Statewide Public Hurricane Shelter Criteria State Department of Emergency Management

PURPOSE OF THIS CRITERIA

The Hawaii State Legislature-enacted Disaster Emergency Preparedness Act of 2005 states:

The department of defense shall develop Hawaii public shelter and residential safe room design criteria by January 1, 2006, and shall facilitate impact resistance testing and certification of safe room design; provided that safe room prototype models are developed with public or private sector grants or investments. These criteria shall include Hawaii performance-based standards for enhanced hurricane protection areas and essential government facilities capable of withstanding a five hundred-year hurricane event and providing continuity of government or sheltering operations thereafter.

The Disaster Emergency Preparedness Act of 2005 is included as Exhibit I. This document provides criteria and reference standards for the enhanced hurricane protection areas and for essential government facilities needed for continuity of government and continuity of operations, as well as for existing buildings used by the counties as temporary hurricane shelters. Residential safe room design criteria are not presented.

HAWAII PUBLIC SHELTER OPERATIONAL SETTING

In Hawaii, residents and visitors cannot move away from a storm's landfall to reduce the lifethreatening effects of a hurricane. They must remain in-place and have immediately available hurricane resistant homes, hotels and other buildings, and public shelters. in which to seek refuge. In that regard, government in Hawaii has a more crucial responsibility to provide for the health, safety and welfare of its citizens. However, very few buildings statewide were originally designed for shelter use. Note: A descriptive table of Hurricane Categories is given in Exhibit VI.

HURRICANE HAZARD

Hawaii windspeed hazard curves were by two independent research derived investigations (Cermak Peterka Petersen, Inc. 2002 and Applied Research Associates, 2001), based on long-term computer simulations of storm tracking. The hurricane hazard determined by ARA has been incorporated into the ASCE 7 Standard for Minimum Design Loads for Buildings and Structures. This information Other on hurricane hazard was used as a reference in order to define the windspeed consistent with a 500-year return period probability, and generally corresponds to a low Category 3 hurricane. A windspeed strength target of 155 mph representing the upper end of Category 3 was used for the strength basis of the Enhanced Hurricane Protection Areas. Page 1 of 22

This is somewhat greater than a 500-year wind, but EHPA shelters should provide better reliability of continued shelter or congregate care operations after the event.

Hurricane	e Categories and	Reference
	Windspeeds	
Hurricane Category	1 Minute	3-Second
	Sustained	Peak Gust
	Windspeed	over land
1	74 to 05 mph	81 to 105
1	74 to 95 mpn	mph
2	06 to 110 mph	106 to 121
	90 to 110 llipli	mph
3	111 to 130 mph	122 to 143
	111 to 150 llipli	mph
4	131 to 156 mph	144-172 mph

CRITERIA AND ADDITIONAL RECOMMENDATIONS

The criteria and reference standards in accordance with public safety considerations comprise a hierarchy of hurricane shelter criteria, taking into account new and existing construction within four main classifications:

- 1. Essential Facility for Continuity of Government and Continuity of Operations (EFCOOP) offering protection and enabling critical functionality in Category 4 hurricanes,
- 2. New or Existing Enhanced Hurricane Protection Areas (EHPA) complying with the Hawaii State Building Code,
- 3. Existing Hurricane Shelter Type A offering significant hurricane wind protection although not up to level of EHPA, and
- 4. Existing Hurricane Shelter Type B, offering high wind protection.

The itemized criteria for the four shelter classifications are presented in tabular form in the following section. Criteria for the appropriate siting of new shelters to account for other natural hazards are included. A number of nonstructural and functional features are included in the shelter selection criteria as well as strength of the structural system. (An additional list of other preferred, but not required, features is given in Exhibit VI.) These four classifications of incrementally increasing protection can be interpreted as follows:

Shelter Classification	Expected Performance Objective	Hurricane
		Category
Type B Hurricane Shelter	Life Safety, with significant structural and	Category 1
	nonstructural damage permitted	Hurricane
Type A Hurricane Shelter	Life Safety, with significant non-structural damage	Category 2
	and low to moderate structural damage permitted	Hurricane
Enhanced Hurricane	Operational during and after a 500 to 1,000-year event	Category 3
Protection Area		Hurricane
Essential Facility for	Protection and Continuity of Operations during and	Category 4
Continuity of Operations	after a hurricane of maximum considered intensity	Hurricane

This concept is graphically illustrated in the figure below that also provides comparisons with the peak gust windspeed strength capacities.





Та	Cable 5. Summary of Criteria and Guidelines for Hawaii Hurricane Shelter Classifications			
Criteria	Evaluation of Existing B designed for sheltering Evaluations shall be car with the DAGS procedur	uildings not originally ried out in accordance res	Criteria for Enhanced Hurricane Protection Areas per the Disaster Preparedness Act of 2005	Criteria for Essential Facilities needed for Continuity of Government /Continuity of Operations
	Туре В	Туре А	EHPA	EFCOOP
Designation	Type B High Wind Shelter	Type A Hurricane Shelter	Enhanced Hurricane Protection Area (EHPA)	Essential Facility for Continuity of Operations
Hurricane Intensity	Saffir-Simpson Category 1	Saffir-Simpson Category 2	Saffir-Simpson Category 3	Saffir-Simpson Category 4
Building Performance Objective	Life Safety, with significant structural and nonstructural damage permitted during a Category 1 Hurricane.	Life Safety, with significant non-structural damage and low to moderate structural damage permitted during a Category 2 Hurricane.	Enhanced Hurricane Protection Areas to be operational during and after a Category 3 Hurricane. Also, per ASCE 7-10: Sustain local damage with the structural system as a whole remaining stable and undamaged.	Protection and Continuity of Operations in <i>Category 4</i> Hurricanes Also, per ASCE 7-10: Sustain local damage with the structural system and primary structural elements remaining stable and undamaged.
Occupancy Period	1 day or more; evacuees are e	xpected to bring their own food a special dietary needs	and water to the shelter, including	Many days to weeks without interruption of operations
Shelter Floor Area	The shelter's usable floor area The net floor area shall be dete columns, fixed or movable obje use as a storm shelter. Spaces s considered as net floor area per	shall be calculated; gross area no rmined by subtracting from the g ects, equipment or other features uch as mechanical rooms, electri rmitted to be occupied during a h	t permitted to be used to determine gross square feet the floor area of ex- that under probable conditions can ical rooms, storage rooms, attic and urricane.	the maximum occupancy count. Accluded spaces, exterior walls, not be removed or stored during crawl spaces, shall not be
Space During the	15 sf per person for minimum on No areas near glass windows to	compliance with ARC 4496 (200 be utilized unless protected	2).	
Tsunami	Locate outside of Tsunami Eva Evacuation Refuge Structure po	cuation zones unless justified by er policies and standards	site specific evaluation or designat	ted as a Vertical Tsunami
Seismic	Comply with ASCE 7-10 requi	rements		

