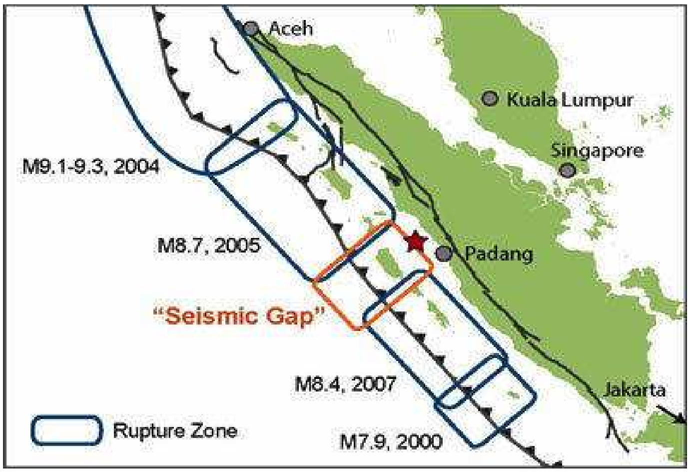
PREDICTING EARTHQUAKES

Seismic Gap Theory

- Focuses on patterns in seismicity.
- Predicts based on irregular activities.
- Also if there is a large gap in activity on an active fault.
- If a change in the pattern occurs, there is a chance for an earthquake.

Seismic gap theory looks at the earthquakes along a fault line and predicts that over time earthquakes will occur at all points along the plate boundary/fault line. Therefore the places or gaps where there have been no recent earthquakes are the sites where they are most likely to occur. Also, earthquakes at certain points along a fault line may release pressure in some areas and built it up in others. The size of the earthquake may also relate to others along the fault.



Studies of precursors and events that occur before an earthquake.

Increase in the rate of a seismic creep and the slow movement along the fault

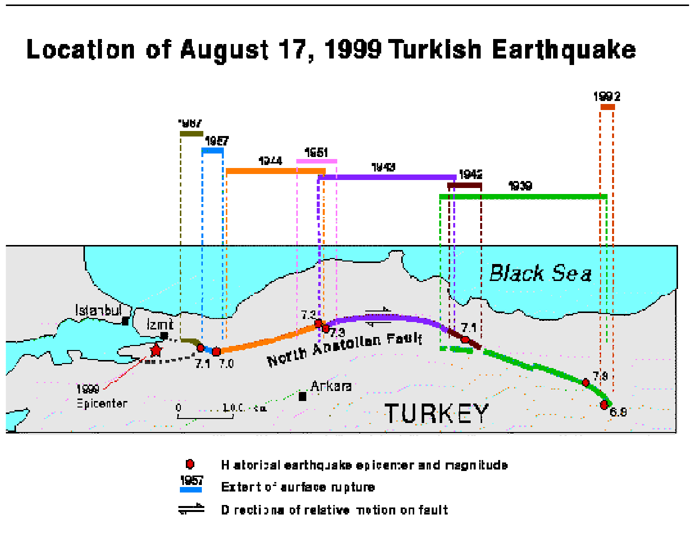
Gradual tilting of the land near the fault zone

Emission of Radon gas

Drop or rise in the water level of a well

Decrease in the number of micro quakes and foreshocks

Animal behavior



Fault Creep Measurements

Measures the slow rate of movement on the fault.

Where lots of fault creep occur there is a small chance of a big earthquake.

Where little amounts of fault creep occur there is a high chance of a big earthquake.

Unusual animal behavior

Hibernating animals leaving their underground nests

Animals refusing to go into pens

Animals seeking higher ground

Birds vacating the area

Deep water fish come closer to the surface

Drop or rise in the water level of a well

Large amplitude surface seismic waves force the particles of the rock near the surface to move adjusting the level.

Before an earthquake water wells are also affected by any fault creeps, crust tilts, or other seismic activity.

Drilling wells in certain locations and measuring the water level and quality can aid in earthquake predictions.

Increased levels of radon gas in well water caused by strain deforming rocks

EMERGENCY PROCEDURES MONITORING AND WARNING

4. Education on Emergency Procedure

Earthquake **drills** are conducted regularly in many earthquake-prone countries to educate and familiarise people on what to do in the event of an earthquake

Governments of earthquake-prone countries also use posters and signs to warn people about areas that are prone to the effects of earthquakes e.g. coastal areas where **tsunamis** can occur

BUT:-

People tend to be complacent and may not see the importance of earthquake education especially if earthquakes have not happened in the region for a long time

Research shows that residents in Tokyo are less prepared for earthquakes than residents in other parts of Japan as the last Tokyo earthquake occurred more than 80 years ago in 1923

5. Earthquake Monitoring and Warning Systems

Earthquake-prone areas should invest in **seismometers** and computers that can monitor tremors of the Earth or change in water levels

