

Article

A New Methodology for Inspection of Bridges in Linear Infrastructures from Optical Images and HD Videos Obtained by UAV

Supplementary Material:

Table S1. Sheet of general information.

| Code: | Logo (If any) |
|--|--|
| Reference: | |
| Bridge abutment 1 location (UTM coordinates) | X: Y: |
| Side 1 photograph | Side 2 photograph |
| Top view photogram | Bottom view photogram |
| Construction date: | Length of bridge: |
| Number of spans: | Maximum height of the columns: |
| Traffic on the bridge: Railway Road vehicles Mixed Pedestrian | Relevance of the upper track: Moderate Medium High |
| Lower circulation: Railway Road Natural feature: river, gorge... | Relevance of the lower track (if any): Moderate Medium High |
| Bridge abutment type Masonry Concrete Reinforced earth wall | Bridge columns (piers) type Masonry Concrete Metal Composite None |
| Bridge superstructure (deck/arch) Masonry Concrete Metal Composite | Steel cables elements Cable-stayed bridge Suspension bridges None |
| Bridge road pavement Masonry Concrete Asphalt pavement Without pavement Not available | Parapet/handrail Masonry Concrete Metal Composite None |
| Bearing Composite neoprene/steel | Expansion joint: Yes |

| | |
|---------------|-----------------------------------|
| Lead | None |
| None | Not available |
| Not available | |
| Wing walls | |
| Concrete | |
| Metal | Number of bridge columns (piers): |
| None | |

Table S2. Potential damages that can affect the different parts of a bridge made of masonry (M).

| Damage | Structural element | | | | | |
|--|--------------------|--------|----------------|--------|-------------------|----------|
| | Abutment | Column | Deck (or arch) | Cables | Parapet/hand-rail | Pavement |
| M1. Mortar joints degradation | X | X | X | - | X | X |
| M2. Biological growth in joints | X | X | X | - | X | X |
| M3. Stone degradation | X | X | X | - | X | X |
| M4. Efflorescence in joints | X | X | X | - | X | - |
| M5. Efflorescence in masonry stones | X | X | X | - | X | - |
| M6. Mineral precipitation in joints (speleothems) | X | X | X | - | - | - |
| M7. Lichens growth | X | X | X | - | X | X |
| M8. Loss and/or disengage of masonry stones | X | X | X | - | X | - |
| M9. Erosion or scour of columns and/or abutments | X | X | - | - | - | - |
| M10. Damp and seepage through abutments | X | - | - | - | - | - |
| M11. Displacement of the beam or the elastomeric bearing pad | X | X | - | - | - | - |
| M12. Elastomeric bearing pad degradation | X | X | - | - | - | - |

For each type of damage of the masonry elements (M1 to M12) the general damage state of the element must be stated according to next criteria:

Table S2.1. Damage M1: Mortar joints degradation.

| |
|--|
| A. Damage spreading: |
| 1. None/limited: none or some joints (<10% of the area) |
| 2. Moderate: Some areas (10-50%) |
| 3. Widespread (> 50%) |
| B. Level of damage: |
| 1. None/low: none or only discolouration |
| 2. Moderate: weathering (the mortar looks like a sandy soil) |
| 3. High/very high: disintegration of joints |
| C. Risk |
| R1. None/low: A1/B1, A1/B2, A2/B1, A3/B1 |
| R2. Moderate: A1/B3, A2/B2, A3/B2 |

| |
|---|
| R3. High/very high: A2/B3, A3/B3: R3 |
| IC. Intervention criteria (recommendation) |
| IC1. New regular inspection (frequency according to the age of the bridge): R1 |
| IC2. A detailed inspection by specialised engineer is needed, with auxiliary means if necessary: R2 |
| IC3. An URGENT detailed inspection by specialised engineer is needed, with auxiliary means if necessary: R3 |

Table S2.2. Damage M2: Biological growth in joints

| |
|---|
| A. Damage spreading: |
| 1. None/limited: none or some joints (<10% of the area) |
| 2. Moderate: Some areas (10-50%) |
| 3. Widespread (> 50%) |
| B. Level of damage |
| 1. None/low: Without biological growth or only non-woody plants with small root |
| 2. Moderate: small woody plants |
| 3. High/very high: woody plants that can open up joints and dislodge stones |
| C. Risk |
| R1. None/low: A1/B1, A1/B2, A2/B1, A3/B1 |
| R2. Moderate: A1/B3, A2/B2, A3/B2 |
| R3. High/very high: A2/B3, A3/B3 |
| IC. Intervention criteria (recommendation) |
| IC1. New regular inspection (frequency according to the age of the bridge): R1 |
| IC2. A detailed inspection by specialised engineer is needed, with auxiliary means if necessary: R2 |
| IC3. An URGENT detailed inspection by specialised engineer is needed, with auxiliary means if necessary: R3 |

Table S2.3. Damage M3: Stone degradation

| |
|---|
| A. Damage spreading: |
| 1. None/limited: none or some stones (<10% of the area) |
| 2. Moderate: Some areas (10-50%) |
| 3. Widespread (> 50%) |
| B. Level of damage |
| 1. None/low: none or only discolouration |
| 2. Moderate: slight spalling or weathering |
| 3. High/very high: important spalling or weathering |
| C. Risk |
| R1. None/low: A1/B1, A1/B2, A2/B1, A3/B1 |
| R2. Moderate: A1/B3, A2/B2, A3/B2 |
| R3. High/very high: A2/B3, A3/B3 |
| IC. Intervention criteria (recommendation) |
| IC1. New regular inspection (frequency according to the age of the bridge): R1 |
| IC2. A detailed inspection by specialised engineer is needed, with auxiliary means if necessary: R2 |
| IC3. An URGENT detailed inspection by specialised engineer is needed, with auxiliary means if necessary: R3 |

Table S2.4. Damage M4: Efflorescence in joints

| |
|--|
| A. Damage spreading: |
| 1. None/limited: none or some stone (<10% of the area) |
| 2. Moderate: Some areas (10-50%) |
| 3. Widespread (> 50%) |
| B. Level of damage |
| 1. None/low: none or some salt crystallisation |
| 2. Moderate: light to medium salt crystallization |
| 3. High/very high: dense salt crystallization |
| C. Risk |
| R1. None/low: A1/B1, A1/B2, A2/B1, A3/B1, A1/B3 |
| R2. Moderate: A2/B2, A3/B2, A2/B3, A3/B3 |
| R3. High/very high: - |
| IC. Intervention criteria (recommendation) |
| IC1. New regular inspection (frequency according to the age of the bridge): R1 |
| IC2. A detailed inspection by specialised engineer is needed, with auxiliary means if necessary: R2 |
| IC3. An URGENT detailed inspection by specialised engineer is needed, with auxiliary means if necessary: - |

Table S2.5. Damage M5: Efflorescence in masonry stones

| |
|--|
| A. Damage spreading: |
| 1. None/limited: none or some stones (<10% of the area) |
| 2. Moderate: Some areas (10-50%) |
| 3. Widespread (> 50%) |
| B. Level of damage |
| 1. None/low: none or some salt crystallisation |
| 2. Moderate: light to medium salt crystallisation |
| 3. High/very high: dense salt crystallisation |
| C. Risk |
| R1. None/low: A1/B1, A1/B2, A2/B1, A3/B1, A1/B3 |
| R2. Moderate: A2/B2, A3/B2, A2/B3, A3/B3 |
| R3. High/very high: - |
| IC. Intervention criteria (recommendation) |
| IC1. New regular inspection (frequency according to the age of the bridge): R1 |
| IC2. A detailed inspection by specialised engineer is needed, with auxiliary means if necessary: R2 |
| IC3. An URGENT detailed inspection by specialised engineer is needed, with auxiliary means if necessary: - |

Table S2.6. Damage M6: Mineral precipitation in joints (speleothems).

