

ROCK SLIDE BARRIERS PROPOSAL

MACCAFERRI

10303 Governor Lane Blvd
Williamsport, MD 21795
Tel: 301-223-6910
Toll Free: 800-638-7744
Fax: 301-223-4356
Web Site: www.maccaferri.com/us

HIGH RESISTANCE ROCKFALL BARRIER CANTILEVER POST STYLE (NO UPSLOPE BRACING CABLES) (100kJ) RB 100/UAF

DESIGN LOADS AND STANDARD FOUNDATIONS

UPDATE / REVISION NR.		CHANGE / REVISION DESCRIPTION			DATE / SIGNATURE	
Rev. 2 – January 1st 2018						
REPLACES		DATE	REPLACED BY		DATE	
		SIGNATURE			SIGNATURE	
	DRAWN	CHECKED ON	APPROVED	SCALE	SHEET	
DATE					ID NUMBER	
SIGNATURE						

NOMINAL ENERGY LEVEL		100 kJ
MODEL		RB 100/UAF
Foundation Design Loads (Based on MEL Test Data)		
Tensile force on lateral foundations - (max value)	171.40 kN (38.53 kip-force)	
Tensile force on anchor bars at post base - upslope side (max value)	148.80 kN (33.45 kip-force)	
Compressive force on anchor bars at post base – downslope side - (max value)	148.80 kN (33.45 kip-force)	
Shear force at the base of the posts - (max value)	66.78 kN (15.01 kip-force)	
Quantity of Foundations		
Quantity of lateral foundations (per alignment)	n.2	
Characteristics of Standard Foundations		
Foundations in SOIL		
Lateral anchor (drilling diameter, length, type)	90 mm (3.5"), 4.0 m (16.4'), Double Cable Anchor Ø5/8" (16mm)	
All Thread Bars (3 Bar Pattern - 2 upslope 1 downslope) for base plate (drilling diameter, length, type)	90 mm (3.5"), 3.0 m (10'), All-Thread Gr75 #8 Ø1" (25mm)	
Micropiles (2 Bar Pattern) for base plate (drilling diam., length, type)	90 mm (3.5") , 3.5 m (11.5'), All-Thread Gr75 #9 Ø1-1/8" (28mm) -OR- T40S Hollow Bar Ø1-9/16" (40mm) -OR- B7X Hollow Bar Ø1-1/2" (38mm)	
Foundations in ROCK		
Lateral anchor (drilling diam., length, type)	65 mm (3.5"), 3.0 m (13'), Double Cable Anchor Ø3/4" (18mm)	
All Thread Bars (3 Bar Pattern - 2 upslope 1 downslope) for base plate (drilling diameter, length, type)	65 mm (3.5"), 2.5 m (8.2'), All-Thread Gr75 #8 Ø1" (25mm)	
Micropiles (2 Bar Pattern) for base plate (drilling diam., length, type)	65 mm (3.5") , 3.0 m (10'), All-Thread Gr75 #9 Ø1-1/8" (28mm) -OR- T40S Hollow Bar Ø1-9/16" (40mm) -OR- B7X Hollow Bar Ø1-1/2" (38mm)	

NOTES:

- 1) The Double Leg Wire Rope Anchors are manufactured from a Wire Rope Class 6x19 IWRC EIPS, with a minimum breaking loads in accordance ASTM A1023 for each diameter used.
- 2) The design loads indicated in the table above are the peak forces recorded on the cables and/or on the foundations during the MEL (Maximum Energy Level) full-scale crash test carried out according to ETAG 027.
- 2) Foundations shown are the standard options supplied with the kit, designed on the basis of assumed general conditions. The characteristics of the foundations, in particular the length and the drilling diameter, can be modified and specifically designed in case of particular ground conditions and needs.
- 3) All foundations used on a project should be checked for suitability and approved for use by the project engineer in accordance with the relevant procedures, standards, laws etc.

MAC.RO. SYSTEM - RB 100/UAF – 100 kJ

HIGH RESISTANCE CANTILEVER POST STYLE ROCKFALL BARRIER

Product Description

The **RB 100/UAF** is a 6.5ft (2.0m) high ETAG 027 tested rockfall barrier, meeting the 100 kJ (36.8 ft-tons) classification level.

