INTERNATIONAL SYMPOSIUM ON SEISMIC RETROFIT OF UNREINFORCED MASONRY CHURCHES OF THE PHILIPPINES
National Museum Auditorium, Manila, Philippines
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Overview: Seismic Retrofit

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What I am going to talk about today

- Risk preparedness and limiting vulnerabilities
- General Heritage Conservation Guidelines
- Some retrofit ideas

Risk Preparedness and Limiting Vulnerabilities

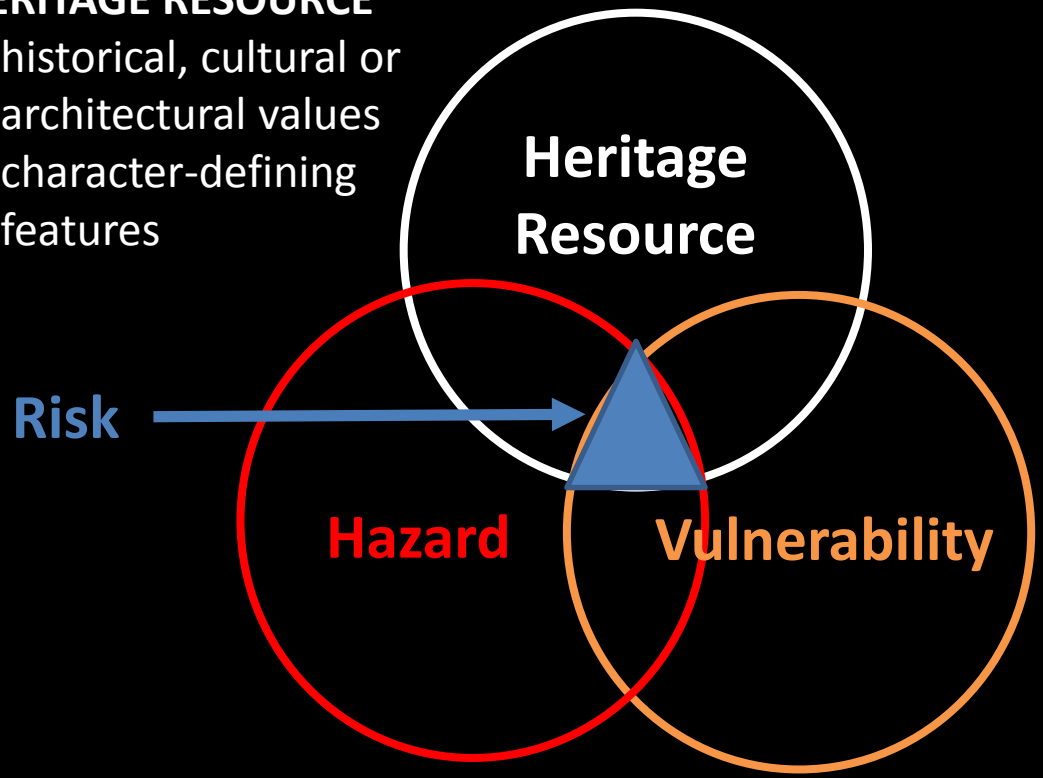
Hazard – the danger of injury or harm. Hazards generally cannot be controlled.

Vulnerability - susceptibility or exposure of a community to the hazard. The inherent weakness due to its location, condition or specific characteristics. Vulnerabilities CAN be mitigated.

Risk – A choice for potential loss which could occur to a community due to a future hazard event. Risk can be reduced by addressing vulnerabilities.

How these terms interconnect

HERITAGE RESOURCE
- historical, cultural or architectural values
- character-defining features

