

# MANUAL AND GUIDELINES FOR EMERGENCY SAFETY MEASURES IN EARTHQUAKE DAMAGED MASONRY AND HERITAGE BUILDINGS

## 1

In the earthquake there are two reasons for the development of defects in any building.

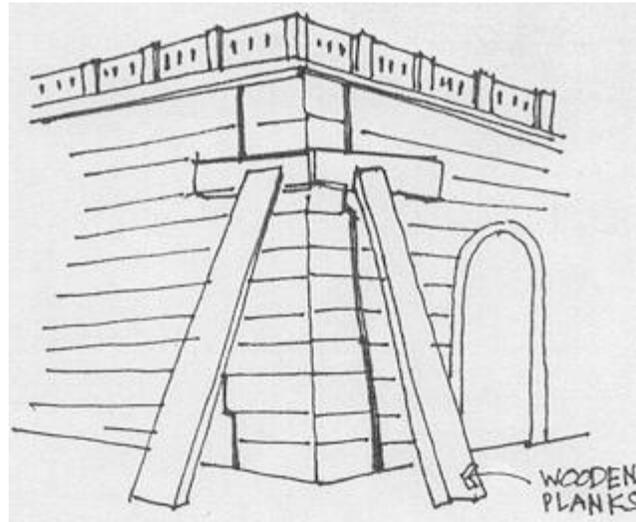
- a Due to settlement in the soil the walls settle down vertically, creating cracks in the building.
- b Due to the forces of the shake the different components of the building become loose and fall or move out of plumb.

When a building cracks, it is finding a new equilibrium in the changed conditions of the soil.

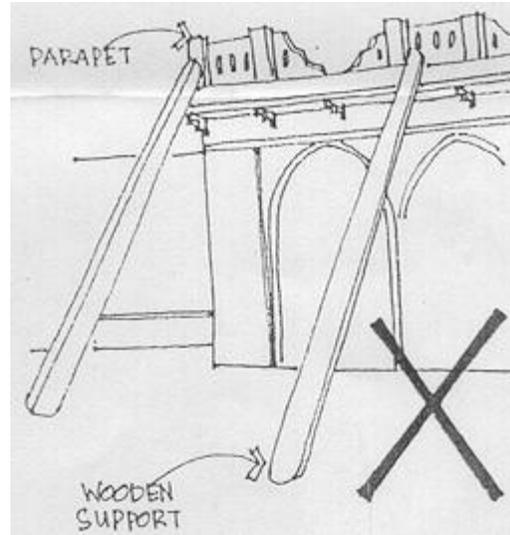
- If your building has been damaged in the 26<sup>th</sup> January 2001 earthquake the after shocks may continue to damage it further. Therefore it is *necessary to support the walls and the roof to minimize further damage.*
- In case of damaged external walls facing the public areas it is important to protect the public from injuries.
- Your building can be assessed by an architect or a sompura or an engineer for the degree of damage to decide whether the damaged part should be brought down or if it can be saved by the suggested emergency measures.
- Most buildings are designed to take two types of forces:
  1. Compression that act vertically
  2. tension that pulls the building elements horizontally

## 2

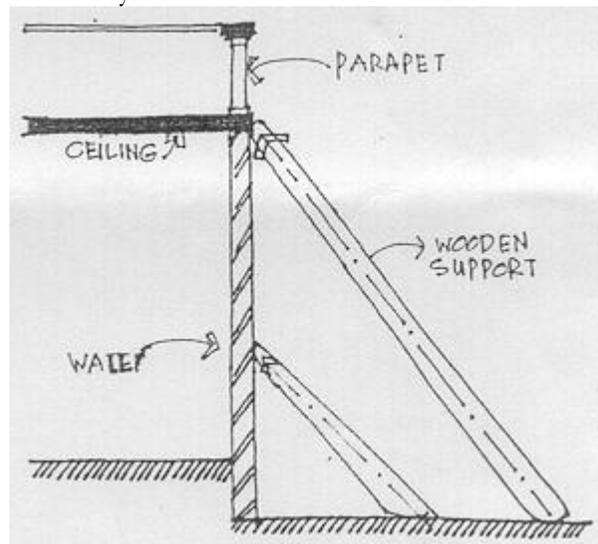
1. In cracked external corners place wooden planks across the crack and then support the planks with wooden members.