Standards and Reference Guidelines:

ETAG 027 "Guideline for European Technical Approval of Falling Rock Protection Kits" Rev 2008

Primary Material Standards:

ASTM A53 "Standard Specification for Pipe, Steel, Black and Hot Dipped...";

ASTM A36 "Standard Specification for Carbon Structural Steel";

ASTM A325 "Standard Specification for Structural Bolts...";

ASTM A123 "Standard Specification for Zinc (Hot-Dip) Coatings on Steel Products" (Related Standard **ASTM A153** for Hardware);

ASTM A764 "Standard Specification for metallic-Coated Carbon Steel Wire..." (Related Standard **ASTM A856** for coating weights);

ASTM A975 "Standard Specification for Double-Twisted Hexagonal Mesh..."; (Related Standard **ASTM A641** for coating weights);

ASTM A1023 "Standard Specification for Stranded Carbon Steel Wire Ropes for General Purposes".

System technology

The catchment layers consist of double twisted wire mesh and HEA cable net panels, placed on the downslope side of the support posts. The support posts act independently of the net; if a post is hit by falling rock and damaged, the adjacent posts take up the additional forces, ensuring that the performance of the system is not compromised. Impact forces are shared among spans, therefore the stresses on the individual system components are minimized. During an impact, the system ensures that the energy of the falling rock is dissipated, and the rock is prevented from moving any further downslope. The energy dissipaters absorb the applied energy through deformation, not friction, thereby guaranteeing a predictable and dependable performance.

Main barrier features

The barrier layout makes it ideal for use on rugged slope and may be installed on any rock or soil type. Due to the system geometry, bracing cables require a smaller pull out resistance, therefore shorter anchor lengths are needed. Posts plinths have only a ground-smoothing purpose. The applied forces are transferred to the ground through the foundation anchor bars and / or micropiles. The HEA cable net system will allow for elevation and alignment changes during construction on rugged slopes.

Design

The minimum recommended barrier length is 100ft (30m). The optimum barrier length is between 100 ft (30 m) to 330 ft (100 m). Foundation designs are dependent on the forces acting at the post base and anchor locations, and on the soil type.



FIGURE 1: ETAG 027 FULL SCALE TEST PHOTO

If the slope geometry produces an offset in the barrier alignment, causing an upslope angle measuring less than 180° (e.g. 160°), a downslope anchor is required.

These features ease the barrier construction process, and the installation can be accomplished in a short time.

Testing Methodology and Results

Dynamic impact tests were performed at the Maximum Energy Level (MEL) on a full scale **RB 100/UAF** sample barrier of three 33ft (10m) spans (Post-To-Post Distance), with a nominal barrier height of 6.5ft (2.0m). Testing performed followed the program instructions per "ETAG 027 – Guideline for European Technical Approval of Falling Rock Protection Kits". (Certificate released by).

MEL (Maximum Energy Level) Test Results:

Energy: 40.9 ft-tons (111 kJ)

Barrier Nominal Height: 6.98 ft (2.13 m)

Maximum Barrier Elongation: 6.88 ft (2.10 m)

Barrier Residual Height > 80% - Category A of ETAG 027

*Changes to the geometry of the Barrier's tested configuration, will affect the Barrier's Maximum Elongation and Residual Height.

*TYPICAL RB 100/UAF BARRIER CONFIGURATIONS

NOMINAL HEIGHT	POST-TO-POST DISTANCE
6-13 ft (2-4 m)	26-40 ft (8-12 m)

WARNING: Install the product in accordance with accepted safety standards! If the job is done with suspension or security ropes, personal protective equipment against fall risk should be employed in accordance with OSHA 29 CFR 1926.104

The rockfall barrier RB 100/UAF is the property of the Officine Maccaferri Group.

Maccaferri reserves the right to amend product specifications without notice and specifiers are requested to check as to the validity of the specifications they are using.

MACCAFERRI

www.maccaferri.com/us

HEADQUARTERS:
10303 Governor Lane Boulevard
Williamsport, MD 21795-3116
Tel: 301-223-6910
Fax: 301-223-6134
info@maccaferri-usa.com

AREA OFFICES:

AZ, Phoenix
CA, Sacramento
MD, Williamsport

MO, St. Louis
NJ, Trenton
NM, Albuquerque

PR, Caguas
TX, Lewisville
UT, Salt Lake City

MAC.RO. SYSTEM - RB 035 - 35kJ

HIGH RESISTANCE LIGHTWEIGHT ROCKFALL BARRIER

DESCRIPTION:

The Lightweight Rockfall Barrier is a single layer mesh barrier system with no upslope bracing cables. The reinforced posts transfer loads from the mesh to the ground. The barrier is capable of withstanding the impact of a rock with energy levels up to 35 kJ (25,800 ft.lbs).

