

1. Details of Module and its structure

Module Detail	
Subject Name	Geography
Course Name	Geography 02 (Class XI, Semester - 2)
Module Name/Title	Natural Hazards and Disaster-Earthquakes and Tsunami – Part 2
Module Id	kegy_20702
Pre-requisites	Basic Concept about the formation of earthquakes
Objectives	After reading this lesson, learners will be able to: <ul style="list-style-type: none">• Acquire knowledge and understanding about the disaster caused due to earthquakes and Tsunami.• Acquire knowledge and understanding about the effects of both earthquakes and tsunami on the life of people.• Understand how to act before, during and after a disaster caused due to an earthquake or tsunami.
Keywords	Seismic waves, Tsunami,

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Earthquake

An earthquake is the vibration or shaking of the earth surface produced by the sudden displacement of rock on the earth's crust. Earthquakes result from volcanism, landslides, tectonic plate movements, subsidence, impounding of dams and collapse of caverns. Stress accumulates in response to the energy released until it exceeds the strength of the rock. The rock then breaks along a pre-existing or new fracture called a fault. This breakage extends outward in all directions along the fault plane from its point of origin (seismic focus).

Earthquakes are recorded by seismograph which records the speed of travel of seismic waves. This is registered in Richter scale. In a Richter scale of magnitude less than three, the impact of earthquake is imperceptible where as a magnitude of more than seven causes serious damage over a larger area. Intensity of shaking is measured on the modified Mercalli scale. In India Medvedev-Sponheuer-Karnik scale, also known as the MSK or MSK-64, which is a macro seismic intensity scale, is used to evaluate the severity of ground shaking on the basis of observed effects in an area of the earthquake occurrence.

Earthquakes are by far the most unpredictable and highly destructive of all the disasters. Earthquakes that are of tectonic origin have proved to be the most devastating and their area of influence is also quite large. These earthquakes result from a series of earth movements brought about by a sudden release of energy during the tectonic activities in the earth's crust. As compared to these, the earthquakes associated with volcanic eruption, rock fall, landslides, subsidence, particularly in the mining areas, impounding of dams and reservoirs, etc. have limited area of influence and the scale of damage. Earthquakes in Himalayan belt is mainly caused due to the plate movement and the consequent release of energy.

Some of the most vulnerable areas include valley of Kashmir, Northern bordering districts of Uttarakhand, Chamba and Dharamashala of Himachal Pradesh, North central Bihar all north eastern states, and Kachchh of Gujarat.



Image 1: BHUJ earthquake 2001

Source : <https://www.nicee.org/photos/Bhuj/RC22elevator.jpg>

Earth scientists have found it difficult to explain the occurrence of earthquakes in one of the oldest, most stable and mature landmass of Peninsular block for a long time. Recently, some earth scientists have come up with a theory of emergence of a fault line and energy build-up along the fault line represented by the river Bhima (Krishna) near Latur and Osmanabad (Maharashtra) and the possible breaking down of the Indian Plate Below are given some of the well-known earthquakes occurred in India.

