Manual

Structures Inspection Manual

Part 3 - Appendix D: Standard Component Condition State Guidelines

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Queensland Government

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Component 1C	Concrete wearing surface	Cast insitu concrete
Units of measurement:	**Square Metres**	

This item applies to concrete decks which form the running surface for traffic. This element also includes reinforced concrete overlays placed over deteriorated timber decks (note that such use is not recommended for the reinstatement of sub-standard timber decks). Also included are unreinforced concrete wearing surfaces (often coloured) placed non-compositely over T-beam bridge decks

Condition State 1

The concrete surface is in good condition and may have minor shrinkage or plastic settlement cracks. The surface texture is pronounced and the aggregate is not worn and there is adequate crossfall or grade to efficiently drain any surface water. All scuppers are clear.

Condition State 2

Shrinkage or plastic settlement cracks are of moderate width and there may be minor cracking and spalling due to corrosion of reinforcement. Some wear or polishing of aggregate is evident but there is only a marginal loss of surface texture and skid resistance. There may be surface irregularities which hold surface water and the ability to shed and drain surface water has been slightly impaired. Some scuppers may be blocked with debris and isolated patches of weed are growing at the kerbs.

Condition State 3

Shrinkage and plastic settlement cracks are moderate to severe and the deck has a crazed appearance but there is no differential movement between honeycomb sections. Patches of cover concrete less than 0.5 m^2 have delaminated, exposing reinforcement which may have lost up to 20% of its sectional area. The surface matrix is worn. Aggregate may be polished, with surface mortar being continually scaled over irregular areas. There may be significant depressions or other surface irregularities which are impairing the surface drainage; that is, lack of crossfall or gradient. Deck drainage is not functioning efficiently as a result of obstructions at or in kerbs and/or scuppers or inadequate provision for drainage.

A cracked component shall be rated in Condition State 3 on the basis of the following criteria:

- a crack width exceeds 0.3 mm in concrete located in a non-aggressive environment (Exposure Rating 1 or 2) or
- a crack width exceeds 0.15 mm in concrete located in an aggressive environment (Exposure Rating 3 or 4).

Condition State 4

The surface matrix is worn and the aggregate polished to the extent that skid resistance is compromised. The deck has extensive crazed honeycomb cracking with differential movement between sections. Patches of cover concrete in excess of 1.0 m^2 have delaminated as a result of corrosion of reinforcement and/or defective concrete. Whole patches of concrete to full overlay depth may be completely missing. Reinforcement may have lost in excess of 20% of the sectional area. Deck drainage has not been provided or has ceased to function as a result of blocked scuppers and channels. Excessive weed is growing on the surface at the kerbs.

Component 1O Fill/Wearing surface Other

Units of measurement: Square Metres

This item includes those structures with fill, gravel or asphalt over the deck. This element includes asphalt overlays which have been reinforced with fibreglass mesh or polypropylene geogrid mesh. Also included is the pavement on masonry arch bridges in which the fill forms the road surface.

Please note that if the depth of the asphalt overlay exceeds the depth shown on the design drawings by more than 40 mm, the actual depth should be entered into the Design Inventory of the Bridge Information System (BIS). The details of the structure should also be forwarded to the department's Structures Directorate for the purpose of assessing the impact that the additional surfacing may have on the load-carrying capacity of the structure. This also applies to concrete decks/wearing surfaces which have been subjected to an asphalt overlay.

Condition State 1

The asphalt surface is in good condition with no cracking, pot holes, rutting, bumps or depressions. The surface has adequate crossfall or gradeline to efficiently drain surface water from it. A fine transverse crack may have opened in the asphalt over fixed or buried expansion joints.

Condition State 2

There may be minor cracking, rutting, small bumps or depressions. These irregularities cause a minor hindrance to drainage of the deck. Potholes may be beginning to form in cracked areas. Ride qualities are beginning to be affected. A moderate crack may have opened in the asphalt over fixed or buried expansion joints.

Condition State 3

Potholes, cracking, rutting, bumps or depressions are holding moisture on the deck and allowing it to penetrate the fill. Ride qualities have been affected to a moderate extent. Asphalt surface may not extend across the full width of the bridge or deck drainage systems may be poor or inadequate. Severe cracks may have opened in the asphalt over fixed or buried expansion joints. Crazing of the adjacent asphalt may be evident but there is no differential movement between sections and asphalt is bonded to deck.

Condition State 4

Potholing, cracking, rutting, bumps or depressions are having a marked effect on the drainage and rideability of the asphalt surface. The asphalt surface may not extend the full width of the bridge and may have excessive weed or grass growth, or no deck drainage has been catered for. The asphalt surfacing over fixed joints, buried expansion joints or joints between ply deck sheets may be cracked and crazed and sections are acting independently and have debonded from the deck. Sections of asphalt may have been lost.

Component 2S Bridge railing/Barriers Steel

Units of measurement: Lineal Metres

This item defines all types of steel or iron railings including tubes, water pipes, rolled hollow sections, rolled shapes or beams. Also included in this item are the posts and end posts which support the railings, regardless of material type. Common post types used are RHS, precast and reinforced concrete, steel channels and timber. This item also includes steel girders used to support the edge of the deck, electrification barriers and pedestrian grilles attached to the barrier.

Condition State 1

The paint or galvanising on the rails and/or posts is in good condition with no rust spotting. Posts are in good condition with no splitting of timber, corrosion of steel or cracking of concrete members. No accident damage is visible.

Condition State 2

The protective system is no longer effective and spot rusting has occurred on the rails and/or posts. There may be minor splitting of timber posts, minor cracking in concrete posts or spot rusting of steel posts but all bolting and joint supports are tight. Any accident damage is minor and of no consequence.

Condition State 3

The protective system may have broken down and there is surface pitting in a number of locations on the rails and/or posts but there is minimal effect on strength or serviceability. There may be some corrosion of steel posts, split timber posts or moderate cracking and spalling of concrete posts. Bolted connections to rails may be loose but there is no cracking of welds. Nuts and bolts may be corroding. The anchor bolts or sockets for the posts are tight. Accident damage has only a minor effect on strength or serviceability of the barrier.

Condition State 4

Corrosion is well advanced and some loss of section has occurred in the rails and/or posts which is affecting both strength and serviceability. Bolted connections are extremely loose and bolts may be missing altogether, or rails may have broken free from mountings. The anchor bolts or sockets of posts may be loose and the containment capacity is significantly reduced. Nuts and bolts may be corroding significantly and/or welds may be cracked. Timber posts are severely split or decayed, concrete posts are badly cracked and spalled, and steel posts are badly corroded. Accident damage is severe with posts knocked out of line, loss of rail or badly damaged posts and anchorages. Packers between rails and posts may be missing.

Component 2P Bridge railing/Barriers Precast concrete

Units of measurement: Lineal Metres

This item defines all types and shapes of barriers where the principal component is precast concrete. It includes any RC terminals, steel safety rails or traffic barriers mounted on top and holding down bolts. Inspectors should use the state descriptions for Component 2C *Cast insitu concrete barriers* in addition to the descriptions given here for the fasteners.

Condition State 1

Mortar seating is continuous and sound and there is no evidence of moisture ingress into the base joint. Alignment is true to line and level and all bolts are tight.

Condition State 2

Mortar seating is substantially intact with a few isolated failures. Some moisture may be penetrating the bedding joint but there is no rust staining evident. There are visible discontinuities in alignment of panels but barrier is fit for purpose.

Condition State 3

Mortar seating is missing or crumbling out of significant portions of the bedding joint and surface water run-off is freely passing through some sections of the joint. Rust stains are evident on the kerb/plinth and anchor bolts may show signs of active corrosion. There may be visible discontinuities in alignment of panels but the containment capacity is substantially intact.

Condition State 4

The mortar seating may be missing over large areas and the anchor bolts are significantly corroded, such that the containment capacity has been significantly reduced. Severe rust staining and leakage through the joint is evident.

Component 2C Bridge railing/Barriers Cast insitu concrete

Units of measurement: Lineal Metres

This item defines all cast insitu concrete bridge barriers and includes terminals and any steel safety rails or traffic barriers mounted on top. The item also includes cast insitu concrete portions constructed to join precast concrete parapets to the deck.

Condition State 1

The barrier is in good condition with only minor cracking due to shrinkage or corrosion of reinforcement. The correct traffic face profile has been constructed. Steel rails are in good condition with no rust spotting and bolted and welded connections show no signs of deterioration. No accident damage is evident.

Condition State 2

There is minor cracking and spalling due to corrosion of the reinforcement. The correct traffic face profile has been constructed with no overlays affecting the upstand. Steel railings on top of the parapet may have rust spotting and bolted connections are tight and in good condition. There are no cracked welds. Accident damage is slight and of no consequence.

