

Why Hospitals Fail and what to do about it (with emphasis on meteorological hazards)

Tony Gibbs

CEP International Ltd

Consultant to, and supported by, PAHO

A Member of the Global Alliance for Disaster Reduction

The Client's Role

*"If you do not take trouble
at the beginning, you will
most certainly be given it
before the end."*

Sir Hugh Casson

What is often lacking is a clear
articulation of:

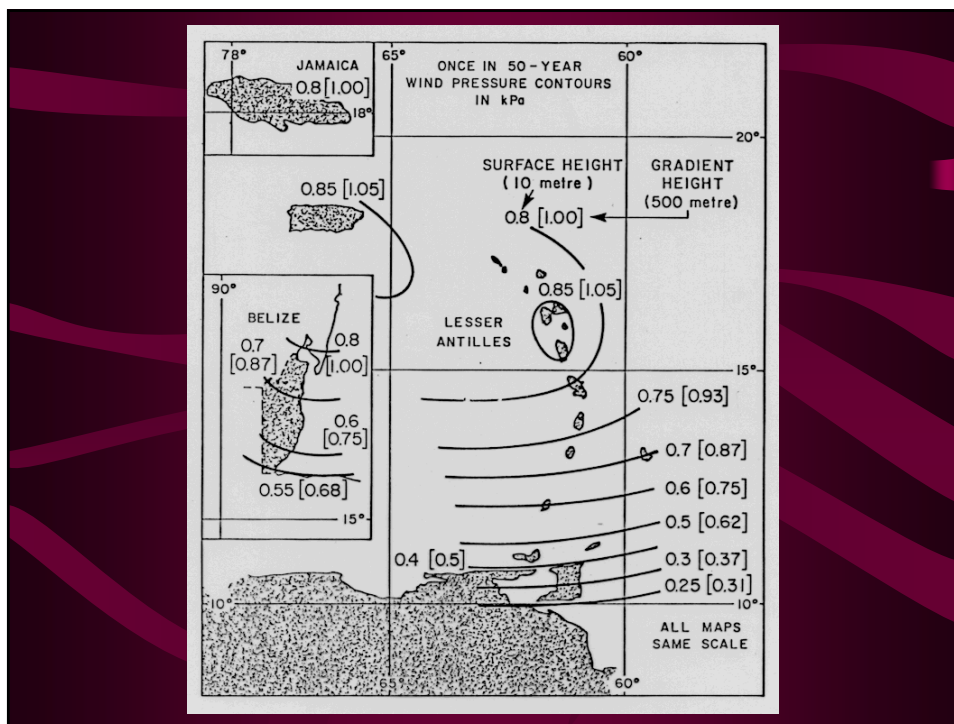
- o standards;*
- o performance criteria;*
- o performance expectations;*

by the ministry of health's representative
to consultants and suppliers.

In the best of circumstances there would be:

- o **legally-mandated codes (laws and regulations);**
- o **defined technical standards;**
- o **effective enforcement of standards.**

*Standards
and
Criteria*



Neutral Wind Pressure

adjusted for:

topography

height above ground

ground roughness

size of relevant structure

required level of safety

=

Design Wind Pressure

Importance Factor

The client, in consultation with the design team, must make conscious decisions with respect to desired levels of safety for different facilities.

These decisions are translated into importance factors in codes and standards.



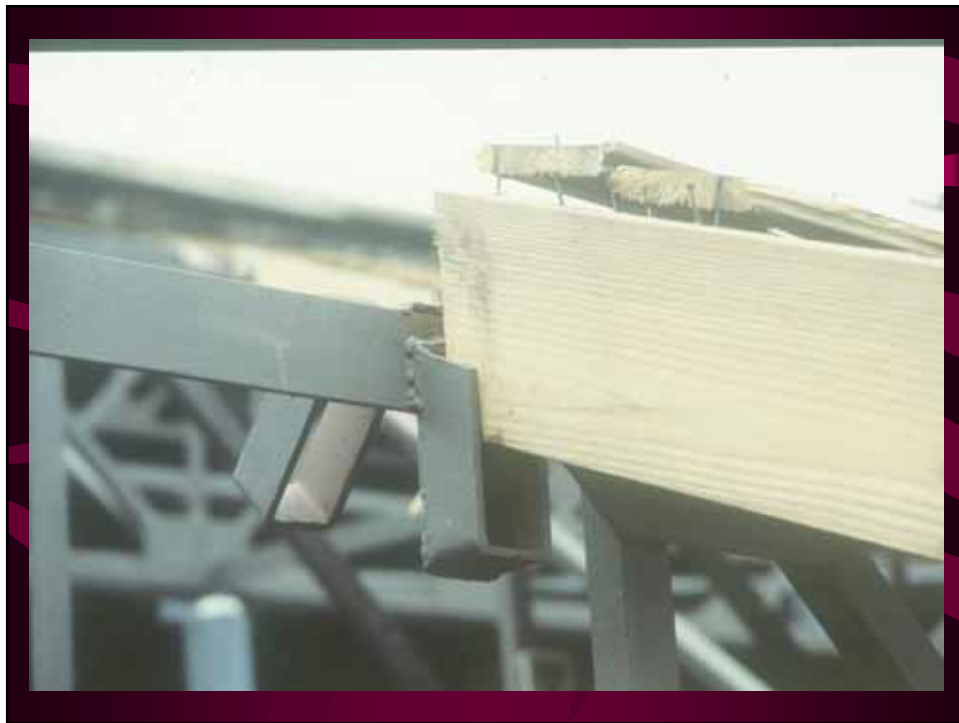
Wind Damage

(not damages)











