PRODUCT SPECIFICATION

P2-01 Beaver

EUROPEAN TEST COMPLIANCE ENV 1317-4

PEFC Promoting Sustainable Forest Management PEFC/18-31-56 www.pefc.org

ON THE ROAD

MARGARITELLI ROAD SAFETY

SPD 031-02 Rev 02

The **P2-01 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 P2 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.

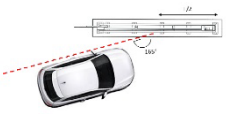
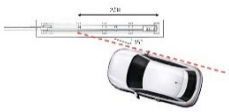
This mechanism, responsible for absorbing the longitudinal impact energy, has been refined through calculations and rigorous static and dynamic tests conducted at the LAST laboratory of Politecnico di Milano.

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 P2 performance,** according to UNI ENV 1317-4:2003, at the UNI CEI EN ISO/IEC 17025 **CSI SpA** accredited center in Bollate – Milan.

PERFORMANCE CHARACTERISTICS.
Tests carried out according to UNI ENV 1317-4:2003.

Test reports	Trial code	Point of Impact	Velocity	Mass	Vehicle Type
Requisite	TT 2.1.80		80 km/h	900 kg	Car
0186/ME/HRB/19 of 11/12/2019			80.9 km/h	865,20 kg	Fiat UNO
Requisite	TT 5.1.80		80 km/h	900 kg	Car
0222/ME/HRB/22 of 22/12/2022			80.7 km/h	880.20 kg	Fiat UNO
Requisite	TT 4.2.80		80 km/h	1300 kg	Car
0223/ME/HRB/22 of 22/12/2022			80.4 km/h	1307.60 kg	Alfa Romeo 156

Test results.

Test	Parameters	Detected value	Limit value
TT 2.1.80	ASI index	0,8	≤ 1.0
	THIV (km/h)	33	≤ 44
	Impact severity class	A	
	VCDI Index	FS 0000000	
	Exit Box Class	Z2	
TT 5.1.80	ASI index	0,8	≤ 1.0
	THIV (km/h)	23	≤ 33
	Impact severity class	A	
	VCDI Index	LF 0000000	
	Exit Box Class	Z1	
TT 4.2.80	ASI index	0,7	≤ 1.0
	THIV (km/h)	24	≤ 33
	Impact severity class	A	
	VCDI Index	RF 0000000	
	Exit Box Class	Z1	

