

DOME

TITLE

**Damages on the dome arch beams and
shutters**

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Reference documents

N°	Document title	Code	Issue

List of acronyms and abbreviations

GTC	Gran Telescopio CANARIAS
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CONTENTS

1. INTRODUCTION.....	6
2. DEFECTS ON THE ARCH BEAM “A”	9
3. DEFECTS ON THE ARCH BEAM “B”	13
4. SHUTTERS DEFECTS.....	18
5. WIDESPREAD DEFECTS	21
6. ATTACHMENT	22

1. INTRODUCTION

This document describes the damages observed on the dome arch beams and on the dome shutters and different areas of the dome.

The defects observed on the arch beams are cracks, corrosion and deformations. Some of the deformations and cracks were produced during the manufacturing and assembly processes and some additional cracks have been presented in the early years of operation, when there was no control on the chain loads, so the system suffered important impacts and overloads. In some cases the cracks show signs of corrosion, which could indicate stress corrosion cracking processes.

The following sections present a photographic report of the observed damages indicating the location and a short description of the defects. Photographic report of beams damages refers to defects positions presented in fig. 1.2 and fig. 1.3 and location of defects on the beam section according to areas defined in fig. 1.4. Photographic report of shutters damages refers to defects positions according to fig. 1.5.

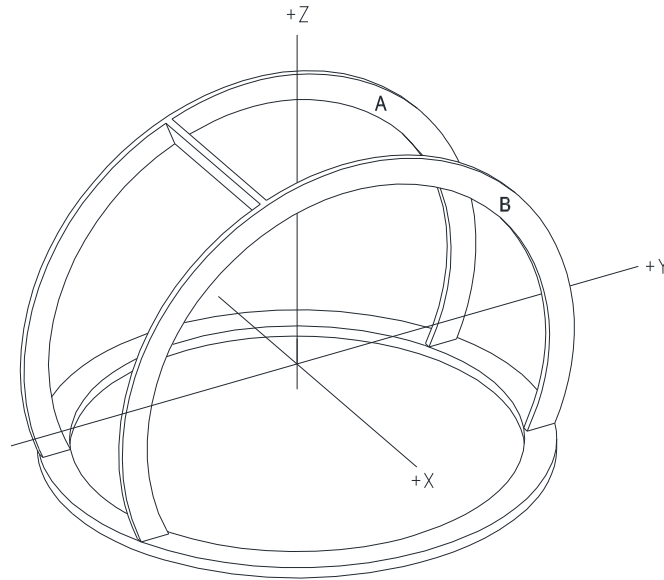


Fig. 1.1 Arch beams identification.

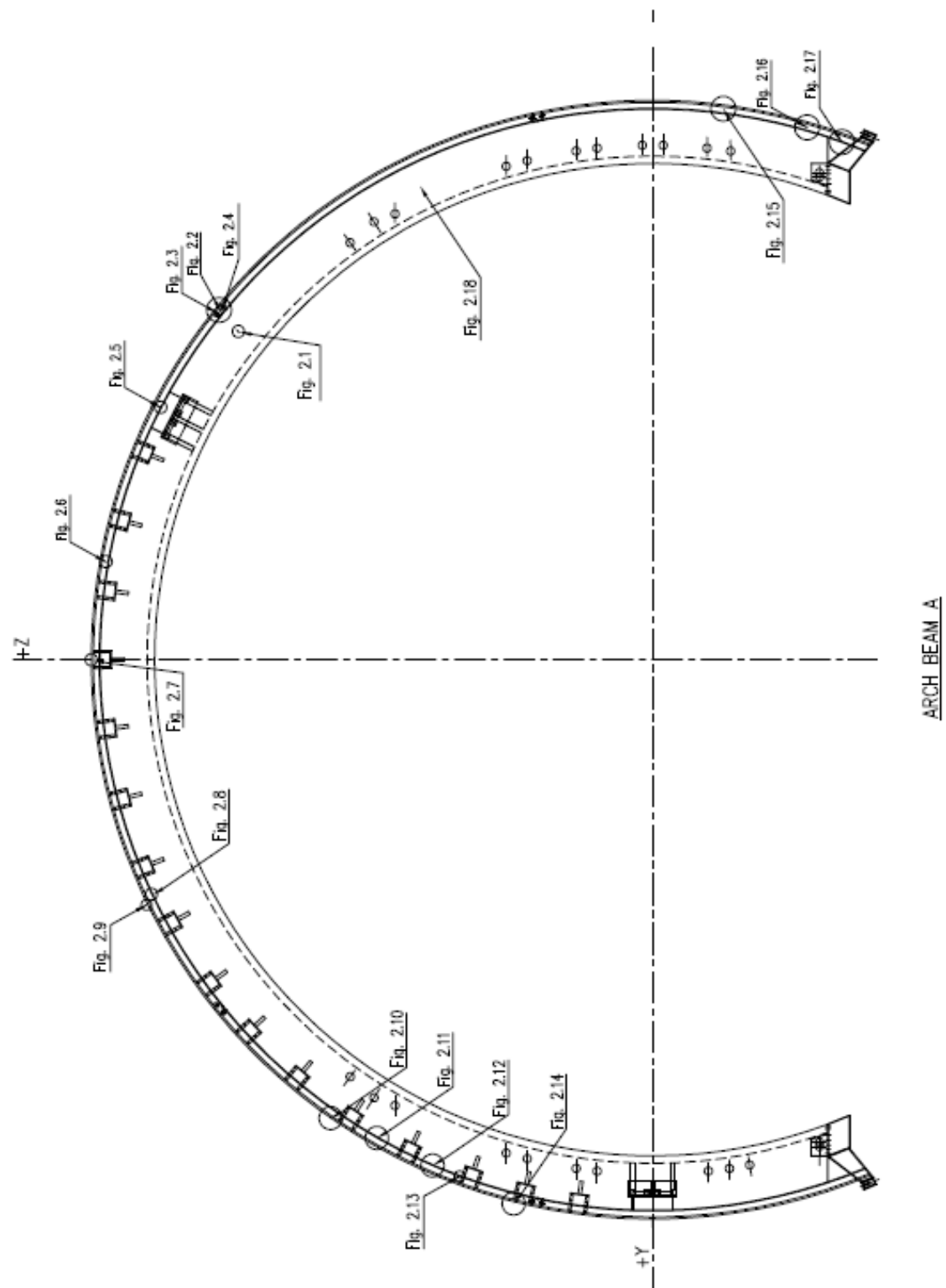


Fig. 1.2 Schematic view of the defects on the arch beam "A"

