

Engineering Standard

Structures

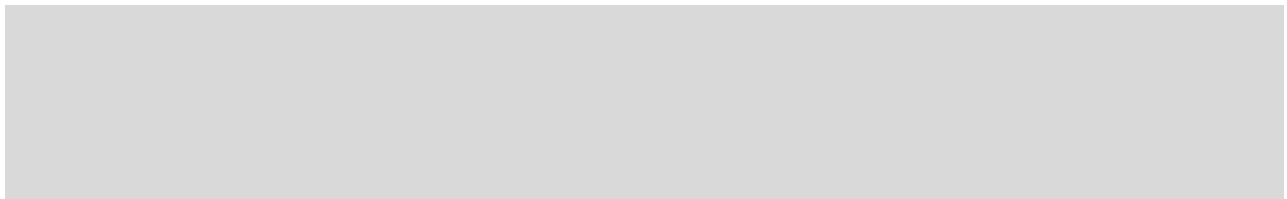
OTCS 302

STRUCTURES DEFECT LIMITS

Version 1.0

Issued August 2018

Approved by:



Document control

| Revision | Date of Approval | Summary of change |
|----------|------------------|---|
| 1.0 | August, 2018 | First Issue. Includes content from the following former RIC standards: TS 30 000 5 04, C 3102 and CRN CS 302 Ver 1.1. |
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Summary of changes from previous version

| Section | Summary of change |
|---------|-------------------|
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1 Purpose, scope and application

This document specifies the defect limits and mandatory responses that apply to structures.

They are intended to be observed and implemented during examinations of structures.

The frequency of examination is prescribed in OTCS 100 "Civil Technical Maintenance Plan" and associated specific Tailored Technical Maintenance Plans for major structures.

Procedures for the examination of structures are provided in OTCM 301 "Structures Examination Manual".

2 References

2.1 Australian and International Standards

Nil

2.2 OTHR documents

OTCS 100 - Civil Technical Maintenance Plan

OTCM 301 - Structures Examination Manual

2.3 Other references

Nil

2.4 Definitions

The following terminology is used in this Standard:

Bridge Examiner: Person with Engineering Authority to examine and report on condition of bridges and other civil structures. This is normally the person conducting cyclic examinations but may also be specialist personnel responding to incidents etc.

Structures Superintendent: Person with Engineering Authority to manage the condition bridges and other civil structures.

Defect: Deterioration of a component from its original condition.

Defect Category: Classification of a defect into a category that indicates the severity of the defect and response time recommended for continuing train operations and engineering assessment.

Repair Priority: Time frame for the repair of a defect

3 Engineering authority

Inspection and assessment of structures detailed in this standard may only be undertaken by persons who have been granted appropriate Engineering Authority by the Engineering Manager.

4 Introduction

Structures on the rail network deteriorate over time from their „as-new“ condition, owing to loading cycles from trains, aging of materials and climatic factors such as the sun, wind, rain and salt air. Defects that develop include pipes in timber members, rusting of steel members and cracking and spalling of concrete.

Examinations are undertaken at prescribed intervals of all structures, to monitor their condition and to measure the extent of any deterioration. The results of the examinations are also used to prepare maintenance programs for the repair or replacement of components.

Defect Categories and Limits have been set to guide the bridge examiner in the appropriate level of action to be taken when examining and measuring structural members.

5 Defect categories

The person undertaking bridge or structure examination shall measure any defects and assign a defect category. Depending on the extent of any defects found, immediate action may need to be taken to ensure the safety of rail, road or pedestrian traffic.

The results of the examination shall be forwarded to the Structures Superintendent, who must also respond as summarised in the Table 1.

| Defect Category | Bridge Examiner Response | Structures Superintendent Response |
|-----------------|---|--|
| A | Immediately stop trains in the case of an underbridge, or close if an overbridge or footbridge. Advise Structures Superintendent immediately. | Assess immediately. |
| B | Immediately impose a 20km/hr speed restriction in the case of an underbridge. Advise Structures Superintendent immediately | Assess the same day. |
| | For footbridges and overbridges, the area shall be barricaded and a report provided to the Structures Superintendent the same day. | |
| C | Report to Structures Superintendent the same day | Assess within 24 hours. |
| D | Report to Structures Superintendent on the Weekly Summary of Defects Form for the appropriate action. | Assess within 7 days. |
| E | Record in bridge examination report. | Assess as part of bridge management process. |

Table 1 - Defect Categories

Note – The use of the term “immediately” in the response requirements indicates that inspection, verification and removal of the defect is urgent and train movements are dependent on condition.