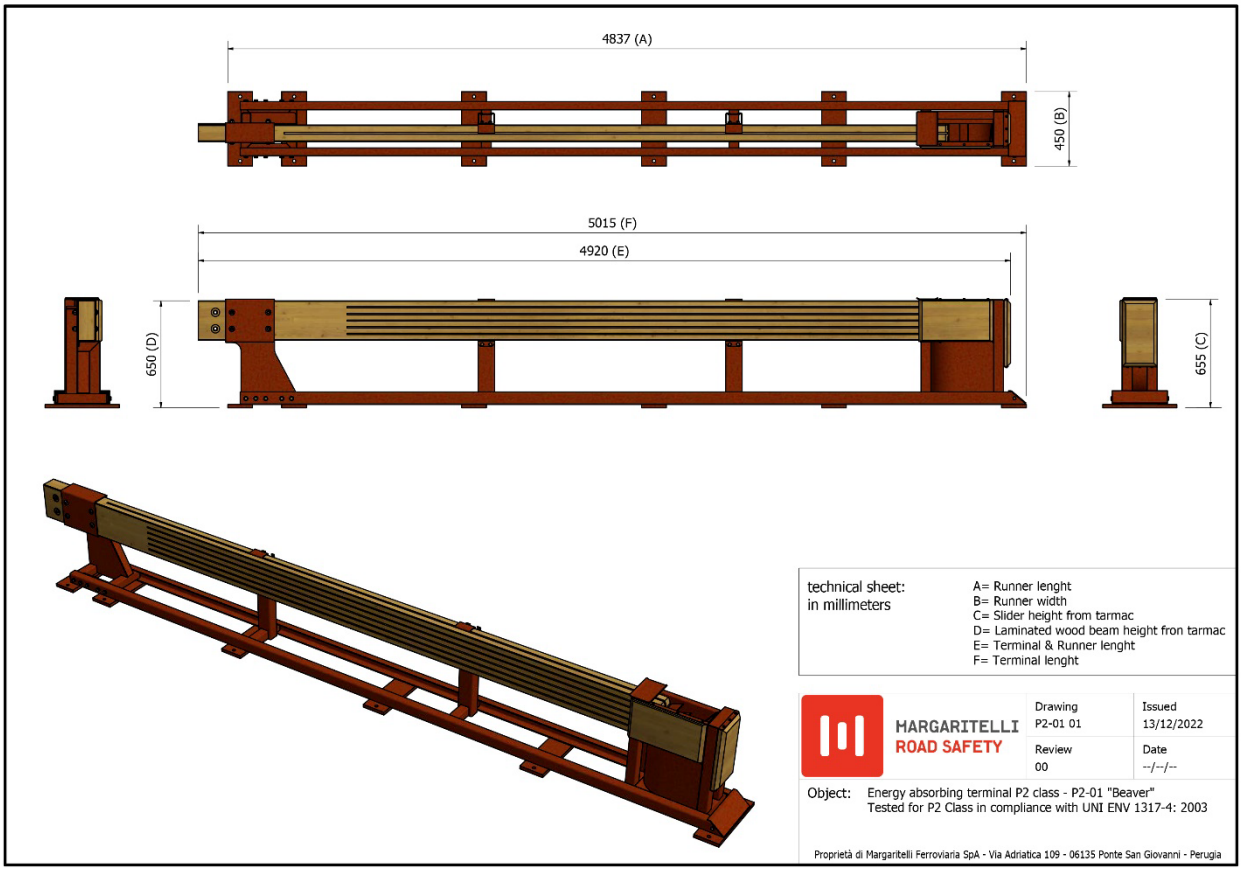


Figure 5 P2-01 Beaver

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

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.

As shown in Figure 7, the terminal connects to the barriers in three different configurations:
Pos. A: The terminal connects directly to a protective rail of the N2BL-01 barrier. With this configuration, starting from the first rail, the N2BP-01 and H2BP-03 barriers can also be connected.
Pos. B: The terminal connects directly to a protective rail of the N2BL-01 barrier, following an H-N transition element. With this configuration, starting from the H-N transition, the H1BL-01, H2BL-01, H2BP-01, and H2BP-02 barriers can be connected.
Pos. C: The terminal connects directly to an N-N transition element. With this configuration, starting from the N-N transition, the N2BL-02 barriers can be connected.

