

PRODUCT SPECIFICATION

P1-01 Beaver



MARGARITELLI
ROAD SAFETY

The **P1-01 Beaver** is a certified terminal for road side safety barriers, designed in-house with technical input from LAST Laboratories at the Milan Polytechnic University. It is compatible with our full product range and it is the first ever crash cushion made of laminated wood and corten steel. It has successfully passed full testing for Class P1 in compliance with UNI ENV 1317-4: 2003.



Figure 1 Transparent surface treatment, natural color - front view



Figure 2 Transparent surface treatment, natural color - barrier side view



Figure 3 Deep brown color surface treatment - front view



Figure 4 Deep brown color surface treatment - barrier side view



GENERALITY

The main element of the terminal is a laminated wood beam with five grooves on each of the lateral faces and one groove on each of the horizontal faces. Apart from the grooves, the beam's cross-section matches that of the Margaritelli N2-BL-01 barrier, with which it connects seamlessly. Unlike the barrier, however, the terminal's beam does not include a rear steel reinforcement strip.

In the terminal, the beam primarily serves to absorb impact energy and mitigate potential lateral impacts.

The beam is supported at the front by a sliding head, referred to as the "slider," at the rear by the arresting support, or "backstop", and in between by two intermediate posts, called "carriages." The slider can move longitudinally along the guide, or "runner", which prevents transverse and vertical movements and rotations. Similarly, the two carriages can slide along the runner and are held in position relative to the beam by a wood screw each.

The backstop, fixed to the rear end of the runner, is designed to absorb the entire longitudinal impact force of a vehicle, transferring it fully to the guide structure. Consequently, the terminal does not transmit any longitudinal load to the barrier and could function independently.

The guide consists of two longitudinal U-shaped folded sheet metal elements connected by six welded crossbeams. These crossbeams are anchored to a reinforced concrete foundation using twelve threaded rods, two per crossbeam.

The foundation, in turn, is anchored to the ground by six piles (in the configuration used for cohesive soils during the ITT test), driven into the ground to a depth of approximately 1800 mm.

Both the foundation and the guide anchoring system are designed to withstand impacts exceeding the terminal's performance limits, such as those caused by heavy vehicles. In such cases, the terminal may be destroyed and require replacement, but the foundation and guide anchoring will remain undamaged, eliminating the need for their repair or replacement.

In frontal impacts, the vehicle pushes the slider, equipped with five horizontal blades, against the front part of the beam. As the slider advances along the runner, the blades divide the beam into six strips, which are progressively bent, broken, and ejected—three upwards and three downwards, transversely towards the road's outer side.

This mechanism, responsible for absorbing the longitudinal impact energy, has been refined through calculations and rigorous static and dynamic tests conducted at the LAST laboratory of Politecnico di Milano.

When the slider pushes the first carriage, the wood screw connecting it to the beam breaks, and the carriage moves along the guide together with the slider. This process repeats when the first carriage pushes the second carriage. The entire impact energy is absorbed before the slider and both carriages reach the backstop.

Since the terminal does not transfer longitudinal load to the barrier, it can be used with all types of barriers, provided there is a seamless connection element without steps or steep inclines, both vertically and horizontally.

The device has been successfully tested for **Class P1 performance**, according to UNI ENV 1317-4:2003, at the UNI CEI EN ISO/IEC 17025 **CSI SpA** accredited center in Bollate – Milan.

SUSTAINABILITY

At Margaritelli Road Safety, our commitment to sustainability is evident across all aspects of environmental management. This includes strict adherence to environmental legislation, the efficient use of energy and natural resources, the promotion of a circular economy through waste recovery, and active efforts to combat climate change by minimizing greenhouse gas emissions generated during the production of safety devices.

For the P1-01 Beaver, an EPD (Environmental Product Declaration) has been registered and published on www.environdec.com. This declaration, prepared in accordance with the voluntary certification scheme outlined by the **ISO 14025** and **EN 15804** standards, pertains to the environmental performance of the product. The EPD serves as an objective assessment tool for evaluating the environmental performance of a product. It is based on the application of LCA (Life Cycle Assessment) methodologies, which assess the environmental footprint throughout the entire life cycle, from the extraction of raw materials to the product's end-of-life ("Cradle to grave") or to the factory gate ("Cradle to gate").

In the "Cradle to gate" analysis for the P1-01 Beaver, the total global warming potential (GWP) indicator due to greenhouse gases is expressed in kilograms of CO₂ equivalent emitted per meter of product.