Some better known damaging earthquakes in India

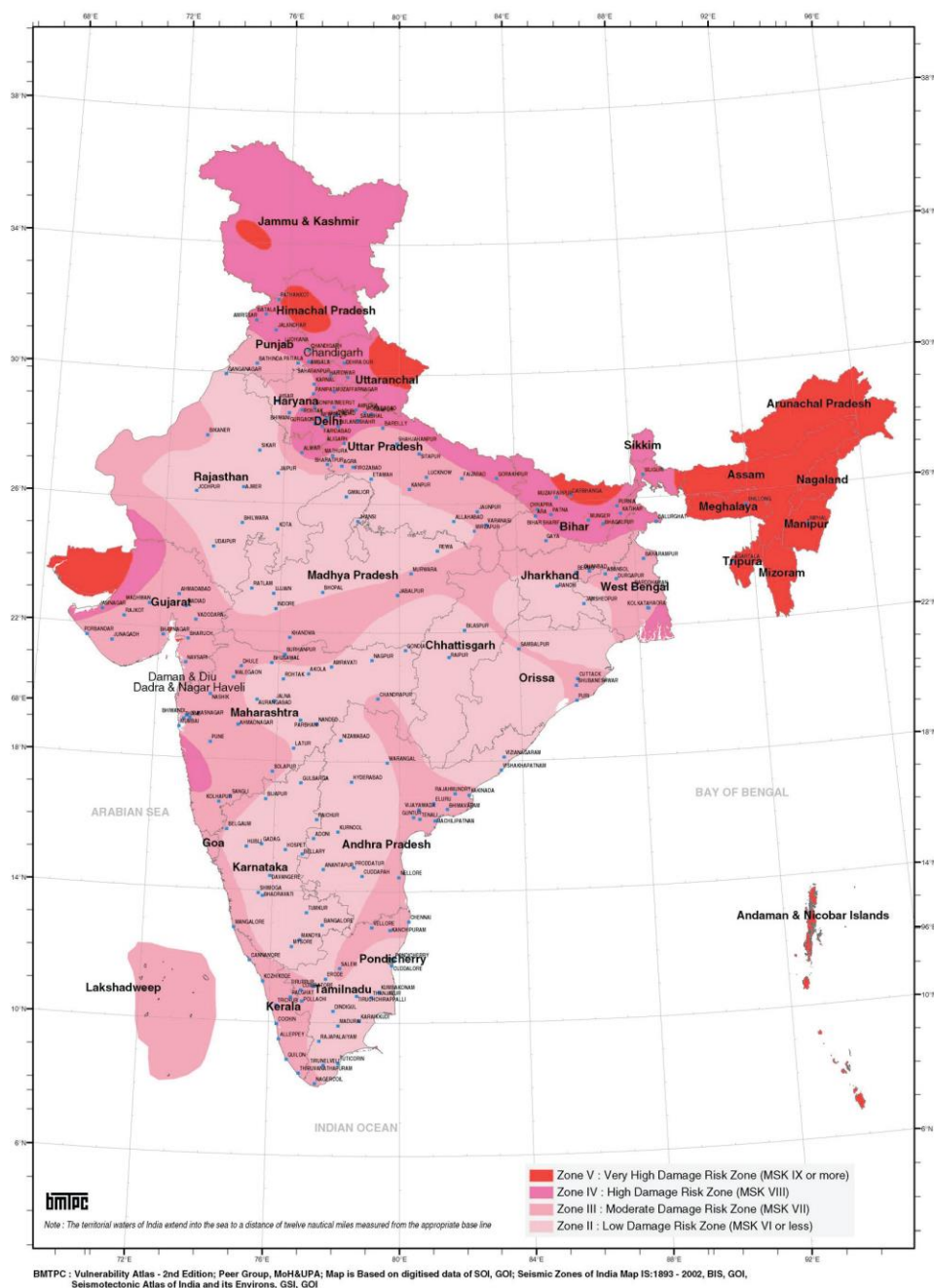
Year	Area	Date	(IST) Time hr:m:s	Latitude degrees North	Longitude degrees East	Magnitude M	Max. MM Int.	Deaths
1819	Gujarat (Kutch)	Jan.16	Mid Night	-	-	8.0	XI	Many Thousand
1833	Bihar	Aug.26	-	27.5	86.5	7.7	XI	Hundreds
1897	Assam (Shillong)	Jun.12	16:36:-	25.0	92.0	8.7	XI	1600
1900	Kerala (Palghat)	Feb 8	-	10.7	76.7	6.0	-	
1905	Himachal Pradesh (Kangra)	Apr 4	06:20:-	32.5	76.5	8.0	XI	20000
1930	Assam (Dhubri)	Jul 3	02:33:34	25.8	90.2	7.1	IX	Many*
1934	Bihar -Nepal	Jan 15	14:13:26	26.6	86.8	8.3	XI	14000
1941	Andamans	Jun 26	-	12.4	92.5	8.0	X	Many
1943	Assam (NE)	Oct 23	22:53:17	26.8	94.0	7.2	X	
1950	Assam (NE)	Aug 15	19:39:28	28.7	96.6	8.6	XI	1500
1956	Gujarat (Anjar)	Jul 21	21:02:36	23.3	70.0	7.0	VIII	Hundreds
1956	Uttar Pradesh (Bullandshahar)	Oct 10	-	28.1	77.7	6.7	VIII	Many
1958	Uttar Pradesh (Kapkote)	Dec 28	-	30.0	80.0	6.3	VIII	Many
1960	Delhi	Aug 27	21:28:59	28.3	77.4	6.0	VII	
1963	Kashmir (Badgam)	Sep 2	07:04:32	33.9	74.7	5.5	VII	Hundreds
1966	Western Nepal	Jun 27	-	29.5	81.0	6.3	VIII	
1966	Uttar Pradesh (Moradabad)	Aug 15	-	28.0	79.0	5.3	VII	
1967	Nicobar	Jul 2	-	9.0	93.4	6.2	-	
1967	Maharashtra (Koyna)	Dec 11	04:21:19	17.4	73.7	6.5	VIII	200
1970	Andhra Pradesh (Bhadrachalam)	Apr 13	-	17.6	80.6	6.5	VII	
1970	Gujarat (Broach)	Mar 23	07:23:03	21.7	72.9	5.7	VII	
1975	Himachal Pradesh	Jan 19	-	32.5	78.4	6.5	VIII	
1988	Bihar - Nepal	Aug 21	04:39:10	26.76	86.62	6.6	VIII	1003
1991	Uttar Pradesh (Uttarkashi)	Oct 20	02:53:-	30.75	78.86	6.6	VIII	715
1993	Maharashtra (Killari)	Sep 30	03:55:47	18.07	76.62	6.3	VIII	7928
1997	Jabalpur	May 22	04:22:31	23.1	80.1	6.0	VII+	38
1999	Uttaranchal (Chamoli)	Mar 29	00:35:13	20.45	79.42	6.8	VIII	hundreds
2001	Gujarat (Bhuj)	Jan 26	08:46:43	23.40	70.28	6.9** (7.7)	X	13800

* Many will mean less than a hundred

** 6.9 on Richter Scale & 7.7 on Moment Magnitude

Source: http://www.bmtpc.org/DataFiles/CMS/file/Earthquake_Hazard_Guidelines_2010.pdf

You can see the Seismic zone map of India given below showing the areas of moderate to vulnerable seismic hazard zone.



Source: <https://ndma.gov.in/images/guidelines/earthquakes.pdf>

National Geophysical Laboratory, Geological Survey of India, Department of Meteorology, Government of India, along with the National Institute of Disaster Management, have made an intensive analysis of more than 1,200 earthquakes that have occurred in India in different years in the past, and based on these, they divided India into the following five earthquake zones:

- (i) Very low damage risk zone.
- (ii) Low damage risk zone
- (iii) Moderate damage risk zone

- (iv) High damage risk zone
- (v) Very high damage risk zone

Out of these, the last two zones had experienced some of the most devastating earthquakes in the past in India.