Condition State 3

Moderate cracking and spalling is evident with an excess of 20% loss of reinforcement area. The steel barrier may be pitted on the surface and connections may be slightly loose. Post anchorages may have minor cracking due to vehicle impact. The traffic face profile may have been constructed incorrectly or a surfacing overlay placed which reduces the height of the vertical upstand and barrier. Accident damage has only a minor effect on strength and serviceability.

A cracked component shall be rated in Condition State 3 on the basis of the following criteria:

- a crack width exceeds 0.3 mm in concrete located in a non-aggressive environment (Exposure Rating 1 or 2) or
- a crack width exceeds 0.15 mm in concrete located in an aggressive environment (Exposure Rating 3 or 4).

Condition State 4

Severe cracking may be visible due to advanced corrosion of the reinforcement which may have lost in excess of 20% of its sectional area. Corrosion may be well advanced in the steel barrier, bolts may be loose or rails may have broken free from their mountings. The anchorage area of the steel barrier posts may be cracked and spalled. Strength and serviceability of the barrier is adversely affected. The traffic face profile may have been constructed incorrectly on surfacing overlays, placed such that the upstand height is significantly reduced. Accident damage may be severe with serious cracking and spalling of the concrete barrier or loss of sections of the railing.

Component 2T Bridge railing/Barriers Timber

Units of measurement: Lineal Metres

This item defines those rails constructed using timber either from a sawn section or glued laminated sections. This item includes also the supporting posts.

Timber railing is considered to be inappropriate and represents a significant hazard to road users. The presence of barriers of this type are to be noted in the comments field in the 'overall rating' section of the *Bridge Condition Inspection Report – Form B2/1*.

Condition State 1

The element shows only minor deterioration and all the bolting is tight. No accident damage is visible.

Condition State 2

The element shows signs of minor decay, splitting or cracking but does not affect the strength or serviceability. Bolting of the posts and rails is generally tight. Accident damage is only minor with no effect on strength or serviceability.

Condition State 3

Medium decay, splitting, cracking or crushing may be present, affecting the strength and serviceability of the railing to a minor extent. Bolting may be loose in a number of areas. Accident damage may have a minor effect on the strength or serviceability of the railing. The paint system on rails and posts may have broken down.

Condition State 4

Heavy decay, splitting, cracking, crushing or termite damage may be present, affecting the strength and serviceability of the railing. Bolting may be quite loose, corroded or missing completely, affecting the strength of the railing. Major accident damage is affecting the serviceability of the railing.

Component 2O Bridge railing/Barriers Other

Units of measurement: Lineal Metres

This item defines all types of shapes and barrier materials other than those already covered. Included in this item are masonry parapets, aluminium rails with steel tensioning cables inside, GWI pipe, post and rails, wire mesh fencing panels, wire or chain cables. The item covers any posts required to support the railing system or cables.

Condition State 1

The element shows only minor signs of deterioration with minor cracking between masonry blocks or rusting of steel work. No accident damage is visible.

Condition State 2

Minor cracking, spalling, loss of mortar between masonry blocks, surface or spot rusting has occurred but is having little or no effect on strength or serviceability. Accident damage is very minor with no effect on strength or serviceability.

Condition State 3

Moderate cracking, spalling, loss of mortar between masonry block, or corrosion of metal is occurring but having a minor effect on strength or serviceability. Accident damage may have a minor effect on the strength or serviceability of the railing.

Condition State 4

Severe cracking, spalling, loss of mortar or corrosion has a large effect on rail strength or serviceability. Accident damage is major, affecting the strength or serviceability of the railing.

Component 3S Bridge kerbs Steel

Units of measurement: Lineal Metres

This item defines kerbs that are fabricated from steel hollow section which form an upstand at the edge of bridge and/or carriageway. Bridge barriers will not generally be mounted on these members.

Condition State 1

The steel is in good condition and firmly bolted in place. Paint or galvanising is in good condition, with no rust spotting. No accident damage is visible.

Condition State 2

The protective system is no longer effective and spot rusting has occurred on the member. All fixings are tight. Any accident damage is minor and of no consequence.

Condition State 3

The protective system may have broken down and there is surface pitting in a number of locations on the member but there is minimal effect on strength or serviceability. There may be some corrosion evident. Fixings may be loose but the kerb is still in the correct location. Fixings may be corroding. Accident damage has only minor effect on strength or serviceability.

Condition State 4

Corrosion is well advanced and some loss of section has occurred which is affecting both strength and serviceability. Fixings are extremely loose and may be missing altogether. The kerb may no longer be in the correct position. Accident damage is severe with the kerb member knocked out of line, or badly damaged anchors.

Component 3P Bridge kerbs Precast concrete

Units of measurement: Lineal Metres

This item defines those upper portions of precast concrete deck units which form an upstand at the edge of the bridge and/or carriageway. Bridge barriers are normally mounted on these members.

Condition State 1

The precast kerbs and any cast insitu connections are in good condition with no cracking or spalling.

Condition State 2

There is minor cracking or spalling at the joints or face of kerb due to corroding reinforcement. The repairs to lifting lugs or holes may be cracked or spalled. If ASR is prevalent in the area, then minor map cracking may be evident around the repairs and on the front and top face of the kerb.

Condition State 3

There is moderate cracking at joints or on the face of the kerb due to corroding reinforcement. There is loss of section of reinforcement due to corrosion of up to 20%. Cracking and spalling may also be occurring at fixed joints filled with mortar due to bearing pressures caused by deck flexing. There may be moderate cracking at the base of barrier posts as a consequence of vehicle impact but containment is still effective. Moderate map cracking due to ASR may be evident.

A cracked component shall be rated in Condition State 3 on the basis of the following criteria:

- a crack width exceeds 0.3 mm in concrete located in a non-aggressive environment (Exposure Rating 1 or 2) or
- a crack width exceeds 0.15 mm in concrete located in an aggressive environment (Exposure Rating 3 or 4).

Condition State 4

Kerbs are severely cracked and spalled as result of corrosion, ASR, bearing at kerb joints or the effects of vehicle impact on the barrier. Containment capacity of the barrier may be reduced to unsafe levels. The reinforcement in the kerb may be exposed and more than 20% of the sectional area may have been lost.

Component 3C Bridge kerbs Cast insitu concrete

Units of measurement: Lineal Metres

This item defines kerbs that are constructed of cast insitu concrete on deck units or deck slabs which form an upstand at the edge of the bridge and/or carriageway. Bridge barriers are normally mounted on these members. Also included are concrete kerbs cast on timber bridge decks, with or without attached barriers.

Condition State 1

Kerbs are in good condition with only minor cracking due to shrinkage or corrosion of reinforcement.

Condition State 2

There is minor cracking or spalling at the joints or on faces due to movement restraint, shrinkage or corrosion of reinforcement. Bolts to timber girders may be slightly loose.

Condition State 3

There is moderate cracking or spalling at the joints or on faces due to movement restraint, shrinkage or corrosion of reinforcement. The reinforcement may have lost up to 20% of its section. Some minor flexural cracking may be evident on the top face over piers on continuous joints. There may be moderate cracking at the base of barrier posts as a consequence of vehicle impact but containment is not impaired. Bolts to timber girders may be moderately loose.

A cracked component shall be rated in Condition State 3 on the basis of the following criteria:

- a crack width exceeds 0.3 mm in concrete located in a non-aggressive environment (Exposure Rating 1 or 2) or
- a crack width exceeds 0.15 mm in concrete located in an aggressive environment (Exposure Rating 3 or 4).

Condition State 4

Severe cracking and spalling is evident as a result of movement restraint at joints, corrosion of reinforcement or the effects of vehicle impact on the barrier. Containment capacity may be reduced to unsafe levels. The reinforcement may have suffered a loss of section in excess of 20%. Bolts to timber girders may be very loose, severely corroded or missing completely.

Component 3T Bridge kerbs Timber

Units of measurement: Lineal Metres

This item defines kerbs that are constructed of timber which form an upstand at the edge of bridge and/or carriageway. Kerbs may be formed from either hardwood or plywood construction.

Condition State 1

The timber is in good condition and firmly bolted, nailed or screwed in place. There is little or no evidence of rot or decay. Minor splits and cracks may be evident; however, these will have no effect on member strength.

Condition State 2

Minor decay, splitting or cracking may be present but not sufficient to affect the strength or serviceability of the member.

Condition State 3

Medium decay, splitting or crushing may be present, affecting the component's serviceability, including containment capacity if barrier attachment capacity is reduced. In most instances, timbers will have loosened considerably. There may be an active termite presence but with only minimal damage sustained. The paint system on the kerb may have broken down.

