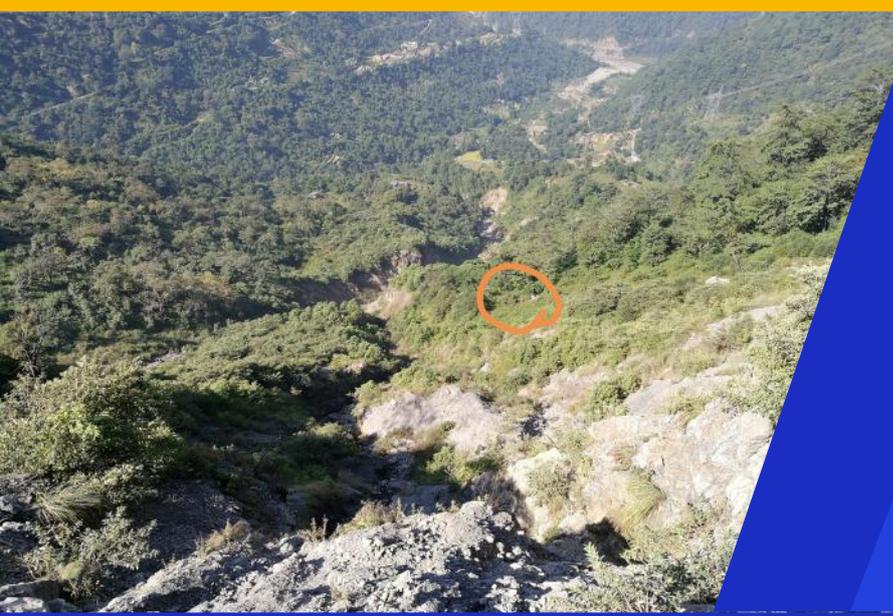


Project Dossier



PROJECT DOSSIER

NARENDRA NAGAR LANDSLIDE MONITORING

PROJECT OVERVIEW

Narendra Nagar is a township in Northern Hills in the Indian State of Uttarakhand. The region experiences frequent landslides caused by flash floods due to excessive rainfall.

Himalayas and other hilly regions of India are affected a lot by landslides and landmass movement activities. Landslide hazards rank high because they pose a threat to life and livelihood, property, infrastructure as well as large-scale destruction in mountainous region of India.

The potential landslide areas may take toll of human lives in the near future and cause damage to residential

and commercial area and infrastructure. Thus, Government has been taking major steps in slope protection and landslide risk reduction and management works such as hazard mapping; preparedness, response and relief mechanism through monitoring and early warning system; stabilization and mitigation of landslide etc.

Encardio-rite was entrusted with the monitoring contract for “Real Time Monitoring of Narendra Nagar Landslide (RETMONAL)”. The Real-Time Monitoring of Narendra Nagar Landslide uses various geotechnical instrumentation for landslide investigations aimed for developing an Early Warning System (EWS). The total area of Narendra Nagar landslide site covered for monitoring is approximately 0.25 km². Typical real-time landslide monitoring systems consists of geotechnical instrumentation with automatic data collection and wireless transfer to central server having online data management software.

Project	Narendra Nagar Landslide
Location	Uttarakhand, India
Client	DRDO/DTRL
Duration	2019 - till date (2021)



Monitoring solution

The real-time monitoring of landslide prone hill slope involved monitoring plan that not only provided immediate warning of landslide activity but also provided understanding about dynamics of slope failures.

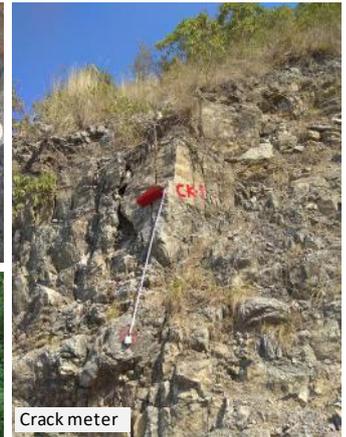
Turnkey services

Encardio-rite was awarded the sub-contract for complete monitoring works of the project. Scope of works included:

- Supply and installation of geotechnical instruments
- Supply and commissioning of datalogger with wireless (GSM/GPRS) data transfer facility
- Drilling for all the boreholes required for installation of our instruments
- Real time database management system



Crack meter



Crack meter



Piezometers, IPI with datalogger & solar panel



IPI sensor being installed



In-place inclinometer; piezometer and datalogger



Creep meter



Datalogger being configured

INSTRUMENT USED

- **In-place Inclinometer** for monitoring sub-surface lateral movement/deformation
- **Piezometer** for monitoring sub-surface water pressures for slope stability evaluation
- **Borehole extensometer** – three-point (electrical) for monitoring sub-surface settlement/movement
- **Crack Meter** for monitoring crack opening
- **Creep Meter** for monitoring large displacements/deformations of an active geologic fault in the earth
- **Raingage** for co-relating data from above geotechnical instruments
- **Datalogger** to collect data from all of the above instruments and transfer to central server

Location of the instruments were at three levels on the mountain i.e. at the crown, mid-level and toe. Drilling and installation at the three locations in the slopes was a difficult task, especially at the toe. However, all the instruments were installed successfully and are giving reliable data at pre-set frequency. Monitored data was available online through Encardio-rite's in-house developed DRISHTI, a web based data management system. The data is available in near real time to the stakeholders on their laptops and mobile phones.



TUNNELS



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