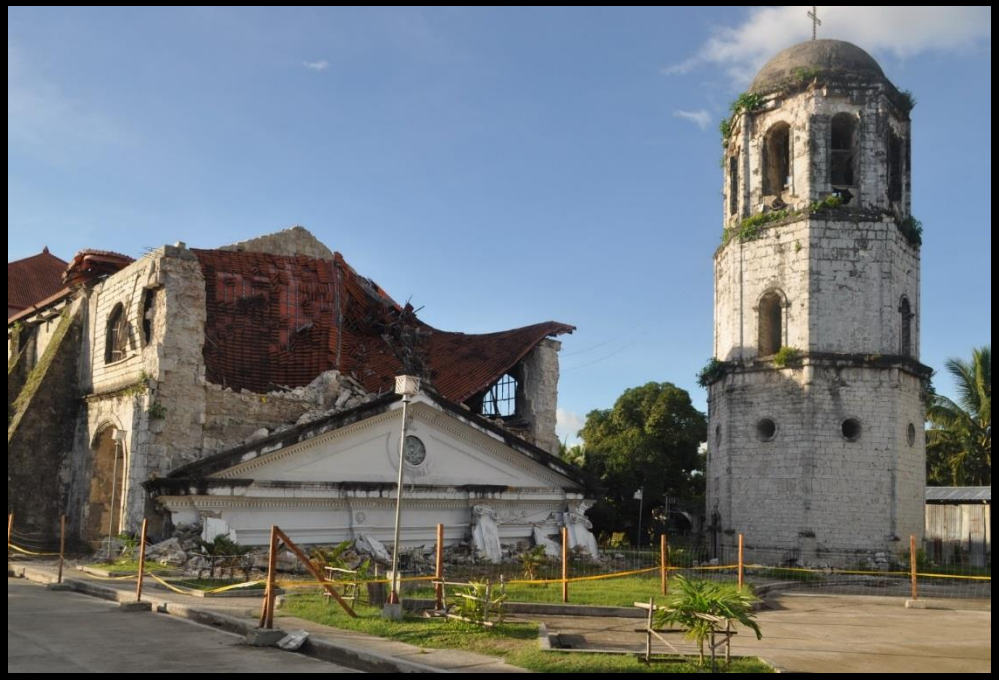


HAZARD
- meteorological
- geological
- biological
- human-induced
- climate change

VULNERABILITY
- physical
- environmental
- social
- economic

Vulnerabilities – Poor or inadequate maintenance.
Seismic, wind or flood events instantly bring out the weaknesses in building structures.

Vulnerabilities – Inappropriate repairs and additions



Vulnerabilities – loss of traditional knowledge

Vulnerabilities – the engineer's general tendency of maximizing performance levels

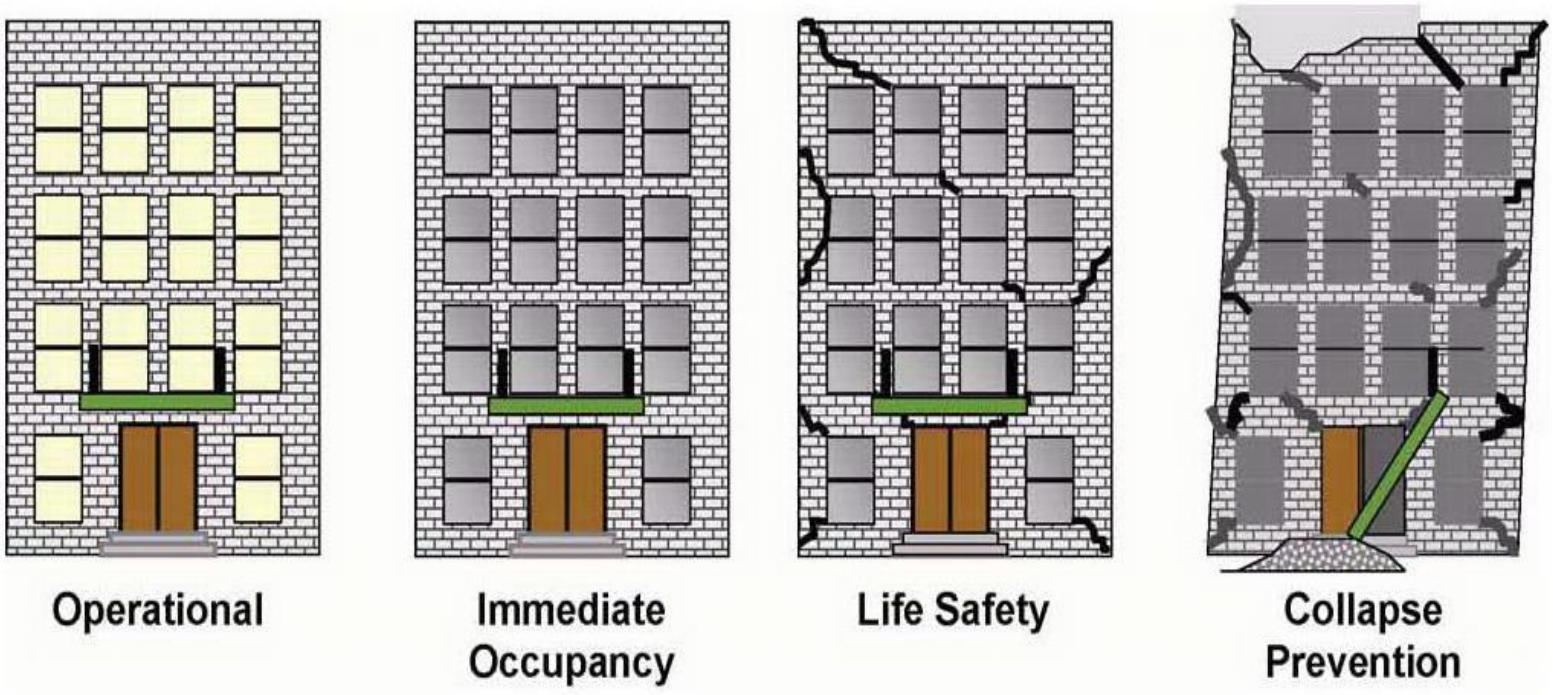


Figure 4-3 Graphic illustration of Operational, Immediate Occupancy, Life-Safety, and Collapse Prevention Performance Levels. (Courtesy of R. Hamburger)

