Assessing Buildings impacted by earthquakes

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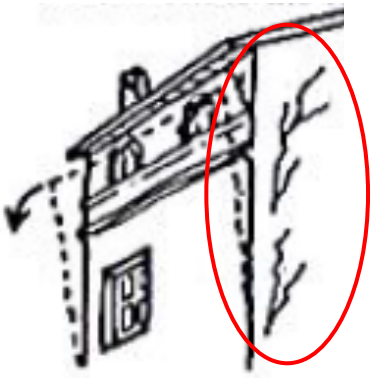
OBJECTIVES

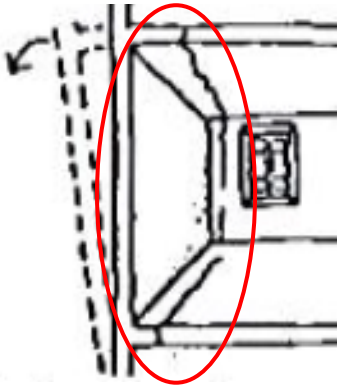
Participants will get basic understanding on:

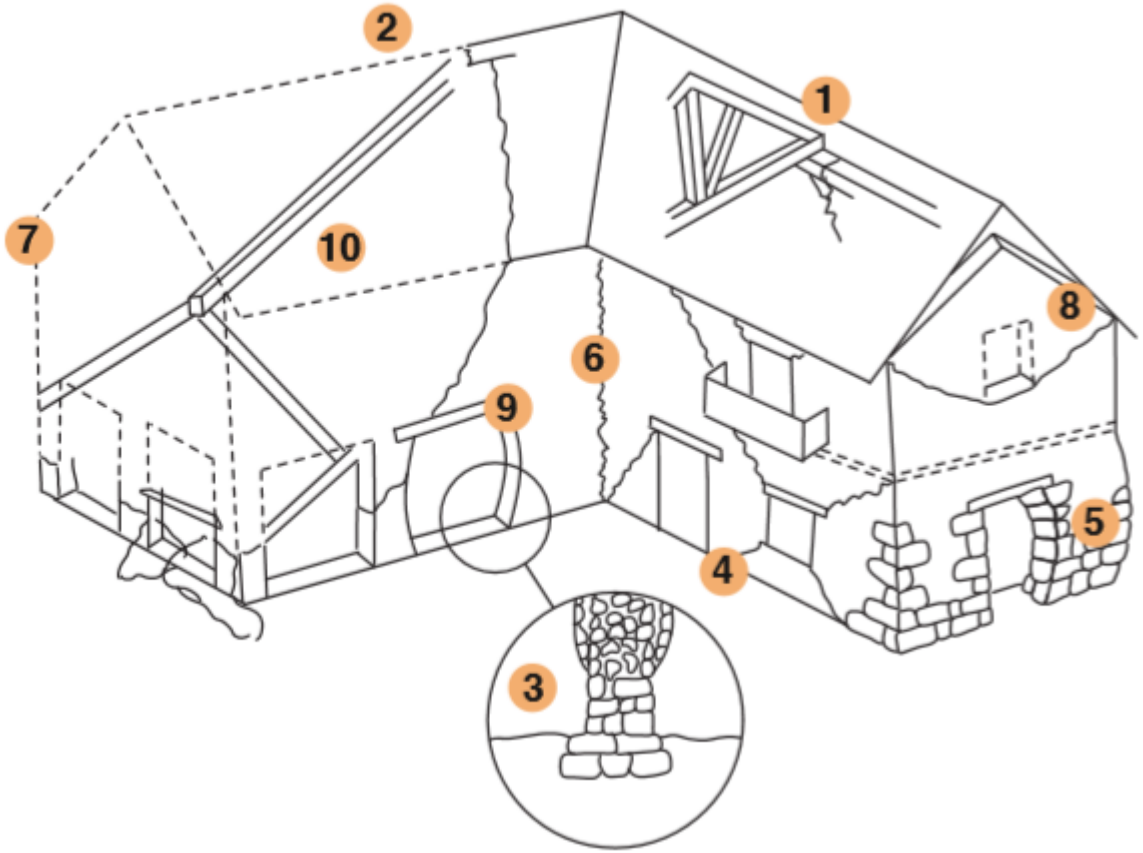
- Earthquake damage to structures;
- Recommended skills and resources for developing a stabilisation plan;
- Documentation and monitoring associated with structural stabilisation actions.

