

**ROAD WIDENING OF THE NH21 HIGHWAY
KIRATPUR, INDIA**

RETAINING WALLS & SOIL REINFORCEMENT

Product: Terramesh[®], Green Terramesh[®], ParaLink[®]

Problem:

Himachal Pradesh, a North Indian state in the Himalayas, is known for tourist sites and hill stations. The National Highway Authority of India (NHAI) proposed the four-laning of the Kiratpur to Ner-Chowk section of NH-21 from Km 73.200 to Km 186.500 in the states of Punjab and Himachal Pradesh. The new road connecting Kiratpur and Ner Chowk, bypasses the busiest hill stations like Sawarghat, Bilaspur and Sundarnager enabling the tourist hubs of Himachal Pradesh such as Kullu and Manali to be reached more easily and safely. The objective of this project is to improve the existing highway by carrying out widening so as to increase its capacity and also reduce the travel time by realigning the road in certain stretches to divert the traffic away from towns to avoid congestion. The alignment and level has been planned in such a way that the overall distance is reduced and the travel is comfortable as well.



Existing highway, showing the downslope area

In order to facilitate the widening of the highway, a combination of cut and fill works are planned to be made in the hill slopes; the excavated material shall be used as fill material on valley sides to maintain the proposed width of the highway. Additionally, in some locations, the newly steepened cuts within the hilly terrain had a danger of rock / boulder detachments from the surface of the cut due to the jointed/ fractured and loose nature of the strata. The rock / boulder detachments could cause significant damage, road closures, mortalities, injuries and damage, and also had to be addressed.

Solution adopted:

The site is prone to high seismicity and lies in Indian seismic zone V. Thus any system selected for the construction of the retaining structures had to be highly resilient to withstand the earth quake forces, high pore-water pressure, very steep slopes and substantial sub-surface water flows. Additionally the structure had to blend with the scenic natural beauty of the region. The strata consists of alluvium deposits followed by highly weathered sandstone.

Conventional masonry and RCC retaining walls were ruled out due to the prevailing extreme site conditions. A flexible retaining wall with a free draining fascia was an ideal choice for this high terrain and very steep slopes due to its inherent ability to accommodate settlements and vibrations due to dynamic forces.



Project site

Client:

NATIONAL HIGHWAYS AUTHORITY OF INDIA

Main contractor:

IL & FS PVT LTD

Designer:

SEGMENTAL CONSULTING & INFRASTRUCTURE

Products used:

TERRAMESH, GREEN TERRAMESH, PARALINK

Date of construction

2015



Green Terramesh units being placed, ready for backfilling

Maccaferri proposed a composite reinforced soil systems with a gabion fascia (Terramesh® system) and vegetated fascia (Green Terramesh® system) for stabilization.

The Terramesh® and Green Terramesh® systems consist of a modular fascia element, with an integral steel wire woven mesh geogrid. The geogrid is sandwiched between layers of compacted backfill which is thereby reinforced by the presence of the grid. This enables the soils to stand steeper, accommodate greater loads and settle less than an unreinforced soil.

These solutions have been tried and tested within earthquake zones around the world with great success.

The Terramesh® System features a gabion fascia unit, and Green Terramesh® has a fascia that is designed to promote the revegetation of the reinforced soil slope, integrating the slope with nature.

The potential of greening the fascia using natural materials was one of the key factors to select the system from among the different alternatives proposed.

On the taller reinforced soil structures and where the geotechnical forces are far higher, the Terramesh units provided secondary soil reinforcement only. Primary soil reinforcement was provided by ParaLink® geogrids. ParaLink® is a geogrid engineered from polyester fibres encased within an ultra-tough polyethylene sheathing. Available in strengths up to 1350kN/m, it is ideal for use in these demanding seismic zones.

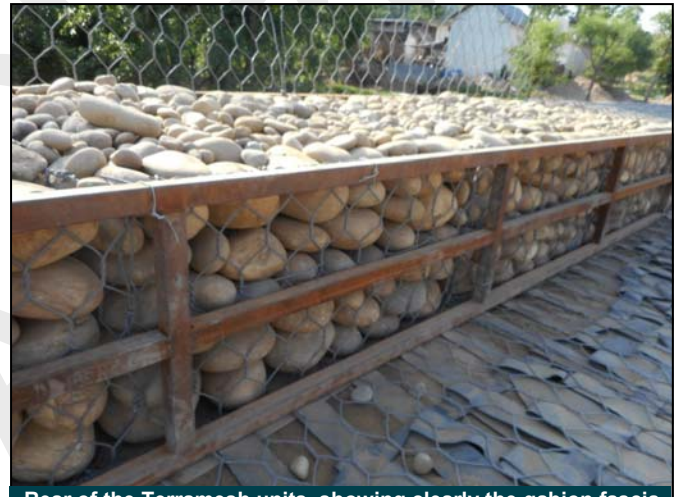
During the excavation activity for the construction of the reinforced soil structure, unstable rock blocks and boulders detached from the hillside, causing a serious threat to the safety of the construction crews as well as to the road users.

A Maccaferri dynamic rockfall barrier system was therefore proposed and installed in vulnerable locations in order to protect the traffic from falling rocks.

By drawing from a wide portfolio of soil reinforcement and natural hazard mitigation systems, Maccaferri was able to provide a package of solutions to the client.



Terramesh reinforced soil structure gaining height



Rear of the Terramesh units, showing clearly the gabion fascia



Paralink primary geogrids placed, ready to receive backfill



Terramesh (bottom) and Green Terramesh (top) structure

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