Та	able 5. Summary of Criteria and Guidelines for Hawaii Hurricane Shelter Classifications			
Criteria	Evaluation of Existing E designed for sheltering Evaluations shall be car with the DAGS procedu	Buildings not originally rried out in accordance res	Criteria for Enhanced Hurricane Protection Areas per the Disaster Preparedness Act of 2005	Criteria for Essential Facilities needed for Continuity of Government /Continuity of Operations
	Туре В	Туре А	EHPA	EFCOOP
Surge / Flood	Locate outside of V and Coast specific analysis or designed for Floor slab on grade or the bott be above Base Flood Elevation methodology that predicts th combined effects of storm su	al A flood zones and 500-year flo or vertical evacuation. om of lowest structural framing o n + 1.5 ft., , or at higher elevation ne maximum envelope and dept urge and wave actions with resp	od zones unless justified by site- f an elevated first floor space to as determined by a modeling h of inundation including the ect to a Category 3 hurricane.	Floor slab on grade or the bottom of lowest structural framing of an elevated first floor space to be above Base Flood Elevation + 3 ft., , or at higher elevation as determined by a modeling methodology that predicts the maximum envelope and depth of inundation including the combined effects of storm surge and wave actions with respect to a Category 4 hurricane
Windspeed Strength Design Capacity Objectives	Shelter to be evaluated by a Structural Engineer per ASCE 7-10 Design Strength Rated for 105 mph minimum peak gust design speed Use Hawaii State Building Code 2006 Topographic and directionality factors for the site	Shelter to be evaluated by a Structural Engineer per ASCE 7-10 Design Strength Rated for 121 mph minimum peak gust design speed Use Hawaii State Building Code 2006 Topographic and directionality factors for the site	Shelter to be evaluated by a Structural Engineer per ASCE 7-10 Design Strength Rated for 143 mph minimum peak gust design speed Use Hawaii State Building Code 2006 Topographic and directionality factors for the site	Shelter to be evaluated by a Structural Engineer per ASCE 7-10 Design Strength Rated for 172 mph minimum peak gust design speed Use Hawaii State Building Code 2006 Topographic for the site Directionality Factor = 1.0
Wind Exposure Categories		B or C per Hawaii S	tate Building Code Maps	

Та	Table 5. Summary of Criteria and Guidelines for Hawaii Hurricane Shelter Cl		vaii Hurricane Shelter Class	ifications	
Criteria	Evaluation of Existing E designed for sheltering Evaluations shall be car with the DAGS procedu	Buildings not originally rried out in accordance res	Criteria for Enhanced Hurricane Protection Areas per the Disaster Preparedness Act of 2005	Criteria for Essential Facilities needed for Continuity of Government /Continuity of Operations	
	Туре В	Туре А	EHPA	EFCOOP	
Debris Impact Resistance Objectives	Minimum conformance to ASTM E1996-12 Level A 2g steel balls at 130 fps (90 mph) and ASTM E1996-12 Level C 4.5 lb. 2 X 4 @ 40 fps (27 mph) Design for interior pressure based on largest door or window or unprotected openings on each facade Anchor Rooftop Equipment to meet wind load criteria if needed for operations. Anchor photovoltaic panels in		Walls and Glazing must resist ASTM E1996 -12 Level D 9 lb. 2 X 4 @ 50 fps (34 mph) Design for interior pressure based on largest door or unprotected window openings on each facadeWalls and Glazing must resist ASTM E1996-12 Level E 9 lb. 2 X 4 @ 80 fps (55 m Provide windborne debris protection for all windows each façade of the building		
Rooftop Equipment Anchorage	Anchor Rooftop Equipment to meet wind load criteria if needed for operations. Anchor photovoltaic panels in accordance with the wind criteria of ASCE 7-16.		Air intakes and exhausts, rooftop equipment and their anchorage shall be designed or retrofitted to meet wind load and missile impact criteria. Anchor photovoltaic panels in accordance with the wind criteria of ASCE 7-16.		
Adjacent Buildings	The potential risks associated structures shall be considered shelters.	with unanchored portable when evaluating Type A and B	The building shall not be located hazardous material facilities defin Unanchored portable structures s feet of the shelter.	within 1,000 feet of any ned by IBC Table 1604.5. hall be not permitted within 300	
Outline of Shelter Survey & Evaluation – More Specific Procedures to be developed for use by Building Owners and Civil Defense Agencies	 Screening evaluation sincluding ARC 4496 a Forms and ranking of facility Initial Wind Code and review and building in documentation indicat facility. 	surveys of existing shelters and ARC 6564 Facility Survey 15 least risk criteria for each Benchmark documentation ispection including floor plan ing all shelter portions of the	 Construction Documents include Basis of Design of shall include opening pro- construction Quality Ass Floor plans shall indicate exiting routes included in Design and construction reviewed by an independ Defense. 	shall include General Notes to criteria and Project Specifications stection devices and a urance program all portions of the facility and the hurricane protected zone documents shall be peer- ent SE engaged by State Civil	

