Uttarakhand tunnel collapse

Published On: 23-11-2023

Why is in news? Uttarakhand tunnel collapse: ‘In building Himalayan tunnels, support and monitoring key’, say experts

With efforts to rescue the **41 workers trapped inside the under-construction Silkyara-Barkot tunnel** in Uttarkashi undergoing several setbacks, authorities have come up with a five-point plan that involves drilling operations from three sides.

The under-construction Silkyara-Barkot tunnel on the Yamunotri National Highway in Uttarakhand’s Uttarkashi district collapsed at dawn on November 12.

There will be a **vertical drilling operation** taking place from the top of the hill under which the workers are trapped. The efforts to drill horizontally through the debris blocking the tunnel at the Silkyara side will continue, and an operation to drill a small tunnel from the Barkot side will also begin, according to the plans.

Five-point plan:

According to details provided by the government, **five different agencies** – the Oil and Natural Gas Corporation (ONGC), Sutluj Jal Vidyut Nigam (SJVNL), Rail Vikas Nigam Limited (RVNL), National Highways and Infrastructure Development Corporation Limited (NHIDCL), and Tehri Hydro Development Corporation Limited (THDCL) – have been **assigned responsibilities to carry out the five different aspects of the rescue plan**.

The **Border Roads Organisation (BRO) has created an access road** to, and built a platform at, the top of the hill where vertical drilling is set to take place

The **Border Roads Organisation (BRO) has created an access road** to, and built a platform at, the top of the hill where vertical drilling is set to take place.

RVNL has started work on a **six-inch-wide vertical pipeline** from this platform into the place where the workers are trapped. This pipe will work as another means by which supplies can be passed to them.

SJVNL will **drill a vertical tunnel** from the top of the hill to rescue the trapped labourers. Accordingly, equipment has been mobilised from Gujarat and Odisha with the help of the Railways. ONGC, which has expertise in deep drilling, has also taken part in the initial work of drilling the vertical tunnel.

The third part of the plan **involves horizontally drilling 483 metres** to reach the workers by creating a “micro” tunnel from the Barkot side. This will be undertaken by THDCL. Heavy machinery has already been mobilised and the work is expected to start soon.

The fourth part is the **strengthening of the existing tunnel**, and after working on safety arrangements, NHIDCL will continue to drill from the Silkyara end under the fifth part of the plan.

About the tunnel:

The total length of the tunnel, which is meant to **connect Silkyara to Dandal gaon in Uttarkashi district**, is 4.5 km.

The **double-lane tunnel** is pegged as one of the longest tunnels **under the Char Dham road project**.

It aims to **reduce the journey from Uttarkashi to Yamunotri Dham** by 26 kilometres.

From the Silkyara side, 2.3km of tunnel has been constructed, while 1.6km of tunneling work has been completed from the Barkot end. Approximately, a 400m stretch of the tunnel is yet to be constructed.

The workers are trapped in the Silkyara Tunnel located on the Uttarkashi - Yamnotri Road.

The collapse happened about 270m from the entrance of the Silkyara side.

Defence Research Development Organisation (DRDO) **deployed the Remote Operated Vehicle - Daksh** that is specifically designed to be used on a pan-tilt platform to help reach the risky terrain.

It can operate continuously for 3 hours, covering distances ranging from 100 to 500 meters.

Possible reasons for the collapse:

The collapsed section is located around 200-300 metres from the mouth of the tunnel.

It could have happened **due to a loose patch of rock**, which wasn't visible during the construction. The patch might have consisted of **fractured or fragile rock with a lot of joints** that may have made it weak.

Water could have entered through loose patch, eroding the loose rock over time creating a void on the top of the tunnel, which can't be seen.

The **shear zone is created** when there is movement between two rocks and the rock gets crushed. This crushed rock can change its behaviour, it may have clay, or it may get weathered over time.

The Main Central Thrust of the Himalayas passes a few kilometres north and northwest of the incident site. The **seismic wave generated** could have triggered a possible landslide in the tunnel.

Experts have expressed doubts **whether geological and geotechnical studies** like petrographic analysis, seismic refraction waves analysis, were **conducted before undertaking the tunnel excavation work**. These experiments help to determine help to determine, whether the **rock can take the load of the overburden** when a tunnel is created.

Experts have also pointed that one of the reasons of collapse could be the **lack of proper geological mapping studies** of the shear zone.

There was also **failure to take protection measures** to prevent the collapse of the shear zone using steel ribs, rock bolts, or shotcrete due to lack of regular monitoring.

The authorities **failed to ensure that an escape tunnel** is designed simultaneously with the main tunnel. Design and construction of an escape tunnel is a must for emergencies like collapse and fire.

Besides these reasons given by experts, questions have been raised on the fragility of the Himalayas in sustaining massive infrastructure projects like the Char-Dham project, massive hydroelectric power projects.

Other Incidents of Collapse in Himalayas:

Subansiri Lower Hydroelectric Power Project- A major landslide disrupted construction and blocked diversion tunnels of the project.

Teesta River Flash Floods- Flash floods damaged the Chungthang Dam and Teesta hydropower stations, leading to significant financial losses.

Kiratpur- Nerchowk Tunnel collapse in Himachal Pradesh, 2015

Tehri Hydropoject Tunnel Collapse 2004

Challenges in constructing tunnel in Himalayan region:

Himalayas are **still growing** due to the collision between the Indian and the Eurasian tectonic plate.

They are characterized by a **complex combination of rock types**, fault lines, and seismic activity.

Extreme weather variations like heavy snowfall and freezing temperatures in winter to intense monsoons and landslides during rainy season significantly impact tunnel construction projects.

The challenges include logistical complexities, limited accessibility and increased transportation costs for manpower and construction materials.

The Himalayas are situated in a **seismically active zone**, making earthquake preparedness a top priority during tunnel construction.

Way forward:

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.

Currently, in India the design and construction of a tunnel project is done simultaneously. **More detailed geotechnical studies** like the petrographic analysis, needs to be done to incorporate in the design and the construction of the tunnel project.

Conducting third party risk assessments periodically, considering geological, environmental, and usage factors.

Regular site visits of an independent specialist geologist must be conducted to check for probable failures and to determine the rock's stand-up time.

Training personnel in tunnel management and emergency response procedures. **Public awareness campaigns** can educate users and nearby residents about safety measures and reporting mechanisms.

There must be **deployment of NDRF personnel & proper safety equipments** to ensure safe evacuation in case of any mishap. The construction companies must submit a safety plan along with the bid for the projects.

Explore **innovative technologies** like Artificial Intelligence, drones, or robotics for more efficient inspections, maintenance, and early detection of potential issues.

Guidelines on safety practices in tunnel construction prepared by the **International Tunnelling and Underground Space Association** say that particular attention should be given "to the means of escape in an emergency situation in contingency planning"