Disaster Risk Management Cycle

Disaster response

- Search and Rescue
- Restore basic services
- Store artifacts
- Emergency stabilization

After the disaster

- Damage assessments
- Treatments
  - Repairs
  - Rehabilitation
  - Restoration
  - retrofitting

Before the next one

- Risk assessments
- Risk mitigation
- **MAINTENANCE**
- Emergency preparedness

General Heritage Conservation Guidelines

“Historic Buildings should set their own standards rather than be made to comply with current standards that have been established for contemporary construction.”

ISCARSAH Principle: Repair should address root causes rather than symptoms.

ISCARSAH Principle: No repair should be undertaken without demonstrating that it is necessary.

ISCARSAH Principle: Where possible, any repairs adopted should be “reversible” so that they can be removed and replaced with more suitable measures when new knowledge is acquired. Where they are not completely reversible, interventions should not limit further interventions.

ISCARSAH Principle: Imperfections and alterations, when they have become part of the history of the structure, should be maintained so far so they do not compromise the safety requirements.

US National Park Service Preservation Brief 41 - The Seismic Retrofit of Historic Buildings: Keeping Preservation in the Forefront

- Historic materials should be preserved and retained to the greatest extent possible;
- New seismic retrofit systems, whether hidden or exposed, should respect the character and integrity of the historic building and be visually compatible;
- Seismic work should be "reversible" to the greatest extent possible to allow removal for future use of improved systems and traditional repair of remaining historic materials.