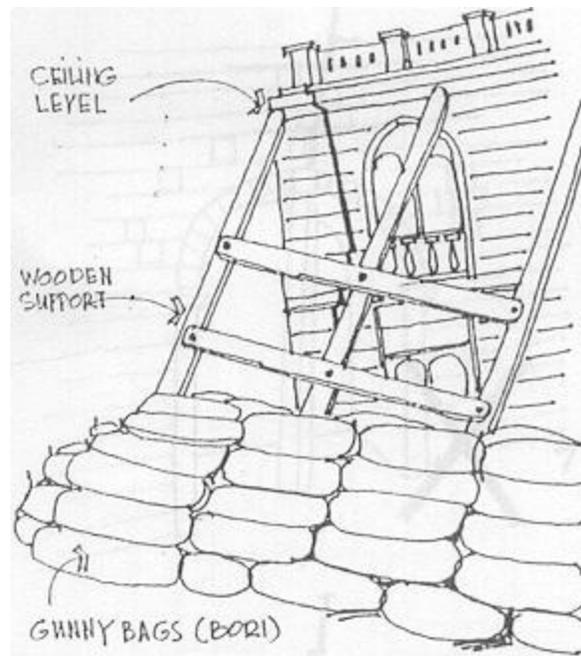
2. **Do not** prop the damaged wall at the parapet level. It may cause more damage.



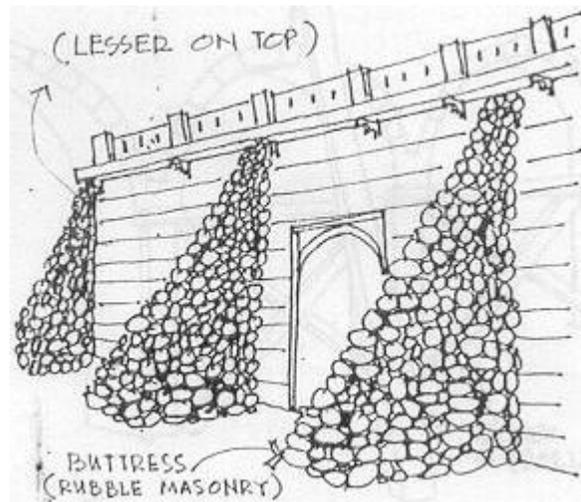
3. Propping in a single storied structure support at ceiling level. Use supports at different level, if necessary.



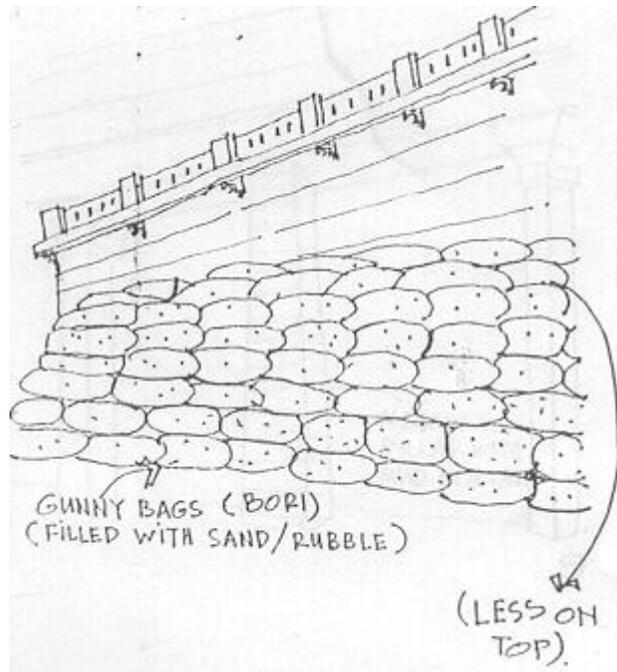
4. In 2 storeyed structures use jute bags filled with rubble or sand till the lintel level of the ground floor and then use the planks and the wooden supports. Use folded jute bags at the end of the support. At the corner of the wall use supports at various levels.



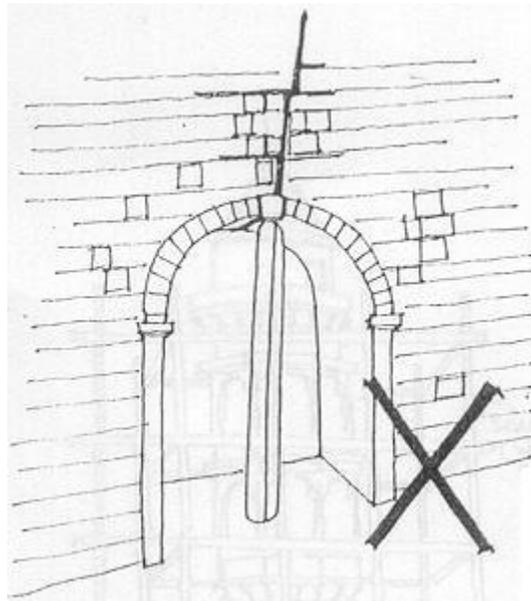
5. Long lengths of damaged walls can be supported using rubble masonry of regular intervals along the length of the wall. Mud mortar could be used.