Condition State 4

Heavy decay, splitting or crushing may be present, affecting the serviceability of the component. Timbers will be loose or may in fact be missing. There may be an active termite infestation causing severe damage. The paint system on the kerb may have broken down. Attachment bolts may be very loose, missing completely or heavily corroded. Unsleeved attachment bolts may be severely corroded due to contact with preservative treatment in stress-laminated decks. With ply kerbs, bolt heads may be punching into the kerb if insufficient washer sizes are used.

Component 4S Footways Steel

Units of measurement: Lineal Metres

This item describes those footways which are constructed of steel plates. Any thin layer of surfacing material should be included with this item as it greatly influences the action and rate of deterioration of the steel decking.

Condition State 1

The steel is in good condition with no evidence of any corrosion. The plates are rigidly bolted to supports and are good and tight. The surfacing is in good condition with no evidence of cracking, pop-outs or delamination.

Condition State 2

Minor pitting of the surface due to corrosion may be evident but there is no loss of section. Plates remain firmly bolted to supports and are good and tight. There may be minor cracking of the surfacing.

Condition State 3

Moderate corrosion may have occurred, occasioning a loss of section of up to 10%. The hold down connections may be slightly loose, permitting excessive flexing or vibration or rattling of the plates. The surfacing may exhibit moderate cracking and some local loss of material.

Condition State 4

Severe corrosion may have occurred, occasioning significant loss of section. The hold down connections may be loose and the plates are rattling up and down under load. Bolts or edge material of the plates may have sheared under this action. The surfacing is breaking up and delaminating from the plates.

Component 4P Footways Precast concrete

Units of measurement: Lineal Metres

This item describes those kerbs constructed using precast concrete RC kerb units connected by small cast insitu infills, or footways which are constructed using precast RC slabs spanning between cast insitu road and outer kerbs and includes all components making up the footway.

Condition State 1

The precast kerbs and their cast insitu connections are in good condition with no cracking or spalling. Footway slabs are in good condition with only minor superficial cracking, and all units are at the same level.

Condition State 2

Precast kerb units may have minor cracking or spalling at the joints or in the face of kerb due to corroding reinforcement. Minor cracking and/or steps of less than 10 mm between footway units may exist but present no danger to pedestrians.

Condition State 3

Moderate cracking and spalling at the kerb joints may exist. There may be moderate to severe cracking due to non-structural mechanisms, such as corrosion of reinforcement or ASR. There may be loss of section of reinforcement due to corrosion of up to 20%. Steps in excess of 10 mm between footway slabs may present some danger to pedestrians. Some precast slabs may be badly cracked or broken.

A cracked component shall be rated in Condition State 3 on the basis of the following criteria:

- a crack width exceeds 0.3 mm in concrete located in a non-aggressive environment (Exposure Rating 1 or 2) or
- a crack width exceeds 0.15 mm in concrete located in an aggressive environment (Exposure Rating 3 or 4).

Condition State 4

Kerb joints are heavily cracked and spalled, affecting their operation. There may be loss of section of reinforcement, due to corrosion, that is greater than 20% (and the resultant cracking and spalling this may cause). Large stepping between footway slabs with numerous broken slabs presents a danger to pedestrians.

Component 4C Footways Cast insitu concrete

Units of measurement: Lineal Metres

This item defines those kerbs or footways which are fully constructed from cast in situ concrete.

Condition State 1

The slabs are in good condition with no cracking or spalling. Footway slabs may have minor superficial cracks of no importance.

Condition State 2

Kerbs may have minor cracking or spalling due to movements or corrosion of steel reinforcement. Footway slabs may also have minor cracks or spalls due to shrinkage, temperature, relative movement or corroding reinforcement. Differential vertical movement between footway slabs should be less than 10 mm to present minimal danger to pedestrians tripping over.

Condition State 3

Kerbs and footways may have moderate cracking and spalling due to movement or steel reinforcement corrosion. There may be a loss of section of reinforcement due to corrosion of up to 20%. Differential movement between footway slabs may have caused broken edges and vertical displacements greater than 10 mm, presenting a danger of tripping to pedestrians.

A cracked component shall be rated in Condition State 3 on the basis of the following criteria:

- a crack width exceeds 0.3 mm in concrete located in a non-aggressive environment (Exposure Rating 1 or 2) or
- a crack width exceeds 0.15 mm in concrete located in an aggressive environment (Exposure Rating 3 or 4).

Condition State 4

Kerbs and footways may have severe cracking and spalling. There may be loss of section of reinforcement due to corrosion greater than 20% (and the resultant cracking and spalling this may cause). Footway slabs may be badly broken and uneven in areas or have large vertical displacements causing major danger to pedestrians.

Component 4T Footways Timber

Units of measurement: Lineal Metres

This item defines those kerbs or footways constructed of timber.

Condition State 1

The timber is in good condition and firmly bolted, nailed or screwed in place. There are no large gaps between footway timbers and ends of timbers are at a similar level.

Condition State 2

Minor decay, splitting or cracking may be present but not affecting the strength or serviceability of the timber. A few planks may be loose but do not cause a danger to pedestrians. Gaps or uneven timbers are small enough not to be a danger to pedestrians.

Condition State 3

Medium decay, splitting or crushing may be present, affecting the component's serviceability. Planks are generally loose and, along with gaps and uneven ends of timbers, present a danger of tripping to pedestrians. Non-slip surfacing on ply decks may be starting to delaminate.

Condition State 4

Heavy decay, splitting or crushing may be present, affecting the serviceability of the component. Planks may be broken, missing or very loose, presenting a major danger to pedestrians. Non-slip surfacing on ply decks may be missing in substantial areas. Acute termite infestation and damage may have occurred. The exposed ends of ply decking may be badly weathered and delaminated.

Component 4O Footways Other

Units of measurement: Lineal Metres

This item defines those kerbs or footways constructed with a gravel or asphalt or sprayed seal surface, brick or masonry blocks. The surface of asphalt-filled steel decking is also included in this item. The steel trough sections shall be covered under Component No. 30S. Kerbs may also comprise a steel plate with gravel or asphalt behind, or simply be a built up mound of asphalt.

Condition State 1

The element is in good condition with only minor superficial cracking of the surface, minor rusting of the steel kerb face plate or edge plate or broken masonry blocks.

Condition State 2

The asphalt surface may have some minor cracking, but no broken-up areas. Steel kerb face plate or edge plate may be rusty but no corrosion pitting. Masonry kerb blocks may be cracked or have minor edge spalls but still be basically in fair condition.

Condition State 3

The kerb face plate or edge plate may have moderate corrosion but still be effectively holding the footway material in place. Masonry kerb blocks may be heavily cracked and broken up but still be effectively holding the footway material in place. Asphalt surfacing may have moderate cracking or small broken-up areas.

Condition State 4

Asphalt surface may be heavily cracked and broken up in large areas. Steel kerb face plate or edge plate may be severely corroded with holes or loss of edges. Masonry kerb blocks may be completely broken with sections missing.

Component 10O Pourable joint seals Other

Units of measurement: Lineal Metres

This item defines those joints filled with pourable joint sealant or asphalts, and includes buried expansion joints.

Materials used in pourable joints are bitumen, polyurethanes, 2 part pack polyester polyurethanes, rubberised bitumen, megaprene and polymer modified bitumens. Epoxy or fibre reinforced concrete nosings are also included.

Asphalt joints encompass normal asphalt, rubberised asphalts and polymer modified asphalts, such as the Thormajoint or SAMIfilla HM bridge joint systems.

Condition State 1

The seal shows little or no deterioration and completely seals the joint against moisture penetration. There is no cracking of the nosings or fretting of the surrounding asphalt. There are no adhesion cracks along the sides of the joint or any cohesion cracks due to elongation of the sealant.

Condition State 2

There may be minor fine adhesion and/or cohesion cracks, allowing minor leakage of the joint. The deck or asphalt adjacent to the joint may have minor spalling. Overfilled sealer may be flowing out of the joint or may be impacted by traffic. Thin asphalt surfacing over the joint may be cracked. Minor cracking may be evident in the nosings but there is no loss of adhesion to deck.

Condition State 3

Adhesion and/or cohesion cracking may be moderate, allowing reasonable leakage of moisture through the joint. The adjacent deck or asphalt may have medium spalling. Overfilled sealer may be heavily impacted by traffic and tending to rip the sealer out. Thin asphalt surface over the joint may be breaking up with minor areas lost. The nosings may be badly cracked but there is no differential movement between sections and there is no loss of adhesion to deck. The asphalt is beginning to fret at the edges.

Condition State 4

The joints have completely failed, allowing extensive moisture penetration. Pourable joint sealant may be almost completely lost. Bitumen/cork filler may be broken up and being ripped out in chunks by traffic. The nosings may be excessively cracked and sections are delaminating from the deck. The surrounding asphalt is fretting and some material may be lost from the margins.