Some (very schematic) Retrofit Ideas for the Churches in Bohol

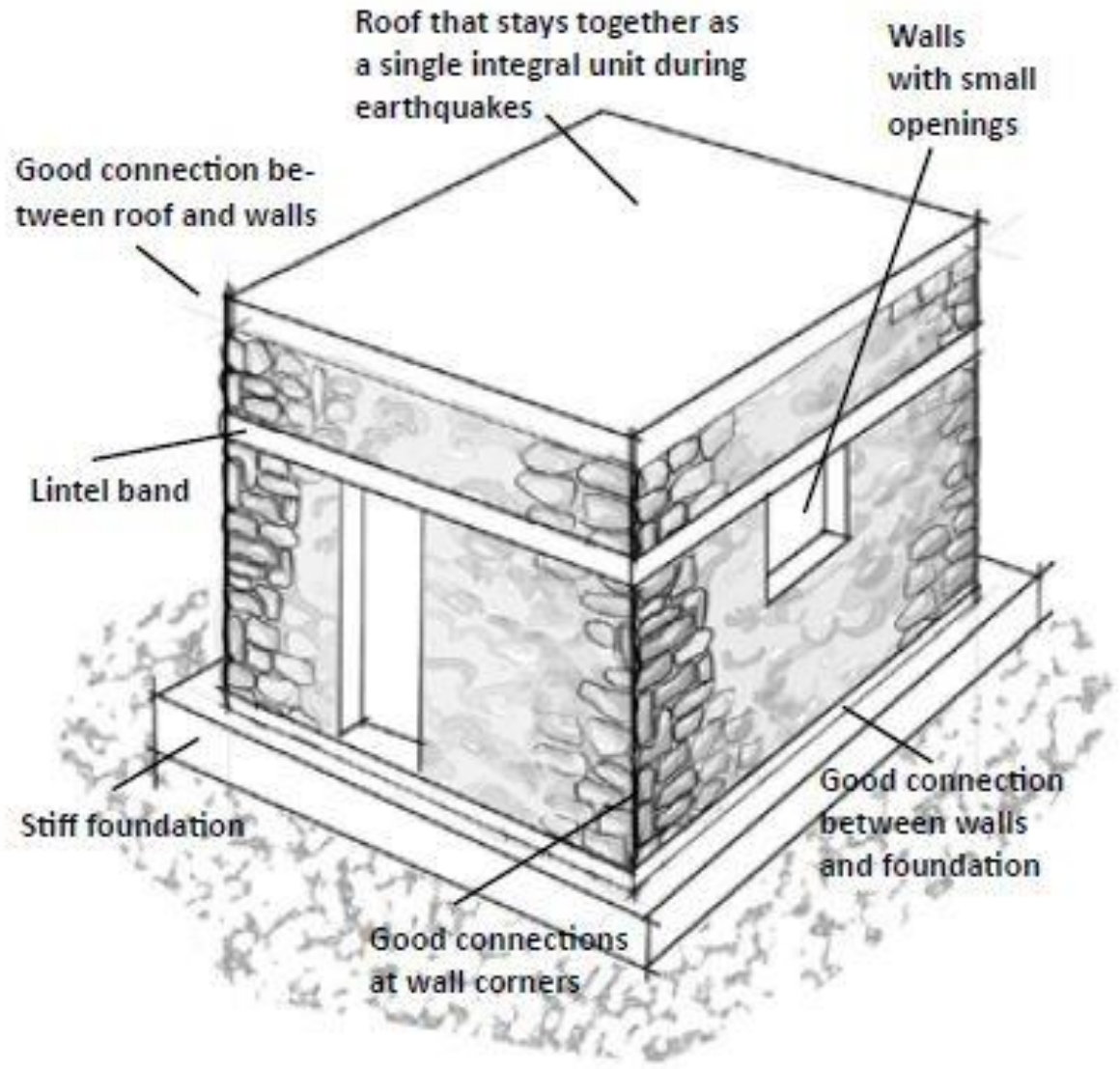
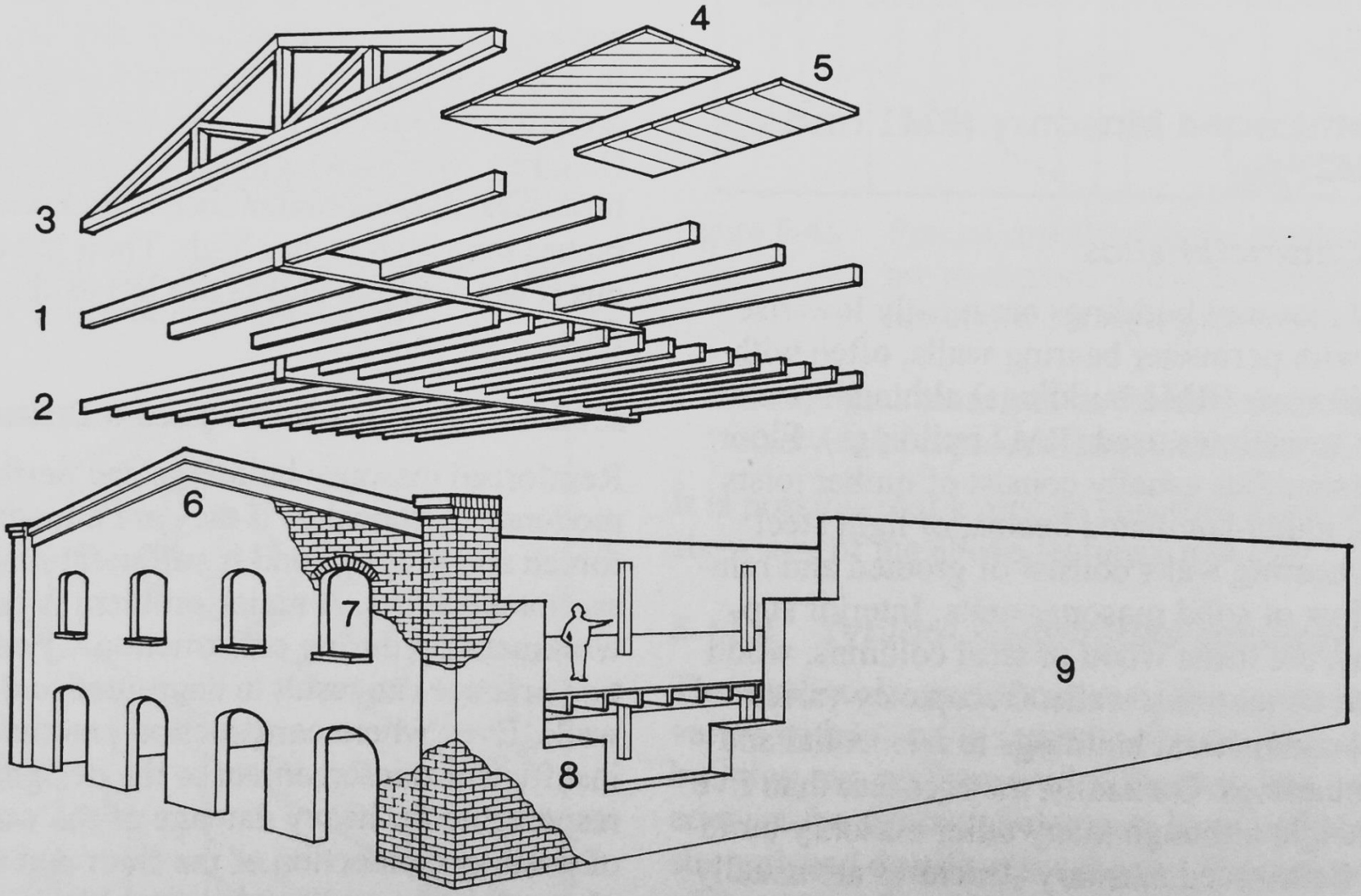


