Mitigation and Preparedness Strategies for Museums

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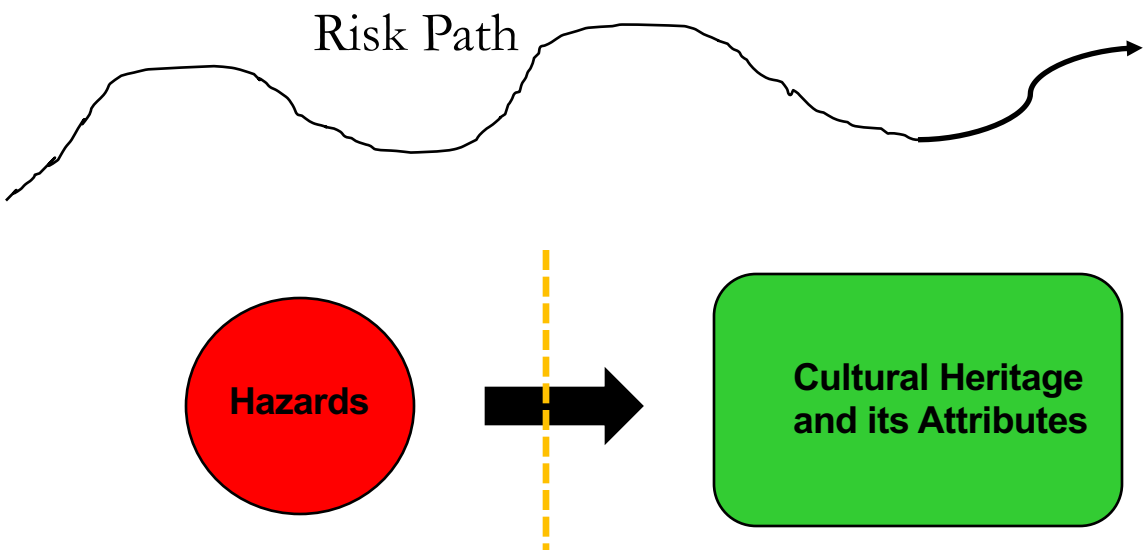
Disaster Risk Mitigation

Disaster Risk Mitigation involves taking proactive measures to prevent or minimize the potential impacts on cultural heritage due to catastrophic hazards that may create disaster


Risk Path
Hazards
Cultural Heritage
and its Attributes

Basic Methods for Mitigating Risks

- **Avoiding** primary or secondary hazards by removing or acting on the agent/source for the hazard
- **Blocking** primary or secondary hazards through a barrier/buffer
- **Detecting** the hazards in advance (warning/monitoring systems)
- **Reducing** physical, social, economic, institutional, attitudinal vulnerability(ies) of the heritage components/attributes that are being severely impacted. E.g. Physical vulnerability might be reduced by Retrofitting the heritage component (s) to reduce the impact of hazard.
- **Building on** existing adaptive/coping capacities at different levels

Types of Mitigation

- Strategic Level : Policies, Legislation
- Physical Planning Level : Land use, transportation, infrastructure, development plan etc.
- Technical Level : Structural, Non-Structural and Material
- Management, Maintenance and Monitoring Systems
- Awareness and Capacity Building

The Levels for Mitigation Actions

- Region/district
- Site
- Building (Structural and Non Structural components)
- Display/Storage Shelves/Packaging & Supports/Fittings
- Collections (organic, inorganic, composite)

✖Strategic Level : Policies, Legislation

Including cultural heritage in national disaster law

Building codes and specifications for museum buildings

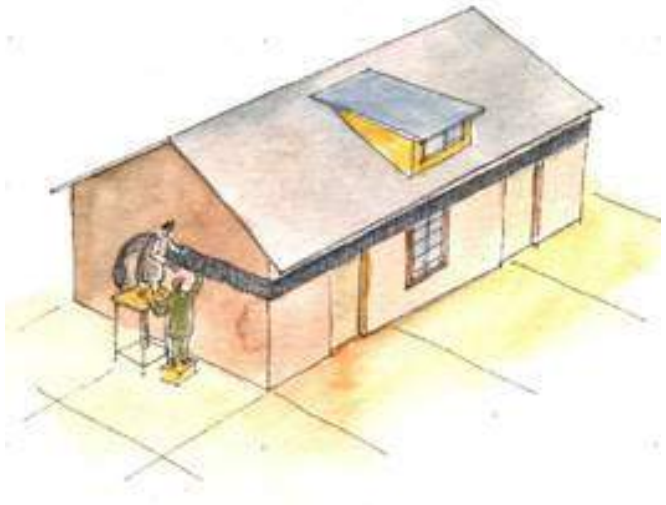
Coordination mechanisms with structural safety/public works department

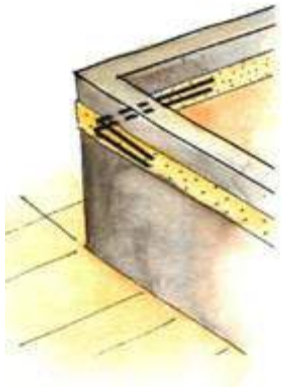
✖Strategic Level : Policies, Legislation

Visitor management policy taking into account COVID -19 safety measures

Remote access of collection records and cyber security measures

Adding Structural Bands

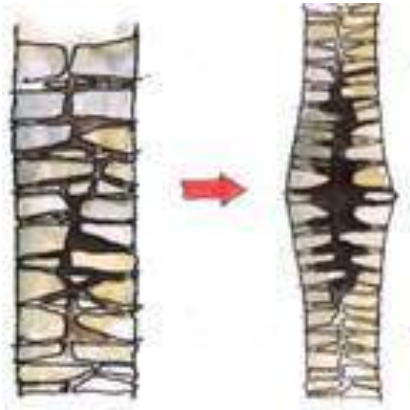




Using dowels for belt continuity through wall

Adding Keystone blocks

Need for Installing Bond Element



Delamination of RR walls due to absence of bond element / key stone

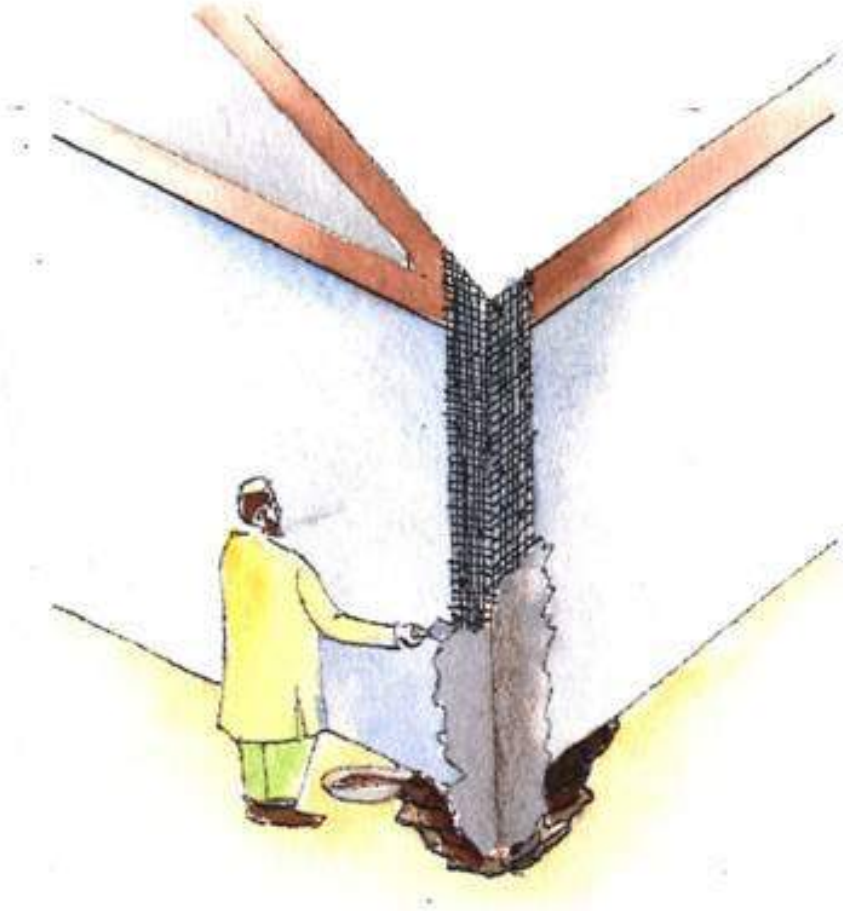
Step 5- The key stone or stitching element

