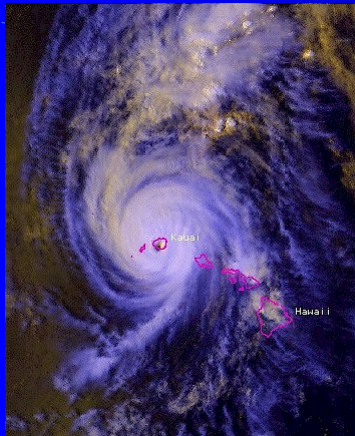


The Loss Mitigation Grant Program

Grants for Home Retrofits using Wind Resistive Devices

Saturday June 2, 2007



OUTLINE

- Introduction to the Loss Mitigation Grant Program
- Hurricane Probabilities in Hawaii
- Damage to Hawaii Housing Units during Hurricane Iniki 1992
 - Physical Damage to Buildings
 - Economic Losses
 - Risk Factors
- Basics of the retrofits
 - The 5 types of retrofits eligible for grants
- Does the homeowner need to prepare, submit or receive anything before starting the work?
- How do we get the information we need?
- Questions and Answers



Introduction to the Loss Mitigation Grant Program

Grant Amount

- 35 percent of the cost
- Up to a maximum of \$2100

Do the retrofit first, then apply for grant

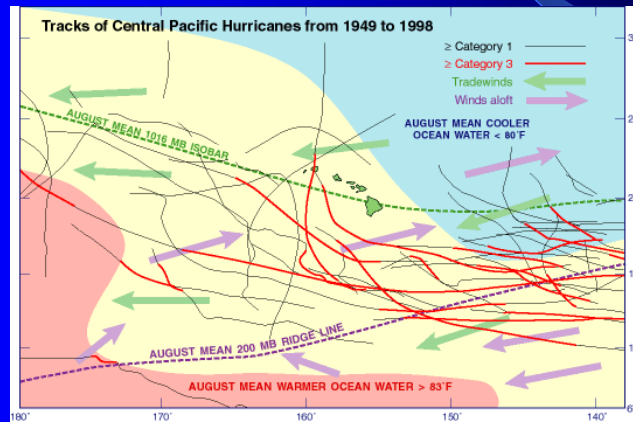
Follow the Wind Resistive Devices technical specifications

Do it yourself options

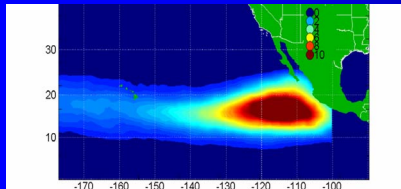
- Roof to wall retrofits (hurricane clips)
- Plywood opening protection
- An Inspector is required
- The grant reimbursement would just be for the cash outlays for materials and inspection, not your labor.



Hurricane Probabilities in Hawaii



Hurricane Long-Term Annual Odds of Occurrence



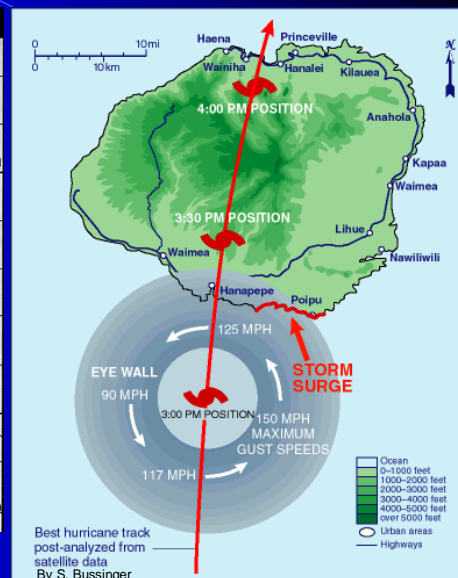
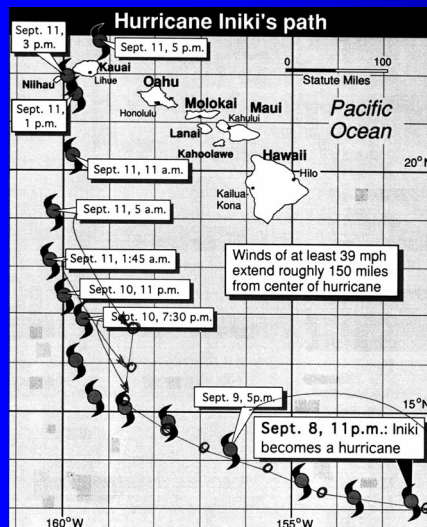
Hurricane Category	Sustained Wind	3 -sec. Peak Gust	Anywhere in Hawaii
1	74 to 94 mph	82 to 108	1 in 25
2	94 to 110 mph	108 to 130	1 in 50
3 or 4	110 to 155 mph	130 to 191	1 in 75
Any Hurricane	Greater than 74 mph	Greater than 82	1 in 15

