USER GUIDE

For Housing Safety Campaign in Earthquake Affected Areas

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About the Housing Safety User Guide

This user guide is developed based on piloting of a campaign in 20 villages in Bhachau taluka of Kutch District. The campaign concept was articulated after consultation with Mr. Vivek Rawal (People in Centre), Mr. Rajendra Desai (NCPDP) and Mr. Mahavir Acharya (Hunnarshala). The films, material and publications developed by these experts was of great help in systematising the steps of campaign for housing saftey in Kutch district of Gujarat. We are thankful for the support of these experts.

People in Centre Consulting has developed the poster set based on thier years of work on earthquake saftey in Kutch district. Our sincere thanks to the team.

Without the support of the artisans, house owners and Gram Panchayat representatives this campaign would not have been made the desired impact. Our sincere thanks to all.

We are greatful to Gujarat State Disaster Management Authority (GSDMA) in particular Dr. V. Thiruppugazh, IAS for the encouragement to pilot the housing safety campaign and draw the lessons which finally led to the production of this user guide.

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Limited copies are available in print form. Digital/Electronic copies are available for dissemination.

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Housing Safety Campaign in Disaster Prone Areas

Background

Housing damage and collapse in disasters is a major cause of injury and loss of life. It also adversely affects the lives and livelihood of people. Rebuilding a house takes out life long earning of a family. It is, therefore, of utmost importance to understand the vulnerabilities of existing housing and identify the extent of risks so as to undertake disaster mitigation measures. Within the framework of Community Managed Disaster Risk Reduction (CMDRR), preventive and mitigation measures along with community readiness and surveillance are main aspects. As part of risk and vulnerability assessment, housing stock also need to be reviewed scan for the comprehensive risk reduction plan. In the context of housing, apart from economic and social capacities, physical vulnerability and technical vulnerability are important aspects in the assessment.

There are millions of rural non-engineered houses have been constructed by people themselves involving local artisans and using materials that are easily available. There is a need to revisit the structural vulnerability of these houses. Looking at the vulnerability assessment, the community can be made aware to introduce safety features in the house constructions.

This user guide is prepared based on the awareness campaign organised in Bhachau Taluka of Kutch district during 2012 by

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Unnati. In the reconstruction of the 2001 earthquake affected areas, earthquake safety features were implemented. After the decade of the reconstruction, it was observed that some of the critical safety features were ignored in the new construction or extensions/up gradation of the existing houses. An awareness campaign was organised promoting safety in the housing construction. This user guide is developed to facilitate pre campaign assessment and preparation to conduct the campaign event.

Campaign Process

The awareness campaign was organized to promote a culture of disaster preparedness in the communities. It sensitize the community, house owners, artisans on the issues of housing vulnerability and the importance of safety as preventive measures to reduce life risk during any hazards. It is a mutual learning and sharing process between different stakeholders like house owners, artisans, representative of Panchayati Raj Institutions (PRI), building material producers and suppliers. It helps to include safety features in the housing design, choice of material and construction practices. The entire process can be divided in two phases: (i) Preparatory phase (ii) Implementation phase.

Preparatory Phase

Along with selection of houses, housing typology and housing elements are at risk needs to be identified in the selected villages. New ongoing construction can be the best site of community level discussion. After the appropriate rapport building with the community, meetings can be organized with community representatives, artisans, PRI members to discuss the

importance of safety parameters in the houses. It is always easy to work out if the housing stock in the village can be broadly categories in 4 to 5 typologies based on housing design, plan and construction material. Following processes could be followed to conduct the need assessment for awareness campaign based on the housing vulnerabilities of different typologies.

1. Community level housing safety awareness can be best done when people themselves identify the safety features through transect walk with artisans, house owners, PRI members. The parameters includes site, design, plan and construction practices. A small group discussion can be organized at the site with the members accompanying the transect walk.
2. After the preliminary assessment of four to five houses of different typologies, the facilitator can hold a meeting to summaries the enabling factors which enhance the housing safety and also gaps or limitations which need to be improved.
3. After the village visit contents and the agenda for the awareness campaign event can be drawn out. A village specific list of issues can be prepared to plan the awareness campaign.
4. Date and schedule for the awareness campaign event should be discussed and decided during the debriefing meeting considering villagers availability.
5. Responsibilities should be shared among the village level volunteers, artisans and community members for the campaign event.

After the need assessment of identified houses and preparatory meetings, the facilitators has to work on the preparation of educational material, methodology and tools for the campaign. Awareness materials like posters, games and models which explain the safety issues and corrective measures for the safe housing need to be collected. Models can be used to explain some of the technical aspects. These models can be developed for different hazards and housing typology.

Implementation of the campaign

The campaign was conducted at multiple sites in selected villages of Bhachau taluka of Kutch district. It was an interactive process with house owners, masons and PRI members. The facilitating team spent about an hour at each site discussing about the safety issues before coming to the campaign meeting. In the beginning of the event, the facilitator conducted a transect walk around the identified houses. After that all members got assemble at a central place for discussion. Along with the primary interaction the facilitating team arranged the poster set, models and placards on the site and the local volunteers/masons explained the issues related to safe housing of the village. Then the facilitators explained each of the posters starting from site, foundation, wall, band and joints and roof and simultaneously relate with the identified house to educate on the different safety aspects of the house.

Sample discussion points

1. Site and foundation:

Based on the prior assessment, discussion can be done on the importance of site and foundation for the safety of the houses. The key points are depth of the foundation in the different soil types, types of material and quality of material.

2. Housing design:

It includes issues like shape of the houses, uneven changes in additions or extensions, length of the rooms, projections, location of doors and window opening.

3. Material and Structural systems:

The masons and facilitating team can explain about importance of quality of construction material like cement, sand, bricks/ stones along with construction practices like joineries, bands and RCC columns

4. Extensions, Compound wall and parapet:

It may be told that some of the key safety features were ignored or missing from the new extensions like addition of rooms or kitchens; construction of compound wall and parapet of the RCC roof.

5. Construction material:

Quality of locally used material such as sand, water, cement concrete blocks, steelbars, stones and bricks are important concerns for the safety of the houses. Pre testing, preparation of such material before use for construction can be discussed during the event and local masons can share the local popular practices regarding such material.

6. Trained masons and artisan:

Importance of trained masons, artisans is one of the points should be discussed during the event. The facilitating team can provide information about training programmes for the mason and

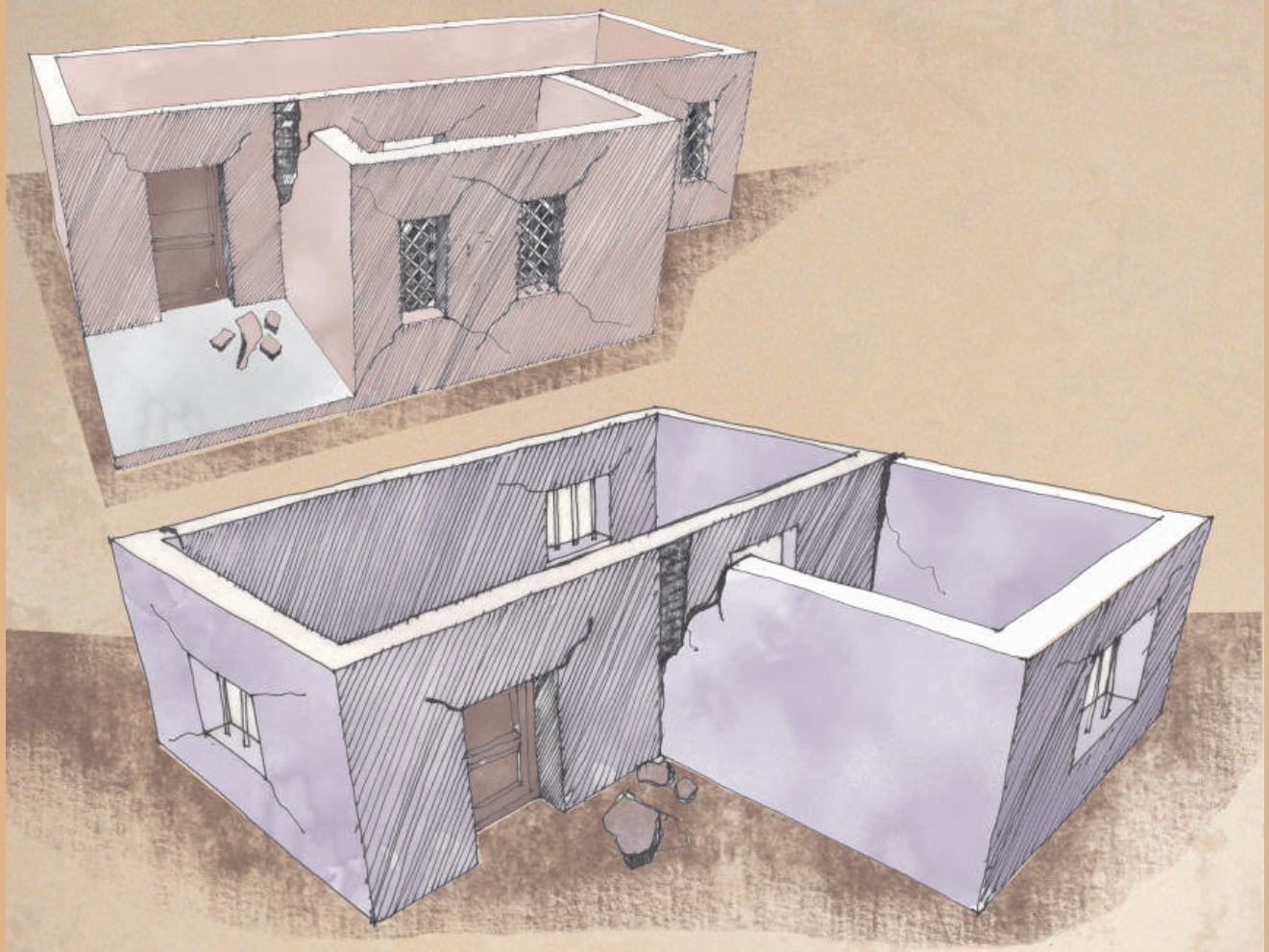
artisan training. Masons should be encouraged to share concern for unavailability of proper tools and equipment for the corrective measures and retrofitting.

Points to remember in organizing a campaign

1. Appropriate timing for such events should be discussed and decided in consultation with community to ensure participation of key stakeholders and masons in the campaign. Monsoon season, harvesting season or festive seasons should be avoided for such events.
2. Pre campaign need assessment is very important for the each village or location, it gives the facilitators fare idea about different typologies of the houses, design, material, construction practices etc. it helps the facilitators to visualized the local conditions about safety of the houses
3. Materials should be in the form of posters, models, films and pictures as the technical issues can be best communicated through these mediums.
4. Pictures, models and illustrations should have the local references so that the community and masons can easily relate with their local conditions.
5. To make the event interactive and interesting, some of the popular method like sheriferi (hamlet yatra), slogan shouting, banners can be used. The team can identify some of the house owners

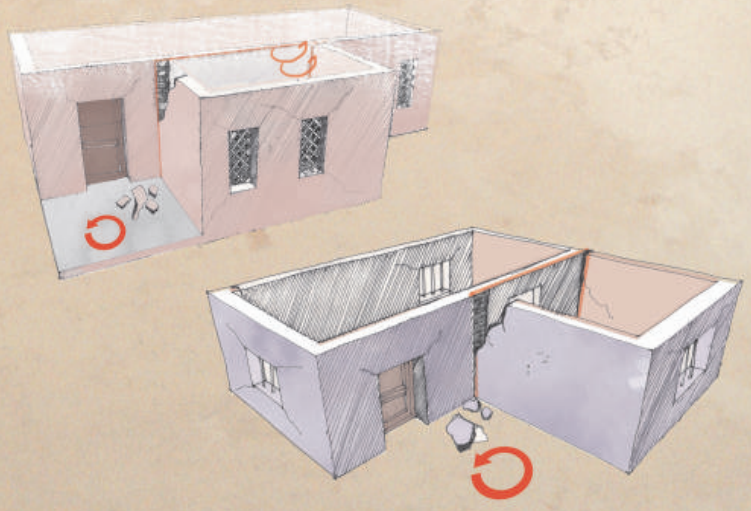
who are going to construct new houses in the near future so that they can be oriented specifically on the safe housing.

6. The facilitating team should be comprised of person having technical and social background so it will help the team to interact with the community
7. The locations of the housing safety discussion shall be at a place where the posters and banners can be displayed easily.
8. Normally, the local communities and masons are afraid of housing vulnerability assessment, hence the team should make efforts to reduce their fear by confidence building reassuring that unsafe houses can be retrofitted and made safe.
9. PRI members should be involved in the process of assessment and in the actual event so that they can leadership role in addressing housing safety.
10. An action points or road map could be discussion in the summing up of the event so that the community, PRI, mason guild or any other CBO can follow up in the future.
11. Other stakeholders such as building material producers and suppliers, petty contractors, mason guilds could be invited during the campaign to share their experiences about safety and they can also learn about need for safety features in different aspects of housing constructions
12. To promote social housing and green housing special massages and inputs could be added in the campaign. Community assets like Panchayats, School, and community centers can also be assessed during the campaign.



Irregular Forms

Irregular shape of the buildings induces torsional forces causing the structure to twist. This causes damage at the junctions where simpler shapes join. Damage can result in collapse of walls and serious threat to structure.