Retrofitting of the internal walls after plaster removal: (a–c) rebar grid technique and (d) application of thick plaster.

Carbon fiber wrap applications on masonry walls (a and b).

Strengthening Corners:

Installing Vertical Reinforcement for Retrofitting Masonry Walls



Vertical belt made of welded wire mesh

Damage due to poor wall to wall bonding

Diagonal Cracking in walls around openings

Installing WWM around window opening

Retrofitting of door and window gaps using steel plates (a and b).

Problem: Inadequate Tying & In-Plane Strength of Roof

Roof damaged due to inadequate tying.

Roof Retrofitted by tying with collar beams

Need for installing Collar beams (Horizontal Ties) / Diagonal Bracings

Approaches to Strengthening of Heritage Structures

(1) Additions using traditional techniques and traditional materials.	(2) Additions using traditional techniques and modern materials.
Reinforcement by palm tree rope 	Reinforcement by Carbon fiber sheet 
(3) Additions using modern techniques and modern materials.	**(4) Replacements using modern techniques and modern materials.**
Burden share by Iron frame 	Introduction of Base Isolator 

Northern Kashmir Earthquake 2005

Resilient Heritage

Pagoda Temple, Kathmandu, Nepal

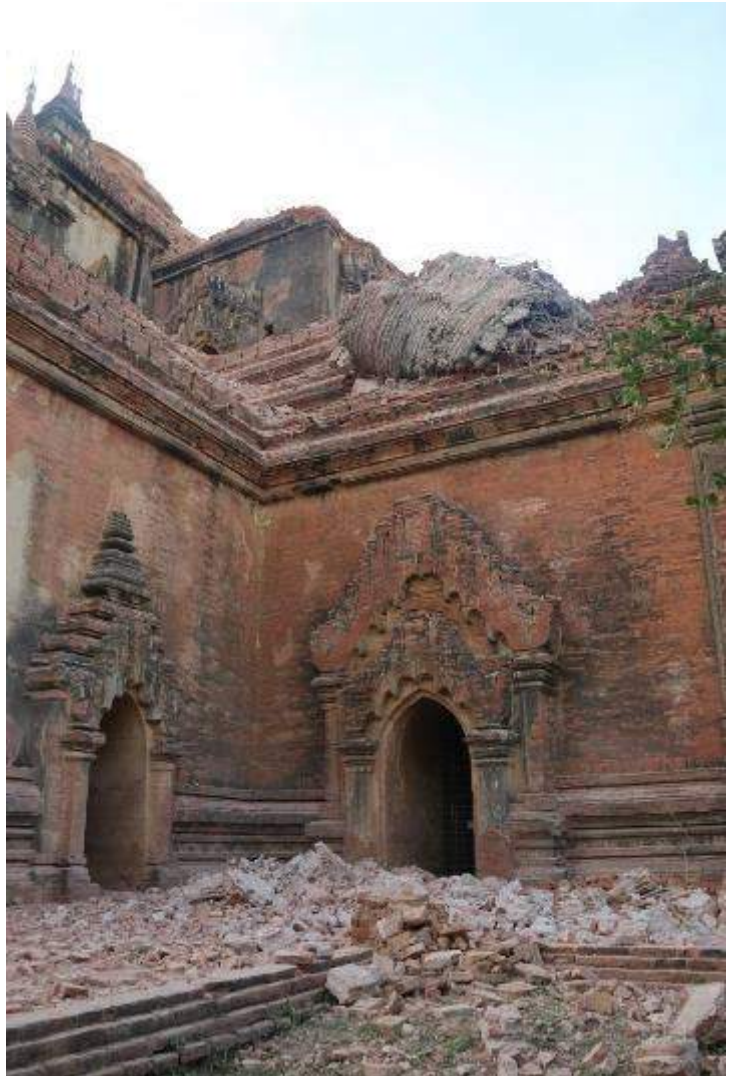
Gingerbread House, Haiti

HERITAGE SITE OF BAGAN, MYANMAR

On 24 August 2016, 6.8 magnitude earthquake

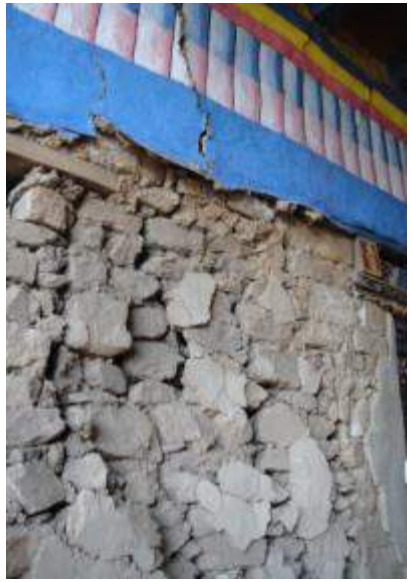
Epicenter: 24 km from Chauk, Magway, Myanmar

MYANMAR EARTHQUAKE, 24 AUGUST, 2016



Past Interventions / Additions and Alterations

Yangneer Lhakhang



Traditional buildings have different materials and construction systems, which impact their performance differently than contemporary structures.

✖Technical Level : Non Structural

Fixtures, false ceilings and partitions have to ward off multiple hazards

So what should be the terms of reference of engineer?

- Sound knowledge of structural and non-structural vulnerabilities as well as resilience of traditional buildings.
- Record history of past damages and interventions in the building
- Understand risks to the building coming from the surroundings e.g. drainage, trees etc.
- Understand geo-technical vulnerability (related with foundations and soil conditions)
- Appreciation and analysis of tangible and intangible heritage values of the building.

✖Technical Level : Structural and Material

- Well sealed shelves can protect objects from multiple hazards

READ MORE: https://www.nedcc.org/free-resources/preservation-leaflets/4.-storage-and-handling/4.2-storage-furniture-a-brief-review-of-current-options

✖Technical Level : Structural and Material

Enclosures and coverings play an important role in reducing the impact of hazards.

Read more :
http://canada.pch.gc.ca/eng/1484772999602/1484939184568?wbdisable=true

Practice not theory!

Source : Gael de Guichen

MOUNTS AND MONOFILAMENTS

Mounts must be strong enough to hold objects in place during seismic activity.

Contour

Monofilaments are used as passive restraint to hold the top of the object to the contour mount.

