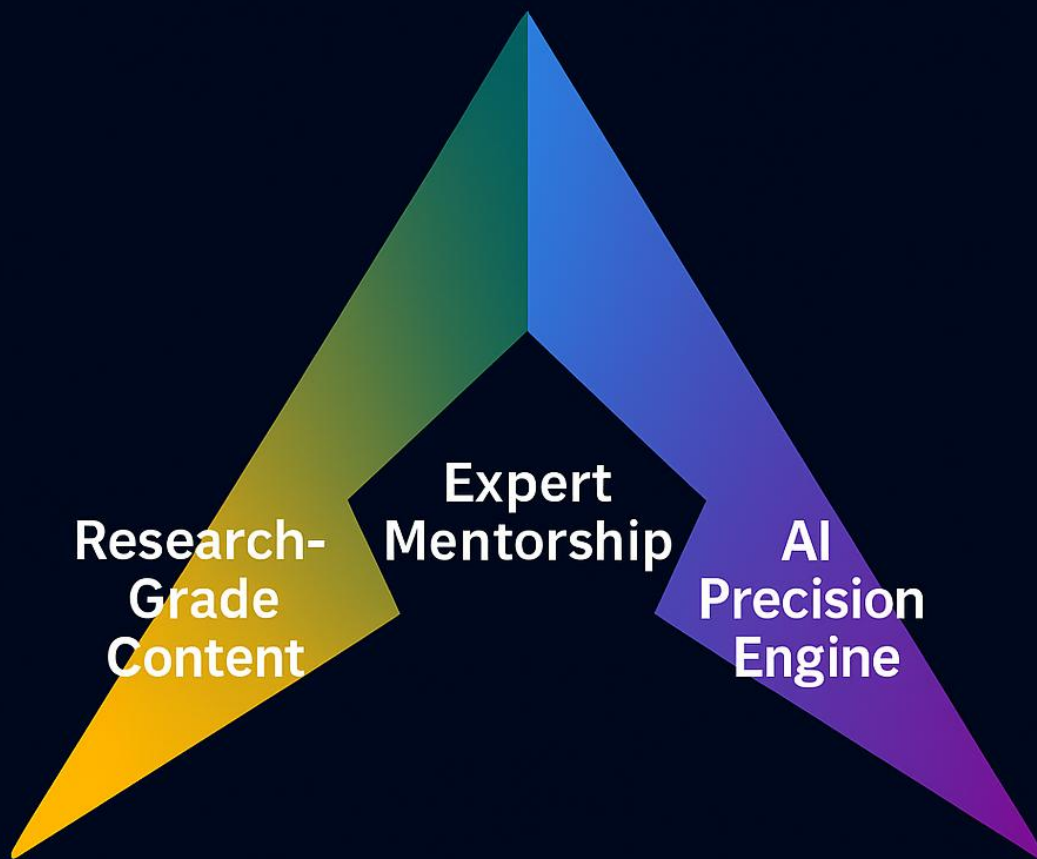


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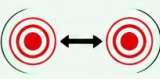
GS Paper I: Geography

1. Seismic Doublets and the Venezuela Earthquake

a. Introduction

Earthquakes are among the most destructive geophysical hazards, but not all seismic events follow the conventional pattern of a major earthquake followed by smaller aftershocks. In some rare cases, two earthquakes of nearly equal magnitude occur within a very short interval and close geographical proximity. Such events are known as seismic doublets and can significantly magnify disaster risk by prolonging ground shaking and complicating emergency response.

The recent earthquake in Venezuela, where earthquakes of magnitude 7.2 and 7.5 struck within 39 seconds, is one such example. Classified by the United States Geological Survey (USGS) as a seismic doublet, it provides important insights into plate tectonics, fault mechanics, earthquake hazards and disaster preparedness.

SEISMIC DOUBLET vs MAINSHOCK-AFTERSHOCK SEQUENCE		
FEATURE	SEISMIC DOUBLET	MAINSHOCK-AFTERSHOCK SEQUENCE
 Number of major earthquakes	 Two	 One
 Magnitude	 Nearly equal	 Aftershocks much smaller
 Time gap	 Seconds to hours	 Minutes to months
 Fault behaviour	 Separate linked faults	 Same fault adjusting
 Damage	 Repeated severe shaking	 Damage mainly from first shock
 Disaster risk	Very High	Moderate

b. What is a Seismic Doublet?

A seismic doublet refers to two earthquakes of nearly similar magnitude that occur within a short interval of time and in close geographical proximity. Unlike a conventional mainshock-aftershock sequence, both earthquakes originate from separate but mechanically linked fault ruptures, making each event a major earthquake in its own right.

