



Delhi Earthquake 2025

[Source: IE](#)

Why in News?

An **earthquake of 4.0 magnitude** struck Delhi in February, 2025 that was caused due to **hydro fracturing** beneath the **Aravalli-Delhi Fold Belt**.

What are the Key Facts Regarding Delhi Earthquake 2025?

- **Seismic Origin in Delhi:** It had an **epicenter within the city** (not in Himalayas) at a shallow depth of **5 km** resulting in **shallow earthquake**, sending **more seismic waves to the surface** and creating **more tremor at the surface**.
 - Epicenter is the point on the Earth's surface that is **directly above the focus or hypocenter** (where the **earthquake originates** within the Earth's crust).
 - **Shallow earthquakes** are between **0 and 70 km deep**, intermediate earthquakes, **70 - 300 km deep**, and deep earthquakes, **300 - 700 km deep**.
- **Seismic Zone Classification:** Delhi lies in **Zone 4** of [India's earthquake hazard map](#), indicating high seismic risk with **MSK-8 intensity** (**Zone 5**, most vulnerable, corresponds to **MSK-9 intensity**).
 - The **MSK (Medvedev-Sponheuer-Karnik) scale** is a measure of **intensity**, rather than strength (energy released) that is described by magnitude.
- **Hydro Fracturing:** The earthquake was caused by **normal faulting** (with vertical rock movement) and **hydro fracturing** was identified as a key **trigger** of this **earthquake**.
 - Beneath Delhi, **aquifers and underground water channels erode rock formations**, causing fractures that occasionally **release stress as seismic waves**.
- **Aravalli-Delhi Fold Belt:** Delhi lies in the **Aravalli-Delhi Fold Belt**, with deformed rock layers folded millions of years ago.
 - While tectonic activity has reduced, **some active faults** still cause occasional mild earthquakes.
- **Difference from Himalayan Earthquakes:** Himalayan earthquakes result from **tectonic plate movement** i.e., subduction of the **Indian plate under the Eurasian plate**, causing intense stress and large quakes.
 - The **Delhi earthquake** was caused by **localized geological stress** rather than tectonic plate movement.
- **Role of Local Faults:** Several **local faults**, such as the **Mahendranagar Fault** and **Sohana Fault**, exist in the Delhi region that can create **earthquakes upto 6 magnitude**.
- **Sounds During Earthquake:** Earthquakes do generate **low-frequency sound waves**, but these are usually **not heard**.
 - The sounds reported during the quake may have been caused by **vibrations in buildings and structures**, not the quake itself.
- **Large Earthquake in Delhi:** A magnitude 8 earthquake along the **Main Central Fault (MCF)** in the Himalayas could trigger large quakes in Delhi, as the **Yamuna's alluvial plains** are **less able to absorb the energy** than harder rocks.
 - **MCF** lies between the **Greater Himalayas** in the north from **lesser Himalayas** in the south.

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EARTHQUAKE



ABOUT

- Shaking of the earth; caused due to release of energy, generating **seismic waves in all directions**

HYPOCENTER

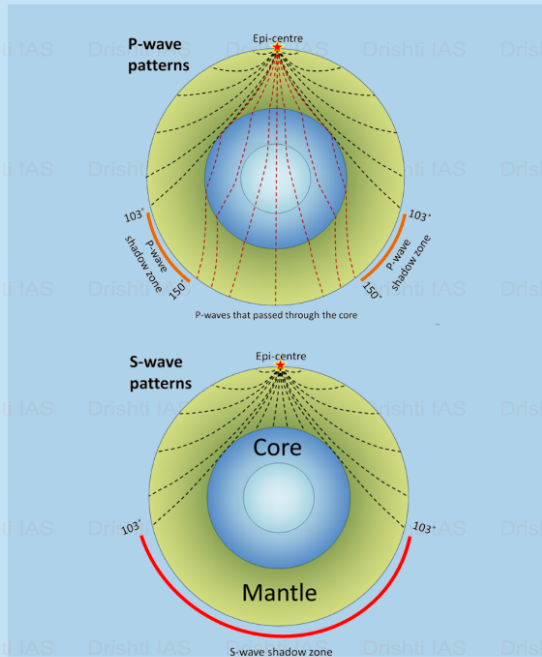
- Location where the earthquake starts (below earth's surface)

