ENGLISH VERSION

U-bahn beton

www.daliform.com

Permanent formwork for lightened single direction structures in reinforced concrete cast on site

daliform GROUP

Building Innovation © Creatori dell'Iglù®

MADE IN ITALY

KEY:

Formwork

Utility passage

Foundations

Certifications

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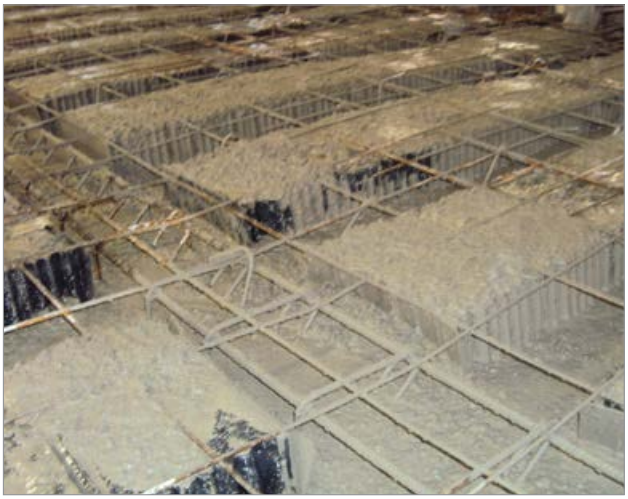
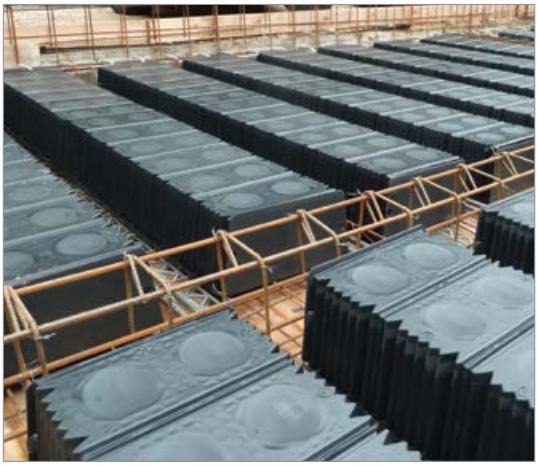


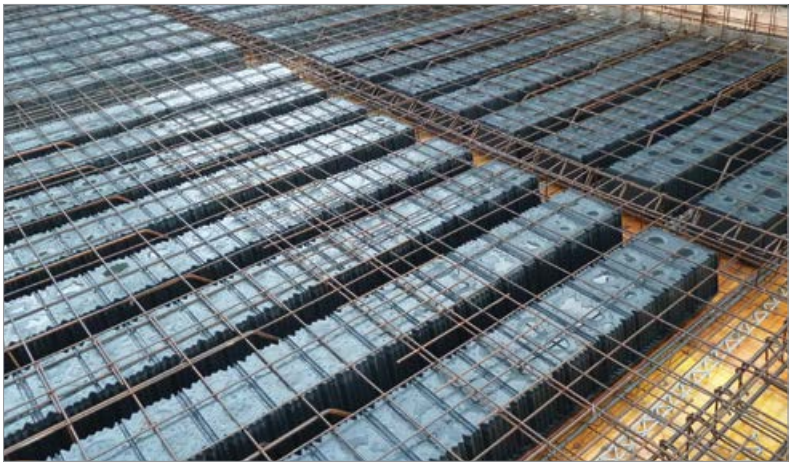
U-Bahn® Beton

U-Bahn® Beton is a modular framework in recycled polypropylene that was specifically designed to create **one way slabs that are cast on site** or semi-prefabricated. The various modules, which overlap on the edges, make it possible to create beams of any length.
Thanks to its conic elevator feet, immersing the U-Bahn® Beton formworks in the concrete casting will obtain thick, parallel beams that are closed from the bottom and top by a flat plate made in sequence with a single casting; this results in reduced use of concrete and steel as well as considerable advantages in terms of fire risk in comparison to formworks in expanded polystyrene.
Light and stackable, it is easy to handle during positioning, functional in its use, can be exposed to bad weather and is easy to store in the yard with minimum dimensions.