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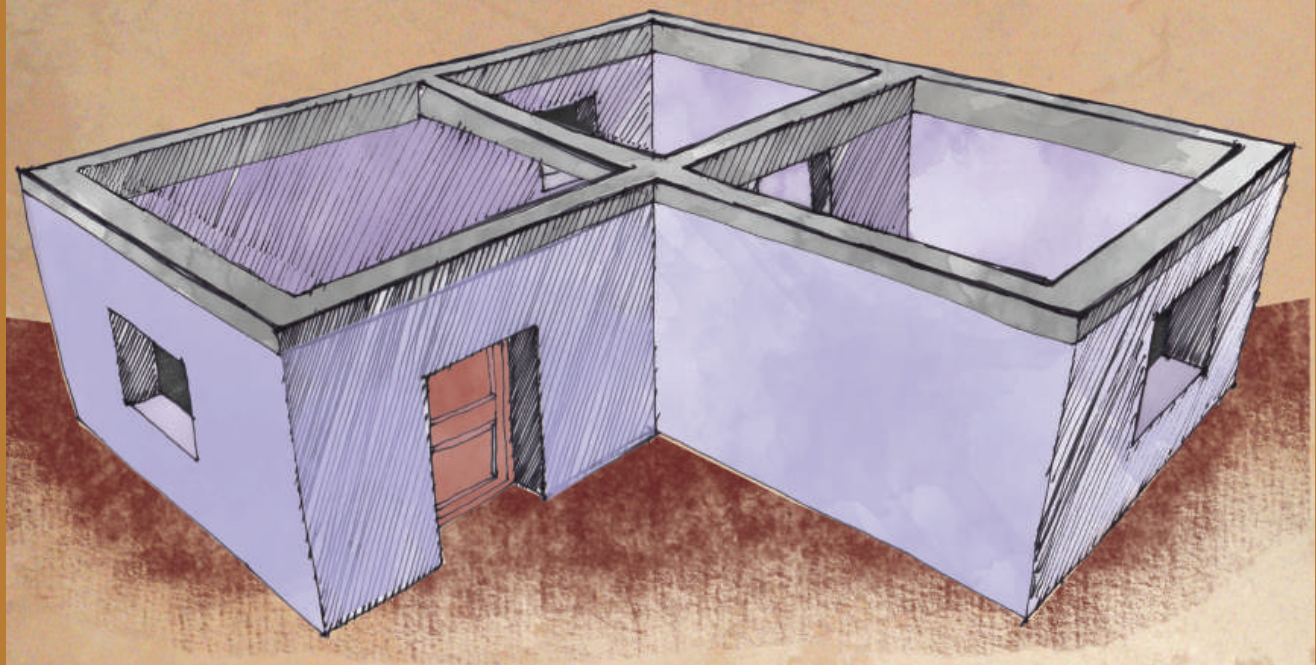
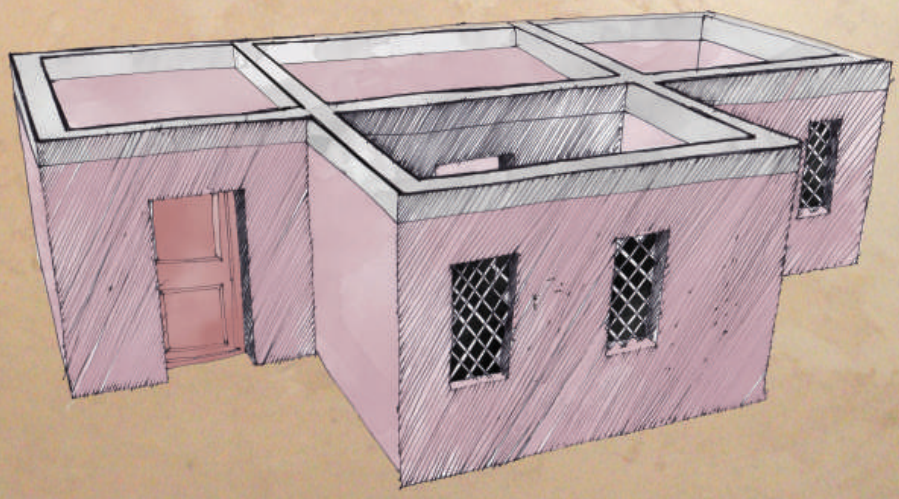


Strengthening Buildings of Irregular Forms

To strengthen an already constructed irregular shaped building, add lintel bands and roof beams in such a way that it gets divided in rectangular shapes. Some examples are illustrated. Irregular shaped buildings with lighter roofs tend to be more vulnerable.



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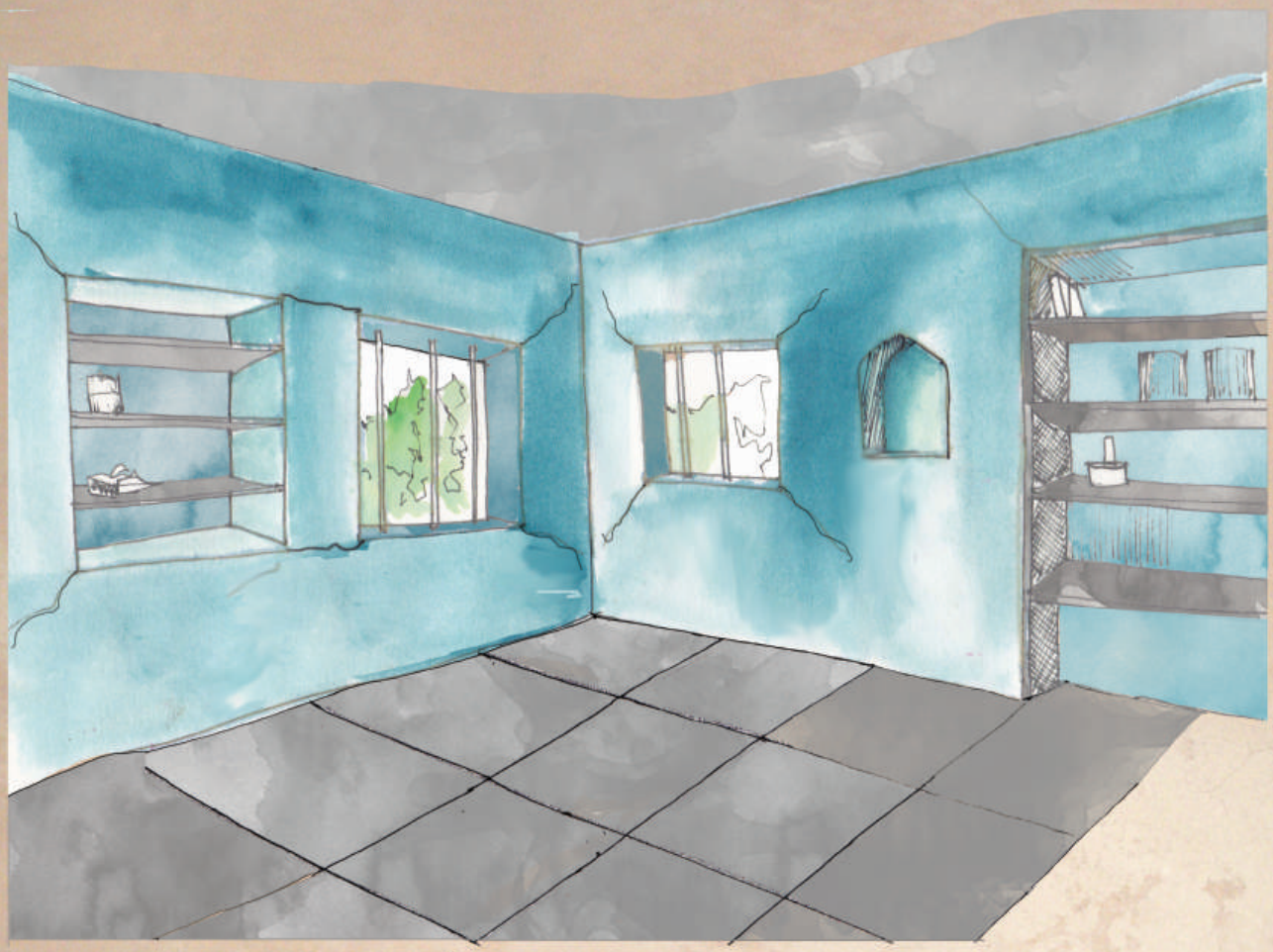
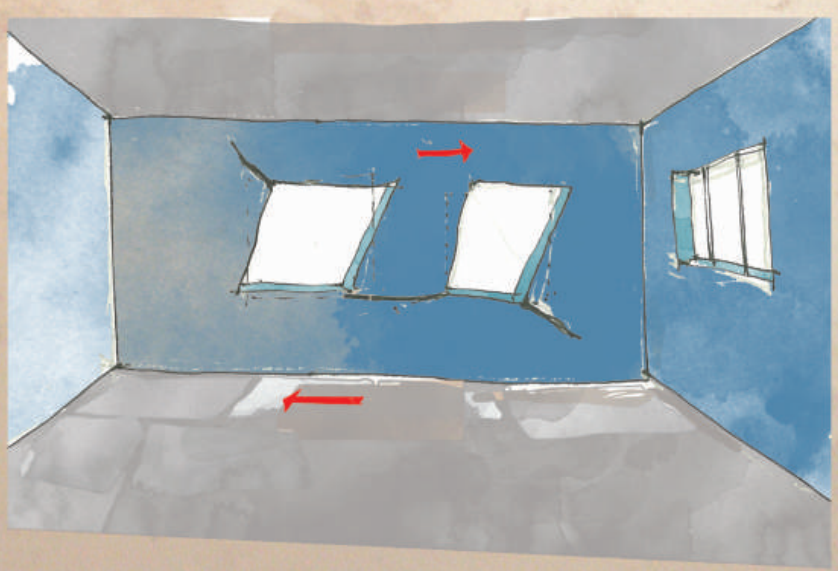


Diagonal Cracks at Openings

Diagonal cracks appear around the openings due to earthquakes. These cracks are due to shear force caused by earthquake shaking. If there are series of openings, these crakcs may significantly damage the walls affecting its strength during earthquake.