Roof deck removed



Structure lost in spite of clips



Paediatric ward

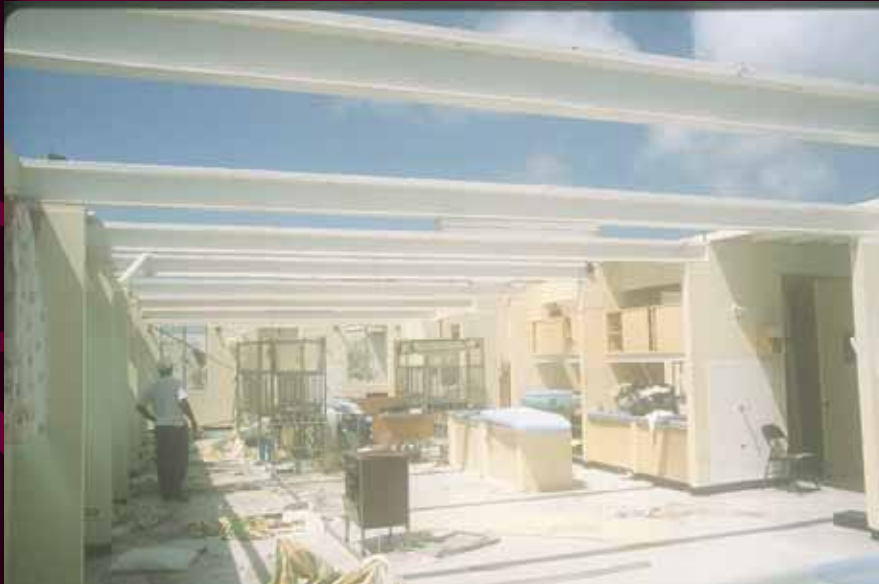




Photo: David Taylor (PAHO)





New Hospitals

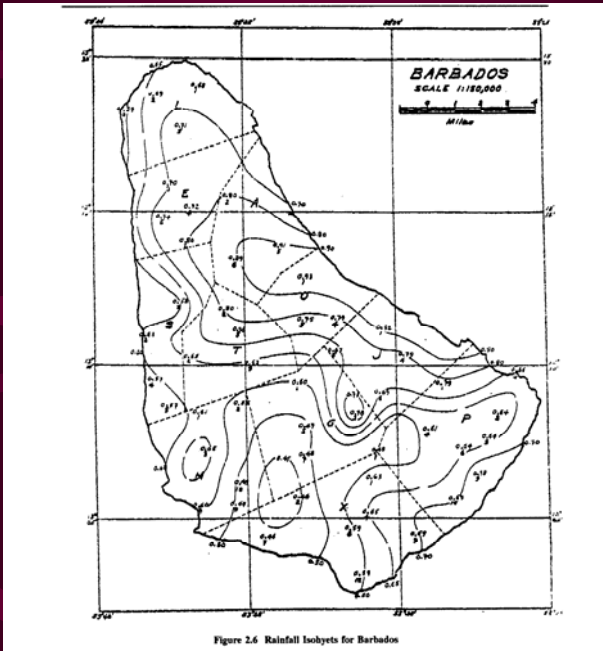


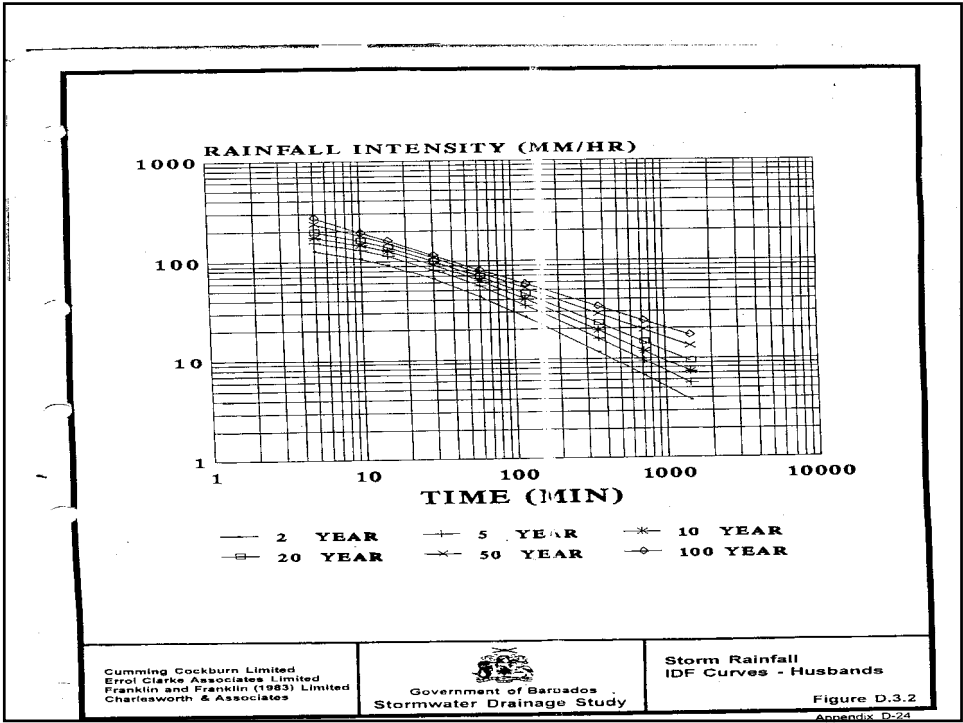


“On account of the fact that there is no glory in the *foundations*, and that the sources of success or failure are hidden deep in the ground, building *foundations* have always been treated as stepchildren; and their acts of revenge for lack of attention can be very embarrassing.”

Prof Karl Terzaghi (birthday 02 October)