A seismic doublet is therefore considerably more destructive than an ordinary earthquake sequence because strong ground shaking is repeated before weakened structures and emergency systems can recover.

Related Concept: Fault

A fault is a fracture or zone of fractures within the Earth's crust along which rock masses move relative to one another. Earthquakes occur when accumulated tectonic stress is suddenly released through movement along these faults.

Tectonic Setting of the Venezuela Earthquake

The Venezuela earthquakes were generated primarily by shallow strike-slip faulting near the boundary between the Caribbean Plate and the South American Plate.

In a strike-slip fault, crustal blocks move horizontally past one another, producing intense ground shaking with little vertical displacement.

c. Why Were the Earthquakes Highly Destructive?

Shallow Focus

- The earthquakes originated at a depth of nearly 10 km.
- Shallow-focus earthquakes release most of their energy close to the Earth's surface, producing stronger ground motion and greater structural damage than deeper earthquakes of comparable magnitude.

Successive Strong Shaking

- The second earthquake struck before buildings weakened by the first shock could stabilise.
- This repeated loading significantly increased the probability of structural collapse and casualties.

Prolonged Ground Motion

- Seismic doublets extend the duration of intense ground shaking.
- They may trigger rupture across a larger section of the fault system, exposing structures to repeated stress and increasing the likelihood of failure.

Tectonically Active Plate Boundary

- Venezuela lies along the active boundary between the Caribbean Plate and the South American Plate.
- Continuous plate movement generates frequent fault activity and high seismic risk.

High Structural and Urban Vulnerability

- Dense urban settlements.
- Ageing infrastructure.
- Inadequate implementation of earthquake-resistant building standards.
- These factors amplified losses, demonstrating that disasters are shaped as much by vulnerability as by the natural hazard itself.

While these factors explain the immediate destruction, the event also offers broader lessons for disaster risk reduction and earthquake preparedness.

d. Analysis/ Observations

The Venezuela earthquake illustrates that earthquake magnitude alone does not determine disaster severity. Disaster risk emerges from the interaction of four key components:

- **Hazard** – Intensity of the earthquake.
- **Exposure** – Population and infrastructure located in the affected area.
- **Vulnerability** – Structural weakness and socio-economic conditions.
- **Preparedness** – Institutional capacity for response and recovery.

The event also highlights the distinctive danger posed by seismic doublets. Emergency response operations often begin immediately after the first earthquake, whereas another equally powerful rupture may still occur. Such successive shocks can:

- Damage already weakened structures.
- Endanger rescue personnel.
- Interrupt evacuation efforts.
- Delay relief operations.
- Increase overall casualties and economic losses.

Further, earthquakes should not always be viewed as isolated point events. Major earthquakes frequently involve rupture across extensive fault systems, underscoring the importance of regional seismic hazard assessment, fault mapping and integrated disaster planning, rather than limiting preparedness to individual cities.

e. Way Forward

Strengthen Earthquake-Resistant Infrastructure

- Strict enforcement of seismic building codes.
- Large-scale retrofitting of vulnerable public infrastructure such as schools, hospitals and bridges.

Improve Disaster Preparedness

- Develop response protocols for multiple-shock and cascading disaster scenarios.
- Strengthen urban search-and-rescue capabilities.

Enhance Scientific Monitoring

- Expand real-time seismic monitoring networks.
- Improve earthquake early warning systems.
- Accelerate fault mapping and seismic microzonation of densely populated regions.

Build Community Resilience

- Conduct regular mock drills.
- Improve public awareness regarding earthquake safety.
- Develop resilient communication and emergency response systems.

f. Case Study: Türkiye–Syria Earthquakes (2023)

The Türkiye–Syria earthquakes of 2023 provide a comparable example, where two major earthquakes struck within a few hours. The successive high-magnitude shocks caused widespread building collapse, disrupted rescue operations and significantly increased casualties. The event demonstrated how seismic doublets or closely spaced major earthquakes can greatly magnify disaster losses.

Conclusion

The Venezuela seismic doublet reinforces the principle that earthquakes cannot be prevented, but disasters can be substantially reduced through scientific planning and resilient development. Strengthening seismic monitoring, enforcing earthquake-resistant construction, improving preparedness for successive shocks and reducing structural vulnerability are essential for transforming earthquake-prone societies from disaster-prone to disaster-resilient.

