Seismic Vulnerability Assessments

Milan-Genoa railway line, Bridge at km 6+279, Italy

% Architecture

100% Engineering

% Geology - Geotechnics

Subcontractor:
Consortium: Minnucci Associati s.r.l.
ETS s.r.l. - Progetto CMR
Engineering Integrated Services S.r.l.
Engineering study Guglielmo Aluisantonio
Sinergo S.p.A - Studio Lombardini S.r.l.
engineering firm
Contracting Authority:
RFI - Rete Ferroviaria Italiana
Direzione Tecnica Standard Infrastruttura
Works designed:
Seismic Vulnerability Assessments
Place of realisation of the works designed:
Milan-Genoa Railway Line, Bridge at km 6+279
Period of provision of the service: 2019

DESCRIPTION OF THE SERVICE PROVIDED

1. Service characteristics and dimensions

This technical description refers to the seismic vulnerability assessment of a three-arch brick viaduct on the Milan-Genoa railway line at kilometre 6+279, in the municipality of Carbonara Scrivia (Alessandria), in a seismic zone 3. The bridge carried a two-track railway line, totalled 17 metres in length and consisted of 3 arches with span of about 4.00 metres; it was about 9.50 metres wide.
The three arches were in solid brick and were all virtually the same shape, with span from 3.98 to 4.07 m and depth of 9.50 m; the summit radius of the shallow arches was between 0.96 m and 1.02 m (rf/l≈0.20).
The piers were also in solid brick, with thickness of about 1.50 metres and varying above-ground height: on both the outer arches the above-ground height was about 2.95 m, while in the central arch this increased to about 4.55 m. The piers had a concrete subfoundation much smaller than that of the abutments, measuring about 1.80 x 1.60 x 9.50 m.
The abutments were in solid brick, with all the characteristics of a vertical structure: the wing walls were vertical with a constant thickness of about 2.0 m and total height from ground level of about 3.0 m; the width between them was 9.50 m, exactly the same as that of the arches.
Both abutments had concrete subfoundations in the form of rectangular blocks of about 3.00 x 3.30 x 9.50 m. The solid brick spandrel was 0.85 m thick, as revealed by the structural surveys described. The buttress above the arches, with a thickness of 0.10 m at the highest point, consisted of concrete with a lime and sand cement binder.

Territorial context of the structure

Denominazione		Sottovia al km 6+279
Tipologia		Arco pluricampata in muratura
Sede Tecnica		TR1187-SD-OA00-PT0-B13
Direzione territoriale di Produzione		Genova
Linea		Milano - Genova
Ubicazione	Progressiva	km 6+279
Comune		Carbonara Scrivia
Provincia		Alessandria
Regione		Piemonte
Coordinate Geografiche (WGS 84)	Longitudine	8,852707 deg
	Latitudine	44,846204 deg

2. Team size and organisation

The service was delivered by the following team:
n.1 Project Manager: analysis, planning and writing of the WBS, performance of the activities necessary for the delivery of the service, coherent, efficient management of resources, monitoring of progress of the services;
n.1 Structural Engineer: preliminary analysis of input data, seismic vulnerability assessment, assessment of any general or local measures to improve the bridge/upgrade it to standard;
n.2 Design assistants.

3. Technical and administrative documentation management procedures

The technical and administrative documentation was managed with the aid of data sharing protocols and project management techniques of high organisational quality, supported by the use of state-of-the-art hardware, software and technological infrastructures and instruments at the technological leading edge.

DATA SHARING PROCEDURES

The project was shared with the Contracting Authority in accordance with the contract schedule, further to formal notification, in compliance with the format, units of measurement, system of coordinates and coding specified in the project input data.

The output consisted of seismic assessment technical reports and data sheets for the works concerned.