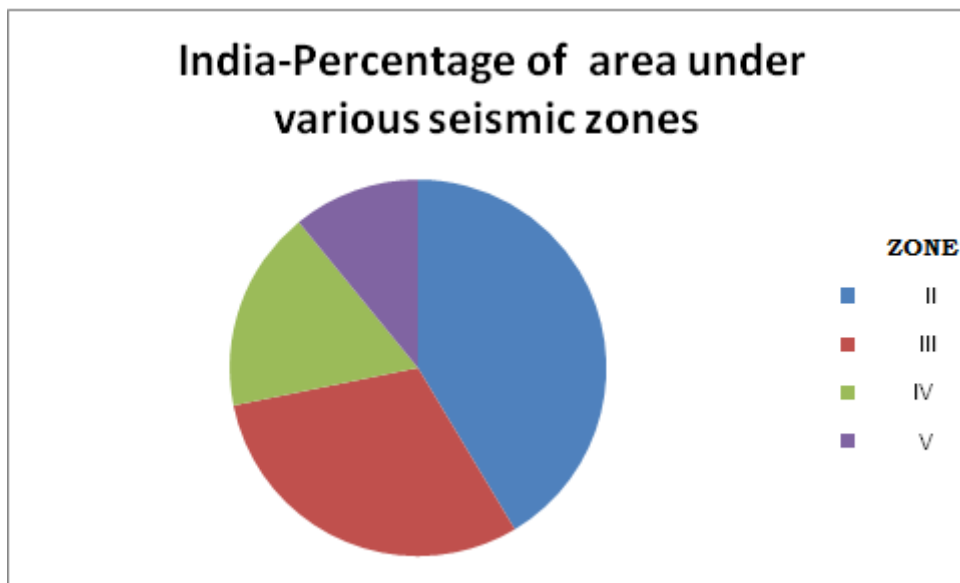
As shown in the map given above areas most vulnerable to earthquakes are the North-east states, areas to the north of Darbhanga and Araria along the Indo-Nepal border in Bihar, Uttarakhand, Western Himachal Pradesh (around Dharamshala) and Kashmir Valley in the Himalayan region and the Kutch (Gujarat). These are included in the Very High Damage Risk Zone. Similarly, the remaining parts of Jammu and Kashmir, Himachal Pradesh, Northern parts of Punjab, Eastern parts of Haryana, Delhi, Western Uttar Pradesh, and Northern Bihar fall under the High Damage Risk Zone. Remaining parts of the country fall under moderate to very Low Damage Risk Zone. Most of the areas that can be considered safe are from the stable landmass covered under the Deccan plateau Intensity of an earthquake is based on the observed effects seen in an area due to the severity of the earthquake and is measured in the MSK scale ranging from I to XII. See the table given below to understand more about it.

Zone	Intensities of earthquake in different zones
II	This zone is susceptible to earthquakes that can be felt by all and may frighten people enough to run outdoors. Dishes and glassware break, books fall down ,heavy furniture gets moved .Few instances of fallen plaster and some damage to buildings may all observed.(Intensity MSK :I to VI)
III	In Zone III, earthquakes of higher intensity may be felt. Earthquakes that frightens everyone, making it difficult for people to stand. Even people in moving vehicles may feel such quakes. Structures/buildings of good design and construction suffer slight damage, while poorly designed/built ones suffer considerable damages (Intensity MSK :VII)
IV	This zone is susceptible to strong earthquakes, which create panic all over, moving even heavy furniture. Such earthquakes could cause moderate damage in well-designed/built structures/buildings, while poorly built structures suffer great damages. Other effects could be landslides on steep slopes, cracks in ground up to widths of a few centimeters and water in lakes could become turbid.(Intensity MSK :VIII)
V	This is maximum risk zone in the country and is susceptible to great earthquakes. Quakes that can cause total panic and considerable damage to life and property. Considerable damages happen even in specially designed

	<p>structures. Great damage in buildings with partial or total collapse. Railway tracks bend and roadways get damaged; ground cracks to widths of several cm, underground pipes break, landslides, rock falls and mud flows occur, large waves in water. Where intensities exceed XI, total destruction may be caused with changes in landscape that could even change the course of rivers.(Intensity MSK : IX and above)</p>
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Earthquake Risk in India

Many parts of India are highly vulnerable to earthquake. This can be understood from the fact that about 59 per cent of India could face moderate to severe earthquakes. Out of which 41.40 per cent land area is coming under seismic zone II, 30.40 per cent is under seismic zone III, 17.30 per cent in zone IV and 10.90 per cent of the earthquake prone area comes under zone V. See the diagram given below and understand the share of area under various seismic zones.



If you analyse the statistics it is evident that many people have lost their life and property during the past two decades due to earthquake. Some of them are the Uttarkashi earthquake of 1991, the Latur earthquake of 1993, the Jabalpur earthquake of 1997, and the Chamoli earthquake of 1999. These were followed by the Bhuj earthquake of 26 January 2001 and the Jammu & Kashmir earthquake of 8 October 2005.

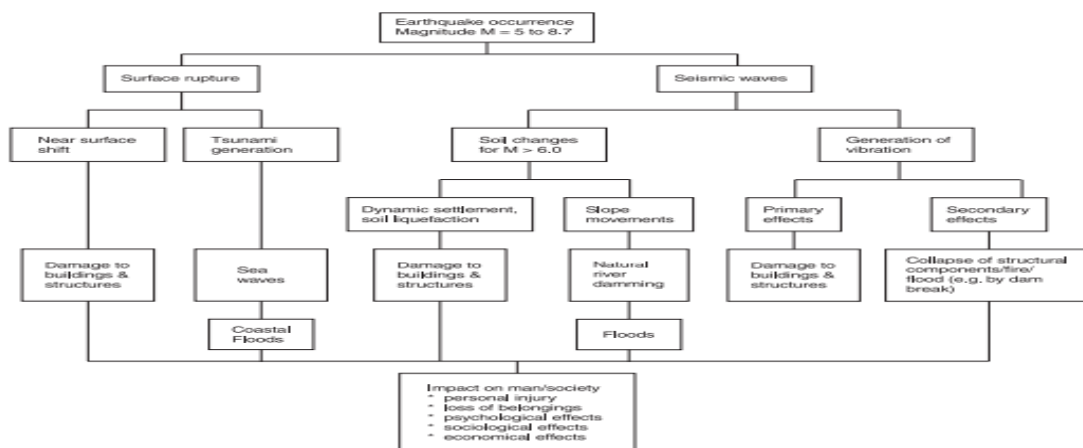
In all these earthquakes more than 95 per cent of the lives were lost due to structural collapse. By understanding and analyzing the impact of earthquakes which happened in the past we should prepare ourselves so that adverse effect of it can be minimized in future. In our country we should give more emphasis on the construction of earthquake resistant buildings and taking

adequate safety measures through awareness program by governmental and non-governmental agencies.