Ta	ble 5. Summary of Criter	ia and Guidelines for Haw	aii Hurricane Shelter Class	ifications
Criteria	Evaluation of Existing B designed for sheltering Evaluations shall be car with the DAGS procedur	uildings not originally ried out in accordance res	Criteria for Enhanced Hurricane Protection Areas per the Disaster Preparedness Act of 2005	Criteria for Essential Facilities needed for Continuity of Government /Continuity of Operations
	Туре В	Туре А	EHPA	EFCOOP
	 Report by Structural Enprotection requirement Structural check of any Door securable with lat GIS geocoding coordin 	ngineer to include statement of o s attached/host buildings shall be tches aates	pinion of compliance with wind de performed	sign and debris impact opening
Periodic Inspections	Facility to be inspected every three years by the owner to determine whether any changes have occurred pertinent to the original basis for classification; report to be submitted to State Civil Defense, unless more immediate repairs are identified by the shelter evaluation. Exposed building appurtenances necessary for operations, such as antenna and equipment, may need more frequent inspections.			
Compliance Re-evaluation	Compliance re-evaluation only	if significantly altered or damag	ed, or retrofitted	
Nonstructural Features and Accessories of the Facility	Concrete or CMU exterior wall Long span roof areas such as g At least two doors Emergency vehicle access ; The 1 Toilet per 50 occupants locat 1 sink per 100 occupants Fire Extinguisher Mechanical ventilation as requi Identifying sign to be posted du Parking	s are preferred yms and auditoriums with light-f e portion of the emergency route red in the building roof-covered a red per Code uring operations, both tactile and	raming should be evaluated by a St within the site shall be above the 1 area, and at least one ADA-accessib	ructural Engineer 00-year flood elevation ole toilet on the ground floor
			ARC 4496 "Preferred" compliance Emergency Power of 2 hour durate generator for use of: Communications Emergency Lighting Emergency HVAC	e tion with coupling for portable

Table 5. Summary of Criteria and Guidelines for Hawaii Hurricane Shelter Classif			sifications	
Criteria	Evaluation of Existing B designed for sheltering Evaluations shall be car with the DAGS procedu	uildings not originally ried out in accordance res	Criteria for Enhanced Hurricane Protection Areas per the Disaster Preparedness Act of 2005	Criteria for Essential Facilities needed for Continuity of Government /Continuity of Operations
	Туре В	Туре А	EHPA	EFCOOP
			All Operational and Life Safety I	Equipment
				Manager's Office Communication system Capability to provide 1 gal potable water per person per 8 hours 1 shower per 40 occupants Food Preparation area
Accommodations for People with Access and Functional Needs	First Story or ADA-accessible space for every 200 shelter occ 40 sf space/person only if bedr	route to a shelter area at each site upants where shelter accommoda idden	e with a minimum of 1 wheelchair ates more than 50 persons	ADA accessible
Sheltering of Pets	Certain shelters are designated separate space. Owners are exp	for pets, which will be kept in cra ected to provide food and other s	ates or other containers in a supplies for their pets.	No Pets

IMPLEMENTATION

- 1. The current inventory of existing and potential shelter facilities should be surveyed statewide and evaluated in accordance with the updated criteria. Most existing shelters will need further retrofits to achieve the level of safety assurance called for in the Disaster Emergency Preparedness Act of 2005.
 - a. This evaluation requires professional structural engineering expertise in assistance to County and State civil defense agency representatives. The due diligence should include review of original construction drawings, physical inspections, and evaluation of the facility's compliance with structural and nonstructural criteria. As a given facility is surveyed, deficiencies should identified, which, if corrected, will improve the shelter's capacity and its relative safety classification.
 - b. The building data questionnaire forms, survey procedures and risk-based documentation forms have been standardized to be used together to enable a unified means of facility data acquisition, vulnerability assessment for multiple hazards, ranking, and facility status management. These surveys ultimately provide a means to identify cost-effective retrofit projects that, as funded, will have a positive impact upon the State's deficit of hurricane shelter space.
- 2. Per the Hawaii State Building Code adopted since April of 2010, new State government facilities of certain high occupancy public assembly and health care facilities, shall be designed and constructed to include Enhanced Hurricane Protection Areas-with the capability and capacity to provide shelter refuge. EHPAs may be a single large room or a combination of rooms, located on one or more stories. The EHPA should be provided in new usable floor area, determined by subtracting from the gross square feet the floor area of excluded spaces, partitions and walls, columns, fixed or movable objects, furniture, equipment or other features that under probable conditions cannot be removed or stored during use as a storm shelter.
- 3. Larger capacity private shelters (such as certain Waikiki hotels) should also utilize these recommended criteria to reestablish their operational qualification with State or County Civil Defense. Since these four classifications utilize more refined criteria, an individual shelter shall not be rated by the shelter classifications that were used prior to 2006. Private facilities operating to provide self-sheltering will need to become in compliance with one of the updated Shelter Classifications. The procedures of the Department of Accounting and General Services should be adapted for use by private building owners, so that adequate documentation of shelter criteria compliance can be reviewed by the approving State or county agency.
 - a. State Law enables private facilities to house the public with relief for negligence liability. Hawaii Revised Statutes (HRS) 128-19 provides relief for negligence liability to private sector owners who volunteer the use of their facilities as an emergency shelter. The immunity protection that may be provided applies when an owner or controller of the facility meets the following criteria: (1) Their actions relating to the sheltering of people are voluntary; (2) They receive no compensation for the use of the property as a shelter; (3) They grant a license or privilege, or permit the property to be used to shelter people; (4) The Director of Civil Defense, or delegated agency or person, has designated the whole or any part of the property to be used as a shelter; (5) The property is used to shelter persons; and (6) The use occurs during an actual impending, mock, or practice disaster or attack.

