Stretto di Messina

Concessionaria per la progettazione, realizzazione e gestione del collegamento stabile tra la Sicilia e il Continente Organismo di Diritto Pubblico
(Legge n° 1158 del 17 dicembre 1971, modificata dal D.Lgs. n°114 del 24 aprile 2003)

EurolinK

PONTE SULLO STRETTO DI MESSINA

PROGETTO DEFINITIVO

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Titolo del documento	Performance Specification - Railway System	

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INDICE

1 Introduction

1.1 The Project

The Messina Strait Bridge will span the Messina Strait between Calabria on the Italian mainland and the island of Sicily. The suspension bridge crossing comprises a 3,300 m main span, which will be longest in the world when constructed.

The bridge carries four marked vehicle lanes, two emergency lanes and two rail lines. The bridge superstructure comprises three separate orthotropic deck steel box girders, one for each of the Sicily and Italy bound roadways and one for the railway. The three box girders are connected by transverse steel box cross girders spaced at 30 m. The superstructure is supported by pairs of hanger cables connected to each cross beam end. The hangers are connected to pairs of main cables on each side of the bridge (four main cables), with each main cable having a diameter of 1.24 m. The main cables are anchored at each bridge end in massive reinforced concrete anchor blocks. The main cables are supported by two steel main towers, each with a height of 399 m above mean sea level. The main towers are founded on reinforced and post-tensioned concrete footings, which are supported on underlying rock formations.

1.2 Scope

This performance specification specifies the requirements for the railway system at the Messina Bridge. The railway line crossing the Messina Strait Bridge forms the link between the future high-speed line Salerno-Reggio Calabria and the Sicily lines Messina-Palermo and Messina-Catania, which are part of the conventional network.

1.3 References

1.3.1 Design Specifications

GCG.G.02.02 "Construction of the road and railway connections, Norm for the execution of the civil works - road and railway infrastructures, Stretto di Messina, 2004 July 6.

GCG.F.04.01 “Engineering – Definitive and Detailed Design: Basis of Design and Expected Performance Levels,” Stretto di Messina, 2004 October 27.

CG.10.00-P-RG-D-P-GE-00-00-00-00-00-02 - Design Basis, Structural

European Union, Directive 96/48/EC - Interoperability of the Trans-European High Speed Rail System, Technical Specification for Interoperability, 2008.

UIC recommendation for design and calculation of unballasted track, UIC 2008

1.3.2 Design Codes

EN 13481 part 1and 5: Railway applications - Track - Performance requirements for fastening systems

EN 13146 part 1 - 8: Railway applications - Track - Test methods for fastening systems.

EN 13232 part 1 - 9: Railway applications - Track - Switches and crossings (expansion devices).

ENV 13803 part 1: Railway applications - Track alignment design parameters - Track gauges 1435 mm and wider - Part 1 : Plain line

EN 13848 Part 1 - 5: Railway applications - Track geometry quality

1.3.3 Material Specifications

EN 13232 part 1 - 9: Railway applications - Track - Switches and crossings (expansion devices).

EN 13674 part 1 : Railway applications - Track - Rail - Part 1: Vignole railway rails 46kg/m and above

1.3.4 Reference documents

CG.10.00-P-RF-D-P-SS-P2-FE-00-00-00-01 - Specialist Technical Design Report - Railway system

1.3.5 Drawings

CG.10.00-P-BX-D-P-SS-P2-FE-00-00-00-01 Railway system, General Layout

CG.10.00-P-BX-D-P-SS-P2-FE-00-00-00-02 Railway system, Details (1)

CG.10.00-P-BX-D-P-SS-P2-FE-00-00-00-03 Railway system, Details (2)

2 Design Basis

In the contract document GCG.E.01.11, article 4.2 it is stated that the railway infrastructure shall be designed and built in compliance with the Technical Specifications of Interoperability (TSI) of the European High Speed (HS) Railway System. Further, in document GCG.F.03.03, article 3.2 it is required that the line must concord with the requirements of the category II of the TSI for High Speed (lines specially adapted for high speed) of the order V=200km/h.

In the TSI, mainly in chapter 4, are described the conditions to be complied with to achieve the specified performances for a category II line, which in this case is a specially upgraded high-speed line equipped for speeds of the order of 200km/h.

The TSI also determines the interoperability constituents and interfaces which must be covered by European specifications and standards which are needed in order to achieve the necessary interoperability within the trans-European high-speed rail system.

