

Zojila Tunnel Breakthrough - Transforming Ladakh Connectivity and Himalayan Engineering

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Zojila Tunnel Latest News

- The Zojila Tunnel, a strategically significant infrastructure project connecting Sonmarg in Jammu & Kashmir with Minamarg in Ladakh, has achieved a major milestone with over 13 km of excavation completed.
- Situated at an altitude of **11,578 feet**, the tunnel is expected to provide year-round connectivity across the Zojila Pass and become operational by **2028**.
- The project highlights India's efforts to strengthen border infrastructure, regional development, and **strategic mobility** in the Himalayas.

Zojila Tunnel

- **About:**
 - It will be **India's longest** road tunnel and is expected to be Asia's longest bi-directional road tunnel, with a length of **14.15 km**. It is being constructed at an estimated cost of ₹6,500–6,800 crore.

- The project forms part of a larger 33-km connectivity corridor spanning Jammu & Kashmir and Ladakh.
- It includes expansion and development of the 18.475-km Z-Morh-Zojila highway stretch, two twin-tube tunnels, five bridges, and two snow galleries.
- The tunnel is one among 19 tunnels being built in the region under projects worth nearly ₹25,000 crore.
- **Need:**
 - **Overcoming seasonal isolation:**
 - The Srinagar-Leh route currently passes through the **Zojila Pass**, one of the most difficult mountain passes in the Himalayas.
 - Heavy snowfall, avalanches, landslides, and slippery roads force closure of the pass for nearly five months annually.
 - During winter, Ladakh remains dependent largely on air connectivity, leading to extremely high transportation costs.
 - **Strategic importance:**
 - Ladakh shares **sensitive borders** with both China and Pakistan.
 - The tunnel will ensure uninterrupted movement of troops, military equipment, and essential supplies.
 - It strengthens India's **border management** and logistical preparedness.
- **Expected benefits:**
 - **Improved connectivity:**
 - Provides all-weather and perennial connectivity between Kashmir and Ladakh.
 - Travel time from Ganderbal to Kargil will be reduced from about three hours to around 20 minutes.
 - The distance between Baltal and Minamarg will shrink from nearly 40 km to 13 km.
 - **Enhanced safety:** The existing route witnesses frequent accidents due to steep gradients, poor visibility, snow and landslides. Tunnel-based travel will significantly reduce weather-related risks.
 - **Integrated regional development:** Better connectivity is expected to **boost tourism**, promote trade and investment, generate employment, and reduce outmigration from remote regions.

Challenges of Tunneling Through the Himalayas

- **Extreme climatic conditions:** High altitude, where temperatures can plunge to -30°C , affecting both workers and machinery. Frequent avalanches pose serious risks to life and infrastructure.
- **Geological complexity of the Himalayas:**
 - **Young and active mountains:** The Himalayas are a young fold mountain system, formed by the collision of the Indian and Eurasian tectonic plates. They remain tectonically active and geologically unstable.
 - **Highly variable rock strata:** Rock formations can change dramatically within short distances. Engineers encounter soft sedimentary rocks, hard boulders, cavities, faults, shear zones, and water-bearing fractures.
 - **Water ingress risks:** The mountains contain large quantities of groundwater and snowmelt channels. Sudden water inflows can flood excavation sites, destabilize rock formations, and increase collapse

risks.

Engineering Solution

- **New Austrian Tunnelling Method (NATM):**

- The Zojila Tunnel is being excavated using the NATM, widely regarded as suitable for difficult geological conditions.

- **Key features:**

- Selective and controlled blasting.
- Excavation in stages (upper half first, lower half later).
- Continuous monitoring of rock behaviour.
- Immediate structural support through shotcrete (sprayed concrete), rock bolts, and drainage systems.

- **Adaptive design approach:**

- Tunnel alignment can be modified to bypass weak geological zones.
- The number and spacing of rock bolts are adjusted according to rock quality.
- Drainage pipes are installed to safely release groundwater pressure.

- **Safety measures:**

- To enhance operational and construction safety, three vertical ventilation and **rescue shafts** have been built.
- Shafts [depth: 474.3 m (India's longest tunnel shaft), 367.5 m, and 213.5 m] facilitate ventilation, emergency evacuation, rescue operations, and disaster response.

Conclusion

- The Zojila Tunnel represents a **landmark achievement** in Himalayan infrastructure development, combining strategic necessity with advanced engineering.
- It is poised to become a **transformative asset** for both regional development and national integration.

Source: IE | IE

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