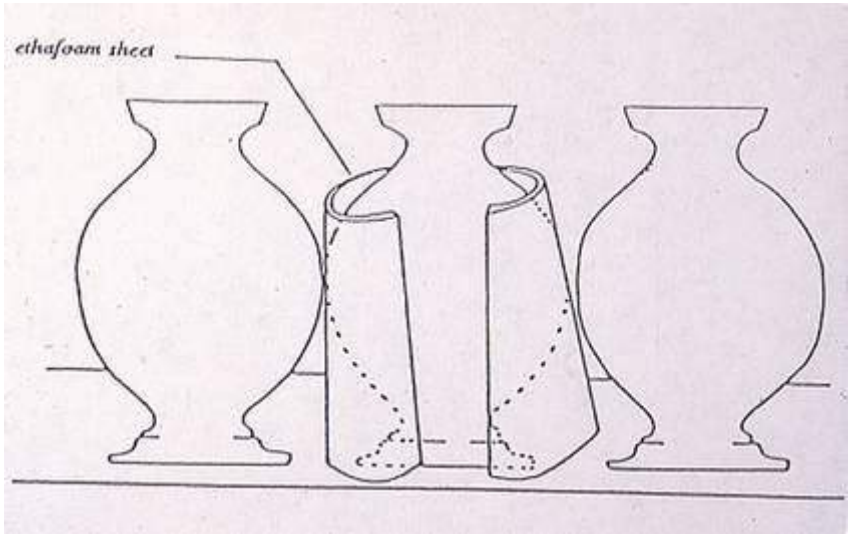
Clips are used to secure objects that have a lower centre of gravity.

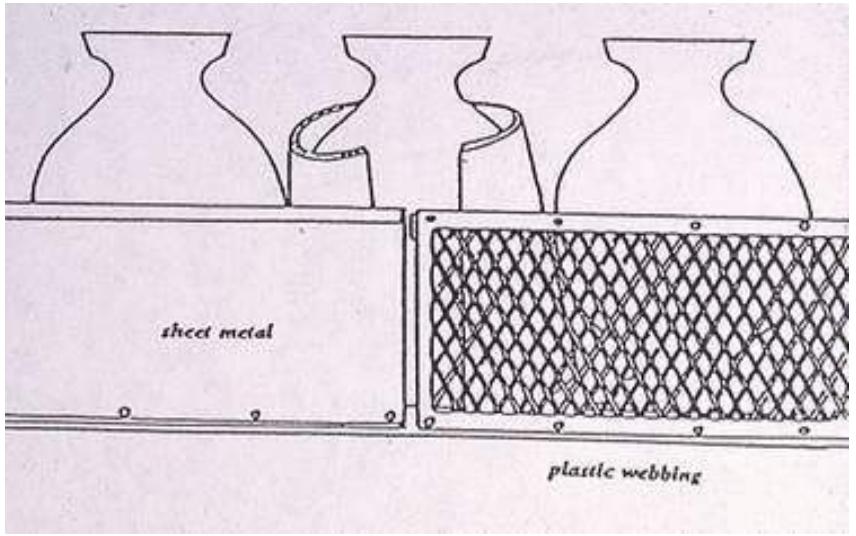
ADEQUATE ANCHORS AND BRACING

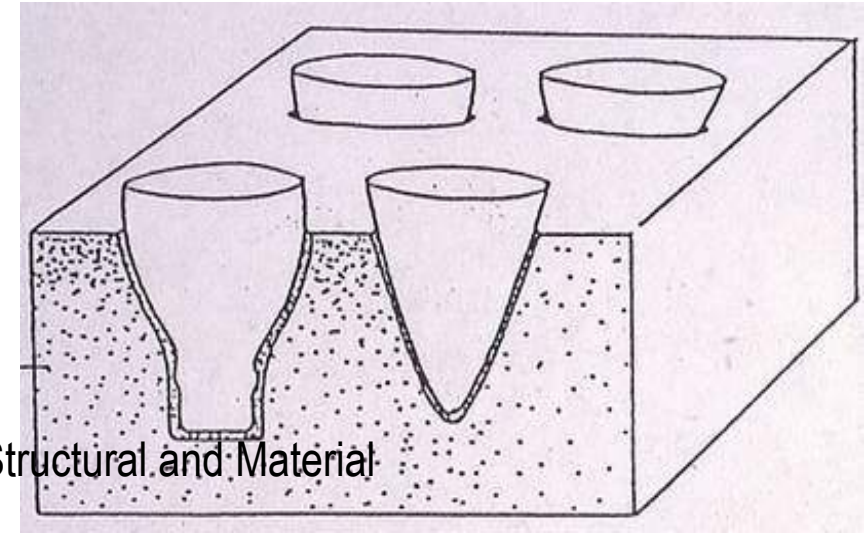
RESTRAINTS TIED ACROSS OPEN SHELVING

✖Technical Level : Structural and Material

BOXING OBJECTS
Padding Between Objects







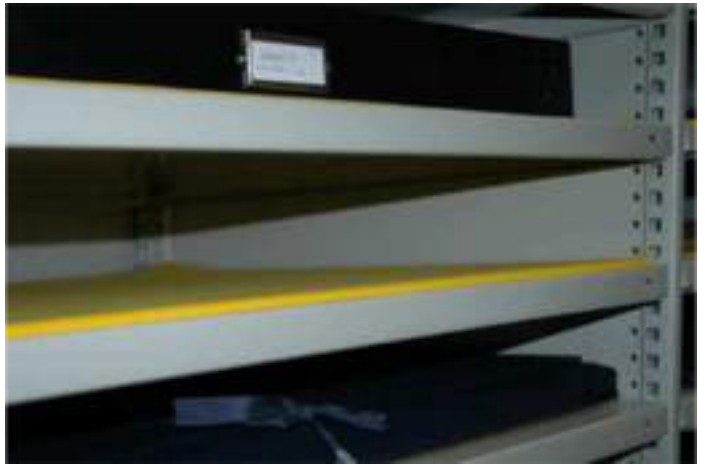
✖Technical Level : Structural and Material

Before

After

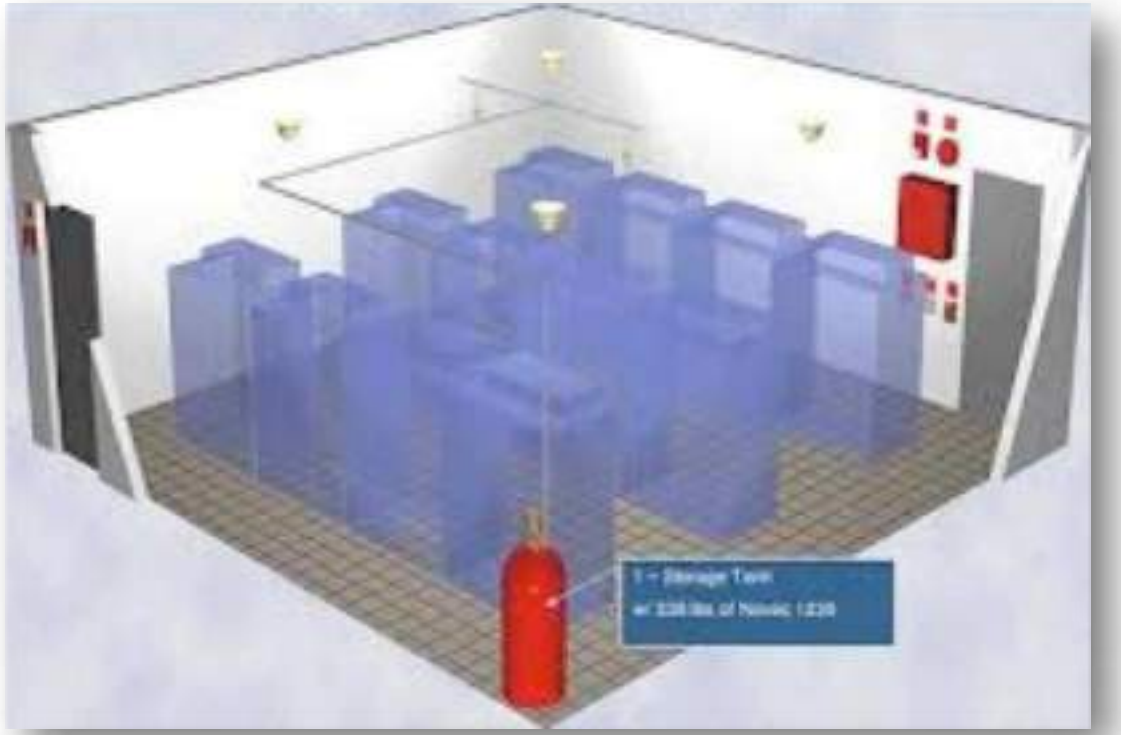
✖Technical Level : Structural and Material