| |
|---|
| A. Damage spreading: |
| 1. None/limited: none or some joints (<10% of the area) |
| 2. Moderate: Some areas (10-50%) |
| 3. Widespread (> 50%) |
| B. Level of damage |
| 1. None/low: none or some mineral precipitation |
| 2. Moderate: light to medium mineral precipitation |
| 3. High/very high: high-volume precipitation, higher than the joint |
| C. Risk |

| |
|--|
| R1. None/low: A1/B1, A1/B2, A2/B1, A3/B1, A1/B3, A2/B2, A3/B2 |
| R2. Moderate: A2/B3, A3/B3 |
| R3. High/very high: - |
| IC. Intervention criteria (recommendation) |
| IC1. New regular inspection (frequency according to the age of the bridge): R1 |
| IC2. A detailed inspection by specialised engineer is needed, with auxiliary means if necessary: R2 |
| IC3. An URGENT detailed inspection by specialised engineer is needed, with auxiliary means if necessary: - |

Table S2.7. Damage M7: Lichens growth

| |
|--|
| A. Damage spreading: |
| 1. None/limited: none or some small area (<10% of the area) |
| 2. Moderate: Some areas (10-50%) |
| 3. Widespread (> 50%) |
| B. Level of damage |
| 1. None/low: none or low-density colonisation |
| 2. Moderate: medium-density colonisation |
| 3. High/very high: high-density colonisation |
| C. Risk |
| R1. None/low: A1/B1, A1/B2, A2/B1, A3/B1, A1/B3, A2/B2, A3/B2 |
| R2. Moderate: A2/B3, A3/B3 |
| R3. High/very high: - |
| IC. Intervention criteria (recommendation) |
| IC1. New regular inspection (frequency according to the age of the bridge): R1 |
| IC2. A detailed inspection by specialised engineer is needed, with auxiliary means if necessary: R2 |
| IC3. An URGENT detailed inspection by specialised engineer is needed, with auxiliary means if necessary: - |

Table S2.8. Damage M8: Loss or movement of masonry stones.

| |
|---|
| A. Damage spreading: |
| 1. None/limited: none or some stone (<10% of the area) |
| 2. Moderate: Some areas (10-50%) |
| 3. Widespread (> 50%) |
| B. Level of damage |
| 1. None/low: none or slight displacement |
| 2. Moderate: displacements lower than 1 cm |
| 3. High/very high: displacements higher than 1 cm or detachments |
| C. Risk |
| R1. None/low: A1/B1, A1/B2, A2/B1, A3/B1 |
| R2. Moderate: A2/B2, A3/B2 |
| R3. High/very high: A1/B3, A2/B3, A3/B3 |
| IC. Intervention criteria (recommendation) |
| IC1. New regular inspection (frequency according to the age of the bridge): R1 |
| IC2. A detailed inspection by specialised engineer is needed, with auxiliary means if necessary: R2 |
| IC3. An URGENT detailed inspection by specialised engineer is needed, with auxiliary means if necessary: R3 |

Table S2.9. Damage M9: Erosion or scour of columns and/or abutments.

| |
|---|
| A. Damage spreading: |
| 1. None/limited: none or some stone (<10% of the area) |
| 2. Moderate: Some areas (10-50%) |
| 3. Widespread (> 50%) |
| B. Level of damage |
| 1. None/low: None or slight erosion |
| 2. Moderate: Depth of the erosion lower than 1/3 of the column or abutment |
| 3. High/very high: Depth of the erosion lower than 1/3 of the column or abutment |
| C. Risk |
| R1. None/low: A1/B1, A2/B1, A3/B1 |
| R2. Moderate: A1/B2, A2/B2, A3/B2 |
| R3. High/very high: A1/B3, A2/B3, A3/B3 |
| IC. Intervention criteria (recommendation) |
| IC1. New regular inspection (frequency according to the age of the bridge): R1 |
| IC2. A detailed inspection by specialised engineer is needed, with auxiliary means if necessary: R2 |
| IC3. An URGENT detailed inspection by specialised engineer is needed, with auxiliary means if necessary: R3 |

Table S2.10. Damage M10: Damp and seepage through abutments

| |
|---|
| A. Damage spreading: |
| 1. None/limited: none or some small area (<10% of the area) |
| 2. Moderate: Some areas (10-50%) |
| 3. Widespread (> 50%) |
| B. Level of damage |
| 1. None/low: dry or slightly humid |
| 2. Moderate: dripping |
| 3. High/very high: flowing |
| C. Risk |
| R1. None/low: A1/B1, A2/B1, A3/B1 |
| R2. Moderate: A1/B2, A2/B2, A3/B2, A1/B3 |
| R3. High/very high: A2/B3, A3/B3 |
| IC. Intervention criteria (recommendation) |
| IC4. New regular inspection (frequency according to the age of the bridge): R1 |
| IC5. A detailed inspection by a specialised engineer is needed, with auxiliary means if necessary: R2 |
| IC6. An URGENT detailed inspection by a specialised engineer is needed, with auxiliary means if necessary: R3 |

Table S2.11. Damage M11: Displacement of the beam or the elastomeric bearing pad.

| |
|---|
| A. Damage spreading: |
| 1. None/limited: none or some small displacement (<10% of the area) |
| 2. Moderate: Some deck areas or beams (10-50%) |
| 3. Widespread (> 50%) |
| B. Level of damage |
| 1. None/low: slight displacement |
| 2. Moderate: displacement lower than 1/3 rd of the support |

| |
|---|
| 3. High/very high: displacement higher than 1/3 rd of the support |
| C. Risk |
| R1. None/low: A1/B1, A2/B1, A3/B1 |
| R2. Moderate: A1/B2, A2/B2, A3/B2, |
| R3. High/very high: A1/B3, A2/B3, A3/B3 |
| IC. Intervention criteria (recommendation) |
| IC1. New regular inspection (frequency according to the age of the bridge): R1 |
| IC2. A detailed inspection by a specialised engineer is needed, with auxiliary means if necessary: R2 |
| IC3. An URGENT detailed inspection by a specialised engineer is needed, with auxiliary means if necessary: R3 |

Table S2.12. Damage M12: Elastomeric bearing pad degradation

| |
|---|
| A. Damage spreading: |
| 1. None/limited: none or some affected elements (<10% of the area) |
| 2. Moderate: Some deck areas or beams (10-50%) |
| 3. Widespread (> 50%) |
| B. Level of damage |
| 1. None/low: slight displacement |
| 2. Moderate: elastomeric bearing pad damaged and/or steel slightly deformed |
| 3. High/very high: bearing pad damaged and/or steel slightly clearly deformed |
| C. Risk |
| R1. None/low: A1/B1, A2/B1, A3/B1 |
| R2. Moderate: A1/B2, A2/B2, A3/B2, |
| R3. High/very high: A1/B3, A2/B3, A3/B3 |
| IC. Intervention criteria (recommendation) |
| IC1. New regular inspection (frequency according to the age of the bridge): R1 |
| IC2. A detailed inspection by a specialised engineer is needed, with auxiliary means if necessary: R2 |
| IC3. An URGENT detailed inspection by a specialised engineer is needed, with auxiliary means if necessary: R3 |

Table S3. Potential damages that can affect the different parts of a bridge made of concrete (C).