Component 11O Pourable joint seals Other

Units of measurement: Lineal Metres

This item describes all joints using preformed compression type seals such as plastic foam strips, rubber based hose joints, Wabo seals or Hercules/Honel seals. Epoxy or fibre reinforced concrete nosings are also included.

Condition State 1

The joint seal and its armouring (if any) are in good condition with no movement of the armouring visible, and no adhesion or sealing problems with the compression seal. There is no cracking of the nosings or fretting of the surrounding asphalt.

Condition State 2

The joint may have lost adhesion with the deck or armouring in small areas, allowing minor leakage of moisture. The adjacent deck may have minor spalls or the armouring may be moving slightly, with cracks developing between the asphalt surface and the steel. Minor cracking may be evident in the nosings but there is no loss of adhesion to the deck.

Condition State 3

The joint may have lost adhesion over a long length, allowing excessive moisture penetration. The seal may have worked to the road surface and may be suffering damage due to traffic impact. The adjacent deck may have moderate spalling or the armouring may be moving, with the asphalt surface breaking away from the steel. The nosings may be badly cracked but there is no differential movement between sections and there is no loss of adhesion to the deck. The asphalt may be fretting at the edges.

Condition State 4

The joint may have completely lost adhesion and is no longer operative or may be lost. Steel armouring may be moving considerably and breaking free. The joint seal may be impacted by traffic to the extent that the seal has suffered extensive damage.

The nosings may be excessively cracked and sections are delaminating from the deck. The surrounding asphalt is fretting and some material may be lost from the margins.

Component 12O Assembly joint seal Other

Units of measurement: Lineal Metres

This item defines those joints which have an assembly mechanism which consists of end dams bolted down to the deck with a gland or gland type seal between. Common joints which are included in this item are products such as Transflex, Alustrip, Felspan, Wabo Maurer gland seals, Cipec and Firmsec (small) joints.

Condition State 1

The seal and anchorages are in good condition and there is no cracking of the surrounding deck, concrete nosings or asphalt.

Condition State 2

There may be minor splits of the seal or gland. Some rubber may be peeling from the end dams. Anchorages may be slightly loose and surrounding deck or concrete nosings may be cracked. Asphalt nosings may be breaking away from the end dams which may also be slightly higher than the approach asphalt due to slight rutting in the wheel paths.

Glands may be pulling out of their housing due to traffic impacting or poor installation.

Condition State 3

The glands may be severely split or pulled out of their housings, allowing moisture and road grit to penetrate. Rubber may have peeled from the end dams, exposing steel shims which may be damaged by traffic. Some anchorages may be quite loose, allowing excessive movement of the end dams. Surrounding concrete or concrete nosings may be badly cracked. Asphalt nosings may be badly rutted or cracked.

Condition State 4

Glands may be severely damaged or completely out of their housings. End dams may be severely damaged by traffic, or have broken loose due to anchorage failure. Concrete nosings may be completely broken up or asphalt nosings are potholing next to the joint.

Component 13S Open expansion joint Steel

Units of measurement: Lineal Metres

This item defines those open expansion joints, constructed with steel edge armouring and designed to allow moisture and grit to penetrate the deck, to be removed by specially designed substructure elements. This item does not include those expansion joints where the expansion seals have been completely lost. Those joints should be considered under their original item with the seal in place.

Condition State 1

The element shows no deterioration, with the steel armouring firmly in place. There is no cracking of the concrete block around the steel armouring. The joint width is sufficiently wide to pass any road grit without it jamming in the joint.

Condition State 2

The steel armouring may have rust staining and/or minor corrosion but it is firmly in place. The deck may have very minor cracking in the vicinity of the joint. Width of the joint is sufficient.

Condition State 3

The steel armouring is showing advanced corrosion and there may be moderate cracking in the deck around the joint, indicating the armouring is loose due to traffic impact. Width of joint may be small, allowing road grit to jam in the joint, or joint width may be excessive, allowing high traffic impact forces onto the armouring.

Condition State 4

The steel armouring may be loose due to excessive traffic impact. The deck may be heavily cracked and spalled due to the loose or broken anchorages of the armouring. The deck joint may have closed up, allowing dirt and grit to be trapped in the joint.

Component 13O Open expansion joint Other

Units of measurement: Lineal Metres

This item defines those expansion joints constructed without armouring and designed to allow moisture and grit to penetrate the deck into drainage systems on the substructure elements. This element does not include those expansion joints where the expansion seals have been completely lost. These joints are to be considered under their original item with the seal in place.

Condition State 1

The ends of the deck slab are intact and the joint width is sufficiently wide to pass any road grit without it jamming the joint.

Condition State 2

There may be minor cracking of the deck slab adjacent to the joint. Width of the deck joint gap is adequate.

Condition State 3

The ends of the deck slab adjacent to the joint may show moderate cracking and/or minor spalling due to traffic impact. The width of the deck joint gap may be small, allowing grit to jam in the joint, or joint width may be excessive, allowing high traffic impact forces onto the ends of the deck slabs.

Condition State 4

The ends of the deck slabs may be severely cracked and spalled as a result of excessive traffic impact loading caused by an excessively wide gap or uneven deck slabs. Alternatively, the deck joint may have closed up or the gap has been blocked with dirt and grit, and the consequential restraint of movement has generated the cracking and spalling.

Component 14S Sliding joint Steel

Units of measurement: Lineal Metres

This item describes those joints constructed mainly of steel which move or slide over or within a mating element on the other side. The joints may have a compression seal, gland, membrane or catch drain beneath, which should be considered as part of the joint element.

Joints included in this item are steel sliding plates, steel finger joints, PSC FT joints, CIPEC and FIRMSEC (large) joints.

Condition State 1

The element is in good condition with only minor rusting. All hold down bolts are in good condition with no movement of the anchorages. The joint shows no moisture penetration.

Condition State 2

Minor corrosion may be showing on the steel and there may be some slight loosening of the anchorage bolts. The adjacent asphalt may have minor cracking at the joint. The joint may show signs of minor moisture penetration.

Condition State 3

Heavy surface pitting of the steel plates may be present, and up to 40% of the bolts may have failed, allowing the anchorages to move. Cracking and minor breaks in the asphalt may be occurring. The joint may show signs of heavy moisture penetration. Catch drains are present, but may be filled with grit or debris, or the drains/membranes may be deteriorated and not functioning correctly, allowing moisture to pass directly through to bearing shelves. Steel fingers are raised above the mating fingers, with a height difference of 10 mm or less. The gaps between the fingers are asymmetrical, but contact between the fingers has not occurred.

Condition State 4

Advanced corrosion of the steel may be present and in excess of 40% of the bolts may have failed, allowing excessive movement of the anchorages. The asphalt around the joint may be badly cracked and pieces breaking out. Catch drains or membranes may have completely failed or are missing. Steel fingers are raised above the mating fingers, with a height difference in excess of 10 mm. Steel fingers are in contact with the mating fingers, with deformation or breakages taking place.

Component 15O Fixed joint Other

Units of measurement: Lineal Metres

This item describes those joints which are basically fixed but may allow very small movement of one or two millimetres. Deck joints with or without a sprayed seal on top, where the decks are cast against each other or with a thin separator such as cork, bitumen impregnated fibreboard, styrene sheets or malthoid sheets, are included in this item.

If fill or surfacing has been placed over the joints, any defect in the road surface resulting from the joint should be considered under Component No. 1 *Fill / Wearing Surface on Deck*. As the actual joint material will not be visible, the joint should be rated on the basis of observed moisture leakage through the joint (typically evident from the degree of water staining on the headstock).

Condition State 1

The element shows no deterioration and the joint material is held firmly in place by the surrounding concrete. There is no moisture penetration of the joint.

Condition State 2

Minor deterioration of the material may have occurred, allowing slight moisture leakage of the joint through the fine crack.

Condition State 3

Moderate deterioration of the material has occurred due to weathering, pressure or movement of the surrounding concrete. Moderate leakage is occurring as the joint material pulls away from the surrounding concrete.

Condition State 4

Severe deterioration has occurred and the joint material has pulled well apart from the surrounding concrete, or the joint material has badly weathered or been lost. Heavy leakage is occurring through the joint and may be affecting the surrounding concrete.

Component 20P Deck slabs Precast concrete

Units of measurement: Each

This item includes all contiguous precast concrete superstructure units forming both the span and the deck. These units include:

- transversely stressed deck units (deck units with a composite slab are considered as components 21P *Closed Web Girders* and 20C *RC Deck Slab*).
- T-slabs (a trapezoidal beam with an integral top flange developed by VicRoads). A reinforced concrete insitu slab is cast over the top flange.
- U-slabs (Sunshine coast only). Units are transversely stressed through cast insitu diaphragms.
- inverted T-slabs. Bottom flanges are contiguous. Voids between units may be filled with insitu concrete; alternatively, a conventional deck slab may be cast over the top flanges.
- Separate condition states have been defined for the U-slabs while the remaining types are covered under a single category.