EXHIBITS

Exhibit Description	Exhibit No.
Disaster Emergency Preparedness Act of 2005, State Legislature SB960 CD1	Ι
Windborne Debris Resistant Wall Construction	II
ARC 4496 (2002) Standards for Hurricane Evacuation Shelter Selection	III
Least Risk Decision Making Criteria (Blank Form)	IV
Other Preferred Features and Operational Considerations	V
Saffir-Simpson Hurricane Scale Range (with additional Hawaii Damage Indicators)	VI

Background References on Existing Shelter Standards and Guidelines:

There have been several efforts over the years to establish hurricane shelter standards based on various criteria of risk.

- The American Red Cross has published its recommendations in ARC 4496 Standards for Hurricane Evacuation Shelter Selection (2002). (Exhibit III). These are general guidelines (and are not engineering based.)
- The International Code Council's Consensus Committee on Storm Shelters has developed the ICC-500 Standard for the Design and Construction of Storm Shelters. This Standard provides technical design and performance criteria that will facilitate and promote the design, construction, and installation of storm shelters to protect the public. However, this standard is for a much rarer and more severe 10,000-year storms, rather than the 500-year storm that the State Legislature stipulated in Hawaii's Disaster Emergency Preparedness Act of 2005.

OTHER REFERENCES

American Society of Civil Engineers, Minimum Design Loads for Buildings and Other Structures ASCE 7-10, Reston, VA, USA, 2010.

ARA, Inc., Hazard Mitigation Study for the Hawaii Hurricane Relief Fund, ARA Report 0476, Raleigh, NC, USA, 2001.

Chock, G. and Cochran, L., Modeling of Topographic Wind Effects in Hawaii, Journal of Wind Engineering and Industrial Aerodynamics, August, 2005.

International Code Council, Inc., 2006 International Building Code, 2006.

Peterka, Jon A. and Banks, David, Wind Speed Mapping of Hawaii and Pacific Insular States by Monte Carlo Simulation – CCP, Inc. Final Report 99-1773, NASA Contract NASW-99046, Ft. Collins, CO, USA, 2002.

Exhibit I

Description:

Appropriates funds for tsunami and hurricane preparedness efforts including updating maps, installing and maintaining alarm sirens, constructing additional shelter space, retrofitting public shelters, developing residential safe room design standards, mitigation, shared mitigation grants, providing around-the-clock alert staff, and expanding public education campaigns. Appropriates funds from the Hawaii hurricane relief fund and improves the loss mitigation grant program. (CD1)

THE SENATE

TWENTY-THIRD LEGISLATURE, 2005

STATE OF HAWAII

S.B. NO. 960 H.D. 1 C.D. 1

A BILL FOR AN ACT

RELATING TO CIVIL DEFENSE.

BE IT ENACTED BY THE LEGISLATURE OF THE STATE OF HAWAII:

PART I

SECTION 1. This Act may be cited as the Disaster Emergency Preparedness Act of 2005.

SECTION 2. The legislature finds that the State's growing population and a general lack of awareness on the part of the public with respect to natural disaster preparedness, dictates appropriate government action. This Act addresses the need for disaster preparedness by appropriating funds for natural disaster preparedness, including tsunami and hurricane preparedness efforts, appropriating funds from the hurricane reserve trust fund to retrofit and protect public buildings against hurricanes, developing standards for residential safe rooms, and improving the loss mitigation grant program by permitting the construction of safe rooms.

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The legislature finds that, although the funding for this Act is financed through the principal in the hurricane reserve trust fund, the expended funds will stimulate the economy and replace any "lost" interest income from the fund without jeopardizing the State's ability to reissue hurricane insurance, if necessary.

The original purpose of establishing the Hawaii hurricane relief fund was to provide a means of financing hurricane insurance coverage for the hurricane after the next one, provided that insurers withdraw from the Hawaii hurricane insurance market. This Act will provide protections against the next natural disaster.

PART II

SECTION 3. Due to Hawaii's experience with tsunamis and hurricanes, a disaster alert system is in place providing early warning to residents. Even with this comprehensive, state-of-theart-monitoring system in place, Hawaii's disaster warning efforts have not kept pace. Antiquated siren systems, outdated evacuation maps in telephone books, insufficient shelter space, limited public education projects, and a lack of around-the-clock alert staff mean Hawaii residents may lose critical seconds in evacuation time or, worse, be unable to access emergency care and shelter in the event a disaster strikes.

The purpose of this part is to appropriate funds for natural disaster preparedness efforts, including installing and maintaining new siren systems, updating evacuation maps in phone books, constructing additional shelter space and retrofitting existing public buildings that could serve as emergency shelters, developing statewide residential safe room design standards by January 1, 2006, providing around-the-clock alert staff for the civil defense division, and expanding public education campaigns that emphasize the need for natural disaster, including tsunami and hurricane preparedness.

SECTION 4. There is appropriated out of the hurricane reserve trust fund the sum of \$2,000,000 or so much thereof as may be necessary for fiscal year 2005-2006, and the sum of \$2,000,000 or so much thereof as may be necessary for fiscal year 2006-2007 for tsunami and hurricane preparedness efforts, including installing and maintaining new siren systems, updating evacuation maps in telephone books, constructing additional shelter space and retrofitting existing public buildings that could serve as emergency shelters, developing statewide residential safe room design standards by January 1, 2006, providing around-the-clock alert staff for the civil defense division of the department of defense, and expanding public education campaigns emphasizing the need for tsunami and hurricane preparedness. The sum appropriated in this part shall be expended by the department of defense for the purposes of this part.