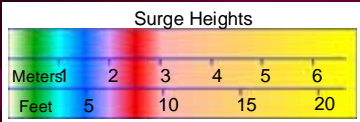
Torrential Rain



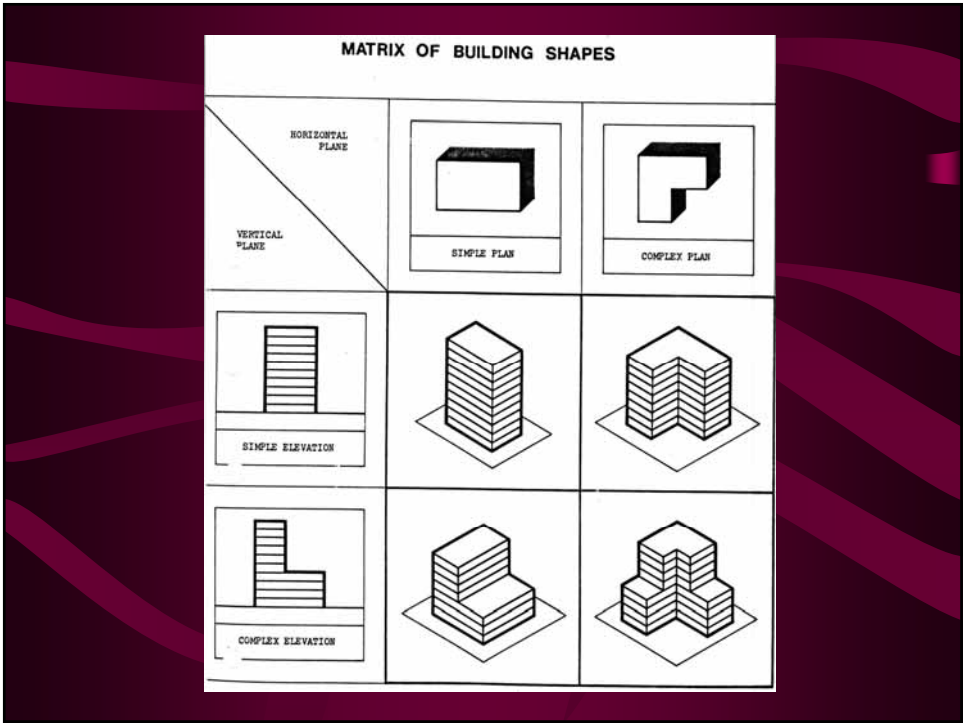


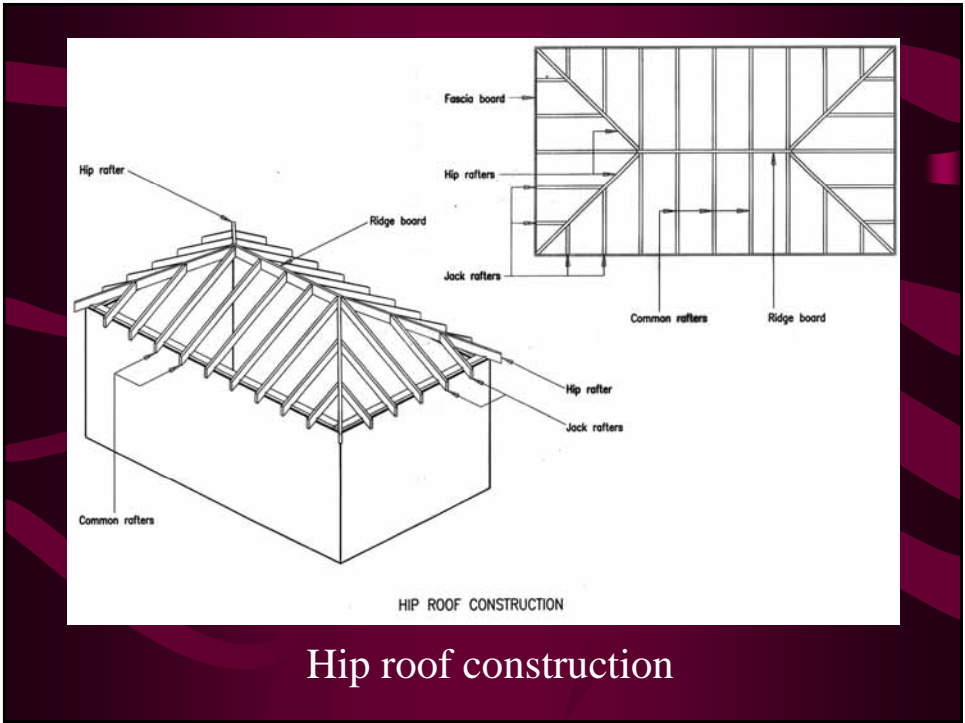
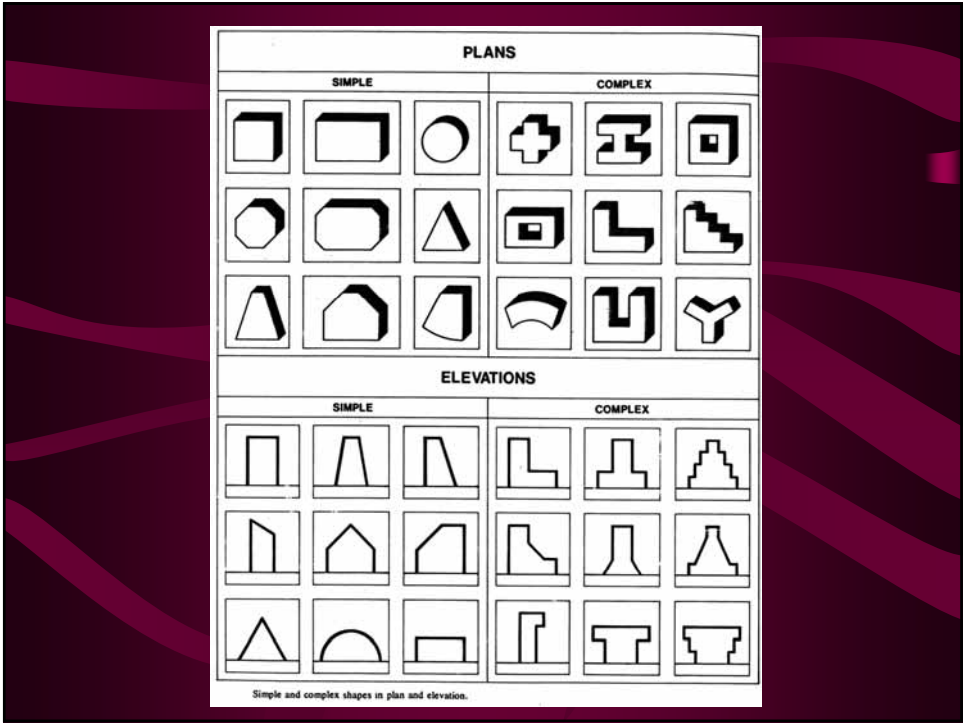
Belize Surge Heights (USAID-OAS CDMP)

The many low Cays of Belize are quite vulnerable to waves and surge, and the low coast of the northern half of the country is easily flooded.



