MACCAFERRI

CASE HISTORY

Ref: INT/CH/RF035 - Rev:01, Mar 11

HYBRID ROCKFALL ATTENUATOR BARRIERS ON INTERSTATE 70
GEORGETOWN,COLORADO, USA

ROCKFALL MITIGATION SYSTEM
Product: HEA Panels, Attenuator Barriers

Introduction
Maccaferri High Energy Absorption (HEA) cable net panels were used by Colorado Department of Transportation (CDOT) to construct rockfall attenuators ("hybrid barriers") to address rockfall hazards along Interstate 70 (I-70) at the Georgetown Incline in Colorado. Rockfall attenuators were chosen in order to decrease velocities of falling rocks prior to their potential impact with the rockfall barriers that are located further downslope. The rockfall attenuators were successfully installed between February and May, 2010.

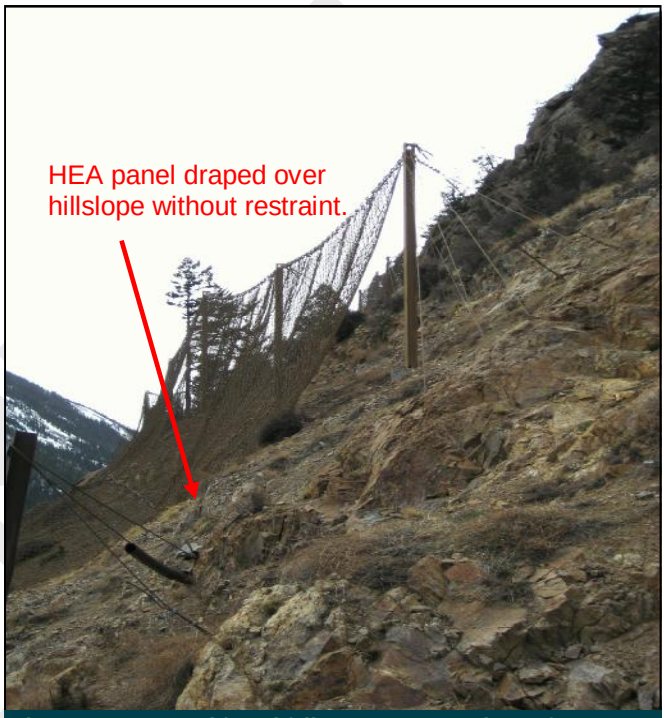

Figure 1. HEA Panel / Rockfall Attentuator Upslope of I-70

Rockfall Issue at Site
Due to the large boulder sizes and the extensive, steep slopes that exist directly upslope of I-70 in this location, falling rocks have the potential for impact energies that exceed the capacities of site-feasible rockfall barriers currently on the market. A recent rockfall event had penetrated an existing barrier at this site, and CDOT responded with a mitigation plan that incorporated the use or rockfall attenuators to intercept and slow the falling rocks before they impact the downslope rockfall barriers (Figures 3 and 4).

The designs for these attenuators incorporated the use of Maccaferri HEA cable net panels fabricated from 12mm (0.5") diameter steel cables in a 200mmx200mm mesh opening configuration (Figure 2). The rockfall mitigation plan included other measures including other Maccaferri systems; 500kJ and 2000kJ rockfall catch fences, HEA cable panels and Double Twist steel wire mesh drapery systems, which are discussed in other case studies.

Solution
Five rockfall attenuators were selected as part of the solution by CDOT and their designer, Yeh and Associates, to address the exceedingly high rockfall impact energies that can occur along the heavily travelled Georgetown Incline upslope of I-70 (Figures 1, 3, and 4). The design of all five of these rockfall attenuators incorporated the use of Maccaferri's High Energy Absorption (HEA) cable net panels (Figure 2).

When falling rock energy surpasses the resisting capabilities of available rockfall barriers, it becomes necessary to install rockfall attenuator(s) upslope of the barrier, in order to slow the falling rock(s) while it is en-route to the downslope barrier.