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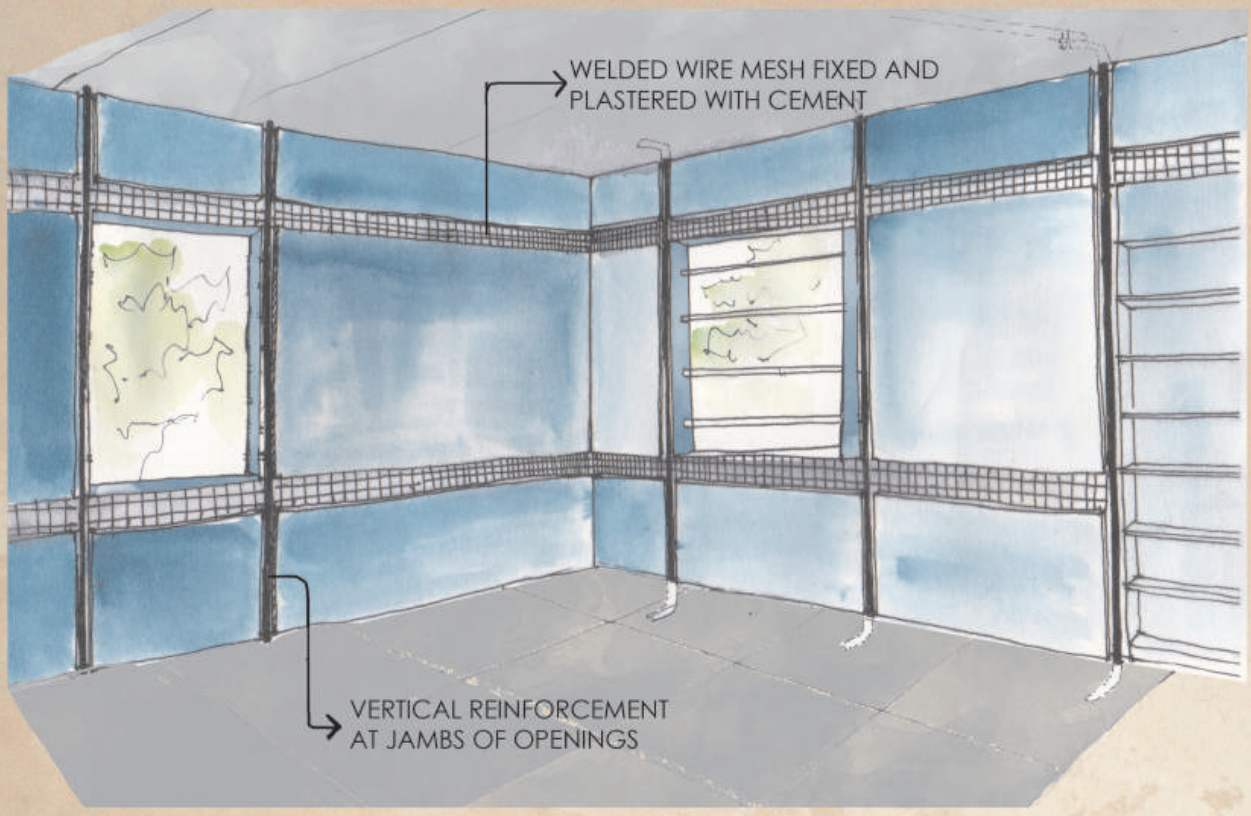
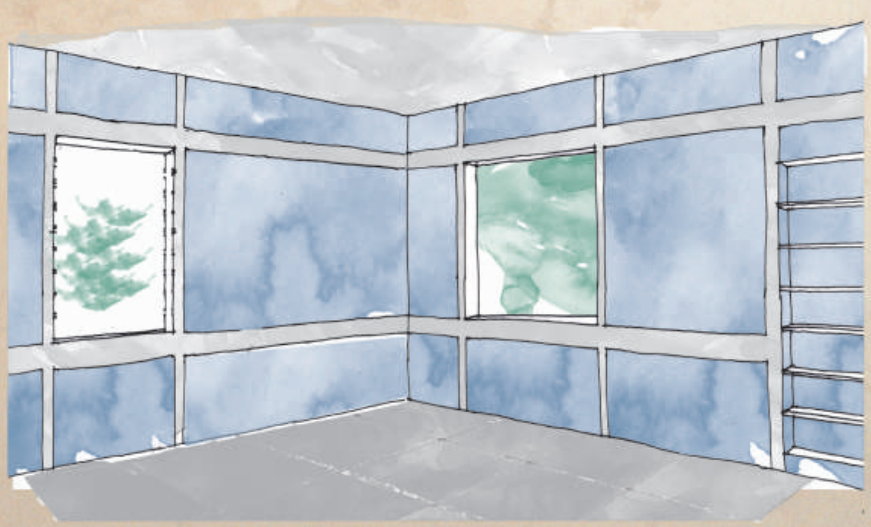
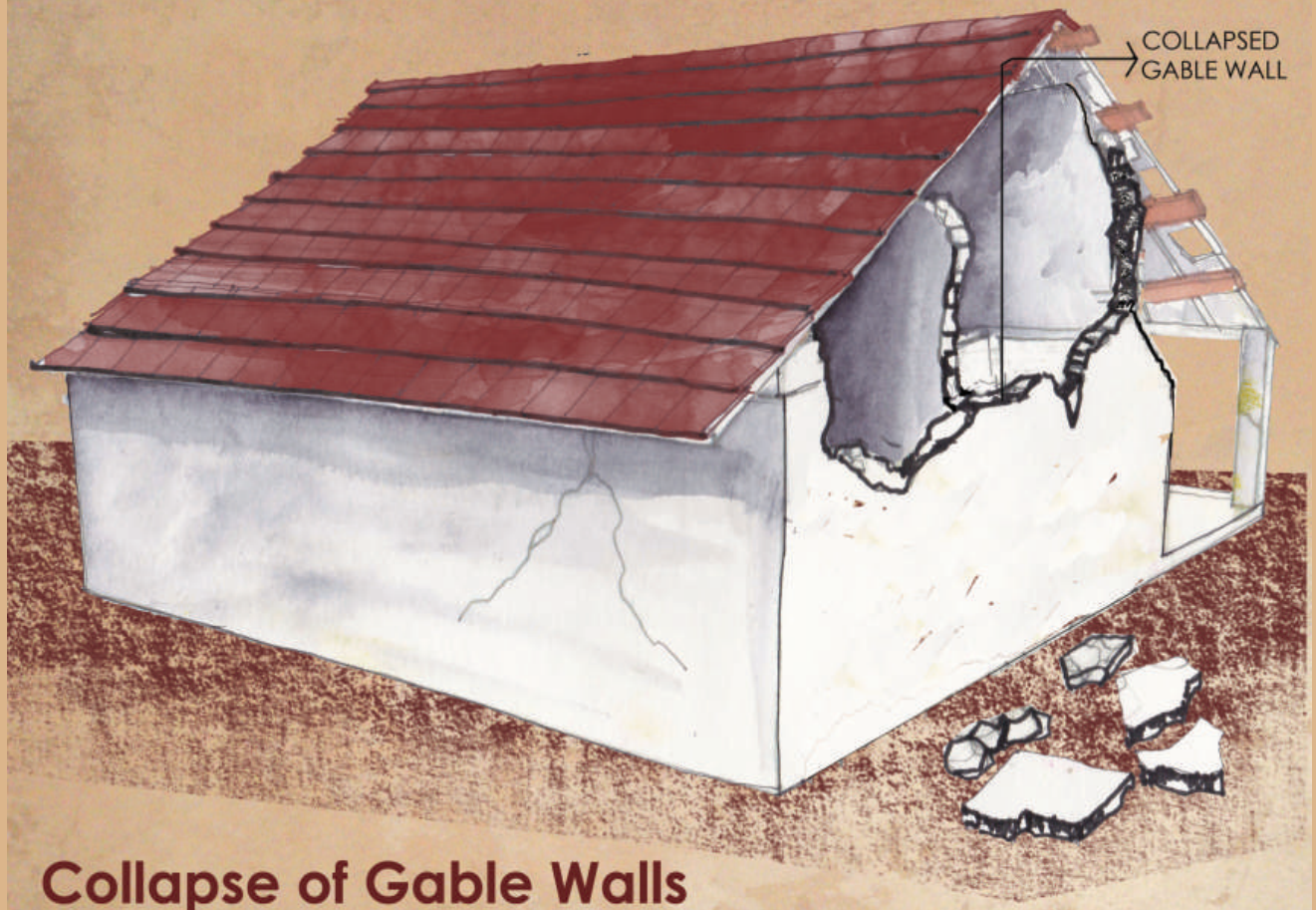


Avoiding Cracks at Openings

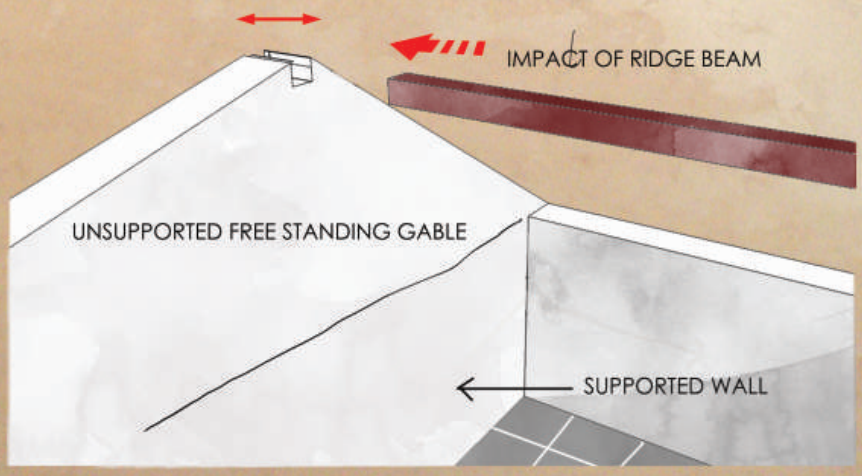
Adding ferro-cement belts at sill and lintel level and vertical reinforcement at the jambs of the openings will strengthen walls against shear cracks. Vertical reinforcement should be embedded inside the floor and roof slab.

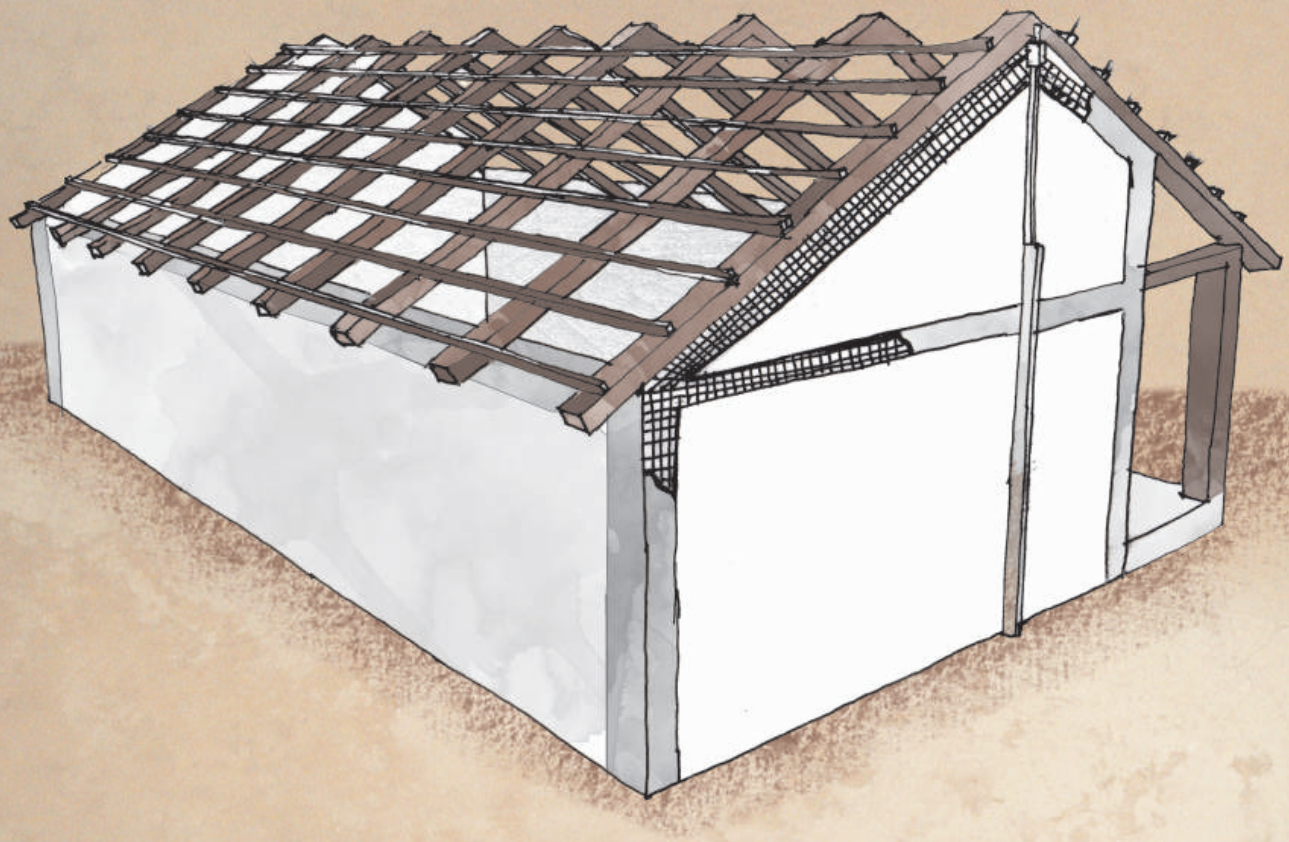




Collapse of Gable Walls

As gable wall is unsupported by cross walls and acts like a free standing wall, it is vulnerable due to shaking. Moreover ridge beam, if not fixed and tied to the wall, acts like a hammer and causes impact on top part of the gable. Hence gable wall can collapse during earthquake.





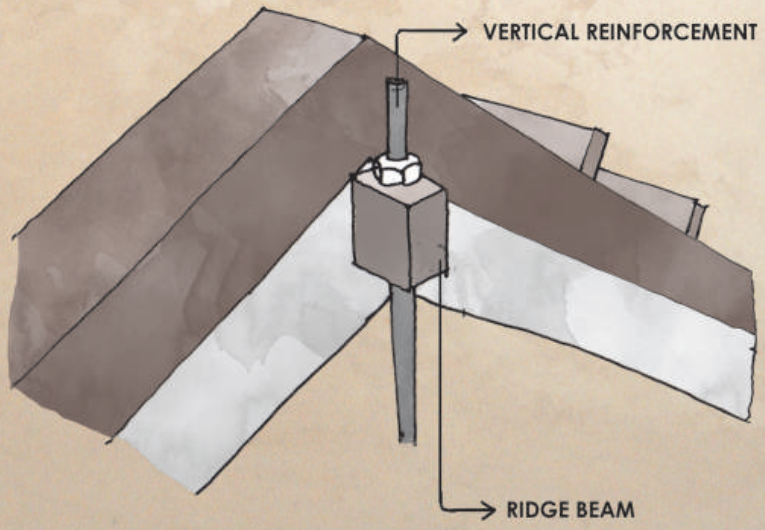
Strengthening of Gable Walls

To strengthen the gable, following three modifications should be made.

a. Add a ferrocement belt on the gable end connecting it with lintel level belt.

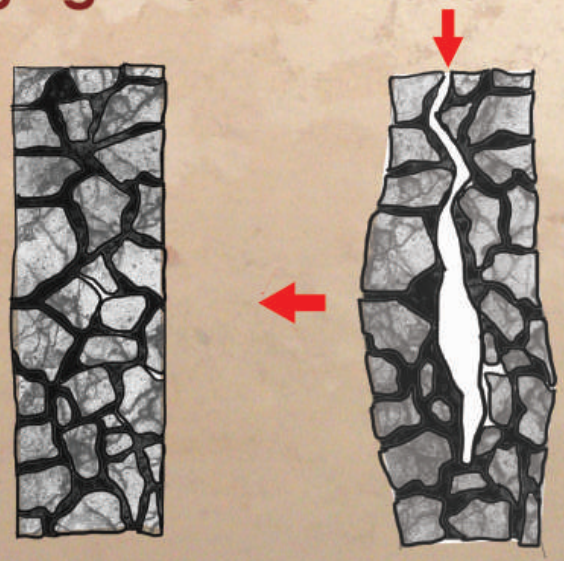
b. Add a vertical reinforcement in middle of the gable wall connecting it with all horizontal bands/belts at plinth, sill or lintel level.