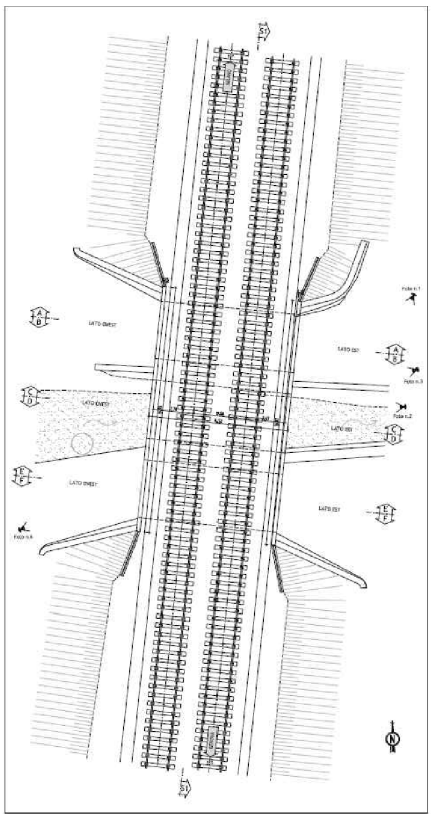
The project was shared in accordance with the conditions specified by the Contracting Authority, for example telematically or on paper (for documents) and/or on digital media (hard disk/CD), all accompanied by a "list of documents" or a "list of informative contents" ensuring the traceability of all the documentation sent or attached, with regard to its position in the Repository or Database.

Data storage procedures

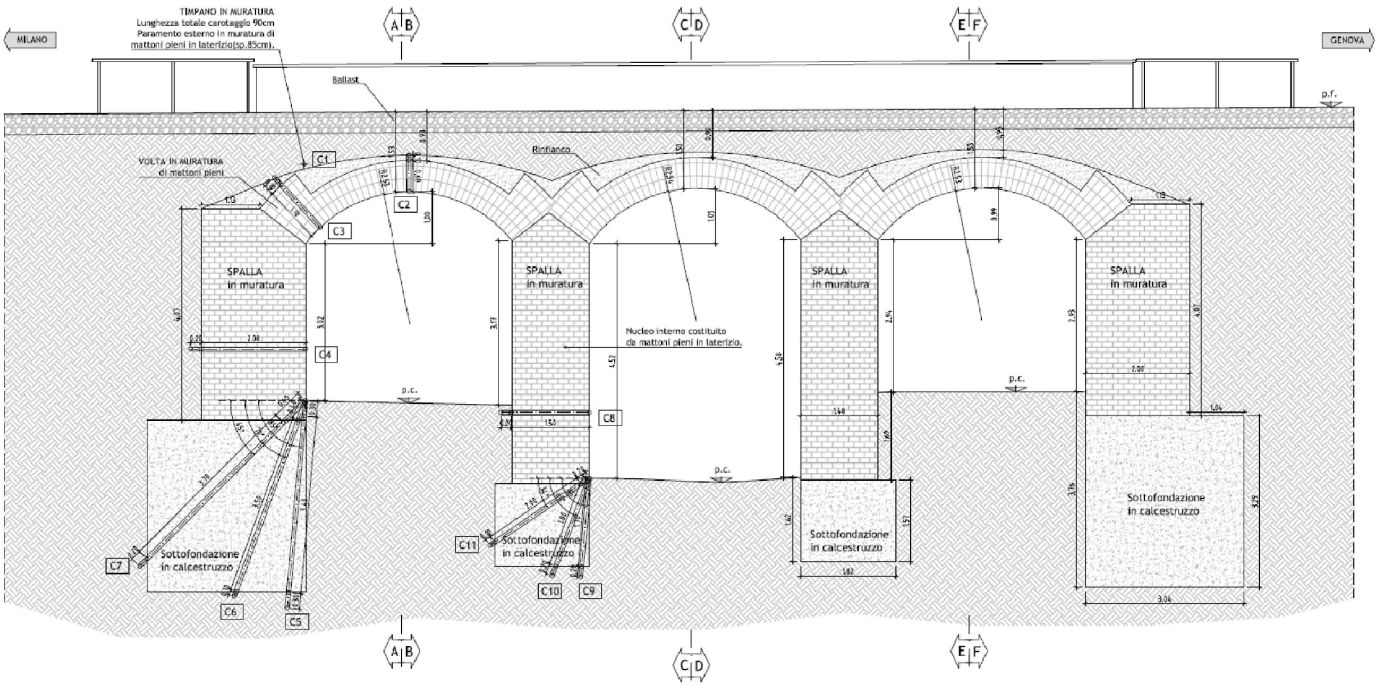
Data were stored with aid of specific servers, NAS and working folders. A tree structure of folders with a specified classification was used. An example of the data storage procedures is provided on the left.