- **Damage to Hawaii Housing Units during Hurricane Iniki 1992**

- Physical Damage to Buildings
- Economic Losses
- Risk Factors and Performance



Hurricane Iniki September 11, 1992



Typical Modes of Damage / Failure

- Loss of Roofing
- Loss of Decking and Roof Framing
- Window & Door Failures
- Foundation Displacement and Loss of Support
- Structural System Instabilities and Structural Damage associated with loading on cladding



Hurricane Iniki Actual Losses to Dwellings Averaged about \$60,000 / home

Direct Economic Loss to Buildings

Type of Construction	Single Wall	Double Wall & Masonry
Economic loss	\$302,400,000	\$418,700,000



**Structural Damage Total =
\$721 Million**

**Contents Losses Total
= \$169 Million**

- Information cited from State of Hawaii Department of Insurance:
Economic Loss (Building Loss plus Content Loss Claims)
888 Million Dollars

The residential housing database of approximately 15,000 dwellings includes low-rise single-family, two-family, multi-family, detached "ohana" homes, limited to units under single ownership. Condominiums were excluded.

Several Risk Significant Variables

- Type of Construction
 - Single Wall – Not Good
 - Double Wall – Better
 - Masonry/ Concrete – Better Still
- Age – generally older homes are worse off
- Roofing
 - Old Style Corrugated Metal Roofs – Worst
 - Built-up & Composition / Asphalt - Average
 - Shingles / Shakes / Tile - Better
- Height and Exposed Topography – increases wind load
- Hurricane roof to wall uplift ties – Good
- Foundation:
 - Elevated Wood Floor on Posts – Not Good
 - Concrete Slab – Good
- Surge Zone – Worst
 - Flood insurance is purchased through FEMA's National Flood Insurance Program. www.floodsmart.gov

Basics of the Retrofits of the Loss Mitigation Grant Program



Note: This presentation is just a short summary. The detailed information distributed by the Insurance Division is the more authoritative reference.

Grants under the Loss Mitigation Grant Program

- Available for owner applicants of single family and multi-family homes, and condominium apartment owners
- Work must comply with the *Wind Resistive Device (WRD) Specifications* (available from the Insurance Division)
- 5 generic types of WRD retrofits
 - **Roof to Wall uplift restraint ties**
 - **Fastening of roof wood sheathing or roof metal decking**
 - **Exterior Opening Protection**
 - **Foundation Uplift Restraint Strengthening**
 - **Hawaii Residential Safe Room**

Attached Carports and Garages and Detached Garages

- A carport is a roof projecting from the side of a building used to provide an open shelter for an automobile.
 - An attached carport would be eligible for roof to wall ties and sheathing fastening.
- A garage is an enclosed structure for housing automobiles.
 - An attached garage would additionally be eligible for opening protection.
- A detached garage is not eligible for grants.

Hawaii Inventory Mostly Lacks Hurricane Ties

There were no requirements for hurricane ties in conventional construction of single family residences until the late 80's and early 90's.

Find out when your home was built. If your home is on Oahu, the City may have microfilm copies of your plans, depending on its age and the original owner / developer's degree of care.