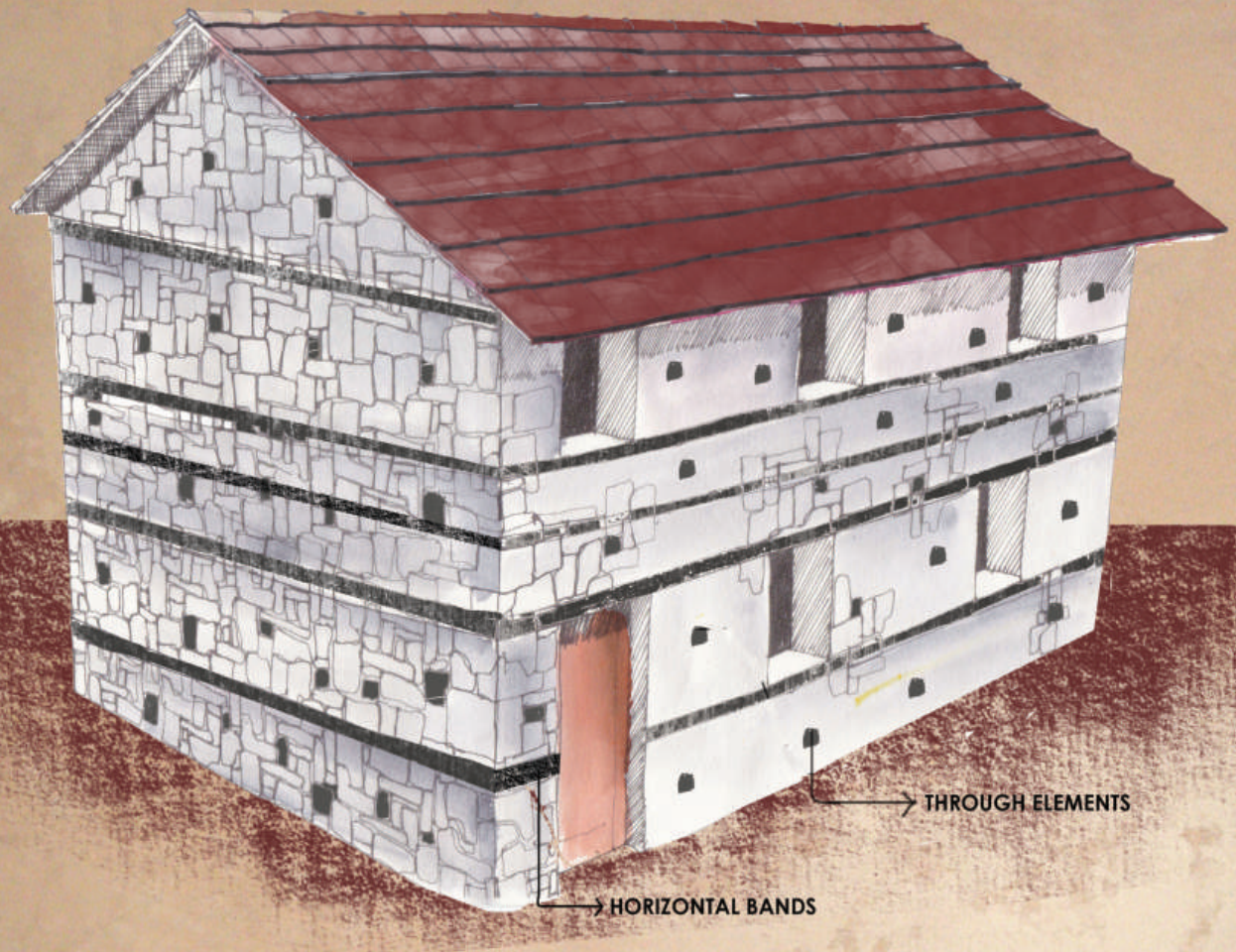
c. Fix ridge beam with the gable end and vertical reinforcement as shown in the figure so that beam and wall do not seperate at time of earthquake.



Delamination & Bulging in Stone Walls

When there are not sufficient through stones to bond two faces of the walls, thick stone masonry tends to bulge at the mid-height during earthquake. Sometimes one face of the wall may even seperate completely and collapse. This can be a serious threat to the whole structure causing its failure.





Avoiding Bulging and Delamination

To ensure that stone walls do not bulge or delaminate during earthaquake, it is essential to ensure that both faces of the wall are stitched together with 'through elements'. If not used during construction they can be casted with RCC in situ by making holes at appropriate intervals. Also horizontal belts at sill, lintel and gable levels should be added.

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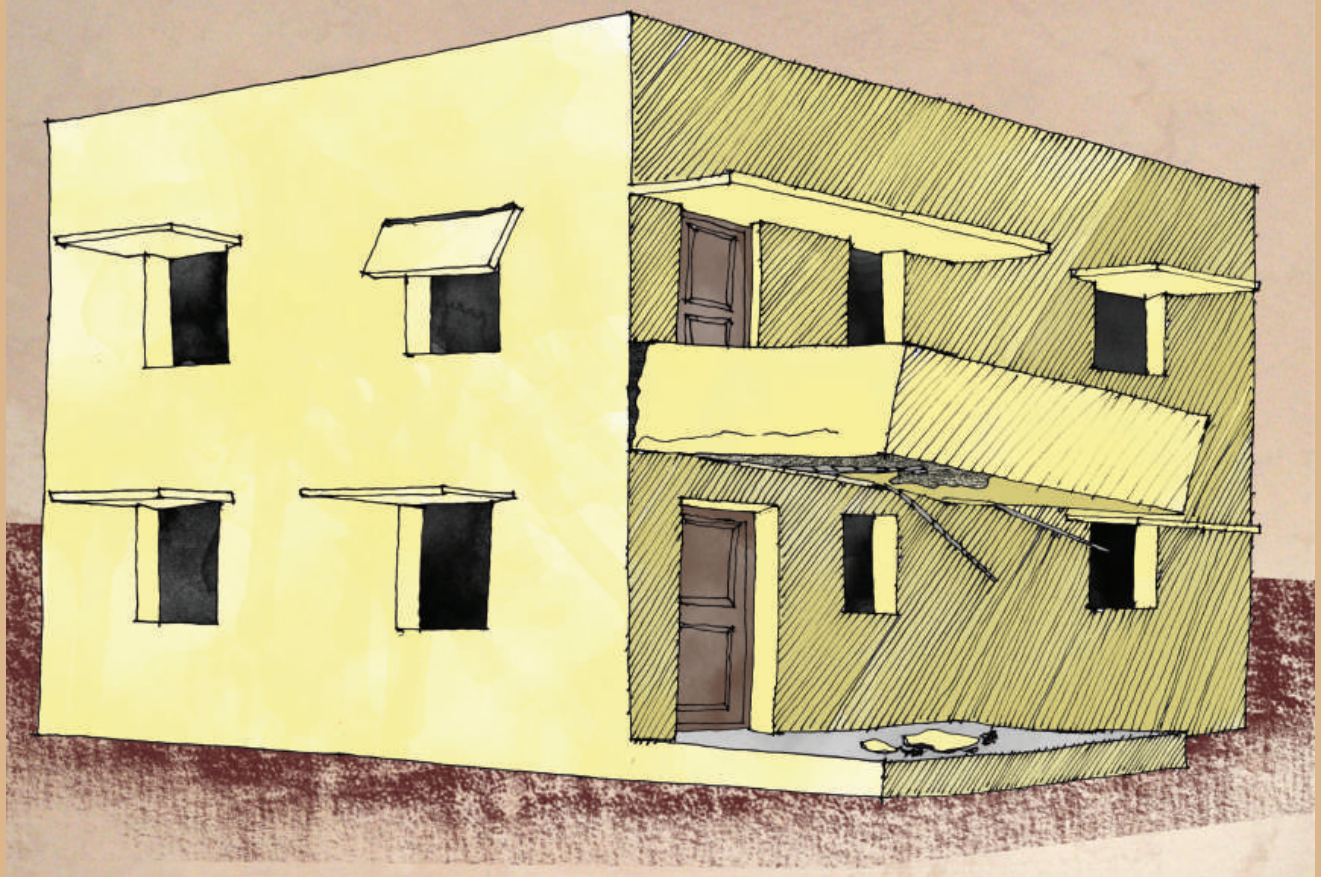
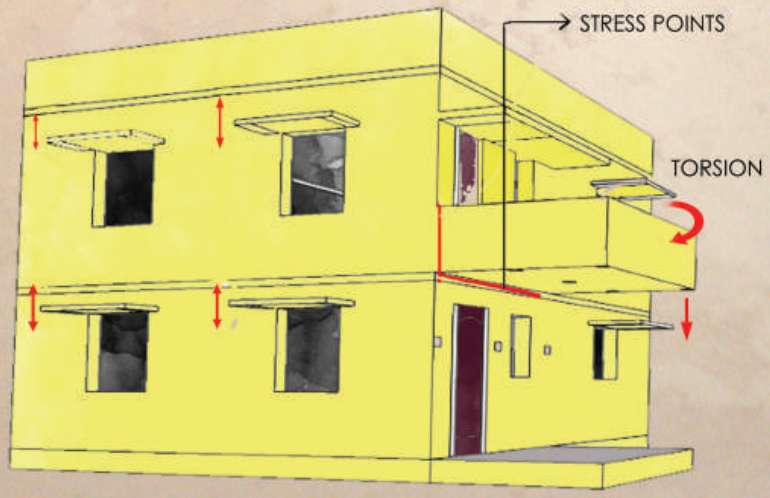
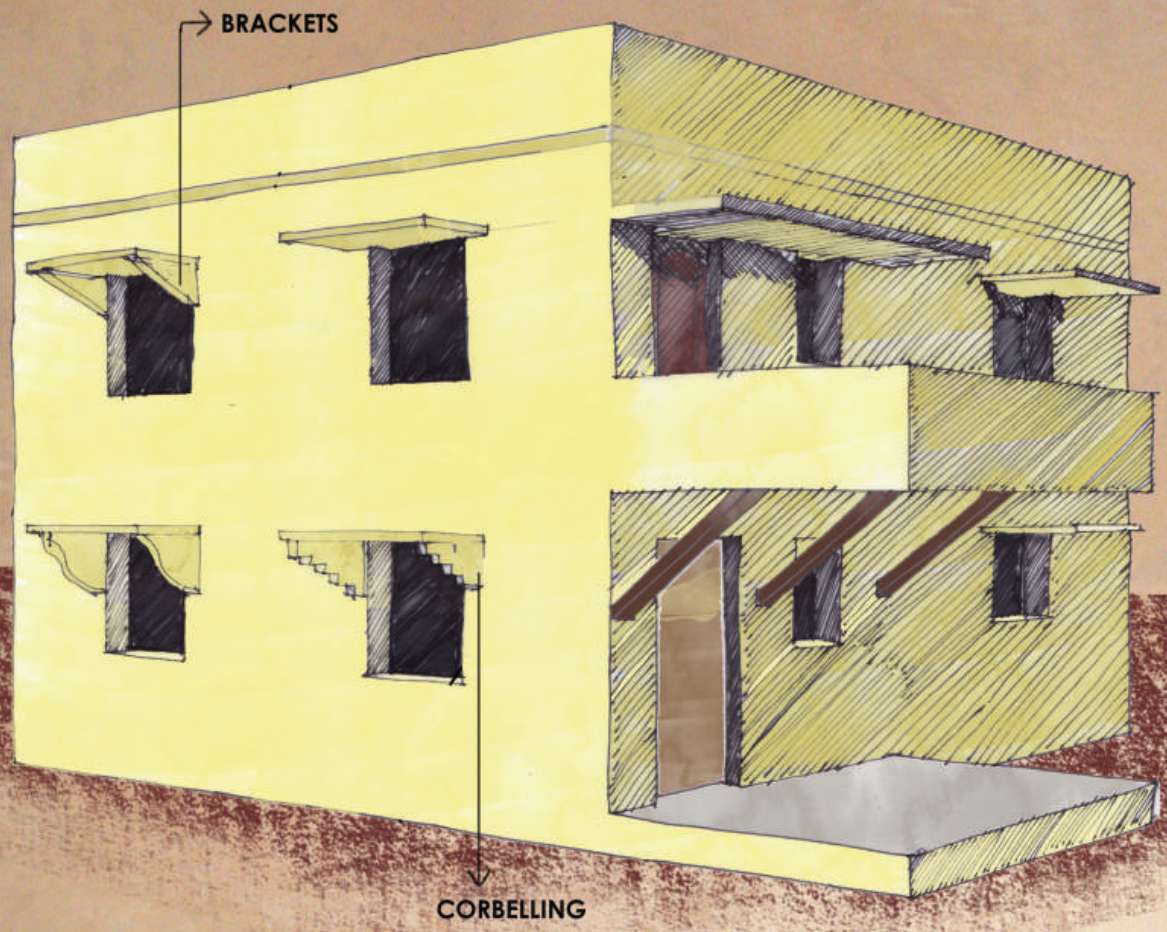


Collapse of Cantilevers and Overhangs

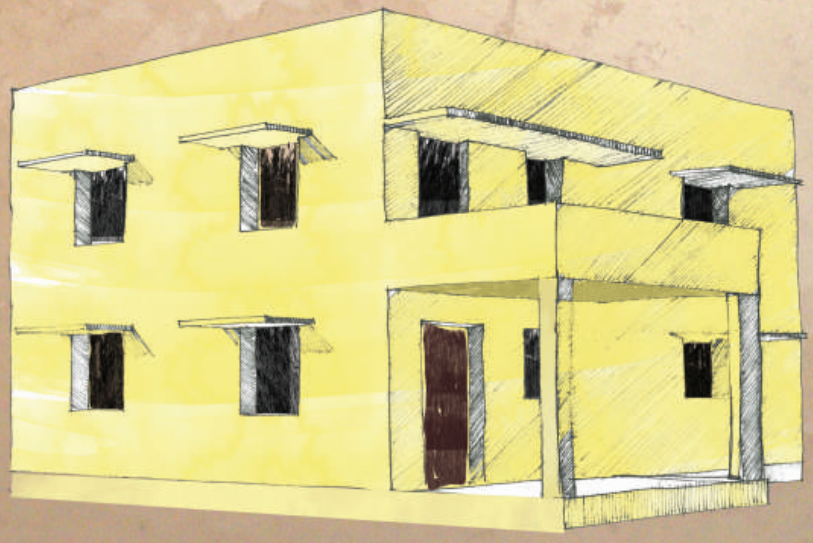
Earthquake forces cause additional flextural stresses on cantilevers. Overhang length increases eccentricity and therefore induces more torsional loads. Larger overhangs bring larger stresses and this can cause collapse of the overhang.

