

ROCKFALL MITIGATION MEASURES FOR HILL SLOPE AT SHRI RAM LAXMAN GAD NAGPUR, MAHARASHTRA, INDIA

Surface Strengthening and Support

Problem

Shri Ram Laxman Gadmandir is located in Ramtek Taluka of Nagpur district. The temple has a very rich history of Hindu mythology and therefore thousands of pilgrims visit the place every year. The temple is constructed over a rocky strata.

The rocky strata being exposed to alternate climatic conditions leads to rocks getting deteriorated and detached from parent rock due to thermal stresses developed and because of this, many cases of rockfall incidents were reported. To avoid further rockfall accidents, proper mitigation measures needed to be adopted.

Solution

Selection of rockfall mitigation was done in such a way that the drapery/netting shall be capable of retaining detached boulders of small as well as large sizes. Composite steel mesh reinforced in a single direction (Steelgrid® MO) along with HEA panels were selected as drapery over weathered rock strata. High resistance steel wire mesh geocomposite (Steelgrid® HR) and diagonal wire ropes were provided at locations where surficial instability was less. In addition to this, additional deep anchors (8m long) were selected for an area where deep cracks were present and drainage pipes were provided for effective drainage.

Considering the importance of the temple and concerns of the local people, vibration monitoring was done at various locations in the temple premises using seismograph. Vibrations induced in the temple due to continuous drilling at the base were checked and monitored in the presence of Executive Engineer (PWD Nagpur), Deputy Engineer and other local dignitaries associated with the temple. The evaluation was carried out in all the four directions of the temple.

Client: PWD, NAGPUR

Designer / Consultant: IIT BOMBAY

Contractor: MACCAFERRI ENVIRONMENTAL SOLUTIONS Ltd

Products used (Qty.)

- Steelgrid	936 sqm with diagonal rope
- Steelgrid HR	3,550 sqm
- HEA Panels	3,050 sqm
- Anchor Bar	6,749 RM (32mm), 329 RM (25mm)
- Geosynthetic Accessories	250 RM, PVC Perforated pipes (50mm dia)

Date of construction: 05/2017 - 05/2018



Photo 1: Scaffolding at site for anchoring.



Photo 2: During installation



Photo 3: Vibration monitoring in the temple premise



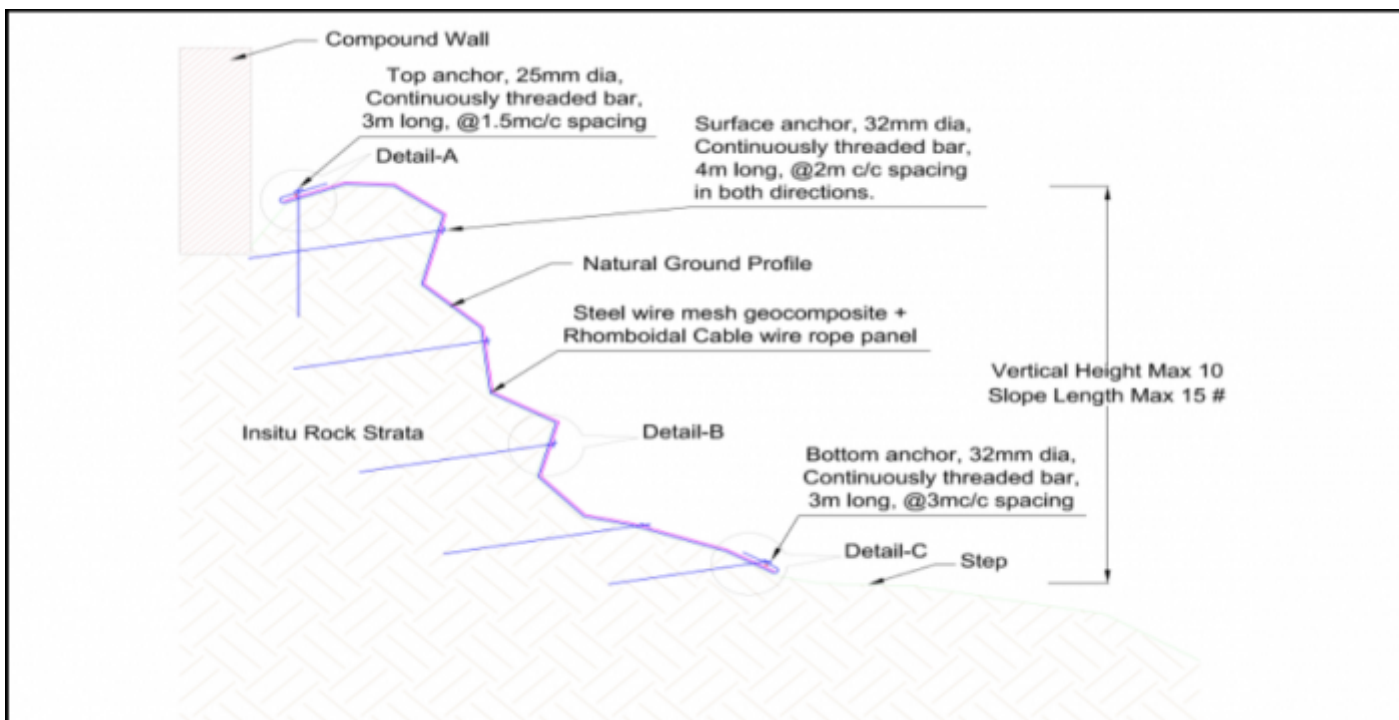
Photo 4: Completed Structure



Photo 5: Completed structure



Photo 6: Mesh installation at the back side of temple



Typical cross section of the solution