2.1 Specified performance for line II categories

All performance levels and specifications in the HS TSI INF are given for lines with standard European track gauge of 1435 mm and under normal service conditions.

2.2 Geographical and technical scope

The performance parameters mentioned in this document only cover the track over the suspension bridge and the tracks on the terminal structures. Tracks on adjacent viaducts are not included. At the transitions between the suspended bridge and the terminal structures and between the terminal structures and the viaducts on land expansion devices will be installed. These are included in this scope.

This part of the track is an open electrified line with double track which is straight in the horizontal plane, without sidings, switches, crossovers, platforms, stations etc. and functional and technical specification for these items are thus not applicable.

Performance parameters for the rolling stock and structures supporting the track are not included in this document.

2.3 General parameters

For the Messina Bridge the general parameters are specified in the Design Basis as follows:

- kinematic gauge: GC, see below
- axle load: max. 250kN
- line speed: 120km/h
- train length: 750m
- horizontal alignment: straight line, R = ∞
- vertical alignment: R = 30000m

The free envelope to be used is in general the P.M.O No. 1 - (Gabarit C – Nuovo impianto), but on the bridge, as required by RFI on all railroad bridges, there must be provided additional clearance of 300 mm and 500 mm in the area above the level PF + 700 mm. The resulting free envelope is shown in the figure below.

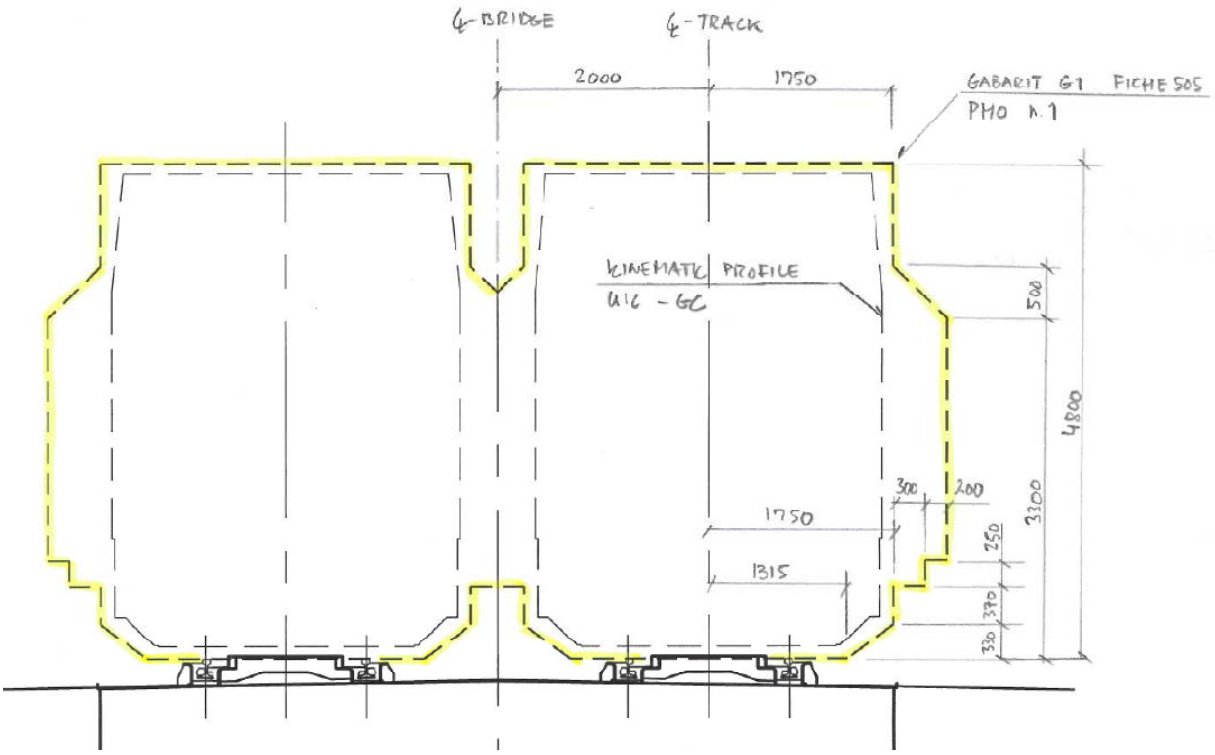

Figure 1 **Free envelope on the Bridge**

3 Functional and technical requirements

In the HS TSI for infrastructure the following essential parameters are mentioned as general provisions.

