The National UN Volunteers-India
Noida International Public School, Noida

Uttarkashi Tunnel Collapse - Presentation
Title: Mathematical Analysis of the destruction
Guide: Mrs. Meenu, Mathematics teacher

1. 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.

2. 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.

3. 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.

4. Aspects in Tunnel Construction:

[1]Rock Investigation: Thoroughly examining the rock's strength and composition through seismic waves and petrographic analysis to assess its load-bearing capacity and stability.

[2]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.

[3]Geologist Assessments: Independent geologists play a crucial role in examining the tunnel, predicting potential failures, and determining the rock's stability duration.

5. What are the Other Major Tunnels in India?

[1]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.

[2]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.

[3]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.

[4]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.

6. Way Forward

[1]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.

[2]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.

[3]Technology Integration: Explore innovative technologies like Artificial Intelligence, drones, or robotics for more efficient inspections, maintenance,

and early detection of potential issues.

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