Designed according to strict quality criteria, the U-Bahn® Beton framework is **guaranteed to resist without concrete 150 kg** concentrated on a load imprint of 8 x 8 cm, as foreseen by current regulations.
Unlike with the use of classical hollow brick blocks, **the empty space left by U-Bahn® Beton can be used for the passage of cables and systems.**

Advantages





- Reduction in time and cost related to positioning the formworks.
- High precision and regularity of the width of the concrete slab ribbing.
- Flexible, practical and simple creation of lengths below the standard size.
- Greater yard cleanliness and improved disposal of the waste in comparison to traditional formworks (hollow blocks and EPS).
- Better work performance guarantee in comparison to expanded polystyrene that, due to its crumbling into granules, tends to attach itself statically to everything, and is difficult to remove, compromising the correct filling of the concrete for the beams and the nodes.
- Possibility to trim the soffit with immediate economic advantages, avoiding expensive plastering.
- Possibility to perform a single concrete casting for the creation of lightened slabs with the slab also in the soffit. In comparison to traditional formworks (hollow blocks and EPS), the layer making up the soffit must first be cast, then the formworks and the reinforcements are positioned, and then concrete is again cast.
- Quicker execution of prefabricated slabs without the need to prepare specific safety vents in the case of a fire.
- Providing the slab with greater fire resistance.
- Considerable reduction in the yard of overall volumes as well as the overhead handling of traditional formworks (hollow blocks and EPS) thanks to its characteristics of stackability, modularity, lightness and manoeuvrability.
- Better seismic behaviour; the presence of a dual reinforced concrete layer, which makes it possible to more solidly connect the vertical structures of a building in comparison to a traditional slab.
- Advantage of using the cavities created using **U-Bahn® Beton,** which run along the entire slab, as an equipment room for various types of systems.

Applications

Application example:
Underground parking building with the 'top-down' technique.

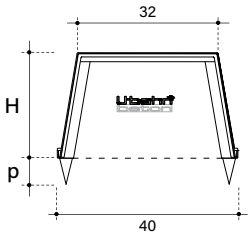
U-Bahn® Beton is the ideal solution for creating lightened one way slabs for all types of structures:
residential, commercial, executive, industrial buildings as well as public structures (schools, hospitals, etc).

U-Bahn® Beton is fundamentally used in all applications that require one way beams and slabs as well as a reduced use of concrete and reduced weight. With **U-Bahn® Beton** slabs with a greater thickness can be created with less concrete.

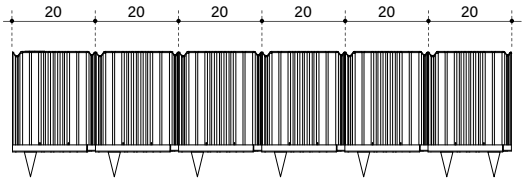
A particular type of use of **U-Bahn® Beton** is for underground constructions made with the so-called **"top down"** technique, where instead of working from bottom to top (as for normal open-air constructions), they proceed building the load-bearing floors from the top to the bottom (precisely top down), alternating the construction of the floor with the excavation of the lower level.
Underground parking buildings in historical city centres are often created using this technique due to the obvious constraints related to the presence of numerous buildings near the excavation, as well as the need to quickly restore traffic flows. For projects that use this technique, it is of strategic importance to supply the yard with light-weight and non-bulky material.

Technical data

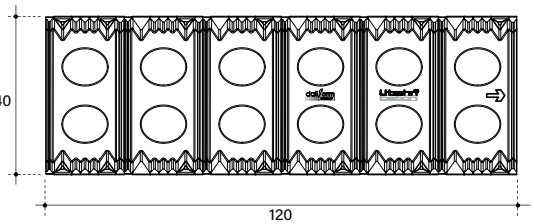
Front view



Side view



View from above

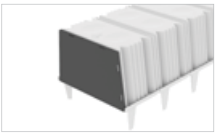





	H cm ▸	13	16	20	24
Useful size*	cm	120 x 40	120 x 40	120 x 40	120 x 40
Height **H**	cm	13	16	20	24
Feet height **p**	cm	0 - 4 - 5 - 6 - 7	0 - 4 - 5 - 6 - 7	0 - 4 - 5 - 6 - 7	0 - 4 - 5 - 6 - 7
Weight per piece	kg	2,526	2,552	2,823	3,154
Piece volume	m^3	0,055	0,068	0,086	0,102
Pallet dimensions 	a x b x h	120 x 120 x 251	120 x 120 x 257	120 x 120 x 258	120 x 120 x 260
	Weight kg	772	780	861	960
	Pieces	300	300	300	300

* In consideration of the recycled material, it is permitted a size variation of ±1,5%.
The product is not affected if weathered.

