

**MITIGATION MEASURES NEAR PANGI BRIDGE APPROACH,  
HIMACHAL PRADESH  
AT KM 373.050 APPROACH OF PANGI BRIDGE ON HINDUSTAN TIBBET (H-T) ROAD (NH-05), HIMACHAL PRADESH, INDIA**

**Dynamic Barriers**

**Problem**

The landslide of Pangi nallah on the old Hindustan-Tibet road (bottom road) at NH-22 at KM 373.05 causes inconvenience to the civilians, Army, BRO, and ITBP Officials. The major problems on the site were rockfall / falling debris, surficial instability, erosion and subsurface water flow, which poses a continuous threat to the people and traffic flow along the section of NH 22 at KM 373.05. Therefore, the site required suitable mitigation measure for a smooth and safe traffic flow.

It was observed from the engineering investigations that the existing road width near Pangi nallah varies from 3.5 to 4 m. Most of the road was damaged and the total stretch covered by the landslide was about 130 m. The hillside height is about 1000 m, whereas the valley is approximately 60 m deep with a steep slope angle of 60-80 degrees.

**Solution**

The solutions for critical stretches with the potential risk of rockfall and surficial instability were identified and adopted. Considering the problems, flexible rockfall barrier lines and a secured drapery system with high tensile wire mesh were proposed.

Based on the optimized design and analyses done on Rocfall software, one line of dynamic rockfall barrier of energy capacity 2000 kj and 150 m long was installed below the village road (top road). Whereas the multiple lines of dynamic rockfall barrier of energy capacity of 5000kj of total 300 m length were installed above the old Hindustan-Tibet road (bottom road).

To counter the surficial instability issue, a secured drapery system with high tensile wire mesh SGHR 30 and surface nails have been proposed.

The secured drapery system with high tensile wire mesh (Steelgrid HR), jute geotextile (BioMac JU) and bio-engineering measures were installed on the hillside comprising of soil/soil mix boulder strata to control erosion and increase vegetation. MacRO Studio has been used in the design of drapery. Self drilling anchors of 8m long, 32mm dia. with 2m c/c spacing in both directions were installed along with meshes to ensure surficial stability. To cater the subsurface water flow, PVC perforated pipes of 100mm dia., 6m long at spacing 6m c/c in both directions were installed.

**Client:** BORDER ROAD ORGANIZATION (BRO)-DEEPAK

**Designer / Consultant:** MACCAFERRI ENVIRONMENTAL SOLUTIONS PVT. LTD

**Contractor:** MACCAFERRI ENVIRONMENTAL SOLUTIONS PVT. LTD

**Products used (Qty.)**

- Rockfall Barriers 2000kj-150 RM,  
5000kj-300 RM(multiple lines)
- Macarmour & Steelgrid SG HR-10000  
Sq.m+SDA-21600RM
- BioMaterials BioMac JU-10000  
Sq.m

**Date of construction:** 06/2020 - 01/2022



**Figure-1-Google earth location-Pangi slid**



**Figure-2-Dynamic rockfall barrier during construction**



Figure-3-Installed dynamic rockfall barrier



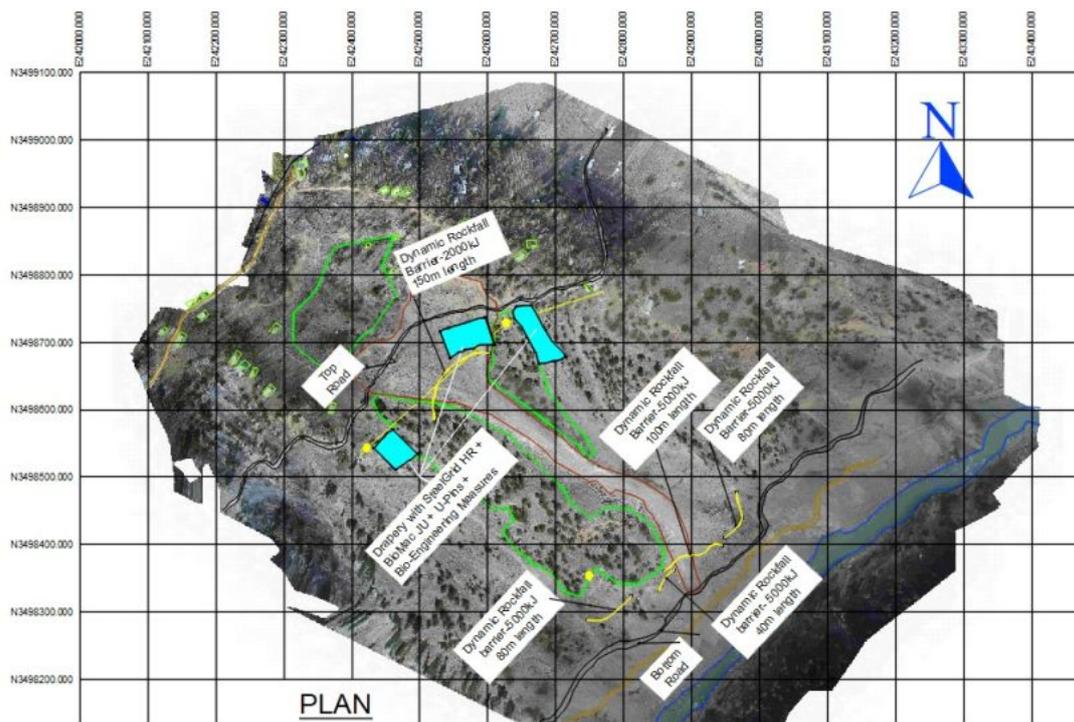
Figure-4-Installed dynamic rockfall barrier.



Figure-5-Installed Steelgrid and jute mat



Figure-6-Installed Steelgrid and jute mat



PLAN

Plan showing scheme