This value is:

Total GWP = **75,30** kg CO₂ eq

In order to manage the environmental aspects characterizing Margaritelli Ferroviaria's activities more effectively and sustainably, the Perugia and Bettona offices operate with an Environmental Management System certified in accordance with the **ISO 14001** standard.

PEFC CHAIN OF CUSTODY

The implementation and maintenance of a PEFC Chain of Custody is the tool through which Margaritelli Road Safety demonstrates its commitment to halting deforestation, conserving biodiversity, and acting responsibly on a social level, through the adoption of a legal and sustainable raw material supply system: the wood used in the Bettona facility for the production of the device comes exclusively from sustainably managed forests.

MAIN DIMENSIONAL CHARACTERISTICS OF THE TERMINAL.

Overall length	5015 mm
Length of the metal rail - guide	4837 mm
Height of the front section over the foundation	655 mm
Width of the terminal, including the guide	450 mm
Height of the connection section over the foundation	650 mm
Maximum total weight of the assembled device	300 kg

MAIN DIMENSIONAL CHARACTERISTICS OF THE FOUNDATION.

Top surface of the foundation over the road surface	0 - 30 mm
Minimum foundation width	700 mm
Minimum foundation length	5200 mm
Minimum foundation depth	300 mm
Concrete characteristic resistance R _{ck} minim	25 N/mm ²