| Damage | Structural element | | | | | |
|---|--------------------|--------|----------------|--------|---------------------|----------|
| | Abutment | Column | Deck (or arch) | Cables | Parapet / handrails | Pavement |
| C1. Cracks due to reinforcement corrosion | X | X | X | - | X | X |
| C2. Concrete spalling due to reinforcement corrosion | X | X | X | - | X | X |
| C3. Breaks caused by impacts | X | X | X | - | X | X |
| C4. Rust stains due to lack of covering in structural reinforcement | X | X | X | - | X | X |
| C5. Rust stains due to lack of covering in the formwork connectors | X | X | X | - | X | - |
| C6. Efflorescence | X | X | X | - | X | X |



| | | | | | | |
|--|---|---|---|---|---|---|
| C7. Lichens growth | X | X | X | - | X | |
| C8. Erosion or scour of columns and/or abutments | X | X | - | - | - | - |
| C9. Damp and seepage through abutments | X | - | - | - | - | - |
| C10. Displacement of the beam or the elastomeric bearing pad | X | X | - | - | - | - |
| C11. Elastomeric bearing pad degradation | X | X | - | - | - | - |
| 12. Structural damage due to compression failure | X | X | - | - | - | - |
| C13. Structural damage caused by earth pressures on wing abutment walls without joints | X | - | - | - | - | - |
| C14. Structural damage caused by bending moments | - | - | X | - | - | - |
| C15. Structural damage by shear failure | - | - | X | - | - | - |
| C16. Structural damage of the shear key due to deck push | - | - | X | - | - | - |
| C17. Bridge expansion joint damage | - | - | X | - | - | - |

For each type of damage of the concrete elements (C1 to C17) the general damage state of the element must be stated according to next criteria:

Table S3.1. Damage C1: Cracks due to reinforcement corrosion.

| |
|---|
| A. Damage spreading: |
| 1. None/limited: none or some small crack (<10% of the area) |
| 2. Moderate: Some areas affected (10-50%) |
| 3. Widespread (> 50%) |
| B. Level of damage |
| 1. None/low: Cracks opening less than 0.2 mm |
| 2. Moderate: Cracks opening less than 1.0 mm |
| 3. High/very high: Cracks opening higher than 1.0 mm |
| C. Risk |
| R1. None/low: A1/B1, A1/B2, A2/B1, A3/B1 |
| R2. Moderate: A1/B3, A2/B2, A3/B2 |
| R3. High/very high: A2/B3, A3/B3 |
| IC. Intervention criteria (recommendation) |
| IC1. New regular inspection (frequency according to the age of the bridge): R1 |
| IC2. A detailed inspection by a specialised engineer is needed, with auxiliary means if necessary: R2 |
| IC3. An URGENT detailed inspection by a specialised engineer is needed, with auxiliary means if necessary: R3 |

Table S3.2. Damage C2: Concrete spalling due to reinforcement corrosion.

| |
|---|
| A. Damage spreading: |
| 1. None/limited: none or some small spalling (<10% of the area) |
| 2. Moderate: Some areas affected (10-50%) |

| |
|---|
| 3. Widespread (> 50%) |
| B. Level of damage |
| 1. None/low: spallings that do not reveal reinforcements |
| 2. Moderate: spallings reveal reinforcements in a length lower than 10 cm |
| 3. High/very high: spallings reveal reinforcements in a length higher than 10 cm |
| C. Risk |
| R1. None/low: A1/B1, A1/B2, A2/B1, A3/B1 |
| R2. Moderate: A1/B3, A2/B2, A3/B2 |
| R3. High/very high: A2/B3, A3/B3 |
| IC. Intervention criteria (recommendation) |
| IC1. New regular inspection (frequency according to the age of the bridge): R1 |
| IC2. A detailed inspection by specialised engineer is needed, with auxiliary means if necessary: R2 |
| IC3. An URGENT detailed inspection by specialised engineer is needed, with auxiliary means if necessary: R3 |

Table S3.3. Damage C3: Failure caused by impacts.

| |
|---|
| A. Damage spreading: |
| 1. None/limited: none or some small breaks (<10% of the area) |
| 2. Moderate: Some areas affected (10-50%) |
| 3. Widespread (> 50%) |
| B. Level of damage |
| 1. None/low: some breaks that do not reveal reinforcements |
| 2. Moderate: spallings reveal reinforcements, but reinforcements are not corroded |
| 3. High/very high: spallings reveal reinforcements and they are corroded |
| C. Risk |
| R1. None/low: A1/B1, A1/B2, A2/B1, A3/B1, A2/B2 |
| R2. Moderate: A1/B3, A3/B2 |
| R3. High/very high: A2/B3, A3/B3 |
| IC. Intervention criteria (recommendation) |
| IC1. New regular inspection (frequency according to the age of the bridge): R1 |
| IC2. A detailed inspection by specialised engineer is needed, with auxiliary means if necessary: R2 |
| IC3. An URGENT detailed inspection by specialised engineer is needed, with auxiliary means if necessary: R3 |

Table S3.4. Damage C4: Rust stains due to lack of covering in structural reinforcement.

| |
|--|
| A. Damage spreading: |
| 1. None/limited: none or some stain (<10% of the area) |
| 2. Moderate: Some areas affected (10-50%) |
| 3. Widespread (> 50%) |
| B. Level of damage |
| 1. None/low: some rust spots |
| 2. Moderate: rust linear stains whose width is lower than 5 mm |
| 3. High/very high: rust linear stains whose width is lower than 5 mm |
| C. Risk |
| R1. None/low: A1/B1, A1/B2, A2/B1, A3/B1 |
| R2. Moderate: A1/B3, A2/B2, A3/B2, A2/B3, A3/B3 |
| R3. High/very high: - |

| |
|--|
| IC. Intervention criteria (recommendation) |
| IC1. New regular inspection (frequency according to the age of the bridge): R1 |
| IC2. A detailed inspection by specialised engineer is needed, with auxiliary means if necessary: R2 |
| IC3. An URGENT detailed inspection by specialised engineer is needed, with auxiliary means if necessary: - |

Table S3.5. Damage C5: Rust stains due to lack of covering in the formwork connectors.

| |
|--|
| A. Damage spreading: |
| 1. None/limited: none or some stain (<10% of the area) |
| 2. Moderate: Some areas affected (10-50%) |
| 3. Widespread (> 50%) |
| B. Level of damage |
| 1. None/low: some rust spots |
| 2. Moderate: circular rust stains |
| 3. High/very high: rust stains with rust flows |
| C. Risk |
| R1. None/low: A1/B1, A1/B2, A2/B1, A3/B1, A1/B3, A2/B2, A3/B2 |
| R2. Moderate: A2/B3, A3/B3 |
| R3. High/very high: - |
| IC. Intervention criteria (recommendation) |
| IC1. New regular inspection (frequency according to the age of the bridge): R1 |
| IC2. A detailed inspection by specialised engineer is needed, with auxiliary means if necessary: R2 |
| IC3. An URGENT detailed inspection by specialised engineer is needed, with auxiliary means if necessary: - |

Table S3.6. Damage C6: Efflorescence.

| |
|--|
| A. Damage spreading: |
| 1. None/limited: none or some stones (<10% of the area) |
| 2. Moderate: Some areas (10-50%) |
| 3. Widespread (> 50%) |
| B. Level of damage |
| 1. None/low: none or some salt crystallisation |
| 2. Moderate: light to medium salt crystallisation |
| 3. High/very high: dense salt crystallisation |
| C. Risk |
| R1. None/low: A1/B1, A1/B2, A2/B1, A3/B1, A1/B3 |
| R2. Moderate: A2/B2, A3/B2, A2/B3, A3/B3 |
| R3. High/very high: - |
| IC. Intervention criteria (recommendation) |
| IC1. New regular inspection (frequency according to the age of the bridge): R1 |
| IC2. A detailed inspection by specialised engineer is needed, with auxiliary means if necessary: R2 |
| IC3. An URGENT detailed inspection by specialised engineer is needed, with auxiliary means if necessary: - |

Table S3.7. Damage C7: Lichens growth.