Accessories



FRONTAL CLOSING TYMPANUM
"Stop-flow" panel, necessary to close the "tunnel" created by the **U-Bahn® Beton** elements.

LOWER CLOSING PANEL
Lower closing plate of the **U-Bahn® Beton** formwork.

Certifications and product test

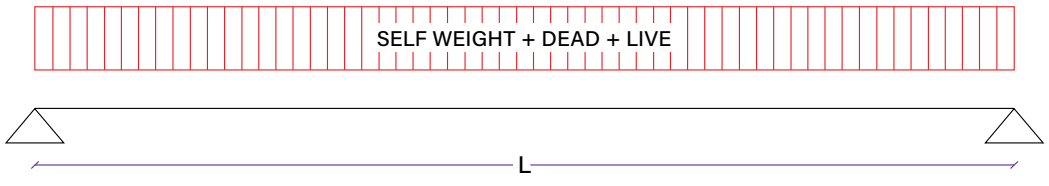
- Loading and breaking test certified by the University of Padua.
- Environmental Compatibility Certification (CCA).

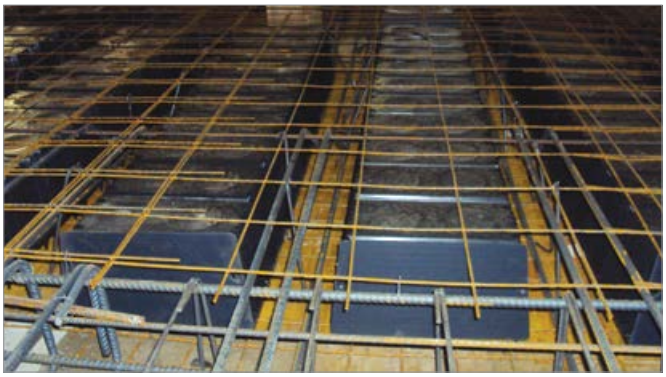
Example of pre-dimensioning of slab with U-Bahn® Beton with one span

The table expresses the value of elastic deformation (in cm) for a given height of slab, according to span and loads; the maximum value of the deformation has been limited to L/1000.

Slab thickness (H cm)	Formwork (H cm)	Lower slab thickness (cm)	Upper slab thickness (cm)	Load (D+L) (kN/m²)	Span (m)	Elastic deformation (cm)
21	13	4	4	4	4	0,11
				6	4	0,15
				8	4	0,18
				10	4	0,21
				4	5	0,28
23	13	5	5	6	5	0,27
				8	5	0,33
				10	5	0,39
				4	6	0,45
				6	6	0,57
25	13	6	6	8	6	0,54
				4	7	0,67
28	16	6	6	10	6	0,48
				6	7	0,63
30	16	7	7	8	7	0,63
				4	8	0,73
32	20	6	6	10	7	0,64
34	20	7	7	6	8	0,66
				4	9	0,86
36	24	6	6	8	8	0,70
38	24	7	7	10	8	0,69
				6	9	0,81
40	24	7	9	8	9	0,83
42	24	7	11	10	9	0,85

STATIC METHOD



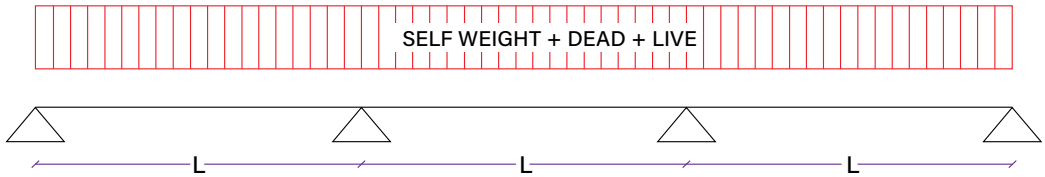


Example of pre-dimensioning of slab with U-Bahn® Beton with three spans

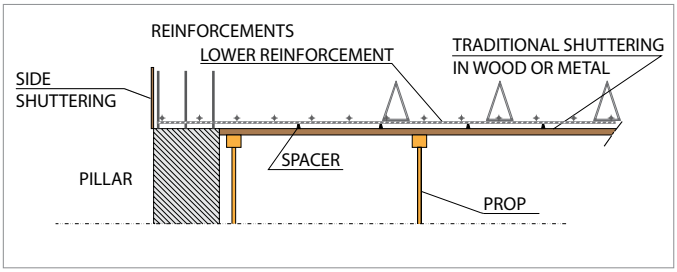
The table expresses the value of elastic deformation (in cm) for a given height of slab, according to span and loads; the maximum value of the deformation has been limited to L/1000.