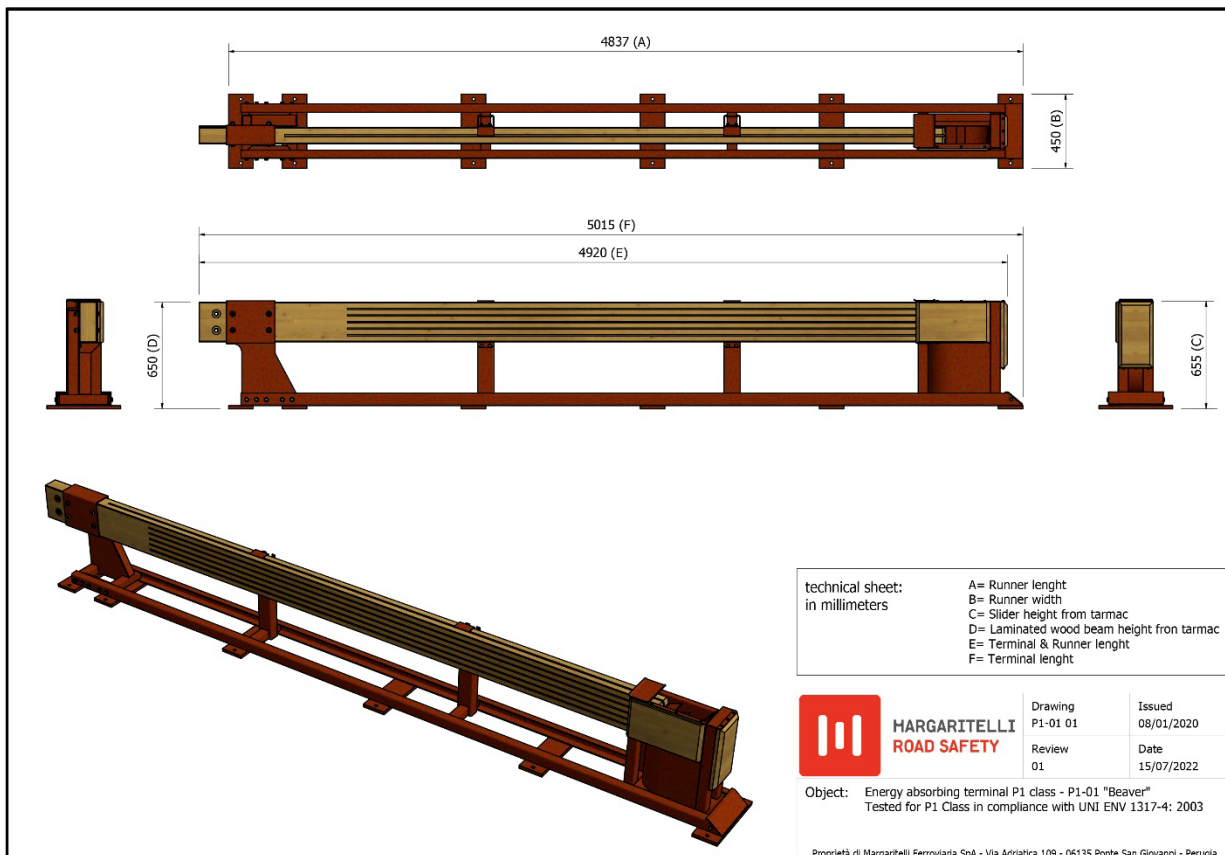


Figure 5 P1-01 Beaver

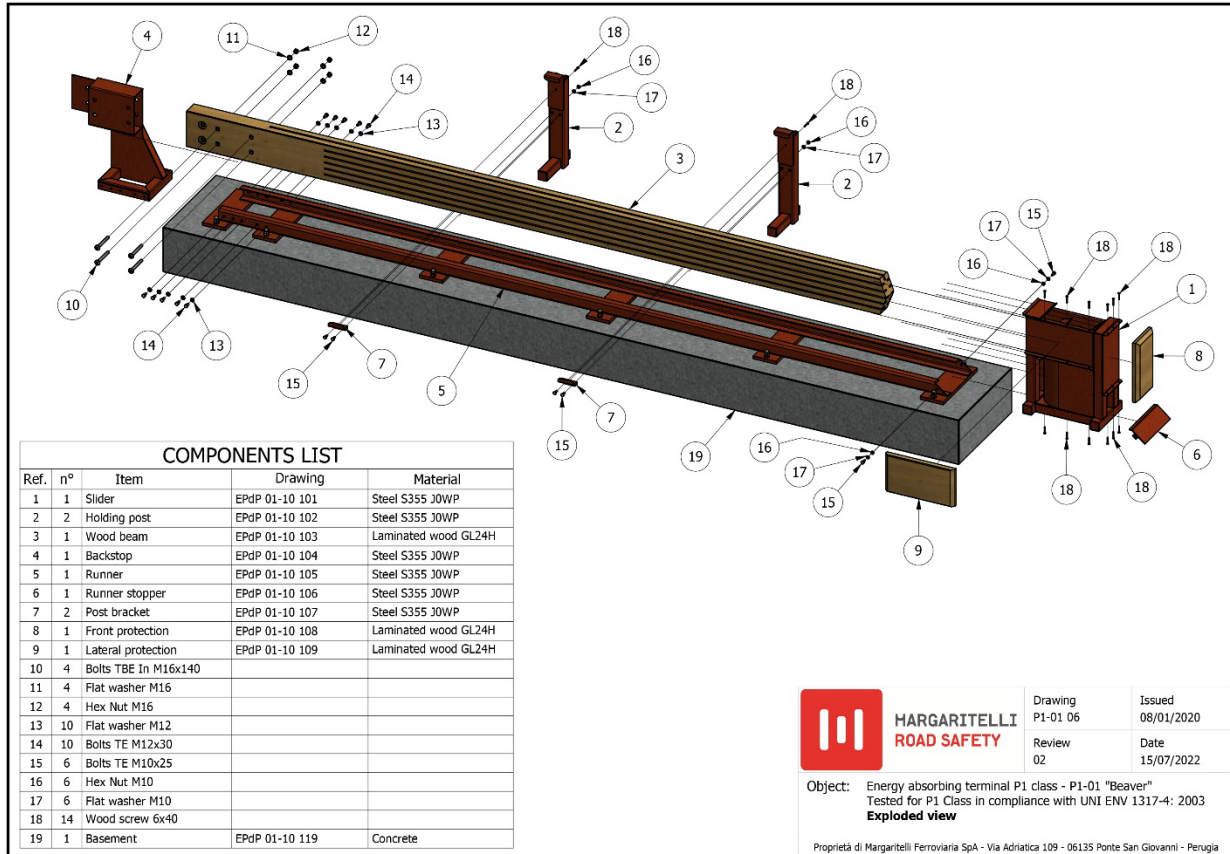


Figure 6 P1-01 Beaver – Exploded view

PERFORMANCE CHARACTERISTICS OF THE DEVICE.

Test carried out.

Test reports	Proof	Point of Impact	Velocity	Mass	Vehicle Type
Required by UNI ENV 1317-4:2003 0186/ME/HRB/19 of 11/12/2019	TT 2.1.80		80 km/h	900 kg	Car
			80.9 km/h	865,20 kg	Fiat UNO

Test results.