Socio-Environmental Consequences of Earthquakes

The idea of an earthquake is often associated with fear and horror due to the scale, magnitude and suddenness at which it spreads disasters on the surface of the earth without discrimination. It becomes a calamity when it strikes the areas of high density of population. It not only damages and destroys the settlements, infrastructure, transport and communication network, industries and other developmental activities but also robs the population of their material and socio-cultural gains that they have preserved over generations. It renders them homeless, which puts an extra-pressure and stress, particularly on the weak economy of the developing countries. Effects of Earthquakes have all encompassing disastrous effects on the area of their occurrence.

Following flow chart of UNDR0 shows some of the possible effects of earthquake of magnitude 5 and above.



Possible overall effects of earthquake hazards
Source: UNDR0

Look at the table given below for some of the other important effects of earthquakes.

Effects of Earthquakes		
<i>On Ground</i>	<i>On Manmade Structures</i>	<i>On Water</i>
Fissures Settlements Landslides Liquefaction Earth Pressure Possible Chain-effects	Cracking Slidings Overturning Buckling Collapse Possible Chain-effects	Waves Hydro-Dynamic Pressure Tsunami Possible Chain-effects

Apart from these, earthquakes also have some serious and far-reaching environmental consequences such as:

1. Seismic waves (surface waves) produce fissures on the upper layers of the earth's crust through which water and other volatile materials gush out, inundating the neighbouring areas.
2. Earthquakes are also responsible for landslides
3. Earthquakes can also cause obstructions in the flow of rivers and channels resulting in the formation of reservoirs.
4. Rivers also change their course causing floods and other calamities in the affected areas.

Earthquake Hazard Mitigation

Unlike other disasters, the damages caused by earthquakes are more devastating. Since it also destroys most of the transport and communication links, providing timely relief to the victims becomes difficult. It is not possible to prevent the occurrence of an earthquake; hence, the next best option is to emphasis on **disaster preparedness and mitigation** measures such as:

- (i) Establishing earthquake monitoring centres (seismological centres) for regular monitoring and fast dissemination of information among the people in the vulnerable areas.
- (ii) Use of Geographical Positioning System (GPS) can be of great help in monitoring the movement of tectonic plates.
- (iii) Preparing a vulnerability map of the country and dissemination of vulnerability risk information among the people and educating them about the ways and means minimising the adverse impacts of disasters.
- (iv) Modifying the house types and building designs in the vulnerable areas and discouraging construction of high-rise buildings, large industrial establishments and big urban centres in such areas.
- (v) Finally, making it mandatory to adopt earthquake-resistant designs and use light materials in major construction activities in the vulnerable areas.
- (vi) Creating Public awareness by involving family and community.
- (vii) Involving NGOs and volunteer groups within the community for preparing disaster management plans and its execution at the time of any disaster.
- (viii) Conducting mock drills from time to time.

So far we have studied about earthquakes, causes, areas vulnerable to it etc. We cannot prevent the occurrence of future earthquakes, but we can reduce the impact of earthquakes through

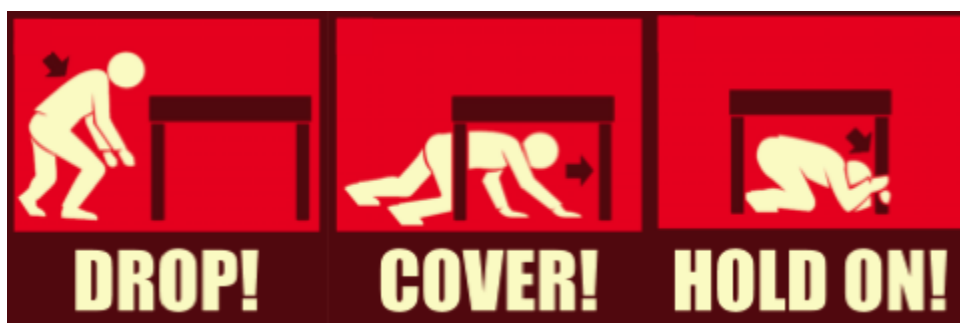
preparedness and by safe building practices. It is advisable to understand and follow the do's and don'ts mentioned below:

Before an earthquake

1. Prepare a disaster management plan for the family /school and practice it regularly.
2. Preparation of an emergency kit comprising of food, water, prescription of medications, and first aid supplies, a battery operated radio, extra batteries, shelter clothing, sturdy shoes and personal toiletries.
3. Identification of few safe meeting places.
4. Conduct regular mock drills for school children.
5. New buildings are to be constructed in consultation with professionals so that it can resist earthquake.
6. Identification of out of area phone number of one or two persons.

During an earthquake

1. Do not be panic. Stay calm and do not jump from the building.
2. If you are near an exit leave the building as soon as possible.
3. Cover your head with your arms to avoid any falling object. Watch out for traffic
4. If you are inside a high rise building and you cannot reach out to the exit, then stay inside, look for firm furniture, then **DROP, COVER and HOLD!** Cover as much of your head and upper body as you can. Hold on to any secure furniture so that it does not move away from you.