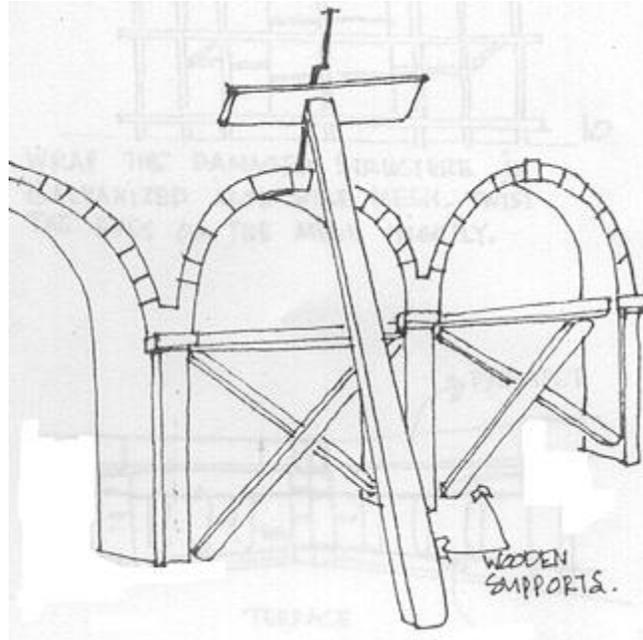
6. Jute or plastic bags filled with rubble or sand collected on site can also be stacked at intervals to support the walls.



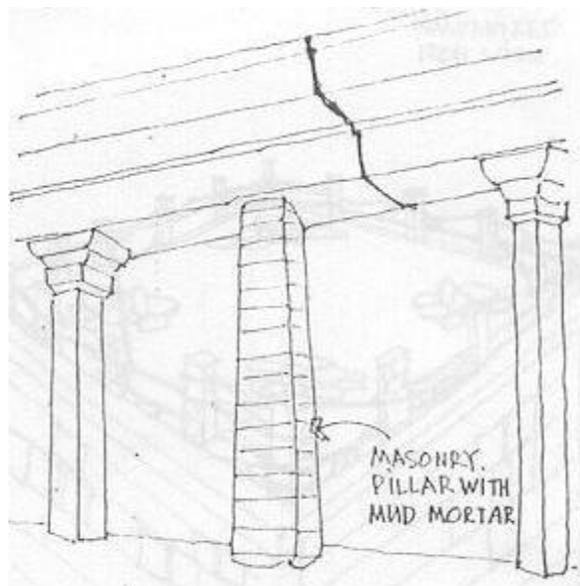
7. **Do not** support the arches at the center or along the curves.



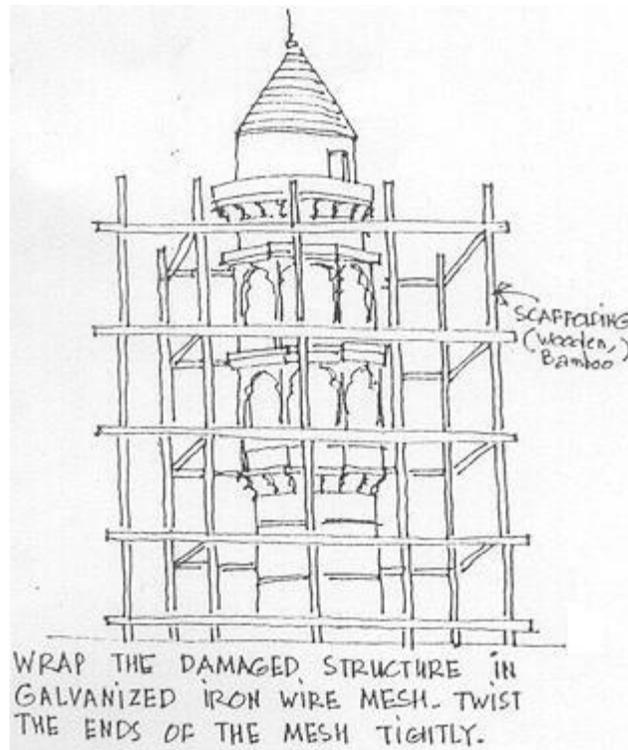
8. Support them at the spring point of the arch. Use wooden supports. In case of metal support use folded gunny bags at the end of the support.