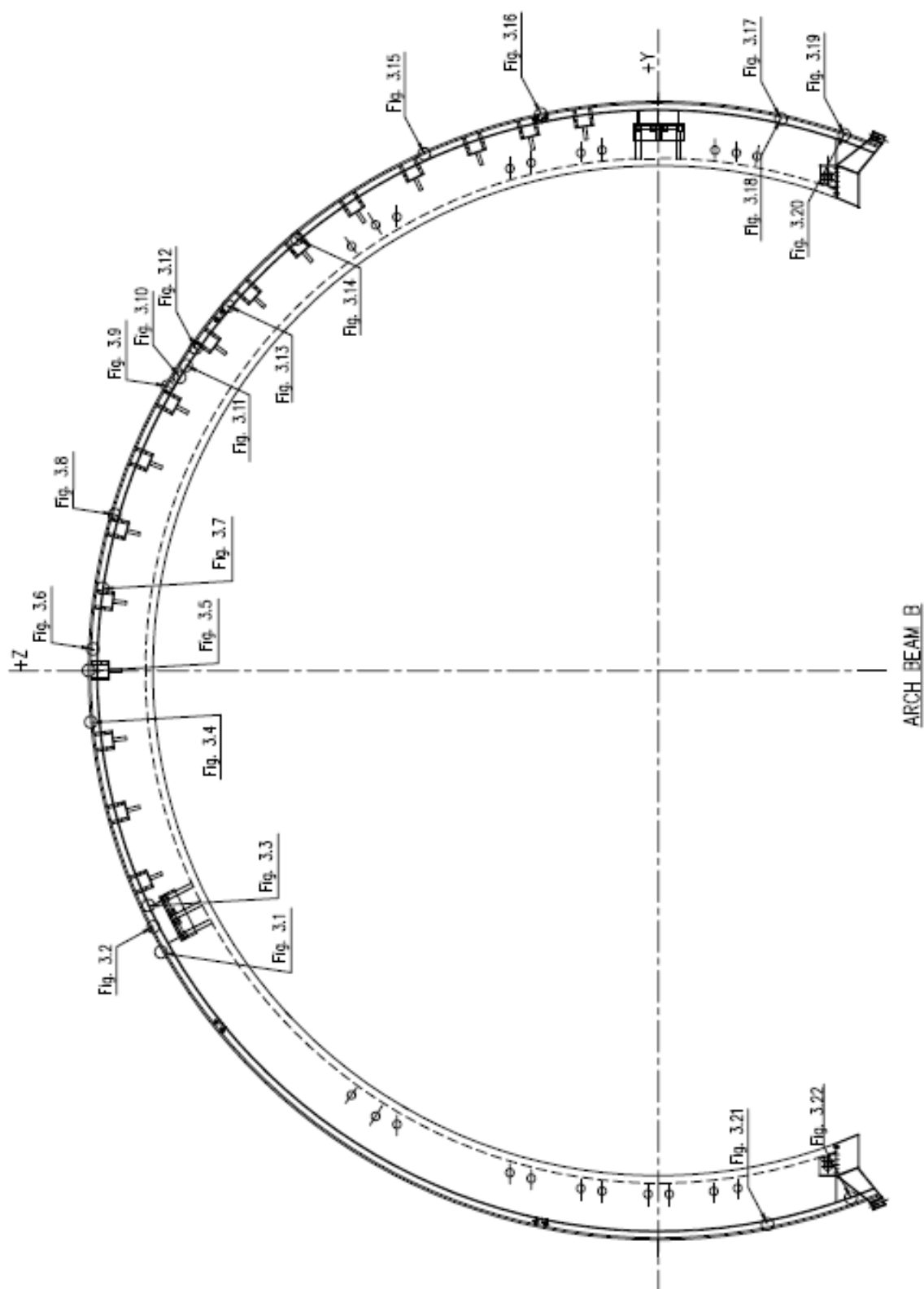


Fig. 1.3 Schematic view of the defects on the arch beam "B"

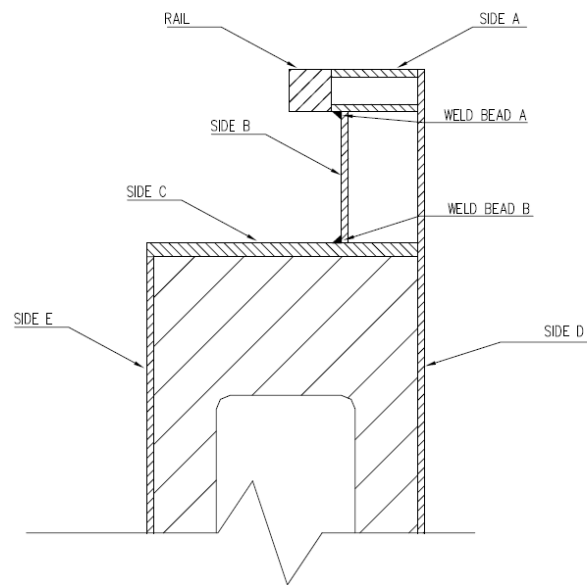


Fig. 1.4 Schematic view of the arch beam section. Identification of areas.

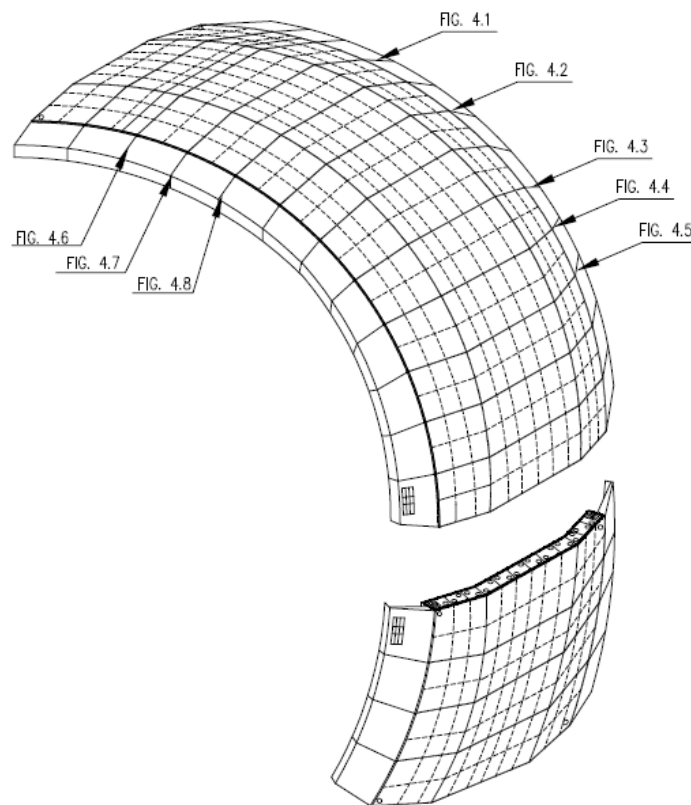


Fig. 1.5 Location of the defects on the shutters.

2. DEFECTS ON THE ARCH BEAM “A”

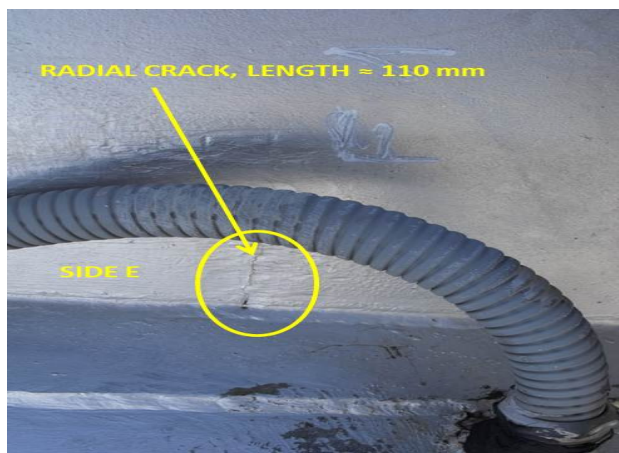


Fig. 2.1 Radial crack. Side E.



Fig. 2.2 Radial crack. Side B.



Fig. 2.3 Radial crack. Side B.

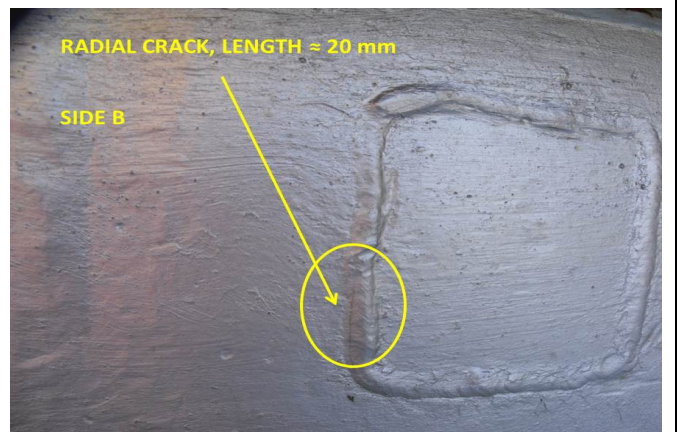


Fig. 2.4 Radial crack. Side B.



