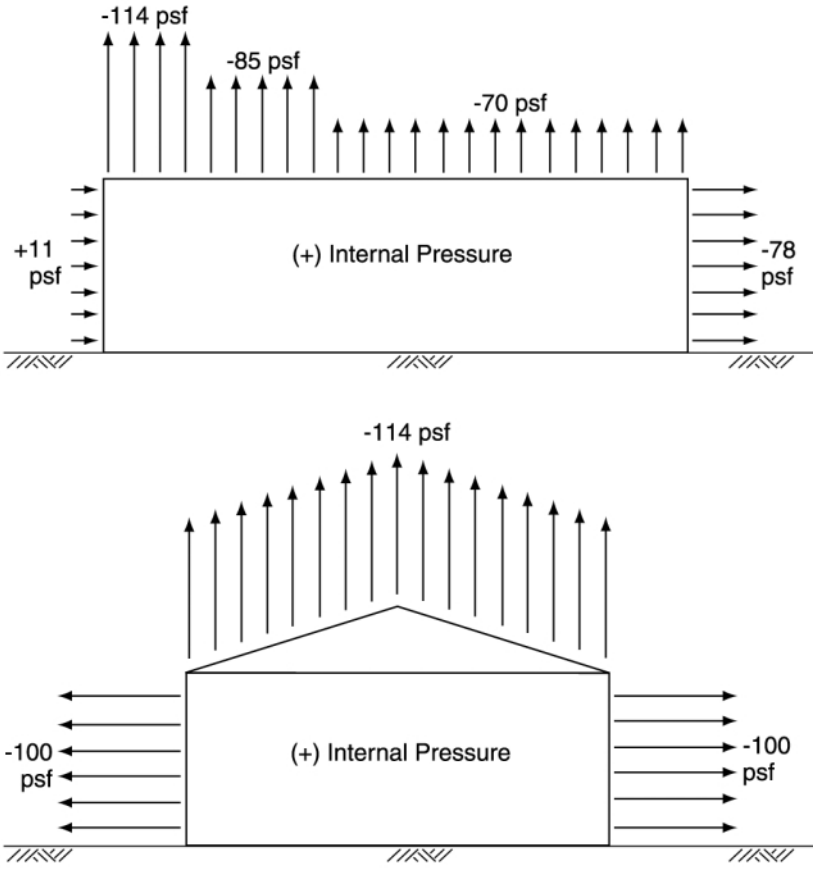
(for positive internal pressures)

$p_{wi} = (q_z)(G)(C_{p1} - q_h)(GC_{pipos})$	p_{wi} = 11.32	windward wall
$p_{lee2a} = (q_z)(G)(C_{p2a} - q_h)(GC_{pipos})$	p_{lee2a} = -78.35	leeward wall (wind parallel to ridge)
$p_{lee2b} = (q_z)(G)(C_{p2b} - q_h)(GC_{pipos})$	p_{lee2b} = -84.86	leeward wall (perpendicular to ridge)
$p_{side} = (q_z)(G)(C_{p3} - q_h)(GC_{pipos})$	p_{side} = -99.66	side wall
$p_{roof1} = (q_z)(G)(C_{p4} - q_h)(GC_{pipos})$	p_{roof1} = -114.46	roof pressures (0–11.75 ft from windward edge)
$p_{roof2} = (q_z)(G)(C_{p5} - q_h)(GC_{pipos})$	p_{roof2} = -84.86	roof pressures (11.75–23.5 ft from windward edge)
$p_{roof3} = (q_z)(G)(C_{p6} - q_h)(GC_{pipos})$	p_{roof3} = -70.07	roof pressures (more than 23.5 ft from windward edge)

(for negative internal pressures)

$p_{wi} = (q_z)(G)(C_{p1} - q_h)(GC_{pineg})$	p_{wi} = 107.06	windward wall
$p_{lee2a} = (q_z)(G)(C_{p2a} - q_h)(GC_{pineg})$	p_{lee2a} = 17.39	leeward wall (wind parallel to ridge)
$p_{lee2b} = (q_z)(G)(C_{p2b} - q_h)(GC_{pineg})$	p_{lee2b} = 10.88	leeward wall (perpendicular to ridge)
$p_{side} = (q_z)(G)(C_{p3} - q_h)(GC_{pineg})$	p_{side} = -3.92	side wall
$p_{roof1} = (q_z)(G)(C_{p4} - q_h)(GC_{pineg})$	p_{roof1} = -18.71	roof pressures (0–11.75 ft from windward edge)
$p_{roof2} = (q_z)(G)(C_{p5} - q_h)(GC_{pineg})$	p_{roof2} = 10.88	roof pressures (11.75–23.5 ft from windward edge)
$p_{roof3} = (q_z)(G)(C_{p6} - q_h)(GC_{pineg})$	p_{roof3} = 25.68	roof pressures (more than 23.5 ft from windward edge)

Figure C-1
Design wind pressures when wind is parallel to ridge with positive internal pressures (community shelter in North Carolina).