Concept
and
Configuration

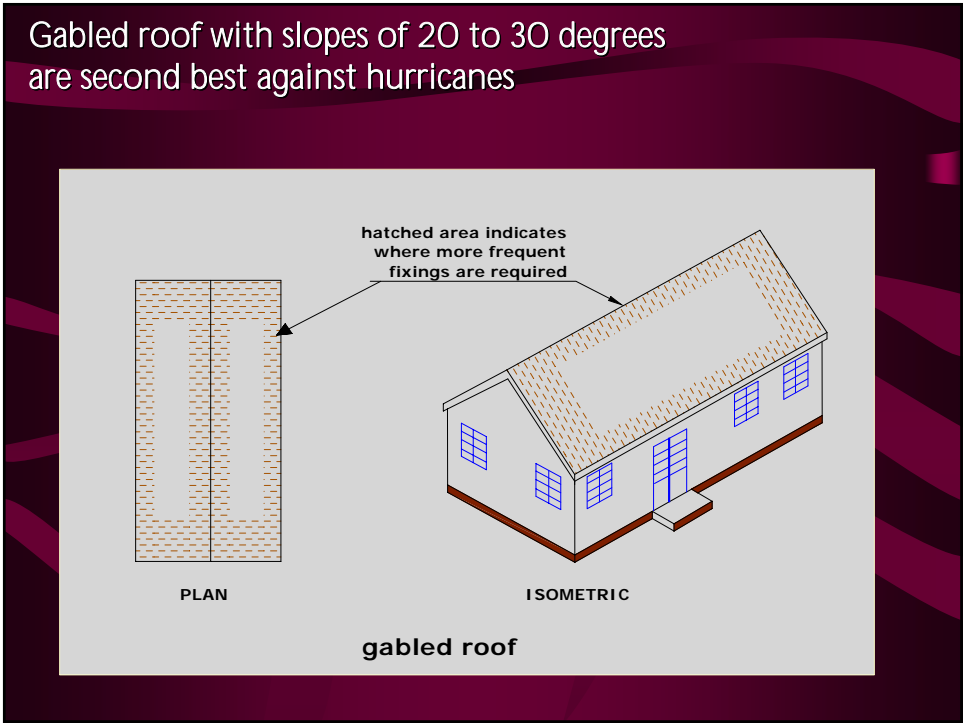
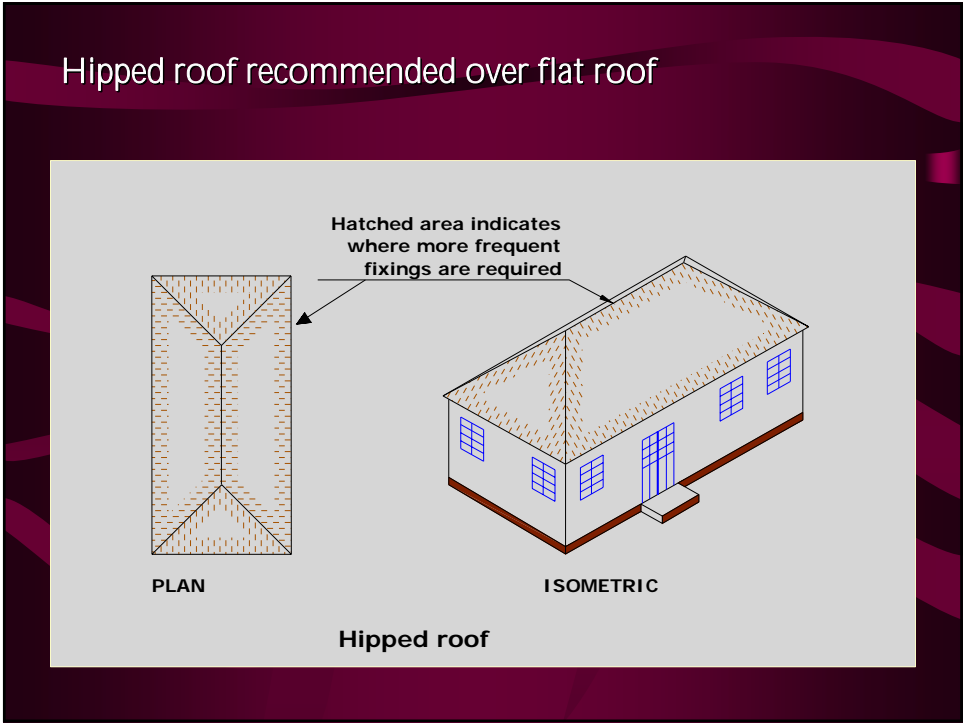




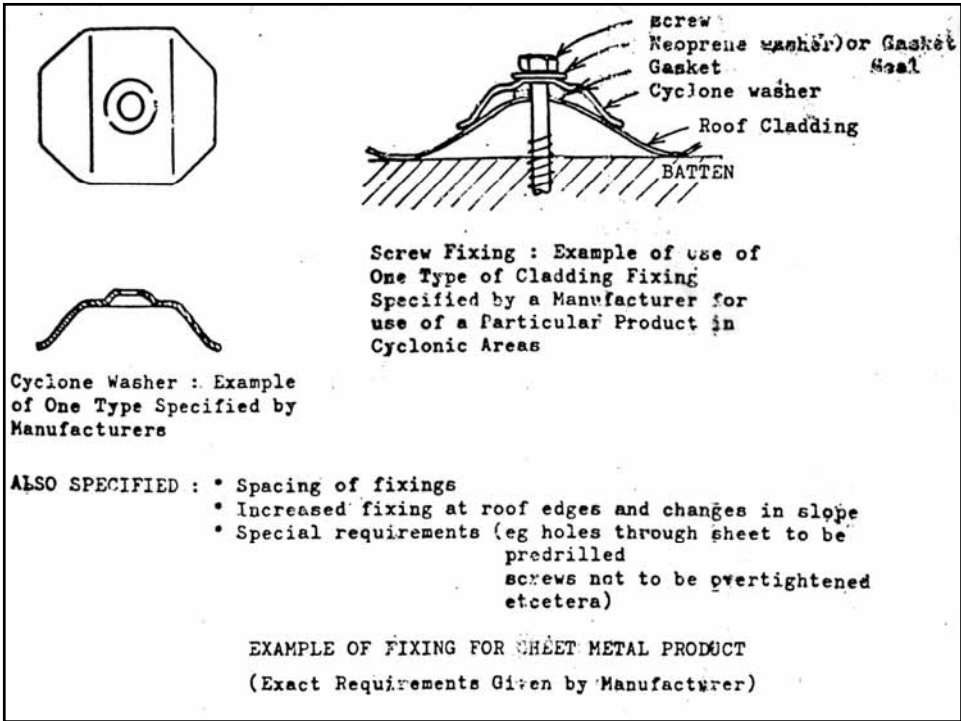
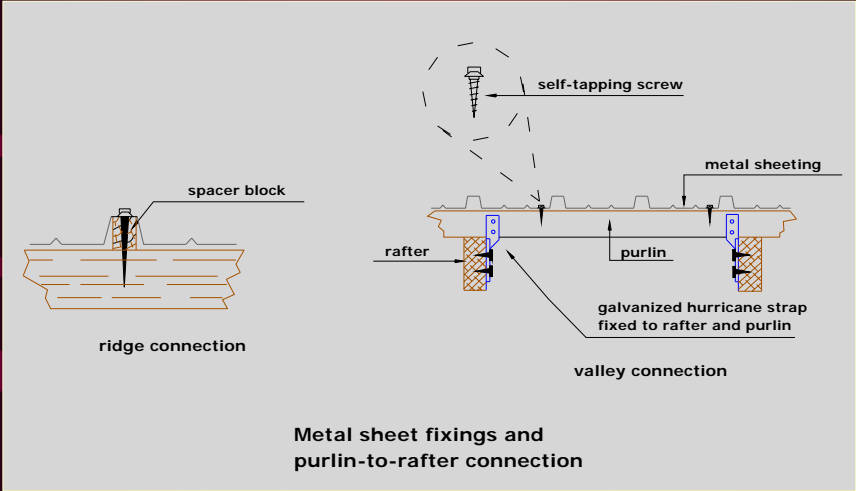
Roof framing completed