Fig. 2.5 Corrosion. Side B and side C.



Fig. 2.6 Corrosion. Side C.



Fig. 2.7 Axial crack. Side A.

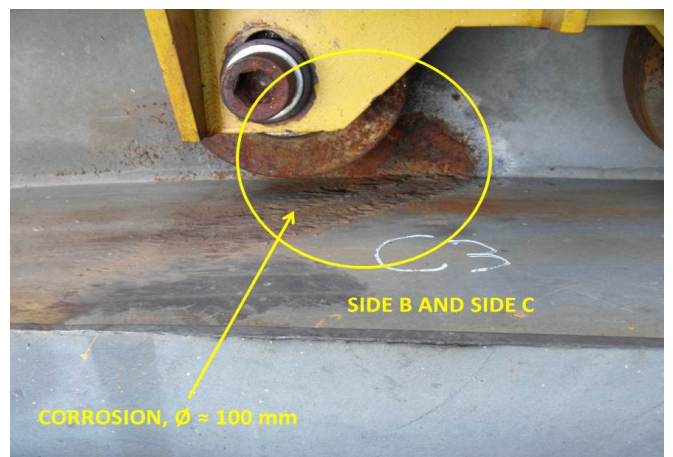


Fig. 2.8 Corrosion. Side B and side C.



Fig. 2.9 Pitting. Side A.



Fig. 2.10 Pitting. Side A.

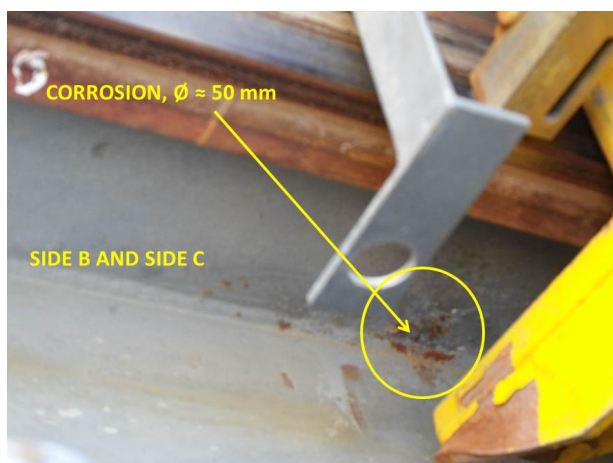


Fig. 2.11 Corrosion. Side B and side C.

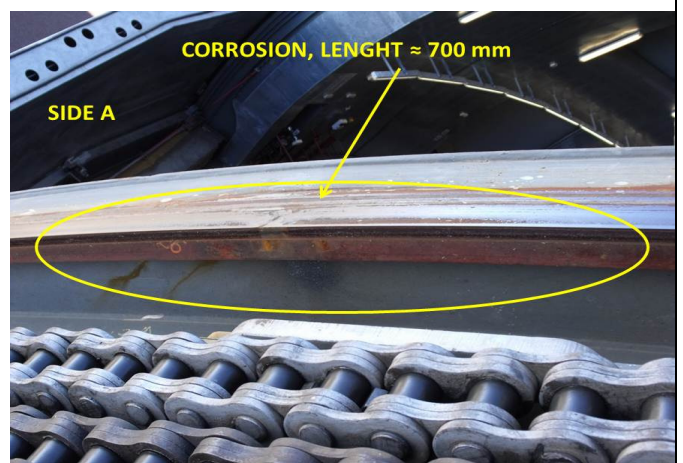


Fig. 2.12 Corrosion. Side A.

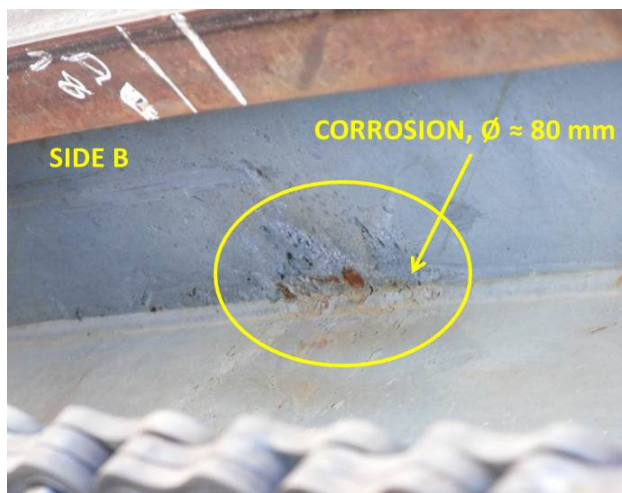


Fig. 2.13 Corrosion. Side B.

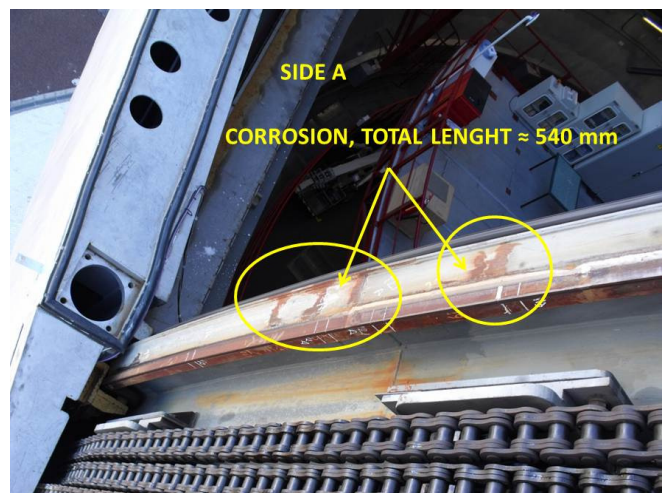


Fig. 2.14 Corrosion. Side A.



Fig. 2.15 Buckling. Side B.

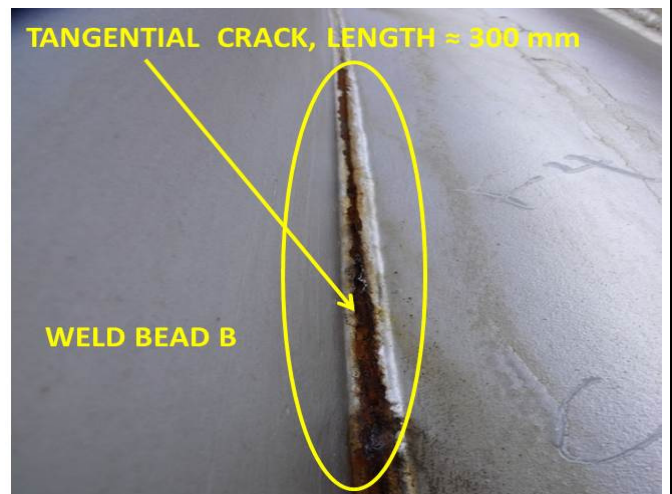


Fig. 2.16 Tangential crack. Weld bead B.

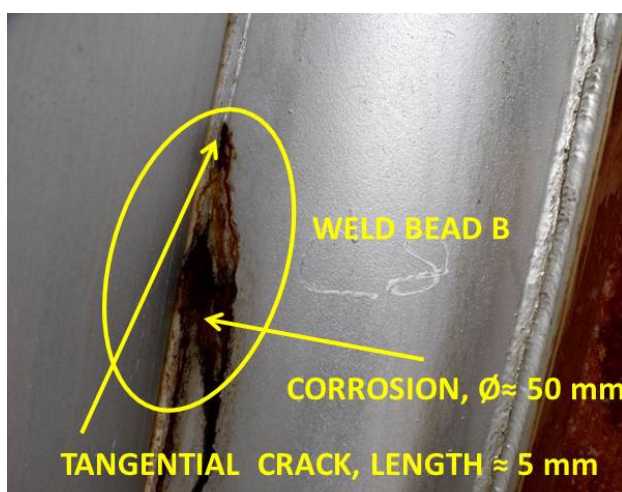


Fig. 2.17 Tangential crack and corrosion. Weld bead B.

