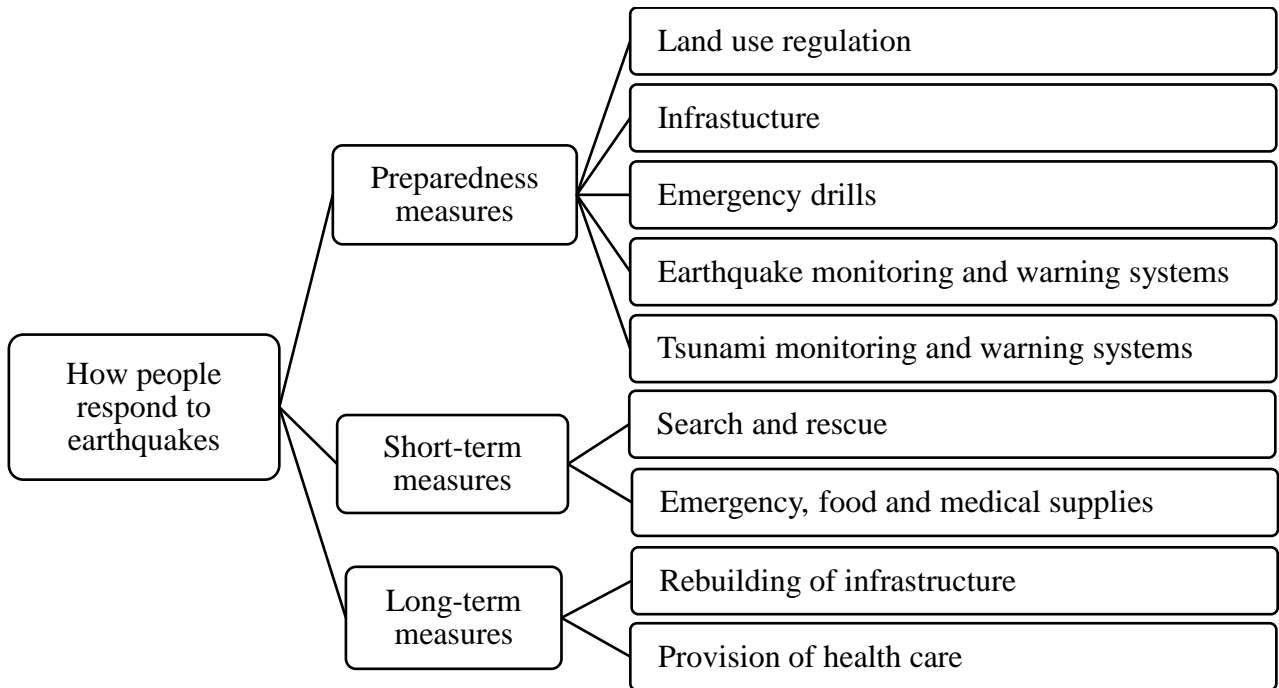


## Chp 1 Gateway 3 – How do people prepare and respond to earthquakes?

Main points:

- Preparedness measures
- Short-term measures
- Long-term measures

### How people respond to earthquakes



## Preparedness measures

Measure	Explanation	Success	Limitations
1. <b>Land use regulation</b>	Set of rules to restrict developments in certain areas	Building development: × build 1) across fault lines 2) areas with risk of liquefaction 3) low-lying land → protective barriers (seawalls)	1) Carried out in areas already developed / privately owned 2) Government authorities buy land from private owners – costly 3) Private owners × want to sell land.
2. <b>Infrastructure</b>	Developed with advanced engineering to withstand vibration <ul style="list-style-type: none"> <li>• Reduce collapse of buildings, minimise damage</li> <li>• Resist shaking of ground – do not collapse</li> <li>• Fitted with <b>trip switches</b></li> </ul>	1) <b>Steel &amp; reinforced concrete</b> 2) <b>Damping devices</b> (act as shock absorbers & counterweights → × sway too much) 3) <b>Wide &amp; heavy bases</b> 4) <b>Base isolation bearings</b> (buffer – absorb force of earthquake → × shake too much)	Cost more to construct & maintain
3. <b>Emergency drills</b>	People practise the steps to take when earthquake occurs <ul style="list-style-type: none"> <li>• Awareness among population</li> <li>• Reduces levels of panic &amp; irrational behaviour</li> <li>• People take part <ol style="list-style-type: none"> <li>1) Move to safe locations</li> <li>2) Listen to instructions given by trained personnel</li> <li>3) Practise first aid</li> <li>4) Become members of local response teams</li> </ol> </li> </ul>	<b>Disaster Prevention Day: 1<sup>st</sup> September</b> <ul style="list-style-type: none"> <li>• Stimulate high magnitude earthquake</li> <li>• Prepare people mentally to react to disaster</li> <li>• Main roads blocked → Emergency vehicles seek alternative routes to reach affected areas</li> </ul>	1) Designed based on most serious earthquake that has ever struck a region 2) Only effective if there is enough time for people to evacuate 3) Earthquakes are hard to predict → insufficient time
4. <b>Earthquake monitoring and warning systems</b>	<ol style="list-style-type: none"> <li>1) Study history of when and where earthquakes occurred → Estimate frequency &amp; magnitude</li> <li>2) Seismic risk maps: show likelihood of locations at risk from earth movements / liquefaction</li> <li>3) Install earthquake sensors on roads &amp; bridges <ul style="list-style-type: none"> <li>• Monitor frequency of vibrations</li> <li>• Detect possible developments of earthquake</li> <li>• Estimate damage to infrastructure</li> </ul> </li> <li>4) Observation stations: gather earthquake motion data</li> </ol>		<ol style="list-style-type: none"> <li>1) Earthquake sensors: expensive to obtain, install and use</li> <li>2) Earthquake usually occurs seconds after sounding warning → Not enough time to evacuate</li> <li>3) Multiple earthquakes occur close to one another → Difficult to give accurate warnings</li> </ol>

	<ul style="list-style-type: none"> <li>• Monitor ground motion</li> <li>• Predict occurrence of earthquake</li> </ul>		
5. Tsunami monitoring and warning systems	<p>Tsunami monitoring devices</p> <ul style="list-style-type: none"> <li>• Help predict tsunamis</li> <li>• Linked to warning systems → Activated to warn people about occurrence of tsunami</li> </ul>	<p>Operation of deep-ocean tsunami detector</p> <ul style="list-style-type: none"> <li>• <b>Surface buoy</b> connected to <b>pressure sensor</b> (anchored to sea floor)</li> <li>• Temperature &amp; pressure: measured + relayed to buoy</li> <li>• Information sent via <b>satellite</b> → <b>tsunami warning station</b></li> </ul>	<ol style="list-style-type: none"> <li>1) Sensors: prone to giving false alarms when waves are high</li> <li>2) Little time to evacuate once approaching tsunami is detected</li> </ol>

### Short-term measures

Measure	Explanation	Success	Limitations
1. Search and rescue	Quickly locate and free people trapped under collapsed buildings	<ul style="list-style-type: none"> <li>• Some survivors found trapped for couple of weeks without food</li> <li>• Deploy <b>sniffer dogs &amp; heat sensors</b> – successfully rescue many trapped</li> </ul>	Rescue workers only have limited time of 72 hours to find trapped survivors → without food and water, trapped people are unlikely to survive after 3 days
2. Emergency, food and medical supplies	<ol style="list-style-type: none"> <li>1) Treat the injured</li> <li>2) Provide clean drinking water prevent dehydration and spread of diseases</li> </ol>	The provision of immediate aid helps survivors continue with their lives	Medical supplies, food and water may not be sufficient and this may cause social unrest

### Long-term measures

Measure	Explanation	Success	Limitations
1. Rebuilding of infrastructure	Infrastructure & amenities: rebuilt & improved after disaster	Authorities develop stricter building codes → infrastructure restored at higher safety level	<ol style="list-style-type: none"> <li>1) Reinforced buildings, which are built to protect against earthquakes, are not necessarily protected against tsunamis</li> <li>2) Additional protection could be in the form of coastal protection structures such as breakwaters</li> </ol>
2. Provision of health care	<ul style="list-style-type: none"> <li>• Health options provided (long-term counselling)</li> <li>• Loss of loved ones / homes / jobs → long-lasting trauma</li> </ul>	Problems identified & addressed early	Improving health options is challenging (restore resilience of people after earthquake)