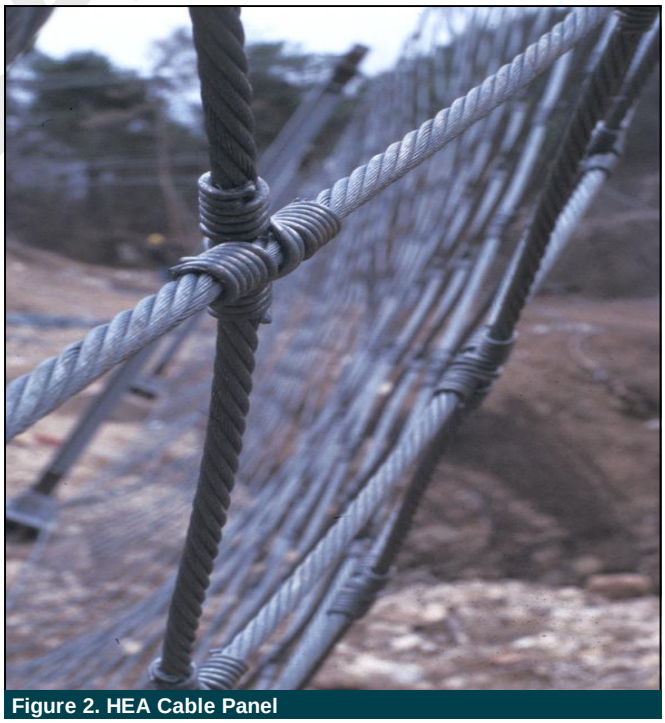
Figure 2. HEA Cable Panel

Client:

COLORADO DEPARTMENT OF TRANSPORTATION

Main contractor:

MIDWEST ROCKFALL

Designer:

YEH AND ASSOCIATES

Products used:

HEA CABLE NET PANEL

Date of construction

FEB-MAY, 2010

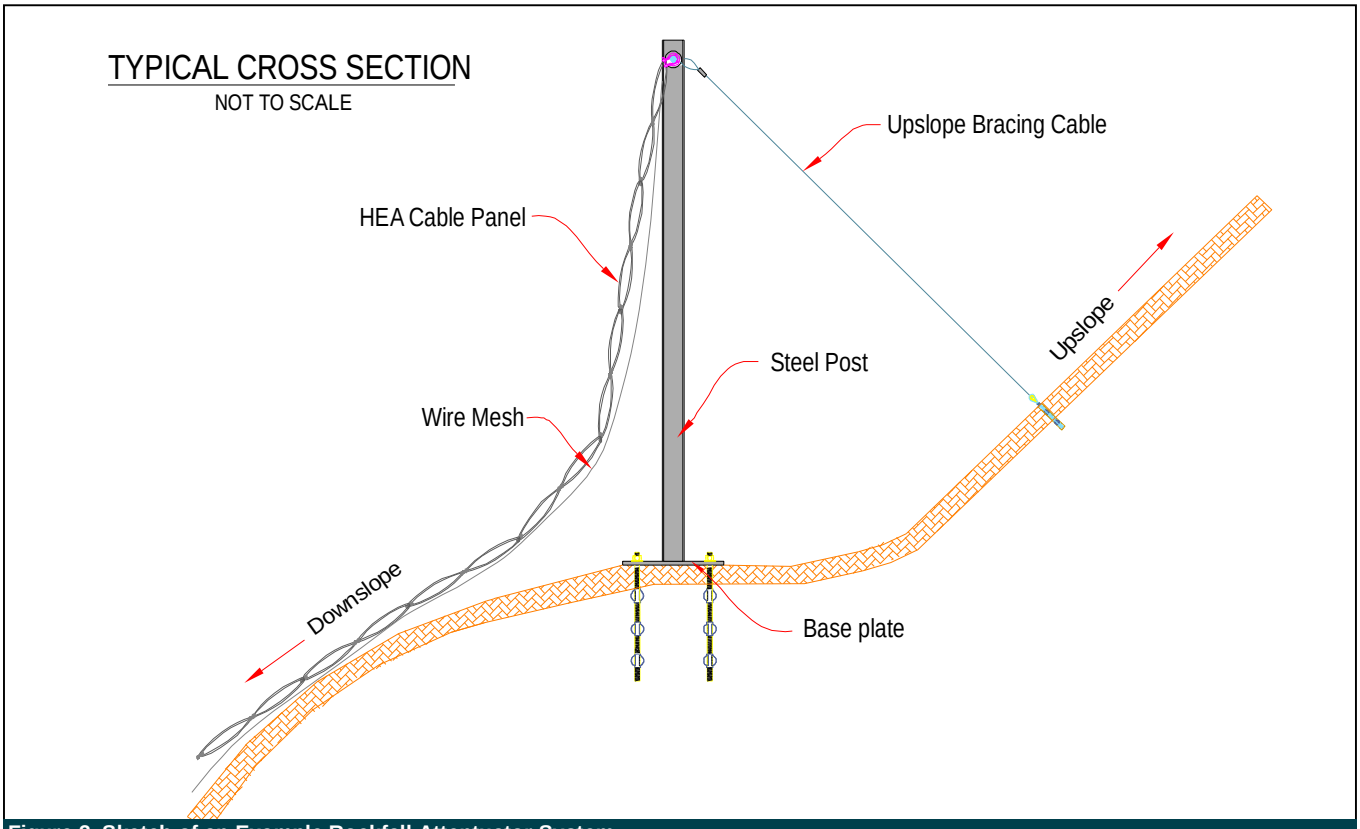

Figure 3. Sketch of an Example Rockfall Attentuator System

The energy of the falling rock is dissipated by the attenuator; as it impacts the attenuator the mesh panels are lifted, and partially envelop the rock, slowing its decent and rotational forces. The rock is therefore re-directed into the ground and forced between the mesh and the ground surface.

These rockfall attenuators were constructed by suspending Maccaferri HEA cable net panels (approximately 1,600m2 (17,000 ft^2) in total) from an upper, anchored support cable which runs through steel posts. The panels are draped freely over the ground surface and extend down the slope a distance of approximately 6m (20ft) from the support cable.

Maccaferri HEA panels were chosen in-part because they withstood repeated rockfall impacts, with the least amount of damage when compared to 10 other (non-Maccaferri) rockfall mesh and cable net panels in the recent CDOT study; Full-Scale Field Testing of Rockfall Attenuator Systems (Arndt, Ortiz, and Turner, 2009). For more information see Maccaferri Technical Note: HEA Cable Net Panel - Performance Test). Test rocks with weights up 3,800kg (8,360 lb) were released upslope of the test barriers, to achieve realistic translational and rotational energies before impacting the attenuator systems throughout a series of 119 rolling tests.

The strength and dynamic qualities (especially robustness to resist the 'slicing' rotational forces of falling rocks), of Maccaferri's HEA panels make the product an ideal cable net panel to use as part of an effective attenuator system.

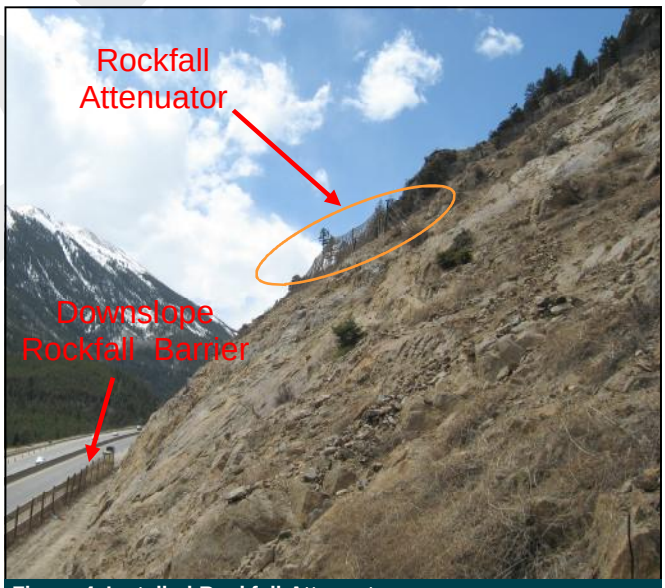

Figure 4. Installed Rockfall Attenuator

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