4. Move to an inside wall and sit with your back to the wall, bring your knees to your chest and cover your head.



5. Stay away from mirror and windows.

6. Do not exit the building during the shaking.

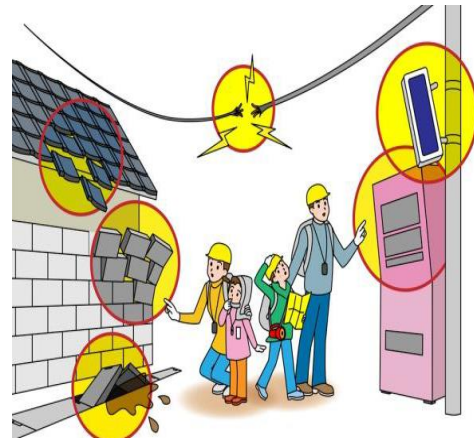


7. Do not use lift

8. If outdoors, move to an open area away from all structure, especially building, bridges, trees.



9. Stay away from electric poles.



After an earthquake

1. Move carefully and do not step on unstable and hazardous objects.
2. Try to move out of the buildings at the earliest.
3. If you are capable of helping others lend your hands for the needy.
4. Check yourself for injuries.
5. Anticipate aftershocks, especially if the earthquake lasted for more than two minutes.
6. Stay away from the partially damaged buildings.
7. Do not try to enter in to the damaged building.
8. Gather information from the battery operated radio.



Source for diagrams: CBSE textbook on natural hazards and disaster management of class XI

Some Important Facts

1. Prediction of earthquakes is not possible. Do not listen to or, spread rumors.
2. Expect aftershocks. Aftershocks are normally less intense and gradually die out.
3. Long term strengthening or, retrofitting must be done to avoid future failures. The technology, expertise and the codes of practice for this exist in the country.

Some Interesting Facts

History of Earthquake Monitoring

Earthquake monitoring through instrument was started in India on 1 December 1898 at Alipore (Kolkata), where the first Seismological observatory of the country was established. This was set up after the devastating earthquake which took place at shilling plateau in 1897. Now the NCS (The National Centre for Seismology) established by Ministry of Earth Sciences is the nodal agency of the government of India for monitoring seismic activities in and around the country on a 24x7 basis.

Now let us learn more about earthquakes through a game.

SLAKE AND LADDER GAME FOR EARTHQUAKES AWARENESS (Ver-1)

UNDERSTANDING OF YOUR ROLES AND RESPONSIBILITY

BEFORE DURING AND AFTER EARTHQUAKES

HAVE BETTER UNDERSTANDING

ORIGINAL DESIGN - ASHISH RANA, STU

TOLL-FREE EMERGENCY HELPLINE **FIRE-101** **AMBULANCE-102/108** **POLICE-100** **DISASTER CONTROL ROOM-1077**

SH RANA, STUDENT & DR HEMANT VINAYAK, ASST. PROF.

NIT-HAMIRPUR, MODERATION: PROF. C. GHOSH, NIDM

100. Take expert advice before making your house and follow Indian seismic codes and guidelines.

99. Take pictures of the damage, both of the house and its contents, for insurance claims or for documentation purpose.

98. Do not be Panic: Stay calm and take necessary action.

97. Develop strategy of retrofitting or rehabilitating existing structures and infrastructure that were built under earlier using less advanced codes or standards.

96. Keep Family Disaster Plan ready and practice it regularly.

95. It may not be possible to make earthquake proof buildings; however, it is possible to make buildings earthquake resistant.

94. Do not re-enter badly damaged buildings and do not go near damaged structures.

93. Secure items that might fall (television, books, computers, etc.) against strong latches or bolts on cabinets.

92. Evaluate the earthquake safety of your building and retrofit/strengthen if advised by experts.

81. Create a culture of safety such as how to screen buildings to identify those potentially in need of seismic rehabilitation; how to secure the nonstructural components of buildings to reduce earthquake damage, casualties, and losses.

82. Retrofit old structures and implement building codes for new structures.

83. Education is a human right, universal and unavoidable. This right must not disappear or get disappearing because of earthquakes induced disasters!!

84. Keep away from old buildings, electricity wires, slopes and walls, which are liable to collapse during Earthquake.

85. In order to have disaster insurance and other benefits, it is important to have completion certificate from multiple authorities, which will be based on resistance measures taken by you.

86. Make sure to have a functional railway among the fire stations, ambulance services, police, consumer organisations in coherence with city municipalities and suburbs.

87. Proper structural design and engineering practices should be followed while constructing a house.

88. Move away from power lines, walls, false ceiling, parapet, falling flower pot and other element that may fall or collapse.

89. Earthquake insurance, covering earthquake drills, strengthening buildings must be done by households, companies, neighbourhoods, disaster regions in regular basis.

80. Conserving, shopping and enforcing seismic building codes, including seismic provisions and the standards referenced by these provisions, are among the most effective strategies available for earthquake risk reduction.

79. ...schools built world-wide routinely collapse in earthquakes due to avoidable errors in design and construction, causing predictable, unacceptable and tragic loss of life...we must stop it by all means....

78. Capacity is the resources of communities to cope with a threat or resist the impact of a hazard. Risk is the probability/likelihood of a disaster happening.

77. Know well the construction of your area, get your house evaluated for retrofitting (if required) and ensure expert Civil Engineer's help in making your house earthquake resistant as per IS code (IS-1893-2002) (details at www.bs.org.in & www.bmcg.org.in)

76. Teach all members of your family how to turn off the electricity, water and gas supply.

75. Move away from windows, glass and unfastened objects.

74. Do not try to cross bridges, flyovers, which may be damaged.

73. A hazard is a physical event that can potentially trigger a disaster. Vulnerability is the degree to which communities are susceptible to loss, damage, suffering and death, in the event of a disaster.