6 Repair priorities

6.1 General

An initial assessment and allocation of a Repair Priority as detailed in Table 2 shall be made by the Bridge Examiner as part of the examination process.

| Code | Meaning | Application |
|------|--------------------------------|-------------------------------------|
| Rm1 | Repair within 1 month | Applies to Defect Categories A to D |
| Rm6 | Repair within 6 months | Applies to Defect Categories A to D |
| Ry1 | Repair within 1 year | Could apply to any Defect Category |
| Ry2 | Repair within 2 years | Could apply to any Defect Category |
| Ry5 | Repair within 5 years | Applies to Defect Category E only |
| Ryxx | No repair for 5 years | Applies to Defect Category E only |
| Mm1 | Monitor monthly | Applies to Defect Categories A to D |
| Mm3 | Monitor quarterly | Applies to Defect Categories A to D |
| Mm6 | Monitor half yearly | Applies to Defect Categories A to D |
| My1 | Monitor yearly | Applies to Defect Categories A to D |
| Axx | Assess/Inspect next inspection | Applies to Defect Category E only |

Table 2 - Repair Priorities

In assigning repair priorities, considerations such as the location of the defect, importance of the affected member, the degradation rate, the effect of multiple defects and the operating environment (type, speed, density of rail, road or pedestrian traffic) need to be taken into account.

The initial response to a Repair Priority may include a risk management action such as increased monitoring, installation of temporary supports or imposition of a speed or load restriction, pending final repair. This may lead to the Repair Priority being redefined to a lower level by the Structures Superintendent, e.g. from Rm1 to Ry2.

6.2 Mandatory repair priorities

For all structures, some nominated defect types shall have a mandatory repair priority and those defects shall be repaired within the mandatory timeframe.

The nominated defect types are:

- Loose rivets & bolts in steel bridge members
- Missing or broken holding down bolts in bearing and bed plates
- Loose transom bolts
- Minor cracks and spalling in main members and decks in concrete bridges
- Blocked culverts.

The nominated defect types with a mandatory repair priority are detailed in Appendix 1.

7 Paint index

Paint indices shall be assigned for all steel bridges as part of the examination process. The indices reflect the condition of the surface coating, the order of the indices from worst to best being Paint1, Paint2 & Paint3. They are defined as follows:

- Paint Index – **Paint1**: Paint broken down throughout. Program to paint within 5 years.
- Paint Index – **Paint2**: Paint broken down locally. Patch paint as required within 2 years.
- Paint Index – **Paint3**: Paint in satisfactory condition.

8 Defect category limits

Appendix 1 provides a general guide to defect limits and associated actions to be taken by the Bridge Examiner.

In general, the limits and defect sizes have been set on the basis of them being located at the most highly stressed area of the member.

9 Structurally critical members

Structurally critical members are defined as members of a structure that are critical to the strength and safety of the structure and where failure of the member could lead to catastrophic collapse.

A list of structurally critical members and the critical areas for defects in these members is provided in Appendix 2.

10 Transoms

The defect limits for transom condition shall be applied using the following definitions

| | |
|---------------------------|---|
| Failed / missing transoms | Are those that are broken, missing or do not give vertical support to the rails. |
| Effective transoms | Transom/fastener system where the required fastenings are in place and which provides vertical support and lateral restraint. Restraint must allow no lateral movement of the fastenings relative to the transom. The transom must provide gauge restraint and must be one piece that will not separate along its length or transversely. Transoms must have a flat rail plate seat within 2mm. Transoms may not have more than 20% loss from any part. A transom that can be re-drilled will become effective again. It must have sufficient material between the rail fastenings (in the "four foot") to distribute the load adequately. |
| Ineffective transoms | Transom that is not effective. Transoms with rot or holes through which "daylight" can be seen are not satisfactory. |

For the purposes of assessment ineffective transoms include those that are missing or failed.

