Text Box 1

Important Actions, Questions and Constraints to Consider on Standards and Vulnerability

Actions

- *Reach agreement on standards through public review and consensus*
- *Balance objectives for standards with objectives for affordable housing*
- *Ensure resources exist for managing regulatory procedures, including enforcement*
- *Use risk analysis to inform standards*

Public Agencies and Corporations

- *Who regulates standards for agencies responsible for telecommunications, water, electricity, roads?*
- *If they are self regulated, transparency, public knowledge of and support for standards important*
- *Self regulation can create conflict of interest that could be counterproductive*

Constraints To Implementing Standards

- *Affordability (cost is a factor particularly for low income groups)*
- *Enforcement due to levels of resource requirement and administrative capacity*

a) Reducing Vulnerability of Buildings to Hurricane

Factors influencing re-insurance and insurance rates since Hurricane Andrew in 1992, include:

1. Availability and capacity from re-insurers
2. Severity & frequency of natural hazards
3. Building Standards (existence of codes)
4. Vulnerability of properties

(Source: United Insurance Company)

Since insurance companies can do little to effect # 1 and # 2 is out of their control the strategy they pursue has two components:

- Lobbying of governments to mandate and enforce building codes
- Provision of rebates on premiums for hurricane-resistant measures used on *roofs, windows and external* doors. These are considered the most vulnerable parts of buildings to hurricanes

While the emphasis so far has been on hurricane damage, the application of similar policies to floods is also widespread and more attention to earthquakes and other hazards can be expected in the future.

It is now widely accepted that under high wind loads wooden buildings using light-gauge metal straps to connect adjacent components (e.g, roof to external wall, walls to foundation) often outperform buildings using nails and wood connectors.

Evidence from recent hurricanes indicates that the most vulnerable parts of a building to wind damage are the roof, windows and external doors. Mitigation therefore requires attention to details in these areas. United Insurance Company Limited (UICL) which covers a large number of properties in the region provides a Homeowners Hurricane-Resistant Safeguard Guide which can be used by its policy holders to obtain reduction on premiums up to 25 per cent for new and old buildings. Mitigation planners should become familiar with codes and standards enforced by relevant authorities and with the hurricane resistant standards used by insurance companies.

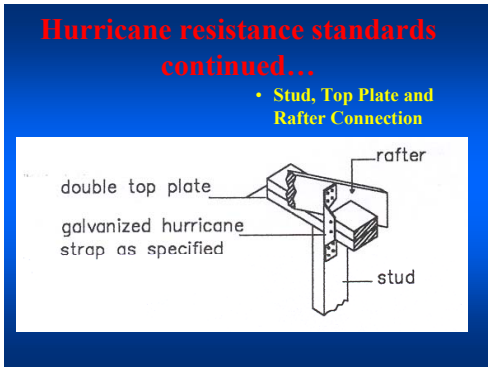

Figure 24: Hurricane resistance standards (a)

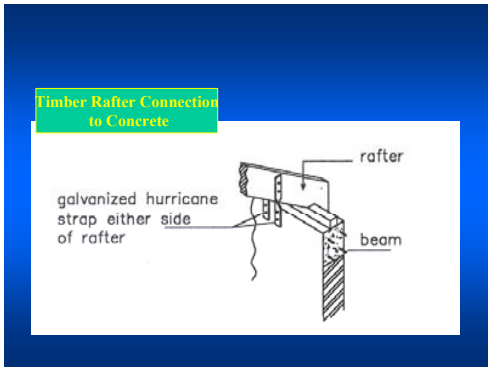

Figure 25 Hurricane resistance standards (b)

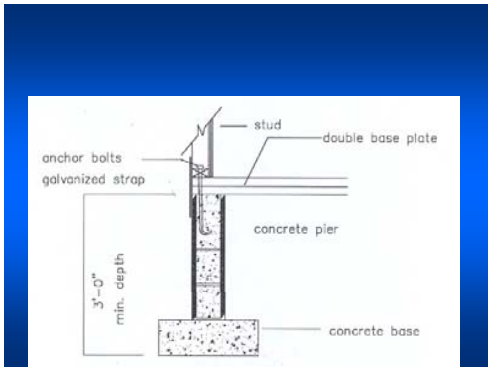

Figure 26 Hurricane resistance foundation/exterior wall connection (c)