Benchmark Years when roof to wall wind uplift ties were first required:

County	Date of Plans	Probable Construction Period
Kauai	1989	1990 to 1993
Oahu	1987	1988 to 1995
Maui	1989	1990 to 1995
Hawaii	1993	1994 and later

Benchmark Years when a complete load path of connectors was first required:

County	Date of Plans	Probable Construction Period
Kauai	1992	1993 and later
Honolulu	1994	1995 and later
Maui	1994	1995 and later
Hawaii	1993	1994 and later

The Complete Load Path is What is Recommended by SEAOC and is now in the Current Building Code

see http://www.fema.gov/pdf/rebuild/mat/fema499/hgcc_fact10.pdf

HOME BUILDER'S GUIDE TO COASTAL CONSTRUCTION FEMA 499/August 2008 Technical Fact Sheet No. 10

Purpose: To illustrate the concept of load paths and highlight important connections in a *wind uplift load path*.

Key Issues

- Loads acting on a building follow many paths through the building and must eventually be resisted by the ground, or the building will fail.
- Loads accumulate as they are routed through key connections in a building.
- Member connections are usually the weak link in a load path.
- Failed or missed connections cause loads to be rerouted through unintended load paths.

LINK 1
High winds lift the roof upward, forcing fasteners back the roof covering to the sheathing, and sheathing fasteners back the sheathing to the roof framing members (see Fact Sheet No. 18).

LINK 2
Nonstandard roof load is carried through roof-to-wall connections. Special roof ties connect the roof framing to the bearing walls (see Fact Sheet No. 17).

LINK 3
Upper walls transfer loads directly to the lower walls. The floor framing is bypassed by using metal straps or embedded exterior sheathing that directly connects upper wall studs to the lower wall studs. A similar connection is used to connect the lower wall to the main floor beams.

LINK 4
The accumulated uplift force is transferred from the main floor beams to the pile foundation with special brackets or bolts (see Fact Sheet No. 12). **Note:** Some of this load is offset by the weight of the building.

Vertical load path from roof to ground on a platform-and-pile-construction building. Note: Load paths will vary depending on construction type and design. Adjacent framing members will receive more load if a connection fails.

FIG. 10 - Load paths

If a connection fails, an alternative load path will form. If the members and connections in the new load path have inadequate resistance, progressive failure can occur. Loads must be routed around openings, such as windows and doors. Accumulated loads on headers are transferred to the studs on the sides of the opening.

LINK
An adequate connection must be made between the header and the king stud to ensure the load to continue down the path.

LINK
The bottom of a wall could have points of high uplift due to an accumulated load from above. Suitable hardware should be installed in the proper locations.

Load paths can be complex through a connection. It is important that each link within the connection be strong enough to transfer the full design load. The detail at left shows a typical floor-to-pile connection. Uplift loads are transferred through the joint in the following order:

- 1 from upper story to strap
- 2 from strap to floor beam
- 3 from floor beam to bolts
- 4 from bolts to pile
- 5 from pile to ground

FIG. 10-20 - Load paths

WRD Option 1: Roof to Wall uplift restraint ties at roof ridges and roof framing members to wall or beam supports.

- Hurricane “clips” or “straps” shall be installed to provide uplift resistance between each rafter or roof truss and the supporting structural wall or beam supports at the perimeter of the structure
- All devices shall be corrosion-resistant and installed per the manufacturer’s specifications



WRD Option 2. Fastening of roof wood sheathing or roof metal decking for high wind uplift

- The roof decking upgrades for houses require that the entire roofing (tiles, shakes, shingles, etc.) be removed, so this WRD option should be done when the existing roof needs replacement.
- The State will provide a matching grant only on the retrofit portion of the total cost that is above and beyond the cost of a standard re-roofing job.



WRD Option 2. Fastening of roof wood sheathing or roof metal decking for high wind uplift

- The roof decking upgrade consists of
 - install 8d deformed shank nails to achieve a net 6-inch spacing at all panel supports and edges
 - If the roof lacks a full wood decking, install a fully sheathed, nominal 5/8-inch thick plywood deck
 - install a self-adhering underlayment sheet membrane to the plywood decking to provide secondary water resistance.
- Ring-shank or Spiral Shank nails shall be used for the attachment of roof structural sheathing for greater uplift capacity



- Installation of tie straps into the rafters or trusses at 48" spacing along the ridges.
- Roofing shall be installed per the manufacturer's or industry association's recommendations for high wind uplift.