*God
is in the details*

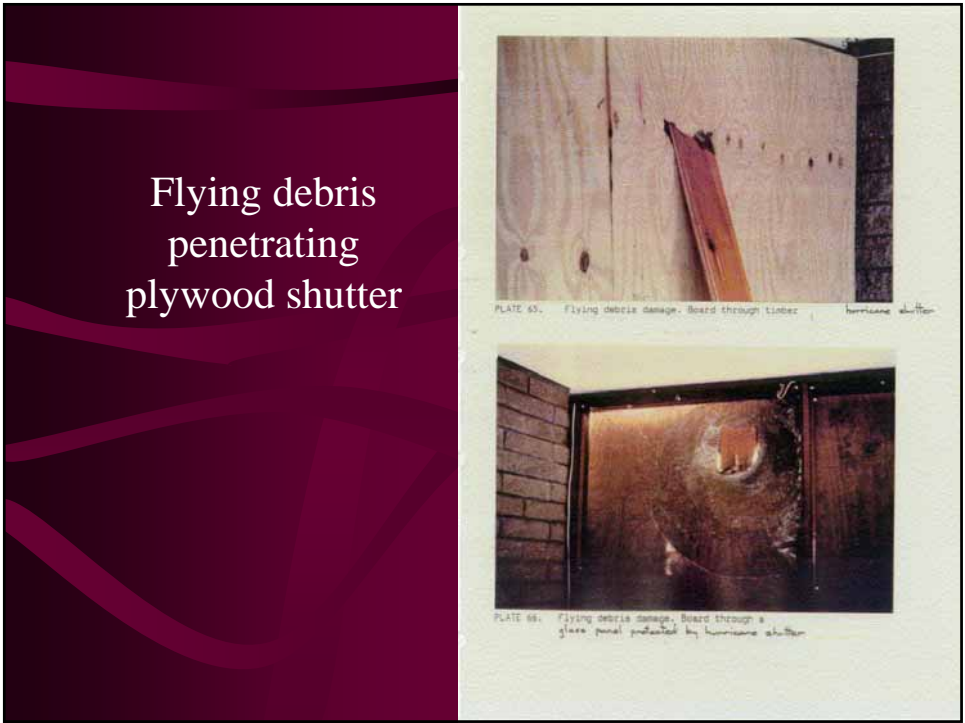
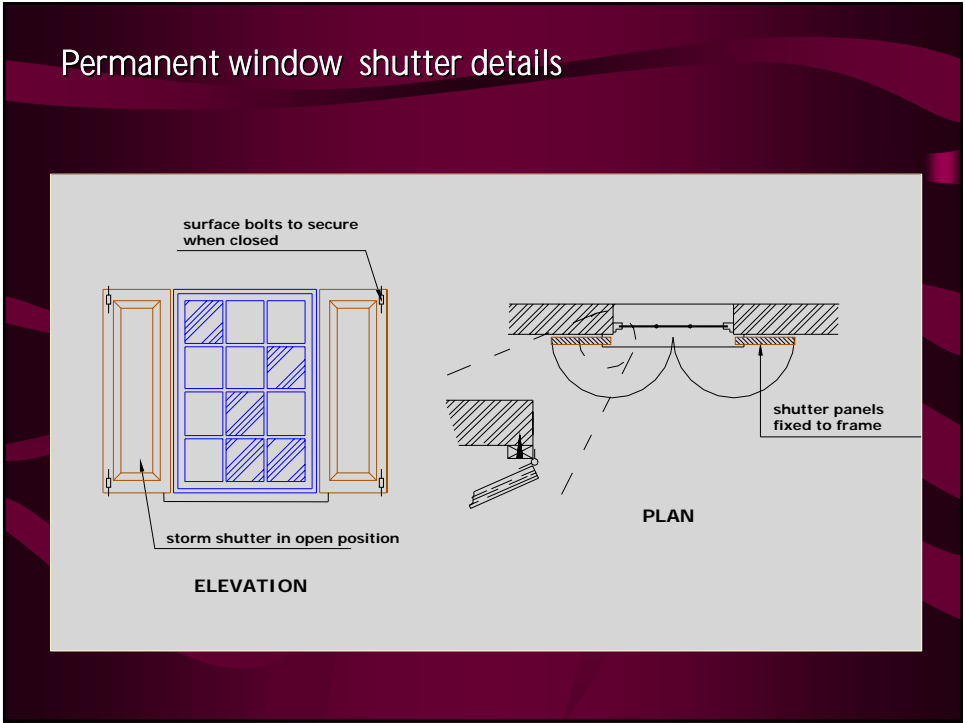