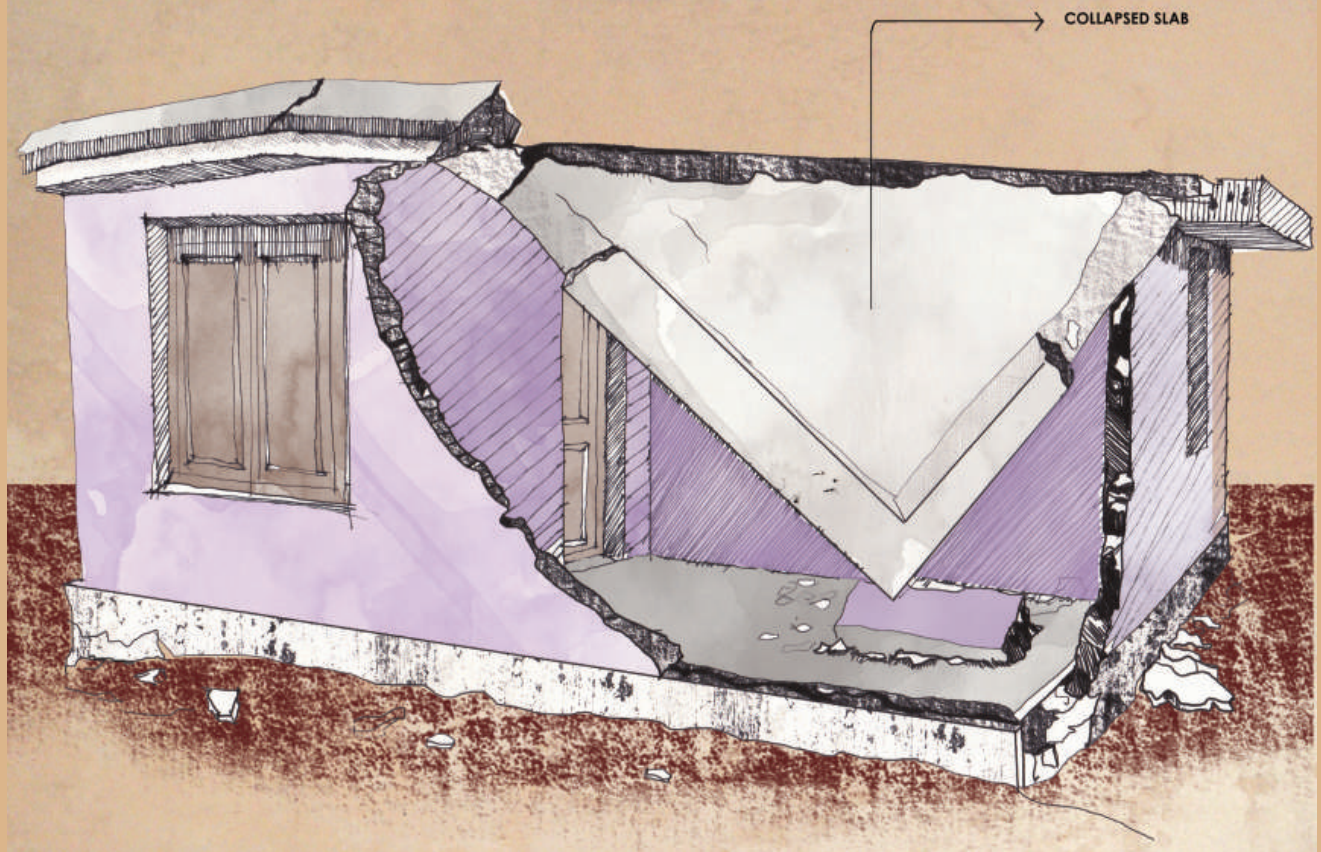




Strengthening Cantilevers and Overhang

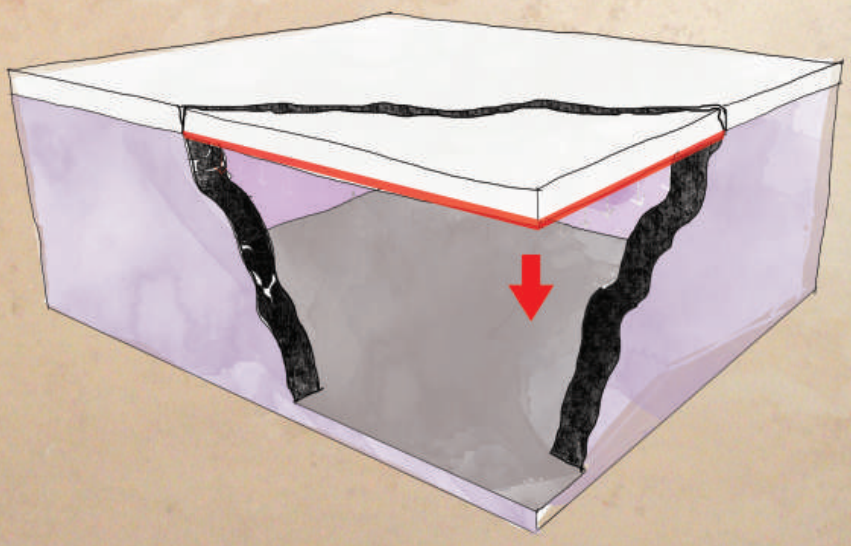
Overhangs need to be supported. It can be done either by adding brackets or by supporting with columns. Brackets can be made with stone, wood or steel. The masonry feature of corbelling can also suport the overhang. It is important to ensure good joinery between the bracket or the column and the overhang.





Cracks & Collapse of RCC Slab

During an earthquake, RCC slab can crack or collapse if the supporting walls are critically damaged. Unsupported roof is pulled down by the gravity and torsional stresses.



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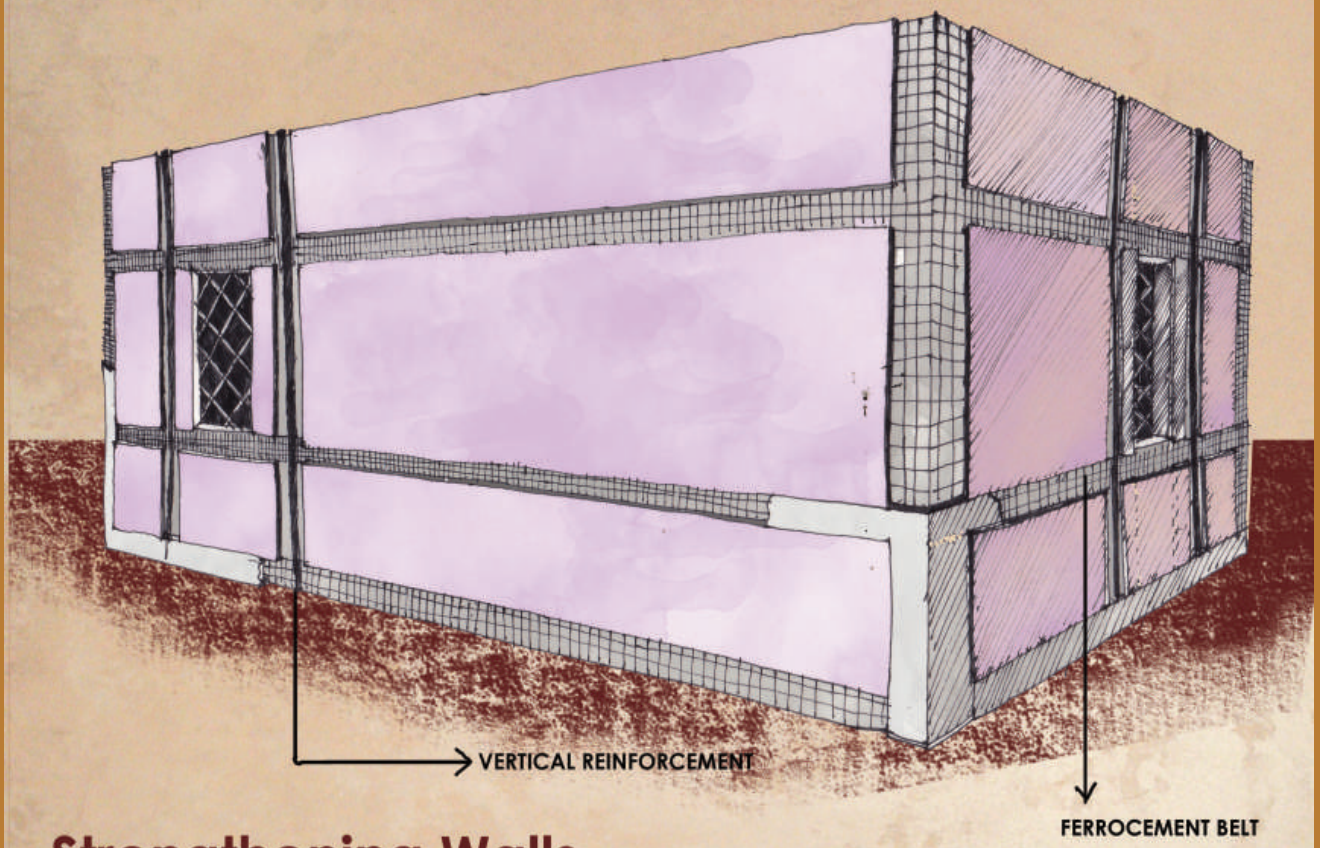
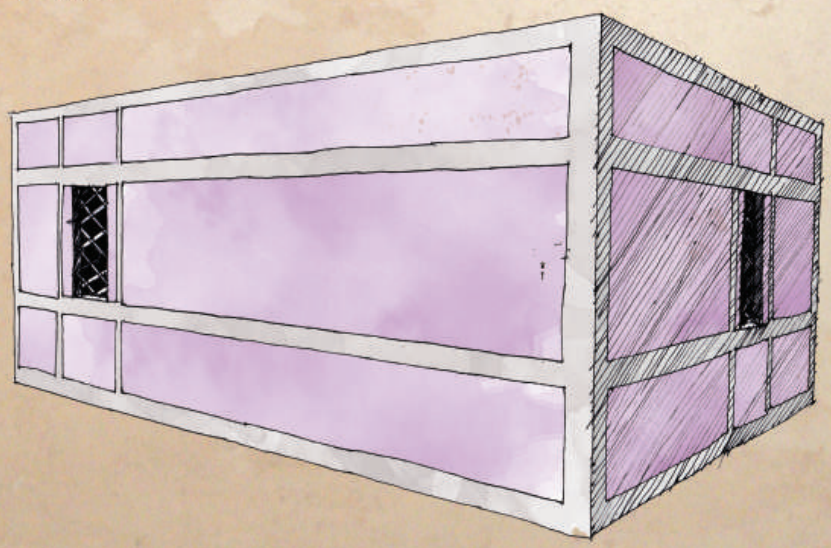


Strengthening Walls

It is important to strengthen the supporting walls and columns. Towards that, horizontal belts at sill and lintel level should be added. For improving ductile behaviour, vertical reinforcements at corners and jambs of openings should be provided. It is also necessary to tie the roof slab with vertical reinforcements in the walls.



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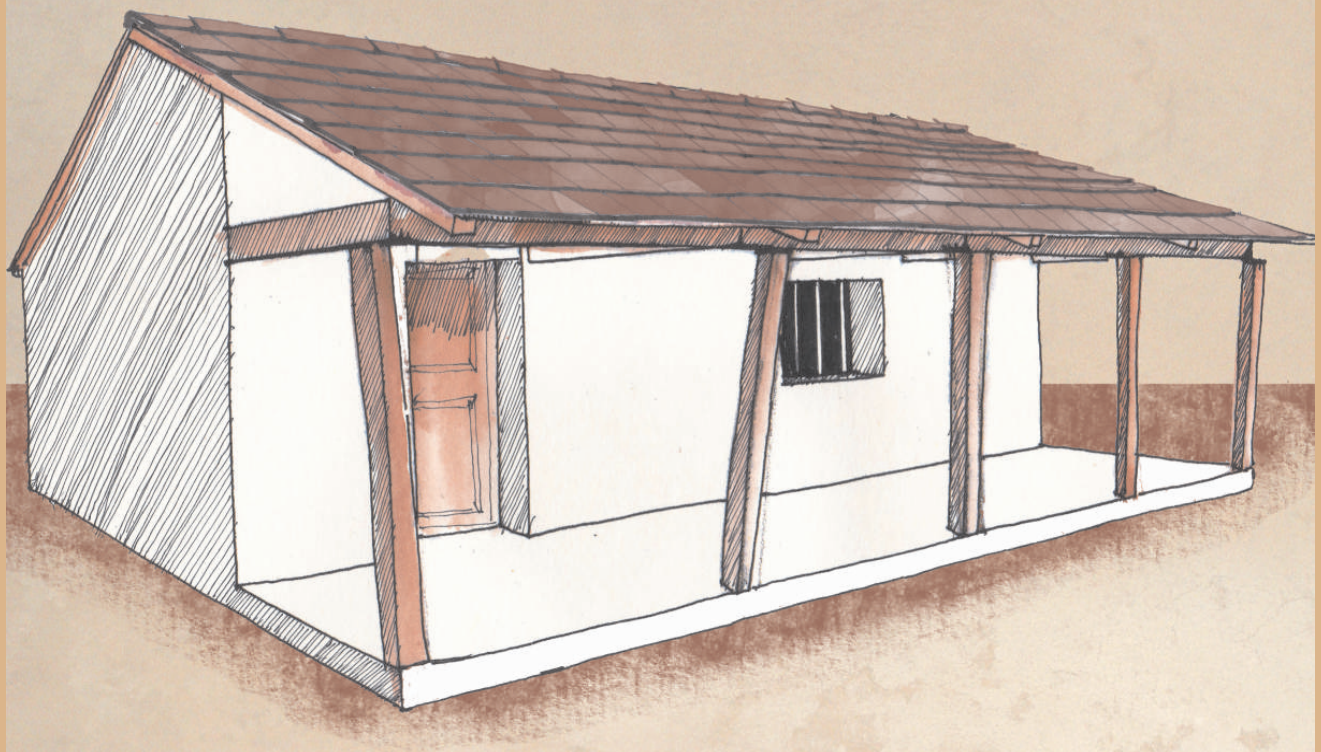
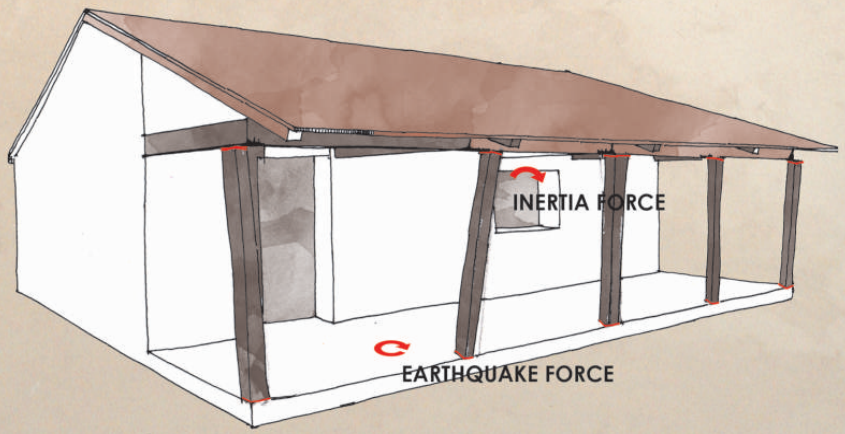


Displacement of Posts or Columns

If the posts or columns are not fixed, these can be displaced due to earthquake shaking and inertia force. Severe displacement of posts can weaken the structure. As a result, supported roof structures can also get displaced and collapse.