PARAMETER	Detected value	Limit value
ASI index	0,8	≤ 1.0
Flight time (ms)	138	
THIV or theoretical impact speed (km/h)	33	≤ 44
Impact severity class	A	
VCDI index - no cabin deformation detected	FS 0000000	
Maximum longitudinal deformation (m)	2,83	
Maximum lateral deformation (m)	0,00	
Za - exit box approach side (m)	0,00	6
Zd - exit box departure side (m)	4,60	6
Control line crossing speed A (km/h)	9,00	
Exit box class	Z2	
Detached elements weighing more than 2 kg	None	
Terminal elements penetrated into the passenger compartment	None	
Deformation and/or intrusion into the passenger compartment	None	

COMPATIBILITY WITH SIDE SAFETY BARRIERS.

The terminal essentially functions as an energy-absorbing attenuator, without transferring stresses to the underlying barrier, as these are fully absorbed by the back-stop. During ITT testing, no movement of the barrier installed behind the device was recorded. For this reason, its installation is not dependent on the type or length of the underlying barrier. The terminal can also be used as an anchoring system for the barrier itself, allowing (following appropriate verification) the installation of barrier sections shorter than those tested during ITT.

Connection mode.

With reference to figure 7, the connection of the terminal with the barriers takes place with three different configurations.

Pos.A: there is a direct connection with a protection band of the N2BL-01 barrier; with this configuration, starting from the first band, the N2BP-01 and H2BP-03 barriers can be connected.

Pos.B: there is a direct connection with a protection band of the N2BL-01 barrier, following an H-N connecting element; with this configuration, starting from the H-N fitting, the H1BL-01, H2BL-01, H2BP-01 and H2BP-02 barriers can be connected.

Pos.C: there is a direct connection with an N-N connecting element; with this configuration, starting from the N-N fitting, the N2BL-02 barriers can be connected.