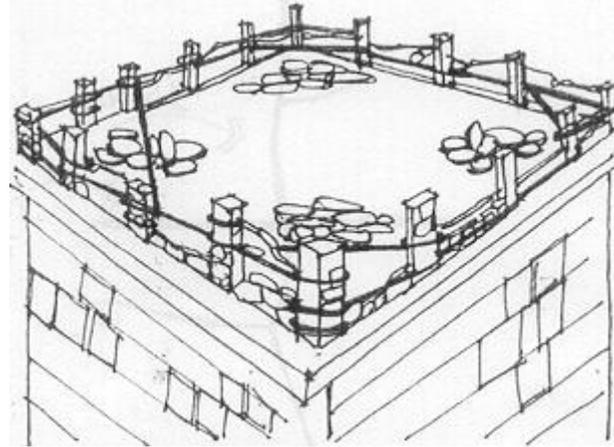
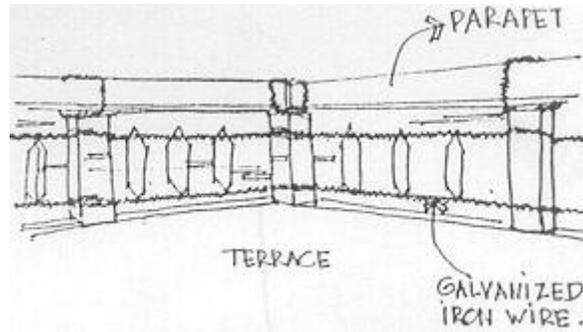
9. In a column beam situation support the beam in the middle with either a masonry pillar or stacking sand filled jute or plastic bags. If a flat ceiling is being supported with wooden or metallic supports do not forget to use folded jute bags at the end of the support.



10. For tall towers like structures erect a wooden scaffolding all around and carefully remove all the loosely hanging elements. In case you are dismantling arches, **do not** remove the keystone.



11. On roofs tie the loose damaged parapet with GI wires (Galvanized Iron). Collect the rubble either at the corners or at the periphery. **Do not stack in the middle of the slab or on the cracks.** Too many people **should not** get on the top of a damaged roof at the same time.

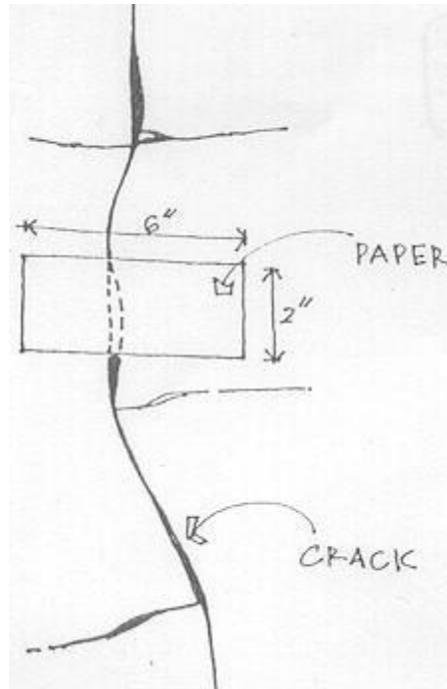


## MONITORING CRACKS

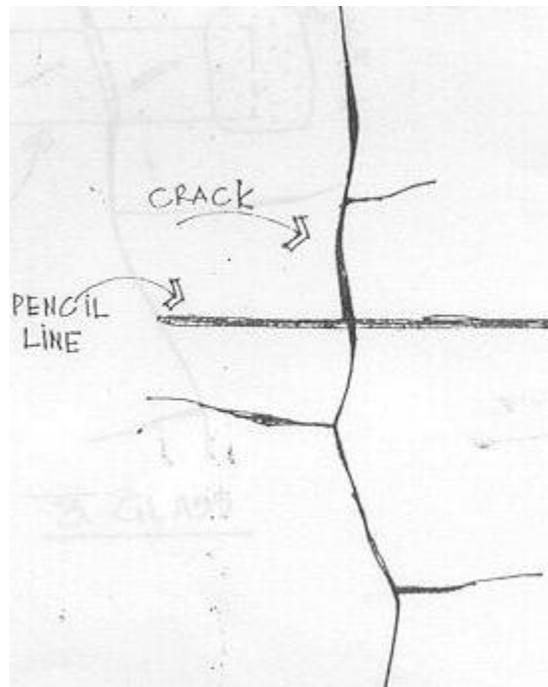
### 3

The region of Gujarat is still experiencing tremors, the structures may still be settling. Certain measures are necessary to monitor the existing cracks to ascertain that the building is settling or not. Few of the measures are:

**1. Striking Paper Across The Cracks:** Strong paper of size 2" x 6" should be struck across the crack with strong glue. The paper should be kept tight along the length of the width. If the wall is till settling the paper will tear. This method is good for interiors only.



