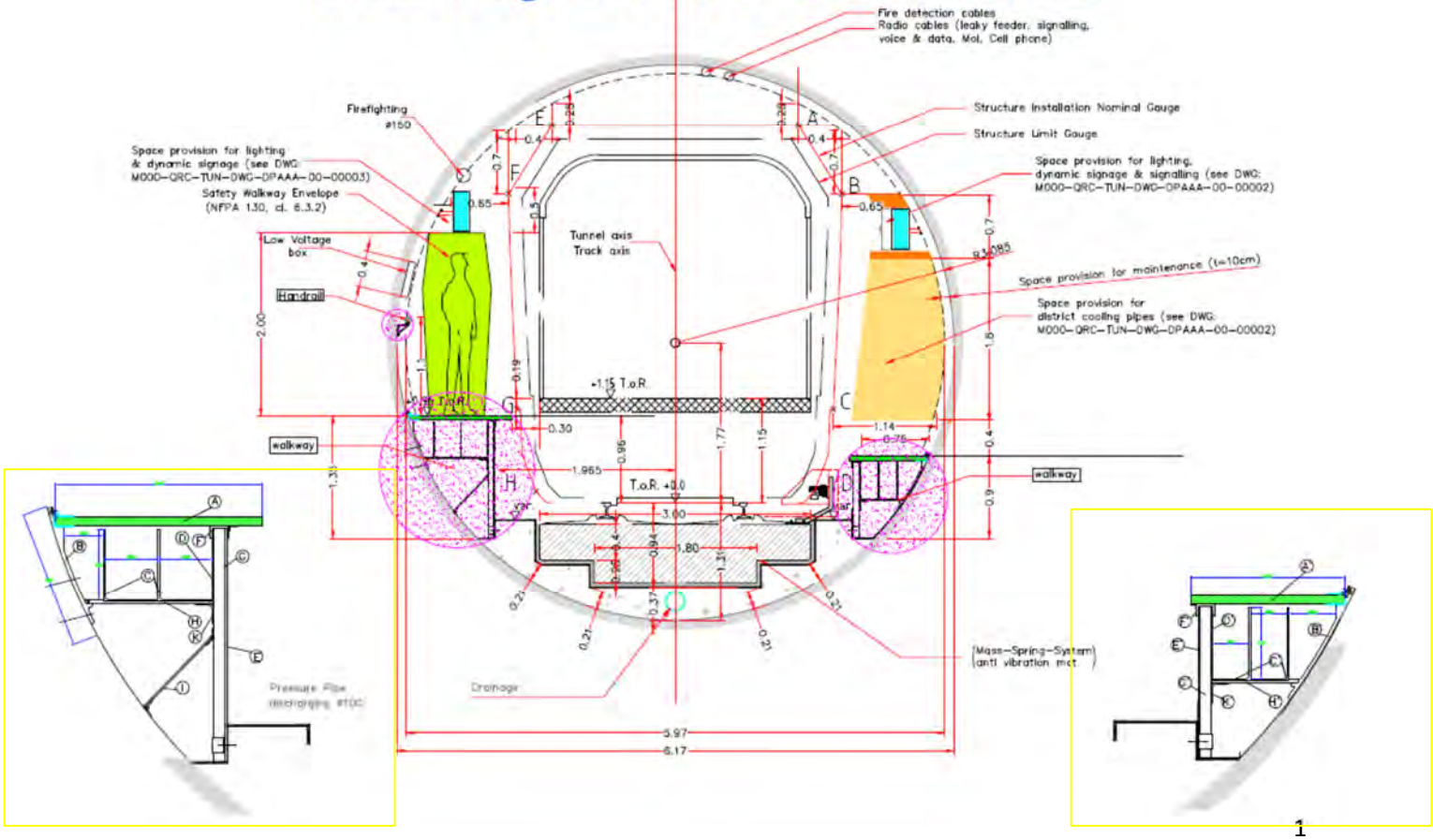
construction composites

GFRP WALKWAYS and HANDRAIL

for

Railway and Metro Tunnel



ATP srl - via Casa Pagano, 31 - 84012 Angri (SA) - tel +39 081 94 77 77 (pbx) - fax +39 081 94 77 40