Appendix 1 Defect category limits

| Member | Defect Type | Defect Size | Defect Category | Mandatory Repair Priority |
|--|---|---------------------------------------|--|---------------------------|
| A. Underbridges – Steel and Wrought Iron | | | | |
| For steel, wrought iron and broad flange beam underbridges items in the table are defined as follows: Main structural members are main girders, cross girders, stringers, truss chords, diagonals and verticals, columns, trestle legs and headstocks. Secondary structural members are bracing, bearing/bed plates, gusset plates, bearing and web stiffeners, tie bars etc. An element of a member is typically a flange or web and may consist of multiple plates and/or angles. For piers, abutments, wingwalls and reinforcement see Underbridges – Concrete | | | | |
| Main member (excluding BFBs) | New crack or extension of previously assessed crack | > 80mm long (total if old & new) | A | |
| | | 50mm - 80mm long (total if old & new) | B - 20kph speed Observe under load | |
| | | 10mm – 49mm long (total if old & new) | B | |
| | New crack | 0mm-9mm long | C | |
| | Missing | Any | A | |
| Main member | Crack at bearing zone | > 300mm | C | |
| | | ≤300mm | D | |
| Main member | Corrosion loss | Perforation to any element | C | |
| | | > 60% section loss | C | |
| | | 30-60% section loss | D | |
| | | < 30% section loss | E | |
| Secondary member | Crack | Any | D | |
| | Missing | Any | B | |
| | Corrosion loss | Perforations to any element | D | |
| Main Member Fastenings (at connections) | Bolts / Rivets missing | > 60% | A | |
| | Loose | > 60% | B | |
| | Loose / Missing | 40% to 60% | B | |
| | | 20% to 39% | C | |
| Main Rivets | Corroded away in any 600mm length of girder | > 50% of rivet heads | C | |
| | | ≤ 50% of rivet heads | D | Ry2 |
| | | Loose / Missing | 50% to 75% | D |
| Secondary Fastenings | Missing | > 75% | B | |
| | Loose | > 75% | C | |
| | Loose / Missing | 25% to 49% | E | Ry2 |
| | | 20% to 39% | C | |
| Segmental Bearings | Locked over | | D. Reset but only after structural /geotechnical investigation into abutment stability | |
| Bed or Bearing Plate HD Bolts | Missing / Broken | > 50% | D | |
| | | ≤ 50% | E | Ry2 |

| Member | Defect Type | Defect Size | Defect Category | Mandatory Repair Priority |
|--|---|---|--|---------------------------|
| Bed Plate | Broken | | D | |
| Bearing Pads | Broken / Missing mortar | > 25% | D | |
| | | ≤ 25% | E | |
| Painting – any member | Flaking paint | Any | D | |
| Impact Damage | | | | |
| Track | Out of alignment (bridge has moved) | > 50mm | A | |
| | | 30mm – 50mm | B | |
| | | ≤ 30mm | D | |
| Main member | Major structural damage | Structure likely to be unable to carry load | A | |
| Girder Flange | Flange outstand deformed vertically | > 60% of outstand width | B | |
| | | 30-60% of outstand width | C | |
| | | 20-29% of outstand width | D | |
| | | < 20% of flange outstand width | E | |
| | Flange deformed horizontally within bracing bay | > 60mm | B | |
| | | 30mm – 60mm | C | |
| | | 20-29mm | D | |
| | | < 20mm | E | |
| Notched | > 30mm | B | | |
| | ≤ 30mm | C | | |
| Trestle | Column deformed in any direction | > 100mm | A | |
| | | 50-100mm | B | |
| | | 25mm-49mm | D | |
| | | < 25mm | E | |
| Main Rivets | Sheared off in any 600mm length of girder | > 50% of rivets | D | |
| | | ≤ 50% of rivets | E | |
| Any Joint Fastenings | Rendered ineffective | > 50% | B | |
| | | ≤ 50% | D | |
| B. Underbridges – Broad Flange Beams | | | | |
| All the above limits for steel and wrought iron underbridges apply to B.F.B. underbridges except for the “Main Girder/Truss”, “New Crack” items which are to be replaced with the following. | | | | |
| Unplated B.F.B. spans | | | | |
| BFB Flange | Crack | > 25mm | A | |
| | | 10-25mm | B - observe under load. Stop road traffic during passage of each train | |
| | | 5-9mm | B | |
| | | < 5mm | C | |