U-slabs

Condition State 1

The units are in good condition with no moisture or staining between the units, though there may be minor efflorescence powder under the slab section of the beams. The units may have faint flexural cracking at midspan but there is no spalling. Bolts between high strength U-slabs are all tight.

Condition State 2

The U-slabs may have fine flexural cracking of the legs and there may be other minor cracking or spalling due to corroding steel reinforcement. Moderate moisture and staining between the units indicates the shear key concrete is cracked in high strength U-slabs bridges and there may be longitudinal cracking of the asphalt on top of the slabs. Bolts between the units are generally tight, though there may be a few loose. If the bearings are badly positioned at the ends of the U-slabs, there may be minor cracking in the bearing areas. Impact damage has not exposed reinforcement.

Condition State 3

Medium flexural cracking may be noticed in the U-slab legs with moderate moisture staining between the units. The asphalt surface will be moderately cracked and U-slab bolts will be loose between these units. The shear key concrete between the tops of the units will be badly cracked. There may be moderate cracking and spalling of the U-slab legs caused by structural mechanisms or due to corroding reinforcement or ASR. There may be loss of section of reinforcement due to corrosion of up to 20%. If bearings are badly positioned at the ends of the U-slabs, there may be moderate cracking in the bearing areas of the U-slab legs. There may be impact damage comprising spalls of cover concrete of less than 0.5 m^2 with no significant damage to reinforcement or prestressing strands.

A cracked component shall be rated in Condition State 3 on the basis of the following criteria:

- a crack width exceeds 0.3 mm in concrete located in a non-aggressive environment (Exposure Rating 1 or 2) or
- a crack width exceeds 0.15 mm in concrete located in an aggressive environment (Exposure Rating 3 or 4).

Condition State 4

Medium flexural cracking may be seen in the U-slab legs at midspan with heavy moisture staining between the units. The asphalt surface may be heavily cracked, with some areas completely broken out. The shear key concrete between the high-strength U-slabs may be badly cracked and sections may be broken out. U-slab bolts will be loose, many with nuts completely missing, or they may have been retightened and badly cracked the top of the slab. There may be severe cracking and spalling of the U-slab legs caused by structural mechanisms or loss of section of reinforcement due to corrosion with section loss of 20% or greater (and the resultant cracking and spalling this may cause).

There may be severe cracking of the ends of the U-slab legs due to badly positioned bearings. Impact damage comprising spalls of cover concrete in excess of 0.5 m^2 and damaged or severed prestressing strands.

Prestressed slabs (includes deck units)

Condition State 1

The units are in good condition with minor moisture staining and white efflorescence powder in the joints between units. The units may have minor faint cracking but no spalling. The transverse tensioning rods are in good condition, and show no signs of corrosion.

Condition State 2

The units may have moderate moisture staining with stalactite growths and efflorescence powder visible but no rust staining, due to corrosion of the transverse rods. There may be minor cracks and spalls but no exposure of the stressing strands. Impact forces have caused minor damage but have not exposed reinforcement. Fine longitudinal cracking of the soffit and edges of the units near the supports may be evident as a result of ASR in deck units. The transverse tensioning rods may have minor surface corrosion.

Condition State 3

The units may have medium moisture staining and efflorescence powder in the joints, along with heavy rust staining, due to corrosion of transverse tensioning rods. The asphalt surface may have moderate cracking, due to differential movement between the units or loss of tensioning force in the transverse rods; however, the anchorages are still tight in the recesses. There may be moderate cracking and spalling with minor loss of section of the stressing strands due to corrosion. Non-prestressed reinforcement may be heavily corroded with up to 20% section loss. Impact damage comprising spalls of cover concrete less than 0.5 m^2 with no significant damage to reinforcement or prestressing strands.

A cracked component shall be rated in Condition State 3 on the basis of the following criteria:

- a crack width exceeds 0.3 mm in concrete located in a non-aggressive environment (Exposure Rating 1 or 2) or
- a crack width exceeds 0.15 mm in concrete located in an aggressive environment (Exposure Rating 3 or 4).

Condition State 4

The units may have heavy moisture staining and efflorescence powder in the joints with heavy rust staining, due to corrosion of the transverse tensioning rods. The asphalt surface may be badly cracked or broken along the lines of the precast units. There may be severe cracking and spalling, with loss of

section of the non-prestressed reinforcement greater than 20%. Stressing strands may be broken or have lost up to 10% of section due to corrosion. Transverse tensioning may be loose and the bar anchorages may have popped clear of the recess. There may be impact damage comprising spalls of cover concrete in excess of 0.5 m^2 and damaged reinforcement or severed prestressing strands.

Component 20C Deck/Slabs Cast insitu concrete

Units of measurement: Square Metres

This item includes all reinforced concrete decks cast insitu, including overlays cast non-composite with precast units beneath. It also includes thin slabs cast over the top of defective timber deck planks; however, such use is not recommended for the reinstatement of deteriorated timber decks. Cantilevers in excess of 1.0 m long on closed web girders, Component No. 21, shall also be included in this item.

Condition State 1

The deck shows little or no deterioration though there may be some dampness and efflorescence. Minor cracking due to corroding reinforcement may be present. The characteristic shrinkage crack down the centre of flat slab bridges is fine and dry.

Condition State 2

Minor cracking and spalling may be present with corroding reinforcement visible. Dampness patches and efflorescence powder may be more prominent. The characteristic shrinkage crack along the centre of flat slab bridges is fine and dry.

Condition State 3

There is moderate cracking due to structural mechanisms, or moderate to severe cracking and spalling due to non-structural actions such as corrosion of the reinforcement, with loss of section up to 20% in areas. Patches of dampness and efflorescence may be large with numerous stalactites and lime flows visible. The characteristic shrinkage crack along the centre of flat slab bridges may be medium with some moisture and staining around the adjacent crack. The deck has extensive crazed cracking but no differential movement between sections.

A cracked component shall be rated in Condition State 3 on the basis of the following criteria:

- a crack width exceeds 0.3 mm in concrete located in a non-aggressive environment (Exposure Rating 1 or 2) or
- a crack width exceeds 0.15 mm in concrete located in an aggressive environment (Exposure Rating 3 or 4).

Condition State 4

There may be severe cracking due to structural mechanisms or advanced corrosion of the reinforcement over large areas, with loss of section of reinforcement greater than 20% (and any cracking or spalling associated with it). The characteristic shrinkage crack along the centre of flat slab bridges may be severe with excessive moisture penetration and heavy staining around the crack. The deck has extensive crazed cracking with differential movement between sections of the deck: that is, lateral load distribution has been greatly affected.

Component 20T Deck/Slabs Timber

Units of measurement: Square Metres

This item includes all types of timber decks constructed using fully treated timber and acting as a plate deck. Included in this item are stress laminated timber decks and glued laminated timber sheet (plywood) decks, either as a longitudinal decking or transverse decking replacement, or as a span replacement. Distributor members are also covered.

Condition State 1

The timber may have minor cracks, splits or checks but is fully protected by the preservatives, with no untreated heartwood exposed. The decks are well bolted to the supports. Tensioning rods have adequate stressing and there is no damage to the timber at the stressing plates. Distributor members are connected tightly.

Condition State 2

Preservative protection may be beginning to dissipate with minor leaching of preservative salts (white powder on underside of deck) and with minor weathering and rot of timber. Bolting of the deck may be slightly loose with fine reflective cracks through the asphalt on top. Tensioning rods should still have adequate stressing and there should be no damage to the timber at the stressing plates. There may be minor corrosion on the protruding ends of tensioning rods. Distributor members may be slightly loose or held down at the ends only, and decking surfacing at joints is mostly intact.

Condition State 3

Further leaching of the preservative is occurring, with the timber looking well-weathered and rot pockets forming. The exposed ends of ply sheeting may be starting to delaminate. Bolting of the decks may be loose and there may be minor bolt corrosion, with medium reflective cracking through the asphalt on top. With transverse sheeting, reflective cracking may also be occurring due to differential movement between the slabs under loading, or due to inadequate bolting and/or joint treatment. Tensioning rods may be losing stress, with minor movement or separation of the laminations beginning to occur. There may be moderate corrosion on the protruding ends of tensioning rods. There may be noticeable squashing of timber behind stressing plates. Distributor members are missing, or have not been installed. Where present, distributor members are broken or have experienced complete loss of section. Distributor members may be moving significantly under traffic, resulting in significant cracking of surfacing at deck joints.

Condition State 4

Deterioration of the timber may be well advanced, with substantial loss of the preservative protection. Weathering and rot of the timber is severe, with some laminations almost rotted out. The exposed ends of ply sheeting may be badly delaminated and there may be substantial impact damage to the ends. With transverse sheeting, the surfacing material may be breaking up as a result of differential movement between the slabs under loading or due to inadequate bolting and/or joint treatment.