www.atp.sa.it

GFRP WALKWAYS and HANDRAIL

Railway and Metro Tunnel

Lightweight

. Easy, Fast and Low Cost installation

Best Corrosion Resistance

. Low maintenance cost and durability

Completely dielectric system

. Safety

Radio transparency

. Safe and clear radio communication

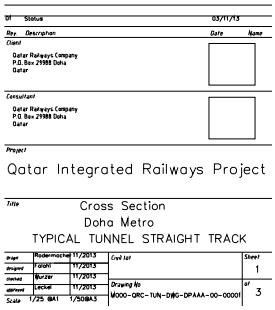
ATP srl - via Casa Pagano, 31 - 84012 Angri (SA) - tel +39 081 94 77 77 (pbx) - fax +39 081 94 77 40

www.atp.sa.it

GFRP (Glass Fibers Reinforced Plastics) PULTRUDED WALKWAYS

Proposal for Qatar integrated Railways Project

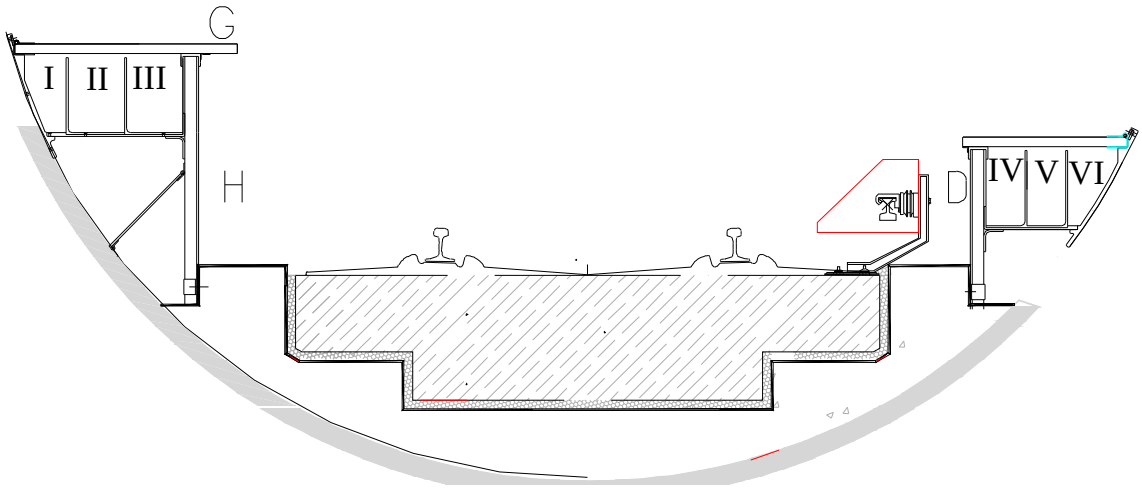
The GFRP walkways (see PDF: ATP-E-DTE-2210-A) are designed based on geometric properties reported in DWG: M00-QRC-TUN-DWG-DPAAA-00-00001 drawing.


Qatar Integrated Railways Project

Cross Section
Doha Metro
TYPICAL TUNNEL STRAIGHT TRACK

(i.e., coordinates respect to the track centerline and top of rail of points: G and H for safety walkway and D for walkway of district cooling pipes) and preserving the idea to maintain accessibility to the wiring spaces under them.

The global aspect of final object is like in figure:



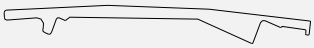
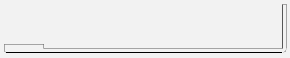
In detail, there are three wiring spaces (I=73082mm^2, II=118782 mm^2 and III= 118133 mm^2) under the safety walkway for signaling, telecom, fiber optic and low voltage power supply, and three wiring spaces (IV=81275mm^2, V=81883 mm^2 and VI=75575 mm^2)under the walkway of district cooling pipes for MV-TPS and MV-SPS cables.