| Member | Defect Type | Defect Size | Defect Category | Mandatory Repair Priority | | | |
|--|---------------------------------------|--------------------------------|--|---------------------------|------|---|------|
| Plated B.F.B. spans | | | | | | | |
| Both BFB Flange and Flange plate | Crack | > 25mm | A | | | | |
| | | 10-25mm | B - observe under load. Stop road traffic during passage of each train | | | | |
| | | 5-9mm | B | | | | |
| | | < 5mm | C | | | | |
| Either BFB Flange or Flange plate | Crack | > 50mm | A | | | | |
| | | 20-50mm | B - observe under load. Stop road traffic during passage of each train | | | | |
| | | 10-19mm | B | | | | |
| | | < 10mm | C | | | | |
| C. Underbridges – Timber | | | | | | | |
| The following maintenance limits are based on nominal 300mm x 300mm timber section | | | | | | | |
| Girder/Corbel | Pipe / Trough in any girder or corbel | > 250mm | A | | | | |
| | | 226-250mm | B | | | | |
| | | 200-225mm | C | | | | |
| | | 151-199mm | D | | | | |
| | | 50-150mm | E | | | | |
| | Crushing | | B | | | | |
| Solid Headstock | Pipe / Trough | > 250mm | A | | | | |
| | | 226-250mm | B | | | | |
| | | 200-225mm | C | | | | |
| | | 151-199mm | D | | | | |
| | | 50-150mm | E | | | | |
| | Crushing | Any | B | | | | |
| Girder | Mid span deflection | Exceeds values tabulated below | | | | B | |
| | | Span (m) | 4.27 | 4.57 | 7.32 | | 7.92 |
| | | Deflection (mm) | 8 | 9 | 20 | | 22 |
| Girder/Corbel small section 250x150mm | Rotted out | | B | | | | |
| Waling Headstock | Rotted out | | B | | | | |
| Waling Sill | Rotted out | | C | | | | |
| Body Bolts | Loose | > 25% | D | | | | |
| | | ≤ 25% | E | | | | |
| Corbel bolts | Loose | > 25% | D | | | | |
| | | ≤ 25% | E | | | | |
| Trestle Bolts | Loose | > 25% | D | | | | |
| | | ≤ 25% | E | | | | |

| Member | Defect Type | Defect Size | Defect Category | Mandatory Repair Priority | |
|--|---|---|----------------------------------|---------------------------|-----|
| Piles | Section loss in more than 50% of piles in any trestle or abutment | > 75% | A | | |
| | Section loss in more than 25% of piles in any trestle or abutment | > 75% | B | | |
| | Section loss in any pile | > 75% | C | | |
| | | 50-75% | D | | |
| | | 40-49% | E | | |
| Pumping | Any | D | | | |
| Decking | Split or rotted out | > 20% | D | | |
| Abutment and wingwall sheeting | Broken, decayed, missing or displaced | Any | D | | |
| Any Timber Section | Termite infestation | Any evidence of damage | C | | |
| D. Underbridges – Timber Transoms | | | | | |
| Track class | | 1, 2, 3 | 5 | | |
| Transoms | Ineffective | 3 Adjacent | 4 Adjacent | B | |
| | | 2 Adjacent | 3 Adjacent | C | |
| | | 2 in 3 | 2 Adjacent | D | |
| | | One isolated | | E | |
| Transom Bolts | Missing | 3 Adjacent transoms | 4 Adjacent transoms | B | |
| | | 2 Adjacent transoms | 3 Adjacent transoms | C | |
| | | One transom (2 bolts) isolated | 2 Adjacent transoms | D | |
| | Loose | Any | | E | Ry2 |
| E. Underbridges – Concrete | | | | | |
| Main-P.S.C or R.C | Differential deflection between units under live load | Visible | C | | |
| Main-P.S.C | Crack | Other than shrinkage (surface) crack > 0.3mm | B | | |
| Main-R.C | Crack | > 3mm wide | C | | |
| | | 1-3mm wide | E | Ry2 | |
| Main Reinforcing. Bar | Section loss in one bar | > 30% | D - Undertake diagnostic testing | | |
| Stirrup Reinforcing. | Section loss in one bar | > 60% | D - Undertake diagnostic testing | | |
| Prestressing Ducts/Tendons | Exposed | Any | C | | |
| Piers/Abutments | Crack | > 5mm wide & 1 metre long especially under bearings | C | | |
| | | 3-10mm wide | E | | |