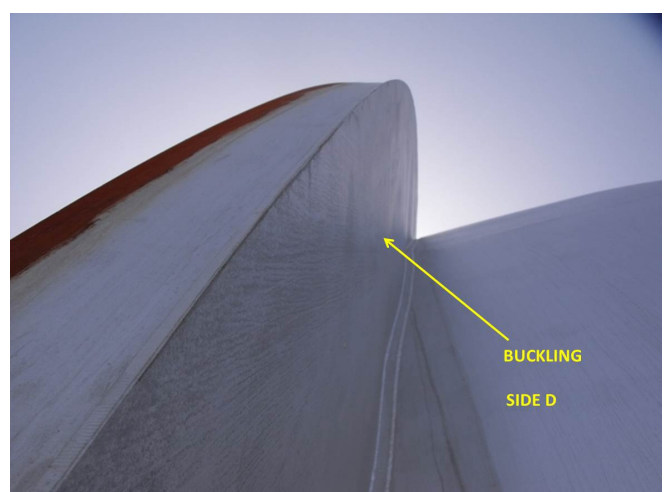


Fig. 2.18 Buckling. Side D.

Identification	Pathology	Type	Approx. size	Location
Fig. 2.1	Crack	Radial	110 mm	Side E
Fig. 2.2	Crack	Radial	45 mm	Side B
Fig. 2.3	Crack	Radial	10 mm	Side B
Fig. 2.4	Crack	Radial	20 mm	Side B
Fig. 2.5	Corrosion	Rust	Ø300 mm	Side B and Side C
Fig. 2.6	Corrosion	Rust	Ø260 mm	Side B
Fig. 2.7	Crack	Axial	70 mm	Side A
Fig. 2.8	Corrosion	Rust	Ø100 mm	Side B and Side C
Fig. 2.9	Pitting	Small holes	-----	Side A
Fig. 2.10	Pitting	Small holes	-----	Side A
Fig. 2.11	Corrosion	Rust	Ø50 mm	Side B and Side C
Fig. 2.12	Corrosion	Rust	700 mm	Side A
Fig. 2.13	Corrosion	Rust	Ø80mm	Side B
Fig. 2.14	Corrosion	Rust	540 mm	Side A
Fig. 2.15	Buckling	Lateral deflection	3000 mm	Side B
Fig. 2.16	Crack	Tangential	300 mm	Weld Bead B
Fig. 2.17	Crack and Corrosion	Tangential crack and rust	300 mm	Weld Bead B
Fig. 2.18	Buckling	Lateral deflection	----	Side D

Table 2.1 Summary table of the localized defects on the arch beam A

3. DEFECTS ON THE ARCH BEAM “B”

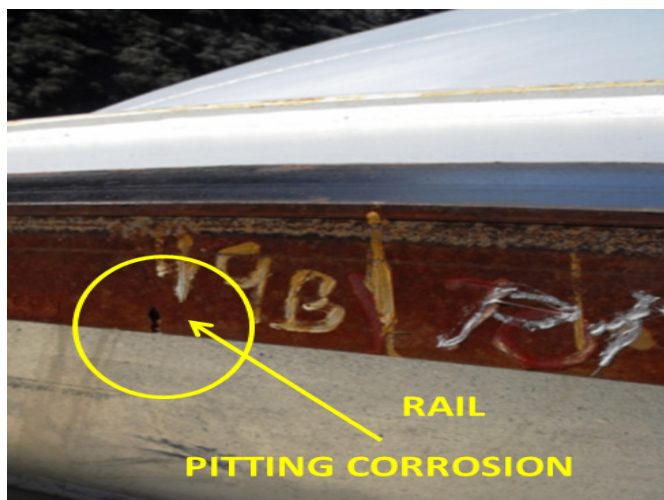


Fig. 3.1 Pitting. Rail

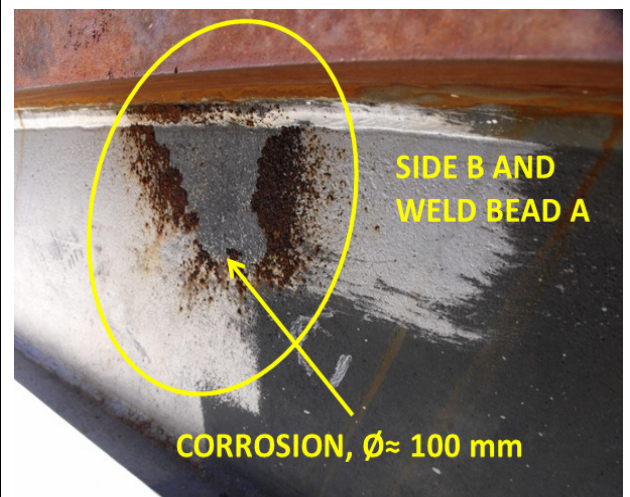


Fig. 3.2 Corrosion. Side B and weld bead A.

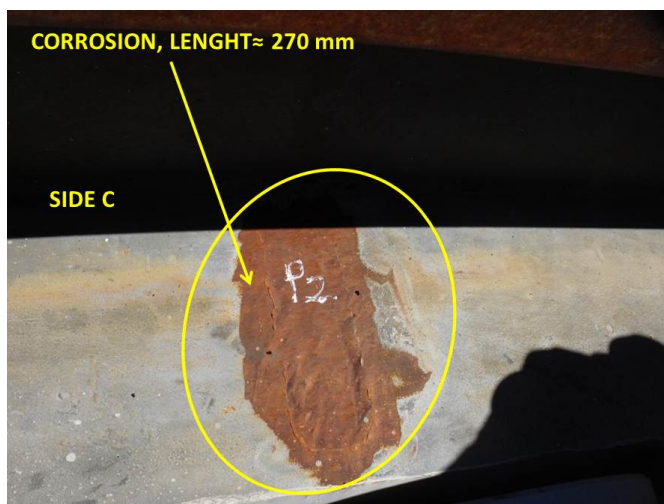


Fig. 3.3 Corrosion and Pitting. Side C.

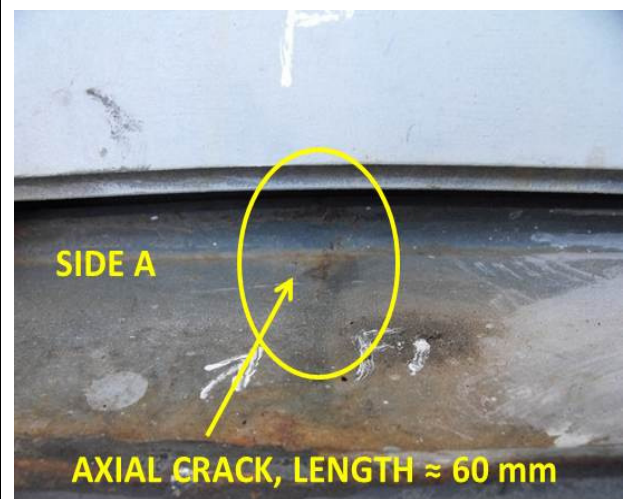


Fig. 3.4 Axial crack. Side A.