ATP srl - via Casa Pagano, 31 - 84012 Angri (SA) - tel +39 081 94 77 77 (pbx) - fax +39 081 94 77 40

www.atp.sa.it

SAFETY WALKWAY

The walkway is made by implementing modules of 2 meters in length (see PDF: ATP-E-DTE-2210-B). It is realized by assembling GFRP profiles. In the following table are reported the area, the weight, the quantity (for each GFRP profile) and the total weight (for each GFRP profile) necessary in realizing modules of 2 meters in length:

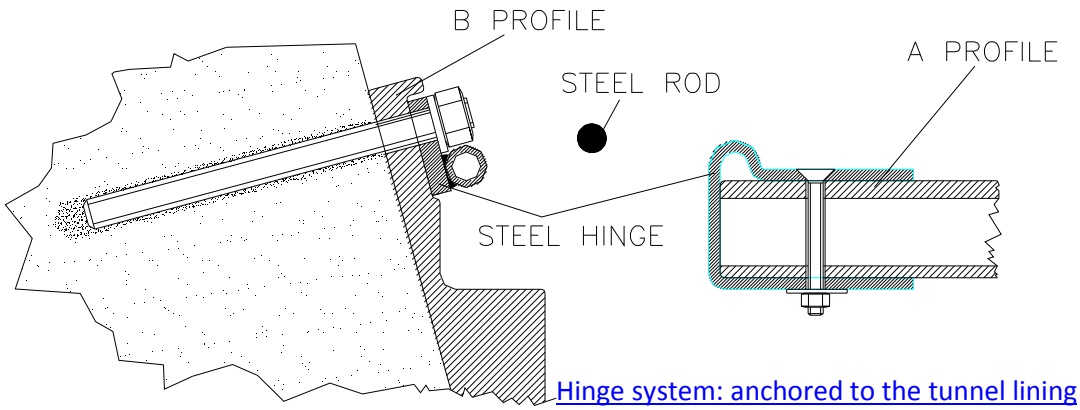
Profile		Weight (kg/ml)	Quantity (m/each profile)	Total weight (kg/each profile)
	A	11.9	4.57	54.4
	B	34.3	2.00	68.6
	C	13.3	4.00	53.2
	D	5.4	2.00	10.8
	E	9.9	2.00	19.8
	F	4.7	2.00	9.4
	G	6.5	2.57	16.7
	H	17.4	2.00	34.8
	I	10.0	0.53	5.3
	K	3.7	2.00	7.4

The total weight for each modulus of 2 meters length (considering also assembling accessories) is about 300 kg, corresponding to 150 kg / meter.

ATP srl - via Casa Pagano, 31 - 84012 Angri (SA) - tel +39 081 94 77 77 (pbx) - fax +39 081 94 77 40

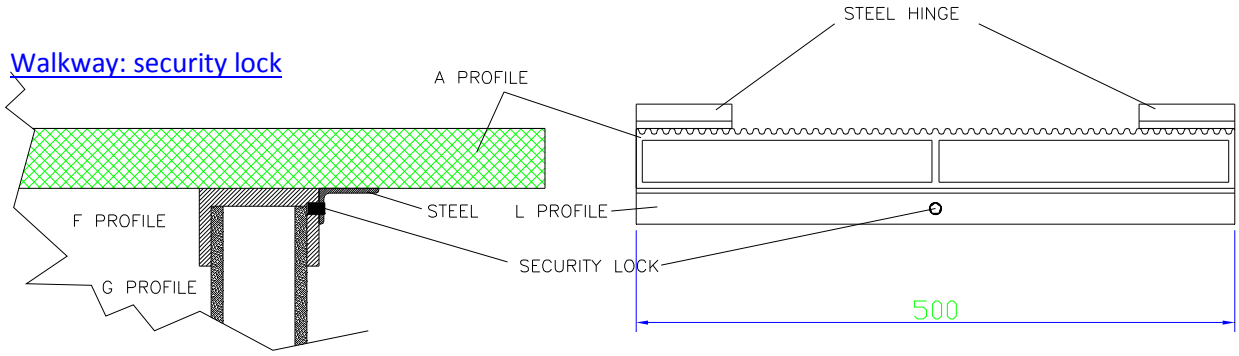
www.atp.sa.it

In order to guarantee the accessibility to the wiring spaces, the walkway (made by modules of profile “A” 500 mm length) can be tipped up thanks to a steel hinge made of two parts: one prefixed to profile “B” and anchored to the tunnel lining and the other one to a reclining “A” profile.



