

RESTORATION OF GILBERT HILL
MUMBAI, MAHARASHTRA, INDIA**Surface Strengthening and Support****Problem**

Gilbert Hill is situated at Andheri (West) in Mumbai suburbs and contains a unique assemblage of spectacular vertical columns of black basalt rock of approx. 60m high. These columns usually have a hexagonal cross section and are believed to have developed by cooling of basaltic lava (which poured out from long fissures) near Mumbai, 65 million years ago. It is the only hill of its kind in India and was declared as a national park in 1952 by central government and was declared a grade II heritage structure by the Municipal Corporation of Greater Mumbai (MCGM) in 2007. Atop the rock column, the Gaodevi and Durgamata temples are also situated.

A series of rockfall events were observed from the Gilbert hill affecting residential apartment complexes at the foothills. Adverse geological conditions and unscientific excavation for building construction seem to be the reasons for instability of hill-rock mass which lead to detachment of boulders from the slope surface. Considering the uniqueness of the hill, its heritage importance and risk to human life and property due to rockfall events, it was necessary to adopt rockfall mitigation measures on the hill slope.

Solution

Considering the space restrictions at toe of hill, presence of buildings in the vicinity and nearly vertical slopes, secured drapery system with raster of nails was proposed to impart surficial stability.

Selection of meshes for secured drapery system was done considering capability of meshes to retain detached boulders of smaller and as well as bigger sizes. HEA panels (for retention of larger size boulders) along with Steelgrid MO mesh (for smaller size boulders) were selected as drapery over weathered rock strata. Continuously Threaded Anchors (CTA) were installed for intact strata and Self Drilling Anchors (SDA) were installed for collapsible strata. Nail lengths were of approx. 3m for surface anchors and 4m for top anchors.

Top anchoring using anchor trench was constructed where soil strata was prevailing at crest. Provision of subsurface drainage pipes were also taken into consideration so as to avoid seepage issues.

Client: PWD, Mumbai**Designer / Consultant:** IIT Bombay**Contractor:** Maccaferri Environmental Solutions Pvt Ltd**Products used (Qty.)**

- Steelgrid	MO- 4,433.65 sqm
- HEA Panels	4,433.65 sqm
- Anchor Bar	CTA-32mm dia- 2,100 RM

Date of construction: 02/2018 - 10/2018**Photo 1: Drilling in progress****Photo 2: Installation of surface anchors**



Photo 3: Mesh installation on in progress



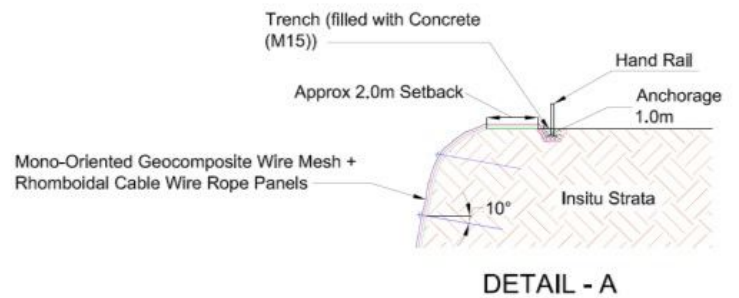
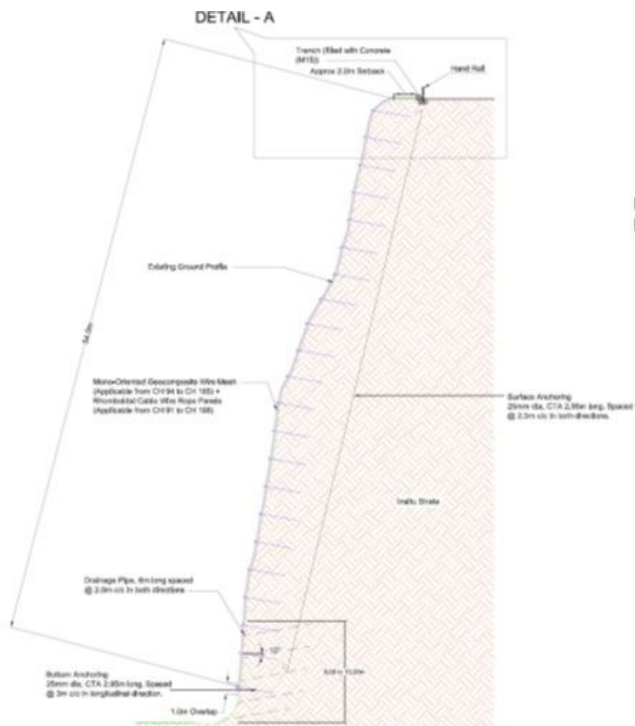
Photo 4: Installation of surface anchors



Photo 5: Completed protection work



Photo 6: Completed protection work



Cross sectional drawing

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