TRAINING OUTLINE FOR BUILDERS, UPGRADING TRAINING

This is a refresher course for builders to make sure that they are up to date with the techniques and requirements necessary to make the buildings that they work on disaster resistant. It could be a requirement that a builder have attended the course for employment in repair, new build and retrofitting work. If run regularly, say once or twice a year, all existing and new builders would be able to attend over time, providing a consistency in building standards.

1. Introduction to disasters:

A disaster on any scale occurs when events overwhelm our ability to cope. This applies for a personal, community or national disaster. Natural hazards such as hurricanes or earthquakes are often national disasters for islands of the Caribbean, as they affect everyone. Unlike the case of large countries, there may be no unaffected community that can render assistance. For this reason, regional organisations are important (such as CDERA), and so are mitigation measures. The existing builders, tradesmen and contractors have a responsibility to ensure that rebuilt houses are able to withstand the next hazard with a much lower likelihood of damage. To do this requires a constant state of awareness of hazards and their potential effects on the structures that are built or repaired.

The trainee should be addressed by the building and housing officials as well as the national disaster organisation, so that the importance of good practice is reinforced and sources of backup advice are available.

2. What hazards do we face?

The most common hazard that does the most damage in our region is Hurricanes. These bring not only high winds, but add high rainfall, causing flooding, landslides and mudslides, storm surge and storm waves. A mitigation plan that deals with the threat of hurricanes must deal with their many different effects.

For the housing sector, additional threats of fires and earthquakes are to some extent taken care of if preparations are made for hurricanes, as masonry walls would already have reinforcement to withstand wind pressure, and nearby trees would be controlled to prevent damage.

3. What are safe building practices?

Good building work is a compromise between cost, utility and resistance to damage.
Safe building practices are based on experience, ie. what gets damaged during a storm (or earthquake etc). Building codes generally do not specify good practice, but simply a level of resistance to forces to be attained based on the best known data. The shape and design of a building affects the forces imposed upon it, while the materials and strength of the connections determines the resistance to those forces. Good building practice in a country is a combination of shape and design, materials and connections that can resist extreme events in a culturally acceptable way

4 Repairing roofs

The underlying assumption here is that repairs to damage from hazards such as hurricanes, which are likely to return, should be resistant to damage a second time around.

Roofing repairs should start with an assessment of the damage. This needs to both assess the overall situation, such as whether the damage warrants demolition, or whether the roof is still the proper shape. The connections between each element from galvanize sheet to foundation are like the links in a chain, any one of which may fail. The assessment needs to decide down to which connection in the chain the roof should be dismantled in order to start rebuilding. When exposing elements of the roof, it is wise to bring all connections up to standard, as the roof or rafters may not have blown off because the sheeting came off first. If the sheeting is properly fixed, the same rafters may then be the weakest connection and fail next time.

Builders and contractors should have the competence to deal with the assessment of small structures and housing of traditional technology (known often as “non-engineered structures”.

5 Retrofitting roofs

“Retrofitting” usually means in this use “going back to strengthen”, but is also now taken to mean to “bring up to a standard”, or to include the maintenance and replacement that should have been done. This is a “standard” of resistance to, say, hurricanes.

Too often it is not possible, because of technical or financial reasons, to bring a building up to the desired level of strength. A judgement must be made as

to what detail or connection poses the highest risk, and an attempt made to address this area (to strengthen the weakest link in the chain).

Safer building practices address these areas of damage – strengthening the connections that carry the load from the sheeting (mainly an uplift load) down to the ground. When these standards are applied to an existing roof, it is termed “retrofitting”

Technical areas

A Overview of issues

Builders and contractors often have to provide the following services, and should be aware of the need, even if only to know when to request assistance from an engineer or other expert.

1) Siting assessment

The question of whether to rebuild a badly damaged house in the same place must be addressed, and whether there are activities that can reduce the vulnerability from particular hazards.

2) Demolition assessment

A decision on whether to repair or demolish a building must be made by a competent person. If the building is out of shape, or the foundations have failed, this may be the quickest and least costly solution.

3) Damage assessment

Deciding what to repair requires some level of dismantling of the structure, to determine what “layer” it is necessary to rebuild from. Determining what started the chain of events that resulted in the damage visible often requires some investigation but can be useful in order to prevent future repetition.

4) Re-roofing/redesign decision

The client as well as a technical person must decide on whether to put back what was there before or whether to change the shape or design in order to provide more resistance to damage.

B Pitch/overhang adjustment, choice of materials

For small buildings the builder would often have to decide on details such as overhang, and sometimes the pitch of the roof. The builder should be able to determine that the materials to be used are appropriate. A materials and connectors standards list is included in this outline.

C Load path analysis

The training should explain the use of the load path analysis to check that the forces can be transmitted through the connections between building elements. This is a way of checking structures to ensure their resistance to hazards.

D Details

The following list of areas should be discussed with the builders, with visual materials and where possible, examples of the connections and materials themselves. Use of photographs and video showing both structures that have failed and that have survived would illustrate the issues.

<u>Roofing connectors, spacings, type and length</u>

These connections are:
1. Ridge capping
2. Galvanized sheeting fixings
3. Other roof coverings
4. Sarking fixings
5. Purlin/lath fixings
6. Rafter fixings
7. Wall plate fixings
8. Wall to foundations

And in addition,
9. Collar ties (rafter to rafter)
10. Window shutters and hinges
11. Bracing timber walls
12. Foundations and Posts

F Standards for materials and connectors

The trainee should be familiar with the following specifications and understand the reasons for their existence and use.

- Overhangs are less than 18” at eaves and gables unless special provision is made. Preferable overhang 12” (300 mm) or less.

- Roof pitch at least 22 degrees (or 1 in 4), preferably over 30 degrees

- Roof is hip shaped, preferable to gable

- All timber used in roofing will be pressure treated lumber or otherwise treated against termite attack

- Wall plate, minimum 4” x 3” (100x75 mm) to be held down by ½ “ (12 mm) bolts spaced at least at 4ft (1200 mm) , preferable 3ft (900 mm), centres or other approved method

- Rafters will be secured by twisted metal hurricane straps or galvanized hurricane clips, one per rafter, or other approved method.

- Rafters will be at maximum spacing 2ft 6inch (750 mm), preferably 2ft. (600 mm)

- Every second pair of rafters will be connected against separation by collar ties or approved straps at the ridge

- Purlins (Laths) will be minimum section 1 x 4 inch (25 x 100 mm) set at maximum spacing 2ft 6inch (750 mm) and secured with two nails at each rafter intersection. Alternately, 2x3 inch (50 x 75 mm) minimum purlins fixed with one screw per rafter may be used.

- Steel based sheeting to be at least 26 gauge thickness (preferably 24 gauge.) Aluminum based sheeting to be at least 22 gauge thickness

- Sheeting is fixed at every corrugation at gables, every second corrugation at eaves and ridge, (preferably every corrugation), and every third in the center of the roof.

- Sheets are fixed with dome headed sheeting nails using timber fillets as spacers, drive screws with washers or with bolts and washers are preferable