Hinge system: anchored to the tunnel lining

Furthermore, in order to avoid the unintentional reclining of GFRP “A” profile (e.g. during metro traffic), it is possible to lock it by means of security lock as in figure.



Walkway: security lock

ATP srl - via Casa Pagano, 31 - 84012 Angri (SA) - tel +39 081 94 77 77 (pbx) - fax +39 081 94 77 40

www.atp.sa.it

WALKWAY OF DISTRICT COOLING PIPES

In similar way to safety walkway and with some differences in geometric dimensions, the walkway of district cooling pipes is realized by assembling GFRP profiles (see PDF: ATP-E-DTE-2210-B)

In the following table are reported the area, the weight, the quantity (for each GFRP profile) and the total weight (for each GFRP profile) necessary in realizing modules of 2 meters in length:

Profile		Weight (kg/ml)	Quantity (m/each profile)	Total weight (kg/each profile)
	A'	11.9	3.37	40.1
	B'	38.7	2.00	77.4
	C'	13.3	4.00	53.2
	D'	5.4	2.00	10.8
	E'	9.8	2.00	19.6
	F'	4.7	2.00	9.4
	G'	6.5	1.60	10.4
	H'	12.1	2.00	24.2
	K'	3.7	2.00	7.4

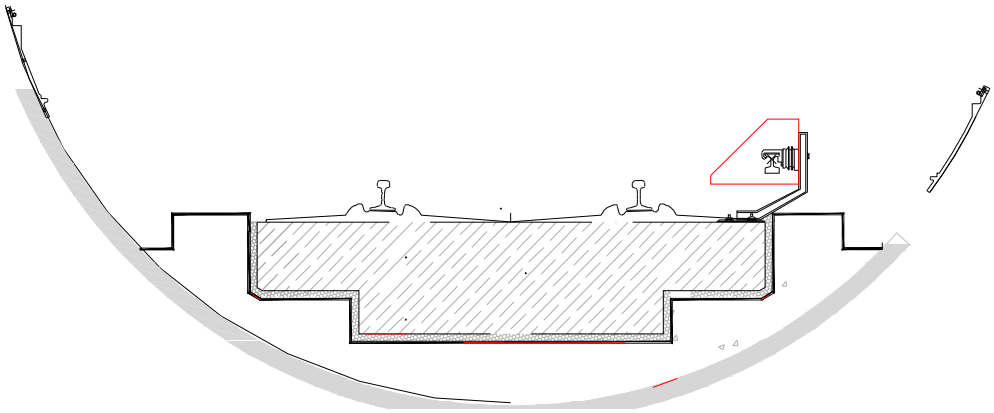
The total weight for each modulus of 2 meters length (considering also assembling accessories) is about 280 kg., corresponding to 140 kg / meter.

ATP srl - via Casa Pagano, 31 - 84012 Angri (SA) - tel +39 081 94 77 77 (pbx) - fax +39 081 94 77 40

