

Housing: earthquake-proofing

In 2001, Gujarat in India, was hit with a devastating earthquake that killed over 20,000 people and made thousands more homeless. This briefing looks at the work that has taken place to re-house people who lost their homes. Details of several different shelters are included and students could model these. The briefing is designed to teach aspects of the citizenship curriculum in Design and Technology lessons.

Resources needed for student activities

Students are asked to build model shelters and earthquake simulators to test them on. They may need the following resources: springs, boards, glue, nails, electric motor, straws, thin wire, plastic sheets, stones, clay, cement, small tiles, mud, string, and anything else you think will be useful.

Gujarat earthquake

On January 26 2001, at 8.46am, a huge earthquake measuring 6.9 on the Richter scale shook the entire state of Gujarat, resulting in thousands of deaths and massive destruction of property, infrastructure and livestock. It affected 7,633 villages, spread over 25 districts. The government estimates that almost 20,000 people died, 166,000 were injured and 1.1 million houses were damaged or destroyed, although this is widely considered to be a serious underestimate.

Why did it happen?

Earthquakes are caused by collisions between tectonic plates in the earth's crust. This cracks rock and sends out a shock wave of vibrations away from the crack.

'Natural disasters' such as earthquakes can occur at any time, but they do not affect all people equally, and the cause of the devastation is often human as much as natural. Poor people are hit hardest by disasters, and they have fewer resources to help them recover. Poor people are often treated in a way that makes them more vulnerable in emergencies. Those killed, injured or left homeless by earthquakes are often the people in poor housing in areas of high risk.

The rights-based approach to emergencies

Emergencies often hit poor people hardest, and they can undo development work that has already taken place. People's rights are often denied in emergency situations. When an emergency happens, ActionAid works with the most vulnerable communities to discuss their needs and provide immediate help. ActionAid also

starts long-term work to help people rebuild their lives and protect themselves from future emergencies.

Relief work in Gujarat

ActionAid responded to the Gujarat crisis immediately – providing food, temporary shelter, trauma counselling, community centres and day care for orphaned children. Since the earthquake, ActionAid has been working with local organisations to identify and create the support needed by affected communities.

Work has targeted the most vulnerable groups; those who have either been left out of mainstream rehabilitation or are lagging far behind in getting what they need and securing their basic rights. They include tens of thousands of people disabled, orphaned or widowed by the quake, as well as Muslims, Dalits (formally known as 'untouchables' at the bottom of the caste system) and tribal people.

ActionAid's long-term work in Gujarat helps ensure that poor people's assets are not lost, that they can earn a living now and in the future, and that they are involved in the decisions which affect them. It also helps them get a fair share of the resources available and prepares them to cope with future emergencies.

Details of earthquake-proof shelter/ housing

One of the immediate needs after the earthquake was shelter. ActionAid worked with a local partner called Sneh samudaya to provide interim shelter to the most needy families who had no other means of support. Consultation with local communities and trialling of models using an earthquake simulator led to five principles for the design of the interim shelters, and three different models that could be used. In total, 1,976 families were helped with constructed shelter or materials.

The design criteria were:

- the shelter should be earthquake resistant
- the design of the shelter should incorporate the

community's view points

- the shelter should be built in a way that makes it possible to upgrade it later
- the shelter should be accessible for disabled people
- the shelter should be built where it is going to stand

The three models developed were:

1 Bamboo shelter

Made of bamboo matting and covered in tarpaulin. The shelter is semi cylindrical in shape and measures 5m x 3m.

2 BSC model

Each shelter measures 3.5m x 3.5m. The lower 1.2m of each wall is made of stone and cement and the upper part of the wall consists of an iron frame with tiles on it. Tiles are often tied down with wire in case there is a cyclone.

3 Bhoonga

Each shelter measures 3.5m x 3.5m. The lower 1m of each wall is made of mud and stone whilst the upper wall is made of bamboo and tiles. Bamboo is a good material as it is cheap, light and flexible, so it will possibly remain standing during an earthquake and is unlikely to cause injury if it does fall.

Permanent houses are now being built. These contain reinforced concrete in strategic places to add strength to the design. Cement reinforced soil is being used to make bricks with an interlocking design. These will not slide over each other during an earthquake and so the houses are more likely to resist damage.

Earthquake simulators

Ideas, diagrams and pictures of large and small simulators are available at the following websites:

<http://www.allshookup.org/seismic.htm>

<http://www.ktca.org/newtons/12/earthquk.html#main%20activity>

<http://scsc.k12.in.us/SMS/Teachers/Elliot/notes.htm>

<http://school.discovery.com/lessonplans/programs/earthquakeproof/>

<http://www.bbc.co.uk/education/rocks/rockcycle/expnline.html>

Housing: earthquake-proofing

In 2001, Gujarat in India was hit by a devastating earthquake that killed over 20,000 people and made thousands more homeless. After the initial shock, people had to re-build their lives and homes. Lots of organisations tried to design earthquake-proof shelters, and this paper looks at some designs.

The earthquake

On January 26 2001, a huge earthquake shook the entire state of Gujarat in India. The earthquake measured 6.9 on the Richter scale. Over 20,000 people died, 166,000 were injured and 1.1 million houses were damaged or destroyed, most of it happening within a few seconds. Many people lost their loved ones and were left without a way to earn a living.