In the case of UICL the vulnerability of properties of its policy holders to the effects hurricanes is evaluated using a checklist that includes the following categories:

- External sides
- Roofs
- Windows
- Doors
- Other apertures
- Solar Water Heaters and Air Conditioners
- Roof shapes

Text Box 2

Building Insurance Issues

In addition to meeting the standards set by insurance companies, it is important to understand how insurance policies affect insurance costs:

1. For example, cost is determined in part by "Perils":

   - Coverage plans are often based on different rates assigned to different perils (fire, riot, strike, flood, explosion, aircraft damage, hurricanes, earthquakes, seawave).
   - Rates for hurricane coverage are significantly higher than for most other perils and can increase the overall premium for property insurance by 8 per cent or more for risk areas.

2. The determination of Risk Zones in adjusting insurance rates is quite arbitrary and done for the most part without reference to hazard maps. It is therefore important to find out who makes this determination:

   - Insurance Companies?
   - Planning and Regulatory Authorities? and
   - If regulation covering risk penalties is needed.

3. It is also useful to find answers to the following questions:

   - Do standards used by insurance companies complement national building codes or standards of Planning Authorities. If not, are their implications that must be addressed?
   - What is the level of Public knowledge/awareness of risk areas?
   - Will higher costs of insurance in risk zones influence land values and decisions to purchase or build property?
   - What are the implications for land use and regulation of development in risk areas?

Design and Retrofitting Considerations

Generally, in the design and/or retrofitting of properties, planners, architects, engineers and contractors must be mindful that wind causes sliding, overturning and uplift of structures. Uplift forces cause the most damage during hurricanes and the evidence can be seen from damage to roofs and external walls. Thus the basic concept of protecting a building from high winds associated with hurricanes is to secure roofs and windows and ensure the level structural integrity that mitigates against lateral and uplift forces.

Experiences in the region indicate that the components of a building that should be upgraded to improve resistance to hurricanes include:

- Connection of wooden studs to rafters and top plate or rafter to top plate
- Steel truss and rafter connection to concrete
- Wood rafter connection to concrete beam
- Installment of shutters (fixed or removable; wood or metal)
- Connection of foundation to bottom plate and studs

Retrofitting benefits holders and non-holders of insurance policies; the latter being usually the most critical where the insurance of property and household belongings is unaffordable. Persons operating under severe budget constraints could initially target lower cost hurricane resistant measures. The relative cost of reducing the vulnerability of a 1 bedroom wooden structure to hurricanes is provided in Text Box 3.

Text Box 3:

Cost of Improving Hurricane Resistance of 1 Bedroom 600 sq. ft. Structure, Antigua

• *Connection of roof to external walls: 60 hurricane straps @ EC$3.50 = $210* • *Installation of window shutters* - *5 windows 30"x36" @EC$200 = $1000* - *2 doors 36"x 80" @ EC$350 = $700* • *Connection of external walls to foundation (6 points for connection of bottom plate to footing, 6 anchor bolts @ EC$25, plus labour of EC$600) = $750*	***EC$ 2660 (US$ 992)***

b) Reducing Vulnerability to Floods and Mudslides

Ideally flood prevention should be achieved by siting buildings and installations away from flood prone areas and source of water. Retrofitting to mitigate flood effects on existing structures requires flood-proofing to reduce the number of times a building and its contents are flooded and damaged as a result. Three approaches can be considered in flood-proofing, namely:

- Raising or moving the building
- Construction of flood walls or levees to stop flood waters from entering the building
- Modifications and relocation of contents

Note that compliance with land development building regulations in building design and siting is not always sufficient to ensure that a structure would not be adversely affected. Additional measures informed by local experience may be required in raising the land development or building standards to reduce vulnerability of the property to floods.

Cost Implications

- Mitigation costs could range from those for installing hurricane clips and shutters to raising the level (above AMSL) of a standby generator to relocating houses from a high risk zone.