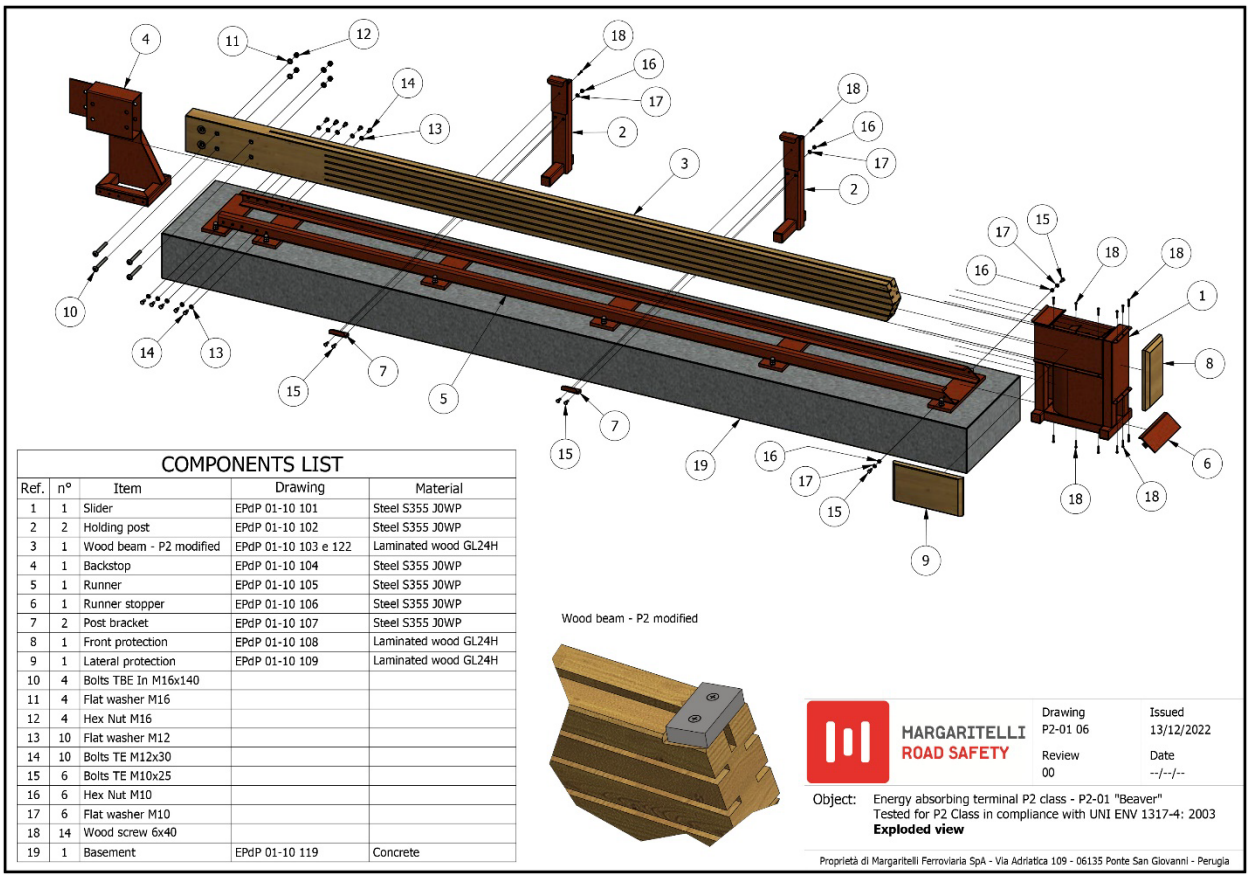


Figure 6 P2-01 Beaver - Exploded view

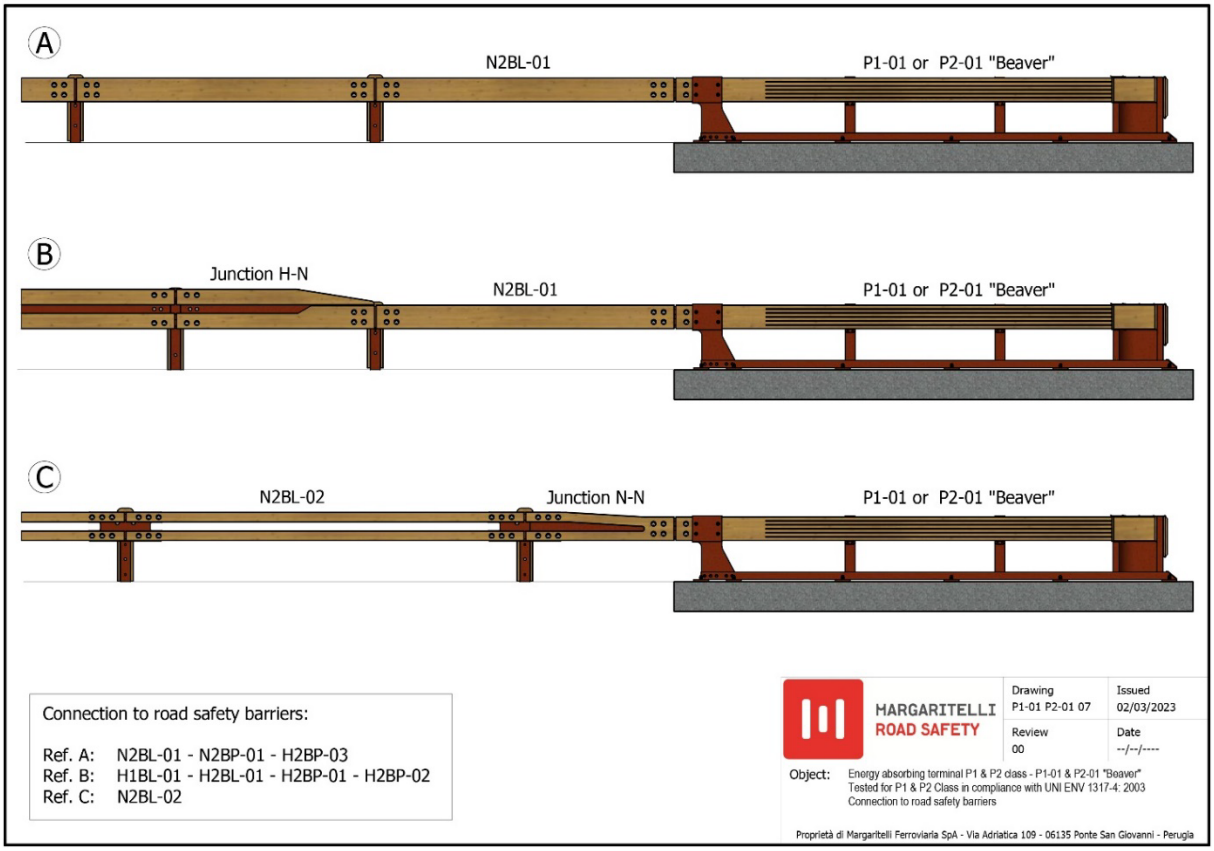


Figure 7 Connection with road side barriers

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.

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.

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