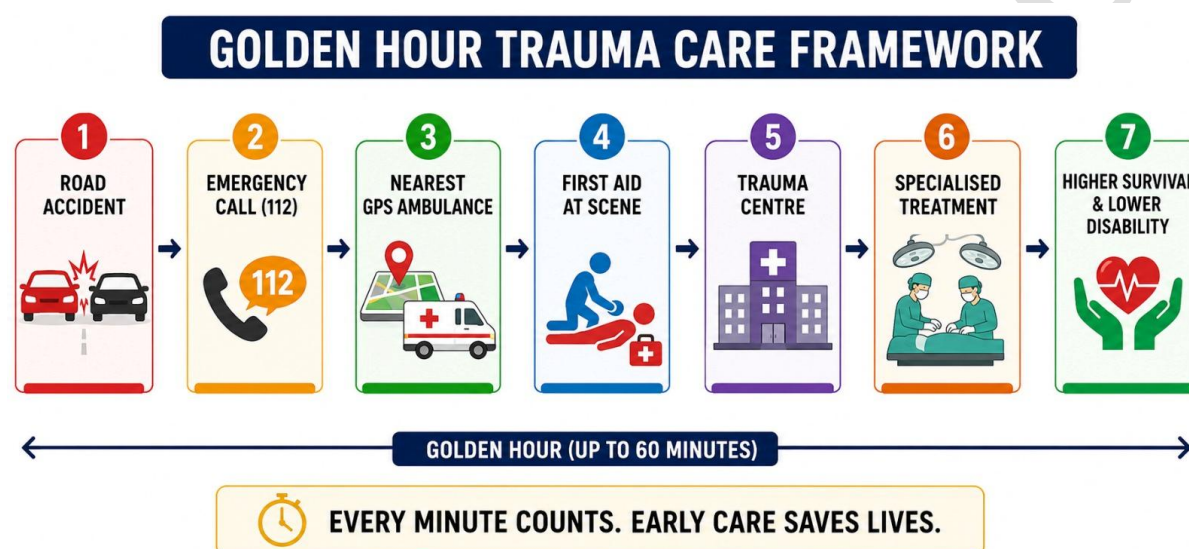
GS Paper II: Current Affairs

2. Road Accident Trauma Care: Supreme Court Flags Poor State Compliance

a. Introduction

Road accidents constitute one of India's most serious public health and governance challenges, causing thousands of preventable deaths and permanent disabilities every year. While improving road infrastructure and enforcing traffic regulations remain essential, the survival of accident victims often depends on the quality and speed of emergency trauma care. The Golden Hour—the first hour after a serious injury—is particularly critical, as timely medical intervention can significantly reduce mortality and long-term disability.

Recognising these concerns, the Supreme Court has expressed dissatisfaction over the poor implementation of earlier directions relating to road trauma care. The Court observed that despite clear judicial mandates, most States have failed to establish an integrated emergency-response ecosystem, weakening India's ability to provide timely medical assistance to accident victims.



b. Supreme Court's Directions on Road Trauma Care

The Supreme Court directed the States to establish a comprehensive and coordinated road trauma-care architecture capable of delivering rapid and efficient emergency medical assistance.

Integration with the 112 Emergency Response System

- Integrate police, ambulance services, hospitals, transport authorities and district administration with the single emergency number 112.
- Establish a unified command structure to enable coordinated and time-bound emergency response.

GPS-Enabled Ambulance Network

- Develop a Global Positioning System (GPS)-enabled ambulance network connected with emergency command centres.
- Enable real-time tracking to identify the nearest available ambulance and minimise response time.

Effective Implementation of the Good Samaritan Framework

- Protect citizens who voluntarily assist accident victims from unnecessary legal or procedural harassment.
- Encourage immediate bystander intervention by providing legal safeguards and institutional support.

Establishment of a Trauma Registry

- Create a comprehensive database containing information on road accidents, injuries, treatment and patient outcomes.
- Use evidence-based data to identify accident hotspots, assess trauma-care performance and guide policy interventions.

Standardised Rescue Protocols

- Develop uniform operating procedures involving the police, health department, transport authorities and district administration.
- Clearly define institutional responsibilities to ensure seamless emergency coordination.

Although the judicial framework is comprehensive, implementation across States has remained uneven, resulting in significant gaps in India's emergency trauma-care system.

c. Major Deficiencies Identified

Incomplete Integration with the 112 Platform

- Emergency services in many States continue to function through separate communication channels.
- Fragmented coordination delays accident response and reduces operational efficiency.

Inadequate GPS-Enabled Ambulance Coverage

- Real-time ambulance tracking remains limited.
- Many private ambulances are not integrated into the public emergency network, restricting optimal utilisation.

Weak Implementation of the Good Samaritan Framework

- Limited public awareness regarding available legal protections.
- Continued fear of police questioning, hospital formalities and court appearances discourages bystanders from assisting victims.

Absence of Functional Trauma Registries

- Lack of standardised accident and injury databases.
- Authorities are unable to accurately identify accident hotspots, evaluate response times or assess trauma-care outcomes.