72. School bags can be used to protect head in place of desks.

71. Preparedness saves lives. Mitigation saves lives. Consult expert Civil engineers and follow norms as per building codes (www.bs.org.in)

60. Protect yourself by staying in the corner of a room, under at table or a bed.

59. Do Not rush to the exit point. Get out calmly in an orderly manner.

58. When driving a vehicle pull to the side of the road and stop.

57. Keep corridors of your school free from furniture or other store items.

56. Help neighbors who may require special assistance after the shaking stops.

55. Place 'objects' on the floor or lowest shelves.

54. Heavy or bulky objects on the floor or lowest shelves.

53. Disasters are seen as the consequence of inappropriately managed risk. Therefore, it is important to look after disaster safe school facilities.

52. Always remember! "Earthquakes don't kill people, unsafe buildings do."

51. During the 2001 Bhuj earthquake in India (MSK of IX), 971 students and 31 teachers died, and 1051 students and 95 teachers were injured.

41. Do not use elevators.

42. If you are in a seismically secured building stay there.

43. If you are living in a hill area that prone to earthquake, rock falls and landslides? Get your locality checked by experts.

44. If you are living in an earthquake prone area with seismic Zone-III, IV & V? Get your home checked by experts for earthquake protection.

45. Are you living in a hill area that prone to earthquake, rock falls and landslides? Get your locality checked by experts.

46. Are you living within 300m from coast line? Get your locality checked by expert sand take measures against Tsunami/Tidal waves.

47. Is your building having soil storey/stilt parking without earthquake protection? Get your building checked by experts and adopt retrofitting measures.

48. Extra cost of earthquake resistant features for reinforced concrete building (4-6 storeys) would be 6-10%.

49. Schools frequently collapse during earthquakes and will continue to do so unless individuals, communities, scientists, government sand other bodies discuss and devise solutions to address the problem.

50. Our Families associate made assessment of Earthquakes and its impacts.

40. School bags can be used to protect head in place of desks.

39. If you are on a steep hillside, move away in case of landside and falling rocks.

38. If you are inside an old weak structure take the fastest and safest way out.

37. Extra cost of earthquake resistant features in severe earthquake zone for masonry buildings shall be 4-6%.

36. In India about 3% of the 230 million building units are made of concrete walls, 85% of the buildings are non-engineered. About 29% are made of mud walls and 45% are made of burnt bricks walls, which are not at all earthquake resistant.

35. Losses due to natural disasters are 20 times greater (as a percentage of GDP) in developing countries than in industrialized countries.

34. Houses living in earthquake prone areas, get your building designed with earthquake resistant measures and ensure quality constructions as per guidelines available in (www.nrdm.gov.in, www.nrma.gov.in, www.bs.org.in)

33. Always remember! "Earthquakes don't kill people, unsafe buildings do."

32. During the 2001 Bhuj earthquake in India (MSK of IX), 971 students and 31 teachers died, and 1051 students and 95 teachers were injured.

21. School bags can be used to protect head in place of desks.

22. Instead take the 'staircase' to reach open space.

23. In India about 11% geographical area are in Seismic Zone-V (mostly along the Himalaya). 15% in Zone-IV, 31% in Zone-III and rest in Zone-II.

24. Are you living in an earthquake prone area with seismic Zone-III, IV & V? Get your home checked by experts for earthquake protection.

25. Are you living in a hill area that prone to earthquake, rock falls and landslides? Get your locality checked by experts.

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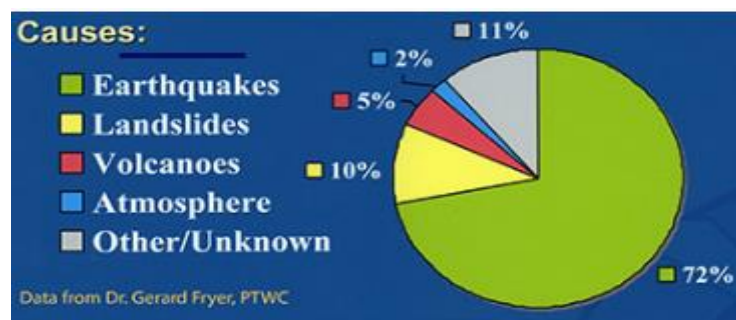
12. Our Families associate made assessment of Earthquakes and its impacts.

11. About 300 school children marching in the 28th January Republic Day, 2001 procession in a narrow lane in the town of Anjar were killed when buildings on both sides collapsed on them.....

Tsunami

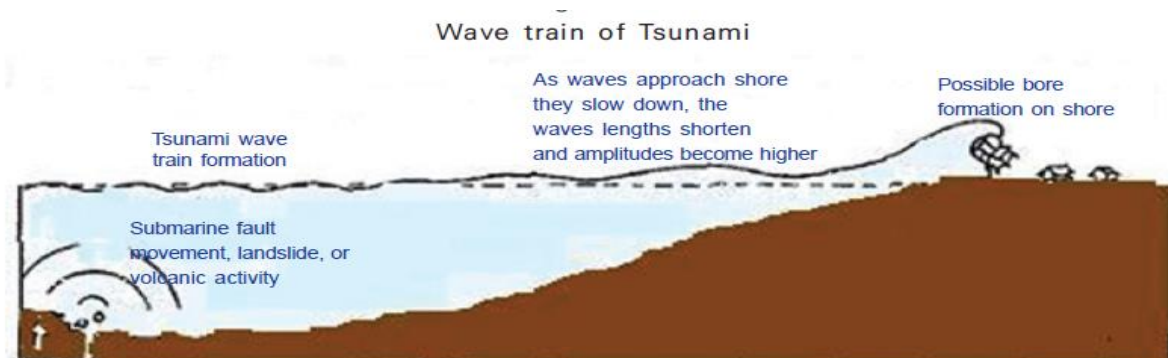
Tsunami is a giant wave triggered by underwater disturbances due to earthquake, volcanic eruption, or due to any tectonic activities. Tsunami can also occur due to large scale landslide, avalanche or due to the fall of meteorite. The word Tsunami is originated from a Japanese word 'Tsu' which means harbour and 'Nami' means waves. Hence "Tsunami" is also known as "Harbour waves".