Notes:
1. Positive pressure values act against the building surface.
2. Negative pressure values act away from the building surface.
3. Wind direction is from left to right on the top figure and going into the page on the lower figure.

BUDGETARY COST ESTIMATE FOR THE NORTH CAROLINA SHELTER

ESTIMATED CONSTRUCTION COSTS (+/- 20%)
(SHELTER AREA = 3,600 Square Feet)

CONSTRUCTION ITEM	COST
• Site work and general requirements	$ 32,000
• Major structural system: footings, floors, columns, pilasters, beams, roof	$140,000
• Interior partitions	$ 17,500
• Doors and hardware	$ 8,100
• Painting, floor seal, exterior waterproofing	$ 37,500
• Roofing (EPDM) single ply	$ 15,000
• Toilet partitions and accessories (ADA)	$ 4,500
• Plumbing	$ 6,000
• Electrical	$ 31,500
• Mechanical	$ 30,000
TOTAL CONSTRUCTION COSTS	$322,000
Profit and Fees	$ 32,000
TOTAL ESTIMATED CONSTRUCTION COSTS	**$354,000**
UNIT COST (PER SQUARE FOOT [SF])	**$98.00/SF**

COMMUNITY DISASTER & TORNADO SHELTER OPERATIONS PLAN: HURRICANE FLOYD HOUSING INITIATIVE, NORTH CAROLINA

DECEMBER 14, 1999

PREPARED FOR:
FEMA REGION IV
3003 Chamblee Tucker Road
Atlanta, GA 30341

PREPARED BY:
GREENHORNE & O'MARA, INC.
9001 Edmonston Road
Greenbelt, MD 20770

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COMMUNITY DISASTER AND TORNADO SHELTER OPERATIONS PLANS

Risk Assessment

Many states are at risk from tornadoes. North Carolina faces a significant threat from the effects of tornadoes. According to the National Oceanic and Atmospheric Administration (NOAA), the State of North Carolina averaged 29 tornadoes per year in the past decade. Between 1950 and 1995, 618 tornadoes occurred in the state, leading to 82 related fatalities and approximately 2,000 injuries (source: North Carolina Disaster Center). This Community Disaster & Tornado Shelter Operations Plan has been developed to help reduce the risk of death and injury to individuals.

Past Performance of Manufactured Housing During High-Wind Events

All buildings that are not designed for high winds are susceptible to damage from tornadoes. However, manufactured housing on non-permanent foundations is particularly vulnerable to high winds. The units can easily overturn or be displaced even if tie-down straps have been used and steps have been taken to securely anchor the home to its foundation. Foundation straps can fail from rust or corrosion, anchor failure, improper installation, or inability to resist wind forces. Foundation or anchor displacement can also be caused by strap or anchor pullout, loosening, or soil failure. In 1996, both manufactured housing and "site-built" conventional housing in North Carolina were severely damaged by Hurricane Fran. Tornadic winds are far more powerful and devastating than the hurricane-force winds encountered during Hurricane Fran and place occupants of any type of housing at risk of death or injury should a tornado strike the community.

In FEMA 342 (Midwest Tornadoes of May 3, 1999: Observations, Recommendations, and Technical Guidance), FEMA concluded, "Shelters are the best means of providing near-absolute protection for individuals who are attempting to take refuge in a tornado." Therefore, a multi-use community shelter has been designed to provide protection for this FEMA planned community in the event of a tornado or other extreme wind event.

Disaster Protection (What To Do)

The National Weather Service issues two types of tornado advisories: a **tornado watch** and a **tornado warning**.

Tornado Watch-

A tornado watch means that conditions are favorable for the development of a tornado in your area and indicates the possibility of tornado occurrence.

Tornado Warning-

A tornado warning means that a tornado has actually been spotted or is strongly indicated on radar.

If a **tornado watch** has been issued, be alert and listen closely for further developments and forecasts by your local weather service. The Community Disaster Management Team should implement their tornado Shelter Operations Plan and prepare to take action. When a **tornado warning** is broadcast, all residents should go immediately to the community shelter and follow procedures set forth by the Community Disaster Management Team. Once a warning is issued, there may be very little time before the onset of the tornado in your area.

The Community Disaster Management Team should post a list of Action Items within the shelter as a reminder to the community residents.

Disaster Management Team and Responsibilities

In order to implement the Shelter Operations Plan, it is necessary that a team be put together with members committed to performing various duties. Team members can take on multiple assignments as long as all tasks can be performed by the team member during an event. Cross training is recommended so that team members can assist each other if needed.