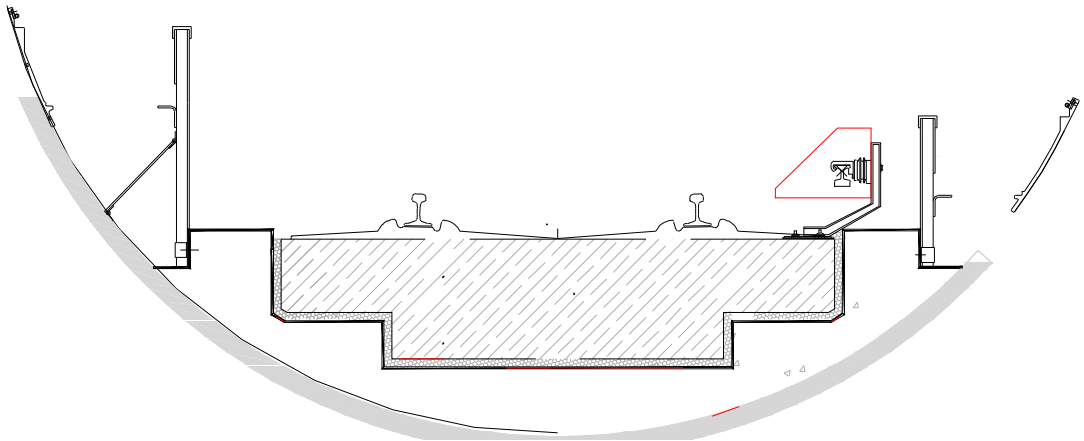
www.atp.sa.it

Steps for assembling the GFRP walkways

1. Fixing the GFRP profiles type B and B’ profiles in the soil:



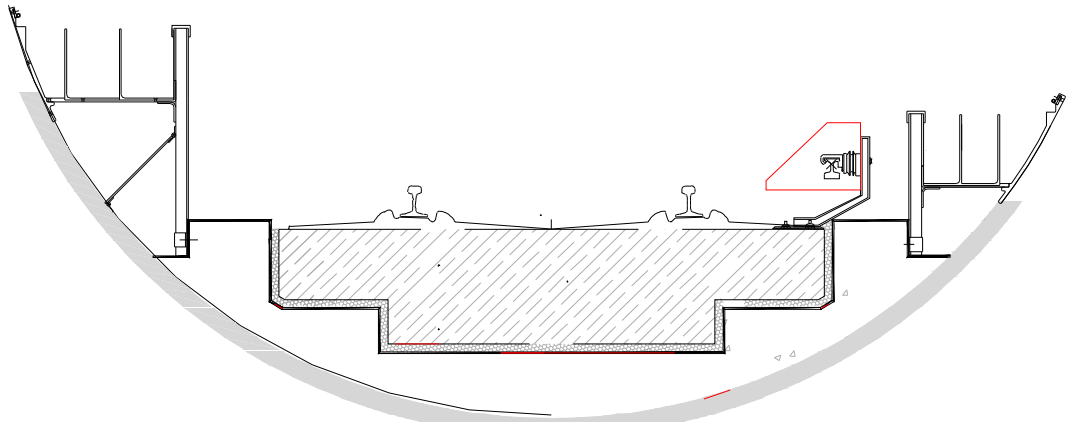
2. Fixing GFRP profiles type G and G’ in the soil (after pre-assembling type D,E,F,G,K and I profiles):



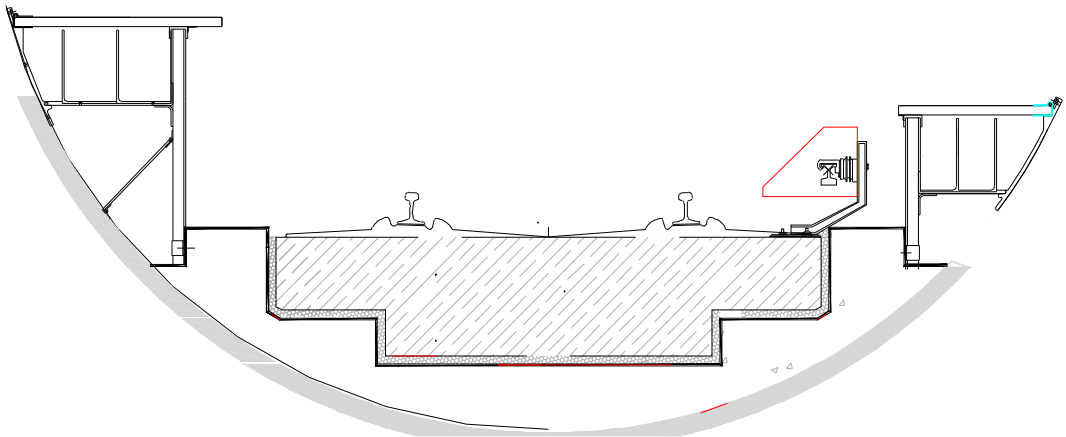
ATP srl - via Casa Pagano, 31 - 84012 Angri (SA) - tel +39 081 94 77 77 (pbx) - fax +39 081 94 77 40

www.atp.sa.it

3. Positioning the wiring site (after pre-assembling type C and H profiles):



4. Positioning the walkable GFRP type A and A' profiles:



ATP srl - via Casa Pagano, 31 - 84012 Angri (SA) - tel +39 081 94 77 77 (pbx) - fax +39 081 94 77 40

www.atp.sa.it

Characteristics of material used for the construction of walkway and cable tray

(Approved in tunnel applications in Europe)