Causes of Tsunami

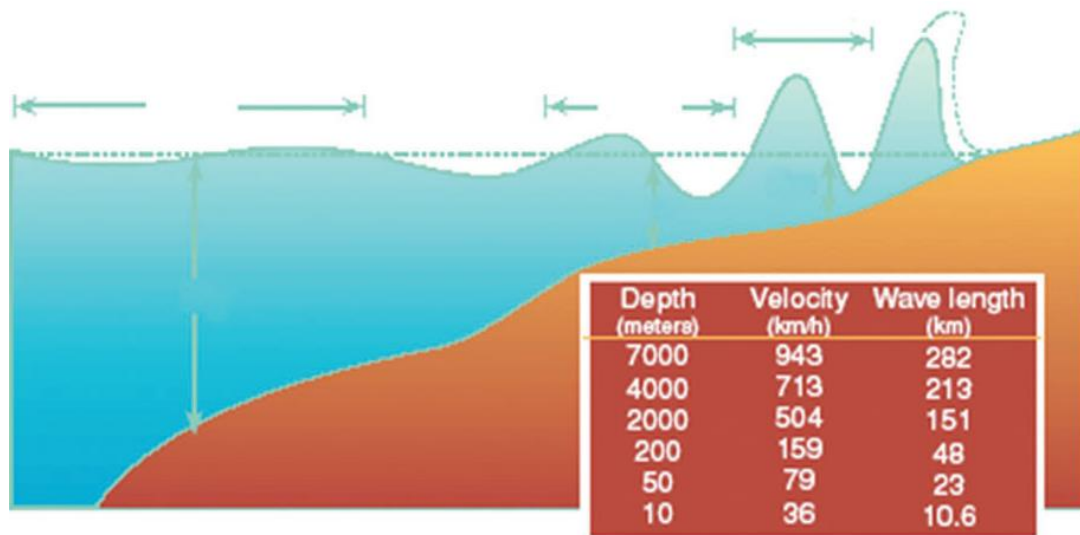


Source : <http://tsunami.org/what-causes-a-tsunami/>

The speed of wave generated as a result of the underwater disturbances in the ocean depends upon the depth of water. It is more in the shallow water than in the ocean deep. (See the two diagrams given below) As a result of this, the impact of tsunami is less over the ocean and more near the coast where they cause large-scale devastations. Therefore, a ship at sea is not much affected by tsunami and it is difficult to detect a tsunami in the deeper parts of sea. It is so because over deep water the tsunami has very long wave-length and limited wave-height. Thus, a tsunami wave raises the ship only a metre or two and each rise and fall takes several minutes. As opposed to this, when a tsunami enters shallow water, its wave-length gets reduced and the period remains unchanged, which increases the wave height. Sometimes, this height can be up to 15m or more, which causes large-scale destructions along the shores. Thus, these are also called Shallow Water Waves.



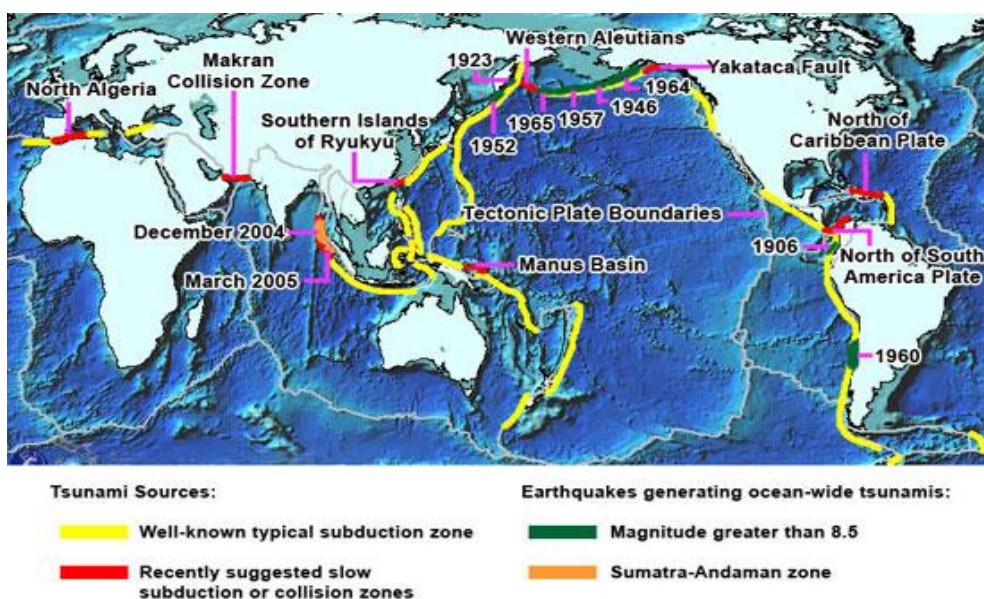
Source:- International Tsunami Information Centre - Geologic Hazard



Tsunami Velocities

Source:http://www.prh.noaa.gov/pr/itic/library/pubs/great_waves/tsunami_great_waves_4.html

Tsunamis are frequently observed along the Pacific ring of fire, particularly along the coast of Alaska, Japan, Philippines, and other islands of Southeast Asia, Indonesia, Malaysia, Myanmar, Sri Lanka, and India etc. You can see the map given below showing tsunami source zones. After reaching the coast, the tsunami waves release enormous energy stored in them and water flows turbulently onto the land destroying port-cities and towns, structures, buildings and other settlements. Since the coastal areas are densely populated the world over, and these are also centres of intense human activity, the loss of life and property is likely to be much higher by a tsunami as compared to other natural hazards in the coastal areas.