The following team members are responsible for implementing the Shelter Operations Plan:

Site Coordinator: _____

Contact numbers: _____ / _____ / _____

Responsibilities:

- organizes and coordinates Community Disaster Plan
- ensures that personnel are in place to facilitate Shelter Operations Plan
- ensures that all aspects of Shelter Operations Plan are implemented
- develops community education and training program
- coordinates shelter evacuation practice drills and determines how many should be conducted in order to be ready for a real event
- conducts regular community meetings to discuss emergency planning
- prepares and distributes newsletters to residents
- distributes phone numbers of key personnel to residents

Assistant Site Coordinator: _____

Contact numbers: _____ / _____ / _____

Responsibilities:

- performs duties of Site Coordinator when he/she is off site or unable to carry out responsibilities

Equipment Manager: _____

Contact numbers: _____ / _____ / _____

Responsibilities:

- understands and operates all shelter equipment (this includes communications, lighting and safety equipment, and securing closure of shelter)
- maintains equipment year-round, ensuring that it will work properly during a tornado event
- informs Site Coordinator if equipment is defective or needs to be upgraded
- purchases supplies, maintains storage, and keeps inventory
- replenishes supplies to pre-established levels following a disaster

Signage Manager: _____

Contact numbers: _____ / _____ / _____

Responsibilities:

- determines what signage and maps are needed to help residents get to the shelter in the fastest and safest manner possible
- prepares or acquires placards to be posted
- ensures that signage complies with ADA requirements
- provides signage in other languages if required
- works with Equipment Manager to ensure that signage is illuminated after dark and that all lighting will operate if power outage occurs

Notification Manager: _____

Contact numbers: _____ / _____ / _____

Responsibilities:

- develops notification warning system that lets residents know they should proceed immediately to the shelter
- implements notification system when tornado warning is given

- ensures that non-English speaking residents understand notification (this may require communication in other languages or the use of pre-recorded tapes)
- ensures that residents who are deaf receive notification (this may require sign language, installation of flashing lights, or handwritten notes)

Field Manager: _____

Contact numbers: _____ / _____ / _____

Responsibilities:

- facilitates Evacuation Plan, ensuring that residents move to the shelter in an orderly fashion
- pre-identifies residents with special needs such as those that are disabled or that have serious medical problems
- arranges assistance for those residents that need help getting to the shelter (all complications should be anticipated and managed prior to the event)
- provides information to shelter occupants during the tornado event
- determines when it is safe to leave the shelter after a tornado event

Assistant Manager(s): _____

Contact numbers: _____ / _____ / _____

Responsibilities:

- performs duties of Equipment Manager, Notification Manager, Signage Manager, and Field Manager when he/she is off site or unable to carry out responsibilities

Community Disaster Planning

The Community Disaster Management Team should coordinate all activities and encourage community involvement. Residents should be given a copy of the Shelter Operations Plan and a list of all key personnel.

The first thing that must be determined is the best way to get residents to the shelter in the shortest amount of time without chaos. Parking is often a problem at community shelters. For the current shelter design, the disaster plan should instruct residents to proceed to the shelter on foot. Main pathways should be determined and laid out for the community. The Signage Manager should distribute maps showing the routes to the shelter as well as the shelter layout. In addition, the Signage Manager should place placards along the pathways to the shelter. Placards should also be installed inside the shelter that instruct occupants on how to properly secure the shelter door. All signage should be well lit and have a backup power source or be luminescent.

The Notification Manager shall determine a warning signal that residents will recognize and upon receiving the signal, go immediately to the shelter. The signal should be an audio system (a siren or alarm sound). As a backup to the audio system, a phone call chain, door-to-door notification, or some combination may be used. Another backup option is to install a phone bank that provides automatic phone service with recorded messages. Residents must be informed and understand the significance of the warning signal, and know how and where to proceed when they get the signal. They will learn the procedures by attending training sessions, practice drills, and reading newsletters issued by the Disaster Management Team.

The Equipment Manager should have knowledge of the operations of all equipment associated with the shelter. This includes radios, phones, transmitters, lighting, and safety equipment. The Equipment Manager is responsible for the closure of all shelter openings (doors, windows, etc.) prior to the event. All equipment must be maintained throughout the year. The Equipment Manager is also responsible for maintaining supplies (first-aid, water, and special needs) in a readiness state within the shelter. All supplies shall be replenished after each disaster event and a running inventory kept of available supplies.

The Field Manager should identify residents that need assistance in getting to the shelter. Arrangements should be made so that the residents that need help (whether it involves assigning people to move them, providing equipment, or just walking them) are provided for and brought to the shelter in time. Practice drills are critical for helping residents with special needs. The drills will highlight complications and allow time to plan ahead.