Figure 3.6 Key requirements for ensuring box action in a stone masonry building (adapted from: Murty 2005)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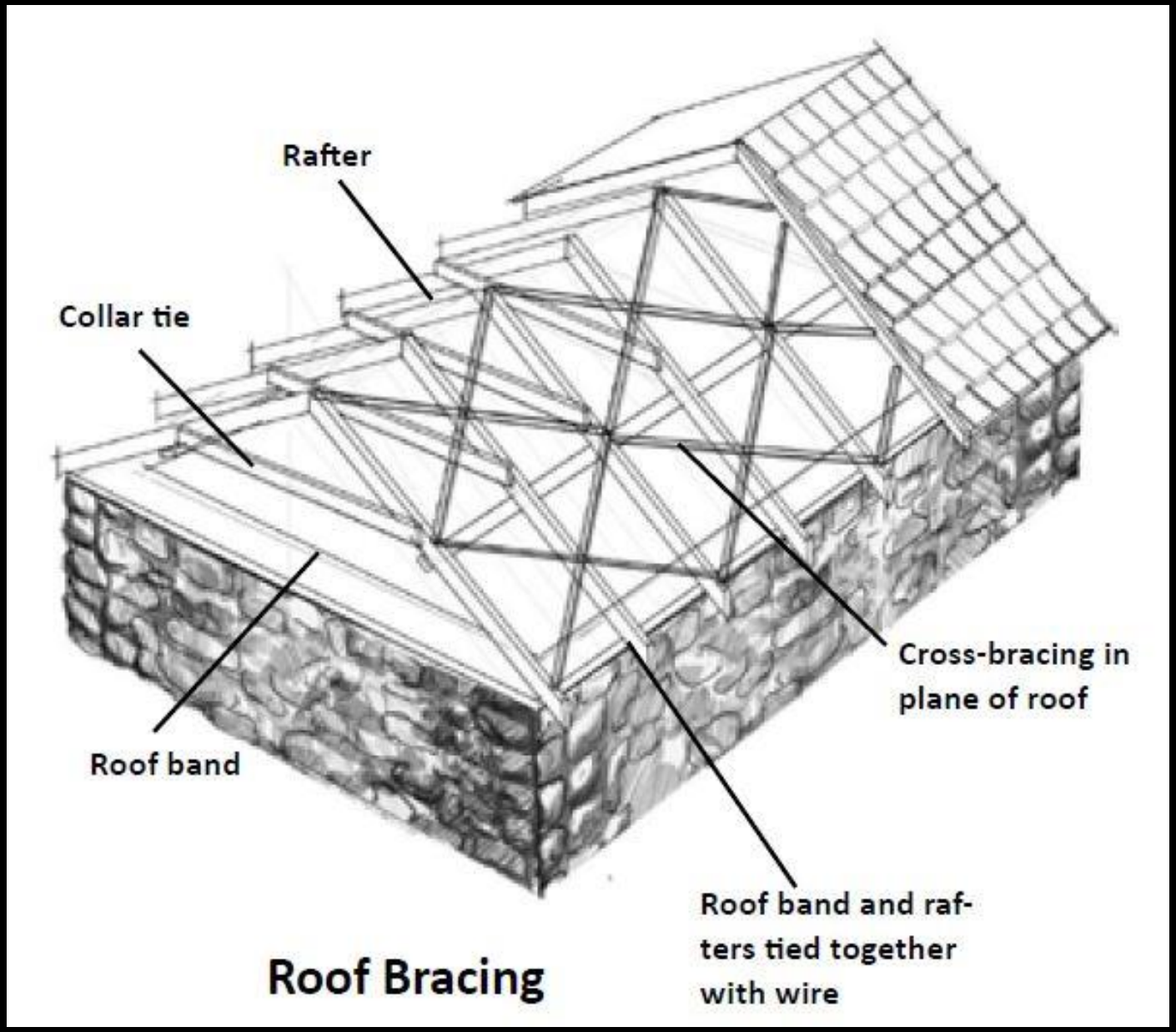