Bolting of the decks is very loose, with excessive movement of the decking, and there may be severe corrosion of the bolts. If small washers were used, the bolts may have punched through the decking, which has contributed to loose panels which are able to ‘grind’ and flog on the girders. Tensioning rods may be loose with movement and separation of the laminations. Longitudinal cracking in the asphalt above the laminations will be seen if this is occurring. The decking will also deflect excessively

under load, particularly beneath the wheel paths of heavy vehicles, as the lateral distribution has been severely affected. There may be severe corrosion on the protruding ends of tensioning rods. There may be substantial squashing of timber behind stressing plates.

Loss of cross-sectional area in the bottom layer, due to abrasion between the girder and plywood panel, is evident. The deck wearing surface has been lost over significant areas, resulting in the top scarf jointed layer being worn away due to traffic abrasion in places. Abrasion between sheet joints, caused by material from the deteriorated deck wearing surface working its way between the sheets, is occurring. Broken pieces of deck wearing surface have worked their way down between the sheets and are contributing to the grinding action of plywood sheets on the girder seating.

Plywood panels are loose, evidenced by the pronounced transverse cracking in the deck wearing surface over every panel joint and by the total loss of the bottom outer layer of the plywood girder interface described previously.

The underside of the bridge has been subjected to severe fire damage, resulting in the loss of the bottom layer and spongy material above the fire damaged section. The latter could be indicative of changes to the wood structure, due to the heat of the fire.

Component 21S Closed web/box girders Steel

Units of measurement: Lineal Metres

This item includes all closed web steel box girder bridges with concrete or steel deck closing the top of the box or boxes. The steel may be painted. The item does not include the deck.

Condition State 1

The paint system is generally sound with minor chalking, peeling or curling but no exposure of the metal. All welds or bolts are in good condition with no corrosion, cracking or loose bolts.

Condition State 2

Rust spotting of the paint system is occurring and the paint system is no longer effective. No corrosion or section loss has occurred. All welds or bolts are in good condition with no cracking, corrosion or loose bolts.

Condition State 3

Paint system has completely broken down with surface pitting present in a number of locations. Active corrosion is occurring in isolated areas, but no significant loss of section is occurring to affect the strength of the member as a whole. Nuts and bolts may be corroding but are still tight and no cracking of welds has occurred. There may be evidence of vehicular impact damage to webs/soffit.

Condition State 4

Corrosion is well advanced and significant loss of section has occurred which may have a detrimental effect on the strength of the member: that is, severe corrosion of webs or top flange over support or bottom flange at midspan. Welds may be cracked. Nuts or bolts are severely corroded and possibly no longer functioning to full capacity. Splice joint bolts may be loose (can be loosened by a spanner). There is gross distortion of webs/soffit as a result of vehicular impact. There is buckling or distortion of webs, flanges or stiffeners.

Component 21P Closed web/box girder Precast concrete

Units of measurement: Lineal Metres

This item includes all closed web or box girder bridges constructed of precast units and includes segmental post-tensioned box girders and precast prestressed 'U' beams with a cast insitu deck to form the closed box shape. This item includes the deck, whether precast with the box or cast insitu at a later date. Deck cantilevers in excess of 1.0 m long will be assessed as deck/slab Component No. 20.

Note:

Transversely stressed deck units with a composite slab are considered as components 21P: *Closed Web Girders* and 20C: *RC Deck Slab*.

Condition State 1

There may be only minor cracking of the units, due to a lack of distribution reinforcement, but definitely no spalling or cracking of a structural nature. Some minor discolouration or white efflorescence powder may be visible at the former lifting hole locations.

Condition State 2

There may be a few minor cracks or spalls, due to corroding reinforcement in isolated areas, but there should be no exposure of any stressing tendons or stressing ducts. Some minor discolouration or white efflorescence powder may be visible at a few joints between the precast units. Minor transverse cracking may be evident on the box soffit at midspan or on the deck surface over supports. There may be impact damage to the box that has not exposed reinforcement.

Condition State 3

There may be some delamination or spalling in isolated areas with the stressing tendons or stressing ducts exposed but with little or no corrosion occurring. Other exposed reinforcement may have corrosion up to 20% of the area of the bars in isolated areas. Moderate transverse cracking may be evident on the box soffit at midspan or on the deck surface over supports. There may be impact damage comprising spalls of less than 0.5 m^2 of cover concrete with no significant damage to reinforcement or prestressing strand/duct.

A cracked component shall be rated in Condition State 3 on the basis of the following criteria:

- a crack width exceeds 0.3 mm in concrete located in a non-aggressive environment (Exposure Rating 1 or 2) or
- a crack width exceeds 0.15 mm in concrete located in an aggressive environment (Exposure Rating 3 or 4).

Condition State 4

There may be severe cracking due to structural mechanisms or advanced corrosion of the reinforcement over large areas, with loss of section of reinforcement greater than 20% (and any delamination, cracking or spalling associated with it). Stressing tendons exposed in the spalled areas may have corrosion up to 10% of their area. Some strands may also be broken or there may be severe cracking or failure at the anchorages. There may also be severe transverse cracking of the underside of the box at the midspan or severe cracking in the deck above the supports. There may be

evidence of failure of glued or cast insitu joints between segments. There may be impact damage comprising spalls of more than 0.5 m^2 of cover concrete and damaged or severed prestressing strand/ducts.

Component 21C Closed web/box girder Cast insitu concrete

Units of measurement: Lineal Metres

This item includes all cast insitu, post-tensioned concrete box girder and voided slab bridges, and includes the deck as part of the item. Voided slab bridges can be recognised by their shallow depth compared to a box girder. These structures are generally built on, or over freeways and are well suited to spans of 34 to 40 metres. Voided slabs greater than 35 metres will generally have a variable depth, due to their massive dead load compared with box girders. Deck cantilevers in excess of 1.0 m long will be assessed as deck/slab Component No. 20.

Condition State 1

There may be minor cracking of the girder or deck due to corroding reinforcement or a lack of distribution reinforcement, but there should be no structural cracking or spalling. Minor discolouration of efflorescence powder may be visible in a few locations. There may be minor longitudinal cracking on soffit under void formers.

Condition State 2

There may be a few minor cracks or spalls due to corroding reinforcement in locations but there should be no exposure of the stressing ducts. Some minor discolouration or white efflorescence powder may be visible in a few locations. There may be minor cracking on soffit transversely at midspan, longitudinally under void formers and on deck over supports. There may be impact damage to a box that has not exposed reinforcement.

Condition State 3

There may be some delamination or spalling in isolated locations with stressing ducts exposed but with little or no corrosion occurring. Other exposed reinforcement may have corrosion up to 20% of the area of the bars in isolated areas. There may be moderate cracking on soffit transversely at midspan, longitudinally under void formers and on deck over supports. There may be impact damage comprising spalls of less than 0.5 m^2 of cover concrete but no significant damage to reinforcement or prestressing strand/ducts.

A cracked component shall be rated in Condition State 3 on the basis of the following criteria:

- a crack width exceeds 0.3 mm in concrete located in a non-aggressive environment (Exposure Rating 1 or 2) or
- a crack width exceeds 0.15 mm in concrete located in an aggressive environment (Exposure Rating 3 or 4).

Condition State 4

There may be severe cracking due to structural mechanisms or advanced corrosion of the reinforcement over large areas, with loss of section of reinforcement greater than 20% (and any cracking or spalling associated with it). Stressing ducts may be exposed in areas with active corrosion of the ducts and tendons within. Some strands within the tendons may have up to 10% loss of section or be broken. Severe cracking or failure may have occurred at the anchorages. There may also be major transverse cracking of the underside of the box at midspan, or the top of the deck above the supports. There may be impact damage comprising spalls of more than 0.5 m^2 of cover concrete and damaged or severed reinforcing bars or prestressing strand/ducts.

Component 22S Open girders Steel

Units of measurement: Each

This item includes all girders constructed of wrought iron or steel. The girders may be rolled sections, welded plate girders, riveted girders constructed of plates and angles, or lattice girders using flat sections crossing each other to form the vertical web/webs. Metal may be painted or galvanised.

Condition State 1

The paint or galvanising system is generally sound with only minor chalking, peeling or curling, but with no exposure of metal. All welds, bolts or rivets are in good condition with no movement of plates or sections in the element.

Condition State 2

Spot rusting of the paint or galvanising system is occurring and the paint system is no longer effective. No corrosion of the section has occurred. All member lines are true. All welds, bolts or rivets are in good condition with no movement of plates or sections in the element.