The Site Coordinator is responsible for resident education and training. This is accomplished through meetings, practice drills, and newsletters. The Site Coordinator will ensure that residents know what to do when a warning signal is transmitted. He/she must also ensure that all manager roles are assigned and that all managers understand and perform their duties.

SIGNAGE

- Well marked routes with proper lighting should be established that guide residents to the shelter.
- Placards should be posted along the route and throughout the community that direct residents to the shelter.
- Signs shall conform to ADA requirements and may be required in other languages.
- Maps showing homes and roads and the best route to the shelter should be provided for residents.
- A layout showing the shelter and its entrances should be prepared and distributed to residents.
- Emergency lights should be provided to enable all residents to reach the shelter in case of power outage.
- Post all restrictions that apply to those seeking refuge in the shelter (e.g., no pets, limits on personal belongings, etc.).

Shelter Operations Plan

When a tornado watch is issued, all key personnel should prepare to take action. When a tornado warning is broadcast, the Notification Manager shall transmit the warning signal alerting residents that they must go immediately to the shelter.

The Field Manager will assist all those with special needs, and direct all residents to the shelter. A count will be taken in the shelter and when all are present, all access doors will be closed tight. Time is crucial and a judgement call may be required as to when to close off the shelter if the tornado is imminent. This decision will be made by the Equipment Manager.

The Equipment Manager will monitor the radio at all times. When a broadcast is received indicating that it is safe to leave, the doors may be opened to allow residents to return to their homes. If anyone is injured, the Equipment Manager will radio or phone for help.

The time that residents are expected to stay in the shelter for a tornado event is approximately 2 hours.

Public Education and Training Plan

- The Site Coordinator will conduct several meetings throughout the year to educate residents on the risks from tornadoes, and the importance of complying with the Shelter Operations Plan. At these meetings, the Disaster Management Team should be introduced and the residents should be informed of each Manager's responsibilities. Details of the Shelter Operations Plan should also be presented (of most importance, are the routes to the shelter).
- The Site Coordinator will conduct at least two evacuation practice drills per year.
- Newsletters with updates and announcements should be prepared and distributed.
- The Disaster Management Team will communicate with local police, fire and rescue teams (PFR teams) :
    - to establish communications protocols to be followed before, during and after an event.
    - to provide the location of the shelter to PFR teams that may respond to the Site after an event, if so necessary.

SUPPLIES

- Communications
  - NOAA weather radio or receiver for commercial radio broadcasts if NOAA broadcasts are not available
  - ham radio or emergency radio connected to police or fire and rescue system
  - cellular phone
  - battery-powered radio transmitter or signal-emitting device that can signal to local emergency personnel
  - portable generator with an uninterrupted power supply (UPS system) portable computer with modem and Internet capabilities
  - fax machine
  - television set
  - public address system
- Emergency Equipment
  - flashlights
  - batteries
  - fire extinguisher
  - blankets
  - pry-bars (to open doors that may be damaged or blocked by debris)
  - trash receptacles
  - trash liners with ties
  - tool kit
  - severe weather equipment
  - heaters
  - blankets

- First-aid
  - adhesive tape and bandages
  - scissors and tweezers
  - antiseptic solution
  - antibiotic ointments
  - aspirin and non-aspirin pain relievers
  - diarrhea medication
  - salts for fainting spells
  - towels
  - foldup cots
  - first-aid handbook
- Water
  - enough for shelter occupancy of 2 hours
- Infant Supplies (if needed)
  - disposable diapers
  - powder and ointments
  - Handi-Wipes
  - pacifiers
  - blankets

Special Needs

Some residents will require assistance in getting to the shelter. Identify who those people are, and determine the kind of help they will require. After a tornado warning has been issued, the Field Manager or his/her designee should make sure that those who require help are assisted.

Residents with medication needs should notify the Field Manager, who will ensure that the required medications are available during the evacuation to the shelter, and during the stay within the shelter.

Needs of Children

If the residential community includes children, they may require additional consideration. Infant needs should be part of the supplies stocked for the event. Additional items may be required to keep children calm and comfortable during this time.

Pets

No pets are permitted in the shelter during a tornado event.

List of Action Items (Shelter Operations Plan)

- Site Coordinator: _____ Contact Number: _____
- Assistant Site Coordinator: _____ Contact Number: _____
- Equipment Manager: _____ Contact Number: _____
- Signage Manager: _____ Contact Number: _____
- Notification Manager: _____ Contact Number: _____
- Field Manager: _____ Contact Number: _____
- Tornado Watch
  - team is on alert
- Tornado Warning
  - team is activated
  - signal is sent to community to go to shelter
  - community is evacuated to the shelter
  - head count in shelter
  - monitor storm from within shelter
  - secure the shelter
  - monitor storm
  - leave shelter when safe
  - restock/clean shelter