Communication for Community Resilience: The Homeowner’s Handbook to Prepare for Natural Hazards

By

Dennis Hwang, Faculty
University of Hawaii Sea Grant College Program, NOAA
djh@opglaw.com
808-544-8608
Resilient - Adaptive - Sustainable

HOMEOWNER'S HANDBOOK

To Prepare For Natural Hazards

First Aid Kit

University of Hawai'i Sea Grant College Program

By
Dennis J. Hwang
Darren K. Okimoto

Fourth Edition
Outline of Talk

Acknowledgements
History of the Handbook
Handbook Content
  Hazard Risk
  Emergency Supplies & Evacuation Planning
  Retrofitting of Homes*
Retrofit Estimation
Strategies to Reach the Whole Community
List of Partners - Government

- University of Hawaii Sea Grant College Program
- School of Ocean, Earth Science & Technology
- State of Hawaii DCCA - Insurance Division
- American Red Cross
- State of Hawaii Emergency Management Agency
- Emer. Man. & Civil Defense - Maui, Kauai, Hawaii, Honolulu
- City Office of Climate Change & Resiliency
- DLNR – National Flood Insurance Program
- FEMA – (Local, Regional & Building Science Branch)
- NOAA National Weather Service
- National Disaster Preparedness Training Center
- Pacific Tsunami Warning Center
- Pacific Tsunami Museum
- International Tsunami Information Center
- Office of State Planning – Coastal Zone Management
- USGS Hawaii Volcano Observatory
- Hawaii State Legislature
List of Partners - Private

- All Island Roll Shutters*
- Building Industry Association
- American Savings Bank*
- Coastal Windows
- Discount Windows
- DR Horton*
- ICAT Insurance*
- Hardware Hawaii
- Hawaiian Electric Company*
- Hurricane Protection Services*
- Martin & Chock*
- Simpson Strong-Tie*
- State Farm Insurance*
- West Oahu Roofing
- Zephyr Insurance*

* indicates Partner since 2007
History of the Handbook

• Started in 2007, now in the 4th Edition - 10 print runs with over 100,000 copies

• Since 2007 – Over 300 outreach events (workshops, seminars, emergency fairs, presentations, & media interviews) on preparedness. For many organizations (Companies, Chambers of Commerce, Churches, Neighborhood Boards, Rotary Clubs, Politicians, Community Groups, AARP, Essential Workers, Schools, Colleges, Conferences, etc.) Many Lessons Learned!!!

• In ten states or countries - Hawaii,* Mississippi, Alabama, Louisiana, Texas (English & Spanish),* Florida, Delaware,* Massachusetts,* Republic of the Marshall Islands (English & Marshallese), Mariana Islands - *means recently updated or updating

• In preparation – Alaska, Georgia, Federated States of Micronesia

Kudos to other Sea Grant Programs!
Goals:
1) Prepare families & homes for multiple natural hazards
2) Reduce risk to property and lives

-Information in the handbook tailored for each location
  * Local hazard risk
  * Multiple references reviewed for applicability
  * Incorporates lessons learned – other disasters
  * Develops new best practices to fill need

Four Key Components:
1) Hazard Risk
2) Emergency Supplies
3) Evacuation Plan
4) Strengthen Home
### Whole Community – All Individuals & Organizations

#### Target Audiences

- Homeowner’s
- Businesses/Owners*
- Government Workers*
- Employees/Workforce*
- Families*
- Elderly*
- Children*
- Minorities*
- Pet Owners*
- Renters
- Tourists
- Injured or infirm
- Military families
- Disadvantaged or disabled
- Other

* Target audiences associated with Homeowner’s

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**Useful tool but not the entire answer!!**
Hazard Risk

Social Science studies and experience indicate a major reason people do not prepare is they do not think there is risk.

Inform of Local Risk to Build Sense of Urgency!

Explain in understandable and graphical manner:
Science of the hazard
How to look up their risk

Understand risk so they can plan and prepare!
Hazard Risk

Tsunamis

Explain
What is cause and historical damage from tsunamis?