Connection details between metal sheet roof and purlins

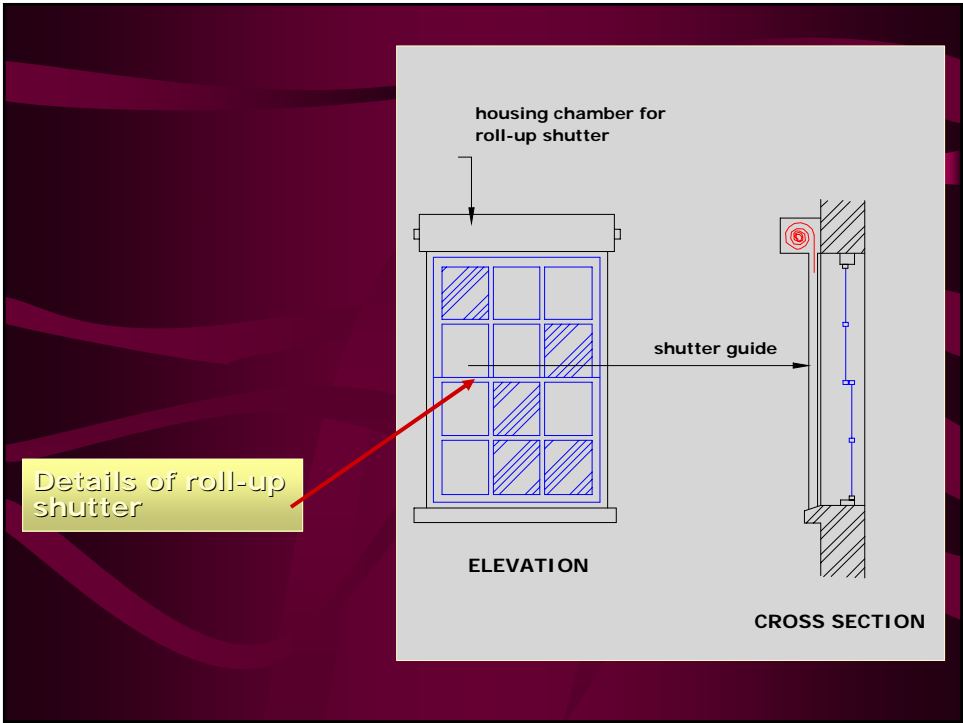


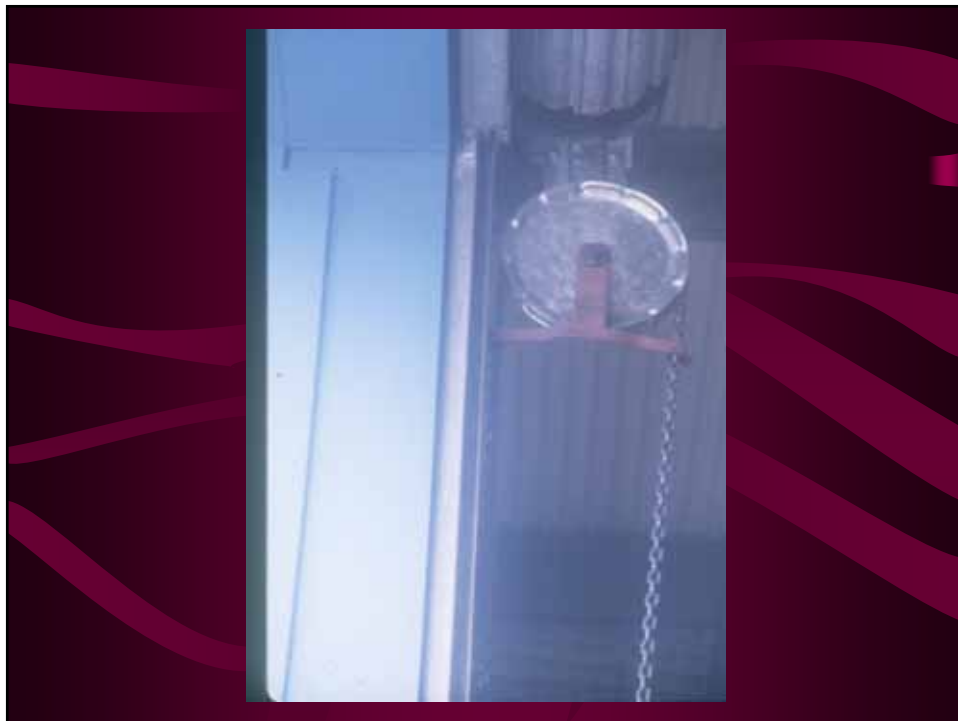
Non-Structural Components





Impact-resistant windows





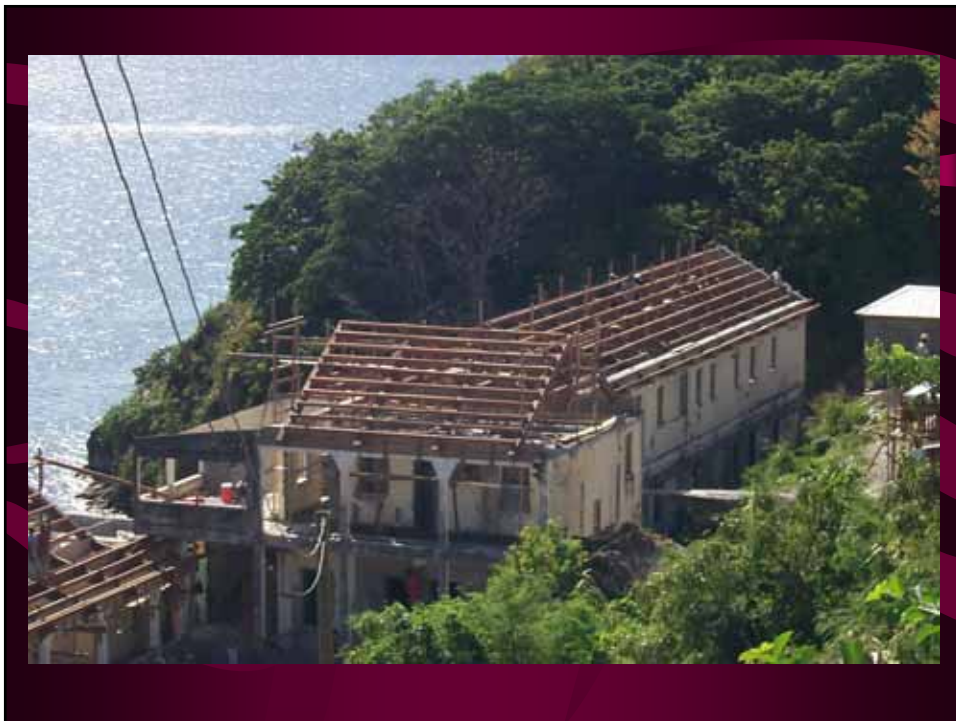


Waterproof membrane removed



Location
Location
Location







To err is human
(To engineer is human)

Peter Rice's book: The Engineer Imagines

"Others not so closely involved must also be asked to review the project, to question the assumptions and demand explanations.