Slab thickness (H cm)	Formwork (H cm)	Lower slab thickness (cm)	Upper slab thickness (cm)	Load (D+L) (kN/m²)	Span (m)	Elastic deformation (cm)
21	13	4	4	4	4	0,06
				6	4	0,077
				8	4	0,09
				10	4	0,11
21	13	4	4	4	5	0,15
				6	5	0,19
				8	5	0,23
				10	5	0,27
23	13	5	5	4	5	0,24
				6	5	0,3
				8	5	0,36
				10	5	0,43
				4	6	0,44
				6	6	0,55
25	13	6	6	8	8	0,53
				10	8	0,61
				4	4	0,60
28	16	6	6	6	8	0,56
				8	8	0,68
				4	9	0,73
30	16	7	7	10	8	0,65
				6	9	0,75
32	20	6	6	8	9	0,78
34	20	7	7	10	9	0,76

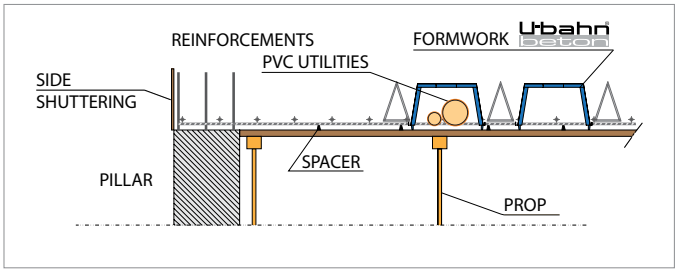
STATIC METHOD



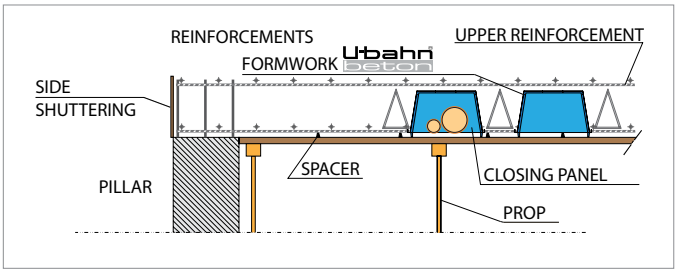
Positioning



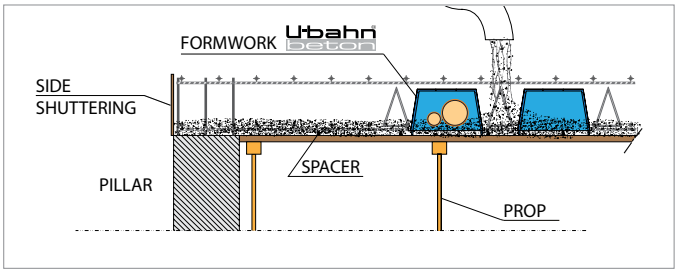
1 The entire surface of the slab to be cast on site is shuttered with wood deck (or similar systems), then the welded reinforcement irons and mesh are positioned according to the design and the spacing lattice for the upper reinforcement is arranged.



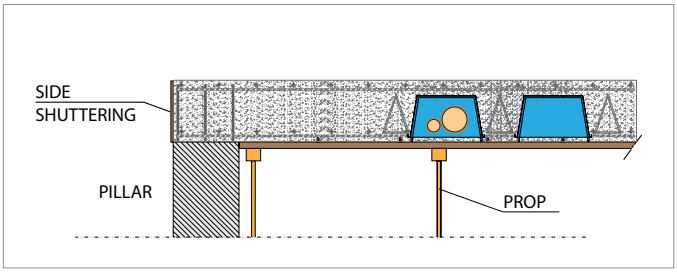
2 The U-Bahn® Beton formworks are positioned with the desired centre distance that will determine the width of the beams. Thanks to the conic elevator foot, the U-Bahn® Beton formworks will be lifted from the surface, making it possible for the lower slab to be formed.
The systems will be arranged in the internal cavities of the formworks.