SECTION 5. The department of defense shall develop Hawaii public shelter and residential safe room design criteria by January 1, 2006, and shall facilitate impact resistance testing and certification of safe room design; provided that safe room prototype models are developed with public or private sector grants or investments. These criteria shall include Hawaii performance-based standards for enhanced hurricane protection areas and essential government facilities capable of withstanding a five hundred-year hurricane event and providing continuity of government or sheltering operations thereafter.

SECTION 6. The department of defense shall coordinate all work performed pursuant to this part with the state or county agencies having responsibility for the repair, maintenance, and upkeep of any public building to be retrofitted.

SECTION 7. Any portion of the appropriations may be used for the purpose of matching federal hazard mitigation funds if these funds become available for use in retrofitting public buildings with hurricane protective measures.

PART III

SECTION 8. The loss mitigation grant program was established to assist residents with installing wind resistive devices to protect their property against hurricanes. The addition of providing grants for safe rooms will also allow residents who may not be able to afford reinforcement of their entire home, protection against natural disasters.

SECTION 9. Section 431:22-101, Hawaii Revised Statutes, is amended by amending the definition of "wind resistive devices" to read as follows:

""Wind resistive devices" means devices and techniques, as identified and determined in accordance with section 431:22-104(b), that increase a building's or structure's resistance to damage from wind forces. The term shall also include safe rooms that are defined and built pursuant to design standards of the department of defense's civil defense division that are adopted pursuant to chapter 91."

SECTION 10. Section 431:22-104, Hawaii Revised Statutes, is amended by amending subsection (a) to read as follows:

"(a) Subject to the availability of funds and the standards in this article, grants for wind resistive devices shall be awarded by the commissioner:

(1) That reimburse [fifty] thirty-five per cent of costs incurred for the wind resistive devices and their installation [and inspection], up to a maximum total reimbursement of \$2,100 per dwelling;

(2) On a first-come, first-served basis, as determined by the commissioner; and

(3) For a wind resistive device or devices installed only in a single or multi-family residential dwelling."

SECTION 11. Section 431:22-104, Hawaii Revised Statutes, is amended by amending subsection (c) to read as follows:

"(c) In addition, a grant may be made to an applicant only if the applicant:

 Has met the descriptions, specifications, guidelines, and requirements established by the commissioner for the grant program;

(2) Has filed a completed application form, as determined solely by the commissioner, together with all supporting documentation required by the commissioner;

(3) Has, in the case of a building with
multiple dwellings, filed together completed
grant applications for all dwellings in the
building[+], for installation of wind
resistive devices indicated in section 431:22104(b)(1), (2), and (4); provided that this
requirement does not apply [+]to[+] section
431:22-104(b)(3);

(4) Has installed a wind resistive device or devices including residential safe room designs that meet the standards established by the state department of defense and that have been designated and approved by the commissioner;

(5) Has fully paid, prior to applying for the grant, the cost of the wind resistive device

or devices, as well as the installation [and inspection] costs for which the grant is sought. The grant shall be used to reimburse only these costs or a portion thereof;

(6) Has hired an inspector, determined by the commissioner to be qualified in accordance with the requirements of the commissioner, who has verified in writing that the installation of the wind resistive device or devices is complete and is in compliance with the grant program specifications, guidelines, and requirements, as determined by the commissioner;

(7) Has installed the wind resistive device or devices after July 1, 2002;

(8) Has provided any other information deemed necessary by the commissioner; and

(9) Has met all additional requirements needed to implement the grant program as determined by the commissioner."

SECTION 12. There is appropriated out of the hurricane reserve trust fund of the State of Hawaii the sum of \$2,000,000, or so much thereof as may be necessary for fiscal year 2005-2006, and the sum of \$2,000,000, or so much thereof as may be necessary for fiscal year 2006-2007, for the deposit into the loss mitigation grant fund.

SECTION 13. There is appropriated out of the loss mitigation grant fund of the State of Hawaii the sum of \$2,000,000, or so much thereof as may be necessary for fiscal year 2005-2006, and the sum of \$2,000,000, or so much thereof as may be necessary for fiscal year 2006-2007, for the loss mitigation grant program established under chapter 431, article 22, Hawaii Revised Statutes.

The sum appropriated in this part shall be expended by the department of commerce and consumer affairs for the purposes of this part.

PART IV

SECTION 14. Statutory material to be repealed is bracketed and stricken. New statutory material is underscored.

SECTION 15. This Act shall take effect on July 1, 2005.

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Wall Assemblies Complying with Hawaii State Building Code Section 422.5.2 Windborne debris impact protection of building enclosure elements

Wall Assemblage	•

³ / ₄ -inch plywood on wood studs at 16-inches on-center with #8 X 3-inch wood screws at 6-inches o.c.
³ / ₄ -inch plywood attached to double studs at 16-inches o.c. with #8 X 3-inch wood screws at 6-inches
0.C.
8-1/4" cementitious lap siding over 22ga sheet metal attached to 350S162-33 studs at 24" o.c.
8-1/4" cementitious lap siding attached to 350S162-33 studs at 24" o.c. studs with interior 3/4" ply
interior sheathing
8-1/4" cementitious lap siding attached to 350S162-33 studs at 24" o.c. with 1/2" interior 22-gage sheet metal composite gypsum wallboard
Since the tail composite gypsian wanted to 2×4 wood stude at 16" of a with 1/2" interior 22 gass short
metal composite gypsum wallboard
8-1/4" cementitious lap siding attached to 2 x4 wood studs at 16" o.c. with 22-gage sheet metal and
1/2" interior gypsum wallboard
Cementitious lap siding attached to 5/8 inch structural plywood on 2 X 4 wood studs @ 16 inches o/c.
Cementitious-panel siding attached to 5/8 inch structural plywood on 2 X 4 or 362S-137-43 steel
studs @ 16 inches o.c.
EFS with ½-inch dens-glass gold exterior sheathing on 362S-137-43 steel studs @ 16 inches and 1/2-
inch interior gypboard
Interior or Exterior wall with laterally braced 2 x 4 wood studs with sheathing on either side of 22-
gage sheet metal
24 gage steel sheet (50 ksi) on girts
4-inch-thick concrete with reinforcing
6-inch CMU with partial grouting at reinforcing spaced at 24 inches o.c.
8-inch CMU with partial grouting at reinforcing spaced at 24 inches o.c.