EPICENTER

- Location right above the Hypocenter (on the earth's surface)

EARTHQUAKE WAVES

- Body Waves:** Move in all directions travelling through the body of the earth
 - P Waves:** Move faster, First to arrive at surface, Similar to sound waves, Travel through gaseous, liquid and solid materials
 - S Waves:** Arrive at surface with some time lag, Travel only through solid materials
- Surface Waves:** Last to report on seismographs, More destructive, Cause displacement of rocks
 - Love Waves:** Same motion as S-waves (horizontal) without vertical displacement, Sideways motion perpendicular to the direction of propagation, Faster than Rayleigh waves
 - Rayleigh Waves:** Cause the ground to shake in an elliptical pattern, Spread out the most of all seismic waves, Move vertically and horizontally in a vertical plane



CAUSES OF EARTHQUAKES

- Release of energy along a **Fault/Fault Zones** (break in the crustal rocks)
- Movement of **tectonic plates (most common)**
- Volcanic eruption** (stress changes in rock-injection/withdrawal of magma)
- Human activities** (mining, explosion of chemical/nuclear devices etc.)

EARTHQUAKE IN INDIA

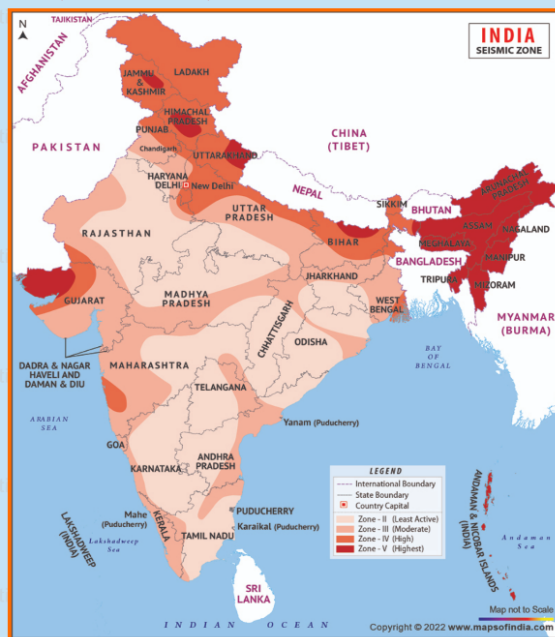
- India is one of the highly earthquake affected countries due to the presence of technically active mountains - the Himalayas.
- India has been divided into **4 seismic zones (II, III, IV, and V)**

MEASURING EARTHQUAKE

- Seismometers** - Measures seismic waves
- Richter Scale** - Measures magnitude (energy released; range: 0-10)
- Mercalli** - Measures intensity (visible damage; range: 1-12)

DISTRIBUTION

- Circum-Pacific Belt** - 81% of earthquakes
- Alpide Earthquake Belt** - 17% of the largest earthquakes
- Mid-Atlantic Ridge** - Mostly submerged underwater



Drishti Mains Question:

Analyze the role of hydro fracturing in the occurrence of earthquakes. How do these differ from the causes of earthquakes in the Himalayan region?

UPSC Civil Services Examination Previous Year Question (PYQ)

Mains

Q. Discuss about the vulnerability of India to earthquake related hazards. Give examples including the salient features of major disasters caused by earthquakes in different parts of India during the last three decades. (2021)

Q. The frequency of earthquakes appears to have increased in the Indian subcontinent. However, India's preparedness for mitigating their impact has significant gaps. Discuss various aspects. (2015)

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