Physical characteristics	**Test method**	unit	**value**
Density	ASTM D792	g/cm³	≥ 1.9
Hygroscopic absorption	ISO 62	%	≤ 0.2
Dielectric strength	ASTM D149	kV/mm	≥ 10
Surface resistivity	ASTM D257	Ω	≥ 10^{12}
Volume resistivity	ASTM D257	Ω	≥ 10^{12}
Fire resistant - art. 10 DM 26.06.84	UNI 8457 e UNI 9174	Category	1
Deflection temperature under flexural load	ASTM D648	°C	≥ 200

Mechanical characteristics	**Test method**	unit	**value**
Flexural strength	ASTM D790	MPa	≥ 400
Elastic modulus	ASTM D790	GPa	≥ 28
Shear strength by punch tool	ASTM D 732	MPa	≥ 85
Inter laminar shear strength	ASTM D4475	MPa	≥ 35
Charpy impact strength	ASTM 5942	kJ/m²	≥ 200
Hardness Barcol	ASTM D2583	°B	≥ 55

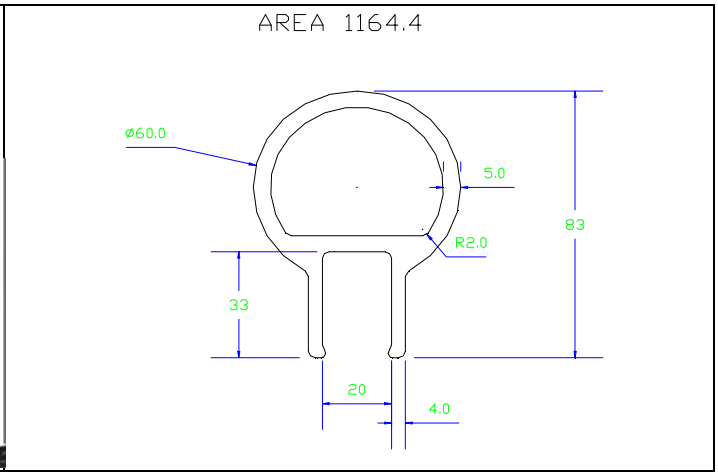
ATP srl - via Casa Pagano, 31 - 84012 Angri (SA) - tel +39 081 94 77 77 (pbx) - fax +39 081 94 77 40

www.atp.sa.it

Product - technical data sheet	N° P5112TD4
HANDRAIL for TUNNEL	REV febbraio 2014

Description

GFRP (Glass Fiber Reinforced Profile) specifically designed for handrail application in tunnel



Characteristics	Test method	unit	Value
Specific weight	ASTM D792	g/cm³	≥ 1.9
hygroscopic absorption	ISO 62	%	≤ 0.2
hardness Barcol	ASTM D2583	°B	≥ 55
Flexural strength	ASTM D790	MPa	≥ 400
Elastic modulus	-	GPa	≥ 28
Charpy impact strength	ASTM 5942	kJ/m²	≥ 200
dielectric strength	ASTM D149	kV/mm	≥ 10
surface resistivity	ASTM D257	Ω	≥ 10^{12}
volume resistivity	ASTM D257	Ω	≥ 10^{12}
Shear strength for shearing	ASTM D 732	MPa	≥ 85
Inter laminar shear strength (short beam test)	ASTM D4475	MPa	≥ 35
Temperature of deflection under load	ASTM D648	°C	≥ 200
Reaction to Fire - art. 10 DM 26.06.84	UNI 8457 e UNI 9174	Category	1

ATP srl - via Casa Pagano, 31 - 84012 Angri (SA) - tel 081 94 77 77 (pbx) - fax 081 94 77 40