| Member | Defect Type | Defect Size | Defect Category | Mandatory Repair Priority |
|---|---|---|---|---------------------------|
| Wingwall | Crack | > 5mm wide & 2 metres long | C | |
| | | 3-10mm wide | E | |
| | Lateral dislocation | > 20mm | D | |
| Deck | Spalling | > 1 square metre with exposed reinforcing | D - Undertake diagnostic testing | |
| | | 300mm x 300mm & no reinforcing exposed | E - Undertake diagnostic testing | Ry2 |
| Deck – joint between slabs | Fouling with ballast/debris | Any | D | |
| Bearings | | Any degradation | D | |
| Impact Damage | | | | |
| Main | Deformation | Any | A | |
| Main-P.S.C or R.C. | Crack | Other than shrinkage (surface) crack more than 0.3mm | A | |
| F. Underbridges – Masonry and Concrete Arch | | | | |
| For piers, abutments, wingwalls and reinforcement see Underbridges – concrete | | | | |
| Arch Ring | Brickwork dislocation | > 50% in any square metre missing or unbonded | B | |
| | | 20-50% in any square metre missing or unbonded | D | |
| | Longitudinal cracking (along arch barrel) | > 3mm wide, through & across full arch width. Visible differential movement under live load | B | |
| | | 2-3mm & not through & across | D | |
| | | < 2mm & not through & across | E | |
| | Circumferential cracking (along arch profile) | > 6mm wide & > 2m long along arch | C | |
| | | 3-6mm wide, or > 6mm wide and < 2m long along arch | D | |
| | Distortion of profile | > 50mm – detectable by undulations in top line of spandrel walls / parapets or track | D | |
| | | 20-50mm | E | |
| | Other than Arch | Brickwork dislocation | > 50% in any square metre missing or unbonded | D |
| 20-50% in any square metre missing or unbonded | | | E | |
| Spandrel Wall | Displacement | Longitudinal > 30mm, or > 20mm Longitudinal + 20mm tilt | D | |
| | | 15-30mm | E | |
| Culvert floor | Heaving | > 50mm | D | |
| | | 25-50mm | E | |

| Member | Defect Type | Defect Size | Defect Category | Mandatory Repair Priority |
|--|---------------------------------------|--|------------------|---------------------------|
| Any other | Brickwork dislocation | Nil | D | |
| Brickwork mortar | Missing or loose | More than 30% in any square metre missing or loose | D | |
| | | 10-30% in any square metre missing or loose | E | |
| G. Culverts and Pipes | | | | |
| For reinforcement see Underbridges – concrete | | | | |
| Culvert, corrugated metal pipe or timber box drain | Collapse | Subsidence of formation/ballast | A | |
| | | No subsidence of formation/ballast | C | |
| | Blocked | 75 - 100% | C | |
| | | 50 - 74% | D | |
| | | 20 - 49% | E | Ry2 |
| Culvert | Cracked barrel | > 50mm | B | |
| | | 10-50mm | D | |
| | | < 10mm | E | |
| Corrugated Metal Pipe | Joint Broken | - | D | |
| | Out of round / distortion | > 50mm | D | |
| Headwall / Wingwall | Cracked | > 50mm wide | B | |
| | | 10-50mm wide | D | |
| | | < 10mm | E | |
| Apron | Scouring under | > 2m | C | |
| | | Any | D | |
| Floor | Heaving | > 50mm | D | |
| | | 25 - 49mm | E | |
| Adjacent Waterways | Blocked - Geotechnical risk site | > 25% | C | |
| | Blocked | > 25% | D | |
| H. Overbridges – Timber | | | | |
| The following maintenance limits are based on nominal 300mm x 300mm timber section The restrictions are to be applied to the road across the overbridge | | | | |
| Girder/Corbel | Pipe / Trough in any girder or corbel | > 250mm | A – Close bridge | |
| | | 226-250mm | B | |
| | | 200-225mm | C | |
| | | 151-199mm | D | |
| | | 50-150mm | E | |
| | Crushing | | B | |

