

EARTH QUAKE: GEOGRAPHY

NEWS: *Delhi rocked by second-strongest quake in three decades*

WHAT'S IN NEWS?

On February 20, 2025, Delhi experienced a 4.0-magnitude earthquake, the strongest since 2007. This shallow tremor, at a depth of just 5 km, caused significant vibrations across the National Capital Region (NCR), underscoring Delhi's high seismic risk due to its placement in Zone 4 of India's seismic zoning system and illustrating the broader implications of such seismic activities.

Seismic Activity in Delhi

- **Historical Data:** Between 1993 and 2025, Delhi recorded 446 earthquakes with magnitudes ranging from 1.1 to 4.6. The strongest prior to the recent event was a 4.6-magnitude quake in 2007.
- **Geological Setting:** Located within the Aravalli-Delhi Fold Belt, Delhi is prone to seismic activities due to tectonic stresses impacting the region's deformed rock layers.

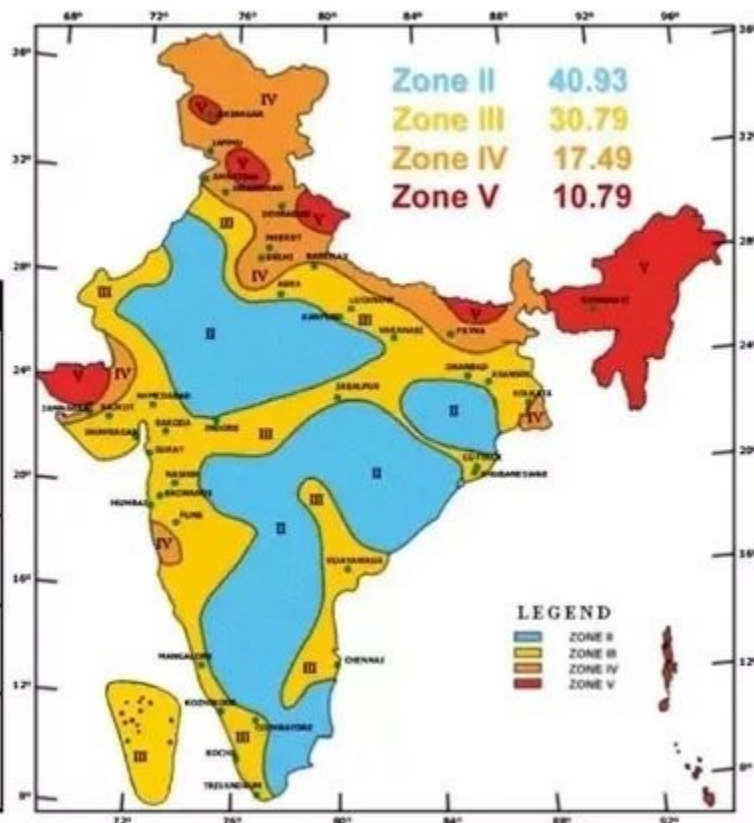
Mechanics of the Recent Earthquake

- **Depth and Impact:** The recent earthquake's shallow depth of 5 km significantly enhanced its surface impact, making it more perceptible compared to deeper seismic events.
- **Faulting and Hydrofracturing:** Triggered by normal faulting, this earthquake was further influenced by hydrofracturing processes, where movement of ancient aquifers beneath the city alters underground pressures and destabilizes rocks.

Seismic Zone Map of India: -2002

About 59 percent of the land area of India is liable to seismic hazard damage

Zone	Intensity
Zone V	Very High Risk Zone Area liable to shaking Intensity IX (and above)
Zone IV	High Risk Zone Intensity VIII
Zone III	Moderate Risk Zone Intensity VII
Zone II	Low Risk Zone VI (and lower)



Seismic Zones and Delhi's Vulnerability

- **India's Seismic Zoning:** The country is categorized into four seismic zones reflecting varying degrees of seismic risk:
 - **Zone II:** Low seismic activity.
 - **Zone III:** Moderate seismic activity.
 - **Zone IV:** High seismic activity, including Delhi, indicating a significant potential for damaging earthquakes.
 - **Zone V:** Very high seismic activity, the most perilous zone with potential for devastating earthquakes.
- **Delhi in Zone 4:** This classification underscores a high likelihood of seismic disturbances capable of causing substantial structural damage.

Magnitude Range and Effects

- **Earthquake Magnitude Categories:**
 - **Minor (3.0 - 3.9):** Often unfelt but recorded.
 - **Light (4.0 - 4.9):** Noticeable shaking of indoor items, rattling noises, significant impact unlikely.
 - **Moderate (5.0 - 5.9):** Can cause major damage to poorly constructed buildings over small regions.

- **Strong (6.0 - 6.9):** Potential to be destructive in areas up to about 100 kilometers across where people live.
- **Major (7.0 - 7.9):** Can cause serious damage in larger areas.
- **Great (8.0 and above):** Can cause serious damage in areas several hundreds of kilometers across.
- **Delhi's Recent Earthquake:** Falling into the "Light" category, the 4.0-magnitude quake caused noticeable tremors but generally minimal structural damage, consistent with its magnitude range.

Historical Earthquake Context

- **Notable Historical Events:** Significant historical earthquakes in Delhi include those around 1720 and 1803, with the latter once thought to have damaged the Qutub Minar, though it is now believed the main effects were from a distant epicenter in Uttarakhand.

Measurement and Effects of Earthquakes

- **Magnitude Scales:** The Richter Scale and the Moment Magnitude Scale measure the energy released by an earthquake, with the latter providing more accuracy for larger quakes.
- **Intensity Scales:** The Mercalli and MSK scales assess the earthquake's effects on structures and human perceptions, which vary based on the quake's distance from the epicenter and local geological conditions.

Risk Management and Preparedness

- **Urban Challenges:** Delhi's dense population and extensive infrastructure amplify its seismic risk, necessitating stringent building codes, public awareness campaigns on earthquake safety, and effective emergency response strategies.
- **Strategies for Resilience:** Enhancing structural resilience, promoting community preparedness programs, and advancing seismic research are essential for mitigating potential earthquake damages in the future.

This detailed exploration not only highlights the seismic vulnerabilities of Delhi, situated in Zone 4 of India's seismic zones, but also emphasizes the range and potential effects of earthquakes, underscoring the critical need for vigilance and preparedness.

Source: <https://www.thehindu.com/news/cities/Delhi/delhi-earthquake-strong-tremors-felt-across-national-capital-region-on-february-17-morning/article69228389.ece>