

CONSTRUCTION GUIDE ON STRENGTHENING EXISTING HOUSES IN HAWAII AGAINST HURRICANES AND EARTHQUAKES

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Department of Defense
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INTRODUCTION

The purpose of this guide is to provide information on methods to upgrade and strengthen their existing homes against earthquakes and/or hurricanes. Although an attempt was made to simplify this guide, unless you have some familiarity with construction, you may find it difficult to understand.

The information presented in this booklet is based on a simplified version of a typical residence of less than 1500 square feet in Hawaii. It is likely that your home is more complicated than shown here and that certain parts of its structural framing may be concealed. Important regulatory, architectural, plumbing, or electrical issues also need to be considered. As a result, you may need to consult with a qualified professional (such as an architect or engineer) in order to adapt the techniques illustrated in this guide to your particular situation. For an idea of construction cost, a licensed contractor with home renovation experience should be consulted.

Actual construction should proceed after a set of construction drawings is produced based on your home's existing condition and site. You should not expect to be able to obtain a building permit based solely on the illustrated structural details presented in this guide.

Home Types Included

The types of homes considered in this guide are limited to homes of wood using construction methods and details felt to be common in Hawaii, and not necessarily characteristic of typical "mainland style" construction. You will find useful information in this guide if your home meets the following criteria:

- **Number of Stories** - limited to one and two story homes
- **Wall Type** - single or double wall construction
- **Size** - less than 1500 square feet under the roof
- **Shape** - rectangular floor plan
- **Foundation Types** - "tofu" block footings, concrete slab-on-grade and hollow tile (CMU) walls
- **Roof types** - hip and gable types with a maximum pitch of 4V:12H (4 vertical to 12 horizontal)
- **Roofing Materials** - pitch and gravel, asphalt shingles, wood shakes, sheet metal

Home Types Excluded

If your home is better described by the criteria below, this guide was not intended for your use. For help with your home, we recommend that you consult a licensed structural engineer. Also, this guide was not intended for new home construction.

- **Wall Type** - hollow block, metal stud
- **Special Designs** - split level, construction on a steep slope
- **Building Dimensions** - width exceeding 32 feet
- **Roof Overhangs** - roof overhangs exceed 3 feet
- **Roofing Materials** - monier tile, clay tile

A WORD ABOUT EARTHQUAKES

- **Cause & Effect** - During an earthquake, your home will tend to shake, tip, rock and try to slide off of its foundation.
- **Building Code** - The Uniform Building Code (UBC) first established seismic zones to differentiate seismic hazard. The higher the seismic zone, the higher the hazard. In Hawaii, earthquakes are related to volcanic activity and sea floor plate tectonic movement. Understandably, the Big Island is in the highest seismic zone while Kauai is in the lowest seismic zone.

A WORD ABOUT WIND

- **Cause & Effect** - During a hurricane, your home will also tend to shake, tip, rock and try to slide off of its foundation. In addition, high winds also cause strong uplift forces. These velocity-related forces are similar to the forces that generate lift on airplanes. These uplift forces will try to lift your roof off. It may even lift your whole house off of its foundation.
- **Load Path** - To keep your roof on your walls and your walls on your foundation, you will need to strap your roof to your walls and your walls to your foundation. This will form a continuous "load path" to resist uplift forces.

HOW TO USE THIS GUIDE

In Choosing the Upgrade - Consider the following:

- *In Hawaii, hurricanes have caused much more damage to homes than earthquakes. Even though Kauai suffered the most damage from Hurricanes Iwa and Iniki, all of the islands are equally susceptible to hurricanes. Consider upgrading your home for wind although it will cost more than a seismic upgrade.*
- *If you upgrade your home for wind, your home will comply with the requirements of the earthquake upgrade for Zone 4. Thus if you upgrade for wind, you “kill two birds with one stone.”*
- *If you live on the Big Island, you should definitely consider at least upgrading your home to Zone 4. However, the seismic upgrade shown does not provide a complete load resistance for wind forces.*
- *If for financial or other reasons, you choose a seismic upgrade instead of a wind upgrade, it is possible to do the wind upgrade at a later date since many of the wind upgrade details are similar to the seismic upgrade details. However, it will involve less effort and be less costly if you can afford to do the wind upgrade initially.*

About the Drawings

- *There are many details in this guide. Depending on the type of your home construction, some will apply and some will not apply. The details are grouped in like sections; i.e. foundation details are grouped in one section and roof to wall connections are grouped in another section.*
- *At the beginning of each section is a list of items to be upgraded, an upgrade procedure, a visual key to upgrades and a list of drawings for that section. These should help you sort through the drawings and decide what you need to do.*
- *On a given sheet, the existing conditions are usually shown on the top or left. (The upgraded condition is usually shown on the bottom or right.)*
- *If you are confused about a particular detail, you may find it helpful to read the Sheet title and Comments at the bottom of the sheet.*

CAUTION

- *While some of the details included herein will not affect the general appearance of your home, other details will not only change its appearance but also will change its size and affect other areas as well.*
- *For example, if you have a single wall home and add wood studs to the inside of your existing walls, affected rooms will become smaller and some things that used to fit may no longer fit.*
- *On the other hand if you add studs to the outside of your existing walls, some exterior stairs may become narrower, some windows may need to*

be re-installed to the new exterior face and some portions of the structure may extend into required setback areas (which is not permitted).

- *The consequences of your decision to upgrade and how you plan to solve them should be carefully considered before starting.*

WARNINGS AND DISCLAIMER

The Construction Guide on Strengthening Existing Houses in Hawaii Against Hurricanes and Earthquakes makes no warranty of any kind, express or implied, Users of the Guide assume all risk and liability in connection with use of the Guide whether used singly or in combination with other information.

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REFERENCES

Department of Commerce and Consumer Affairs, State of Hawaii, "Consumers, Contractors and Contracts".

Department of Commerce and Consumer Affairs, State of Hawaii, "Acting as an Owner-Builder"