Where do tsunamis originate? What is travel time to Hawaii?
Earthquakes

What is my earthquake risk?

Figure 2-10. Distribution of earthquakes in the Hawaiian Islands from 1861 to 2018. The larger dots are associated with the larger earthquakes. The most frequent and larger events are associated with the southeast coast of the island of Hawai‘i. The location of the October 15, 2006 earthquake is marked with dot 8. The magnitude 6.9 earthquake of May 2018 associated with volcanic eruptions is dot 9. Courtesy of USGS and Gerard Fryer – Hawai‘i Institute of Geophysics and Planetology, University of Hawai‘i.

Flooding

How do I look up my flood zone?  What is my flood risk?

Figure 2-12. The Hawai‘i Flood Hazard Assessment Tool (http://gis.hawaiiflip.org/flip) allows users to search for specific properties by site address or Tax Map Key (TMK) and determine their flood zone. A report can be generated for each property which indicates the level of flood risk as explained in Figure 2-13. The report will also indicate if the property is in a tsunami evacuation zone or dam evacuation zone.
Volcanoes

What is my lava risk?

How did 2018 lava flow impact islands locally (720 houses destroyed) and on other islands (VOG).
Climate Change (heat, drought, wildfire, infectious disease, sea-level rise, erosion)

**Drought**

Figure 2-18. The Drought Monitor for Hawai‘i is part of the Drought Monitor for the U.S. and is updated weekly. Drought conditions range from None to Exceptional Drought. D0 can be considered a drought watch with areas going into or coming out of a drought. D1 to D4 are four levels of increasing drought conditions. According to this map, on July 9, 2019, 78.16% of Hawai‘i was in an abnormally dry condition or worse.

**Wildfire**

Figure 2-19. Data put together by the Hawai‘i Wildfire Management Organization contains over 13,500 fire records. This 2014 map is currently being updated. Note the high frequency of roadside ignitions along the wildland-urban interface, indicating the major role of humans in starting fires. Also note the high frequency of wildfires in leeward areas. Yet wildfires can occur anywhere (see Reference Link 14 and Figure 2-20).

**How to Use U.S. Drought Monitor!**

**History of Wildfire in Hawaii from Hawaii Wildfire Management Organization**
Hurricanes

What is Storm Surge?

Figure 2-6. During a hurricane, there is an increased elevation of water levels caused by the low pressure of the hurricane and strong winds blowing onshore. The total water level is equal to the tides, plus the storm surge, plus the waves on top. Photo courtesy of NOAA.

What is common damage from hurricane?

Figure 2-5. A common site on Kaua'i after Hurricane Iniki. Many roofs were blown off due to a lack of proper connection. Photo courtesy of Department of Commerce and Consumer Affairs Insurance Division.
If Iniki turns north 6 hours earlier – about 50,000 houses damaged or destroyed instead of 6,300.

FEMA RISK ASSESSMENT in 2010 confirms
If Category 2 hits Oahu, 52,000 households displaced – $27 billion in damages – 2018 Pacific Disaster Center Study using FEMA HAZUS Tool.
Emergency Supplies

- 14 day supply – non-perishable food and water – flashlight – radio – medications – etc.
“It is important families always have their emergency plans and supplies. The handbook provides helpful tips so people can slowly gather their supplies for the long-term, without placing a burden on vendors or creating shortages in the community. With more people staying at home, we encourage people to stay active by working on their health and on projects to strengthen the home found in the handbook.”

