



Louis Berger



STRUCTURAL INTEGRITY EVALUATION OF THE “CONSTITUCIÓN DE 1812” BRIDGE, OVER THE CÁDIZ BAY (CÁDIZ, SPAIN)

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INTRODUCTION

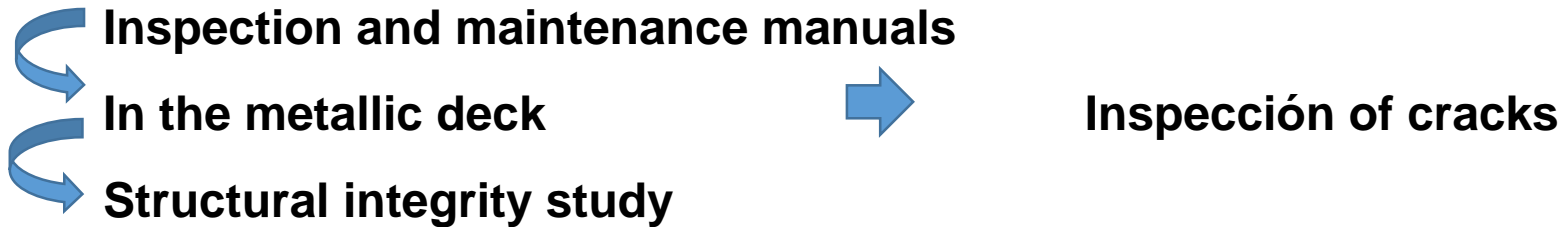
Inspection and maintenance plans: Required by standards EHE-08 or EAE.

SERVICE LIFE 100 YEARS!!!!!!

- **Constitución de 1812 bridge**



OBJECTIVE



Structural integrity study:

- Ensure bridge service
- Safety level of the metal structure
- Inspection deadlines
- Limit the use of the bridge with sufficient guarantees

Determination of critical crack sizes → INSPECTION PLAN



METHODOLOGY

1. **Usual methodology: Small crack sizes are obtained. BS7910**
2. **Inspection: It is not possible to detect small crack sizes by visual inspection**
3. **New methodology:**
A combination of refined structural integrity assessment and the consideration of structural redundancy will be used to justify larger crack sizes.

Crack sizes of at least 10 cm can be detected during a visual inspection of the bridge