Upgraded Roof Decking for Houses with Metal Roofs

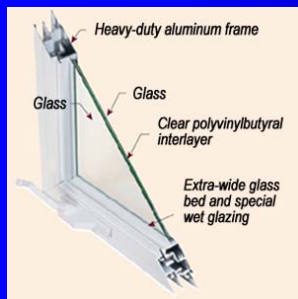
- For houses having corrugated metal roofs in good condition with at least 15 years of remaining life
- Roof decking upgrade consists of adding additional fasteners to improve the connection of the decking to the roof frame.
- In addition, positive uplift resistance using a 400 lb. allowable uplift hurricane clip shall be provided at connections between each purlin and roof truss or rafter.
- The house shall be inspected for corrosion, termites, and dry rot

WRD Option 3: Exterior Opening Protection from windborne debris and wind pressure

- Protect all windows, sliding glass doors, entry doors, garage doors, and skylights, but excluding openings not exceeding a total of 4 square feet in any wall
- A separate grant application may be submitted for the protection of an attached garage, when all openings and walls between the attached garage and the residential portion of the structure are also protected.



There are a variety of opening protection devices in the mainland market!
Here are just a few examples



Impact-resistant glass systems

- **Impact-resistant glass systems** are available as complete units, including the frame, and they can be installed as replacements for conventional windows. These windows are made of a clear plastic-like film, sandwiched between two glass units.
- **Protective laminated films** on the surface of glass windows should be installed as a complete system of securing of glazing to the window frame *and* securing of window frame to walls.

WRD Option 4: Foundation Uplift Restraint Strengthening

- Grant is applicable only to single story, single wall homes on post and beam systems with elevated first floors.
- This work requires preparation of plan drawing and details of the foundation retrofit for the site and foundation conditions of the individual home.
 - Plans directly prepared by a licensed professional structural engineer may make use of alternative designs rather than the technique shown.



The Problem:
Many single wall houses in Hawaii utilize a post and beam system to support the first floor. In most instances, the posts rest on concrete blocks with no uplift resistance.

WRD Option 5: Hawaii Residential Safe Room Designed to Performance Specifications

- The use of a Residential Safe Room does not eliminate the risk of injury, given that the effects of a hurricane are highly variable and are subject to considerable uncertainty. Nevertheless, installing a properly designed and constructed residential safe room shelter can provide an area of enhanced protection within the home.
- To qualify for a grant, the residential safe room shall meet the minimum design and construction performance specifications in the Wind Resistive Device Specifications available for download from the Insurance Division.

One should not construct a Residential Safe Room within areas subject to stream flooding, coastal flooding or dam failure.

- To see what flood zone you're in, on O'ahu call 523-4131 or go online to gis.hicentral.com/website/parcelzoning/viewer.htm.
 - Click on "search" and enter your street address or tax map-key number.
- For the Big Island, call 961-8327;
- Maui, 270-7253; and
- Kaua'i, 241-6619



The inside of an apartment unit that was within the surge zone of Iwa

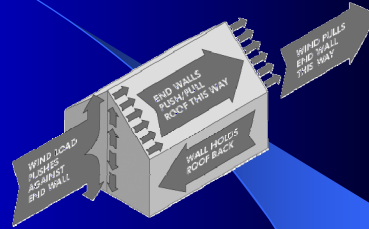
Residential Safe Room Performance Specifications (recommended)

- **Construction Documents Required:** Construction documents for the installation of the safe room in the residence of the applicant shall be directly prepared by a Hawaii licensed professional structural engineer.
 - More expensive FEMA and manufactured storm shelter safe room prescriptive designs may also be followed and are deemed to comply.
- **Inspection:** The construction or installation of the safe room shall be inspected
- **Readiness:** The safe room shall be fully constructed in all respects. It shall be readily accessible and ready for occupancy to person(s) residing on the property within 2 hours notice.