Lt. Governor Josh Green
April 1, 2020

Hurricane Season
June 1, 2020

Sheltering in Home for Covid-19 not the same as Sheltering in Home for Hurricane
Flood Maps

During Hurricane – Triple Threat – Flooding (inland and coastal), Storm Surge, Wind

Important to wait for que from local emergency managers.
# Ability to Shelter in Place During a Hurricane

**Please read instructions before using this table.**

## FEMA or Hawaii's Residential Safe Room

<table>
<thead>
<tr>
<th>Safe room</th>
<th>Concrete or CMU wall house</th>
<th>Double wall house</th>
<th>Single wall house</th>
<th>Suggested Action</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Concrete or CMU wall house</strong></td>
<td>Concrete CMU wall house in poor condition</td>
<td>Concrete CMU wall house in good condition</td>
<td>Concrete CMU wall house with hurricane clips</td>
<td>Concrete CMU wall house with hurricane clips &amp; window protection</td>
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*Based on discussions and review with Ian Robertson, Professor, UH Mānoa, Civil and Environmental Engineering; Gary Chock, Structural Engineer, Martin & Chock Inc.; Tim Waite, PE, Simpson Strong-Tie; and Kevin Richards, Natural Hazards Officer, Hawaii's Emergency Management Agency.*
Storm Surge Maps

Tsunami Evacuation Maps

FOR TSUNAMI ONLY

Flood Maps
2017 Major Hurricane Harvey Impacts – Rockport, Tx.

Numbers Indicate Damage Levels: 4 – the worst, 1 the best
4 – Destroyed House
3 – Major Damage
2 – Moderate Damage
1 – Minor or No Damage

2017 House – built 3 months before Harvey
Modern Building Codes
1. Continuous Load Path Connection
2. Strong Roof
3. Window Protection
Continuous Load Path Connection

A. Rafter-to-Top Plate Connections:
Transfer forces from the roof to the top plate

B. Top Plate-to-Stud Connections:
Transfer forces from the top plate to the stud

C. Floor-to-Floor Connections:
Transfer forces from the second story to the first story

D. Stud-to-Sill Plate Connections:
Transfer forces from wall studs to the mudsill

E. Sill Plate-to-Foundation Connections:
Transfer forces from the mudsill into the foundation

Beam to Truss or Rafter Clip
Column to Beam Tie Down
Foundation Tie Down

Courtesy of Simpson Strong-Tie
Hurricane Iniki-- 1992

90-95 mph winds
HPT Clip Installation

Only Used For Retrofit!!!
A Good Proxy for Retrofit Activity

Roof Rafter

Frieze Board

Trim Board

HPT Clip

Wall

Simpson #10
1.5 inch long

Simpson Strong Drive Screw 1/4
inch 1.5 inch long
Guide for Installing Hawaii Plantation Tie (HPT) Hurricane Tie
For all retrofits – first seek advice of licensed structural engineer or architect.
Almost every house in the State can be relatively easily retrofitted.

Make the roof to wall connection first!
The following demonstration is based off the report by Dr. Ian Robertson and Gary Chock. You may be able to do most of the work yourself, but first, seek the advice of a licensed structural engineer. The work can reduce earthquake and hurricane damage.
Procedures

Remove decorative fencing with multi-tool using flat wood blade, hammer and small nail-trim remover.

Knee brace stabilizer (Simpson KBS1Z) installed for all knee braces.

Drill hole with rotary hammer, clean hole of dust with air spray and brush. Then fill with epoxy. If epoxy used – drill hole is 1/8” larger than anchor bolt. Set anchor bolt and holdown.

Attach 2” x 4” between post and edge of tofu block.

Attach Simpson HDU2 holdown to 2” x 4” and concrete foundation.
Repeat process for outside of post with 2” x 4”

The Titen concrete anchor screw eliminates the need to epoxy. Drill hole with rotary hammer - same size as anchor screw (e.g., 5/8” hole for 5/8” anchor). Drill anchor screw with impact driver. Treat for corrosion with zinc rich galvanizing spray, primer for galvanized metal and enamel paint.

Three coat treatment for corrosion resistance.
1956 single-wall house now has a continuous load path.