Note: sheathing shall be attached to studs at 6-inches on center edge and field fastening.

611							American	Together, we can save a life
	Standards	for	Hurricane	Evacuation	Shelter	Selection		
huricane evacuation shelters. When expacity as defined by the preceding safety officials. This process should include affery officials. This process should include the provious start preasons. All hurricane immutation zones. Certain exceptions may evel of wind, rain, and surge activities will not if ther and a major means of egress are in any film of 1-3 feet expected) necessitates a nees B, C, and D may allow some flexibility.	toroted building safety criteria. As their resident. During hurricane duced. Ideally, this requirement should be ce must be set aside for registration, health reas should still be planned using a 40-square is requirements should follow guidelines	for use as a hurricane evacuation shelter are	be considered. ta from SLOSH and/or SPLASH (storm ion; and obtain hazardous materials	histand wind loads according to ASCE 7-98 m 6564) and a Self-Inspection Work Sheet(Off control in liabilities and the type and the type control inconversion to intervieve of the	serreury yeoparane arean a second or and	evacuation shelter. Facility enhancements a carotion shelter. Facility enhancements a carotion shelter. Continue to advocate that ude provisions to make them more resilient to inty, or school buildings, such as the addition is will make them useful as hurricane.	oorse plans. Share shelter information with rvices for inclusion in state disaster response	ARC 4496 Rev. January 2002

Least-Risk Decision Making

- Sufety is the primary consideration for the American Red Cross in selecting hum anticipated dermarks for hurricane evacuation tabletre spaces exceed existing capaa sandards, there may be a need to utilize less preferred facilities. It is critical that carefully and in consultation with local emergency management and public safely. No hurricane evacuation shelter should be located in an evacuation zone for evacuation shelters should be located outside of Category 4 storm surge imm per necessary but only if there is a high degree of confidence that the level or surpass established shelter safety margins. When a potential hurricane evacuation shelter is located in a flood zone, it is comparing elevations of sites with FIRMs, one can determine if the shelter a danger of flooding. Zone AH (within the 100-year flood phin and pudding. It is estantial that elevations be carefully checked to a void unnecessary prohil in the absence of certification or review by a structural engineer, any building recounding substeam shelter makes, shelter pace requirements may be reduced determined using no states with FIRMs. Cone set discriming obation. Zones B It is essential that elevations be carefully checked to a void unnecessary public the evacution shelter may be in compliance of 40-square for sole are conditions, on a short-term basis, shelter spore requirements may be reduced determined using to less than 15 square feel per person. Adequite space mu services and stery and free considerations. Disast Hall Services areas st feet per person calculation. On a long-term recovery basis, shelter spore requirements for the person calculation. On a long-term recovery basis. Shelter space requirements may be reduced determined using to less than 15 square feel per person. Adequite space mu services and a stery and free considerations. Disast Hall Services areas st feet per person calculation. On a long-term recovery basis. Shelter space requirements the person calculation. Dra 100-starris. Propreduces and Operations

- Hurricane Evacuation Shelter Selection Process
 General procedures for investigating the suitability of a building or facility for u a follows:
 a follows:
 a follows:
 complete a risk assessment on each viable site. Gather all pertinent data fix surgo, IRM (1060 hazzin) models, determine the facility base elevation; an information and previous studies concerning each building's suitability.
 Have astronal engines evaluate the facility and rate its ability to withstar or ANSI A58 (1982) structural design criteri.
 Inspect the facility and complete a *Feed Coss Facility Survey* (ARC Form 65 Premises Liability Checklis, in accordance with ARC 3041. Note all potenti construction. Consider the facility as a whole. One weak section may seriou building.

Increasing Shelter Inventory

annual review of all approved hurricane evacuation shelters is require An

deterioration may change the suitability of a selected facility as a hurrican may also enable previously unacceptable facilities to buesd as hurricane. Work with officials, facility managers, and shool districts on mitigat the building program for new public buildings, such as schools, should in possible wind damage. Suggest minor modifications of municipal, comm possible winterane shutters, while buildings are being planned. Such modifications evacuation shelters.

ters to chapter shelter system and disaster residences and the state lead chapter for Disaster Si Finally, add any new shelt ergency pla local emo plans.