SLANTED SHELVES



Each shelf has a sheet of evasote, an anti-skid form that prevents the boxes from sliding out. Each shelves' back are lower to prevent the boxes from sliding out as well.

✖Technical Level : Structural and Material



Complete fire Suppression Systems. Nonetheless the challenge for installing fire systems in historic buildings remain. Compartmentalizing collections is another solution.

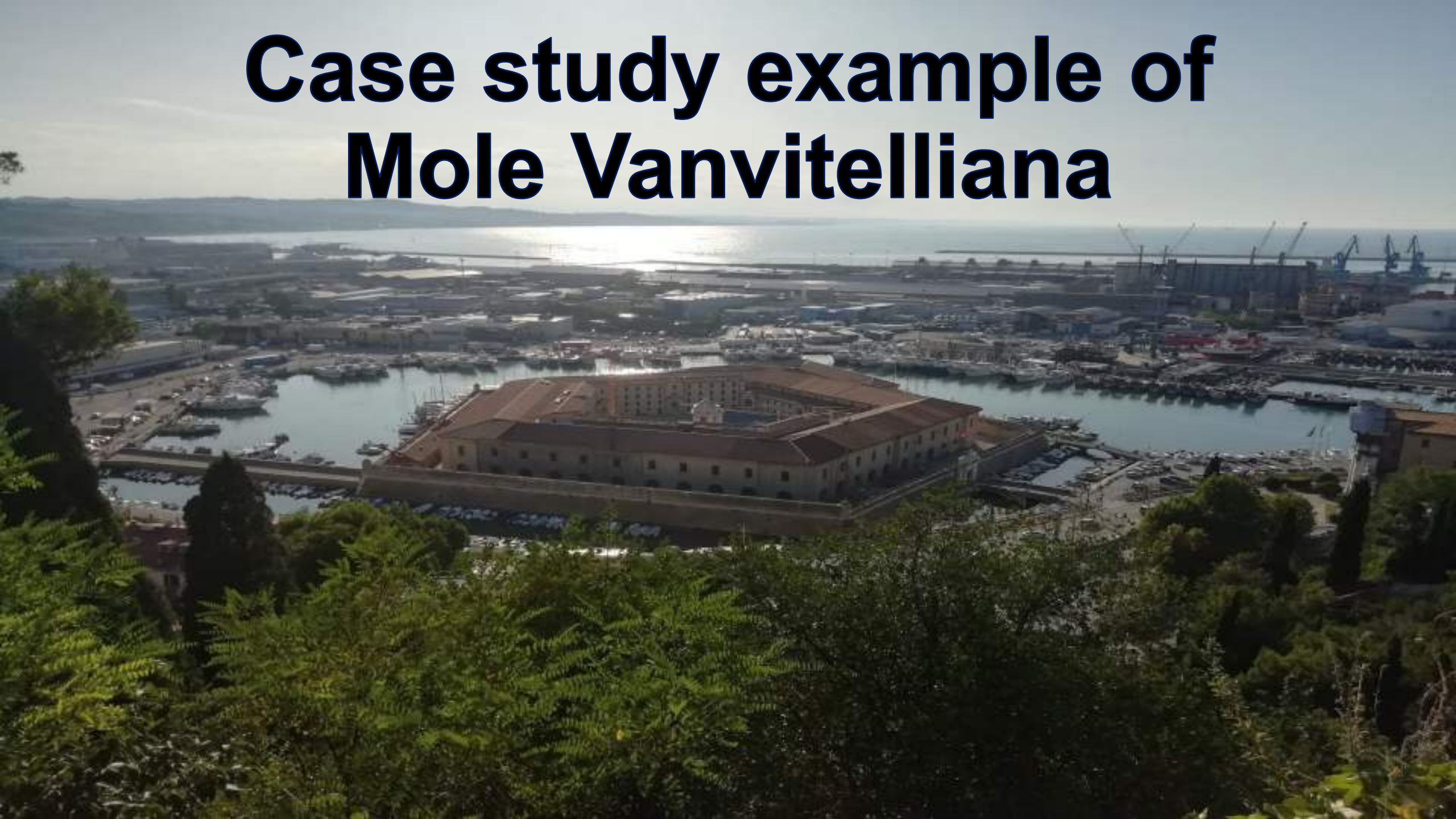
How to compartmentalize