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|----------------------|
| A. Damage spreading: |
|----------------------|

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|--|
| 1. None/limited: none or some small area (<10% of the area) |
| 2. Moderate: Some areas (10-50%) |
| 3. Widespread (> 50%) |
| B. Level of damage |
| 1. None/low: none or low-density colonisation |
| 2. Moderate: medium-density colonisation |
| 3. High/very high: high-density colonisation |
| C. Risk |
| R1. None/low: A1/B1, A1/B2, A2/B1, A3/B1, A1/B3, A2/B2, A3/B2 |
| R2. Moderate: A2/B3, A3/B3 |
| R3. High/very high: - |
| IC. Intervention criteria (recommendation) |
| IC1. New regular inspection (frequency according to the age of the bridge): R1 |
| IC2. A detailed inspection by specialised engineer is needed, with auxiliary means if necessary: R2 |
| IC3. An URGENT detailed inspection by specialised engineer is needed, with auxiliary means if necessary: - |

Table S3.8. Damage C8: Erosion or scour of columns and/or abutments.

| |
|---|
| A. Damage spreading: |
| 1. None/limited: none or some stone (<10% of the area) |
| 2. Moderate: Some areas (10-50%) |
| 3. Widespread (> 50%) |
| B. Level of damage |
| 1. None/low: None or slight erosion |
| 2. Moderate: Depth of the erosion lower than 1/3 of the column or abutment |
| 3. High/very high: Depth of the erosion lower than 1/3 of the column or abutment |
| C. Risk |
| R1. None/low: A1/B1, A2/B1, A3/B1 |
| R2. Moderate: A1/B2, A2/B2, A3/B2 |
| R3. High/very high: A1/B3, A2/B3, A3/B3 |
| IC. Intervention criteria (recommendation) |
| IC1. New regular inspection (frequency according to the age of the bridge): R1 |
| IC2. A detailed inspection by specialised engineer is needed, with auxiliary means if necessary: R2 |
| IC3. An URGENT detailed inspection by specialised engineer is needed, with auxiliary means if necessary: R3 |

Table S3.9. Damage C9: Damp and seepage through abutments.

| |
|---|
| A. Damage spreading: |
| 1. None/limited: none or some small area (<10% of the area) |
| 2. Moderate: Some areas (10-50%) |
| 3. Widespread (> 50%) |
| B. Level of damage |
| 1. None/low: dry or slightly humid |
| 2. Moderate: dripping |
| 3. High/very high: flowing |
| C. Risk |
| R1. None/low: A1/B1, A2/B1, A3/B1 |

| |
|---|
| R2. Moderate: A1/B2, A2/B2, A3/B2, A1/B3 |
| R3. High/very high: A2/B3, A3/B3 |
| IC. Intervention criteria (recommendation) |
| IC1. New regular inspection (frequency according to the age of the bridge): R1 |
| IC2. A detailed inspection by specialised engineer is needed, with auxiliary means if necessary: R2 |
| IC3. An URGENT detailed inspection by specialised engineer is needed, with auxiliary means if necessary: R3 |

Table S3.10. Damage C10: Displacement of the beam or the elastomeric bearing pad.

| |
|---|
| A. Damage spreading: |
| 1. None/limited: none or some small displacement (<10% of the area) |
| 2. Moderate: Some deck areas or beams (10-50%) |
| 3. Widespread (> 50%) |
| B. Level of damage |
| 1. None/low: slight displacement |
| 2. Moderate: displacement lower than 1/3 rd of the support |
| 3. High/very high: displacement higher than 1/3 rd of the support |
| C. Risk |
| R1. None/low: A1/B1, A2/B1, A3/B1 |
| R2. Moderate: A1/B2, A2/B2, A3/B2, |
| R3. High/very high: A1/B3, A2/B3, A3/B3 |
| IC. Intervention criteria (recommendation) |
| IC1. New regular inspection (frequency according to the age of the bridge): R1 |
| IC2. A detailed inspection by specialised engineer is needed, with auxiliary means if necessary: R2 |
| IC3. An URGENT detailed inspection by specialised engineer is needed, with auxiliary means if necessary: R3 |

Table S3.11. Damage C11: Elastomeric bearing pad degradation .

| |
|---|
| A. Damage spreading: |
| 1. None/limited: none or some affected elements (<10% of the area) |
| 2. Moderate: Some deck areas or beams (10-50%) |
| 3. Widespread (> 50%) |
| B. Level of damage |
| 1. None/low: slight displacement |
| 2. Moderate: elastomeric bearing pad damaged and/or steel slightly deformed |
| 3. High/very high: bearing pad damaged and/or steel slightly clearly deformed |
| C. Risk |
| R1. None/low: A1/B1, A2/B1, A3/B1 |
| R2. Moderate: A1/B2, A2/B2, A3/B2, |
| R3. High/very high: A1/B3, A2/B3, A3/B3 |
| IC. Intervention criteria (recommendation) |
| IC1. New regular inspection (frequency according to the age of the bridge): R1 |
| IC2. A detailed inspection by specialised engineer is needed, with auxiliary means if necessary: R2 |
| IC3. An URGENT detailed inspection by specialised engineer is needed, with auxiliary means if necessary: R3 |

Table S3.12. Damage C12: Structural damage due to compression failure.

| |
|---|
| A. Damage spreading: |
| 1. None/limited: none or some crack (<10% of the area) |
| 2. Moderate: Some areas affected (10-50%) |
| 3. Widespread (> 50%) |
| B. Level of damage |
| 1. None/low: Thin cracks (independent vertical cracks or sloped 45°) |
| 2. Moderate: Crack opening lower than 1 mm (independent vertical cracks or sloped 45°) |
| 3. High/very high: Crack opening higher than 1 mm (independent vertical cracks or sloped 45°) |
| C. Risk |
| R1. None/low: - |
| R2. Moderate: A1/B1, A1/B2, A2/B1, A3/B1, A2/B2, A3/B2 |
| R3. High/very high: A1/B3, A2/B3, A3/B3 |
| IC. Intervention criteria (recommendation) |
| IC1. New regular inspection (frequency according to the age of the bridge): R1 |
| IC2. A detailed inspection by specialised engineer is needed, with auxiliary means if necessary: R2 |
| IC3. An URGENT detailed inspection by specialised engineer is needed, with auxiliary means if necessary: R3 |

Table S3.13. Damage C13: Structural damage caused by earth pressures on wing abutment walls without joints

| |
|---|
| A. Damage spreading: |
| 1. None/limited: none or some crack (<10% of the area) |
| 2. Moderate: Some areas affected (10-50%) |
| 3. Widespread (> 50%) |
| B. Level of damage |
| 1. None/low: Thin cracks (independent vertical cracks in the central area of the abutment) |
| 2. Moderate: Crack opening lower than 1 mm (independent vertical cracks in the central area) |
| 3. High/very high: Crack opening higher than 1 mm (independent vertical cracks in the central area) |
| C. Risk |
| R1. None/low: A1/B1, A1/B2, A2/B1, A3/B1 |
| R2. Moderate: A2/B2, A3/B2 |
| R3. High/very high: A1/B3, A2/B3, A3/B3 |
| IC. Intervention criteria (recommendation) |
| IC1. New regular inspection (frequency according to the age of the bridge): R1 |
| IC2. A detailed inspection by specialised engineer is needed, with auxiliary means if necessary: R2 |
| IC3. An URGENT detailed inspection by specialised engineer is needed, with auxiliary means if necessary: R3 |

Table S3.14. Damage C14: Structural damage caused by bending moments

| |
|--|
| A. Damage spreading: |
| 1. None/limited: none or some crack (<10% of the area) |

| |
|---|
| 2. Moderate: Some areas affected (10-50%) |
| 3. Widespread (> 50%) |
| B. Level of damage |
| 1. None/low: Thin cracks (located in the bottom side of beams and/or deck near the centre of the span) |
| 2. Moderate: Crack opening lower than 1 mm (located in the bottom side of beams and/or deck near the centre of the span) |
| 3. High/very high: Crack opening higher than 1 mm (located in the bottom side of beams and/or deck near the centre of the span) |
| C. Risk |
| R1. None/low: - |
| R2. Moderate: A1/B1, A1/B2, A2/B1, A3/B1, A2/B2, A3/B2 |
| R3. High/very high: A1/B3, A2/B3, A3/B3 |
| IC. Intervention criteria (recommendation) |
| IC1. New regular inspection (frequency according to the age of the bridge): R1 |
| IC2. A detailed inspection by specialised engineer is needed, with auxiliary means if necessary: R2 |
| IC3. An URGENT detailed inspection by specialised engineer is needed, with auxiliary means if necessary: R3 |