Images of the bridge

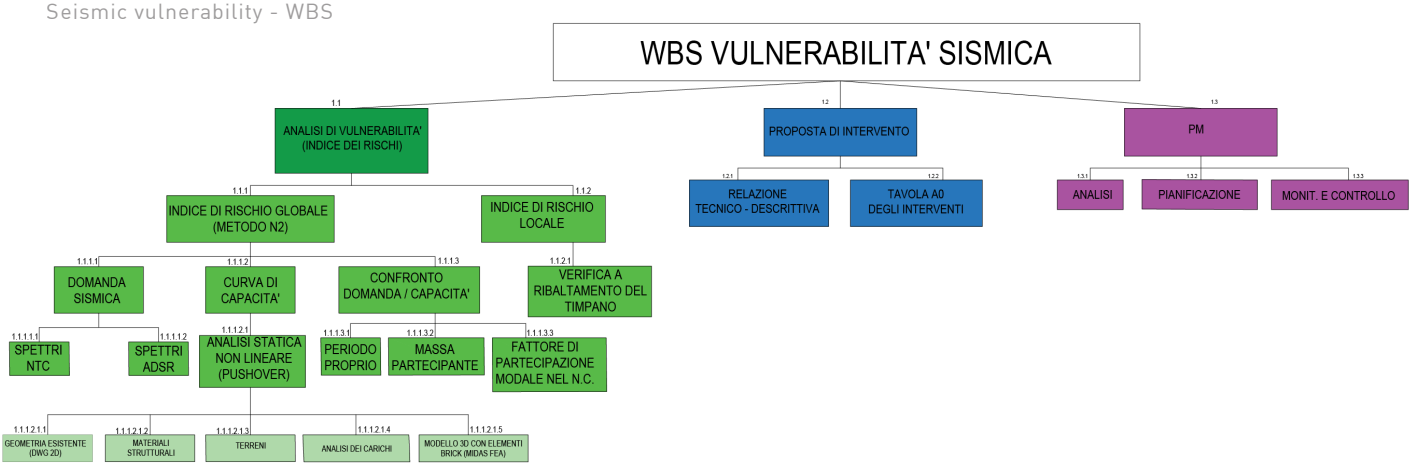
Ground plan of the bridge



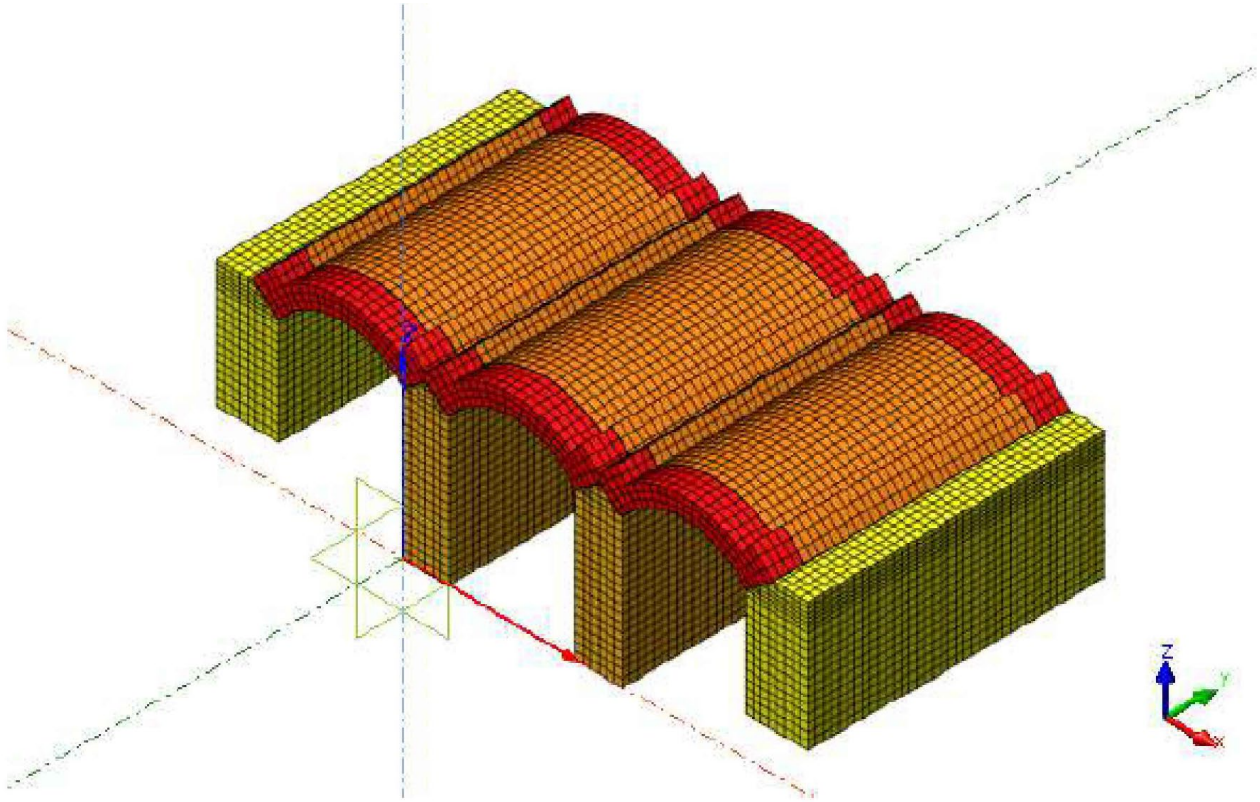
Structural cross-section



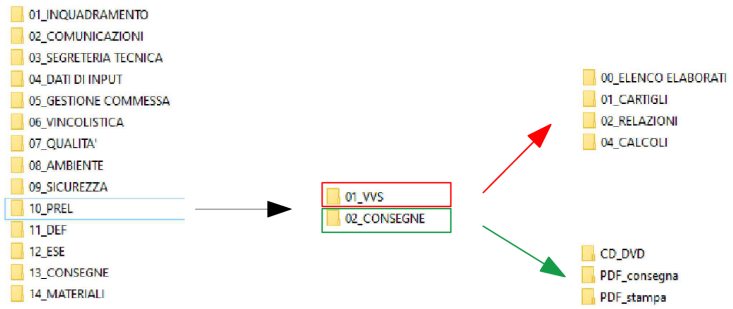
Seismic vulnerability - WBS



Three-dimensional model



Data storage method



PRESIDENZA DEL CONSIGLIO DEI MINISTRI
DIPARTIMENTO DELLA PROTEZIONE CIVILE
UFFICIO RISCHIO SISMICO

SCHEDA DI SINTESI DELLA VERIFICA SISMICA DI "LIVELLO 1" O DI "LIVELLO 2" PER I PONTI STRATEGI DELLA PROTEZIONE CIVILE O RILEVANTI IN CASO DI COLLASSO A SEGUITO DI EVENTO SISMICO
(Ordinanza n. 3274/2003 – Articolo 2, commi 3 e 4, D.M.14/1/2008)

1) Identificazione del ponte

Spazio riservato DPC |__|__|__|__|__|__|__|__|__|__|__|__|__|__|__|__|

SEDE TECNICA TR1187-SD-OA00-PT0-B23

Codice DPCM |__|__|__|__| N° progressivo intervento |__|__|__|__|

Regione PIEMONTE Codice Istat |0|1|

Scheda n°|0|0|0|1| Data |2|1|/|1|2|/|2|0|1|8|

SCHEDA "LIVELLO 0" n° 983

Denominazione rete viaria/ferrov |M|I|L|A|N|O|-|G|E|N|O|V|A|__|__|__|__|__|__|__|__|__|__|__|__|