The essential requirements are marked with "X". Among the parameters a number are not relevant for the present railway line. These parameters are marked in red colour. The parameters marked in green colour are specified in the design documents, whereas the parameters marked in yellow colour require input from suppliers or by testing.

Parameter	TSI reference	Safety	Technical compatibility
Nominal gauge	4.2.2		X
Minimum infrastructure gauge	4.2.3	X	X

Distance between track centres	4.2.4		X
Maximum rising and falling gradients	4.2.5		X
Minimum radius of curviature	4.2.6	X	X
Track cant	4.2.7	X	
Cant deficiency	4.2.8	X	X
Equivalent conicity	4.2.9	X	X
Track geometrical quality and limits on isolated defects	4.2.10	X	
Rail inclination	4.2.11	X	X
Railhead profile	5.3.1	X	X
Switches and crossings	4.2.12 - 5.3.4	X	X
Track resistance	4.2.13	X	
Traffic load on structures	4.2.14	X	
Global track stiffness	4.2.15 - 5.3.2		X
Maximum pressure variation in tunnels	4.2.16		
Effects on crosswind	4.2.17	X	
Electrical characteristics	4.2.18	X	X
Noise and vibrations	4.2.19		
Platforms	4.2.20	X	X
Fire safety and safety in	4.2.21	X	

railway tunnels			
Acces to or intrusion into line installations	4.2.22	X	
Lateral space for passengers and onboard staff in the event of detrainment of passengers	4.2.23	X	
Stabling tracks and other locations with very low speed	4.2.25		X
Fixed installations for servicing of trains	4.2.26		
Ballast pick-up	4.2.27	X	X
Commissioning - Execution of works	4.4.1		
Protection of workers against aerodynamic effects	4.4.3	X	
Maintenance rules	4.5		
Professional competences	4.6		
Health and safety conditions	4.7	X	

Table 1 Infrastructure parameters for category II lines

Legend:

Requirement to be specified in the design	
The fact of the parameter to be established	
Not relevant in this project	

4 Description of the basic parameters

The following parameters are specified for the design of the railway on the Messina Bridge.

Parameter	TSI reference	Parameter acc. to TSI	Specification
Nominal gauge	4.2.2	1435 mm	1435mm
Minimum infrastructure gauge	4.2.3	GC	GC, see 2.3
Distance between track centres	4.2.4	Min. 4.00 m	4.00 m
Maximum rising and falling gradients	4.2.5	< 35 mm/m	Sicilia: ≤ 15.0 mm/m Calabria: ≤ 9.2 mm/m
Track cant	4.2.7	< 180 mm	0 mm
Equivalent conicity	4.2.9	0.20	Not applicable for line speed ≤ 160 km/h
Track geometrical quality and limits on isolated defects	4.2.10	X	
- track twist	4.2.10.4.1	20/L + 3 max. 7mm/m	
- gauge variation	4.2.10.4.2	-7 mm +28 mm	
Rail inclination	4.2.11	1 : 20	1 : 20
Railhead profile	5.3.1	UIC 60 E2	UIC 60 E2 steel grade R260
Track resistance	4.2.13	EN 1991	Included in Design Basis
Traffic load on structures	4.2.14	EN 1991	Included in Design Basis

Global track stiffness	4.2.15 - 5.3.2	EN 13481 + EN 13146	
Effects on crosswind	4.2.17	RFI requirements	Included in Design Basis
Electrical characteristics	4.2.18	> 3 kΩ	
Noise and vibrations	4.2.19	National rules	
Lateral space for passengers and onboard staff in the event of detrainment of passengers	4.2.23	RFI	Emergency walkway provided along the tracks
Commissioning - Execution of works	4.4.1	RFI	
Protection of workers against aerodynamic effects	4.4.3	RFI	

Table 2 Infrastructure parameters for the Messina line

Legend:

Requirement specified in the design	
The fact of the parameter to be established	
Not relevant in this project	

5 Performance

All performance parameters described in the HS TSI INF shall be fulfilled as shown above in the detailed design of the railway system.

Some of the parameters from the TSI will derive from national rules. These have no direct influence in the train operation.

All technical parameters influencing the design of the permanent structures shall be fulfilled in the design.

Documentation from the suppliers of the embedded rail system shall be provided to justify that the rail system is in compliance with relevant codes.