Well built STONE houses can better withstand earthquakes. Here are 9 TIPS ON HOW TO BUILD BACK SAFER

1. CHOOSE A SAFE SITE AND A SAFE EXIT

2. BUILD YOUR HOUSE WITH GOOD MATERIALS

3. BUILD A STRONG SHAPE

4. BUILD ON STRONG FOUNDATIONS

5. TIE YOUR HOUSE TOGETHER WITH TIESTONES

6. BAND YOUR HOUSE TOGETHER

7. TIE YOUR GABLES UP

8. TIE YOUR ROOF DOWN

9. TIE THE ROOF/FLOOR TO THE WALLS

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9 KEY MESSAGES - AVISUAL INDEX
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#1: CHOOSE A SAFE SITE WITH AN ESCAPE ROUTE
Choose a safe location for your house and identify a safe escape route.

HAVE AN ESCAPE PLAN
Ensure safe escape from the site. Have a preparedness plan.

CHOOSE A SAFE SITE
Avoid flood prone areas, like the bottom of valleys or near river beds.

Don't build on steep slopes. Look for landslide signs (cracks, fallen trees)

Remove damaged buildings first.

MAKE YOUR SITE SAFER
Ensure proper drainage of the site.

Plant retaining vegetation on the slope above.

POSITION YOUR HOUSE SAFELY
Keep a safe distance between your house and retaining walls.

Keep away from cliffs.

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#2: BUILD YOUR HOUSE WITH GOOD MATERIALS
Some structures collapse because of poor material usage. Using the right materials in an efficient way are essential for a strong house.

STONE SELECTION
Select large rectangular stones if possible. Irregular stones can be shaped into rough rectangles.

If using stones from your demolished house, clean any mortar from them.

STONE USAGE
Small stones and mud between your outer and inner wall can push your walls apart in an earthquake. Instead use well stacked larger stones between your inner and outer wall.

Avoid use of round shape stones specially in walls

The larger the stones you use and the more they overlap the better

Large stones, no overlap

Large stones, long overlap

MORTAR
Whether you use cement mortar or mud it is important to have the stones placed as close as possible. The gap spaces between the stones should be kept to a minimum and filled with mortar.

Mud Mortar
Use mud free of gravel. Lime can also be added to increase the strength. The ratio would be 1:4 of lime to mud

Cement Mortar Mix
Be careful!
Cement mortar mix is not the safest if you don't know how to use it.

1 Part Cement
4 Parts Sand

Cement Mortar Mix #2

1 Part Cement
1 Part Lime
6 Parts Sand

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#3: BUILD A STRONG SHAPE
The shape of the house, design and construction of the walls are very important for a stronger structure.

SHAPE
Use a regular shape that is not too narrow. L and U shapes will twist during earthquakes.

HEIGHT
Don’t build more than 2 storey plus an attic.
If you want to build a taller building you need stronger materials.
Floor to floor height should not be more than 9’10” and less than 6’6”.

DOOR AND WINDOW OPENINGS
Large openings weaken a wall. Place openings away from corners and leave at least 3ft gap from corners and between openings.

LONG WALLS NEED SUPPORT
For a long and narrow house use regular wall supports or buttresses. It is important to build any dividing walls from the same strong material as the outerwalls. The total length of the building should not be more than 3 times the width of the building.
#4: BUILD ON STRONG FOUNDATIONS
A structure will be stronger if built on strong foundations. Artificial compaction may be used if necessary. Bed for foundation must be levelled properly.

TIESTONES
Tiestones are just as essential in the foundation as they are in the wall above.

PLINTH BAND
Plinth bands add strength to the footings. Plinth bands must be continuous.

DIG TO FIRM GROUND
For soft ground you may have to dig deeper

THE RATIO IS IMPORTANT
The foundation should be as deep as it is wide

Min 2’ 6”

min 2’6” and 3’ for soft soil
#5: TIE YOUR HOUSE TOGETHER WITH TIESTONES

Tiestones (including throughstones and cornerstones) hold your walls together and reduce the risk of the walls collapsing or peeling apart.

**TIESTONE MATERIALS**

Choose strong materials for use as tiestones.

- Select long flat stones for use as tiestones. Shape stones with a tool if needed.
- Reinforced concrete tiestones
- Timber Dowel tiestones

**THROUGHSTONES**

Throughstones help prevent your walls from peeling apart.

Carefully select long and flat throughstones. Make sure they span the thickness of the wall.

- Use throughstones at maximum 2 foot vertical and horizontal spacings.

**TIESTONES AT WALLS**

Cornerstones strengthen your walls and help reduce the risk of corner collapse. Use them on every corner in your building.

Tie your walls together, otherwise they can easily collapse.

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#6: BAND YOUR HOUSE TOGETHER
Banding prevents your walls from swaying to and fro.

PROVIDE STRONG BAND CONNECTIONS
Some bands fail because of weak connections.

PROVIDING BANDS IS ESSENTIAL
Provide as many bands as you can

ENSURE BAND CONTINUITY
It’s important to make strong connections at band corners, band intersections, and where bands intersect door openings.

USE STRONG MATERIALS FOR BANDING
- Reinforced concrete band
- Timber band
- Bamboo band (Strips with skin removed)
#7: TIE YOUR GABLES UP
Use light materials for gables. For extra strength tie them to the roof and walls, the structure will become lighter and safer.

TIE YOUR GABLE

Not tied ×

All gables should be tied to the roof and walls.

LIGHTER GABLES

Stone

Heavier

Lighter

Timber

Lighter gables will attract less force in an earthquake

Bricks

CGI

Bamboo

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#8: TIE YOUR ROOF DOWN
Some structures collapse as the roof pushes the walls apart.

USE LIGHTER MATERIALS
- Stone tiles
- Concrete tiles
- Clay tiles
- Wood
- Thatched mud
- CGI

Heavy
Lighter

USE STRONG ROOF CONNECTIONS
Use a wall plate at the top of your walls and firmly tie your roof to it. Make sure your rafters have a strong connection with the ridge beam.

BRACE YOUR ROOF
Your roof is like the top of a box, a stiffer roof will give you a stronger house.
#9: TIE YOUR ROOF AND FLOOR TO THE WALLS
Stiff roof and floor with strong connections to the walls can help stop your walls from falling down in an earthquake.

CONNECT YOUR FLOORS TO ALL YOUR WALLS
It is important to have a strong connection between your floors and walls.

STRONG FLOOR
The stiffer your floor the stronger your house.

No nails  
2 nails, diagonal  
4 nails

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