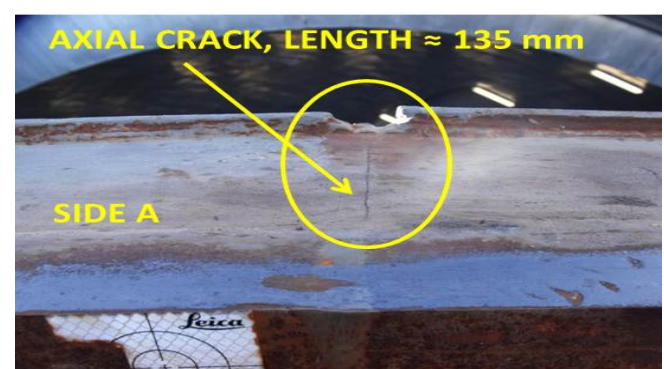


Fig. 3.5 Axial crack. Side A.

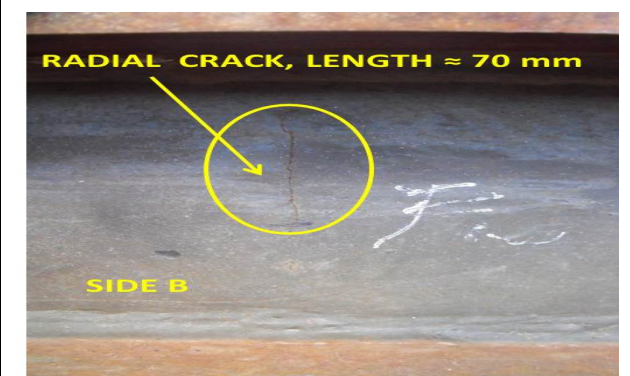


Fig. 3.6 Radial crack. Side B.

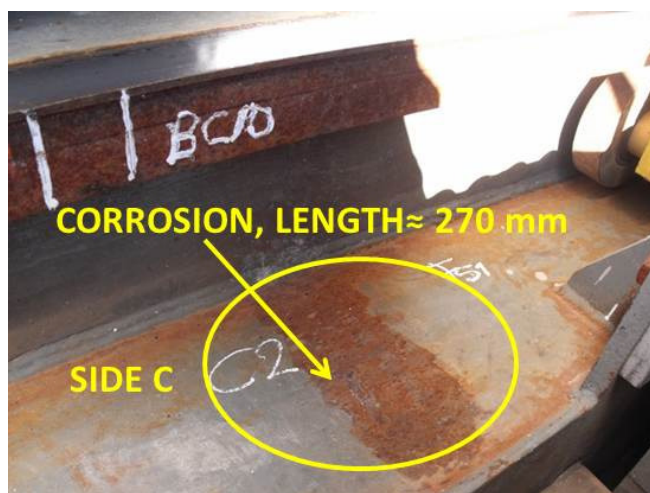


Fig. 3.7 Corrosion. Side C.

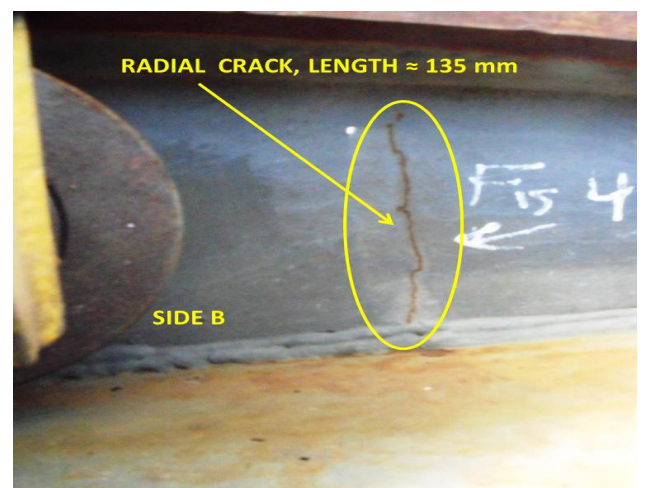


Fig. 3.8 Radial crack. Side B.

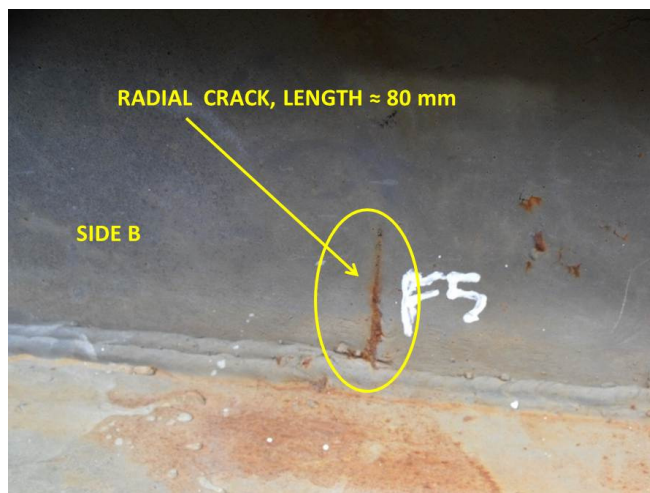


Fig. 3.9 Radial crack. Side B.

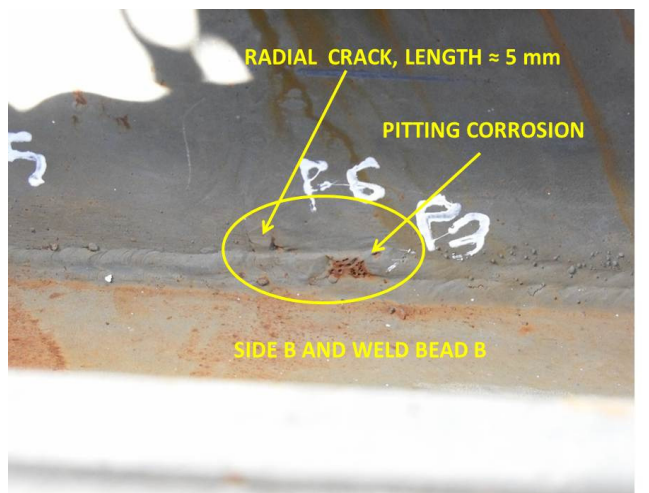


Fig. 3.10 Radial crack and Pitting. Side B and weld bead B.

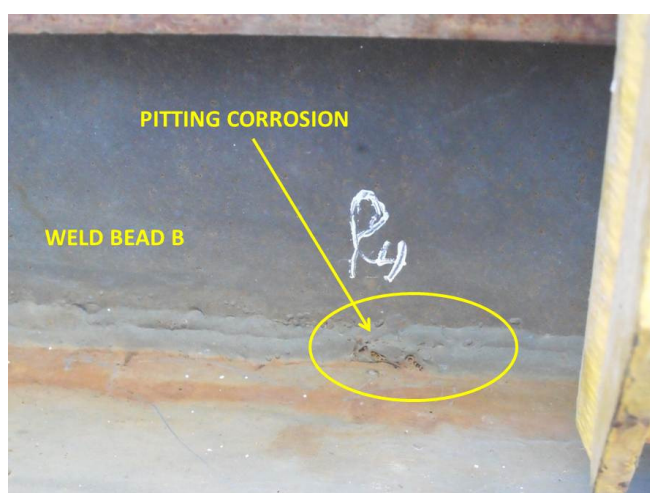


Fig. 3.11 Pitting. Weld bead B.



Fig. 3.12 Radial crack. Side B.



Fig. 3.13 Radial crack. Side B.

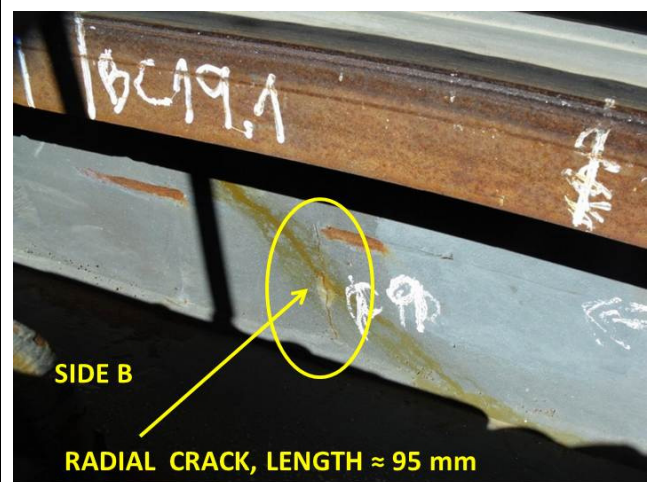


Fig. 3.14 Radial crack. Side B.