The presence of a competent, dedicated and sceptical checking authority is also very important in this respect." - page 123

Roles of the Review Consultant:

- 1 To assist a design consultant in achieving a better and more reliable project by providing independent assessments of the work
- 2 To reduce the incidence of errors or of unsatisfactory designs and construction
- 3 To identify sub-standard work (vital for the fundamental well being of the project, for the protection of the client and for providing security for the funding agency and insurance underwriter)
- 4 To assist in the development of the construction industry

PERCENTAGE INCREASE* IN CONSTRUCTION COST FOR MODEL DWELLINGS INCORPORATING SEISMIC OR WIND DESIGN RECOMMENDATIONS **											
SEISMIC OR WIND LOADING	DWELLING BY MODEL DESIGNATION										
	'A'	'A' 1.5 x O. T.	'A-1' Sliding door	'A-1' Window	'B'	'B-1'	'C'	'C-1'	'C-2'	'E'	'F'
Zone 3	0.3		0.37	0.37	0.42	0.45	0.81	0.74	0.74	0.48	1.4
	0.24		0.29	0.29	0.33	0.35	0.63	0.58	0.58	0.38	1.1
Zone 2	0.28		0.36	0.36	0.29	0.29	0.31	0.28	0.27	0.48	0.24
	0.22		0.28	0.28	0.23	0.23	0.24	0.22	0.21	0.38	0.16
15 psf wind	0.31	0.57	0.41	0.39	0.44	0.61	1.3	1.2	1.2	0.48	0.24
	0.25	0.45	0.32	0.31	0.34	0.47	0.98	0.90	0.95	0.38	0.19
25 psf wind	0.59	1.1	0.60	0.59	0.92	1.0				0.48	0.71
	0.46	0.85	0.47	0.46	0.72	0.79				0.38	0.55
40 psf wind	2.00	2.2	1.6	1.4	2.2	1.9				1.3	1.9
	1.57	1.7	1.2	1.1	1.7	1.5				1.0	1.5

* Estimated upper and lower bounds given

**Design recommendations as given in the report titled "A Methodology for Seismic Design and Construction of Single-Family Dwellings".

“It is unwise to pay too much, but worse to pay too little.

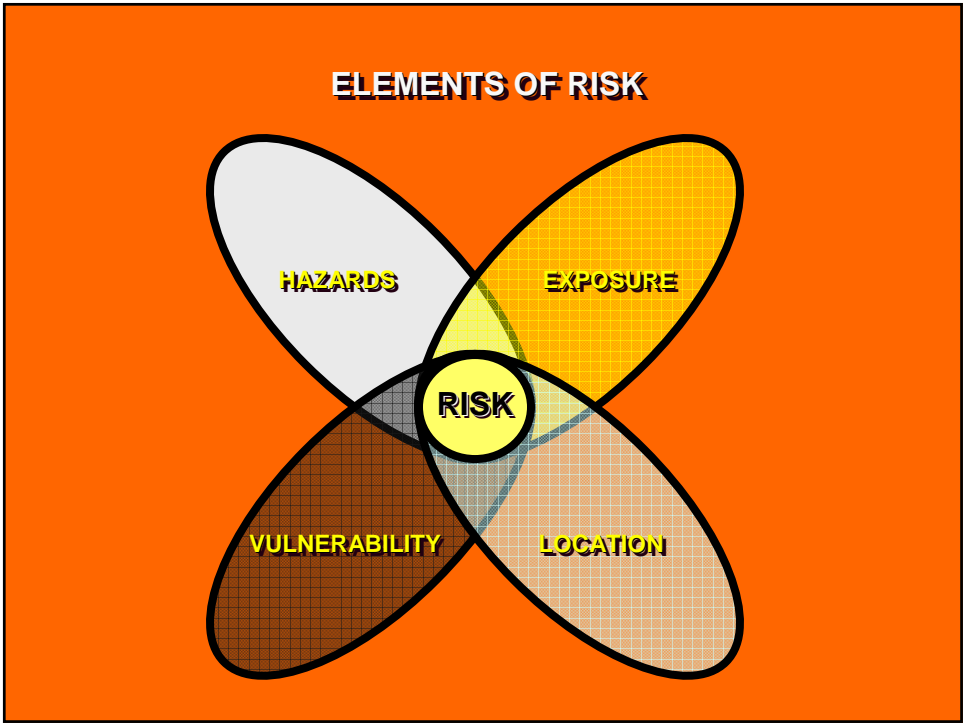
“When you pay too much, you lose a little money, that is all.
When you pay too little, you sometimes lose everything,
.....