**2. Marking Minor Cracks By Pencil Line:** With help of ruler and pencil draw a straight line across the crack. If the pencil line on either side of the crack gets misaligned the wall is settling.



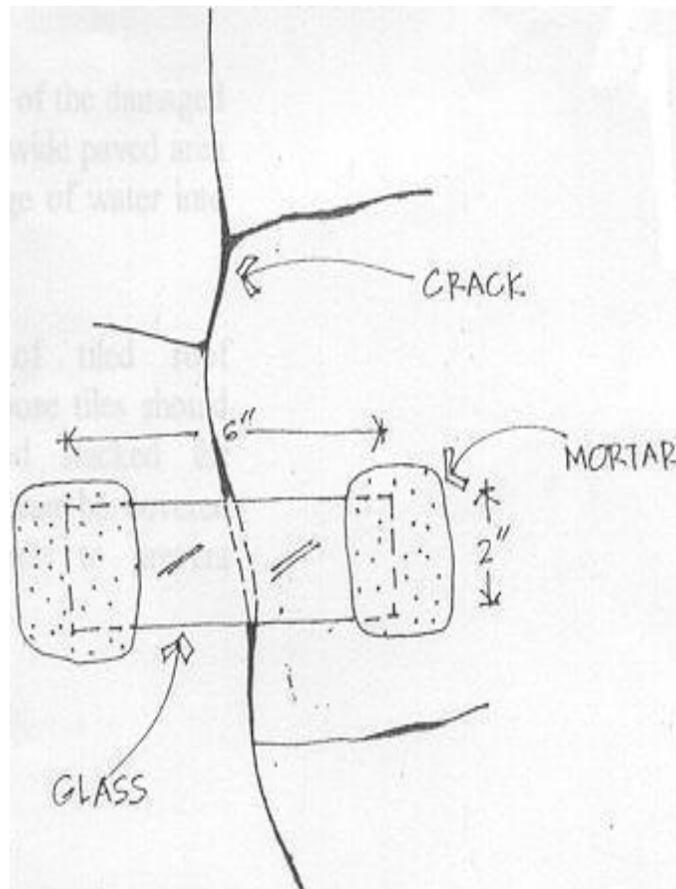
**3. Sticking Glass Across the Crack:**

*Step 1:* Roughen the surface on either side of the crack and wipe the area with a wet cloth to remove the dirt and to wet the surface.

*Step 2:* Mix 1 part cement and 4 parts of sand and water to make a mortar and apply cement on either side of the crack. And place the glass strip to secure it in position.

*Step 3:* After 24 hours, wet the cement to cure it. If the wall is settling the glass strip may break. This may be continued for at least two months (end of April).

**Mark the cracks that are widening with a small red mark.**



## **PROTECTING THE BUILDING IN THE COMING MONSOON**

4

The monsoon is soon expected and may damage many of the standing buildings further. Since many parts of Gujarat have black cotton soil, the water may change the soil conditions causing further movement in the wall. Moisture should be prevented from entering foundations and broken walls.

Do not throw away the plastic sheets that have been distributed by the various agencies as they can be used to protect the building from water through cracks in the ceilings. Seal the cracks in the walls with the help of mud mixed with cow dung and cement (1 part of cement and 15 parts of sand) mixture.

Protect the edges of the damaged walls with 2 feet wide paved area to prevent seepage of water into the foundations.

In case of tiled roof buildings, the loose tiles should be removed and stacked for re-use. The roof can be covered with plastic sheets to prevent seepage of water.

## **GUIDELINES FOR IMMEDIATE/EMERGENCY RESCUE OF HISTORICAL AND LANDMARK BUILDINGS IN EARTHQUAKE AFFECTED GUJARAT**

After assessing the condition at ground, the task force felt that there is an urgent need for:

- **Dismantling** needs to be done of parts of buildings that may be unstable or are extensively damaged and sections that have partially collapsed.
- **Preservations** in-situ is to be done for buildings and sections of building that have some damages but can be restored back, using conservation techniques.

It should be noted that combination of all the three may be applied to sections of the same building depending upon its condition. Please refer to the enclosed INTACH list of surveyed buildings to determine its heritage value and what may be done with it.