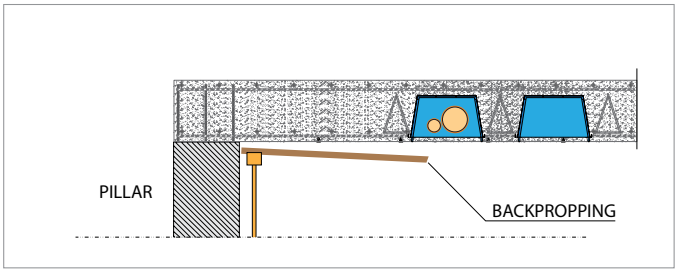
3 The positioning is completed by closing the open final ends of the U-Bahn® Beton formwork with a lateral closing plug above which the reinforcements, welded mesh as well as the instruments for cutting and punching are positioned according to the design.



4 The concrete casting must be performed in two phases to prevent the floatation of the formworks: an initial layer will be cast to form a thickness equal to the height of the elevator foot. Casting will continue for this first portion of the slab until the concrete starts to set and become less fluid.



5 Once suitably set, the casting can be restarted from the starting point, completely burying the U-Bahn® Beton. The casting is then levelled and smoothed in a traditional manner.



6 Once the structure has hardened, the formwork can be removed. The surface is smooth in correspondence of the soffit.

Photographic details of the complete positioning, reinforcing and casting sequence.

U-Bahn® Beton or lightening in polystyrene?

Even if polystyrene is widely used in the construction industry due to its low cost and workability, it has many disadvantages that are being addressed by the technical-scientific community.

With reference to lightened slabs, the Italian Ministerial Decree of 16.02.2007 to enclosure D.5.1 establishes that: *"In the case of polystyrene formworks, or formworks in similar materials, there must be appropriate vents for the overpressures"*. Even prior to this, the UNI 9502 standard - article 7.2.2 - established that: *"In the case of elements incorporating materials that when subject to high temperatures turn to gas, there must be appropriate vents facing the side exposed to fire to ensure that the bearing capacity is not compromised by explosions"*.

Therefore, using polystyrene slabs cast on site requires the extra expense of fitting vents in the cavity to counteract the excessive pressure of gas that is sublimated by the formwork. However, in the event of a fire there would still be the problem of toxic gas escaping into the environment (styrene).

As U-Bahn® Beton is made of polypropylene, it is not toxic even if burnt. Moreover, the slab will not explode due to the escaping of over pressurised gas from the feet (4 every 20 cm of the formwork) that act as safety valves.

Other advantages of U-Bahn® Beton compared to EPS are the dimensions, handling (just think of transferring it overhead on the slabs being built) and outdoor storage. Polystyrene is, in fact, bulky and cannot be stacked; it is particularly fragile on its edges and corners that crumble leaving those annoying balls that, statically charged, stick to everything (especially to the reinforcements) and are very hard to get rid of.

Environmental compatibility

Daliform Group has again demonstrated to be extremely precise with regard to respecting health and the environment having been the first to obtain Environmental Compatibility Certification (CCA) for its products.
This certificate is very important for U-Bahn® Beton because it demonstrates: the lack of dangerous substances in its composition (even if recycled materials are used); the lack of emissivity of toxic substances during the various phases of the product's life and operating cycle, which benefits the health of the intermediate users (production and installation personnel) as well as final users (people living in the building) as well as the environment in general.

Daliform Group technical office

FEASIBILITY STUDY
Predimensioning and optimisation of the structures, alternative and/or revised proposals, material and manpower estimates, cost analysis.
Evaluation of forced ventilation in the case of cold rooms.

CALCULATION REPORT
Reports certifying the execution of Daliform Group constructive systems.

SUPPORT FOR THE EXECUTIVE DESIGN
Support by design professionals. Upon request, the formwork positioning plan can be supplied with a list of the products required to carry out the work and the relative accessories.

ON-SITE SUPPORT
If necessary, our technical staff can be present on-site to help the construction company during the operational phase.

The technical consultancy is only valid for the Daliform Group construction systems.
To contact the technical office: Tel. +39 0422 2083 - tecnico@daliform.com
To obtain updated technical cards, support material, new photos and case studies, go to www.daliform.com

The information contained in this catalogue could be changed. Please request updated informations from DALIFORM GROUP, which reserves the right to make changes at any moment without notice. In consideration of recycled material, it is specified that there are tolerance margins caused by environmental factors.