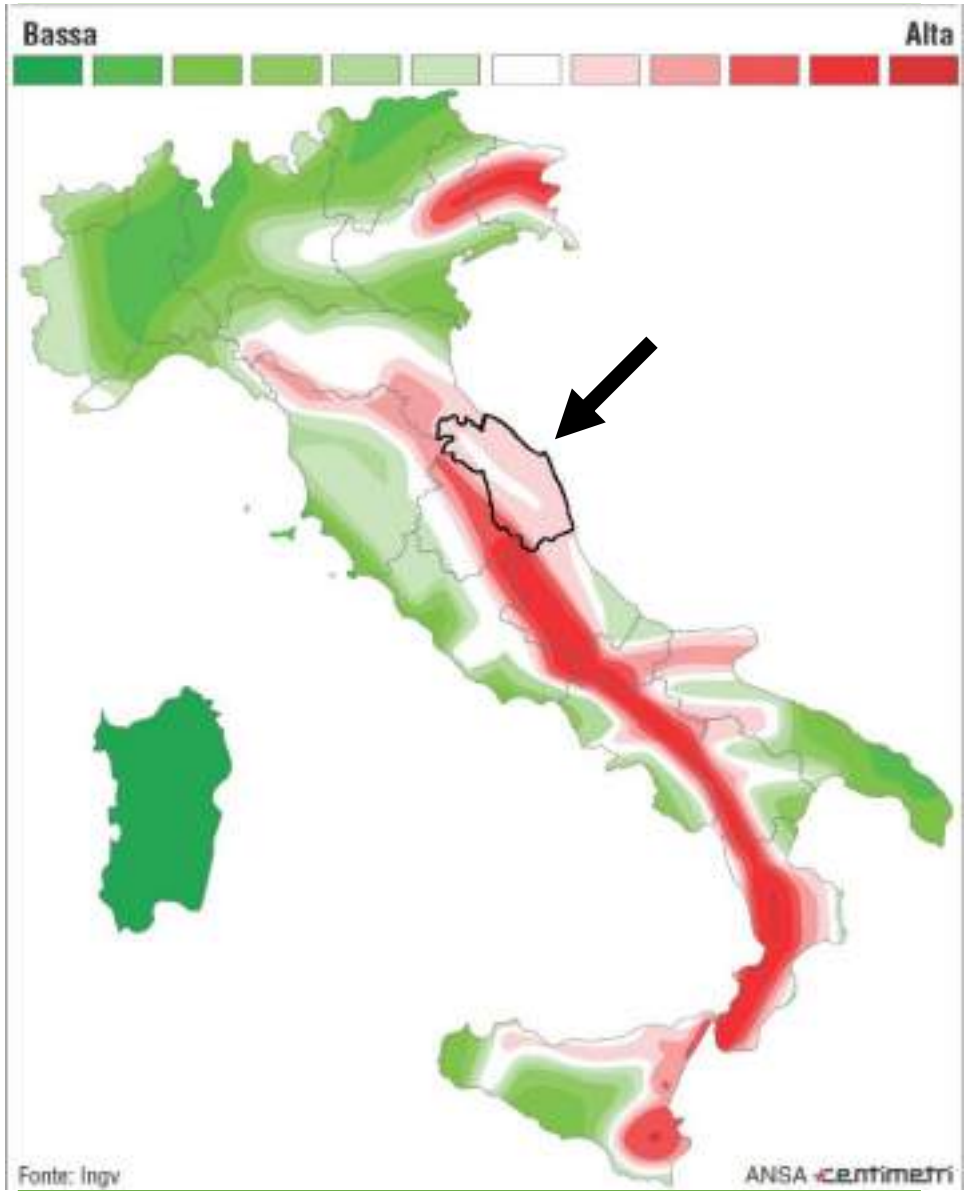
- Identify the paths through which fire can travel
- Identify materials/collections that are in path of the fire
- Erect fire-proof barriers or install fire doors to protect those collections
- Build strong rooms to keep most precious or hazardous collections
- Further isolate them by placing on fire resistant shelving and enclosures

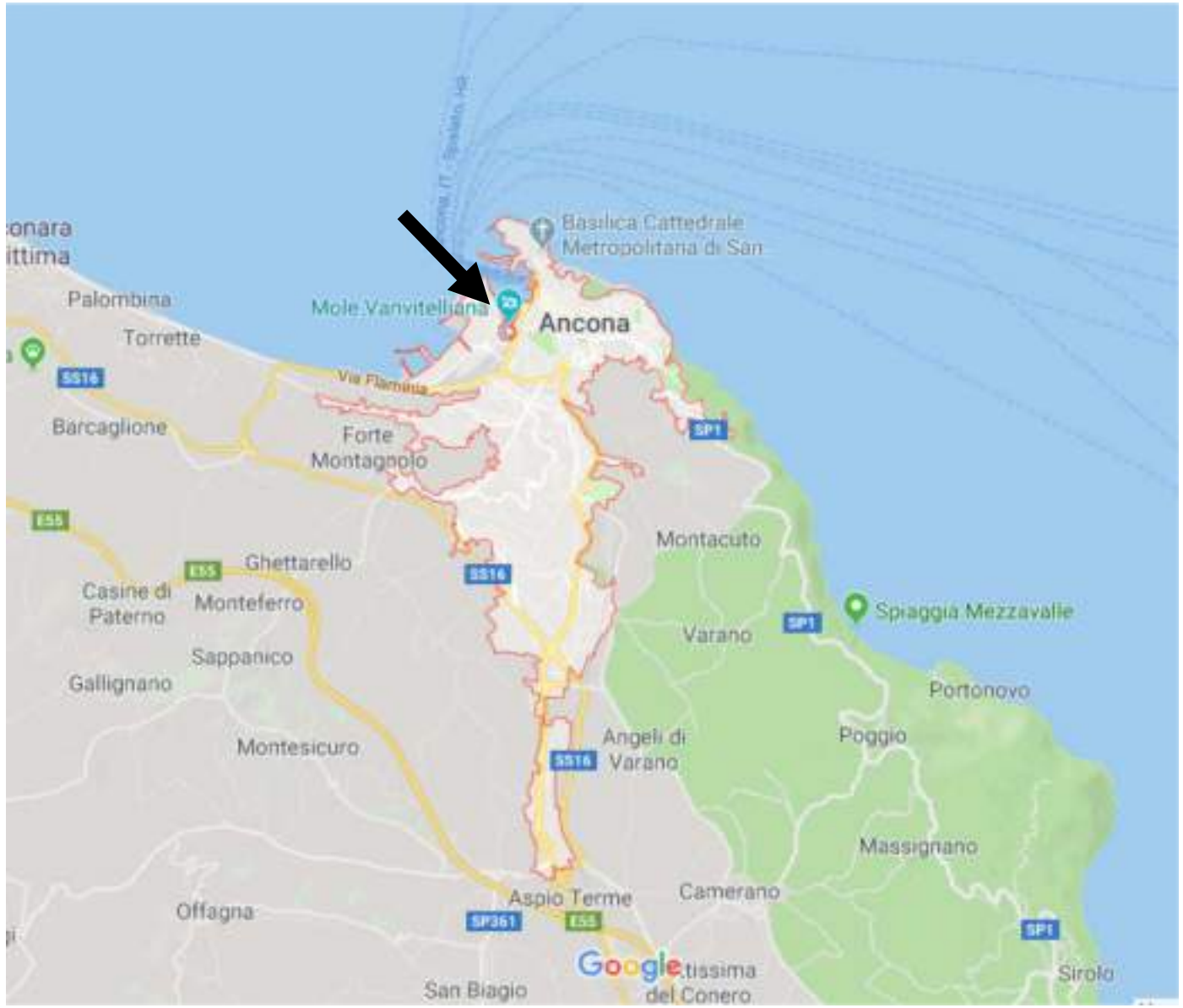
✖Management, Maintenance and Monitoring Systems

