

Enkamat®R²M**DIVISION 2
Site Construction****Hillside Reconstruction****Root Reinforcement****Grader / Landscaper:**

*Iron Horse Construction
Simi Valley, CA*

Geotechnical Consultants:

*Ninyo & Moore
Irvine, CA*

**Surface Stability on Steep Slopes**

This beautifully crafted home in Beverly Hills, California is the result of many years of hard work with a vision of turning a dream home into reality. The breathtaking view of the eastern central Santa Monica Mountains is a luxury few can afford. And likewise, placing a masterpiece on an environmentally and aesthetically sensitive ridge top is a project that can ill-afford mistakes. The grading plan for this awe-inspiring home consisted of cutting and filling the ridge to create a building site surrounded below by existing fine homes. The relatively flat terrain on this ridge top is approximately eight acres.

During the development of the property two major slopes had to be disturbed. Slope #1 faces southeast with a steep upper portion inclined at approximately 1.2:1. The middle and lower portions are inclined at approximately 1.5:1. The slope ranges in elevation from 855 feet above mean sea level (msl) near the toe to 920 msl at the top. Slope #2 faces south, inclined at approximately 1.5:1 near the top and approximately 2:1 in the lower portion of the slope. It ranges in elevation from 835 msl at the bottom of the slope to 920 msl at the top.

The owner's desire was to ensure the aesthetics of the graded slopes were pleasing to their neighbors below, blending into the surrounding scenic hillside. They wanted this area maintenance free with minimal erosion and

sediment transport onto adjacent properties. With these objectives, the project manager organized a team of experts to plan and implement a solution for this very sensitive challenge. The team included Ninyo & Moore from Irvine, California as geotechnical consultants, Colbond Inc. of Enka, North Carolina as the erosion control / slope stabilization material specialist, and Iron Horse Construction, the landscape contractor from Simi Valley, California for implementation of the design.

Ninyo & Moore performed subsurface exploration, laboratory testing of the soils, and slope stability analysis. The general finding of the soil types on the site included: undocumented fill, Quaternary colluvium, and bedrock of the Tertiary Topanga Formation. Ninyo & Moore's findings determined global stability concerns were satisfied, but recommended that additional local (or surficial) stability was required. Two alternatives were offered for the treatment of the slopes.

The first alternative was to increase the surficial factor of safety of the slope to greater than 1.5 by removing the surface soils and rebuilding the slope with a geogrid. The second alternative was to improve the surficial stability of the slope by re-grading and installing a turf reinforcement mat (TRM.) In both alternatives, the slope was to have a re-established vegetation cover.

Continued on reverse side...

Enka-Engineered

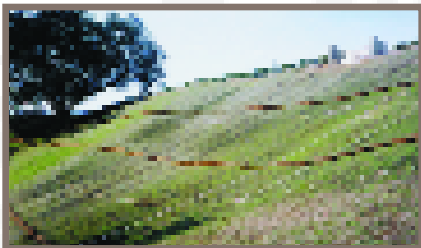
CIVIL ENGINEERING
PRODUCTS

Steep Slope

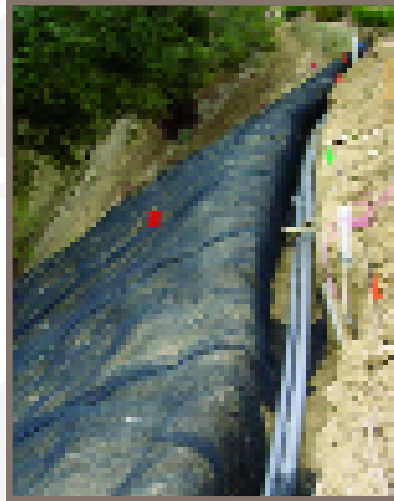
The project manager selected the second alternative, which increased the stability of the slope surface by increasing the erosion resistance. A variety of TRM's and their corresponding features and benefits were considered. Enkamat R²M was chosen after the project manager decided on the types of vegetation needed for this particular locale. The potential for sheet (overland) flow during precipitation was also a consideration. Enkamat "S" was selected for Slope #1 based on the steep angle of the slope (approximately 1.2:1 to 1.5:1.) Enkamat 7020 was chosen for Slope #2 (based on angles of 1.5:1 to 2.1).

Enkamat 7020 is a root reinforcement matrix made of a monolithic three-dimensional nylon matrix that can withstand shear forces of 10 psf in channels and has a superior holding capacity for soil, root mass, and vegetation. Enkamat "S" is a unique product that incorporates the Enkamat matrix (heavy nylon filaments entangled and fused together) with a high-strength polyester geogrid. It has a high tensile resistance of 3,000 lbs/ft, and was developed to be used on very steep slopes.

The slopes were re-graded slightly, dressed and compacted with a sheeps-foot mounted to a winch that was attached to the dozer at the top of the slope. Any existing tree root systems were pruned back but left intact during the re-grading to provide added stability to the slope surface.

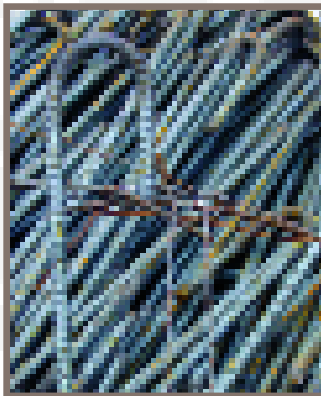


Straw wattles were used to slow down runoff water.



Anchor trench doubles as a utility trench.

The Enkamat was installed into an anchor trench (which doubled as a utility trench) at the top of the slope and deployed downhill. The trench was backfilled and a soil berm was then installed at the top to eliminate runoff from flowing over onto the slope. The Enkamat was intentionally cut and fashioned around any tree or root penetrations and fastened securely around these penetrations. This technique is possible with Enkamat because unlike the typical chopped-fiber TRM, it does not unravel or lose its structural integrity when cut in the field.



The anchoring devices used to hold the Enkamat on the slopes included 10 inch U-shape staples and 18 inch J-hooks made from #3 re-bar. After the Enkamat was installed, straw wattles were installed 2/3 of the way down the slope to slow down any runoff water. 7,000 square yards of Enkamat was installed on the two slopes.

An irrigation system was installed on top of the Enkamat. Iron Horse Construction installed sprigs of rosemary into the Enkamat 18 inches on center for the vegetation cover. The contractor and the project manager were very pleased with how well the Enkamat conformed to the contours of the terrain providing intimate contact with the soil. The construction crew also commented on the improved traction and workability once the Enkamat was installed.

The project manager was very pleased with how the different companies worked together to develop and implement a solution to a very difficult slope issue in a relatively short period of time. This cooperation and response time saved the owner money based on the accurate and quick assessment and the design and implementation of the installation before the slope became uncontrollable.



Runoff is minimized with vegetation.

For more information about Enkamat R²M and other quality products manufactured and marketed by Colbond Inc. please call our toll free number or visit our website.

COLBOND

1301 Sand Hill Road
 P.O. Box 1057
 Enka, N.C. 28728
 Tel. (+1) 828-665-5050
 Toll Free: (+1) 800-365-7391
 Fax (+1) 828-665-5009
 EnkaTech Fax Back (+1) 888-288-2132
 email: enka-engineered@colbond.com
 website: www.colbond-usa.com