Table S3.15. Damage C15: Structural damage by shear failure

| |
|--|
| A. Damage spreading: |
| 1. None/limited: none or some crack (<10% of the area) |
| 2. Moderate: Some areas affected (10-50%) |
| 3. Widespread (> 50%) |
| B. Level of damage |
| 1. None/low: Thin cracks (located near the support, inclined 45° with the horizontal) |
| 2. Moderate: Crack opening lower than 1 mm (located near the support, inclined 45° with the horizontal) |
| 3. High/very high: Crack opening higher than 1 mm (located near the support, inclined 45° with the horizontal) |
| C. Risk |
| R1. None/low: - |
| R2. Moderate: A1/B1, A1/B2, A2/B1, A3/B1, A1/B3, A2/B2 |
| R3. High/very high: A2/B3, A3/B2, A3/B3 |
| IC. Intervention criteria (recommendation) |
| IC1. New regular inspection (frequency according to the age of the bridge): R1 |
| IC2. A detailed inspection by specialised engineer is needed, with auxiliary means if necessary: R2 |
| IC3. An URGENT detailed inspection by specialised engineer is needed, with auxiliary means if necessary: R3 |

Table S3.16. Damage C16: Structural damage of the shear key due to deck push

| |
|--|
| A. Damage spreading: |
| 1. None/limited: none or some key shear (<10% of the area) |
| 2. Moderate: Some shear keys affected (10-50%) |
| 3. Widespread (> 50%) |
| B. Level of damage |
| 1. None/low: Thin cracks (located in the bottom side of the shear key) |

| |
|---|
| 2. Moderate: Crack opening lower than 1 mm (located in the bottom side of the shear key) |
| 3. High/very high: Crack opening higher than 1 mm (located in the bottom side of the shear key) |
| C. Risk |
| R1. None/low: - |
| R2. Moderate: A1/B1, A1/B2, A2/B1, A3/B1, A1/B3, A2/B2, A2/B3, A3/B2, |
| R3. High/very high: A3/B3 |
| IC. Intervention criteria (recommendation) |
| IC1. New regular inspection (frequency according to the age of the bridge): R1 |
| IC2. A detailed inspection by specialised engineer is needed, with auxiliary means if necessary: R2 |
| IC3. An URGENT detailed inspection by specialised engineer is needed, with auxiliary means if necessary: R3 |

Table S3.17. Damage C17: Bridge expansion joint damage

| |
|---|
| A. Damage spreading: |
| 1. None/limited: none or a small part of the joint affected (<10% of the area) |
| 2. Moderate: Some parts of the joint affected (10-50%) |
| 3. Widespread (> 50%) |
| B. Level of damage |
| 1. None/low: low grade of material degradation, vegetation growth, prevented movement, loss of some elements, broken joint, loss of sealing, cracks beside the joint |
| 2. Moderate: moderate of material degradation, vegetation growth, prevented movement, loss of some elements, broken joint, loss of sealing, cracks beside the joint |
| 3. High/very high: high grade of material degradation, vegetation growth, prevented movement, loss of some elements, broken joint, loss of sealing, cracks beside the joint |
| C. Risk |
| R1. None/low: A1/B1, A1/B2, A2/B1, A3/B1 |
| R2. Moderate: A1/B3, A2/B2, A2/B3, A3/B2, |
| R3. High/very high: A3/B3 |
| IC. Intervention criteria (recommendation) |
| IC1. New regular inspection (frequency according to the age of the bridge): R1 |
| IC2. A detailed inspection by specialised engineer is needed, with auxiliary means if necessary: R2 |
| IC3. An URGENT detailed inspection by specialised engineer is needed, with auxiliary means if necessary: R3 |

Table S4. Potential damages that can affect the different parts of a bridge made of metal (S)

| Damage | Structural element | | | | | |
|--|--------------------|--------|-------------------|--------|-------------------|----------|
| | Abutment | Column | Deck (or arch) | Cables | Parapet/handrails | Pavement |
| S1. Corrosion of metal profiles | - | X | X | X | X | - |
| S2. Corrosion of metal gussets | - | X | X | X | X | - |
| S3. Corrosion of connectors (bolts, screws and weld) | - | X | X | X | X | - |
| S4. Cracks in metal profiles | - | X | X | X | X | - |
| S5. Cracks in metal gussets | - | X | X | X | X | - |
| S6. Cracks in connectors (bolts, screws and weld) | - | X | X | X | X | - |
| S7. Breakage of metal profiles connectors (bolts, screws and weld) | - | X | X | X | X | - |
| S8. Breakage of metal gussets | - | X | X | X | X | - |
| S9. Breakage of metal profiles or tubes | - | X | X | X | X | - |
| S10. Excessive deformation of structural elements | - | X | X | X | - | - |

For each type of damage of the metal elements (S1 to S17) the general damage state of the element has to be stated according to next criteria:

Table S4.1. Damage S1: Corrosion of metal profiles.

| |
|---|
| A. Damage spreading: |
| 1. None/limited: none or some profiles (<10% of the area) |
| 2. Moderate: Some areas affected (10-50%) |
| 3. Widespread (> 50%) |
| B. Level of damage |
| 1. None/low: none or change in colour |
| 2. Moderate: surface corrosion with little material loss |
| 3. High/very high: corrosion with important material loss |
| C. Risk |
| R1. None/low: A1/B1, A2/B1, A3/B1 |
| R2. Moderate: A1/B2, A2/B2, A3/B2 |
| R3. High/very high: A1/B3, A2/B3, A3/B3 |
| IC. Intervention criteria (recommendation) |
| IC1. New regular inspection (frequency according to the age of the bridge): R1 |
| IC2. A detailed inspection by specialised engineer is needed, with auxiliary means if necessary: R2 |
| IC3. An URGENT detailed inspection by specialised engineer is needed, with auxiliary means if necessary: R3 |

Table S4.2. Damage S2: Corrosion of metal gussets

| |
|--|
| A. Damage spreading: |
| 1. None/limited: none or some gussets (<10% of the area) |
| 2. Moderate: Some areas (10-50%) |

| |
|---|
| 3. Widespread (> 50%) |
| B. Level of damage |
| 1. None/low: none or change in colour |
| 2. Moderate: surface corrosion with little material loss |
| 3. High/very high: corrosion with important material loss |
| C. Risk |
| R1. None/low: A1/B1, A2/B1, A3/B1 |
| R2. Moderate: A1/B2, A2/B2, A3/B2 |
| R3. High/very high: A1/B3, A2/B3, A3/B3 |
| IC. Intervention criteria (recommendation) |
| IC1. New regular inspection (frequency according to the age of the bridge): R1 |
| IC2. A detailed inspection by specialised engineer is needed, with auxiliary means if necessary: R2 |
| IC3. An URGENT detailed inspection by specialised engineer is needed, with auxiliary means if necessary: R3 |

Table S4.3. Damage S3: Corrosion of connectors (bolts, screws and weld)

| |
|---|
| A. Damage spreading: |
| 1. None/limited: none or some connectors (<10% of the area) |
| 2. Moderate: Some areas affected (10-50%) |
| 3. Widespread (> 50%) |
| B. Level of damage |
| 1. None/low: none or change in colour |
| 2. Moderate: surface corrosion with little material loss |
| 3. High/very high: corrosion with important material loss |
| C. Risk |
| R1. None/low: A1/B1, A2/B1, A3/B1 |
| R2. Moderate: A1/B2, A2/B2, A3/B2 |
| R3. High/very high: A1/B3, A2/B3, A3/B3 |
| IC. Intervention criteria (recommendation) |
| IC1. New regular inspection (frequency according to the age of the bridge): R1 |
| IC2. A detailed inspection by specialised engineer is needed, with auxiliary means if necessary: R2 |
| IC3. An URGENT detailed inspection by specialised engineer is needed, with auxiliary means if necessary: R3 |