✖Awareness and Capacity Building

Case study example of Mole Vanvitelliana

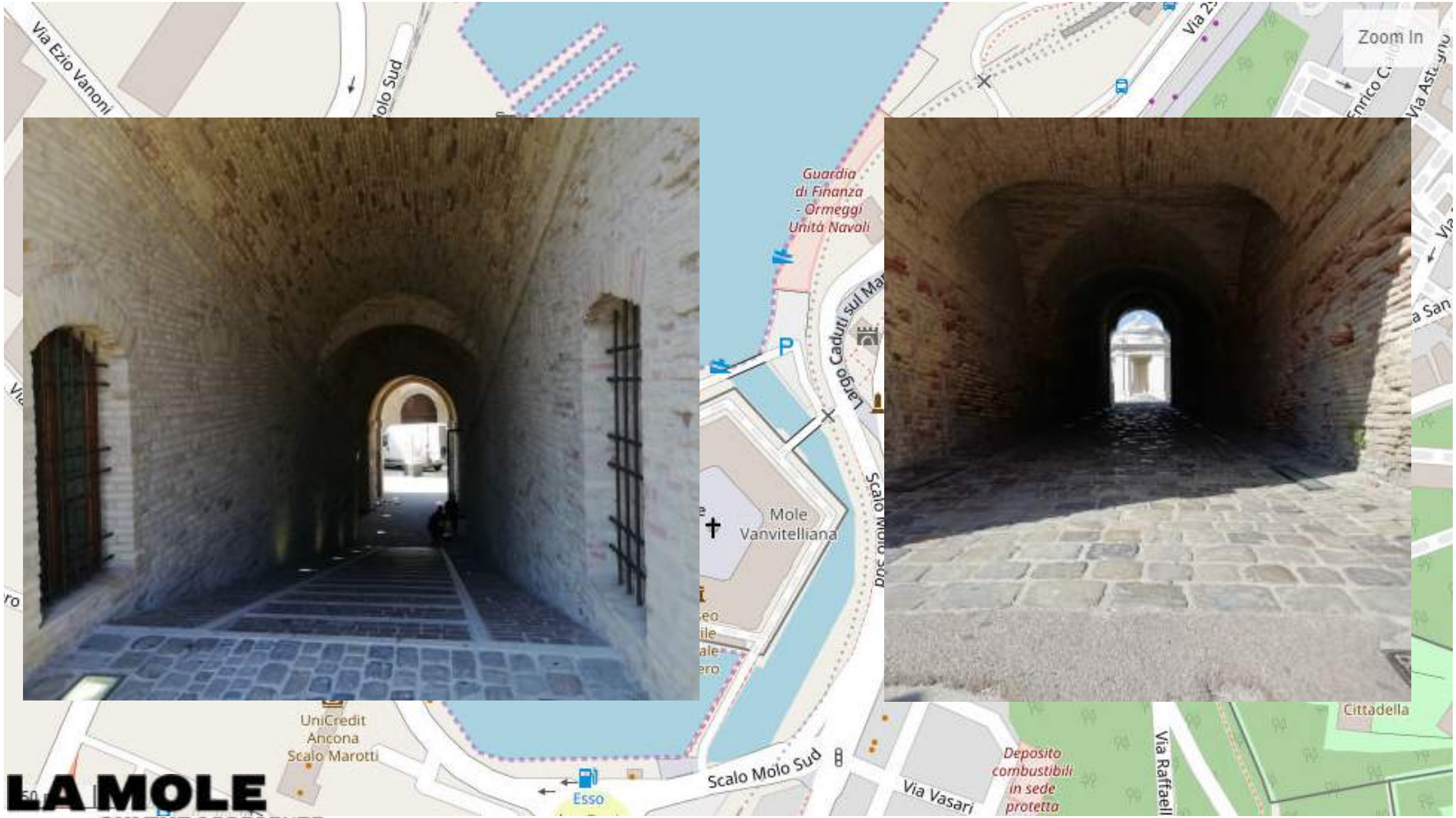



Bassa
Alta
Fonte: Ingv
ANSA centimetri


Basilica Cattedrale Metropolitana di San
Palombina
Mole Vanvitelliana
Ancona
Torrette
SS16
Via Flaminia
Barcaglione
Forte Montagnolo
SP1
E55
Montacuto
Ghettarello
Casine di Paterno
Monteferro
SS16
Spiaggia Mezzavalle
Varano
Sappanico
Gallignano
Portonovo
Montesicuro
Angeli di Varano
Poggio
Massignano
Aspio Terme
Camerano
Offagna
SP361
Sirolo
San Biagio
del Conero