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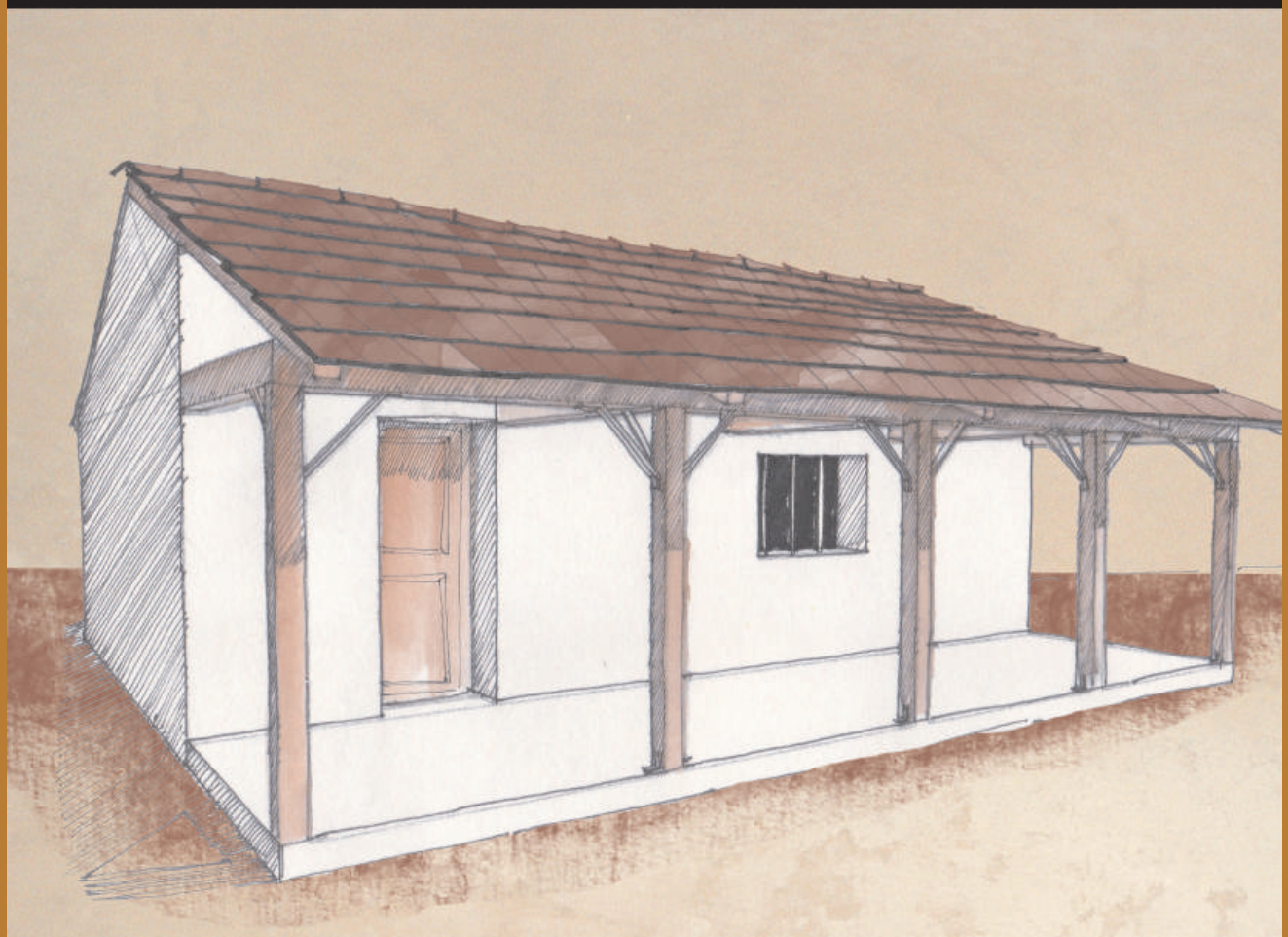
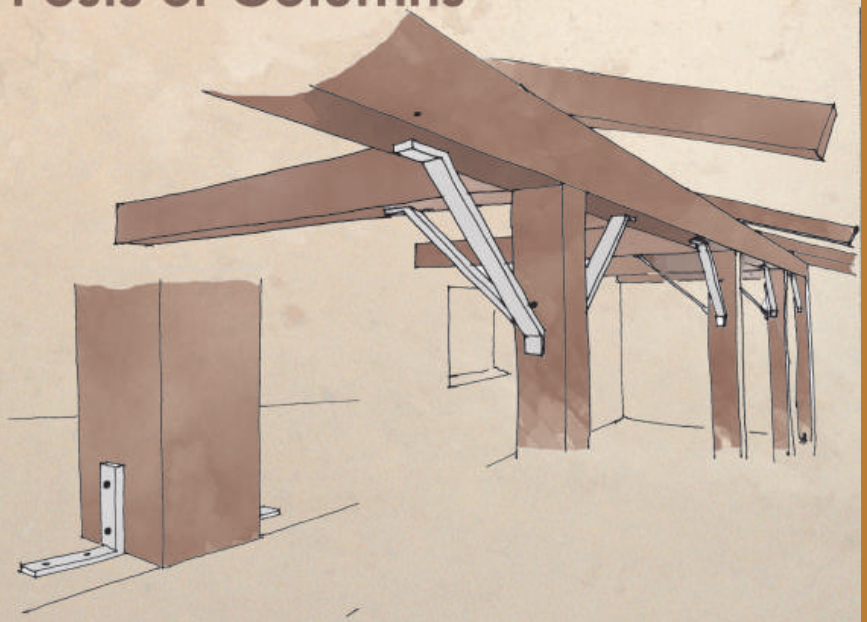


Strengthening Posts or Columns

Posts or columns should be fixed well with the plinth and lintel/roof beam. To ensure rigid joints, steel or wood brackets should be installed as shown in the figure. Column base should also be fixed well with the plinth.



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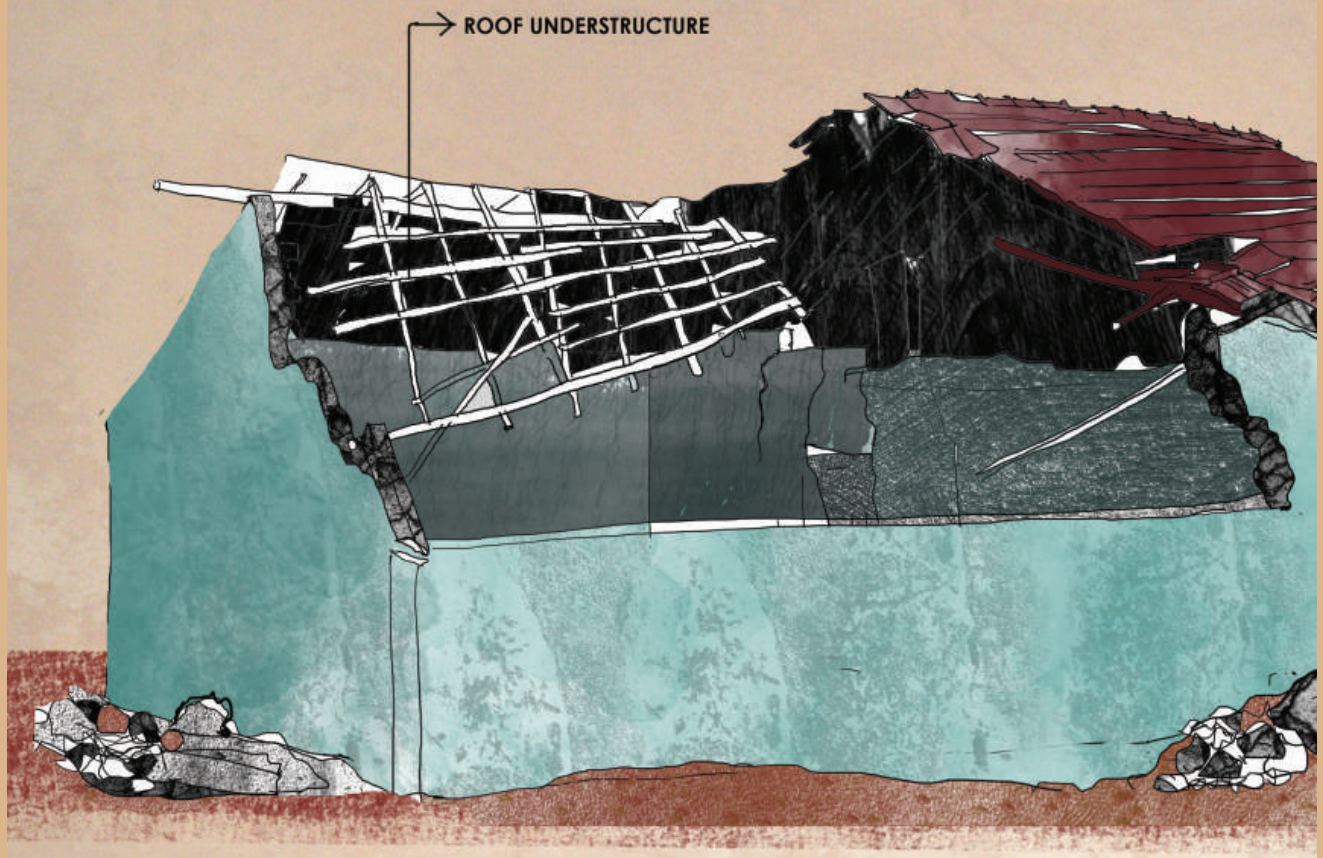
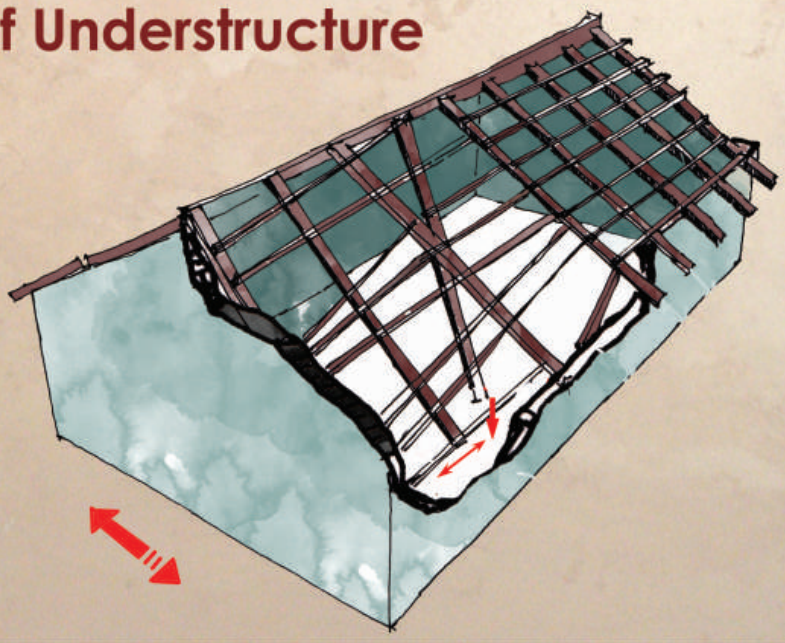
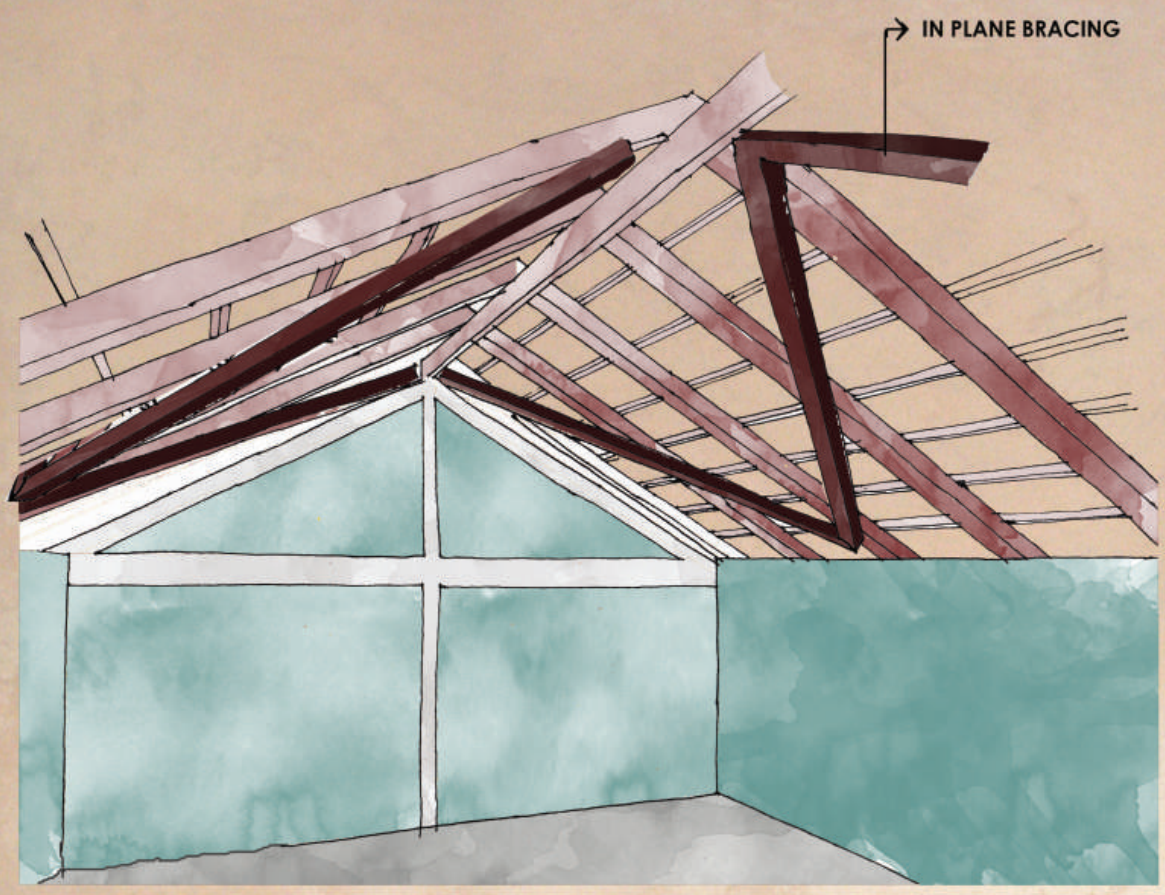