| Member | Defect Type | Defect Size | Defect Category | Mandatory Repair Priority | | | |
|---|---|---|------------------|---------------------------|------|---|------|
| Solid Headstock | Pipe / Trough | > 250mm | A – Close bridge | | | | |
| | | 226-250mm | B | | | | |
| | | 200-225mm | C | | | | |
| | | 151-199mm | D | | | | |
| | 50-150mm | E | | | | | |
| | Crushing | Any | B | | | | |
| Girder | Mid span deflection | Exceeds values tabulated below | | | | B | |
| | | Span (m) | 4.27 | 4.57 | 7.32 | | 7.92 |
| | | Deflection (mm) | 8 | 9 | 20 | | 22 |
| Girder/Corbel small section 250x150mm | Rotted out | | B | | | | |
| Waling Headstock | Rotted out | | B | | | | |
| Waling Sill | Rotted out | | C | | | | |
| Body Bolts | Loose | > 25% | D | | | | |
| | | ≤ 25% | E | | | | |
| Corbel bolts | Loose | > 25% | D | | | | |
| | | ≤ 25% | E | | | | |
| Trestle Bolts | Loose | > 25% | D | | | | |
| | | ≤ 25% | E | | | | |
| Piles | Section loss in > 50% of piles in any trestle or abutment | > 75% | A - Stop trains | | | | |
| | Section loss in > 25% of piles in any trestle or abutment | > 75% | B | | | | |
| | Section loss in any pile | > 75% | C | | | | |
| | | 50-75% | D | | | | |
| | | 40-49% | E | | | | |
| Decking planks (transverse) | Broken or missing, bolts protruding | two or more adjacent planks have collapsed | B | | | | |
| | | isolated planks have collapsed | C | | | | |
| Decking planks (longitudinal) | Rotted out or loose, bolts protruding | two or more adjacent planks have collapsed | B | | | | |
| | | isolated planks have collapsed | C | | | | |
| Wearing surface | Holes or lifting | Any | C | | | | |
| I. Footbridges and Overbridges | | | | | | | |
| In addition to the following, Underbridge defect limits also apply where applicable | | | | | | | |
| Brick parapets | Horizontal crack | > 3mm wide & > ½ of parapet width & > 2m long | D | | | | |
| Brick parapets | Vertical crack | Any crack full height and full width of parapet | D | | | | |

| Member | Defect Type | Defect Size | Defect Category | Mandatory Repair Priority |
|---|---------------------------------------|---------------------------------------|-------------------|---------------------------|
| Pedestrian Safety Aspects | | | | |
| The bridge and stepway maintenance triggers described are of a structural nature and intentionally do not cover defects in walking surface finishes, ie tiles, etc. and associated anti-slip requirements | | | | |
| Pedestrian Barriers | Missing / Broken | Any | B - Seal off area | |
| | Missing / Displaced chain wire infill | Any | B - Seal off area | |
| | Missing vertical balusters | Any | B - Seal off area | |
| | Missing displaced metal sheet | Any | B - Seal off area | |
| | Loose | Any | D | |
| | Missing bolts | Any | D | |
| Traffic Barriers | Missing / Broken / Loose | Any | C | |
| Deck | Walkway planks | Broken, decayed, missing or displaced | B - Seal off area | |
| | Cracks in AC/FC sheets | Any | B - Seal off area | |
| Deck-Nails, Screws | Protrusion above deck | > 10mm | C | |
| | | ≤10mm | D | |
| Safety Screens | Missing / Broken | Any | C | |
| Safety Screen Fixings | Defective | > 50% | C | |
| | | 25-50% | D | |
| Timber Railing, Posts | Section loss | > 25% | D | |
| Protection Screens | Missing / Broken / Loose | Any | D | |
| | Missing bolts | Any | D | |
| Stepways (also includes balustrade and handrail references above) | | | | |
| R.C. Stepway Tread | Broken front edges | > 150mm long x 35mm deep | C | |
| | | > 50mm long x 15mm deep | D | |
| | Cracked | > 2 mm wide | D | |
| R.C. Stepway Landing | Cracked | > 2 mm wide | D | |
| | | ≤2 mm wide | E | |
| Stepway Reinforcing | Protruding at toe | Any | C | |
| Stepway Tread | Rocking between heel and toe | > 5mm | C | |
| | | 2-5mm | D | |
| | Slope heel to toe | > 15mm | D | |
| | | 5-15mm | E | |
| J.Underbridge walkways and refuges | | | | |
| Walkway & Refuge Handrails | Missing / Broken | Any | B - Seal off area | |
| Walkway & Refuge Planks | Broken, decayed, displaced or missing | Any | B - Seal off area | |
| Walkway fastenings | Loose or missing | Any | D | |