teers, the High Winds Consideration of any facility for use as a hurricane evacuation shelter must take into account v Consideration of any facility for use as a hurricane evacuation shelter must take into account v er and construction problems may predude a facility from being used as a shelter. Local buildin inacquate for high wind speeds. r If possible, select buildings that a structural engineer has certified as being capable of accound to ASC (American Society of Engines) 7-39 or ASI (American Nat lination Institute) ASI (982) structural design orienter.	 tick, codes. Failing a certification (see above), request a structural engineer to rank the proposed 1 shorters based on his or her knowledge and the criteria contained in these guidelines. Avoid uncertified buildings of the following types. 	 Definitions with only on open toors pairs longer than 40 feet. Untrainforced masonry buildings. Pre-engineered (steel pre-fabricated) buildings built before the mid-1980s. Buildings that will be exposed to the full force of hurricane winds. Give preference to the following: 	— ———————————————————————————————	 pototial hurriance execution abelter. All facilities manufacturing, using, or storing hazardous materials (in reportable quantities for the start of softy Data Sheets (emergency and hazardous chemical invertory forms) to the Loc. Material Softy Data Sheets (emergency and hazardous chemical invertory forms) to the Loc. Commutee (LEPC) and the local fire department. These sources can help you determine the shuring are evaluation shelter or determine threatman termine the shuring are evaluation shelter or determine threatmain threatman and the start are or source manufacture. Just or so that readous materials may be in manufacture. Just or so that actuation materials Facilities has a source scattable types or quantities of hazardous materials may be in Hurinance evaluation shelters. Hurinance evaluation shelters should not be located within the ten-mile emergency planni power plann. 	 Chapters must work with local emergency management officials to determine if hazardoa concern for potential hurricane evacuation shelters. Chapters Bus do a storm data (e.g., arrival of gale-force winds), determine a notification procedure within gales. Interior Building Safety Criteria During Hurricane concedure within following. Do not use rooms attached to, or immediately adjacent to, unreinforced masony walls or the base. Do not use rooms attached to, or immediately adjacent to, unreinforced masony wills or the base. Do not use rooms attached to, or immediately adjacent to, unreinforced masony wills or the base. Do not use rooms attached to, or immediately adjacent to, unreinforced masony wills or lowing. Avoid areas near glass unless an adequate shutter protects the glass surface. Assume that is the interior conditions. Avoid areas near glass unless an adequate shutter protects the glass surface. Assume that is there is not vore for the avoid contraction of a store and a store and store an	 Avoid basements it there is any chance or isolaring.
teragency group comprised of the Federal Emergency Management Agency, the U.S. Amy Corps of Engineer onmental Protection Agency and Clemson University, has developed hurricane evacuation shelter selection aris. These standards reflect the application of feathing lata complied in hurricane evacuation substa, other enternal to information, and teached to vand Joads and structural problems. These standards are enternal to information contained in ARC 3041, Mass Care: Preparedness and Operations concerning shelter to.	I oral officials responsible for public safety. Technical information contained in Hurricane Evacuation Studies, as using and flood mapping, and other data can now be used to make informed decisions about the suitability of est. est. The experience of the American Red Cross the majority of people evacuating because of a furricane threat in the experience of the American Red Cross the majority of people evacuating because of a furricane threat in the experience of the American Red Cross the majority of people evacuating because of a furricane threat in the experience of the American Red Cross the majority of people evacuating because of a furricane threat in the experiment of the americane threat in the evacuation of the furries of the Americane threat and relatives. However, for those who do seek much called threat threat the advector of relatives.	and protoco to interactive as any our inclusion and there is not our inclusion of the interaction and the interaction of the interaction and the interaction of the interaction of the interaction of the interaction. Hazardous materials	Following standards address the risks associated with each of these hurricane-associated hazards. rege Intundation aread, hurricane evacuation shelters should not be located in areas vulnerable to hurricane surge inundation. T eneral, hurricane evacuation shelters should not be located in areas vulnerable to hurricane Surges from Hurri- son and Weather Servec has developed mathematical models value as and Soveral Portan Hurri- Sovera and Social Portgam to List Amplitudes of Surges from Hurrisane (SPLASH), that are critical in deter- son and Weather Servec has developed mathematical models.	potential level of surge inundation in a given area. Carefully review immdation maps in order to locate all hurricane evacuation shelters outside of Category 4 stor surge immdation zones. The buildings spect to isolation by surge immdation in fivor of equally suitable buildings not subject to possibion. Confirm that ground elevations for all potential shelter facilities and access routes obtained from topographic maps are accuration shelters on barrier islands. Do not locate hurricane evacuation shelters on barrier islands.	ful I looding must be considered in the burrient evacuation sheler selection process. Riserine immediation area on on Flood Insurance Rate apps (FRMs), as prepared by the National Flood Insurance Program, should be wrothen the transfer Rate and also be recleaved in locating abetras in inland counties. Locate burrienne evacuation shelters outside the 100-year floodplain. Avoid selecting hurrienne evacuation shelters in areas likely to be isolated due to riverine immediation of roadwa Make area channel and the flow and the end of the location of the total effecting hurrience evacuation shelters in areas likely to be isolated due to riverine immediation of roadwa Make area a hurrience evacuation shelters in areas likely to be isolated due to riverine immediation of roadwa Make area a hurrience evacuation shelters in areas likely to be isolated due to riverine immediation of roadwa Make area a hurrience evacuation shelters in areas likely to be isolated due to riverine immediation of roadwa Make area a hurrience evacuation shelters in areas likely to be isolated due to riverine immediation of roadwa Make area a hurrience evacuation shelters in areas likely to be isolated due to riverine immediate detecting hurrience evacuation shelters in areas likely to be isolated due to riverine immediation of the detection level for the FIRM area.	