Benefits

- **Stronger House** – Reduced risk - Peace of mind – more likely to be able to shelter in place for weaker tropical cyclone events.
- **Hurricane Insurance Premium per year** $1,184 to $932
- **Hurricane Fortifications** listed on sale of house – distinguished from other older houses in area – greatly facilitated sale – under $500 material cost.
SDWC Structural Screw for New Construction or Retrofit

A. Rafter-to-Top Plate Connections: Transfer forces from the roof to the top plate

B. Top Plate-to-Stud Connections: Transfer forces from the top plate to the stud

C. Floor-to-Floor Connections: Transfer forces from the second story to the first story

D. Stud-to-Sill Plate Connections: Transfer forces from wall studs to the mudsill

E. Sill Plate-to-Foundation Connections: Transfer forces from the mudsill into the foundation

Simulated Rafter or Truss

Top Plate

Stud

Sill Plate

Courtesy of Simpson Strong-Tie
SDWC Structural Screw - New Construction Example

Approved by Building Department, Building Inspector & Project Structural Engineer for this house built in 2017!!

22.5° +/- 6-8°
SDWC Structural Screw – Retrofit Example

Siding flush with wall example

Target orientation of screw, see slide 12.

.31 in.

22.5 degrees

Exposed siding showing bottom of double top plate. Do this once to reveal correct relationship of truss and double top plate for the house.

Stud to double top plate structural screw. In this house the stud and truss do not align but are offset.

H2.5 clip installed in 1992 from inside of house during construction ties roof and wall

SDWC installed in 2018 from outside purposely misses truss to show can tie roof and wall

Consult with licensed structural engineer and architect before proceeding!
1. Install Screw – Tie Stud to Double Top Plate

2. Patch with Silicone Sealant & Cement Filler

1992 double wall house - 156 structural screws at three different levels in 2020 help complete load path. Many during quarantine.
Why Protect Your House from the Wind?
Why You may need to Evacuate even if Inland?

Hurricane Iniki – flying debris punctured the envelope of the house – creating a funnel for the wind which lifted roofs off their walls.
Roll Down Shutters
Hurricane Screening
Accordion Shutters
Hurricane Panels

Steel, Aluminum or Clear Plastic
Plywood Shutters – Cheap. Readily Available, Heavy

New Polycarbonate Panels, Lightweight, Strong, Becoming More Available
Follow the 4 P’s - Panels should be:
1. Precut to Proper Measurements
2. Prelabeled
3. Premark fastener locations
4. Predrill holes
Impact Resistant Windows

Impact Resistant Glass can:

1) dampen sound, which significantly reduces unwanted noise, from traffic to the howling winds of a storm or hurricane. Look for the ASTM Outdoor/Indoor Transmission Class (OITC) rating.

2) block harmful UV radiation, which can fade fabric, furniture, or other materials, but the glass still allows for unaffected plant growth. Look for the Damage Weighted Transmission Measurement (Tdw) for the fading reduction potential.

3) reduce solar heat gain in-take, making houses cooler, reducing energy or air conditioning costs while providing balanced temperatures year round.

4) open view planes while maintaining privacy. The reflective properties of laminated glass create a mirror effect during the day, maintaining privacy even when blinds are open.
Window Coverings

- Impact Resistant Windows*
- Roll Downs*
- Colonial Shutters
- Bahama Shutters
- Accordion Shutters*
- Laminates
- Storm Panels*
- Plastic Honeycomb Panels*
- Hurricane Screen
- Plywood*
Roofing

If Re-roof – 8d Ring Shank Nails 6” on center, or Simpson DSV Wood Deck Screws

If don’t Re-roof – Subfloor Adhesives – AFG-01 standards
Asphalt Shingle Roofing
Guideline Following FEMA Home Builders Guide to Coastal Construction

Create Sealed Roof
Self Adhering Modified Bitumen Layer
– ASTM D1970 - To prevent leaks
Roof Pressure Greatest on edges, ridges & corners.

Asphalt Shingle Roofing (cont.)

Asphalt cement on edges, ridges & corners for most vulnerable part of Roof

Keep the roof cool to lower energy and air conditioning costs, while increasing the life expectancy of roof components. Cool roofs can also reduce peak energy demand and combat the urban heat island effect by lowering local temperature. Look for these factors:

**Solar Reflectivity (TSR)**, measured from 0 to 1, indicates the amount of the solar spectrum that the roof reflects. Higher values indicate more energy is reflected.