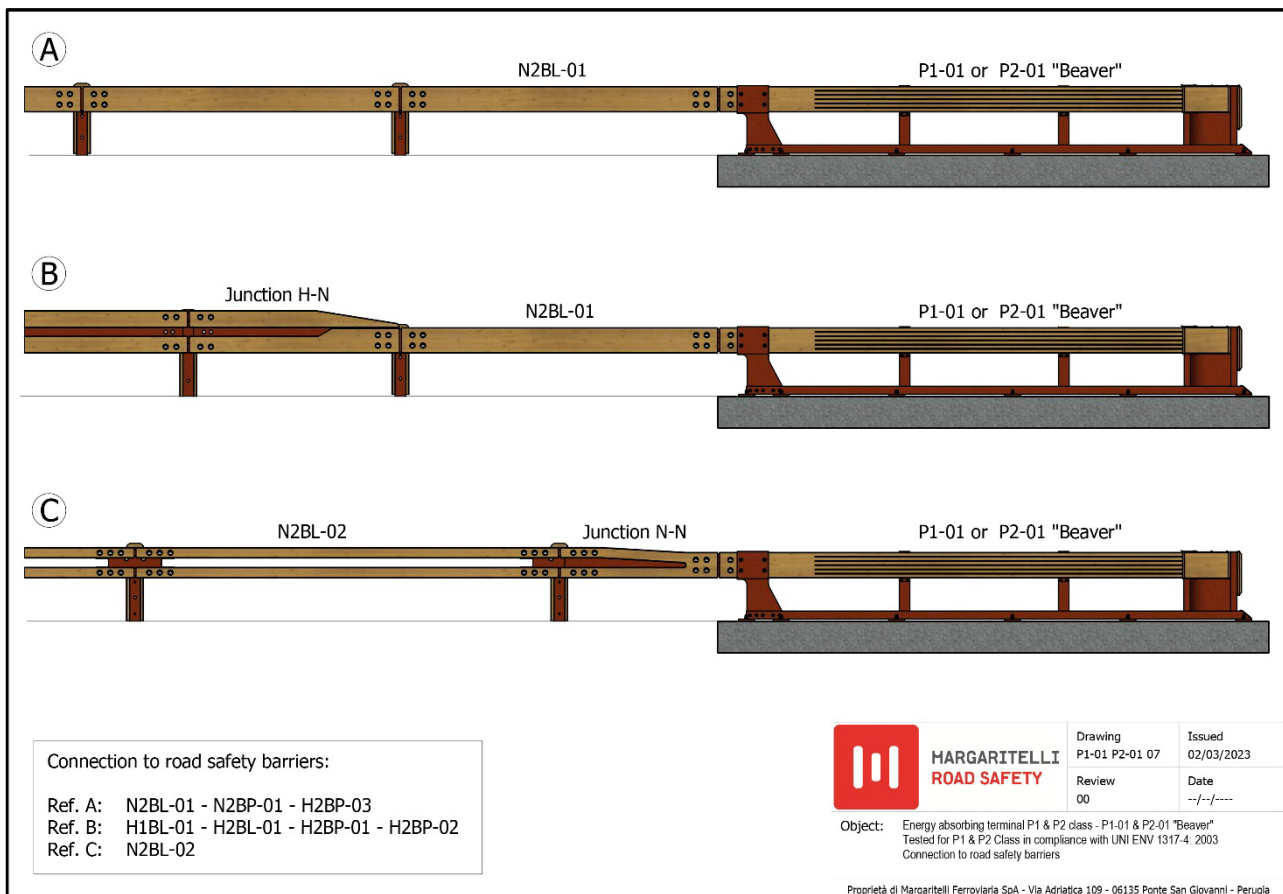


Figure 77 Connection with road side barriers

MATERIALS.

Steel.

EN 10025-S355J0WP steel, CE-certified for structural applications, offers enhanced resistance to atmospheric corrosion (commonly referred to as Corten steel). This steel contains specific alloying elements that improve its resistance to weathering by forming a protective oxide layer on the base metal when exposed to atmospheric agents.

Laminated wood.

The laminated wood used is CE-certified for structural applications in accordance with the harmonized standard EN 14080.



The beams must be manufactured in compliance with the UNI EN 386 standard for Service Class 3, with minimum mechanical properties corresponding to Class GL24C, as specified in UNI EN 1194. This ensures uniformity in the mechanical characteristics of the finished product and compliance with the prototype subjected to crash test evaluations.

The adhesive used is Type I as defined by EN 301, making it suitable for climatic conditions involving relative air humidity equivalent to full exposure to weather.

Additionally, the bonding process is carried out to ensure resistance to autoclave impregnation treatments.

WOOD PRESERVATIVE TREATMENTS.

Autoclave pressure impregnation treatment.

The pressure impregnation treatment in an autoclave, using preservative substances, ensures that the wood is protected both on the surface and deep within against the degenerative effects of atmospheric agents and biological attacks to which the barrier is exposed in outdoor environments (refer to SPD 022).

Treatment: Pressure impregnation with salts using a vacuum/pressure/vacuum cycle in an autoclave.

Preservative substance: Eco-friendly, completely odorless preservative based on copper salts, boron, and organic compounds, free of chromium and arsenic. Absorption: Not less than the R3 value, as specified by CTBA certificate. Usage conditions: Suitable for Risk Class 3 according to EN 355-1, corresponding to the intended use conditions.

Surface treatment – optional pigmentation.

To protect the wood from the degenerative effects of sunlight and atmospheric agents, a hydrophobic surface treatment is applied. This treatment enhances the wood's natural appearance while significantly slowing the typical graying process that occurs with any wood exposed to outdoor environments.

The presence of resins in the surface impregnating agent also reduces moisture exchange with the environment, thereby decreasing the tendency to crack—a common issue for wood used outdoors.

Additionally, the surface treatment can be complemented with a dark walnut finish achieved through the use of specific pigments.

Surface treatment
Transparent
Natural color
Standard production
Ready for shipping



Surface treatment
Pigmented
Deep brown color
On specific request
Delivery in 30 days



DURABILITY AND MAINTENANCE.

Due to the materials used, the construction techniques, and the treatments applied to the wooden components, the installed barrier does not require any maintenance and retains its performance characteristics over time.

However, wood, like any other material permanently exposed to the outdoor environment, tends to lose its original color, more or less quickly, over time due to the degenerative effects of UV rays. In the case of a walnut-colored finish, it may be necessary, after a few years (depending on the extent of exposure to sunlight), to restore the original aesthetic appearance of the barrier by repeating the surface treatment on-site using a manual application of staining impregnators.

CLASSIFICATION OF TREATED TIMBER AS WASTE.

The laminated wood used, subjected to the double impregnation treatment, is assigned the EWC code 170201 (Wood). Therefore, it is classified as NON-HAZARDOUS WASTE, making it easily manageable in the event of replacement during maintenance after accidents.

DECLARATION OF NON-EMISSION OF HAZARDOUS SUBSTANCES.

The use of CE-certified laminated wood, in accordance with the harmonized standard EN 14080, guarantees the non-emission of harmful or dangerous substances listed in the European Community directive 76/769/EEC.

issued by:
Technical Office
Eng. Filippo Leone

verified and approved by:
CEO

Dr. Stefano Lucarini