
SECTION 2 (B)

FACT SHEET

EARTHQUAKES

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EARTHQUAKE

WHAT IS IT? An earthquake is sudden motion or trembling of the ground produced by the abrupt displacement of rock masses.

CAUSES: How do they occur?

The earth's outer shell is divided into seven major and some smaller plates which are constantly in a dynamic state, pushing against, pulling away from, or grinding past one another. Forces build up as the plates attempt to move in relation to each other. When the adhesions along the fault give way, stored energy is released in the form of earth tremors, volcanic activity etc.

Types of plate movements and principal effects:

- ✦ Oceanic plates pulling away from each other leads to hot volcanic material being expelled from cracks to form mid-ocean ridges.
- ✦ Oceanic plates colliding with and forced under continental plates leads to mountain ranges being pushed up, accompanied by earthquakes and volcanic eruptions.
- ✦ Collisions of continental plates force up mountain ranges, release compression energy in quakes.

Hazard Prone Areas in the Caribbean

- ✦ Areas bordering the Caribbean Plate.

FAULTING

Many earthquakes occur as a result of movement along pre-existing faults or fractures occurring in the earth's crust (e.g. along plate margins). Forces of tension and compression created in the earth's crust largely due to tectonic movements of the plate produce sudden movements along the line of fracture (fault lines) resulting in two blocks of crust slipping with respect to each other. This sudden movement produces seismic waves which travel from the source through the crust to the earth's surface. When they arrive, the vibratory motion we feel is called an earthquake.

The Caribbean Plate interacts with the North-American Plate at its eastern boundary where the Atlantic sea floor attached to the North American and South American Plate is being forced or subducted beneath the Caribbean Plate. The subducted material underwent partial melting which because of its then less buoyant nature, was sometimes forced to the surface in the form of volcanic activity to produce the chain of Caribbean islands.

This process of subduction is still occurring and is largely responsible for the seismicity felt today in these islands. In addition, the sometimes slow, upward, less violent intrusion of molten magma into the crust of these active volcanic areas produces seismic activity which we feel on the surface as earthquakes.

LIKELY IMPACT:

Primary Effects of Earthquake

- ✦ Total or partial destruction of structures.
- ✦ Blockage or breakage of transport activities.
- ✦ Interruption of Water Supply.
- ✦ Breakage of Sewage Disposal Systems.
- ✦ Loss of Public Utilities, eg. electricity & gas.

Casualties may be due to:

Direct Hazards

- ✦ Total or partial collapse of structures due to poor design and construction materials.
- ✦ Falling debris and dust from rubble.
- ✦ Transportation casualties due to collapse of bridges, roads, etc.
- ✦ Floods from collapsed dams or river banks.
- ✦ Release of hazardous materials.
- ✦ Landslides.
- ✦ Tsunamis, loss of life by inundating low-lying coastal areas.

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The Eastern Caribbean islands are particularly vulnerable to impact from submarine eruptions from the "Kick-em-Jenny" volcano located five miles north of Grenada, about 450 feet under water. Also historical records have shown that a tsunami was generated by the earthquake of 1867 which affected St. Thomas and Tortola, BVI.

Indirect Hazards

Fires.

Release of hazardous material.

Electrocution.

Exacerbation of chronic diseases.

HOW ARE EARTHQUAKES MEASURED?

Earthquakes generate different types of waves. By measuring the strength of these WAVES, SEISMOGRAPHS record the characteristics of these waves and, from the measurements, scientists can determine their location.

The strength of an earthquake can be measured by magnitude and intensity.

Magnitude is a measure of the physical energy released or the vibrational energy of the shock. It is commonly measured on the Richter scale which is an open-ended logarithmic scale.

The **Richter Scale** measures the magnitude and the **MMI** measures the intensity. (see below)

Intensity is the effect of an earthquake on the earth's surface. The intensity scale consists of certain key responses such as people awakening, movement of furniture, structural damage and finally, total destruction. The most commonly used measure in the Caribbean and the USA is the Modified Mercalli Intensity Scale (MMI).