**Thermal Emittance (TE)**, measured from 0 to 1, is the amount of heat released to the atmosphere, instead of being absorbed in the building. Higher values mean more heat is lost to the atmosphere.

**Solar Reflectance Index (SRI)**, calculated from (TSR) and (TE), indicates how well the roof discards solar heat. The higher the SRI, the cooler the roof.
Other Topics in Book

- Garage Doors
- Solar Units
- Trees
- Landscaping
- Energy
- Flooding, Earthquake, Wildfire Best Practices & Retrofits Practices
- Insurance – Property, Wind, Flood
Potential Risk Reduction Benefit From Retrofit

Category 2 strike on Oahu – 2018 Pacific Disaster Center Study using FEMA Hazus Assessment tool – 52,000 homes damaged or destroyed - $25 billion in residential property damage.

From 2010 to 2019 - 80,202 HPT hurricane clips sold. HPT clips can only be used for retrofit!

Average 33.5 HPT clips for single wall and double wall houses.
80,202 HPT clips sold / 33.5 clips per house = 2,394 Houses

2,394 houses * 1.25 (other clips could have been used e.g., H3 are cheaper and easier to install, or stronger H1, H10, HM9s)
* .75 (not all HPT clips installed) * 1.15 (other retrofit measures, windows, cables – from Hurricane Behavioral Study)

= 2,581
Estimated Number of Houses Retrofitted

2,581 houses / 52,000 * 25 billion in residential damages = 1.27 billion

Approximate 2,500 Homes Retrofitted – Potential Risk Reduction Benefit – over 1 billion dollars.
1. 2,500 homes retrofitted – over 1 billion in Potential Risk Reduction Benefit – Proactive People

2. Importance of education and outreach – have such an impact with very little budget. The low hanging Fruit.

3. Long way to go – 49,500 other houses.

4. How do We Reach Unreceptive/Skeptical – a large part of the population!!
Strategies to Reach the Whole Community

House Bill 571 - Act 61
Signed into Law by Governor Ige on 6/23/2017

Initiated by Rep. Mark Nakashima

UH Sea Grant College Program
House Bill 571 – Act 61

1. Update and Publish Fourth Edition of the Homeowner's Handbook to Prepare for Natural Hazards

2. Conduct Systematic and Targeted Outreach Initiative throughout the State for Emergency Management and Disaster Preparedness.

3. Develop a Communication Strategy (School Education and Community Outreach Plan) for Emergency Management and Disaster Preparedness.
Communication Plan – Informed

1. Concepts of Social Science
2. Hurricane Behavioral Study – FEMA, USACOE, Hawaii Emergency Management Agency
3. Lessons Learned – Outreach – 2007 to 2019 – over 300 events (seminars, workshops, emergency fairs, presentations, classes, etc.)
4. Interviews – Primarily Emergency Managers
Reaching Whole Community

Target Audiences

Homeowner’s
Businesses/Owners*
Government Workers*
Employees/Workforce*
Families*
Elderly*
Children*
Minorities*
Pet Owners*
Renters
Tourists
Injured or infirm
Military families
Disadvantaged or disabled
Other

* Target audiences associated with Homeowner’s

Target Audiences Based on Behavior

Add Strategies For
Proactive

Citizen Emergency Response Teams (CERT)

Hawaii Hazards Awareness & Resilience Program (HHARP)
Proactive (2.)

Attend Seminar on Hazard Preparedness and Strengthening Home
4 attendees taking pictures with smart phone of need to hold wind envelope.

Notes by attendee on foundation upgrade retrofits, adding hurricane clips, window protection options & contractors.

PROACTIVE PEOPLE CAN RECEIVE DETAILED INFORMATION!!!
Proactive (4.)

~2,500 Homes Retrofitted with hurricane clips. Many more with other measures

University Professor – April 29, 2020 “I am sending you pictures of hurricane clips and window protection that were installed. I never would have known why to do this or how if it were not for the Handbook.”