Table S4.4. Damage S4: Cracks in metal profiles

| |
|--|
| A. Damage spreading: |
| 1. None/limited: none or some profiles (<10% of the area) |
| 2. Moderate: Some areas affected (10-50%) |
| 3. Widespread (> 50%) |
| B. Level of damage |
| 1. None/low: none |
| 2. Moderate: trace of small cracks |
| 3. High/very high: clearly visible cracks related to structural damage |
| C. Risk |
| R1. None/low: A1/B1, A2/B1, A3/B1, A1/B2 |
| R2. Moderate: A2/B2, A3/B2 |
| R3. High/very high: A1/B3, A2/B3, A3/B3 |

| |
|---|
| IC. Intervention criteria (recommendation) |
| IC1. New regular inspection (frequency according to the age of the bridge): R1 |
| IC2. A detailed inspection by specialised engineer is needed, with auxiliary means if necessary: R2 |
| IC3. An URGENT detailed inspection by specialised engineer is needed, with auxiliary means if necessary: R3 |

Table S4.5. Damage S5: Cracks in metal gussets.

| |
|---|
| A. Damage spreading: |
| 1. None/limited: none or some gussets (<10% of the area) |
| 2. Moderate: Some areas affected (10-50%) |
| 3. Widespread (> 50%) |
| B. Level of damage |
| 1. None/low: none |
| 2. Moderate: trace of small cracks |
| 3. High/very high: clearly visible cracks related to structural damage |
| C. Risk |
| R1. None/low: A1/B1, A2/B1, A3/B1, A1/B2 |
| R2. Moderate: A2/B2, A3/B2 |
| R3. High/very high: A1/B3, A2/B3, A3/B3 |
| IC. Intervention criteria (recommendation) |
| IC1. New regular inspection (frequency according to the age of the bridge): R1 |
| IC2. A detailed inspection by specialised engineer is needed, with auxiliary means if necessary: R2 |
| IC3. An URGENT detailed inspection by specialised engineer is needed, with auxiliary means if necessary: R3 |

Table S4.6. Damage S6: Cracks in connectors (bolts, screws and weld).

| |
|---|
| A. Damage spreading: |
| 1. None/limited: none or some connectors (<10% of the area) |
| 2. Moderate: Some areas affected (10-50%) |
| 3. Widespread (> 50%) |
| B. Level of damage |
| 1. None/low: none |
| 2. Moderate: trace of small cracks |
| 3. High/very high: clearly visible cracks related to structural damage |
| C. Risk |
| R1. None/low: A1/B1, A2/B1, A3/B1, A1/B2 |
| R2. Moderate: A2/B2, A3/B2 |
| R3. High/very high: A1/B3, A2/B3, A3/B3 |
| IC. Intervention criteria (recommendation) |
| IC1. New regular inspection (frequency according to the age of the bridge): R1 |
| IC2. A detailed inspection by specialised engineer is needed, with auxiliary means if necessary: R2 |
| IC3. An URGENT detailed inspection by specialised engineer is needed, with auxiliary means if necessary: R3 |

Table S4.7. Damage S7: Breakage of metal profiles connectors (bolts, screws and weld).

| |
|--|
| A. Damage spreading: |
| 1. None/limited: none |
| 2. Moderate: Some areas affected (<30%) |
| 3. Widespread (> 30%) |
| B. Level of damage |
| 1. None/low: none |
| 2. Moderate: breakage of some of the connectors of one connection |
| 3. High/very high: breakage of most of the connectors of one connection |
| C. Risk |
| R1. None/low: A1/B1, |
| R2. Moderate: A1/B2, A2/B2, A3/B2 A2/B1, A3/B1 |
| R3. High/very high: A1/B3, A2/B3, A3/B3 |
| IC. Intervention criteria (recommendation) |
| IC1. New regular inspection (frequency according to the age of the bridge): R1 |
| IC2. A detailed inspection by specialised engineer is needed, with auxiliary means if necessary: R2 |
| IC3. An URGENT detailed inspection by specialised engineer is needed, with auxiliary means if necessary: - |

Table S4.8. Damage S8: Breakage of metal gussets.

| |
|---|
| A. Damage spreading: |
| 1. None/limited: none |
| 2. Moderate: Some areas affected (<10%) |
| 3. Widespread (> 10%) |
| B. Level of damage |
| 1. None/low: none |
| 2. Moderate: breakage of some zones of the metal gussets surface |
| 3. High/very high: breakage of most zones of the metal gussets surface |
| C. Risk |
| R1. None/low: A1/B1, |
| R2. Moderate: A1/B2, A2/B2, A3/B2, A2/B1, A3/B1 |
| R3. High/very high: A1/B3, A2/B3, A3/B3 |
| IC. Intervention criteria (recommendation) |
| IC1. New regular inspection (frequency according to the age of the bridge): R1 |
| IC2. A detailed inspection by specialised engineer is needed, with auxiliary means if necessary: R2 |
| IC3. An URGENT detailed inspection by specialised engineer is needed, with auxiliary means if necessary: R3 |

Table S4.9. Damage S9: Breakage of metal profiles or tubes.

| |
|--|
| A. Damage spreading: |
| 1. None/limited: none |
| 2. Moderate: Some areas affected (<10%) |
| 3. Widespread (> 10%) |
| B. Level of damage |
| 1. None/low: None |
| 2. Moderate: Breakage of partial section of profile or tube |
| 3. High/very high: Breakage of complete section of profile or tube |

| |
|---|
| C. Risk |
| R1. None/low: A1/B1 |
| R2. Moderate: A1/B2, A2/B2, A3/B2, A2/B1, A3/B1 |
| R3. High/very high: A1/B3, A2/B3, A3/B3 |
| IC. Intervention criteria (recommendation) |
| IC1. New regular inspection (frequency according to the age of the bridge): R1 |
| IC2. A detailed inspection by specialised engineer is needed, with auxiliary means if necessary: R2 |
| IC3. An URGENT detailed inspection by specialised engineer is needed, with auxiliary means if necessary: R3 |

Table S4.10. Damage S10: Excessive deformation of structural elements.

| |
|---|
| A. Damage spreading: |
| 1. None/limited: none or some elements (<10% of the area) |
| 2. Moderate: Some areas affected (10-50%) |
| 3. Widespread (> 50%) |
| B. Level of damage |
| 1. None/low: None or deformation of non-structural elements |
| 2. Moderate: small deformation of structural elements that does not affect the stresses of the element |
| 3. High/very high: deformation of the structural elements that affect the stress of the element |
| C. Risk |
| R1. None/low: A1/B1, A2/B1, A3/B1, A1/B2 |
| R2. Moderate: A2/B2, A3/B2, A1/B3 |
| R3. High/very high: A2/B3, A3/B3 |
| IC. Intervention criteria (recommendation) |
| IC1. New regular inspection (frequency according to the age of the bridge): R1 |
| IC2. A detailed inspection by specialised engineer is needed, with auxiliary means if necessary: R2 |
| IC3. An URGENT detailed inspection by specialised engineer is needed, with auxiliary means if necessary: R3 |

Table S5. Potential damages that can affect the different reinforce earth walls (REW) of the bridge.