- www.atp-frp.it -

COMPANY WITH QUALITY SYSTEM CERTIFIED BY DNV = ISO 9001 =

Product - technical data sheet

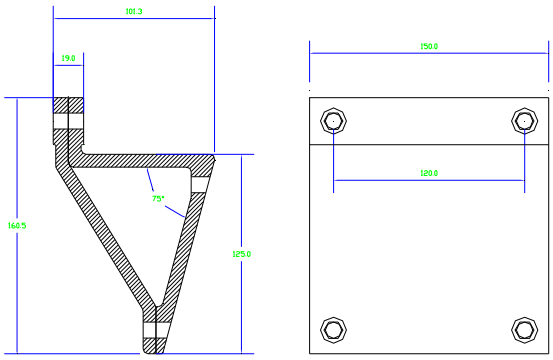
GFRP bracket for tunnel handrail

N° AC69gm14TEMP2

REV febbraio 2014

Description

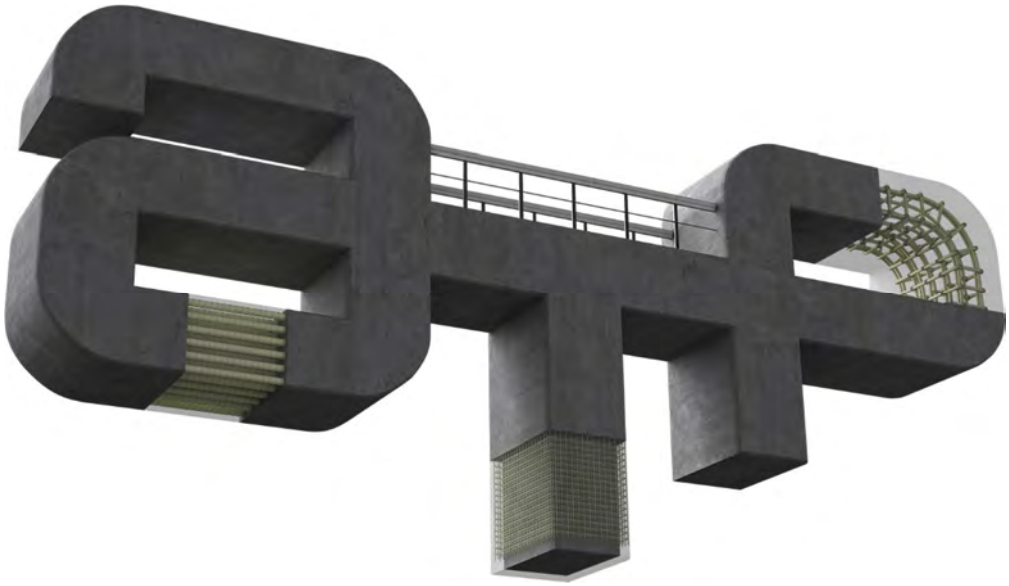
GFRP (Glass Fiber Reinforced Profile) bracket for fixing of the handrail to the tunnel wall.



Characteristics	Test method	unit	Value
Specific weight	ASTM D792	g/cm³	≥ 1.9
hygroscopic absorption	ISO 62	%	≤ 0.2
hardness Barcol	ASTM D2583	°B	≥ 55
Flexural strength	ASTM D790	MPa	≥ 400
Elastic modulus	-	GPa	≥ 28
Charpy impact strength	ASTM 5942	kJ/m²	≥ 200
dielectric strength	ASTM D149	kV/mm	≥ 10
surface resistivity	ASTM D257	Ω	≥ 10^{12}
volume resistivity	ASTM D257	Ω	≥ 10^{12}
Shear strength for shearing	ASTM D 732	MPa	≥ 85
Inter laminar shear strength (short beam test)	ASTM D4475	MPa	≥ 35
Temperature of deflection under load	ASTM D648	°C	≥ 200
Reaction to Fire - art. 10 DM 26.06.84	UNI 8457 e UNI 9174	Category	1

ATP srl - via Casa Pagano, 31 - 84012 Angri (SA) - tel 081 94 77 77 (pbx) - fax 081 94 77 40

- www.atp-frp.it -



ATP s.r.l.

Construction Composites

Via Casa Pagano, 31 - 84012 ANGRI (SA)
Tel. 081.947777 Fax 081.947740
info@atp-frp.com

www.atp-frp.com