MVP Most Valuable Proactive Homeowner Howard - all retrofits & emergency supplies. If an event, will shelter over 20 family members children, grandchildren. Convinced 25-30 homeowners to retrofit with hurricane clips and window protection.
Receptive – Open to the message if proper setting and materials provided
Unreceptive/Skeptical

1. Does not think event will happen, or not that bad or not worth the time and effort. Too busy.

2. Will not collect Emergency Supplies.

3. Will rush to store during a watch or warning for food, water and gas.

4. Returning items after an event.

5. No hurricane insurance – putting in double jeopardy.

6. No evacuation plan for tsunami vs. hurricane.

7. Do not attend emergency fairs, seminars, workshops.

8. Large part of population

TARGET OF THIS STRATEGY
Communication Strategy
Strategy on Behavioral Characteristics

PROACTIVE – Takes the initiative to learn of risk and prepare.

RECEPTIVE – Open to the message if proper setting and materials provided.

UNRECEPTIVE/SKEPTICAL – Hazard will not happen, or too costly or time consuming to prepare. Will not attend seminars or emergency fairs. No supplies or emergency plans.

ASSISTED (People that need assistance – Sick, Infirm and Disadvantaged)
Target is Unreceptive – Simple risk-based messages. Provide Hope and Solutions. How do we deliver the message?
1. Mandatory Training

Effective - Mix of Proactive, Receptive and Unreceptive Citizens - Highest Percentage of Attendance

HECO Training on Hazard Preparedness Reaches 500 Workers - One Session for 200 and 3 for 100.
Examples of Mandatory Training

- University Employees – Title IX Related to Sexual Discrimination
- Financial Institutions – Cyber Security
- Some Companies – Sherman & Clayton Antitrust; Code of Conduct
- Department of Education – Short 14 minute video on tsunami preparation and planning. A similar all hazards video can be created of shorter duration that forms the basis of this strategy.

If it is important enough, it's appropriate. Short session encouraged by policy as a start.
2. Continuing Education Credits

Architects – American Institute Architects
Planners – American Planning Association
Emergency Managers – Int. Assoc. Emergency Managers
Floodplain Managers – Assoc. State Floodplain Managers

National Disaster Preparedness Training Course
2. Continuing Education Credits (Broaden the Scope)

Building Officials, Architects, Engineers

Insurance Agents

Many Opportunities to increase number of professions offering CEC courses with preparation messages

Teachers, Attorneys, Realtors, Health Profession, etc.
3. Public Education

Preliminary Discussion with Department of Education

Interest - Weave Preparation messages into National Science Standards For K-12 with teacher tool kits.

<table>
<thead>
<tr>
<th>2 Earth’s Systems: Processes that Shape the Earth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students who demonstrate understanding can:</td>
</tr>
<tr>
<td>2-ESS1-1. Use information from several sources to provide evidence that Earth events can occur quickly or slowly.</td>
</tr>
<tr>
<td>[Clarification Statement: Examples of Earth events that can occur quickly or slowly include weather changes, volcanic eruptions, and earthquakes. These events can cause significant damage and loss of life.]</td>
</tr>
<tr>
<td>2-ESS2-1. Compare multiple solutions designed to slow or prevent wind or water from changing the shape of the land.*</td>
</tr>
<tr>
<td>[Clarification Statement: Examples of solutions could include different designs of dikes and windbreaks to hold back wind and water, and different designs for using shrubs, grass, and trees to hold back the land.]</td>
</tr>
<tr>
<td>2-ESS2-2. Develop a model to represent the shapes and kinds of land and bodies of water in an area. [Assessment Boundary: Assessment does not include quantitative measures of time and space.]</td>
</tr>
<tr>
<td>2-ESS2-3. Obtain information to identify where water is found on Earth and that it can be solid or liquid.</td>
</tr>
</tbody>
</table>

The performance expectations above were developed using the following elements from the NGSS document, A Framework for K-12 Science Education:

**Science and Engineering Practices**
- Developing and Using Models: Modeling in 2-5 builds on prior experiences and progresses to include using and developing models (i.e., diagram, drawing, physical models, dynamic simulation, or storyboard) that represent concrete events or design solutions.
- Constructing Explanations and Designing Solutions: Constructing explanations and designing solutions in K-2 builds on prior experiences and progresses to the use of evidence and ideas in constructing evidence-based accounts of natural phenomena and designing solutions.
- Making Observations: Observations from several sources to construct an evidence-based account for natural phenomena.
- Construct multiple models that are consistent with observations and ideas about how physical systems work (2-ESS2-1).
- Compare multiple models to a problem (2-ESS2-1).
- Obtain, evaluate, and communicate information in 2-5 builds on prior experiences and uses observations and tests to communicate new information.
- Obtain information using various text, text features (e.g., headings, tables of contents, glossaries, electronic menus, icons), and other media that will be useful in answering a question.

**Disciplinary Core Ideas**
- ESS1.C: The History of Planet Earth: Some events happen very quickly, whereas others occur much more slowly, over a time period much longer than one can observe. (2-ESS1-1)
- ESS2.A: Earth Materials and Systems: Wind and water can change the shape of the terrain. The shape of the land is influenced by processes such as volcanic eruptions, earthquakes, and landslides. (2-ESS2-1)
- ESS2.B: Plate Tectonics and Large-Scale System Interactions: Mass moves where things are located. One can map the shapes and lands of the earth and water in any area. (2-ESS2-2)
- ESS2.C: The Roles of Water in Earth’s Surface Processes: Water is found in the ocean, rivers, lakes, and ponds. Water exists as solid ice and in liquid form. (2-ESS2-3)
- ESS2.D: Optimizing the Design Solutions: Because there is always more than one possible solution to a problem, it is useful to compare and test designs. (secondary to 2-ESS2-1)

**Crosscutting Concepts**
- Patterns: Patterns in the natural world can be observed. (2-ESS2-3, 2-ESS3-3)
- Stability and Change: Things may change slowly or rapidly. (2-ESS1-1, 2-ESS2-1)
- Connections to Engineering, Technology, and Applications of Science: Developing and using technology has impacts on the natural world. (2-ESS2-1)
- Connections to Nature of Science: Science addresses questions about the natural and material world. Scientists study the natural and material world.

Reach the student and parents.

If not successful reaching parent at least change culture of preparation through classroom over many years. Sustained education.
4. Financial Incentive Programs

Hawaii – 2006-2008 Loss Mitigation Grant Program – Retrofitted 490 homes

Existing Retrofit Programs
other States - FIX THE BRICKS Earthquake retrofit Salt Lake City. SOONER SAFE Oklahoma create safe rooms for tornado

Other
- Insurance Discounts for reduced risk
- Property Tax Credits for Safe Rooms
- Real Estate Marketing Incentives
Strategies To Reach Whole Community - Add

1. **Mandatory & Voluntary Training** - Videos of different length – top down strategy as well as bottom up

2. **Continuing Education Credits** – Broaden scope of professions receiving CEC for courses with preparation messages. Initial Targets – Insurance Agents & Realtors. Attorneys, Health Profession and other to follow.

3. **School Education & Community Outreach**
   a) Hazard Risk into K12 National Science Standards with teacher tool kits.
   b) Short video on hurricane/tsunami prep. with current training

4. **Financial Incentives** – tax credits, property tax credits, insurance discounts, retrofit grant programs

5. **Other Programs** – Working with Legislature and other partners. Natural Hazard Center!? Attempts to reach all members of the Community!
Other Important Resources

FEMA Building Science Library
https://www.fema.gov/building-science-publications

National Disaster Preparedness Training Center
https://ndptc.hawaii.edu/

Natural Hazards Center
https://hazards.colorado.edu/


UH Sea Grant – Homeowner’s Handbook – 4\textsuperscript{th} Ed.
https://seagrant.soest.hawaii.edu/homeowners-handbook-to-prepare-for-natural-hazards/
Thank You Everyone & Natural Hazards Center – Stay Safe and PROACTIVE! Hope to work with you in the Future!