



Uttarkashi Tunnel Collapse

For Prelims: Silkyara-Barkot Tunnel, [Char Dham Project](#), National Highways and Infrastructure Development Corporation Ltd, Drill and Blast Method, Atal Tunnel, Pir Panjal Railway Tunnel, Dr Syama Prasad Mookerjee Road Tunnel.

For Mains: Issues Related to Tunnel Construction in India, Challenges Related to Indian Himalayan Region.

[Source: TH](#)

Why in News?

Recently, an under-construction **Silkyara-Barkot tunnel** along the **Yamunotri National Highway in Uttarkashi district, Uttarakhand**, collapsed, trapping a significant number of workers inside.

- The incident raises concerns about [tunnel construction](#), prompting closer examination of **potential causes and preventive measures**.

What Could be the Potential Cause of Tunnel Collapse?

- **About:**
 - The **Silkyara-Barkot tunnel** is part of the ambitious [Char Dham all-weather road project](#) of the Central Government.
 - The construction of the tunnel was tendered to **Hyderabad-headquartered Navayuga Engineering Company** by the **National Highways and Infrastructure Development Corporation Ltd (NHIDCL)**, a fully owned company of the Ministry of Road Transport & Highways, Government of India.
- **Potential Causes of Tunnel Collapse:** The exact cause of the tunnel collapse is yet to be ascertained, but a possible factor could be:
 - The collapsed section, **situated around 200-300 meters from the tunnel mouth**, might have contained a **hidden loose patch** of fractured or weak rock, undetectable during construction.
 - Water seepage through this compromised rock could have **eroded it over time, creating an unseen void atop the tunnel structure**.

What are the Critical Aspects of Tunnel Construction?

- **Tunnel Excavation Techniques:**
 - **Drill and Blast Method (DBM):** Involves **drilling holes into rock** and detonating explosives to break it apart.
 - DBM is often used in regions like the **Himalayas (Jammu & Kashmir and Uttarakhand)** due to the challenging terrain.
 - **Tunnel-Boring Machines (TBMs):** It bore through rock while supporting the tunnel behind with precast concrete segments. It is a more expensive but safer method.

- TBMs are ideal when the rock cover is up to 400 metres tall. Underground tunnels for the Delhi Metro were dug using a TBM at shallow depth.

- **Aspects in Tunnel Construction:**

- **Rock Investigation: Thoroughly examining the rock's strength and composition through seismic waves and petrographic analysis** to assess its load-bearing capacity and stability.
- **Monitoring and Support: Continuous monitoring using stress and deformation meters**, along with various support mechanisms like **shotcrete, rock bolts, steel ribs, and specialized tunnel pipe umbrellas**.
- **Geologist Assessments: Independent geologists play a crucial role in examining the tunnel, predicting potential failures**, and determining the rock's stability duration.

What are the Other Major Tunnels in India?

- **Atal Tunnel: [Atal Tunnel](#) (also known as Rohtang Tunnel)** is a highway tunnel built under the **Rohtang Pass in the eastern Pir Panjal range** of the Himalayas on the **Leh-Manali Highway in Himachal Pradesh, India**.
 - At a length of 9.02 km, it is the **longest tunnel above 10,000 feet (3,048 m) in the world**.
- **[Pir Panjal Railway Tunnel](#):** This 11.2 km long tunnel is **India's longest transportation railway tunnel**.
 - It runs through the Pir Panjal mountain range between **Quazigund and Baramulla**.
- **Jawahar Tunnel:** It is also called Banihal Tunnel. The length of the tunnel is 2.85 km.
 - The tunnel facilitates round-the-year road connectivity between **Srinagar and Jammu**.
- **Dr Syama Prasad Mookerjee Road Tunnel:** It was previously known as Chenani-Nashri Tunnel and is the longest road tunnel of India. The length of this road tunnel is **9.3 km**.

Way Forward

- **Regular Maintenance:** Implement a stringent maintenance schedule, including **inspections for structural integrity, drainage systems, and ventilation** to identify and rectify issues promptly.
 - Employ **sensors and monitoring technologies to continuously assess structural health**, detecting any potential weaknesses or anomalies early.
- **Risk Assessment and Preparedness:** Conducting third party risk assessments periodically, considering **geological, environmental, and usage factors**.
 - Developing contingency plans and emergency protocols in case of any structural concerns.
- **Training and Awareness:** Training personnel in **tunnel management and emergency response procedures**. Public awareness campaigns can educate users and nearby residents about safety measures and reporting mechanisms.
- **Technology Integration:** Explore innovative technologies like **Artificial Intelligence, drones, or robotics for more efficient inspections**, maintenance, and early detection of potential issues.