Residential Safe Room Performance Specifications (recommended)

- **Ventilation:** The room shall be naturally ventilated. This requirement may be satisfied by 12 square inches of venting per occupant. There shall be at least two operable vents. The vents shall be protected by a cowl or other device
- **Exiting:** The room shall be equipped with an inward-swinging door and an impact-protected operable window suitable for a means of alternative exiting in an emergency.
- **Communication:** Equip the safe room with a phone line and telephone that does not rely on a separate electrical power outlet (but it may rely on a Uninterruptible Power Supply (UPS) battery device).
- **Maximum Occupancy:** Maximum occupancy is based on having at least 15 square feet per person with a maximum of 8 persons in a room of up to 128 square feet of floor area.

- Thinking and Planning for what to do
- Does the homeowner need to prepare, submit or receive anything before starting the work?
- How do we get the information we need?
- Questions and Answers



Thinking and Planning What to Do

- Get the information and consider the 5 WRD options
- Find out your home's approximate time of construction and assess your risk factors
- Consider installing the entire wind uplift load path, even if it might not all fall under this grant program
 - http://www.fema.gov/pdf/rebuild/mat/fema499/hgcc_fact10.pdf
- Consider the best timing and the appropriate sequencing
- Always spend your money wisely. Remember that you pay for the full cost first, and then apply for the grant.
- In the final analysis, the benefit is protecting your home.

The WRD Specifications include two sequencing requirements

- Certain devices specified in may only be eligible for awarded grant awards if the following sequencing of installation requirements has been met:
 1. *For “single wall” construction, no other grants except for a Residential Safe Room may be awarded unless the roof to wall connections have been previously or concurrently installed.*
 2. *No grant may be awarded for foundation uplift strengthening unless the roof to wall connections have been previously or concurrently installed.*

Does the homeowner need to prepare, submit or receive anything before starting the work? Yes.

- For Roof to Wall Tie (WRD Option 1), arrange for an inspector if you intend to “do it yourself”. The inspector will need to file a certification of compliance.
- For Roof Deck Upgrade (Option 2) of homes having corrugated metal roofs, the house shall be inspected for corrosion, termites, and dry rot
- For Opening Protection (Option 3), it is recommended that the homeowner should ask for drawing documentation of how the all devices will be attached to the structure before accepting a proposal.
- For Foundation Strengthening (Option 4), you will need to have construction drawings prepared. These are designed by a Hawaii structural engineer
- For Residential Safe Room (Option 5), Have construction documents prepared by a Hawaii structural engineer and submit them for approval to DCCA

The WRD Specifications also require compliance with standards for manufacturers of the devices

- The WRD Specifications only recognizes connectors that can be validated by testing to achieve the loads indicated in the Specifications.
 - Manufacturers can submit test data to substantiate any hurricane tie that has not been approved by a national code.
- Manufacturers of opening protection devices are responsible for submitting test data substantiating compliance with ASTM standards.
- Manufacturers of Impact-resistant glass and laminated film applications are responsible for a system that includes the frame details for the glazing.
- If intended for installation on single wall homes, the manufacturer of an opening protection device is responsible for the design of the means of attachment and to perform testing of those attachment techniques on a sample single wall mock-up assemblage.

Application to submit to the Department of Commerce and Consumer Affairs Insurance Division

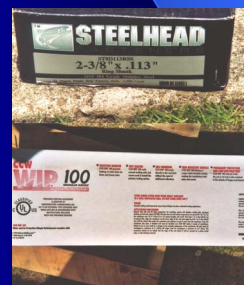
Application form (3 pages)

Certification of completion and compliance of work

- A certification of compliance with the Specifications is required to be submitted by a licensed contractor
- For certain types of “do-it-yourself” work, the certification needs to be filed by an inspector you hire

The Receipts

Photographs showing at least 30% of the work and material labels



How do we get the information we need?

- There is an introductory packet of handouts available at the Insurance Division to get you started.
- The Insurance Division of the Department of Commerce and Consumer Affairs website:
http://www.hawaii.gov/dcca/areas/ins/main/about_ins/
- All grant information discussed today is available from the Insurance Division website link:

<http://hurricaneretrofits.hawaii.gov/>