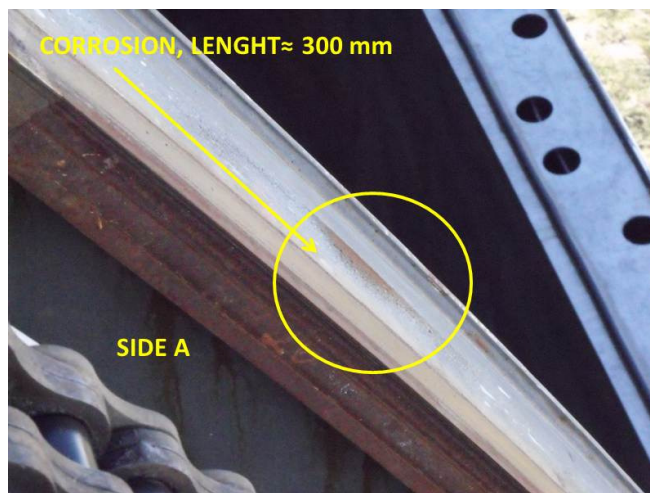


Fig. 3.15 Corrosion. Side A.

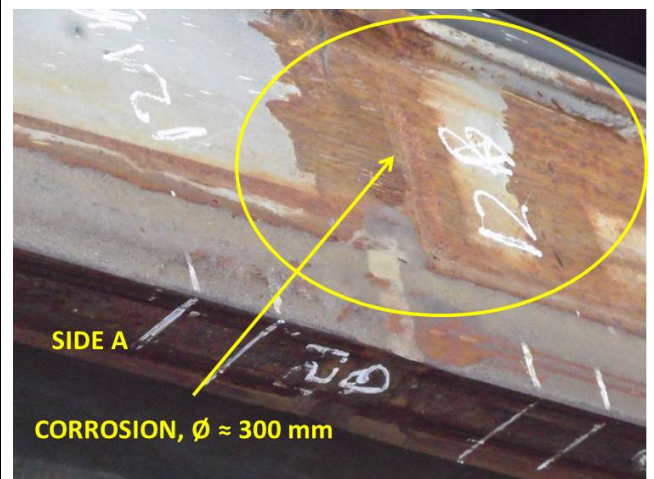


Fig. 3.16 Corrosion. Side A.

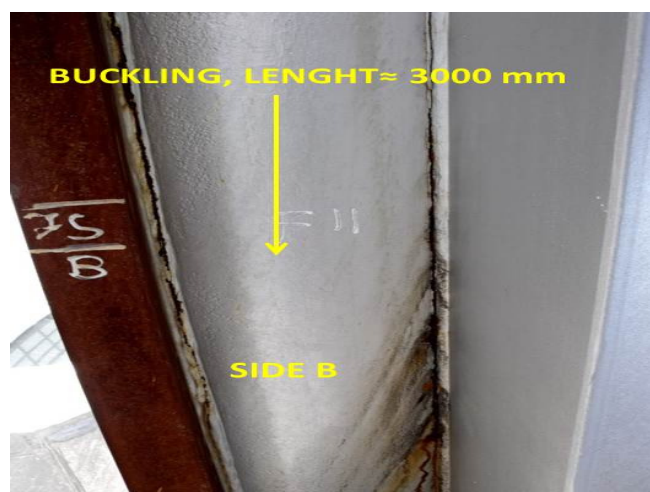


Fig. 3.17 Buckling. Side B.

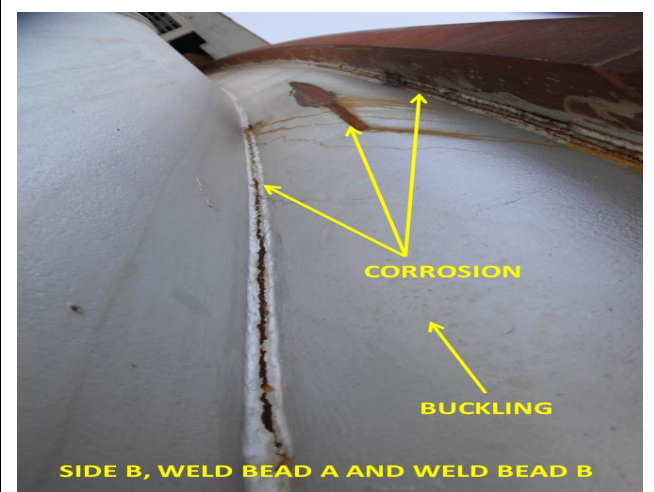


Fig. 3.18 Buckling and corrosion. Side B, weld bead A and weld bead B.

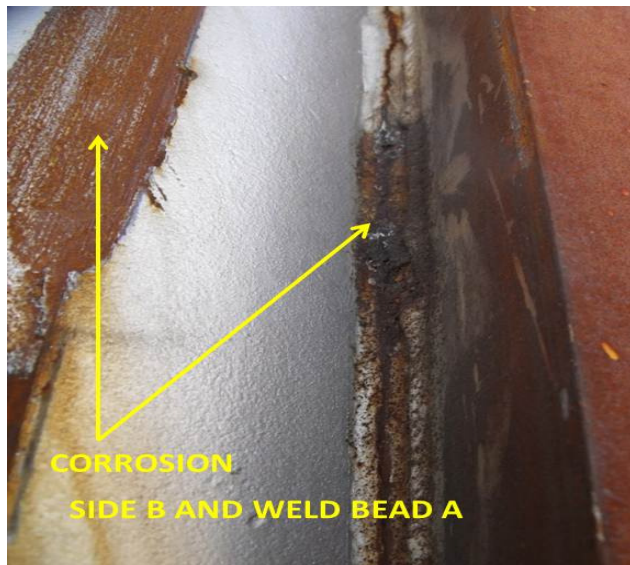


Fig. 3.19 Corrosion. Side A and weld bead B.



Fig. 3.20 Tangential crack. Weld bead B.

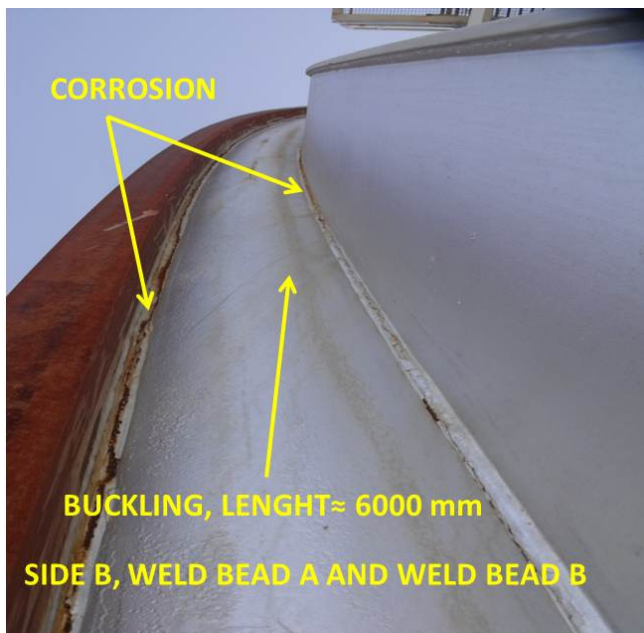


Fig. 3.21 Corrosion and Buckling. Side B, weld bead A and weld bead B.