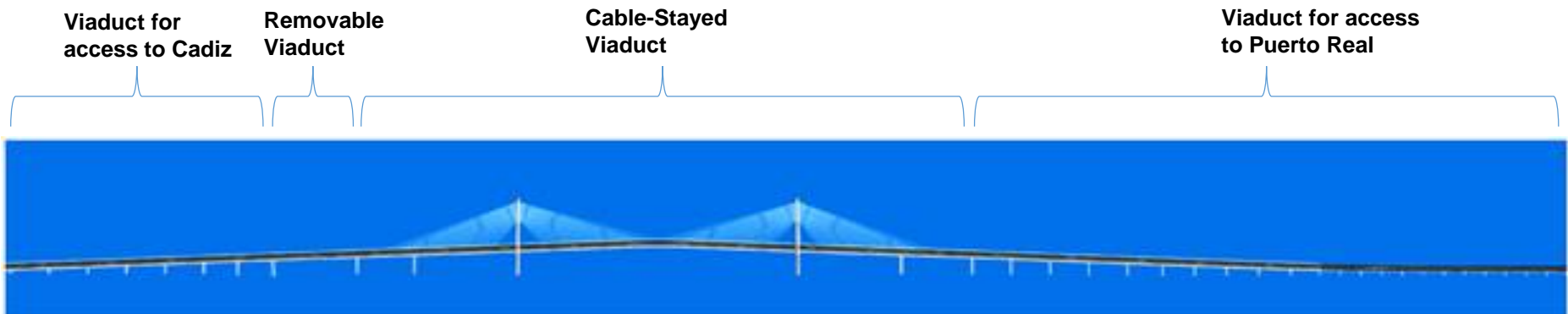
CONSTITUCIÓN DE 1812 BRIDGE. CÁDIZ

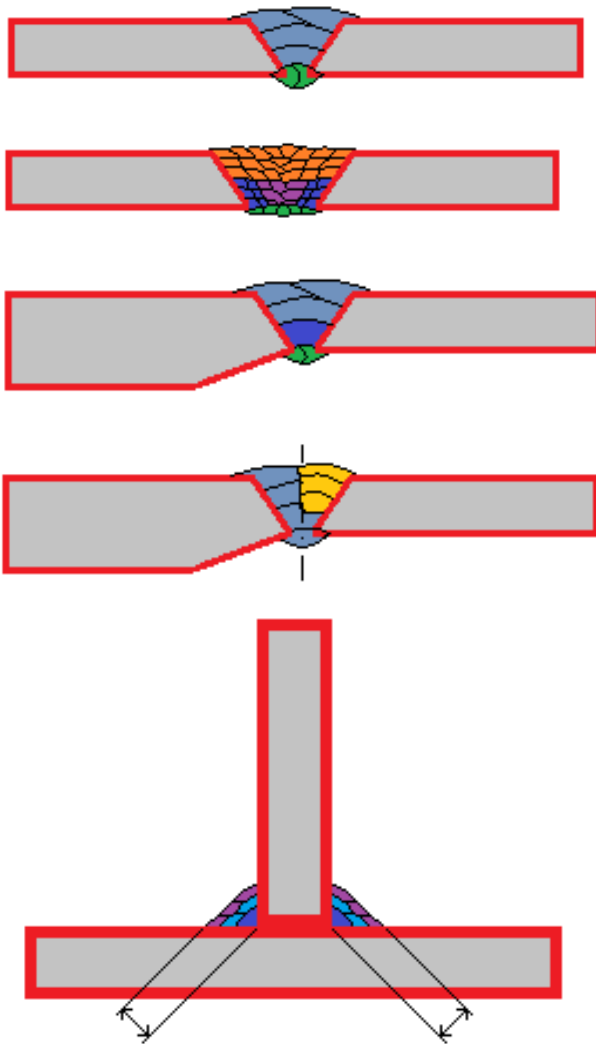
Characteristics

Total length.....3.157 m
Deck width.....34.3 m

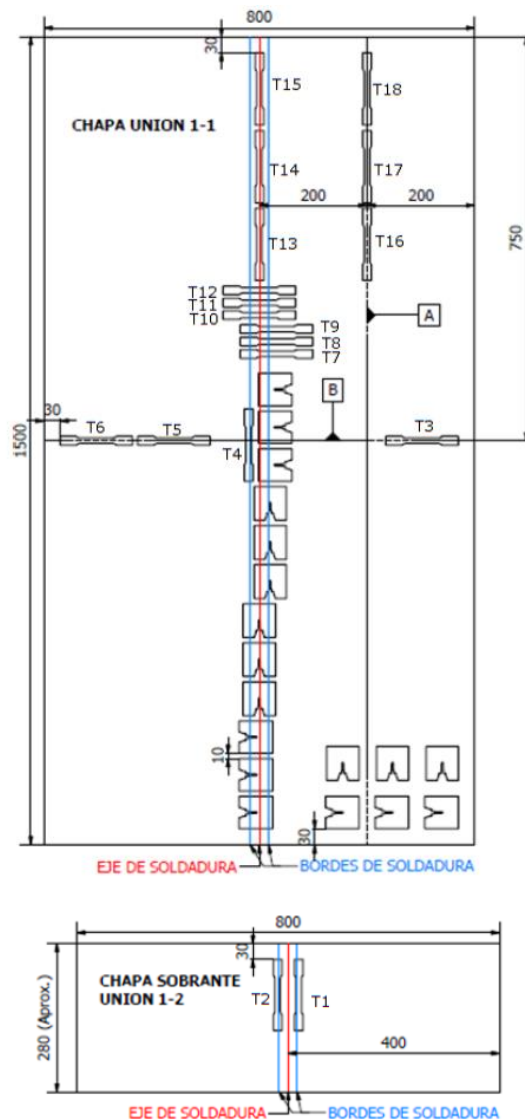
Structures

Viaduct for access to Cádiz.....645 m
Removable viaduct.....150 m
Cable-Stayed viaduct.....1.180 m
Viaduct for Access to Puerto Real1.182 m





136-FCAW EN ISO 4063
121-SAW EN ISO 4063



ASSESSMENT

Tests:

- Tensile
- Microstructure
- Hardness
- Fatigue
- Fracture



Structural integrity assessment:

- Material fracture toughness
- Critical crack sizes

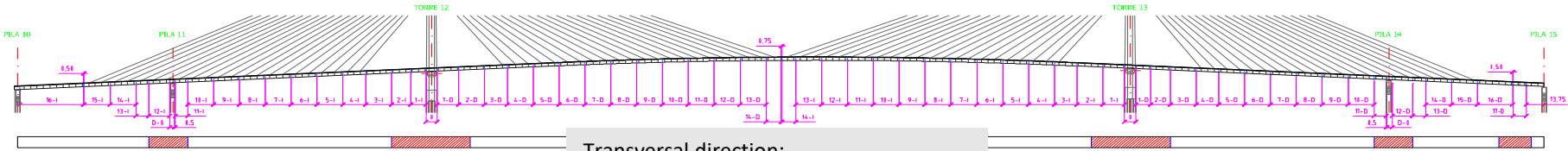
INSPECTION PLAN

Basic Inspection Criteria:

- **Inspection of butt joints in traction**
- **Inspection of butt joints in traction with change of thickness**
- **Inspection of T-joints in traction**

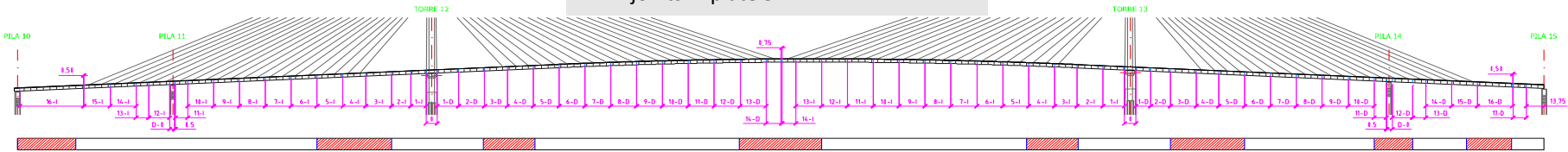
Plates	Crack size (mm)
Through thickness crack in transversal direction for plates 1,2 and 3 (Thickness up to 70 mm)	12
Through thickness crack in transversal direction for plates 1,2 and 3 (Thickness from 80 to 110 mm)	6,6
Through thickness crack in longitudinal direction for plates 1 and 4 (Thickness up to 15 mm)	14

INSPECTION PLAN



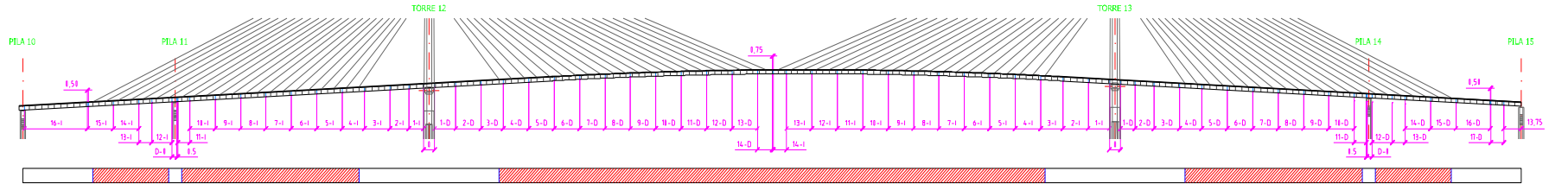
Transversal direction:

- Butt joints plate 3
- Butt joints plate 2 (upper area)
- T joints in plate 3



Transversal direction

- Butt joints plates 1 and 4
- Butt joints plate 2 (lower area)
- T joints in plates 1 and 4



Longitudinal direction:

- Butt joints plates 1 and 4 (diaphragms of cables)
- T joints in plates 1 and 4



CONCLUSIONS

- **In a conservative way the first values of defects to be considered in the inspection tasks of the Constitution of 1812 Bridge have been established.**
- **Structural integrity assessment will allow the establishment of valid criteria to be included in the Inspection and Maintenance plans of future structures in service.**



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QUESTIONS

THANKS FOR YOU ATTENTION!

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- Article published in magazine: Engineering failure analysis. <https://doi.org/10.1016/j.engfailanal.2018.04.012>