

#### 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



#### **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

**X**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



#### Visitor management policy taking into account COVID -19 safety measures

Remote access of collection records and cyber security measures

Strategic Level : Policies, Legislation

#### 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





Damage due to poor wall to wall bonding

#### Diagonal Cracking in walls around openings







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

Installing WWM around window opening

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





## 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



## Past Interventions / Additions and Alterations

#### MYANMAR EARTHQUAKE, 24 AUGUST, 2016





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/freeresources/preservation-leaflets/4.-storage-andhandling/4.2-storage-furniture-a-brief-review-ofcurrent-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

**×**Technical Level : Structural and Material

## Practice not

theory!

Source : Gael de Guichen

#### **MOUNTS AND MONOFILAMENTS**



Contour

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



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**





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

#### ★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











**CULTURA**PRESENTE

## **Heritage Elements**



- 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





## **Hazards for La Mole**





3. Found damages of the Omero Museum's Collection (EQ +Water)

n

 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 <u>raise his/her hand with zoom application</u> and will share the outcomes of the group