| Damage | Structural element | | | | | |
|---|--------------------|--------|----------------|--------|----------------------|----------|
| | Abutment | Column | Deck (or arch) | Cables | Parapet / hand-rails | Pavement |
| REW1. Biological growth in joints between facing panels | X | - | - | - | - | - |
| REW2. Broken facing panels | X | - | - | - | - | - |
| REW3. Efflorescence in facing panels | X | - | - | - | - | - |
| REW4. Lichens growth | X | - | - | - | - | - |
| REW5. Cracks caused by reinforcement corrosion | X | - | - | - | - | - |



| | | | | | | |
|--|---|---|---|---|---|---|
| REW6. Spalling caused by reinforcement corrosion | X | - | - | - | - | - |
| REW7. Facing panels movements | X | - | - | - | - | - |
| REW8. Erosion or scour of columns and/or abutments | X | - | - | - | - | - |
| REW9. Damp and seepage through abutments | X | - | - | - | - | - |

Once the different structural elements of the bridge made of reinforce earth wall have been inspected for each type of damage of the reinforce earth wall (REW1 to REW17) the general damage state of the element must be stated according to next criteria:

Table S5.1. Damage REW1: Biological growth in joints between facing panels.

| |
|--|
| A. Damage spreading: |
| 1. None/limited: none or some joints (<10% of the area) |
| 2. Moderate: Some areas (10-50%) |
| 3. Widespread (> 50%) |
| B. Level of damage |
| 1. None/low: Without biological growth or only non woody plants with small root |
| 2. Moderate: small woody plants |
| 3. High/very high: woody plants that can open up joints and dislodge stones |
| C. Risk |
| R1. None/low: A1/B1, A1/B2, A2/B1, A3/B1 |
| R2. Moderate: A1/B3, A2/B2, A3/B2, A2/B3, A3/B3 |
| R3. High/very high: - |
| IC. Intervention criteria (recommendation) |
| IC1. New regular inspection (frequency according to the age of the bridge): R1 |
| IC2. A detailed inspection by specialised engineer is needed, with auxiliary means if necessary: R2 |
| IC3. An URGENT detailed inspection by specialised engineer is needed, with auxiliary means if necessary: - |

Table S5.2. Damage REW2: Broken facing panels.

| |
|--|
| A. Damage spreading: |
| 1. None/limited: none or some panels (<10% of the area) |
| 2. Moderate: Some areas (10-50%) |
| 3. Widespread (> 50%) |
| B. Level of damage |
| 1. None/low: none or thin cracks |
| 2. Moderate: some cracks |
| 3. High/very high: broken panels |
| C. Risk |
| R1. None/low: A1/B1, A1/B2, A2/B1, A3/B1 |
| R2. Moderate: A2/B2, A3/B2, A1/B3 |
| R3. High/very high: A2/B3, A3/B3 |
| IC. Intervention criteria (recommendation) |
| IC1. New regular inspection (frequency according to the age of the bridge): R1 |

| |
|---|
| IC2. A detailed inspection by specialised engineer is needed, with auxiliary means if necessary: R2 |
| IC3. An URGENT detailed inspection by specialised engineer is needed, with auxiliary means if necessary: R3 |

Table S5.3. Damage REW3: Efflorescence in facing panels.

| |
|--|
| A. Damage spreading: |
| 1. None/limited: none or some panels (<10% of the area) |
| 2. Moderate: Some areas (10-50%) |
| 3. Widespread (> 50%) |
| B. Level of damage |
| 1. None/low: none or some salt crystallization |
| 2. Moderate: light to medium salt crystallization |
| 3. High/very high: dense salt crystallization |
| C. Risk |
| R1. None/low: A1/B1, A1/B2, A2/B1, A3/B1, A1/B3 |
| R2. Moderate: A2/B2, A3/B2, A2/B3, A3/B3 |
| R3. High/very high: - |
| IC. Intervention criteria (recommendation) |
| IC1. New regular inspection (frequency according to the age of the bridge): R1 |
| IC2. A detailed inspection by specialised engineer is needed, with auxiliary means if necessary: R2 |
| IC3. An URGENT detailed inspection by specialised engineer is needed, with auxiliary means if necessary: |

Table S5.4. Damage REW4: Lichens growth.

| |
|--|
| A. Damage spreading: |
| 1. None/limited: none or some small area (<10% of the area) |
| 2. Moderate: Some areas (10-50%) |
| 3. Widespread (> 50%) |
| B. Level of damage |
| 1. None/low: none or low-density colonisation |
| 2. Moderate: medium-density colonisation |
| 3. High/very high: high-density colonisation |
| C. Risk |
| R1. None/low: A1/B1, A1/B2, A2/B1, A3/B1, A1/B3, A2/B2, A3/B2 |
| R2. Moderate: A2/B3, A3/B3 |
| R3. High/very high: - |
| IC. Intervention criteria (recommendation) |
| IC1. New regular inspection (frequency according to the age of the bridge): R1 |
| IC2. A detailed inspection by specialised engineer is needed, with auxiliary means if necessary: R2 |
| IC3. An URGENT detailed inspection by specialised engineer is needed, with auxiliary means if necessary: - |

Table S5.5. Damage REW5: Cracks caused by reinforcement corrosion.

| |
|--|
| A. Damage spreading: |
| 1. None/limited: none or some small crack (<10% of the area) |
| 2. Moderate: Some areas affected (10-50%) |

| |
|---|
| 3. Widespread (> 50%) |
| B. Level of damage |
| 1. None/low: Cracks opening less than 0.2 mm |
| 2. Moderate: Cracks opening less than 1.0 mm |
| 3. High/very high: Cracks opening higher than 1.0 mm |
| C. Risk |
| R1. None/low: A1/B1, A1/B2, A2/B1, A3/B1 |
| R2. Moderate: A1/B3, A2/B2, A3/B2 |
| R3. High/very high: A2/B3, A3/B3 |
| IC. Intervention criteria (recommendation) |
| IC1. New regular inspection (frequency according to the age of the bridge): R1 |
| IC2. A detailed inspection by specialised engineer is needed, with auxiliary means if necessary: R2 |
| IC3. An URGENT detailed inspection by specialised engineer is needed, with auxiliary means if necessary: R3 |

Table S5.6. Damage REW6: Spalling caused by reinforcement corrosion.

| |
|---|
| A. Damage spreading: |
| 1. None/limited: none or some small spalling (<10% of the area) |
| 2. Moderate: Some areas affected (10-50%) |
| 3. Widespread (> 50%) |
| B. Level of damage |
| 1. None/low: spallings that do not reveal reinforcements |
| 2. Moderate: spallings reveal reinforcements in a length lower than 10 cm |
| 3. High/very high: spallings reveal reinforcements in a length higher than 10 cm |
| C. Risk |
| R1. None/low: A1/B1, A1/B2, A2/B1, A3/B1 |
| R2. Moderate: A1/B3, A2/B2, A3/B2 |
| R3. High/very high: A2/B3, A3/B3 |
| IC. Intervention criteria (recommendation) |
| IC1. New regular inspection (frequency according to the age of the bridge): R1 |
| IC2. A detailed inspection by specialised engineer is needed, with auxiliary means if necessary: R2 |
| IC3. An URGENT detailed inspection by specialised engineer is needed, with auxiliary means if necessary: R3 |

Table S5.7. Damage REW7: Facing panels movements.

| |
|--|
| A. Damage spreading: |
| 1. None/limited: none or some facing panel (<10% of the area) |
| 2. Moderate: Some areas (10-50%) |
| 3. Widespread (> 50%) |
| B. Level of damage |
| 1. None/low: none or slight displacement |
| 2. Moderate: displacements lower than 1 cm |
| 3. High/very high: displacements higher than 1 cm or detachments |
| C. Risk |
| R1. None/low: A1/B1, A1/B2, A2/B1, A3/B1 |
| R2. Moderate: A2/B2, A3/B2, A1/B3 |
| R3. High/very high: A2/B3, A3/B3 |

| |
|---|
| IC. Intervention criteria (recommendation) |
| IC1. New regular inspection (frequency according to the age of the bridge): R1 |
| IC2. A detailed inspection by specialised engineer is needed, with auxiliary means if necessary: R2 |
| IC3. An URGENT detailed inspection by specialised engineer is needed, with auxiliary means if necessary: R3 |