Authorities will then inform residents through sirens or public broadcasts of impending danger and begin **mass evacuation**

In Haicheng, China, scientists identified changes in the ground level and increase in small tremors which are signs of an impending earthquake

Authorities were informed and people were warned to evacuate the city

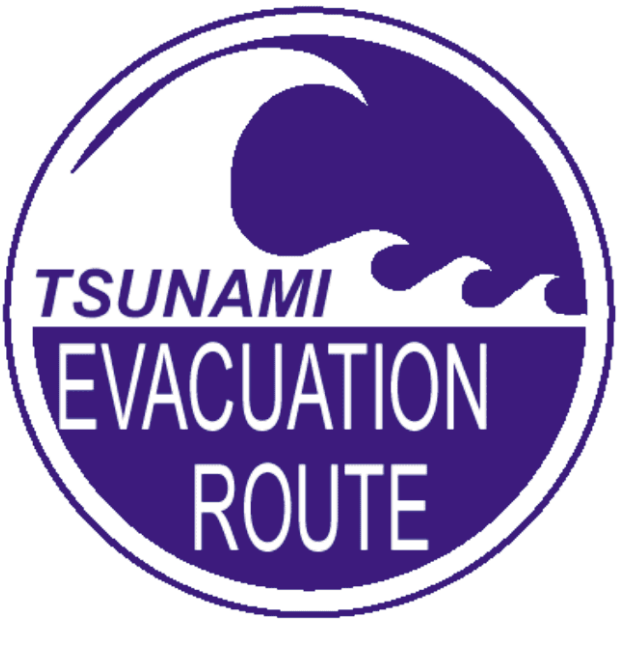
90 000 people were saved from the magnitude 7.3 earthquake that destroyed 90% of the city's infrastructure

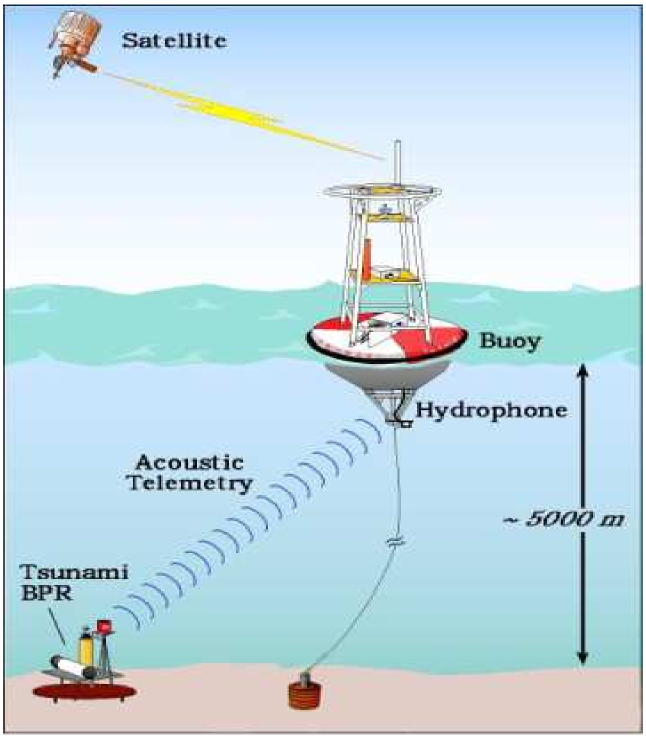
BUT:-

The effectiveness of an earthquake monitoring and warning system is limited

Authorities may choose to ignore warnings to avoid disruptions to business and tourism as

Predictions of scientists may not always be accurate and turn out to be false alarms





MITIGATING AGAINST THE IMPACT OF EARTHQUAKES

Various Methods can be used to **Reduce** the Impacts of Earthquakes

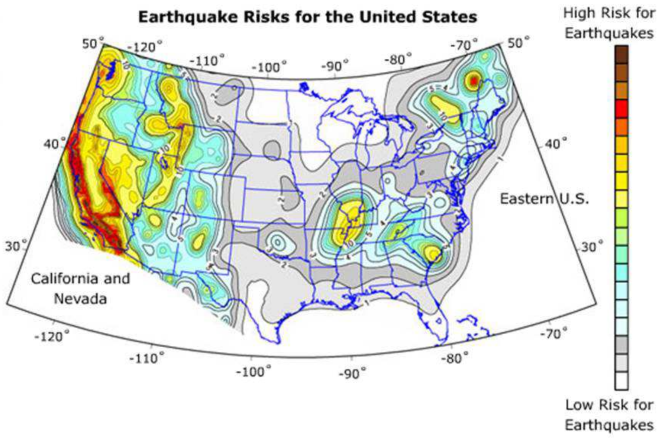
1. Planning the **Location** of Infrastructure
2. Designing Earthquake **Resistant** Infrastructure
3. **Strengthening** Existing Infrastructure
4. **Education**
5. Earthquake **Monitoring** and Warning Systems