Creation of a one way slab in reinforced concrete to be cast on site on suitable horizontal formwork (or on a prefabricated plate). The total thickness of the slab is _____ cm, to be partially lightened (according to the design) with recycled plastic modules, such as "U-Bahn® Beton" from the Daliform Group, with an extended form of 120 cm with an isosceles trapezoid section with a max base of 40 cm height _____ cm, with a length that can be divided in sub-multiples of 20 cm and joinable in line together to overlap the final edge; supplied with 14 truncated-pyramidal feet that are _____ cm in height, resting on the horizontal support for the formation of the thickness of the soffit suitably reinforced with welded mesh, _____ x _____ cm, with a Ø _____ mm steel rod.
This includes the supply and positioning of the "U-Bahn® Beton" modules to be placed in parallel, suitably distanced rows to form continuous joists between beams that are closed on their respective final tunnels with closing panels; a welded mesh _____ x _____ cm - Ø _____ mm is placed above the formworks. The upper and lower reinforcements will be connected, in the joists, with vertical C-shaped steel hooks min Ø 8 mm placed at a centre distance of 30 cm along the joist axis.
Also included is the supply and casting of the concrete needed to create the slab (in the full and lightened zone), filling and vibrating first the part under the formworks until completely covering the feet of the "U-Bahn® Beton" (no further) (minimum resistance class C25/30, fluidity class S5 and diameter of aggregates suitable, in order to avoid phenomenon like "segregation"), the casting will then continue until the slab is completed as soon as the first layer starts to set (in this second phase, a fluidity class different than the previous one is permitted) until the slab is completed with the formation of a min 4 cm layer. The horizontal support formwork, welded mesh, reinforcement bars, beam cages and vertical C-shaped connectors will be entered somewhere else.
The "U-Bahn® Beton" modules, must be produced in "ALAPLEN® CV30", must be safe to walk on and certified with a resistance characteristic of 150 kg in the weakest point on an 8 x 8 cm support; they must not release any polluting substances and must have an Environmental Conformity Certificate and be produced by a company using an Integrated Management system (ISO 9001, ISO 14001, ISO 45001, SA 8000). The executive design of the lightened slabs must have graphs and calculations provided by the company supplying the "U-Bahn® Beton" modules that must exhibit technical sheet and safety sheet for the product and for "ALAPLEN® CV30" grain texture and that must also exhibit the product certificate approved by a EOTA member (European Organisation for Technical Approvals).
The cost for the creation of holes with the dimensions and sections foreseen by the architectural drawings is also included, the price also includes and covers all costs for providing the finished work in a workmanlike manner; it does not include the supply and positioning of the horizontal formwork that supports the slab and the accessories, the lattice and the metal reinforcement, which will be entered separately.

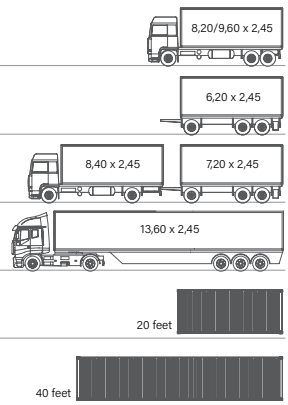
Cost Euro/m² _____

Supply and installation cost grid

No.	Item	U.M.	Quantity	Unit price	Total
1	Supply and casting of concrete fluidity class S5 - thickness ____	m³/m²			
2	Supply of the U-BAHN BETON® formwork	m³/m²	1		
3	Dry positioning of the U-BAHN BETON® formwork	h/m²			
4	Supply and pose of bending reinforcement and shear/punching	kg/m²			
5	Supply and casting of concrete fluidity class S ____	m³/m²			
				Total cost a/m²	

Logistics - pallet capacity

MEANS OF TRANSPORT	NO. OF PALLETS
Tractor (8.20x2.45)	12/14
Trailer (6.20x2.45)	10
Tractor+ Trailer type "BIG" (8.40+7.20x2.45)	12 + 12
Semi-trailer (13.60x2.45)	22
20 feet container	11*
40 feet container	18*



* the m² per pallet can vary based on the type of container.

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DG_UBA - Rev. 14_08/24

Made in Italy

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Certified Manaagement System UNI EN ISO 9001, UNI EN ISO 14001, UNI EN ISO 45001, SA 8000

Member of GBC Italy

Rating di legalità: ★★+

PRODOTTO CONFORME
ai criteri di
COMPATIBILITÀ AMBIENTALE
Attestato rilasciato dal Dipartimento ABC – Politecnico di Milano