Table S5.8. Damage REW8: Erosion or scour of abutments.

| |
|---|
| A. Damage spreading: |
| 1. None/limited: none or a small area (<10% of the area) |
| 2. Moderate: Some areas (10-50%) |
| 3. Widespread (> 50%) |
| B. Level of damage |
| 1. None/low: None or slight erosion |
| 2. Moderate: Depth of the erosion lower than 1/3 of the column or abutment |
| 3. High/very high: Depth of the erosion lower than 1/3 of the column or abutment |
| C. Risk |
| R1. None/low: A1/B1, A2/B1, A3/B1 |
| R2. Moderate: A1/B2, A2/B2, A3/B2 |
| R3. High/very high: A1/B3, A2/B3, A3/B3 |
| IC. Intervention criteria (recommendation) |
| IC1. New regular inspection (frequency according to the age of the bridge): R1 |
| IC2. A detailed inspection by specialised engineer is needed, with auxiliary means if necessary: R2 |
| IC3. An URGENT detailed inspection by specialised engineer is needed, with auxiliary means if necessary: R3 |

Table S5.9. Damage REW9: Damp and seepage through abutments.

| |
|---|
| A. Damage spreading: |
| 1. None/limited: none or some small area (<10% of the area) |
| 2. Moderate: Some areas (10-50%) |
| 3. Widespread (> 50%) |
| B. Level of damage |
| 1. None/low: dry or slightly humid |
| 2. Moderate: dripping |
| 3. High/very high: flowing |
| C. Risk |
| R1. None/low: A1/B1, A2/B1, A3/B1 |
| R2. Moderate: A1/B2, A2/B2, A3/B2, A1/B3 |
| R3. High/very high: A2/B3, A3/B3 |
| IC. Intervention criteria (recommendation) |
| IC1. New regular inspection (frequency according to the age of the bridge): R1 |
| IC2. A detailed inspection by specialised engineer is needed, with auxiliary means if necessary: R2 |
| IC3. An URGENT detailed inspection by specialised engineer is needed, with auxiliary means if necessary: R3 |

Table S6. Potential damages that can affect the different cables (CB) of the bridge.

| Damage | Structural element | | | | | |
|---|--------------------|--------|----------------|--------|--------------------|----------|
| | Abutment | Column | Deck (or arch) | Cables | parapets/handrails | Pavement |
| CB1. Cable corrosion | - | - | - | X | - | - |
| CB2. Unraveled wire ropes | - | - | - | X | - | - |
| CB3. Cable breakage | - | - | - | X | - | - |
| CB4. Wire rope sleeve damage | - | - | - | X | - | - |
| CB5. Breakage or excessive deformation of the connection between cable and deck | - | - | - | X | - | - |

Once the different structural elements of the bridge made of cables have been inspected for each type of damage of the cables (CB1 to CB5) the general damage state of the element has to be stated according to next criteria:

Table S6.1. Damage CB1: Cable corrosion.

| |
|---|
| A. Damage spreading: |
| 1. None/limited: none or some cables (<10% of the area) |
| 2. Moderate: Some areas affected (10-50%) |
| 3. Widespread (> 50%) |
| B. Level of damage |
| 1. None/low: none or change in colour |
| 2. Moderate: surface corrosion with little material loss |
| 3. High/very high: corrosion with important material loss |
| C. Risk |
| R1. None/low: A1/B1, A2/B1, A3/B1 |
| R2. Moderate: A1/B2, A2/B2, A3/B2 |
| R3. High/very high: A1/B3, A2/B3, A3/B3 |
| IC. Intervention criteria (recommendation) |
| IC1. New regular inspection (frequency according to the age of the bridge): R1 |
| IC2. A detailed inspection by specialised engineer is needed, with auxiliary means if necessary: R2 |
| IC3. An URGENT detailed inspection by specialised engineer is needed, with auxiliary means if necessary: R3 |

Table S6.2. Damage CB2: Unravelling wire ropes.

| |
|--|
| A. Damage spreading: |
| 1. None/limited: none or some cables (<10% of the area) |
| 2. Moderate: Some areas (10-50%) |
| 3. Widespread (> 50%) |
| B. Level of damage |
| 1. None/low: none or only first signs of unravelling are seen |
| 2. Moderate: wire ropes have started to be unravelled but still work as a single element |
| 3. High/very high: wire ropes are unravelled and do not work as a single element |
| C. Risk |
| R1. None/low: A1/B1, A2/B1, A3/B1 |

| |
|---|
| R2. Moderate: A1/B2, A2/B2, A3/B2 |
| R3. High/very high: A1/B3, A2/B3, A3/B3 |
| IC. Intervention criteria (recommendation) |
| IC1. New regular inspection (frequency according to the age of the bridge): R1 |
| IC2. A detailed inspection by specialised engineer is needed, with auxiliary means if necessary: R2 |
| IC3. An URGENT detailed inspection by specialised engineer is needed, with auxiliary means if necessary: R3 |

Table S6.3. Damage CB3: Cable breakage.

| |
|---|
| A. Damage spreading: |
| 1. None/limited: none |
| 2. Moderate: Some cables affected (<5%) |
| 3. Widespread (> 5%) |
| B. Level of damage |
| 1. None/low: none |
| 2. Moderate: some minor wire start breaking |
| 3. High/very high: wires or cables broken |
| C. Risk |
| R1. None/low: A1/B1 |
| R2. Moderate: A2/B2, A3/B2, A2/B1, A3/B1, A1/B2 |
| R3. High/very high: A1/B3, A2/B3, A3/B3 |
| IC. Intervention criteria (recommendation) |
| IC1. New regular inspection (frequency according to the age of the bridge): R1 |
| IC2. A detailed inspection by specialised engineer is needed, with auxiliary means if necessary: R2 |
| IC3. An URGENT detailed inspection by specialised engineer is needed, with auxiliary means if necessary: R3 |

Table S6.4. Damage CB4: Wire rope sleeve damage.

| |
|---|
| A. Damage spreading: |
| 1. None/limited: none or some small area (<10% of the area) |
| 2. Moderate: Some areas affected (10-50%) |
| 3. Widespread (> 50%) |
| B. Level of damage |
| 1. None/low: none or surface corrosion or decolouration |
| 2. Moderate: small cracks and/or small breakage and/or little material loss because of corrosion |
| 3. High/very high: Important cracks and/or breakage and/or material loss because of corrosion |
| C. Risk |
| R1. None/low: A1/B1, A2/B1, A3/B1, A1/B2 |
| R2. Moderate: A2/B2, A3/B2, A1/B3 |
| R3. High/very high: A2/B3, A3/B3 |
| IC. Intervention criteria (recommendation) |
| IC1. New regular inspection (frequency according to the age of the bridge): R1 |
| IC2. A detailed inspection by specialised engineer is needed, with auxiliary means if necessary: R2 |

IC3. An URGENT detailed inspection by specialised engineer is needed, with auxiliary means if necessary: R3

Table S6.5. Damage CB5: Breakage or excessive deformation of the connection between cable and deck.

A. Damage spreading:

1. None/limited: none or some parts of the connection (<10% of the area)

2. Moderate: Some areas affected (10-50%)

3. Widespread (> 50%)

B. Level of damage

1. None/low: none or surface corrosion or decolouration

2. Moderate: small cracks and/or small breakage and/or little material loss because of corrosion

3. High/very high: Important cracks and/or breakage and/or material loss because of corrosion

C. Risk

R1. None/low: A1/B1, A2/B1, A3/B1, A1/B2

R2. Moderate: A2/B2, A3/B2

R3. High/very high: A1/B3, A2/B3, A3/B3

IC. Intervention criteria (recommendation)

IC1. New regular inspection (frequency according to the age of the bridge): R1

IC2. A detailed inspection by specialised engineer is needed, with auxiliary means if necessary: R2

IC3. An URGENT detailed inspection by specialised engineer is needed, with auxiliary means if necessary: R3