| Member | Defect Type | Defect Size | Defect Category | Mandatory Repair Priority |
|--|---|--|-----------------|---------------------------|
| K. Underbridge guardrails | | | | |
| Guardrail | Missing | - | D | |
| | Undersize | - | D | |
| Vee section | Missing / End not closed | - | D | |
| Fastenings | Missing / Loose | - | D | |
| L. Underbridge road/pedestrian safety aspects | | | | |
| Clearance signs | Missing | - | D | |
| | Not legible | - | D | |
| Ballast | Falling | - | D | |
| M. Underbridge Ballast Logs/Walls | | | | |
| Ballast Log | Missing / Rotted out | - | D | |
| Ballast Wall | Decayed, displaced or missing | - | D | |
| N. Tunnels | | | | |
| Roof/Wall | Brickwork dislocation | > 30% in any square metre missing or unbonded | C | |
| | | 10-30% in any square metre missing or unbonded | E | |
| | Longitudinal cracking (along tunnel) | > 5mm wide & more than 5m long | B | |
| | | 2-5mm & more than 5m long | C | |
| | | ≤ 2mm & more than 5m long | D | |
| | Circumferential cracking (along tunnel profile) | >5mm wide & > 2m long along unnel profile | D | |
| | | >5mm wide ≤ 2m long along tunnel profile | E | |
| | Spalling | Through the lining or of whole bricks | D | |
| | Seepage | Causing corrosion of track fastenings | D | Ry1 |
| | | Any | E | |
| Portal | Crack | >50mm wide | B | |
| | | 10-50mm wide | D | |
| | | ≤10mm | E | |
| O. Retaining Walls and Platform Walls | | | | |
| Retaining wall | Crack | >10mm wide & > 2 metres long | C | |
| | | >10mm wide & ≤ 2 metres long | D | |
| | | 5-10mm wide | E | |
| | Lateral dislocation | >20mm | C | |
| | | 10-20mm | E | |
| Platform wall | Crack | >50mm wide | C | |
| | | 10-50mm wide | D | |
| | | < 10mm | E | |

| Member | Defect Type | Defect Size | Defect Category | Mandatory Repair Priority |
|--------------------------|--|------------------------------------|--|---------------------------|
| Platform coping | Separation from platform surface and/or wall | Visible | D - Check clearances for possible infringement | |
| | Broken edging | Any | D | |
| P. Gabion Walls | | | | |
| Gabion baskets - bridges | Damaged | Loss of tension/Rocks spilling out | D | |
| | Lateral dislocation | > 100mm | D | |

Appendix 2 Structurally critical members

| A. Steel and wrought iron underbridges | | |
|--|--|--|
| Span Type | Structurally Critical Member | Details of Critical Areas |
| Plate web deck, RSJ and BFB | Main girders | Bottom flange: middle third of span |
| | | Top flange: over intermediate piers and buckling at mid spans |
| | | Web splices: middle half of span |
| | | Web: at support |
| Plate web through | Main girders | Bottom flange: middle third of span |
| | | Top flange: over intermediate piers and buckling at mid spans |
| | | Web splices: middle half of span |
| | | Web: at support |
| | Cross girders | Bottom flange: middle half of span and end connections |
| | | Web: at support |
| | Stringers | Bottom flange: middle half of span and end connections |
| | | Web: at support |
| Lattice girders | Top chord | Over intermediate piers and buckling at mid spans (arches) |
| | Bottom chord | Middle third |
| | Arches/ portal frames | Mid-span arches at end connections |
| | Stringers (2 nd generation) | Bottom flanges and splices: middle third |
| | Cross girders | Connections to bottom chord. Middle third of bottom flange |
| | Diagonal lattice bars | Whole member including chord connections, especially in vicinity of supports |
| Trusses (Pratt) | Top chord | Buckling at mid-span |
| | Bottom chord | Middle half of span |
| | Portal frames | Mid-span frames at end connections |
| | Cross girders | Middle half of span and connections to bottom chords |
| | Stringers | Middle half of span and end connections |
| | First web verticals | Whole member, including connections |
| | Internal web diagonals | Whole member towards abutments |
| B. Timber bridges | | |
| All spans | Girders | Middle third (bending) and over corbels (shear) |
| | Corbels | Over headstocks (shear) |
| | Headstocks | Nil |
| | Piles | At ground level , and 500mm above and below ground level |
| | Transverse decking | Middle third (bending) |
| C. Concrete bridges | | |
| All spans | Pre-Stressed Concrete Girders | Middle third of span |
| | | Over supports (shear) |
| | Reinforced Concrete Girders | Middle third of span |
| | | Over supports (shear) |