Provincia ALESSANDRIA Codice Istat |0|0|6|

Identificativo struttura: ⊗ Ponte O Cavalcavia

Comune CARBONARA SCRIVIA Codice Istat |1|7|4|

Codice identificativo (secondo l'allegato 1 Decr.n.3685 del 21/10/2003) |B|2|1|

Frazione/Località		Coordinate geografiche (ED50 – UTM fuso 32-33) [Km]		
Progr. dal Km	al Km	E	44.84716	Fuso
|__|__|__|6|+|279|	|__|__|__|6|+|279|	N	8.85376	|3|2|

Denominazione ponte |__|__|__|__|__|__|__|__|__|__|__|__|__|__|__|__|__|__|__|__|__|__|__|__|__|__|__|__|__|__|__|__|__|__|__|__|

Proprietario |R|F|I|__|R|E|T|E|__|F|E|R|R|O|V|I|A|R|I|A|__|I|T|A|L|I|A|N|A|__|S|P|A|

Concessionario |R|F|I|__|R|E|T|E|__|F|E|R|R|O|V|I|A|R|I|A|__|I|T|A|L|I|A|N|A|__|S|P|A|

2) Dati dimensionali e età costruzione/ristrutturazione

Superficie totale del ponte [m²]	Numero totale di campate	Anno di progettazione	Anno di ultimazione della costruzione	Anno di progettazione di eventuali interventi di modifica sostanziale eseguiti
A |__|__|1|8|0|	B |__|0|3|	D |__|__|__|__|	E |A|N|8|4|	F |__|__|__|__|

3) Tipologia strutturale e materiale principale delle strutture

P. travi appoggiate	P. trave continua	Ponte a stampella	Ponte a telaio	Ponte ad arco	Ponte strallato	Ponte sospeso	Altro (specificare)
A O	B O	C O	D O	E ⊗	F O	G O	H |__|__|__|__|__|__|__|__|__|__|__|__|__|__|__|__|

Materiale \ Elem. Strutt.		1 Spalle	2 Pile	3 Impalcato
A	C.a.p.	O	O	☐
B	C.a.	O	O	☐
C	Acciaio	O	O	☐
D	Acciaio - cls	O	O	☐
E	Muratura	⊗	⊗	O
F	Altro |__|__|__|__|__|__|__|__|	O	O	O

4) Dati di esposizione

A	Numero autoveicoli transitanti nelle ore di traffico intenso (n° veicoli/ora) – per i ponti stradali |__|__|__|__|__|__|	B	Numero treni/giorno transitanti (n° treni/gg) – per i ponti ferroviari |__|9|6|,|8|4|

5) Dati geomorfologici

Morfologia del sito				Fenomeni franosi	
A O Cresta	B O Pendio Forte	C O Pendio leggero	D ⊗ Pianura	E ⊗ Assenti	F O Presenti

Seismic assessment data sheet

PROJECT TECHNICAL SPECIFICATIONS

Seismic Vulnerability Assessments
Milan-Genoa Railway Line, Bridge at km 6+279

PROJECT DATA:

Consortium:
Minnucci Associati s.r.l.
ETS s.r.l. - Progetto CMR
Engineering Integrated Services S.r.l.
Engineering study Guglielmo Aluisantonio
Sinergo S.p.A - Studio Lombardini S.r.l.
engineering firm
Contracting Authority: RFI - Rete Ferroviaria Italiana
Direzione Tecnica Standard Infrastruttura
Place: Milan-Genoa Railway Line, Bridge at km 6+279
Type of Project: Seismic Vulnerability Assessments
Award: ACCORDO QUADRO n.177/2018 Lotto n.3
Place: Milano - Genova Railway line
Status: Completed

PROJECT MANAGEMENT:

Project Manager: Ing. Ricardo Ferraro
Design of Structures:
Ing. Ricardo Ferraro - Dott. Ing. Matteo Biagio Di Prima

PROJECT TEAM:

Dott. Ing. Matteo Biagio Di Prima

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