Condition State 3

The paint or galvanising system has completely broken down with surface pitting in locations. Active corrosion may be occurring in isolated areas but no loss of section area has occurred which would affect the strength of the member. Nuts and bolts may be corroded but are still tight and no cracking of welds has occurred. Riveted plates may have very minor movements of one to two millimetres but rivets are generally sound. For structures without a composite concrete deck, the top flanges of the girders should be effectively braced at no more than 5 m centres, such that no lateral bowing of girders occurs under load. There may be minor deviations in the member line. There may be some evidence of excessive deflection or movement under load. There may be significant permanent distortion of members as a result of impact damage.

Condition State 4

Corrosion is well advanced and loss of section has occurred, having a detrimental effect on the strength of the member; that is, severe corrosion of webs or top flange over supports or bottom flange at midspan. Bracing may be ineffective or missing, forcing the girder to visibly bow under traffic loading. Permanent bowing of girders may be evident. Girders may also exhibit excessive vertical deflections under load. There may be buckling or distortion of webs, flanges or stiffeners. There may be gross distortion of members as a result of impact damage.

There may be some cracking of the welds between the plates. Rivets or bolts may be severely corroded and no longer carrying full load or functioning as intended. Rivets may be broken or missing, allowing excessive movement of plates of fabricated girders. Splice bolts may be missing. Splice joint bolts may be loose (can be loosened by a spanner). Cracking of tension flanges may have occurred as a result of impact or unsatisfactory welding procedures.

Component 22P Open girders Precast concrete

Units of measurement: Each

This item includes a variety of girders developed over the years using reinforced and prestressed concrete. The vast majority are pretensioned, prestressed concrete members; however, post-tensioned girders, including some segmental constructions, have also been adopted. This component description includes:

- non-standard 'I' girders (including segmental constructions)
- standard NAASRA 'I' and 'U' sections
- bulb-T (basically a thickened I section with a 1.2 m wide top flange – some units have been constructed segmentally)
- super-T (a trapezoidal beam with an integral 2.0 m wide top flange developed by VicRoads).

Condition State 1

The girders are in good condition with only very minor cracking due to corroding reinforcement, shrinkage, lack of curing or prestressing (longitudinal cracks in webs of ends of girder).

Condition State 2

The girders may have minor cracking due to corrosion of reinforcement but there is no rust staining in cracks. There are a few minor spalls but the stressing strand is not exposed. Impact damage has not exposed reinforcement (some minor discolouration or efflorescence powder may be visible at joints between segments).

Condition State 3

Crack widths are moderate and a few spalls may have occurred which have exposed stressing strands. The stressing strands should not show any evidence of corrosion whilst reinforcing bars may exhibit a 20% loss of section due to corrosion. Minor flexural cracks may be evident in girders at midspan or in the deck over supports if girders are continuous. There may be impact damage comprising spalls of less than 0.5 m^2 of cover concrete with no significant damage to reinforcement on prestressing strands (heavy staining and/or cracking occurring at joints between girder segments).

A cracked component shall be rated in Condition State 3 on the basis of the following criteria:

- a crack width exceeds 0.3 mm in concrete located in a non-aggressive environment (Exposure Rating 1 or 2) or
- a crack width exceeds 0.15 mm in concrete located in an aggressive environment (Exposure Rating 3 or 4).

Condition State 4

Delamination, spalls and corrosion of reinforcement is prevalent with loss of reinforcement section in excess of 20%. Exposed prestressing strands may have lost up to 10% of their section. Severe cracking or failure of anchorages may have occurred. Heavy flexural cracking may be present in girders or in the deck above supports. There may be impact damage comprising spalls in excess of 0.5 m^2 of cover concrete and damaged or severed prestressing strand/ducts (evidence of opening of segmental girder joints).

Component 22C Open girders Cast insitu concrete

Units of measurement: Each

This item includes all reinforced concrete beams cast insitu, generally prior to 1950, though a few structures were built as late as 1955 using varying depth beams continuously over pier supports with a larger central span.

These structures were called RC T-beam or grillage bridges and are generally continuous monolithic small span bridges with the longest span being approximately 13 m (beam shape is always rectangular).

Condition State 1

The girders have minor cracking due to corroding reinforcement but there should be no shear cracking or spalling of the concrete. Minor cracking may exist at the built-in supports or fine vertical shrinkage cracks may appear in the beams due to the locked up movements of the structure.

Condition State 2

The girders may have fine flexural and/or shear cracking. Vertical shrinkage cracks and cracking at built-in supports may be fine. Longitudinal cracking along the bottom of the beams due to reinforcement corrosion may be of fine size with a few minor spalls. The ends of simply supported beams may have minor cracking in the bearing areas due to the bearings or locating dowels.

Condition State 3

Flexural cracking and shear cracking may be medium sized with minor cracking along the beam deck joint. Vertical shrinkage cracks and cracking at built-in supports may be medium in size. Longitudinal cracking may be medium along the bottom of the beams due to reinforcement corrosion and there may be large spalls with delaminated cover concrete. Exposed reinforcement may have heavy corrosion with section loss up to 20% in areas. The beams may have moderate cracking in the bearing areas at the ends of the beams.

A cracked component shall be rated in Condition State 3 on the basis of the following criteria:

- a crack width exceeds 0.3 mm in concrete located in a non-aggressive environment (Exposure Rating 1 or 2) or
- a crack width exceeds 0.15 mm in concrete located in an aggressive environment (Exposure Rating 3 or 4).

Condition State 4

Flexural and shear cracking may be heavy with moderate cracking along the beam/deck joint. Vertical shrinkage cracks and cracking at built-in supports may be heavy in size. Severe spalling or delamination of the underside of the beams may be occurring, with loss of reinforcement greater than 20% due to corrosion of the reinforcement. The beams may have severe cracking in the bearing area with severe loss of bearing support.

Component 22T Open girders Timber

Units of measurement: Each

This item includes all timber stringers such as round or octagonal hewn timber logs and saw cut timber sections.

Note:

Pipe rot is quoted as a percentage of the diameter of the girder, while snipe depth is quoted as a percentage of the depth of the girder (which is essentially the diameter of the girder minus the depth of the contact flat or 'benching' on the upper face of the girder).

Members with pipe rot/termite attack/snipes in excess of the values shown in Condition State 4 are critical and should be replaced immediately.

Once a defect has been strengthened/rectified, it may be considered as not being present for the purpose of rating the member at all future inspections, provided that the repair is intact and operating as required.

Snipes treated in accordance with the recommendations of the *Timber Bridge Maintenance Manual* and relevant Advice Notes may be ignored for the purpose of rating the member (but their presence should be noted on the *Timber Drilling Survey Report*). If the treatment is not performing as desired, the member must be repaired or replaced.

The requirements for strengthening in response to rot/section loss are as follows:

- It is only possible to repair 'defects' no greater than the relevant Condition State 4 criteria (for example, girders with up to 50% loss of section at the support or corbels or piles with up to 50% pipe rot).
- For the specified repair techniques for girders and piles, the last two bolts must be located within Condition State 2 material (refer the *Timber Bridge Maintenance Manual* and relevant Advice Notes).
- The repair may be considered to be effective, and the defect rectified as long as:
  - the % of defects observed do not exceed the Condition State 4 criteria following
  - the Condition State 2 portion of the girder/pile (that is, the portion with the bolts as specified above) remains in Condition State 2 and
  - the repair remains intact, in good condition and continues to function as intended.
- Drill records are still to be recorded and entered in the *Timber Drilling Survey Report* form, Appendix A (A2/5) as normal, but on the *Condition Inspection Report* form, Appendix A (A2/2), the component may be rated lower, with comments describing the remedial works as justification for the improved condition state as compared to automatically generated values in the A2/5 form.
- If the defect is found to exceed Condition State 4 at a subsequent inspection, the component must be replaced within three to six months depending on the severity of the defects.

For installation of new components, the snipe guidelines in Figures 8.1(c) and 8.1(d) of the *Timber Bridge Maintenance Manual* should be followed. The condition state criteria described in this *Structures Inspection Manual* should be considered as indicating the following for sniped components:

- Condition State 2: OK in current configuration
- Condition State 3: Monitoring required at subsequent inspections, but no action required at this stage
- Condition State 4: Strengthening/treatment of snipes required.

New components which are sniped up to the Condition State 3 limits as shown in this *Structures Inspection Manual* should still be recorded as Condition State 3. This is an issue resulting from historical work practices with round logs and the necessity of sniping them prior to installation to provide an adequate bearing area compared to the effect that the snipe has on the ultimate capacity of the member, which had not been previously considered. In this situation, rating all of the sniped components as Condition State 3 in the *Condition Inspection Report* form, Appendix A (A2/2) form, and then rating the entire structure as Condition State 2 (subject to no other defects affecting overall condition state) with sufficient detail in the inspector comments about the sniping is considered to be a reasonable approach when inspecting these structures.