1. Planning the location of infrastructure

Build new infrastructure <u>away from earthquake prone areas</u> to reduce economical damage and lower number of deaths caused by earthquakes

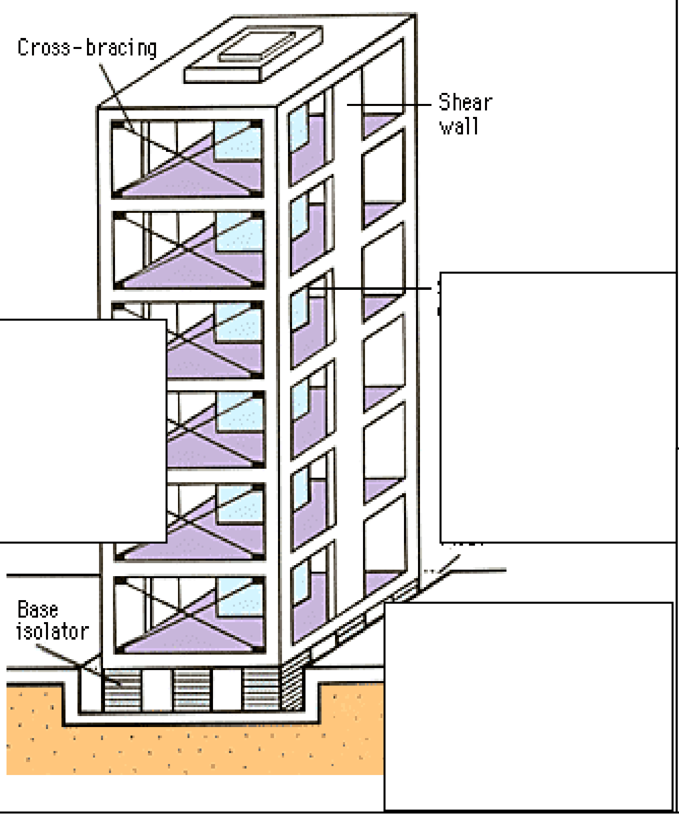
Authorities can <u>implement guidelines on the location</u> of new infrastructure

In USA, authorities use **earthquake risk maps** to <u>control land use</u> so as to minimise damage that may be caused by earthquakes



2. Designing Earthquake-Resistant Infrastructure

New infrastructure can be specially designed to <u>withstand strong tremors</u> by making use of the latest technology



3. Strengthening Existing Infrastructure

New infrastructure can be specially designed to <u>withstand strong tremors</u> and reduce damage from earthquakes by making use of technology

Existing infrastructure can be **reinforced** by <u>wrapping steel frames</u> around the pillars of buildings and bridges, or by <u>placing steel rods</u> in existing structures

geographyjohn

GEOGRAPHY/GEOLOGY

CASE STUDY REVISION BOOKLET

IMPACTS OF AN EARTHQUAKE AND EARTHQUAKE MITIGATION

Earthquake in a MEDC: (case study)

Kobe, Japan, 17Jan 1995 On Tuesday, **January 17th 1995**, at 5.46 a.m. an earthquake of **magnitude 7.2** on the **Richter Scale** struck **Kobe.** This region is the second most populated area after Tokyo, with a population of 10 million. The ground shook for only 20 seconds but in that short time over 5,000 people died, over 300,000 people became homeless and damage worth £100 billion was caused to roads, houses, factories and infrastructure (gas, electric, water, sewerage, phone cables, etc).

Fires spread – many died in these fires

Homeless rose to 310,000

30% of Kobe residents were moved to temporary shelter in camps (in schools, town hall, open parks)

Overcrowded, unsanitary conditions

Food, blankets, medical supplies & clean water in short supply for first few days

Rebuilding costs £70 billion

Damages (includes lost business) £120 million

Only 3% of population had e.g. insurance

Financial lose had huge impact on individuals

Electricity, gas, phones

The quake has **halted 15 generators in thermal power plants** in Osaka. **Electric power supply was cut to over approximately 0.9 million householders at one point**, this recovered down to around 0.4 million householders in Kobe and Nishimiya-Cities by the morning of 1/18. But the damage inflicted upon poles is yet to be investigated. When electricity will be fully recovered is unknown.

Gas supplies are halted to over around 0.83 million householders in Kobe, Ashiya, and Takarazuka-Cities due to **more than 2,600 cases of gas leaks** in Hyogo and Osaka Prefectures. 6,000 staff of Osaka Gas were called to conduct safety inspection. It will take about one and a

The destruction of lifelines and utilities made it impossible for fire fighters to reach fires started by broken gas lines, sparks from severed electrical cables and fallen paraffin lamps. Large sections of the city burned, greatly contributing to the loss of life