PD

LA MOLE
CULTURAPRESENTE



LA MOLE
CULTURAPRESENTE

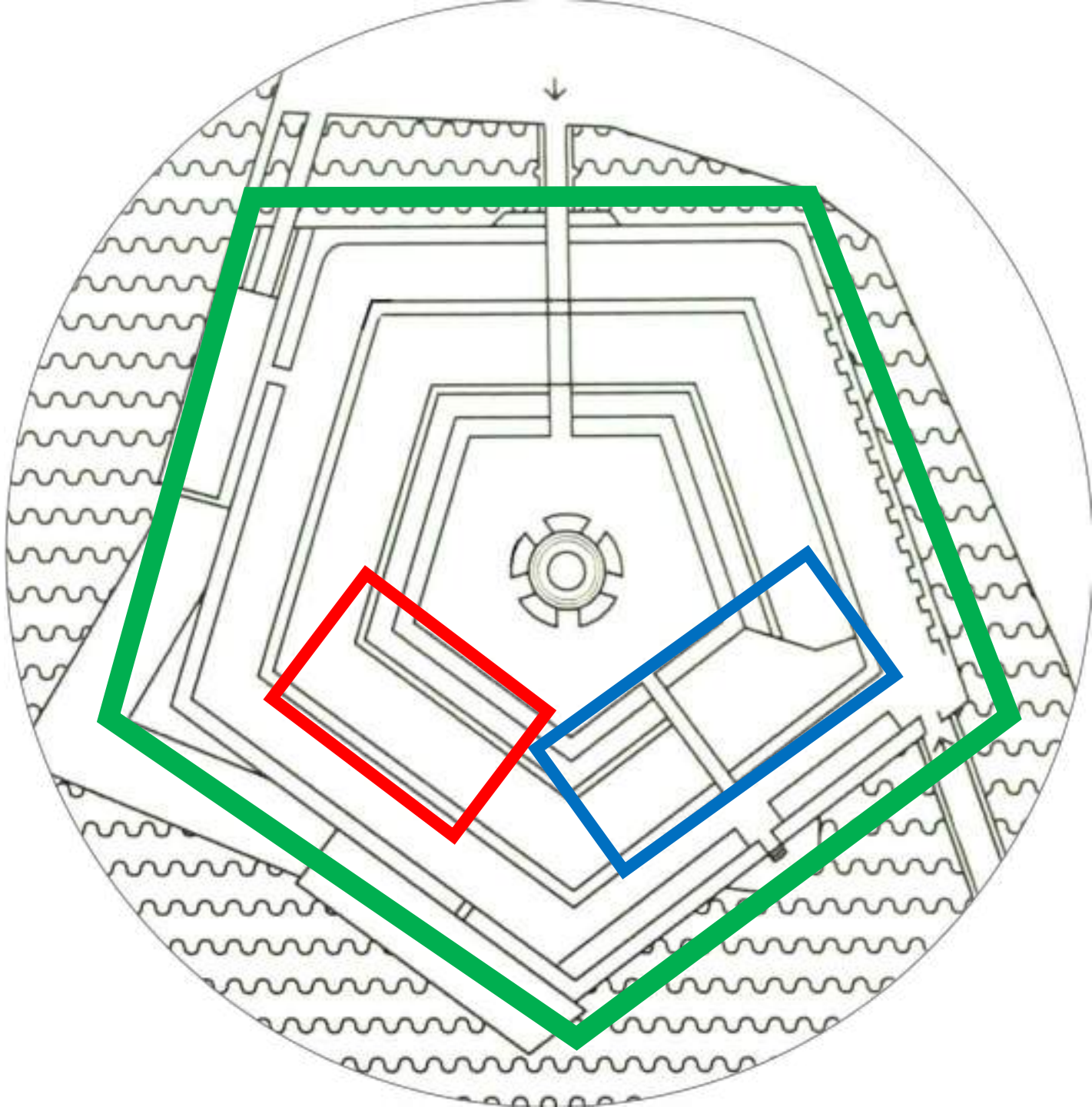
LA MOLE
CULTURAPRESENTE

Heritage Elements

- The Building

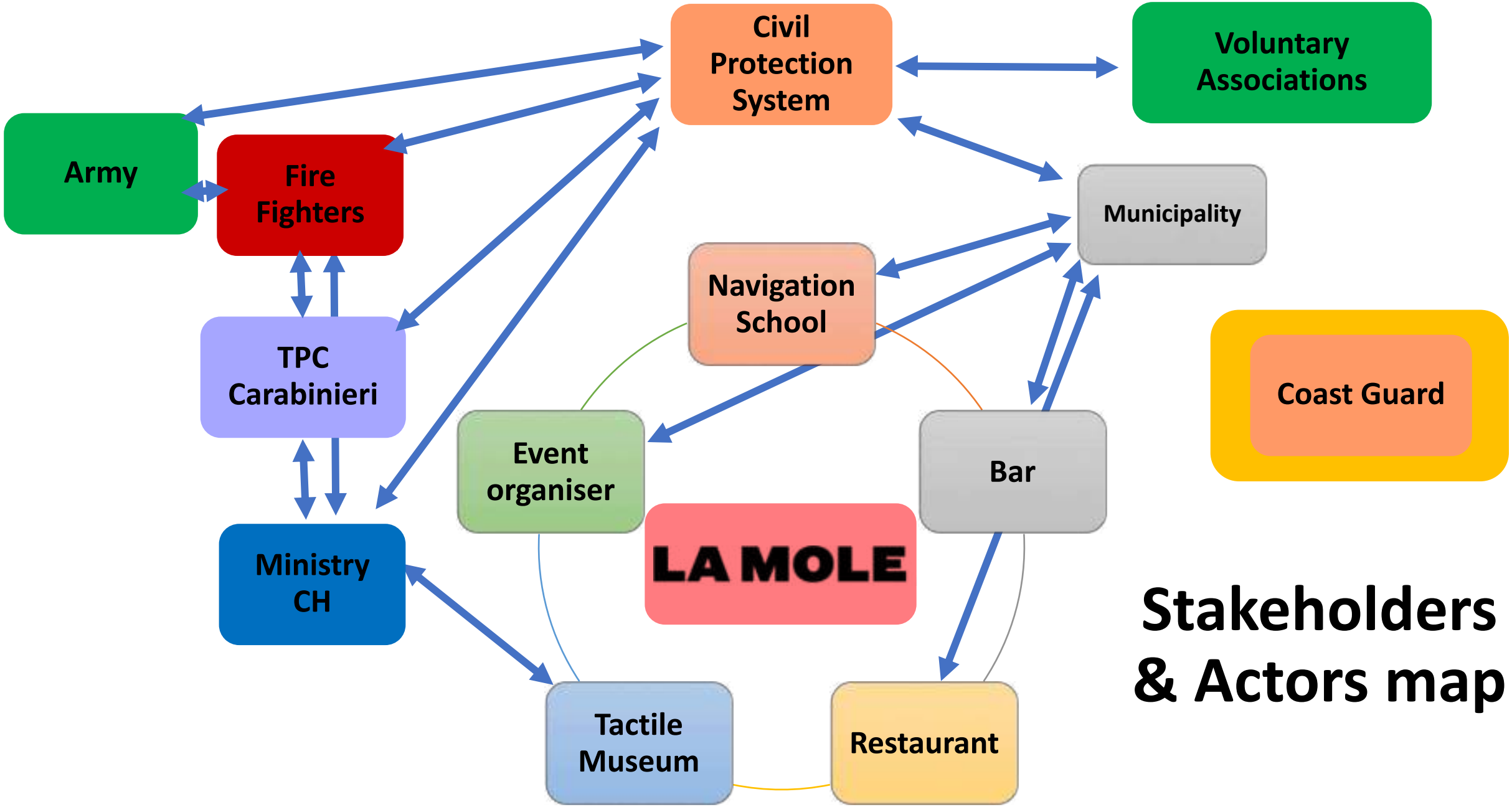
- Tactile Museum *Omero*
  - *Contemporary art collection*
  - *Replicas of important statues collection*

- Works of art rescued after Central Italy EQ in 2016 (c. 700 pieces)



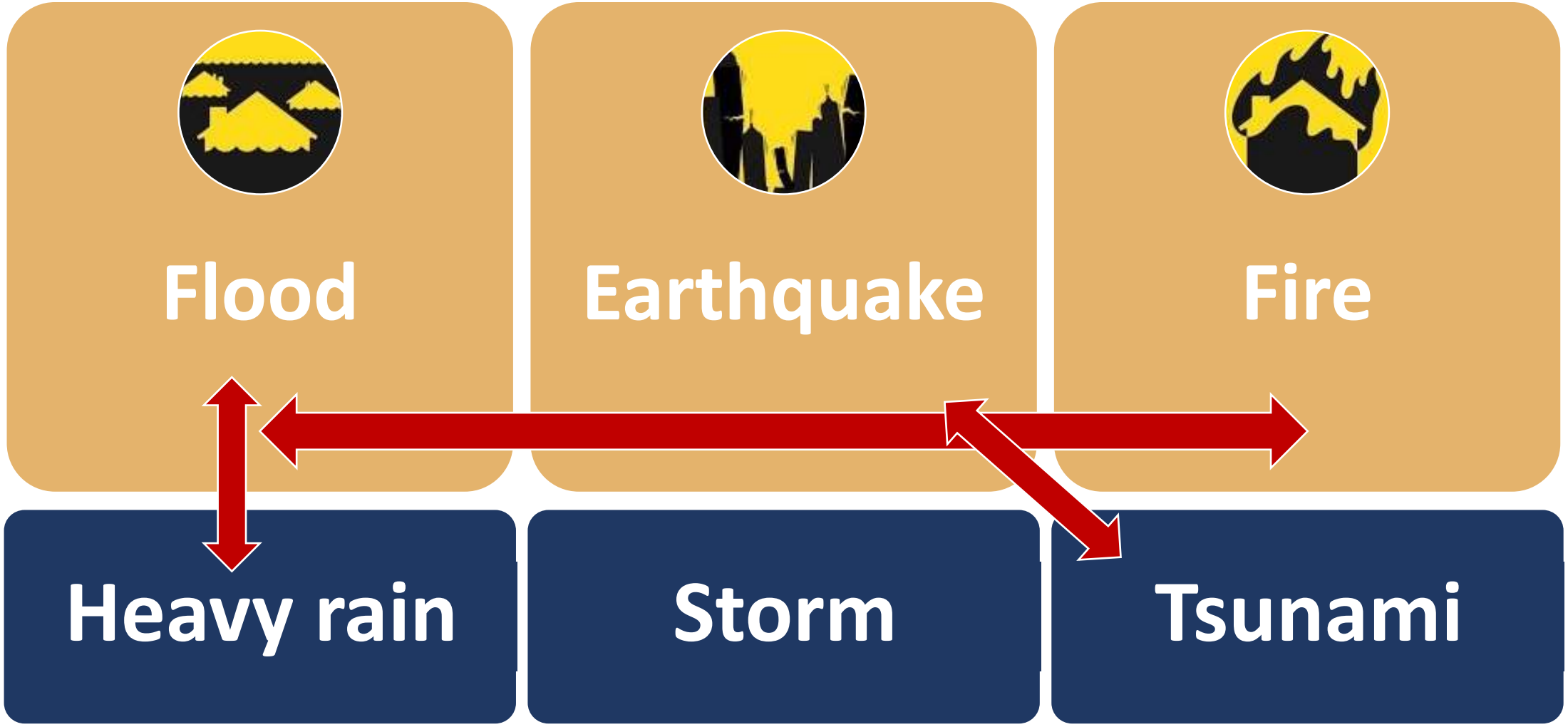
Tactile Museum Omero

Works of art rescued after Central Italy EQ 2016



Stakeholders & Actors map

Hazards for La Mole



Scenario

EQ

Friday
9:20 p.m.