Understanding usual post-earthquake damage

Usual post-earthquake damage to masonry buildings



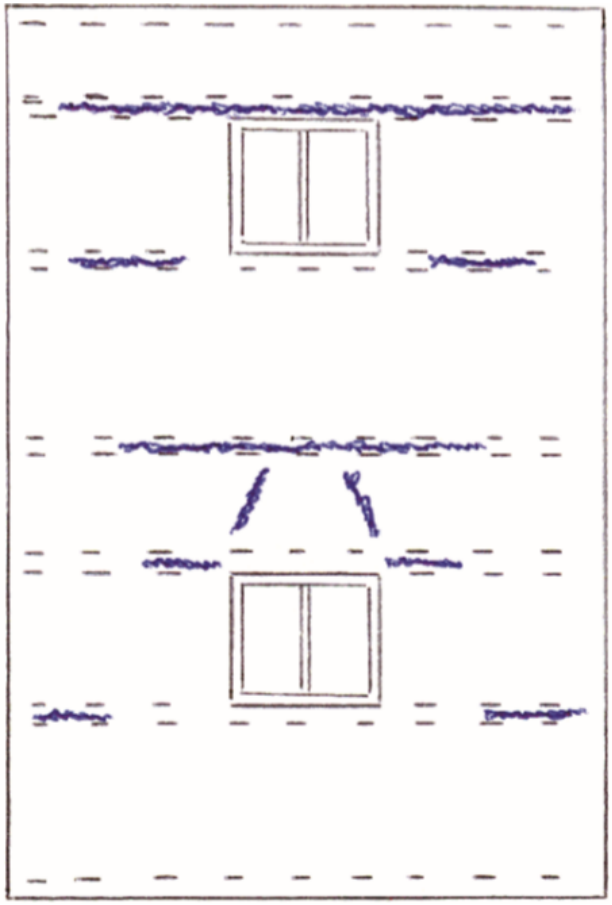




Understanding structural systems and local anti-seismic chararcteristics

Ohrid Lake, Macedonia,
© Milo Hofmann

Masonry cracks: they may be deceiving!



Ohrid Lake, Macedonia,
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Assessing masonry damage

- A crack is not important by itself but **according to the surrounding cracks** (disconnecting elements)
- Most masonry walls can cope with localised collapse.
- Collapsing stones :
  - Infill of a timber structure?
  - Cladding?
  - Part of a load-bearing two-leaves wall ? With or without timber belts ?

Ohrid Lake, Macedonia,
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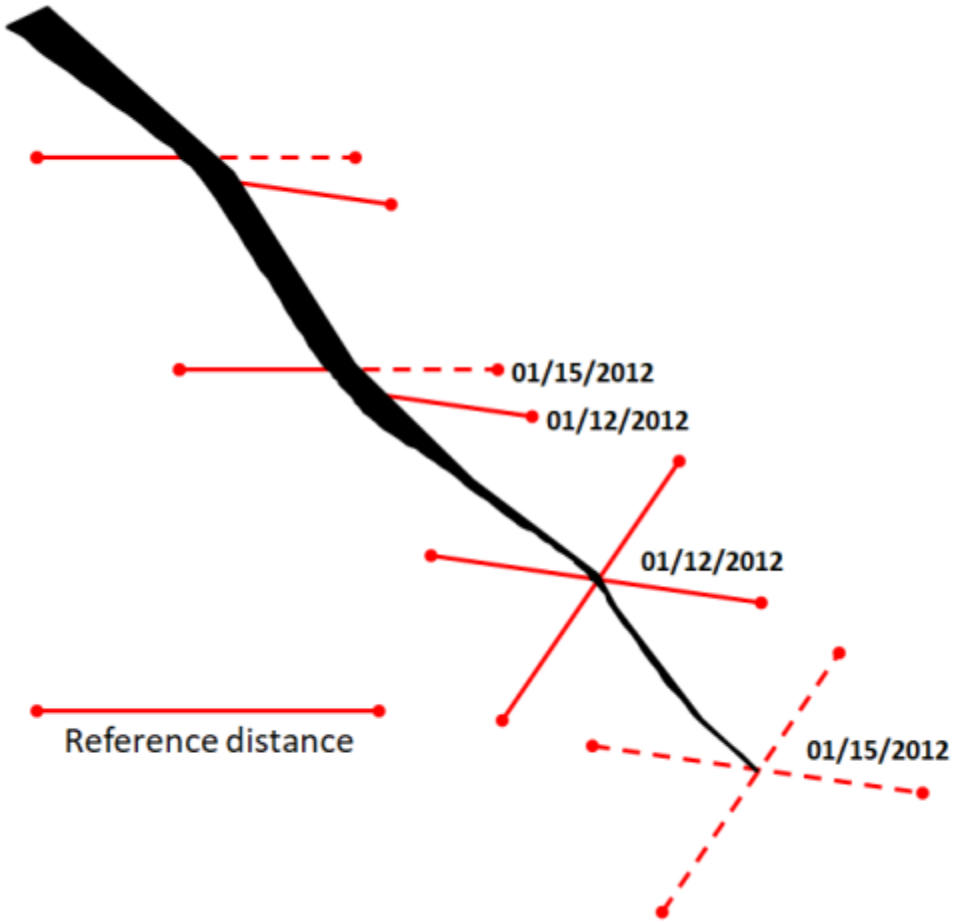
Monitoring a crack



Document

1 **Record the exact location, type, and measurements**

2 **Take photos** of the damaged areas **and their surroundings**, Add an object to establish the **scale**, and record the **date**.