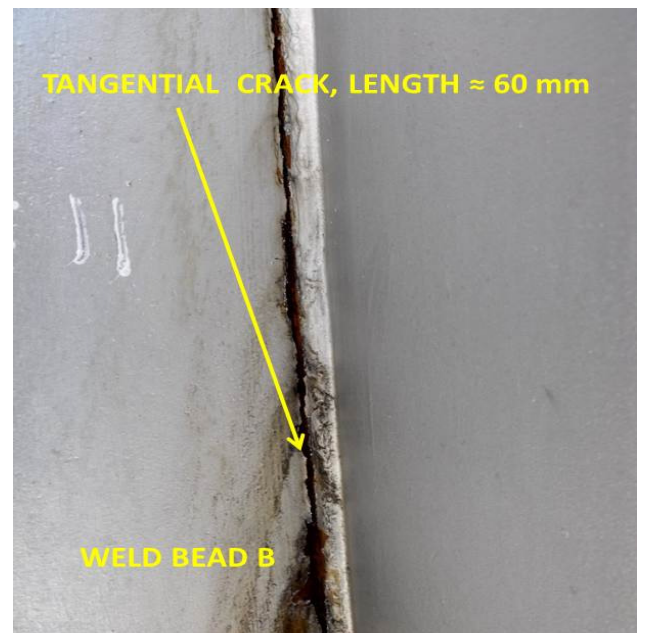


Fig. 3.22 Tangential crack. Weld bead B.

Identification	Pathology	Type	Approx. size	Location
Fig. 3.1	Pitting	Small holes	-----	Rail
Fig. 3.2	Corrosion	Rust	Ø100 mm	Side B and Weld bead A
Fig. 3.3	Corrosion and Pitting	Rust and small holes	270 mm	Side C
Fig. 3.4	Crack	Axial	60 mm	Side A
Fig. 3.5	Crack	Axial	135 mm	Side A
Fig. 3.6	Crack	Radial	70 mm	Side B
Fig. 3.7	Corrosion	Rust	270 mm	Side C
Fig. 3.8	Crack	Radial	135 mm	Side B
Fig. 3.9	Crack	Radial	80 mm	Side B
Fig. 3.10	Crack and Pitting	Radial crack and small holes	5 mm	Side B and Weld Bead B
Fig. 3.11	Pitting	Small holes	----	Weld bead B
Fig. 3.12	Crack	Radial	158 mm	Side B
Fig. 3.13	Crack	Radial	120 mm	Side B
Fig. 3.14	Crack	Radial	95 mm	Side B
Fig. 3.15	Corrosion	Rust	300 mm	Side A
Fig. 3.16	Corrosion	Rust	Ø 300 mm	Side A
Fig. 3.17	Buckling	Lateral deflection	3000 mm	Side B
Fig. 3.18	Corrosion and Buckling	Rust and lateral deflection	----	Side B, Weld Bead A and Weld Bead B
Fig. 3.19	Corrosion	Rust	----	Side B, Weld Bead A
Fig. 3.20	Crack	Tangencial	5 mm	Weld Bead B
Fig. 3.21	Corrosion and Buckling	Rust and lateral deflection	6000 mm	Side B, Weld Bead A and Weld Bead B
Fig. 3.22	Crack	Tangencial	60 mm	Weld Bead B

Table 3.1 Summary table of the localized defects on the arch beam B

4. SHUTTERS DEFECTS

This section presents a photographic report of the observed damages indicating the location and a short description of the defects. Photographic report refers to defects positions presented in fig. 1.5.



Fig. 4.1 Longitudinal crack. Weld bead.

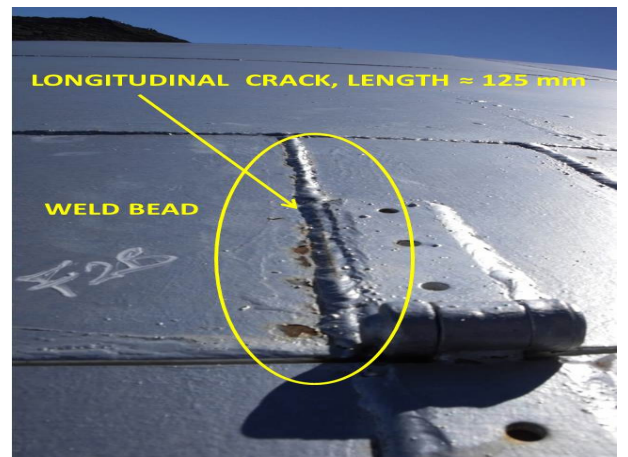


Fig. 4.2 Longitudinal crack. Weld bead.



Fig. 4.3 Longitudinal crack. Weld bead.

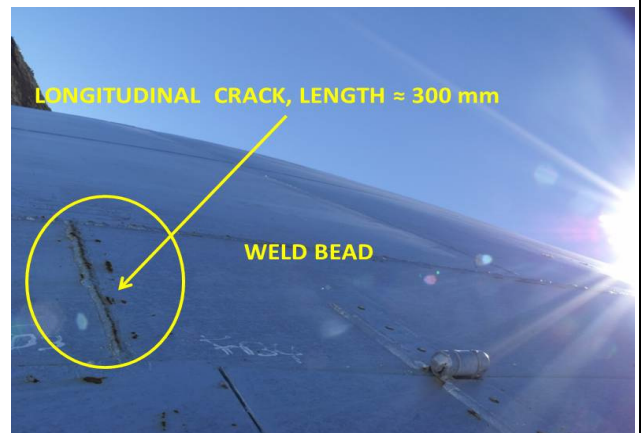


Fig. 4.4 Longitudinal crack. Weld bead.

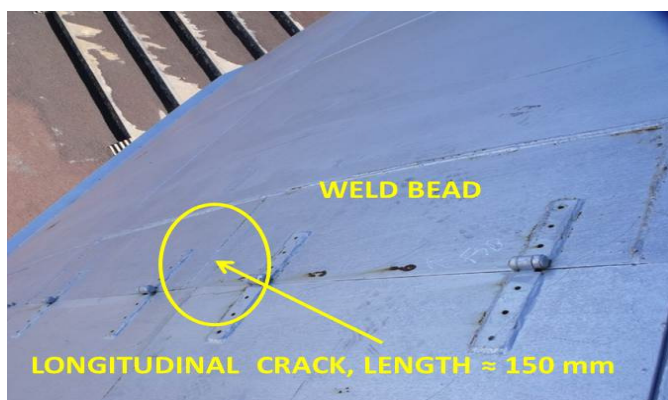


Fig. 4.5 Longitudinal crack. Weld bead.

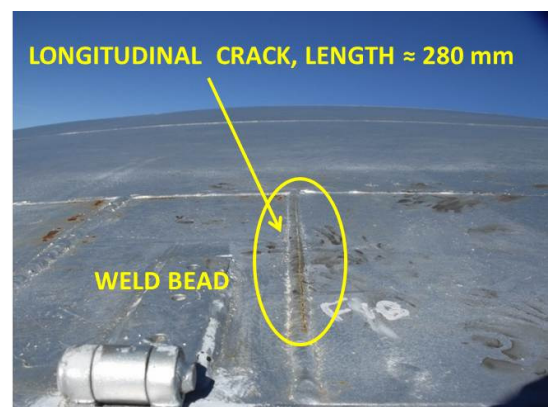


Fig. 4.6 Longitudinal crack. Weld bead.



Fig. 4.7 Longitudinal crack. Weld bead.