Exhibit IV

Least-Risk Decision Making: ARC 4496 Guideline Summary					
Survey Date: Facility Name: City: Coordinates: Latit	State	County: Address: e:Zip Code: Longitud	County: Address: Zip Code: Longitude		
CRITERIA	PREFERRED	MARGINAL	NEEDS FURTHER INVESTIGATION OR MITIGATION		
1. Storm Surge Inundation/SLOS H					
2. Rainfall Flooding/ Dam Consideration/ FIRM Zone					
3. Hazmat Considerations					
4. Lay-down Hazard Exposure					
5. Wind and Debris Exposure					

6. Wind Design Verification		
7. Construction Type/ Load-path Verification		
8. Building Condition		
9. Exterior Wall Construction		
10. Fenestration/ Window Protection		

11. Roof Construction/ Roof Slope		
12. Roof Open Span		
13. Roof Drainage/ Ponding		
14. Interior Safe Space		
15. Life Safety/ Emergency Power Generator		

Exhibit V OTHER PREFERRED FEATURES AND OPERATIONAL CONSIDERATIONS

Other preferred features and operational responsibilities as a clarification of other consideration for shelter facilities

Preferred (optional)	Existing Shelters	Existing Shelters	Enhanced Hurricane	Essential Facilities
features	Туре В	Туре А	Protection Areas	needed for COG/COOP
			Type EHPA	Type EFCOOP
Preferred Features	Buildings with concrete roofs			
	Buildings in topographically sheltered areas			
	Restrooms in the protected area			
	Emergency generators available			
Adjacent Hazard	No hazardous material facilities located nearby.			
Mitigation	No unanchored light-framed portable ancillary structures nearby unless shelter is designed for rollover debris impact hazards			
Operational	24/7 Red Cross management per ARC 3041 and as indicated in the State and County Emergency Operations Plans			
Responsibilities of the	Communications to ARC and EOC			
ARČ	First Aid Kits / Flashlights AM/FM Radio			
	Management of the operational transition from a short-term hurricane refuge to congregate care shelter			
Essential Items that	<i>I gal potable water per person per day (except for EFCOOP which has provisions for water supply)</i>			
the Occupants should	Personal items carry-on bag with:			
bring to the shelter	Family needs, such as 2-week supply of daily prescription medications, a 3-day supply of non-perishable food and any special			
	dietary foods, can opener, infant formula and diapers,			
	Prescription eyewear, and personal hygiene items such as waterless cleaner, toothbrush/toothpaste, toilet paper roll,			
	List of any required Medications/special medical information/Medical Care Directives/health insurance card, Personal ID's and			
	other important documents			
	First Aid Kit			
	Flashlights, batteries, and spare bulbs, portable radio with spare batteries,			
	Change of clothes, towel			
	Pillows, blankets, and folding mattresses / air mattresses			

Exhibit VI Saffir/Simpson Hurricane Scale Ranges with Additional Hawaii Damage Indications			Hurricane Scale Ranges with Additional Hawaii Damage Indications		
Hurricane Category	Central Pressure Mm of mercury at 32 degrees F	Sustained Winds	Peak Gust (over land) mph	Approximate Storm Surge Height (ft.)	Damage Potential Indications
Tropical Storm	979-1007	40-73 mph		2-3 ft	Some. Minor damage to buildings of light material. Moderate damage to banana trees, papaya trees, and most fleshy crops. Large dead limbs, ripe coconuts, many dead palm fronds, some green leaves, and small branches blown from trees.
1	980-992	74-95 mph	82-108	4-5 ft	Significant. Corrugated metal and plywood stripped from poorly constructed or termite-infested structures and may become airborne. Some damage to wood roofs. Major damage to banana trees, papaya trees, and fleshy crops. Some palm fronds torn from the crowns of most types of palm trees, many ripe coconuts blown from coconut palms. Some damage to poorly constructed signs. Wooden power poles tilt, some rotten power poles break, termite-weakened poles begin to snap. Low-lying coastal roads inundated, minor pier damage, some small craft in exposed anchorage torn from moorings.
2	965-979	96-110 mph	108-130	6-8 ft	Moderate. Considerable damage to structures made of light materials. Moderate damage to houses. Exposed banana trees and papaya trees totally destroyed, 10%-20% defoliation of trees and shrubbery. Many palm fronds crimped and bent through the crown of coconut palms and several green fronds ripped from palm trees; some trees blown down. Weakened power poles snap. Considerable damage to piers; marinas flooded. Small craft in unprotected anchorages torn from moorings. Evacuation from some shoreline residences and low-lying areas required.
3	945-964	111-131 mph	130-156	9-12 ft	Extensive. Extensive damage to houses and small buildings; weakly constructed and termite-weakened house heavily damaged or destroyed; buildings made of light materials destroyed; extensive damage to wooden structures. Major damage to shrubbery and trees; up to 50% of palm fronds bent or blown off; numerous ripe and many green coconuts blown off coconut palms; crowns blown off of palm trees; up to 10% of coconut palms blown down; 30%-50% defoliation of many trees and shrubs. Large trees blown down. Many wooden power poles broken or blown down; many secondary power lines downed. Air is full of light projectiles and debris; poorly constructed signs blown down. Serious coastal flooding; larger structures near coast damaged by battering waves and floating debris.
4	920-944	131-155 mph	156-191	13-18 ft	Extreme. Extreme structural damage; even well-built structures heavily damaged or destroyed; extensive damage to non-concrete failure of many roof structures, window frames and doors, especially unprotected, non-reinforced ones; well-built wooden and metal structures severely damaged or destroyed. Shrubs and trees 50%-90% defoliated; up to 75% of palm fronds bent, twisted, or blown off. Many crowns stripped from palm trees; numerous green and virtually all ripe coconuts blown from trees; severe damage to sugar cane; large trees blown down; bark stripped from trees; most standing trees are void of all but the largest branches (severely pruned), with remaining branches stubby in appearance; trunks and branches are sandblasted. Most wood poles downed/snapped; secondary and primary power lines downed. Air is full of large projectiles and debris. All signs blown down. Major damage to lower floors of structures due to flooding and battering by waves and floating debris. Major erosion of beaches.
5	< 920	> 155 mph	>191	> 18 ft	Catastrophic. Building failures; extensive or total destruction to non-concrete residences and industrial buildings; devastating damage to roofs of buildings; total failure of non-concrete reinforced roofs. Severe damage to virtually all wooden poles; all secondary power lines and most primary power lines downed. Small buildings overturned or blown away.

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