3 Make regular inspections to record **the progression of damage**

Examples of security and stabilisation actions

What are security and stabilisation actions?

- **Temporary measures** implemented to prevent further damage, restore temporary access and protect indoor elements.
- They must be properly **documented** and **removable**.
- They should help understanding the movement of the building to **help setting up full conservation actions** (documentation and monitoring).

Provide temporary cover

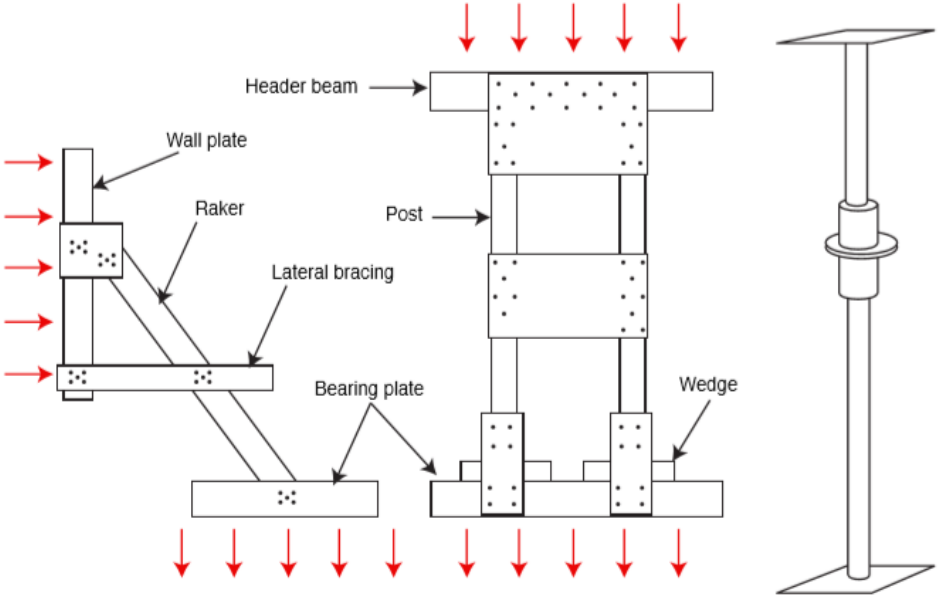
- If left exposed, **mortars and organic cultural materials** can deteriorate rapidly. But don't create a **moisture dam** into the structure!
- Ensure moisture is not trapped by maintaining a **ventilation** of the piles or spaces covered.

Norcia © E.Crété

RESTORE WATER EVACUATION SYSTEMS

Bagan, Myanmar © E.Crété

Shoring

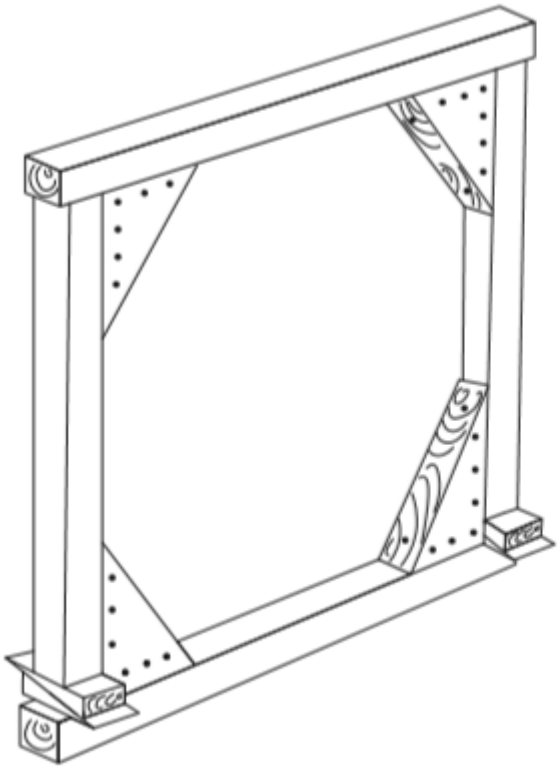

Header beam
Wall plate
Raker
Post
Lateral bracing
Bearing plate
Wedge

Shoring

Cinta, Portugal © E. Pauperio

Norcia, Italy © E. Crété

Shoring access



Drawing: Nelson Vila Pouca

Norcia, Italy © E. Crété

Tightenning disconnecting elements

Norcia, Italy © E. Crété

Monitoring

Monitoring a shore

Shores can become dangerous and must be checked regularly (at least once every 12 hours over the first few days) for any sign of distortion or overloading.

If you notice any, immediately call for a structural engineer.

Conclusion

The information you need to collect to feed the diagnosis

- **The building history**: its construction date, the techniqucs used, repairs and extensions done, interiors…
- **Previous state of the building** and the maintenance modalities
- You may need to organize **plaster removal** and **masonry sampling** to confirm geometrical and mechanical data
- Situation analysis of the **building surroundings**