Collapse of Roof Understructure

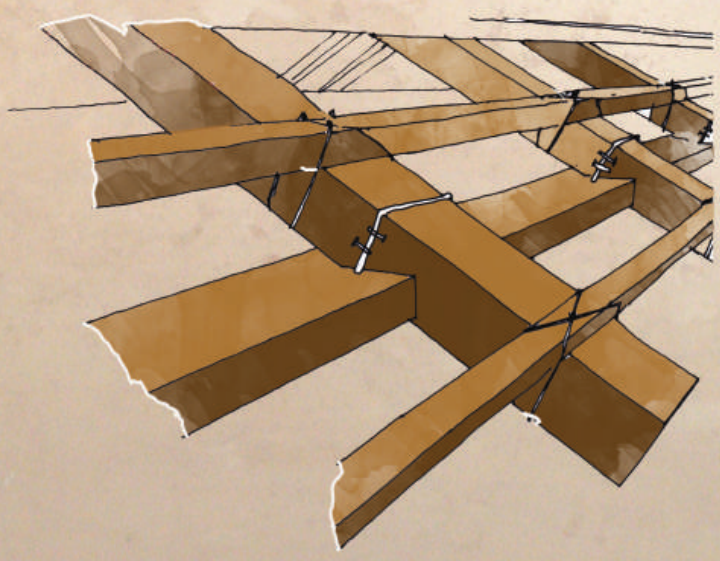
During earthquake, roof elements like beams, rafters and purlins can get displaced from their position. The displacement occurs when these elements are not tied well and suporting walls or columns are damaged.

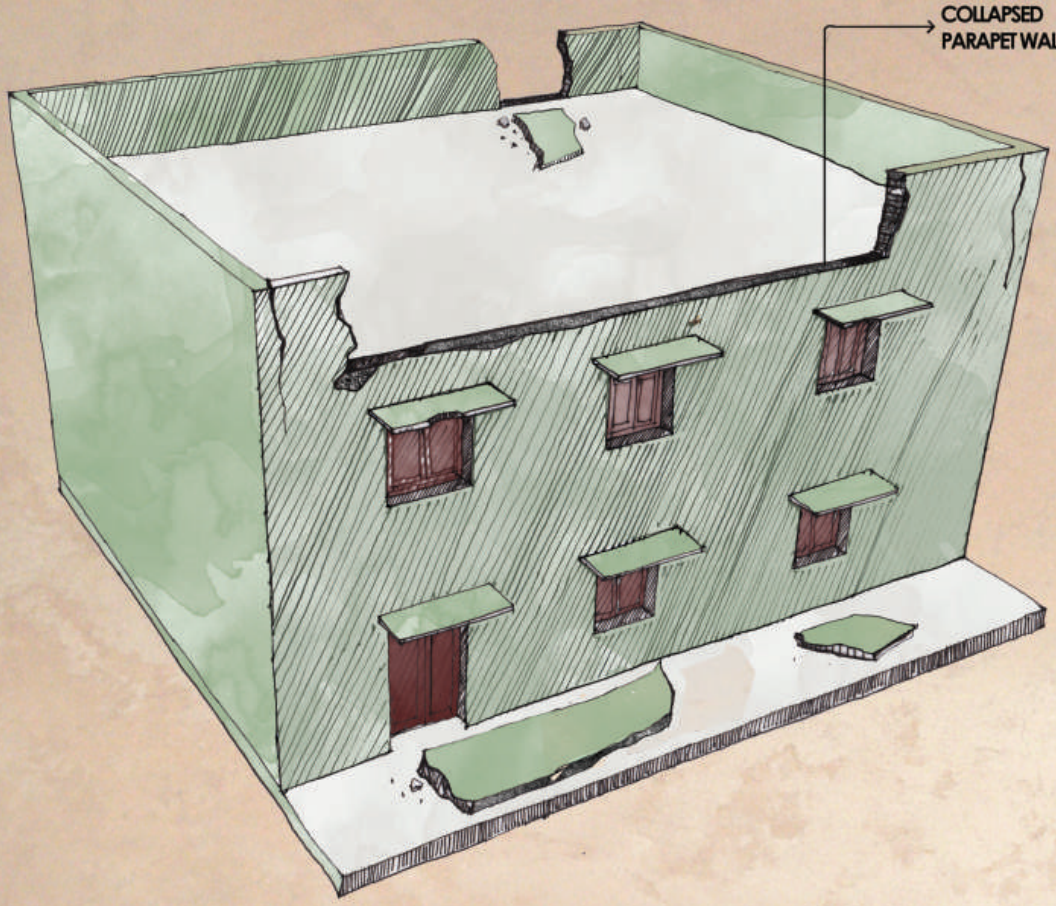




Strengthening Roof Understructure

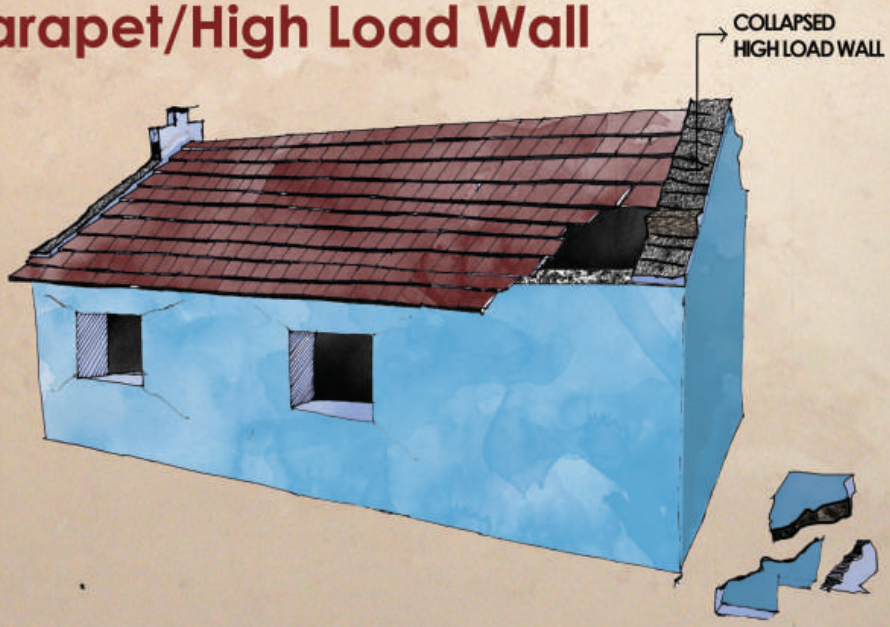
All roof elements should be properly fixed. Merely nailing is not enough. Tying tightly in addition to nails is a good idea. Purlins and rafters should be fixed well at all junctions. In-plane diagonal bracing below the rafters ensures that roof structure doesn't deform due to earthquake shaking.

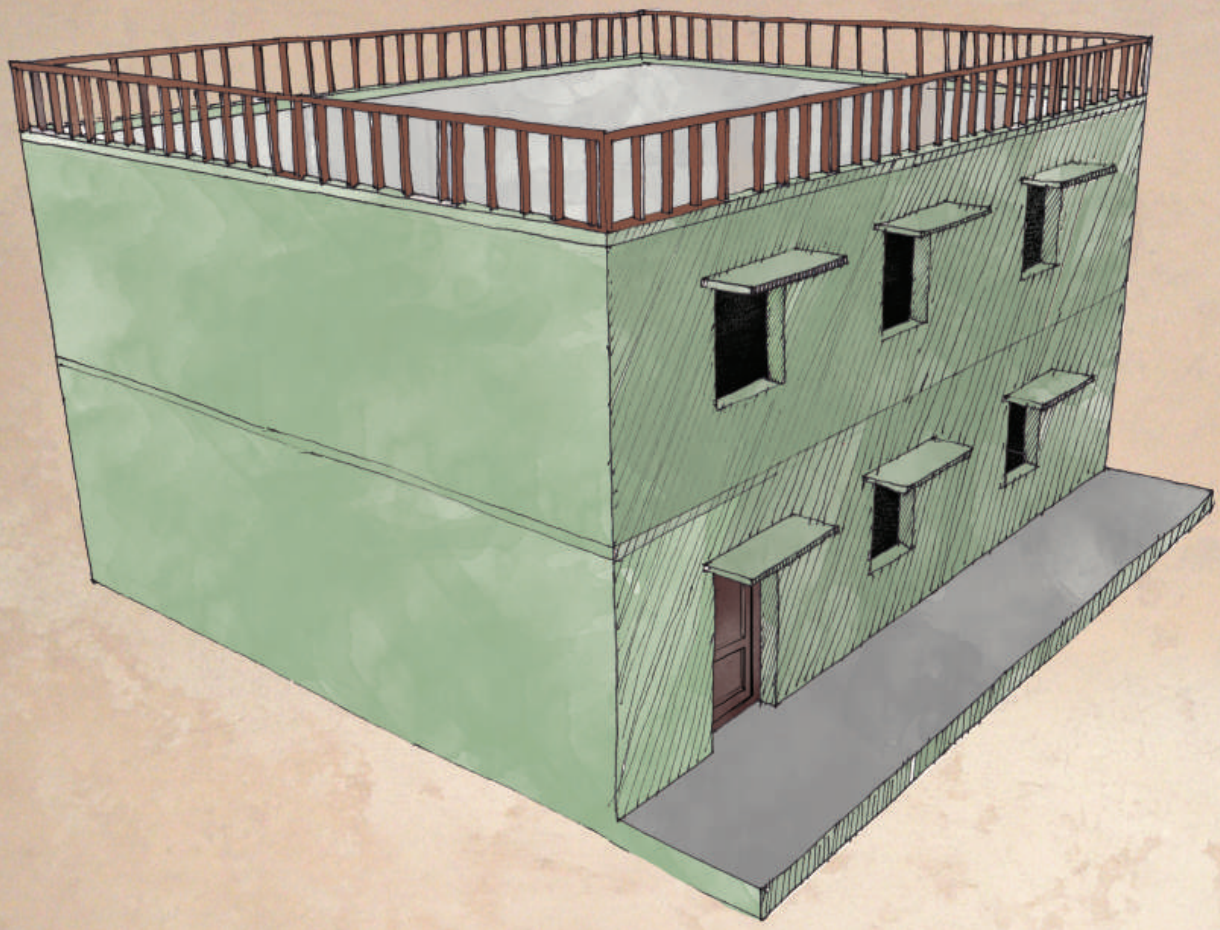




Collapse of Parapet/High Load Wall

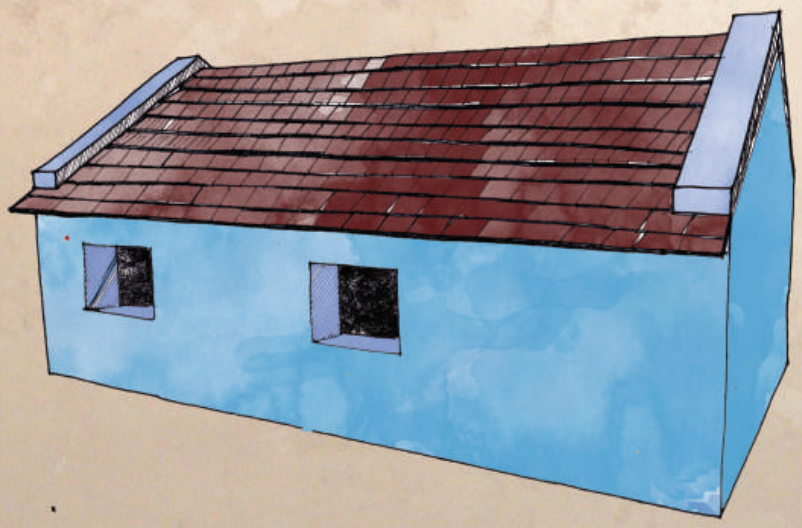
A high parapet wall or a high load wall acts like a free standing wall. Since it is only fixed on one end, it is vulnerable due to shaking. It can collapse during an earthquake.





Strengthening Parapets and Load Walls

To strengthen parapets on RCC roofs or balconies, it is a good idea to replace them with railings. Alternatively an RCC band can be added on top of parapet which is tied well to vertical reinforcements taken out from roof slab or walls. In case of pitched roofs, load wall should not be higher than 6" and should include steel reinforcement.