MATERIAL STANDARDS:

ASTM A53 "Standard Specification for Steel Pipe...",

ASTM A36 "Standard Specification for Carbon Structural Steel",

ASTM A992 "Standard Specification for Structural Steel Shapes",

ASTM A123 "Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products";

ASTM A1023 "Standard Specification for Stranded Carbon Steel Wire Ropes for General Purposes";

ASTM A975 "Standard Specification for Double-Twisted Hexagonal Mesh...";

SYSTEM TECHNOLOGY:

The retaining mesh panel is placed on the downslope side of the barrier post (Figure 1). Posts act independently of the net. If a post is hit by falling block and damaged, the adjacent posts take the additional forces, ensuring that the catching performance of the system is not compromised.

The retaining layer is a continuous panel of woven steel wire mesh. The woven steel wire mesh acts as an energy dissipater absorbing the applied energy by deformation. During an impact, the system ensures that the energy of the falling rock is dissipated, and the rock is prevented from moving any further.

Impact forces are shared among spans, therefore the stresses on the individual system components are minimized. No upslope or downslope bracing cables are required except when noted.

BARRIER FEATURES:

The Maccaferri RB 035 lightweight barrier can be installed in rock or soil with either a pipe or wide-flange post embedded directly into the ground. Alternatively, the wide-flange post may be attached to a jersey barrier along the highway.

Due to the system geometry and layout, the lateral bracing cables require relatively low pullout resistance, minimizing the drilling costs associated with long anchor lengths.

The system is easy to install with minimal installation time and requires very little maintenance. Typical construction drawings are available upon request.

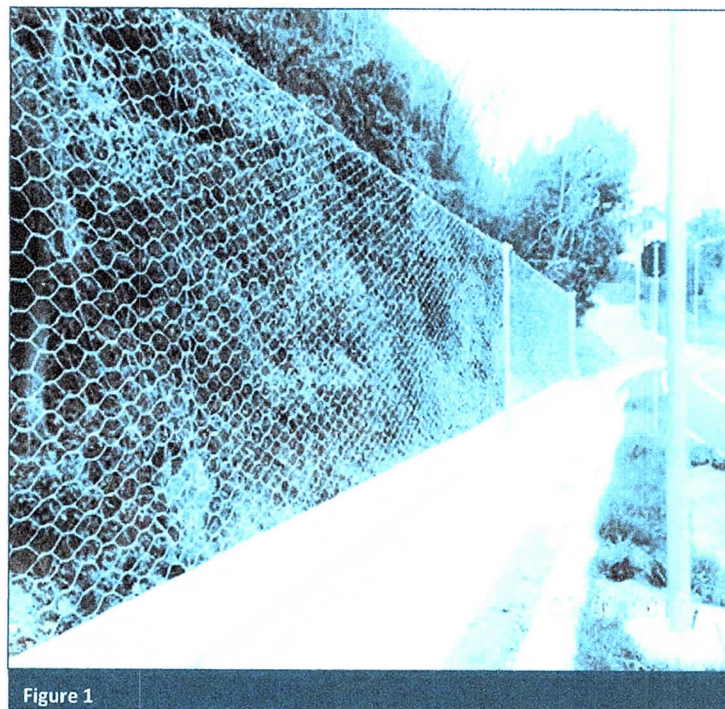


Figure 1

Table 1 - TYPICAL SIZE OF LIGHTWEIGHT BARRIER

BARRIER HEIGHT *	POST-TO-POST DISTANCE
ft (m)	ft (m)
6 (1.8) - 8.5 (2.6)	26 (8) - 40 (12)

* as measured from ground surface or top of jersey barrier

DESIGN:

The optimum barrier alignment length is 80 - 140 ft (25 - 42 m), with a maximum alignment length not exceeding 290 ft (88 m).

If the slope geometry produces an offset in the barrier alignment, causing an upslope angle measuring less than 180° (e.g. 160°), a downslope anchor is required.

The applied forces to the posts are transferred to the ground. Foundation design is dependent on the forces acting at the base, and the soil type.

Grade differential along the barrier alignment should not exceed 2-inches in 10-feet.

DAVID INVERNIZZI
d.invernizzi@MACCAFERRI 512-952-8091
.com

WARNING: Install the product in accordance with accepted safety standards! If the job is done with suspension or security ropes, personal protective equipment against fall risk should be employed in accordance with OSHA 29 CFR 1926.104

The rockfall barrier RB 035 is the property of the Officine Maccaferri Group.

Maccaferri reserves the right to amend product specifications without notice and specifiers are requested to check as to the validity of the specifications they are using.

MACCAFERRI

www.maccaferri.com/us

HEADQUARTERS:
10303 Governor Lane Boulevard
Williamsport, MD 21795-3116
Tel: 301-223-6910
Fax: 301-223-6134
info@maccaferri-usa.com

AREA OFFICES:

AZ, Phoenix
CA, Sacramento
MD, Williamsport

MO, St. Louis
NJ, Trenton
NM, Albuquerque

PR, Caguas
TX, Lewisville