The version of the modified Mercalli Intensity scale that is currently used is a 1956 modification by Richter of the 1931 version by the American seismologists Harry Wood and Frank Neumann. This scale, composed of 12 increasing levels of intensity which range from imperceptible shaking

to catastrophic destruction, is designated by Roman numerals. It does not have a mathematical basis; instead, it is an arbitrary ranking based on observed effects.

The following is an abbreviated description of the 12 levels of intensity and likely impact

- I **Instrumental:** Not felt except by a very few under especially favourable conditions detected mostly by Seismography.
- II **Feeble:** Felt only by a few persons at rest, especially on upper floors of buildings.
- III **Slight:** Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibration similar to the passing of a truck.
- IV **Moderate:** Felt indoors by many, outdoors by few during the day. At night, some awakening. Dishes, windows, doors disturbed, walls make cracking sound. Sensation like a heavy truck striking building. Standing motor cars rock noticeably.
- V **Rather Strong:** Felt by nearly everyone, many awakened. Some dishes, windows broken. Un-stable objects overturned. Pendulum clocks may stop.
- VI **Strong:** Felt by all, many frightened. Some heavy furniture moved, a few instances of fallen plaster. Damage slight.
- VII **Very Strong:** Damage negligible in buildings of good design and construction, slight to moderate in well-built ordinary structures, considerable damage in ordinary structures, considerable damage in poorly built or badly designed structures.
- VIII **Destructive:** Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of factory stacks, columns, monuments, walls. Heavy furniture overturned.

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- IX **Ruinous:** Damage considerable in specially designed structures; well designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.
 - X **Disastrous:** Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bend greatly.
 - XI **Very Disastrous:** Few, if any (masonry) structures remain standing. Bridges destroyed. Rails bend greatly.
 - XII **Catastrophic:** Damage total. Lines of sight and level are distorted. Objects thrown into the air.
- Above Intensity VIII impact is high on the Economy and Health with many deaths and injuries. Food remains available for the first few weeks.



Photograph showing the damage caused by an earthquake

Fact Sheet - Earthquake (Cont'd)

EMERGENCY ACTION

Before An Earthquake

- + Potential earthquake hazards in the home and work place should be removed or corrected.
- + Top-heavy objects and furniture should be fastened to the wall and the largest and heaviest objects placed on lower shelves.
- + Water Heaters and other appliances should be firmly bolted down.
- + Pay special attention to emergency equipment, such as radio transmitters and medical equipment.
- + Set aside emergency supplies and equipment.
- + Learn First Aid.
- + Teach family members how to turn off electricity, gas and water by learning location of safety valves and main switches.

During an Earthquake

- + Protect head and face.
- + Remain calm. Do not rush for exits.
- + If inside, stay there, if outside, stay there.
- + If inside a building, stand in a strong doorway, or get under a desk, table or bed.
- + Move away from windows, glass doors, heavy mirrors, pictures, bookcases, hanging plants and heavy objects.
- + Watch for falling plaster, bricks, light fixtures and other objects.
- + Avoid using elevators as power may fail.
- + If you're in an automobile, don't stop on a bridge, under or near to electrical poles or close to buildings from which debris may fall.
- + Try to remain calm and reassure others.
- + If you are in a store or shop, move away from display shelves containing bottles, cans, or other objects that may fall.

After An Earthquake

DO

- + Check for Fires.
- + Check Utilities - shut off if necessary.
- + Check your house for serious damage - evacuate if there's threat of collapse.
- + Check for injuries - administer First Aid.
- + Be prepared for additional earthquake shocks.
- + Collect Water.
- + Clear up hazardous materials.
- + Assist Others.
- + Turn on a transistor for emergency bulletins.
- + Stay away from landslide prone areas.
- + Stay away from buildings that might have been weakened by the earthquake.
- + Remain calm.

DO NOT

- + Do not light a match or turn on a light switch. Use a flashlight!
- + Never touch fallen power lines.
- + Do not use telephone except in extreme emergency.
- + Do not go to the beach to watch for giant sea waves.
- + Do not go sightseeing! Keep the streets clear for the passage of emergency, and rescue vehicles.
- + Do not attempt to move seriously injured persons unless they are in danger of further injury.