Institutional Fragmentation

- Road accident response is divided among multiple departments.
- Absence of a single operational authority often leads to coordination failures during emergencies.

These deficiencies extend beyond administrative lapses and reflect broader governance and institutional challenges that directly influence public safety.

d. Analysis/ Observations

Importance of Effective Trauma Care

- Timely treatment during the Golden Hour significantly reduces preventable deaths and permanent disabilities.
- Availability of trained responders, ambulances, trauma centres and rapid communication systems often determines patient survival.

- Efficient trauma care also reduces long-term healthcare expenditure and economic losses arising from disability and productivity decline.

Importance of Integrated Emergency Response

- Unified emergency systems improve coordination between police, ambulances and hospitals.
- Shared real-time information enables faster mobilisation of resources and minimises duplication of effort.
- Digital integration strengthens command-and-control capabilities during large-scale emergencies.

Importance of Trauma Registries

- Convert individual accident cases into evidence for policymaking.
- Identify accident-prone corridors and recurring causes of injury.
- Evaluate hospital capacity, response efficiency and trauma-care outcomes.

Governance Challenges

- **Institutional Fragmentation:** Police, health, transport and district administration function under separate administrative structures.
- **Limited Digital Infrastructure:** Many districts lack modern command-and-control systems and integrated emergency platforms.
- **Poor Interoperability:** Police, hospitals and ambulance services often operate incompatible information systems.
- **Inter-State Capacity Gaps:** Variations in financial resources, administrative capability and health infrastructure create unequal emergency-care outcomes across States.

Addressing these governance deficiencies requires strengthening institutional coordination, digital integration and public participation alongside improvements in physical infrastructure.

e. Way Forward

Establish Fully Integrated 112 Emergency Response Centres

- Connect police control rooms, ambulance services, hospitals and disaster management authorities.
- Develop unified operational hubs instead of standalone call centres.

Develop Interoperable Digital Platforms

- Enable seamless real-time information sharing among all emergency-response agencies.
- Integrate ambulance tracking, hospital-bed availability and digital transmission of patient information.

Institutionalise Trauma Registries

- Make trauma registries mandatory across all States.
- Use registry data for monitoring response times, identifying high-risk corridors and improving trauma-care planning.

Strengthen the Good Samaritan Framework

- Conduct nationwide awareness campaigns.
- Train police and hospital staff regarding legal protections.
- Ensure that legal safeguards are translated into practical protection for citizens assisting accident victims.

Improve Institutional Preparedness

- Develop uniform Standard Operating Procedures (SOPs).

- Conduct regular multi-agency mock drills.
- Provide dedicated financial support for emergency medical infrastructure and trauma-care systems.

Nearly two-thirds of India's road fatalities are concentrated in eight States, indicating a highly uneven distribution of road safety risks. This highlights the need for targeted interventions in high-burden regions through safer road engineering, stricter enforcement, integrated emergency-response systems and strengthened trauma-care infrastructure.

Conclusion

The Supreme Court's observations reaffirm that road safety does not end with accident prevention—it extends to ensuring timely and effective post-crash care. Building a resilient trauma-care ecosystem requires coordinated governance, technology-enabled emergency response, evidence-based policymaking and active public participation. Strengthening these pillars will not only save lives during the Golden Hour but also advance India's broader objective of creating a safer, more resilient and citizen-centric transport system.

Reader's Note — About This Current Affairs Compilation

Dear Aspirant,

This document is part of the PrepAlpine Current Affairs Series — designed to bring clarity, structure, and precision to your daily UPSC learning.

While every effort has been made to balance depth with brevity, please keep the following in mind:

1. Orientation & Purpose

This compilation is curated primarily from the UPSC Mains perspective — with emphasis on conceptual clarity, analytical depth, and interlinkages across GS papers.

However, the PrepAlpine team is simultaneously developing a dedicated Prelims-focused Current Affairs Series, designed for:

- factual coverage
- data recall
- Prelims-style MCQs
- objective pattern analysis

This Prelims Edition will be released separately as a standalone publication.

2. Content Length

Some sections may feel shorter or longer depending on topic relevance and news density. To fit your personal preference, you may freely resize or summarize sections using any LLM tool (ChatGPT, Gemini, Claude, etc.) at your convenience.

3. Format Flexibility

The formatting combines:

- paragraphs
- lists
- tables
- visual cues

—all optimised for retention.

If you prefer a specific style (lists → paras, paras → tables, etc.), feel free to convert using any free LLM.

4. Monthly Current Affairs Release

The complete Monthly Current Affairs Module will be released soon, optimized to a compact 100–150 pages — comprehensive yet concise, exam-ready, and revision-efficient.

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