PROMOTING EARTHQUAKE RESISTANT HOUSING

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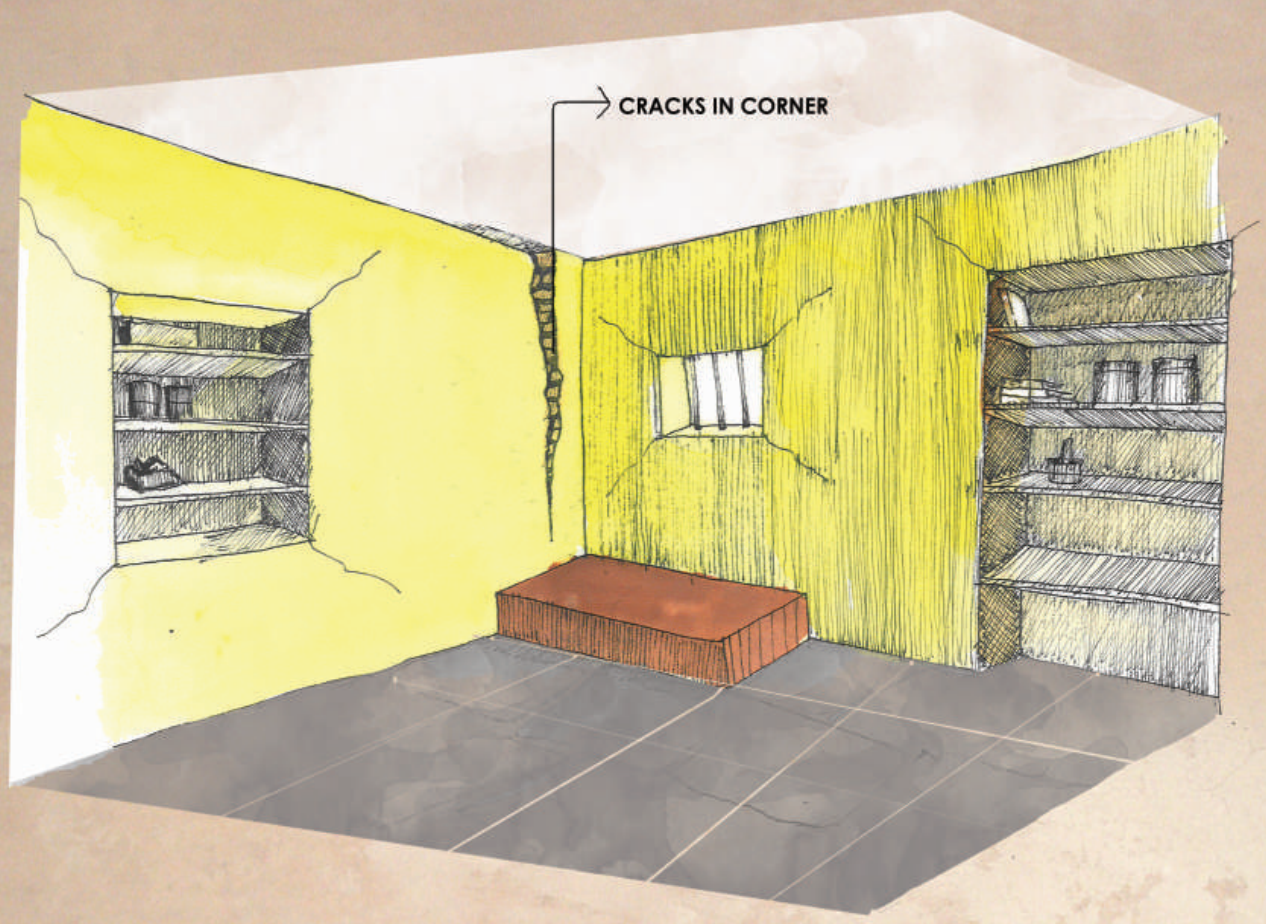
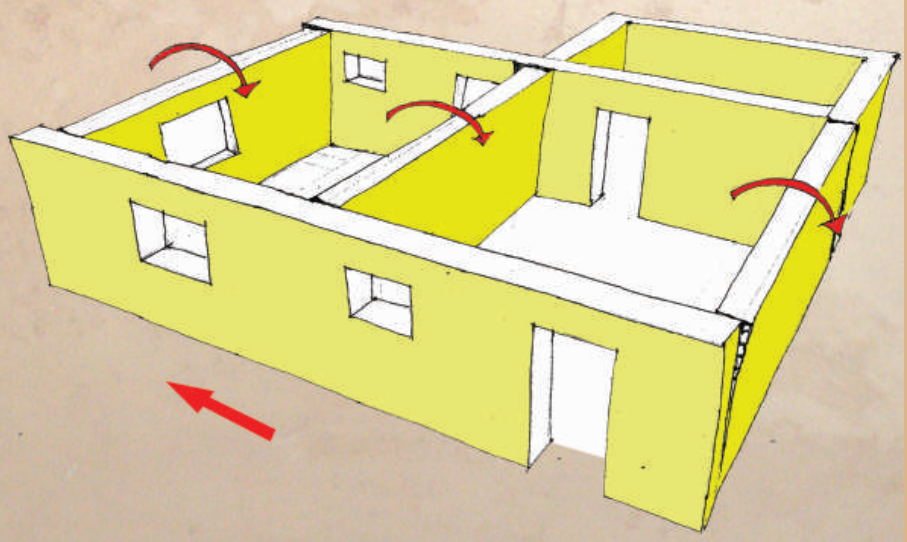
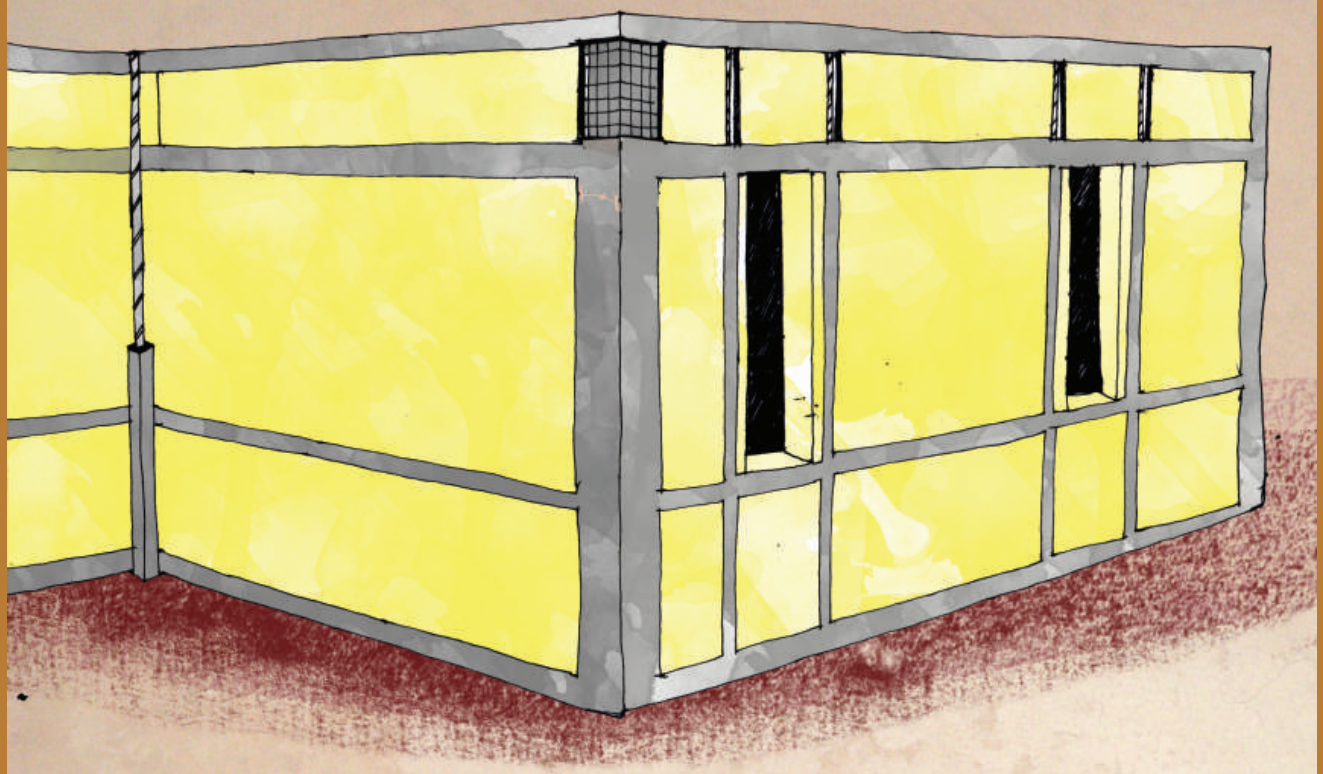
people in centre



Walls go out of plumb and Corner Cracks

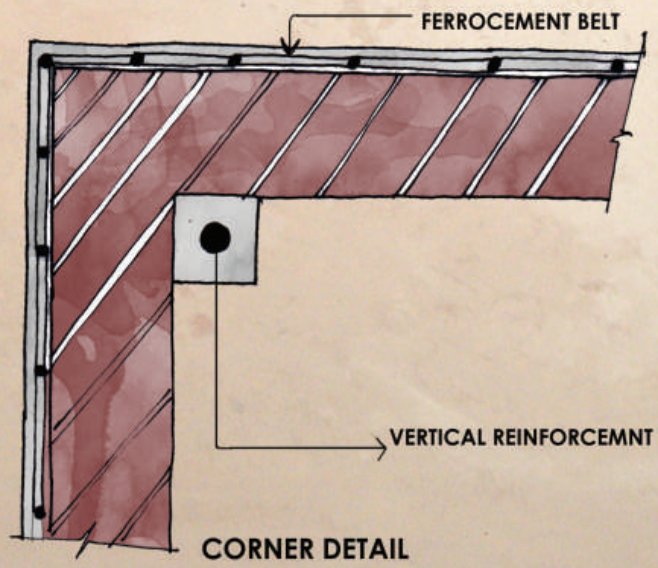
During earthquake, walls tend to go out of plumb. The walls perpendicular to earthquake forces are weak and have tendency to topple. But the walls in the direction of earthquake forces behave strongly. If the corners of the walls are not well-connected, they develop cracks.





Corner Reinforcement

To prevent the cracks at the corners or resulting collapse, it is necessary to strengthen the corners with vertical reinforcement on the inner side and ferrocement belt on the outer side as shown in the adjascent figure. This, along with horizontal belts at multiple levels, ensures that walls do not go out of plumb.



CORNER DETAIL

Publications on Disaster Risk Reduction

Titles

1. Assessing Damages After Disaster:
   A Participatory Framework and Toolkit, *English*

2. CMDRR Training Manual:
   Shaksham Samudayonka Gathan, *Hindi*

3. Agamcheti
   – Compilation of Case Studies on Preparedness, *Gujarati*

4. Disaster Management Act,
   Policy and Institutional Framework, Gujarat, *English*

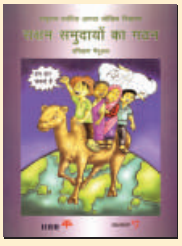
5. Disaster Management Act,
   Policy and Institutional Framework, Gujarat, *Gujarati*

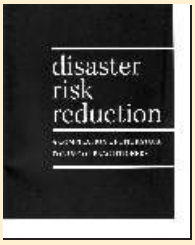
6. Disaster Management Act,
   Policy and Institutional Framework, Rajasthan, *English*

7. Disaster Management Act,
   Policy and Institutional Framework, Rajasthan, *Hindi*

8. Disaster Risk Reduction:
   A Compilation of Literature for Use of Practitioners
   English

9. Psycho-social Care
   – Emergency Response Case Study, *English*





USER
GUIDE
For Housing Safety
Campaign in Earthquake
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10. Water and Sanitation
– Emergency Response Case Study, *English*

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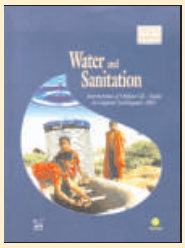


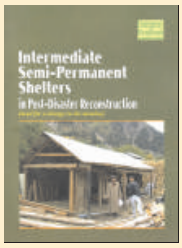

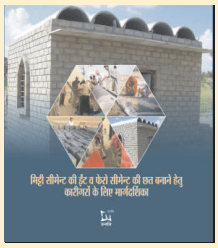
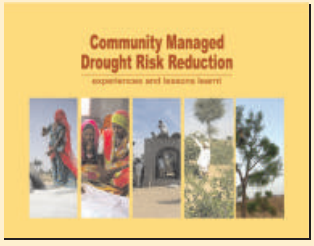



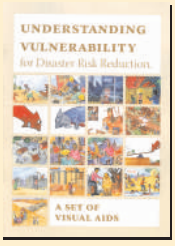

In the series of campaign on disaster safety
our new user guide on school safety!

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USER GUIDE

For School Safety Campaign in Disaster Prone Areas

About us

Vision

To create an inclusive society where all stakeholders, particularly the vulnerable, participate with full empowerment and gain equal access to and control over services, resources and institutions.

Mission

To promote social inclusion and democratic governance so that the vulnerable sections of our society, particularly the dalits, tribals, women and persons with disabilities, are empowered to effectively and decisively participate in mainstream development and the decision - making process.

Strategy

We work at the field level in partnership with local civil society and people's organisations. The collective experience, learning and insight enable us to work on knowledge building, training and advocacy. All initiatives are executed in a framework of collaboration and partnership to empower people for demanding their entitlements and enable the service providers, including the government, to deliver in a transparent and accountable manner.

All our activities are carried out through three thematic centres:

Social Inclusion and Empowerment
Civic Leadership Governance and Social Accountability
Social Determinants of Disaster Risk Reduction

The learning derived from our field experiences are consolidated and disseminated in print and electronic forms for wider sharing through a Knowledge Resource Centre. It is our endeavour to build an academy for community leaders, especially dalits and women, so that they can effectively address local issues.

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