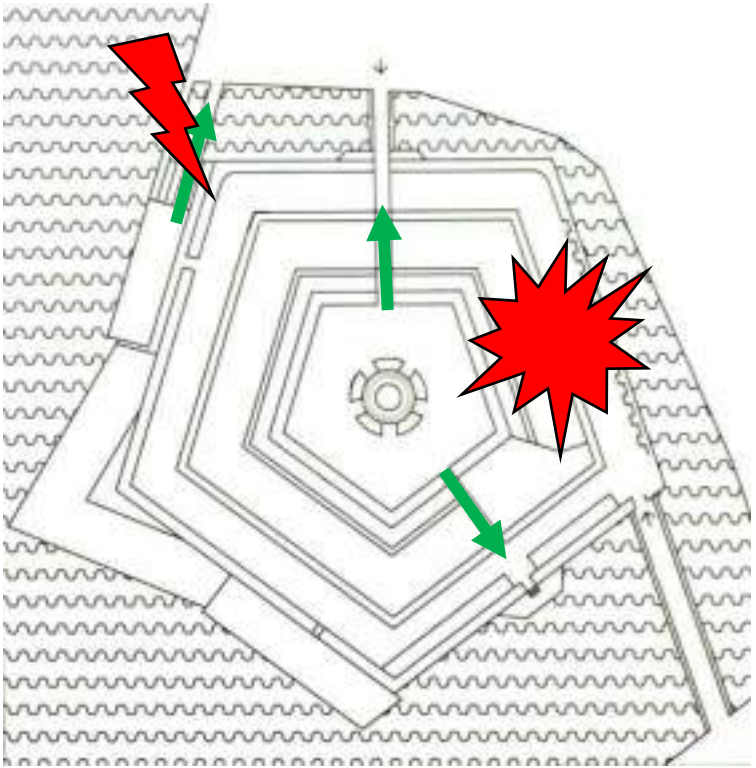
FIRE

Saturday
11:00 a.m.
Omero
Museum

1:00 p.m.
Works of art
rescued after
2016 EQ

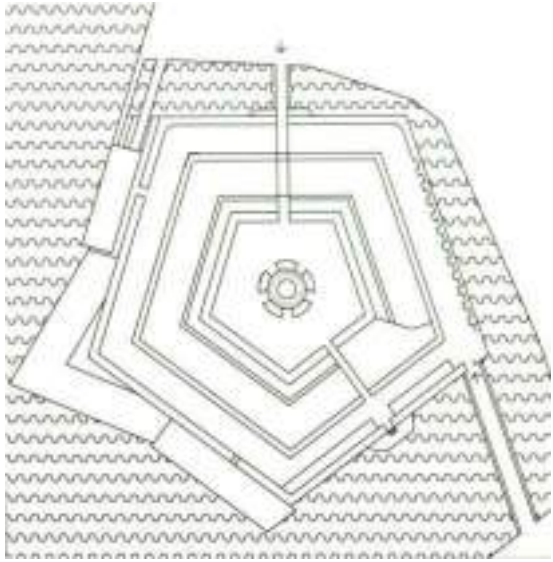
Human Life rescue

Cultural Heritage rescue



1. EQ: collapse the bridge
2. Fire in the wing under restoration
3. Found damages of the Omero Museum's Collection (EQ +Water)
4. Works of art rescued after 2016 EQ found flooded due to water pipe breakage following the EQ

Mitigation & Preparedness



Evacuation Routes

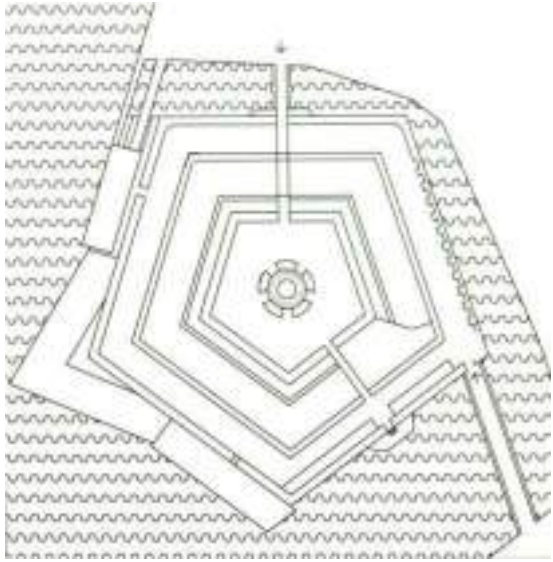
- For the tunnels: light with back-up batteries/candles installed
- Two kits for opening the gates
- Alternative route by sea: with Red Cross or Fire Brigade boats
- Alternative route by sea: Asking permission for using the private boats nearby
- Retrofitting the bridges

Wing under restoration

- Electrical isolation of the construction site every day
- Implementation of fire detectors and fire extinguisher
- Training for the workers

- Wooden roof: drencher system
- Back up water system with seawater only in case of emergency
- Traditional water resource of the fortress for drinking

Mitigation & Preparedness



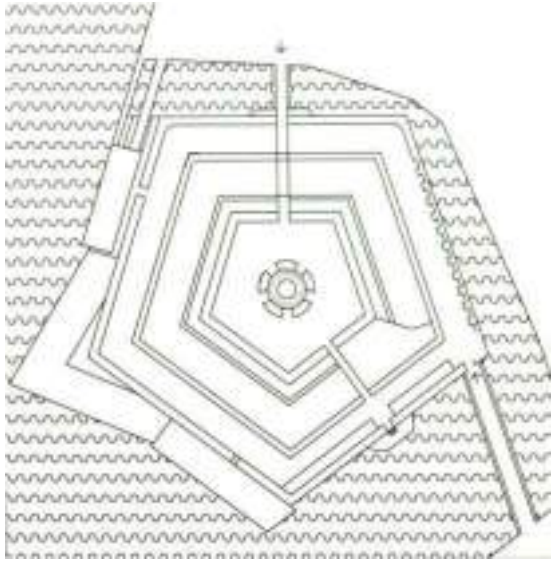
Museum Omero's Collections

- Prioritise the contemporary art collection
- Safety measured tailored for each pieces following the priority list
- UCCR Task Force for CH should be reached easily + connection with volunteers in the City/Marche Region
- Create access to fresh water from the fortress
- Prepare and store kit for dryer objects

Works of art rescued after Central Italy EQ in 2016

- Prioritise the objects (parameters: values + damaged)
- Retrofitting the storage and fixing the water leakage
- Lift the items / no objects under 40 cm
- Safety measured tailored for EQ:
  - protection from falling from shelves
  - secure statues and vertical paintings

Mitigation & Preparedness



Policy for identifying a safety storage(s)

- Identify a safety temporary storage for collections:
  MOU with owner (private/public)
- Plan the evacuation through a safety route
- Make a list of the stakeholder & volunteers for the evacuation
- Train & Re-trained team once a year

Policy for overtime work of Ministry CH officers in disasters

Policy evacuation exercise for Ancona’s inhabitants from Mole

Mitigation measures: group working

- We are going to break you in groups
- Please, read carefully and follow the instructions below:
- Time: **20 minutes**

- In the small groups:
  - Choose a leader who will share your outcomes to the main group
  - One by one, each participant shares 1 threat (secondary threat?) of his/her Museum
  - Choose ONE threat to work together and find mitigation measure/s

- Once back in the main group
- The leader will raise his/her hand with zoom application and will share the outcomes of the group