Roof Bracing

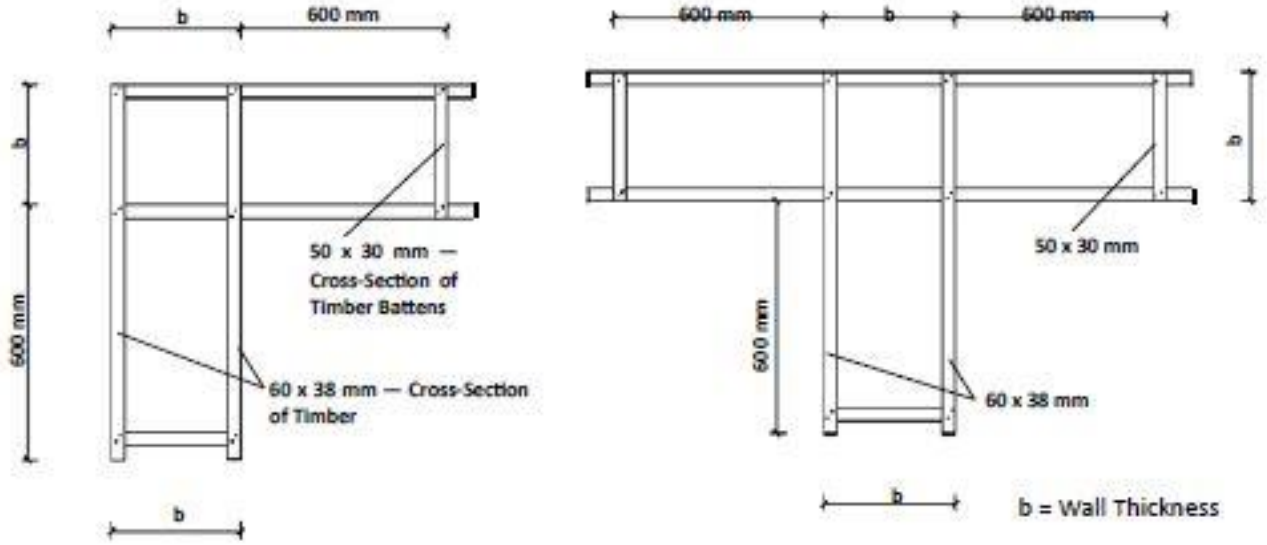


Figure 3.32 Stitches made from wood dowels at wall corners and intersections (adapted from: Bothara et al. 2002)

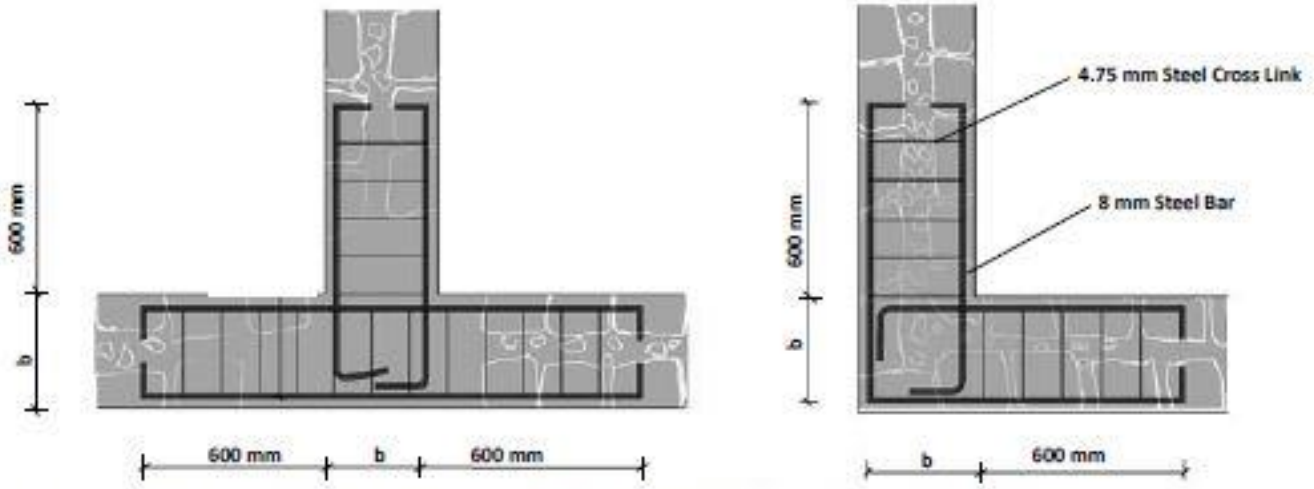


Figure 3.33 Wall stitches made from reinforced concrete with steel reinforcement (adapted from: Bothara et al. 2002)