Source:http://itic.ioc-unesco.org/images/stories/oldsite/upload/WorldMap_PacificCentered_Plates_big.jpg

Tsunamis are rare events, but they are very destructive. People who are living in the low lying coastal areas and small islands are highly vulnerable to these waves. In the past two decades we have witnessed the occurrence several destructive tsunamis. Tsunami which took place on 26th December 2004 near Indonesia and the Tsunami of 1st March 2011 near Japan took the lives of thousands of people.

Tsunami poses a significant threat to various sensitive establishments located in the coastal areas. Many countries have their airports, Industrial complexes or nuclear power plants located near the coastal areas. Nuclear power plants of Japan suffered a lot due to the devastating Tsunami occurred in March 2011. It created a threatening situation to people not only in Japan but also to the world at large. Hence it is a matter of great concern to set up such establishments which are potentially hazardous to nature and humans, near the coastal areas which are highly vulnerable to Tsunami.

How can we save the lives of people from Tsunami?

1. Educate people on Tsunami risk.
2. Have early warning system.
3. Protect the coastal areas with natural or manmade structures.
4. Maintain and use indigenous and traditional knowledge and practices about tsunami to save lives.
5. Prepare a disaster plan and identify the safer areas in advance.
6. Relocate Infrastructure such as Industries, power plants etc to safer places.

Do you know the natural Tsunami Warnings?

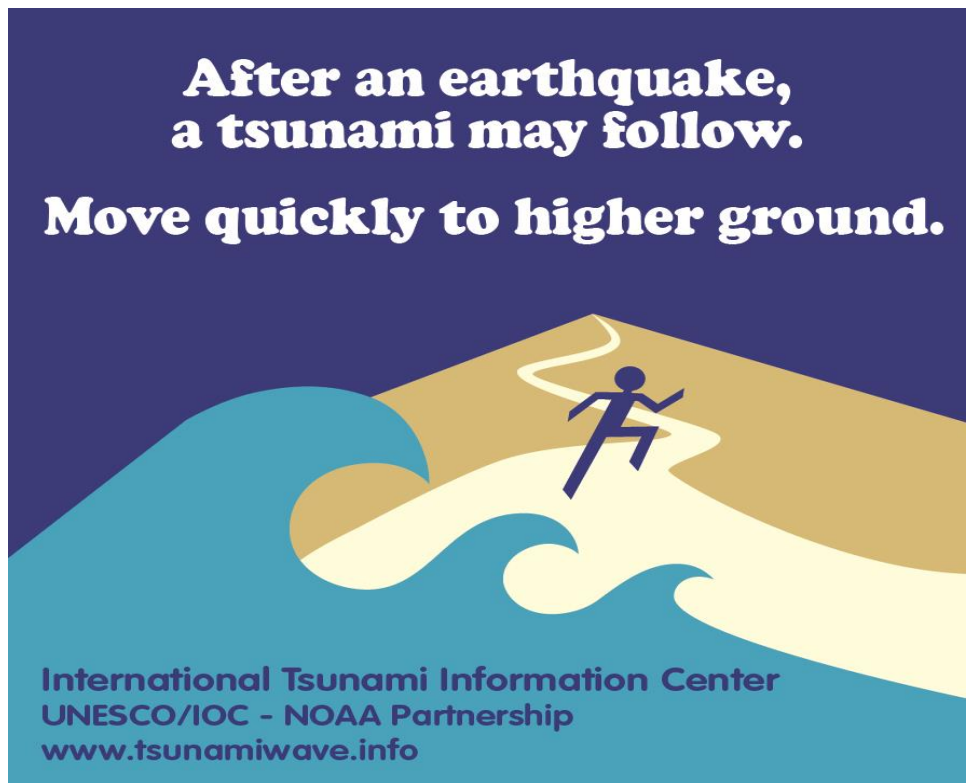
Tsunamis can happen anytime of the day or night. If you are in a tsunami hazard zone.

FEEL strong ground shaking OR

SEE the unusual changes in the sea level OR Oncoming wall of sea waves

Hear a loud roar of the sea waves of very high intensity

ACTION: Immediately leave the coastal area, move to higher ground or towards interior part of the land.



Source:http://itic.ioc-unesco.org/images/stories/photos_video_graphics/tsunami_safety/tsunami_awareness_sticker.jpg

Do's & Dont's:

Before & During

- Find out if your home is in the danger zone
- Know the height of your street/house above sea level and the distance from the coast.
- People living along the coast should consider an earthquake or strong ground rumbling as a warning signal.
- Try and climb a raised platform or climb the highest floor of any house or building which you might see.
- Make evacuation plans and a safe route for evacuation.
- Stay away from the beach.
- Never go down near the beach to watch the Tsunami.
- Listen to a radio or television to get the latest information and be ready to evacuate if asked to do so.
- If you hear an official warning, evacuate at once.
- Return home only after authorities' advice it is safe to do so.

After

- Stay tuned to the battery-operated radio for the latest emergency information.
- Help injured and trapped persons.
- Stay away from flooded and damaged areas until officials say it is safe to return
- Enter your home with caution
- Use flashlight when entering damaged houses.
- Check for electrical short circuit and live wires.
- Check food supplies and test drinking water.

Disasters can occur at any time anywhere, hence a prior knowledge about it and the ways and means to mitigate it can reduce its impact to a certain level. Therefore, it is pertinent to be a citizen who is not only knowledgeable about it but also ready to cooperate with the initiatives of the authorities given from time to time to save our precious life.