- Conditions and the level of effort required will determine costs:

  - *For Hurricane clips & shutters*: cost would involve material (including transportation) and labour
  - *For relocating a generator*: cost of material, transportation, technical fees, labour
  - *For relocating houses*: cost of land, replacement (fees, construction), inconveniences

- Audit costs (for vulnerability assessment) involves professional fees & expenses plus retrofitting actions.

- EIA costs (for vulnerability prediction and mitigation) would involve professional fees and expenses plus mitigation, that is, reducing impacts from proposed activities or finding suitable alternatives.

- Cost recovery (pay-back time) analysis can be build into Audits, EIAs or any other procedure used for vulnerability assessment and reduction (mitigation)

- At times impact mitigating alternatives to proposed actions are less costly and pay- back time for recovery of costs may justify mitigation expenditure.

Self Assessment- Planning for Vulnerability Reduction

At this point you should be able to:

- Identify planning functions critical to the reduction of vulnerability
- Appreciate the need for collaboration among key agencies in reducing damages to essential services from natural disasters
- Understand the importance of using EIAs (for new projects) and Environmental Audits (for existing facilities and uses) as procedures to mitigate against future damage from natural disasters

Recognize the importance of complying with building codes and hurricane resistance measures in reducing the vulnerability of buildings to natural disasters

Annex 1
Vulnerability Reduction Exercise

❖ Aim of Exercise

Participants are expected to gain an understanding of the vulnerability of an essential service. Two factors to consider are:

a) The risk associated with buildings, installations, equipment or supplies to natural hazard due to location;
b) Vulnerability due to deficiencies in building codes, standards or practice.

❖ Definitions

Essential Services (see Glossary)

These include:

- Health facilities, e.g., hospitals, clinics, pharmacies;
- Utility plants e.g., water production or treatment facilities, electrical generating plant/facility, sewage treatment plant;
- Education, e.g., schools, day care centers
- Security, e.g, prisons;
- Data repositories (e.g, cadastral data, court records, financial records)
- Communications (e.g, telephone exchanges, transmitters)

❖ **Specific Tasks**

Your specific tasks are to:

1. Select an essential service (ensure it fits definition of essential service)
2. Identify hazard risk based on location
3. Identify vulnerability based on design and/or construction
4. Select 2-3 mitigation actions to reduce vulnerability and explain the mitigation objective in relation to direct or indirect costs.

❖ **Normal Data/information Requirements**

- Understanding of vulnerability indicators (see tables on hazard risk and vulnerability indicators);
- Local knowledge about hazard risk or hazard mapped data
- Knowledge of building standards or codes, or acceptable building practices
- As-built construction information
- Land and construction costs
- Demographic and socio-economic data on the essential service (e.g, # persons served, cost or value of service)

(For the exercise, availability of demographic and cost data would be useful but not essential. Use assumptions were necessary)!!

Table 57
Selected Hazard Risk Indicators

Hazard Risk Indicator	Potential Hazard
❑ Location to HWM <1/4 mile	Storm surge
❑ Elevation in relation to MSL <6m (depending on event)	Storm surge, flooding
❑ Location to river or stream bank <10m	Flooding, erosion
❑ Location to volcano <20 miles	Dust, pyroclastic flows
❑ Location in flood plain	
❑ Frequent flooding (> 2 times /year)	Floods
❑ Frequency of landslides (>1time/5 years)	Rain, earthquakes
❑ Location to cliff <30m	
❑ Location on poorly drained reclaimed land	

Table 58
Selected Physical Vulnerability Indicators

Vulnerability Indicators (Physical)	Potential hazard
Sanitation/Living Conditions	
❑ Absence of municipal sewage lines	Flood, wind
❑ Outdoor toilets	Flood, wind
Construction & Engineering	
❑ Roof pitch <20 °	Wind
❑ Roof Bracing (no hurricane clips)	Wind
❑ Glass doors without wooden or metal shutters	Wind
❑ Glass windows without wooden or metal shutters	Wind
❑	
❑ Building not bolted to foundation (wood structure)	Earthquake, wind
❑ Inadequate steel reinforcement (concrete structure)	Earthquake, wind
❑ Floor below grade	