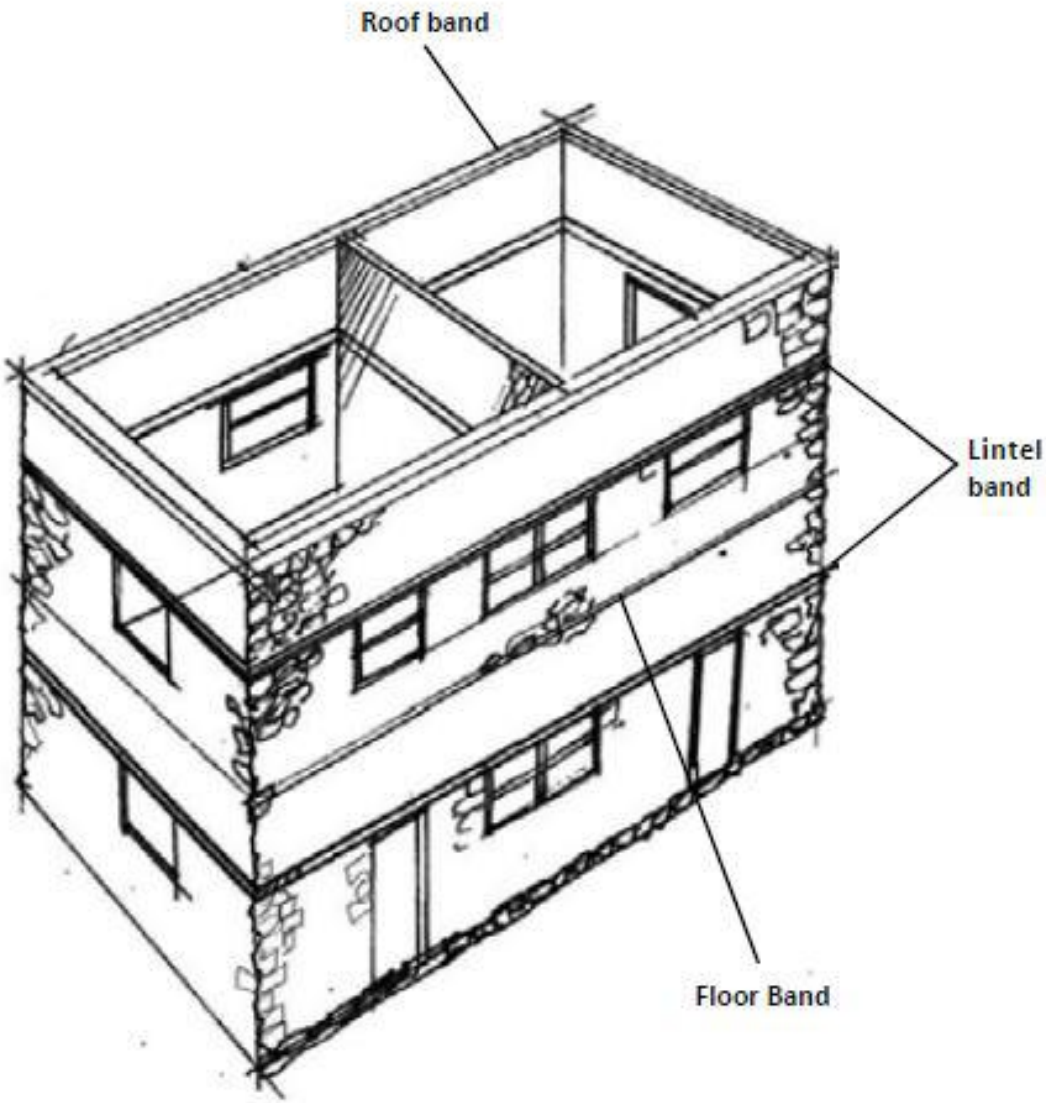
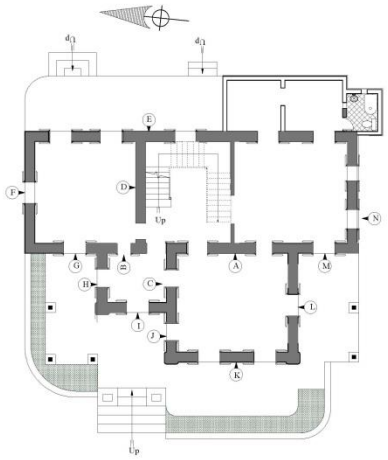
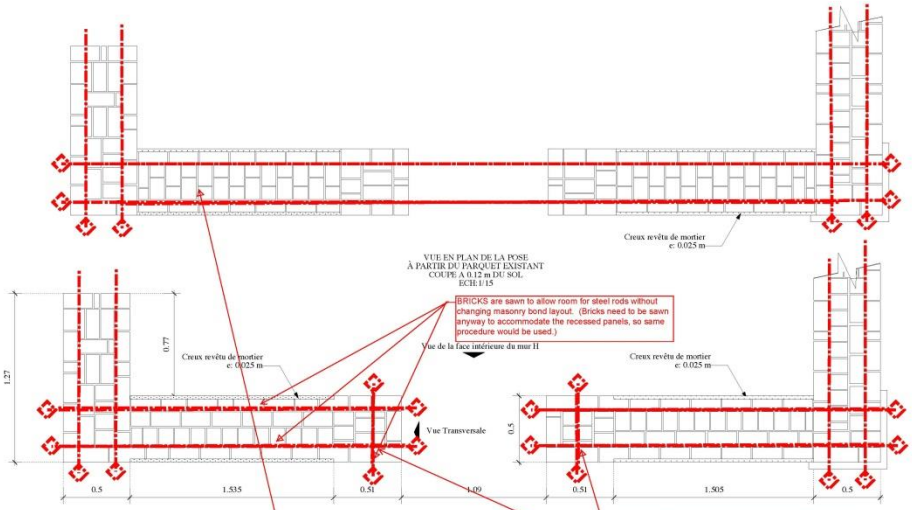