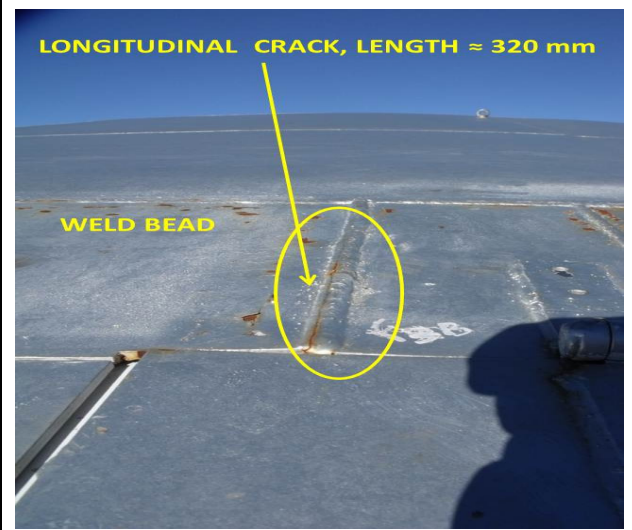


Fig. 4.8 Longitudinal crack. Weld bead.

Identification	Pathology	Type	Approx. size	Location
Fig. 4.1	Crack	Longitudinal	330 mm	Weld bead
Fig. 4.2	Crack	Longitudinal	125 mm	Weld bead
Fig. 4.3	Crack	Longitudinal	100 mm	Weld bead
Fig. 4.4	Crack	Longitudinal	300 mm	Weld bead
Fig. 4.5	Crack	Longitudinal	150 mm	Weld bead
Fig. 4.6	Crack	Longitudinal	280 mm	Weld bead
Fig. 4.7	Crack	Longitudinal	340 mm	Weld bead
Fig. 4.8	Crack	Longitudinal	320 mm	Weld bead

Table 4.1 Summary table of the localized defects on the Dome Upper Shutter

5. WIDESPREAD DEFECTS

After successive visual inspections, it has detected the presence of widespread corrosion in several points of the Dome. Corrosion is found on the steel plates that covering the dome and the shutters, corrosion on the support beams of external access platforms to the dome, etc.

The corrosion is present as rust and is a result of poor primer paint and paint absence in several areas of the dome. Other cause is the accumulation of water in several points as consequence of an inadequate evacuation of rainwater.



Fig. 5.1 Corrosion on the support beams of external access platforms

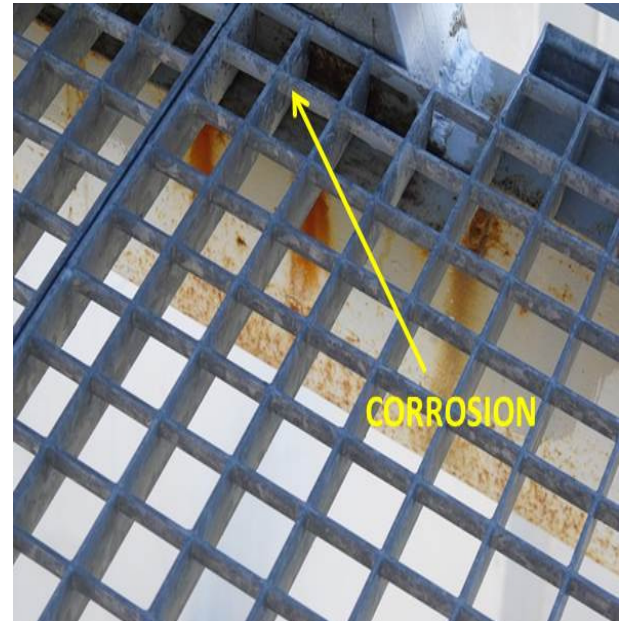


Fig. 5.2 Corrosion on the support beams of external access platforms



Fig. 5.3 Corrosion on the support beams of external access platforms

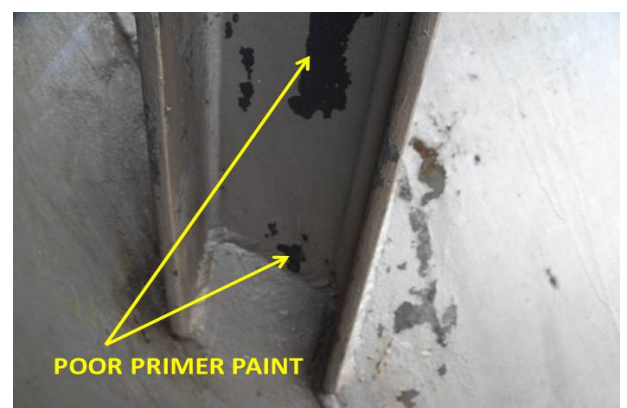


Fig. 5.4 Poor primer paint on the support beams of external access platforms

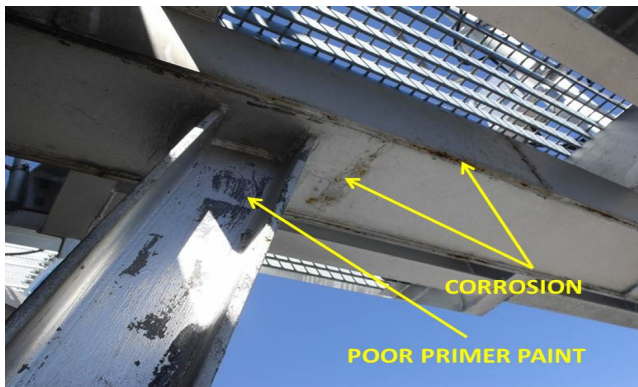


Fig. 5.5 Poor primer paint and corrosion on the support beams of external access platforms



Fig. 5.6 Poor primer paint and paint absence



Fig. 5.7 Poor primer paint and paint absence



Fig. 5.8 Poor primer paint and paint absence

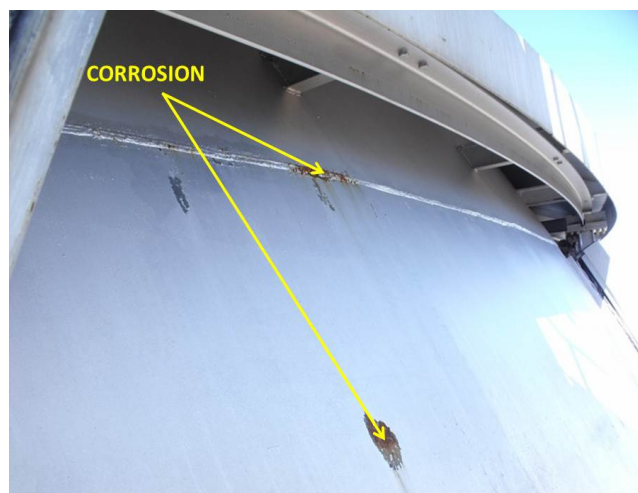


Fig. 5.9 Corrosion on the steel plates that covering the dome

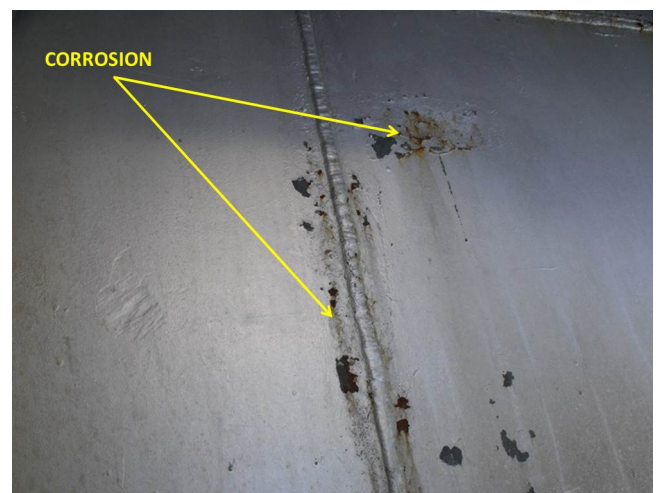


Fig. 5.10 Corrosion on the steel plates that covering the dome

6. ATTACHMENT

1	DR/XX-XX-XX/XXX	Corrosión and cracks on arch beams