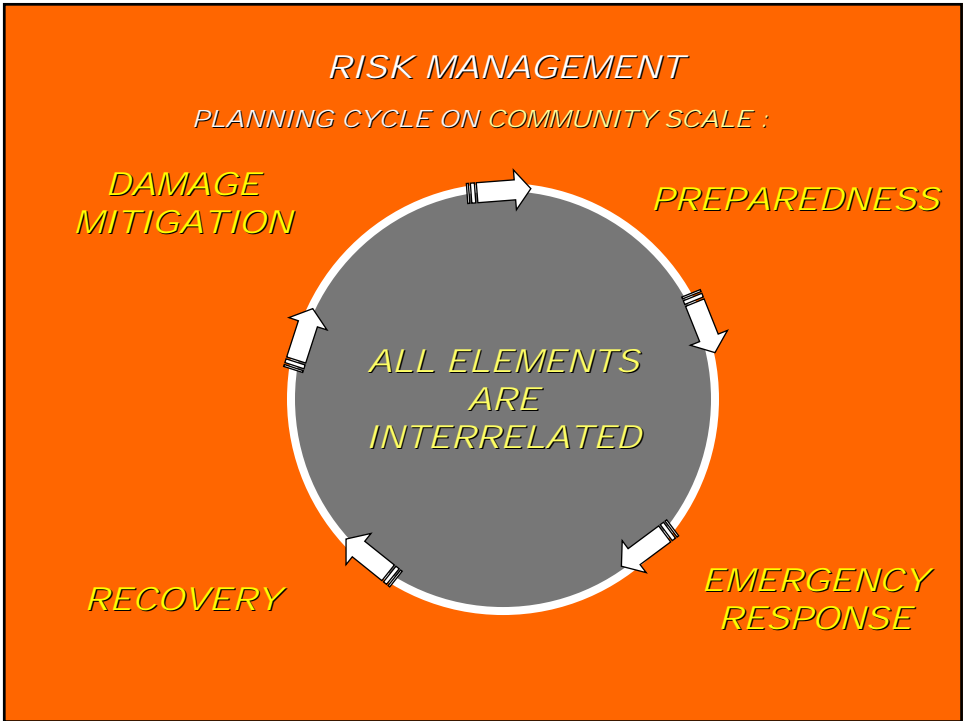
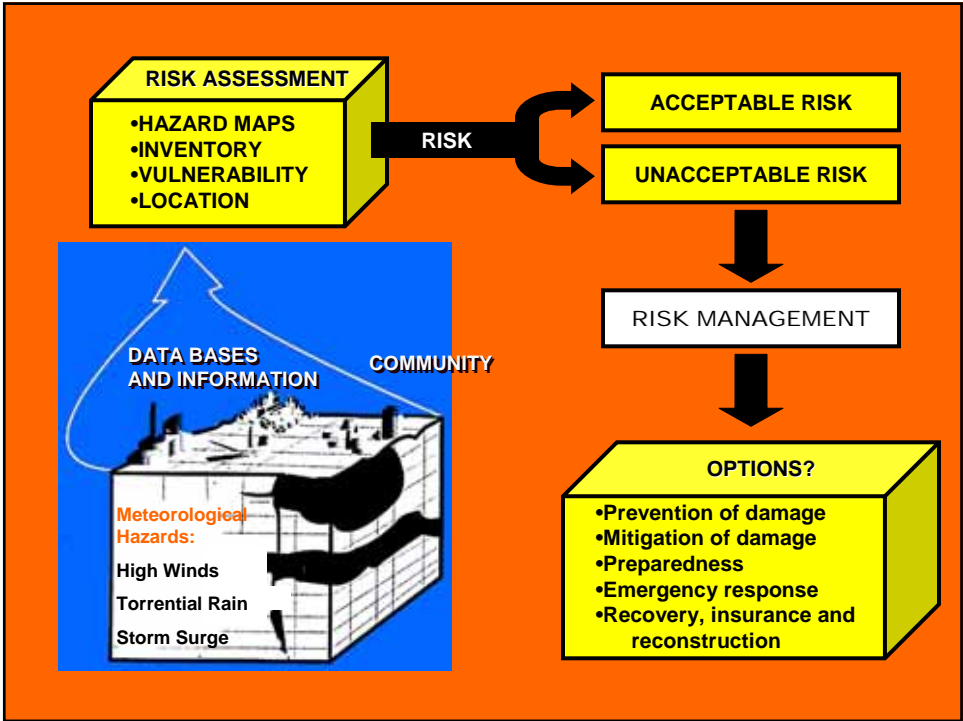
“The common law of business balance prohibits paying a little
and getting a lot.

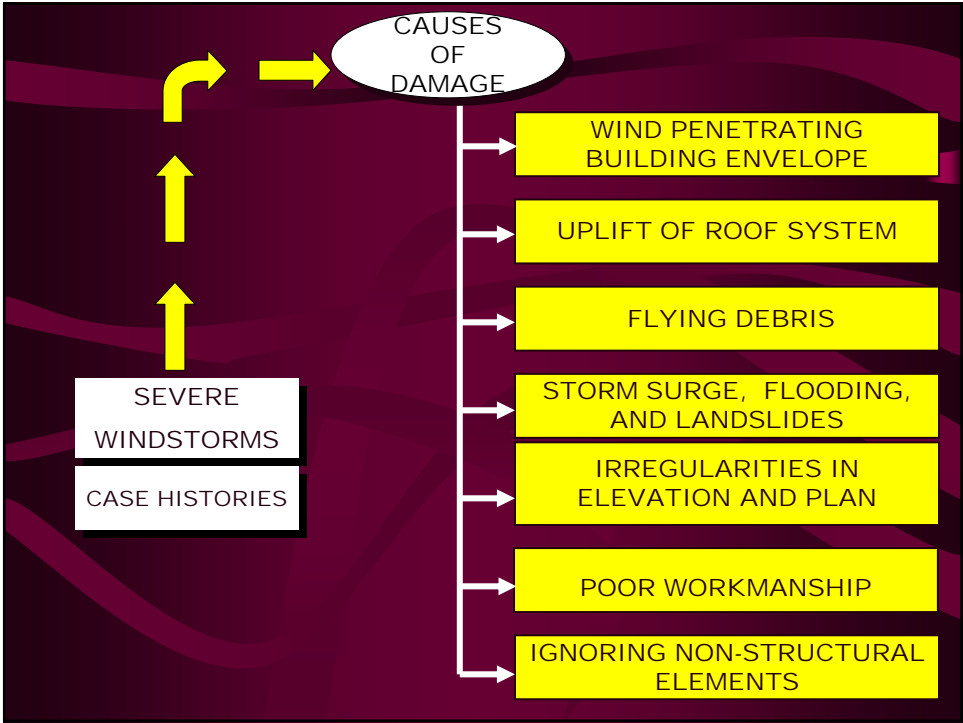
“There is hardly anything in the world that someone can’t
make a little worse and sell a little cheaper -
.....”

John Ruskin, 1819-1900
(*Plus ça change, plus c’est la même chose*)

**The most expensive hospital
is the one that fails.**







What we need:
better designs
not better accounting

reduction in damage requires:

- # legal mandating of codes
- # effective enforcement mechanisms
- # preparation of modern standards
- # setting up a maintenance mechanism for standards
- # land-use planning
- # maintenance of buildings and infrastructure