Figure 3.9 Locations of seismic bands in a stone masonry building (roof omitted for clarity) (adapted from: UNCRD 2003)



REZ-DE-CHAUSSÉE
PLAN D'ÉLÉVATION DES MURS
ECH: 1/100

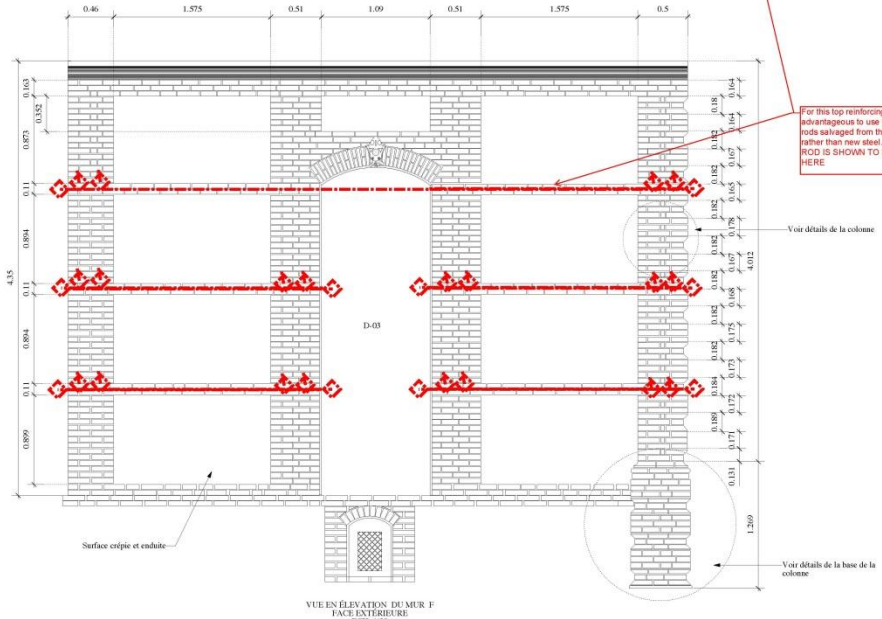


VUE EN PLAN DE LA POSE
À PARTIR DU PARQUET EXISTANT
COUPE A 0.12 m DU SOL
ECH:1/15

VUE EN PLAN DE LA POSE
À PARTIR DU PARQUET EXISTANT
COUPE A 0.23m DU SOL
ECH:1/15

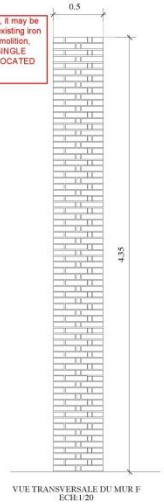
Make a STRONG connection between the rods where they cross (typ). This will avoid the need for an external plate that wraps around the corner.

(If an external plate is preferred, then the cross bar at door opening would be placed a half-brick in rather than as shown, with a full brick in from the door opening).



VUE EN ÉLÉVATION DU MUR F
FACE EXTÉRIEURE
ECH: 1/20

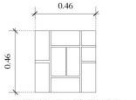
For this top reinforcing rod, it may be advantageous to use the existing iron rods salvaged from the demolition, rather than new steel. A SINGLE ROD IS SHOWN TO BE LOCATED HERE



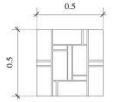
VUE TRANSVERSALE DU MUR F
ECH:1/20

This diamond shape represents a plate of attractive design against the wall, with a washer and nut to hold the end of the rod.

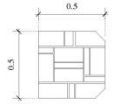
DÉTAILS DE LA COLONNE
VUE DES SECTIONS 4-4, 5-5
ECH: 1/8



DÉTAILS DE LA COLONNE
VUE EN PLAN
SECTION TRANSVERSALE 4-4
ECH: 1/15



DÉTAILS DE LA COLONNE
VUE EN PLAN
SECTION TRANSVERSALE 5-5
ECH: 1/15



DÉTAILS DE LA COLONNE
VUE EN PLAN
SECTION TRANSVERSALE 6-6
ECH: 1/15

id | co

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Notes :

MODIFIED BY RANDOLPH LANGENBACH TO SHOW SEISMIC MITIGATION ELEMENTS, January 31, 2013

Projet

RESTAURATION DE LA MAISON DUFORT

Localisation : 2eme Rue du Travail

Client : Fokal

Titre

PLAN DETAILLE DES MURS (MUR F)

No	Modifications	Date

Etudié par : FG, FK
Code:
Déssiné par : FG, YM
Planche :
Echelles : 1/100 1/15 1/20 1/8
Date : Décembre 2011
Approuvé par :


Salamat Po!