Why did it happen?

Earthquakes are caused by vibrations in the earth's crust. This crust is made of several tectonic plates which float on the semi-molten rock underneath, and sometimes collide. This collision cracks the rock and sends out shock waves which cause vibrations on the earth's surface.

Helping people recover

Emergencies often affect poor people more than richer people. Poor people will suffer more if their homes are destroyed, or they lose their jobs, because they won't have back-up sources of support and income, and this makes them vulnerable. Vulnerable people's rights are often denied in emergency situations. When an emergency happens, ActionAid works with the most vulnerable communities to discuss their needs and provide immediate help. ActionAid also starts long-term work to help people rebuild their lives and protect themselves from future emergencies.

ActionAid responded to the Gujarat crisis immediately, by providing food, temporary shelters, trauma counselling, community centres and day care for orphaned children. Since the earthquake, ActionAid has been working with local organisations to find out what people need and to help them find ways of providing this.

Work has targeted the most vulnerable groups such as widows, orphans, people who have been disabled, Muslims, Dalits (people at the bottom of the caste system who used to be called 'untouchables') and tribal people. These people are often forgotten in recovery

programmes because they do not have a lot of power in the community. This means that these people may find it even harder to recover, and they might have problems getting their basic rights.

It's important to look beyond the immediate problems and think of the future. ActionAid's long-term work in Gujarat helps make sure that poor people can earn a living now and in the future, and that they are involved in the decisions which affect them. It also helps them get a fair share of the things they need and prepares them to cope with future emergencies.

Building a shelter

After the earthquake there were over a million people who had nowhere to live. These people needed some sort of shelter until they had the time and materials to build proper houses again. ActionAid worked with a local group called Sneh samudaya to provide short-term shelter to families who had no other means of support. Before the actual building work took place, the shelters had to be designed. Communities and experts were consulted and the following design criteria were agreed:

- the shelter should be earthquake resistant
- the design of the shelter should incorporate the community's view points
- the shelter should be built in a way that makes it possible to upgrade it later
- the shelter should be accessible for disabled people
- the shelter should be built where it is going to stand

Order – put the five criteria into the order that you think is the most important. Discuss your choice in a group of about five people. Did you all agree? If not, discuss the reasons for your choice. Develop a new order that everyone is happy with.



Temporary shelters

Various models were made and tested on an earthquake simulator. The models that best fitted the criteria were developed into full-scale shelters.

The three types of shelters chosen were:

1 **Bamboo shelter**

This is made of bamboo matting and covered in tarpaulin. The shelter is a semi cylinder shape and measures 5m x 3m.

2 **BSC model**

Each shelter measures 3.5m x 3.5m. The lower 1.2m of each wall is made of stone and cement and the upper part of the wall consists of an iron frame with tiles on it. Tiles are often tied down with wire to stop them blowing off in a cyclone.

3 **Bhoonga**

Each shelter measures 3.5m x 3.5m. The lower 1m of each wall is made of mud and stone whilst the upper wall is made of bamboo and tiles. Bamboo is a good material as it is cheap, light and flexible, so it will possibly remain standing during an earthquake and is unlikely to cause injury if it does fall.

Get building

Design – an earthquake simulator that you could use to test a model shelter. Work in the group you were in before. You could use an electric motor or several springs.

Build – your earthquake simulator.

Design – a shelter that fits the criteria above. Assume that the community want something cheap and quick to build. Remember the order of importance that your group chose for the criteria earlier, but work on your own.

Build – your model shelter.

Test – your group's shelters on your earthquake simulator. Make sure your testing is fair.

Evaluate – your shelters against the criteria. Which was the best and why? Which was the worst and why? What could be improved on each?

A home of your own

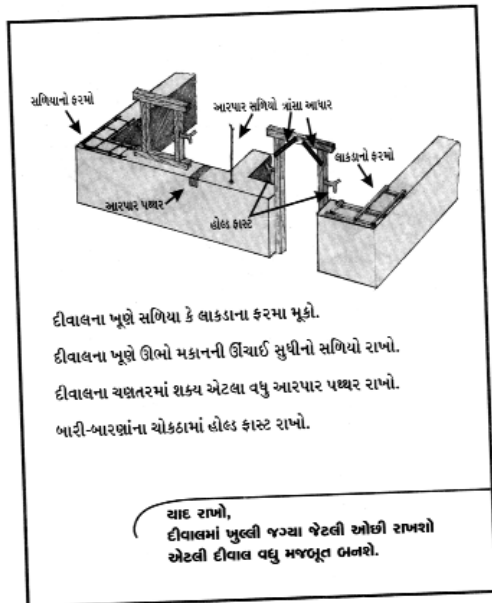


Many new houses have reinforced concrete in certain places to add strength to the design. Reinforced concrete is not used throughout the house because it's too expensive. The bricks are made out of soil that is reinforced with cement and moulded to a interlocking design. This means that the bricks won't slide over each other if there's another earthquake and so the houses are more likely to remain standing.



Permanent houses are now being built in Gujarat.

People have been given booklets showing them how to make their new house more earthquake resistant.



Look – at the scan of one page of the booklet, written in Gujarati. What is it showing? What do you think the labels say? How would each of the steps shown help to make the house earthquake-proof?