Condition State 1

The girders are in good condition with little or no pipe rot or decay. There may be minor splits or checks having no effect on member strength. Girder to corbel bolts are tight. Depth of snipes may be up to 5% of the depth of the girder. Where packers have been installed between the girder and corbel, there must be continuous contact between girder, packer and corbel along the entire length of the girder/corbel interface. The packer must be fixed in place to prevent loss/displacement under vehicle loading. No crushing or splitting of the packer is evident.

Condition State 2

Girders are in good condition and may have pipe rot/termite attack (including the depth of the end snipe) of up to 30% of the diameter at midspan and/or 20% at the supports. They may also have minor surface or non-central decay, fire damage, splitting, checking or crushing but not of sufficient magnitude to affect the strength of the member. Depth of snipes may range from 6% to 10% of the depth of the girder. There are no horizontal cracks propagating from the roots of snipes. Girder to corbel bolts are slightly loose. Where packers have been installed between the girder and corbel, there must be continuous contact between girder, packer and corbel along the entire length of the girder/corbel interface. The packer must be fixed in place to prevent loss/displacement under vehicle loading. There may be minor splitting of the packer.

Condition State 3

Girders have a reasonable amount of pipe rot/termite attack (including the depth of the end snipe) of up to 50% at midspan and/or 35% at the supports. They may have large splits or checks which may reduce the strength of the member. Splits may be separating under load, causing crushing of the member, or crushing may be due to water ingress softening the load bearing areas of the timber. Depth of snipes may range from 11% to 15% of the depth of the girder. Horizontal cracks propagating from the roots of snipes may be present but do not exceed 300 mm in length. There may be a medium amount of surface or non-central decay or fire damage present. Girder to corbel bolts are loose or corroding. Where packers have been installed between the girder and corbel, there must be

continuous contact between girder, packer and corbel along the entire length of the girder/corbel interface. The packer must be fixed in place to prevent loss/displacement under vehicle loading. There may be moderate splitting or minor crushing of the packer.

Condition State 4

The timber girders may have excessive pipe rot/termite attack (including the depth of end snipes) of up to 70% at midspan and/or 50% of the supports, accompanied by severe splitting or crushing. Strength of the member has been severely affected and failure may be imminent. There may be observable movement under load of decking planks/spiking planks relative to the girders as a result of lack of support from the girder due to significant rot or piping (as detected in drilling tests). Depth of snipes may range from 16% to 30% of the depth of the girder. Horizontal cracks propagating from the roots of snipes may be present and of length exceeding 300 mm. There may be severe surface or non-central decay, fire damage or possibly large rot holes present. Girder to corbel bolts may be very loose, with threads or nuts severely corroded.

Where installed, there may be moderate to severe splitting or crushing of the packer between the girder and the corbel or continuous contact between girder, packer and corbel along the entire length of the girder/corbel interface may not have been provided.

Component 22O Open girders Other

Units of measurement: Each

This item applies to fibre composite girders used as a replacement element in timber bridges. Most fibre composite girders in service are either Wagners or Loc Composites products.

Type 1 – Wagners Fibre Composite girder

The Wagners Fibre Composite (Wagners FC) girder consists of glass fibre reinforced plastic pultrusions, steel reinforcement and exterior flow coat.

The Wagners specification requires girders to be inspected at six months and 12 months after installation and then every 12 months thereafter.

The condition rating may be increased at the discretion of the inspector if, in his/her opinion, any combination of defects present has an accumulative effect that justifies the higher rating.

Note:

Members with defects in excess of values shown in Condition State 4 are in a critical condition and should be replaced immediately. Wagners Fibre Composite Technologies division is to be contacted for advice and further investigation where fire damage, incorrect seating or transverse cracking is found.

Condition State 1

The girders are in good condition with no delamination, cracking, chipping, impact or fire damage, distortion, twisting, bulging or exposure of steel. They may have surface chalking of flow coat or discoloration (including soot deposits, but no charring from fire). Girder to corbel bolts are tight. There is no crushing or splitting in the packer (if present) between the girder and the corbel.

Condition State 2

Girders are in good condition with no delamination, cracking, impact damage or distortion, twisting, or bulging. They may have chipping of the flow coat but with no visible damage to laminate or glass fibres exposed. There may also be some exposure of steel, providing it is free of corrosion and/or damage. There may be minor splitting in the packer (if present) and girder to corbel bolts may be slightly loose.

Condition State 3

Girders will be free of cracks and distortion, twisting or bulging, but may have delamination of composites or minor impact damage up to a depth of 1 mm and an area not exceeding 50 mm x 50 mm or equivalent in any one location with damage restricted to the first layer of fibreglass. There may be evidence of minor corrosion of exposed steel, providing it can be confirmed to be free of damage. Fire damage may also be visible, but with no apparent distortion of the girder or cracks in glue. The girder seating may have minor misalignment. Girder to corbel bolts may be very loose, with threads or nuts corroded. There may be moderate splitting or minor crushing in the packer between the girder and the corbel (if present).

Condition State 4

Girders may have exposed steel that is corroded or damaged. They may have significant impact damage or delamination, cracking or splitting exceeding 1 mm deep and/or exceeding an area of

50 mm x 50 mm or equivalent. They may also exhibit excessive deflection under load, twisting, evidence of fire damage causing cracks or distortion, bulging in the sides of pultrusions, and/or significant misalignment of the girder seating. Girder to corbel bolts may be very loose, with threads or nuts severely corroded. There may be moderate to severe crushing or splitting in the packer between the girder and the corbel (if present). Any longitudinal cracks that develop in the girder near the supports, delamination of the top or bottom laminates at midspan, as evidenced by cracks in the glue lines, or transverse cracking across the width indicates the girder is in a critical condition and should be replaced immediately.

Type 2 – Loc Composite girder

This element is the University of Southern Queensland (USQ) designed fibre composite 'hybrid' girder consisting predominantly of Alkaline Copper Quaternary (ACQ) treated laminated veneer lumber (LVL) reinforced with glass fibre reinforced plastic pultrusions, steel reinforcement and steel stressing strand.

The Loc Composites specification requires the girders to be inspected within one month of installation, at six months and 12 months and subsequently in accordance with the *Structures Inspection Manual* defined frequencies.

The condition rating may be increased at the discretion of the inspector if, in his/her opinion, any combination of defects present has an accumulative effect that justifies the higher rating.

Note:

Members with defects in excess of values shown in Condition State 4 are in a critical condition and should be replaced immediately. The department's Bridge Construction, Maintenance and Asset Management section is to be contacted for advice and further investigation where fire damage, white ant or fungal attack or transverse cracking is suspected or found. Routine drilling of the girders is not permitted, but may be carried out under the supervision of a USQ representative if white ant or fungal attack is suspected.

Condition State 1

The girders are in an 'as new' condition with no evidence of cracking, crushing and damage due to fire, impact, fungal attack, white ant attack or loss of protective coating due to wearing including flaking, peeling or spalling. Girder to corbel bolts are tight and there is no crushing or splitting in the packer between the girder and the corbel (if present).

Condition State 2

Girders are in good condition and with no evidence of damage due to fire, fungal attack, white ant attack, crushing of the girder, or transverse cracking (cracking across the width of the girder). They may have minor loss of the protective coating with areas not exceeding 1000 mm x 50 mm (or equivalent). There may be minor longitudinal cracking (cracking along the length of the girder) less than 600 mm long, 1 mm wide and no greater than 15 mm deep. There may be minor splitting in the packer (if present) and girder to corbel bolts may be slightly loose.

Condition State 3

Girders show no evidence of damage due to fire, fungal attack or white ant attack. They may have loss of the protective coating, of an area between 1000 mm x 50 mm (or equivalent) and 1000 mm x 100 mm (or equivalent). There may be transverse cracks (cracking across the width of the girder) less than 50 mm long, 1 mm wide, and 5 mm deep. There may be longitudinal cracks between

600 mm and 1000 mm long, 1 to 2 mm wide and not exceeding 15 mm deep. Crushing of the girder may be evident, but does not exceed 5 mm in depth. There may be minor crushing or moderate splitting in the packer between the girder and the corbel (if present). Girder to corbel bolts may be loose or corroding.

Condition State 4

The surface of the girder may be blackened due to fire; however, no loss of section has occurred. Girders may exhibit evidence of fungal attack or white ant attack resulting in loss of section. There may be transverse cracks (cracking across the width of the girder) between 50 mm and 100 mm long, 1 to 2 mm wide, and 5 mm deep. They may have loss of the protective coating, of an area in excess of 1000 mm x 100 mm (or equivalent). Longitudinal cracking exceed 1000 mm in length, are greater than 2 mm wide and exceed 15 mm in depth. The girders may also exhibit crushing exceeding 5 mm in depth. Girder to corbel bolts may be very loose, with threads or nuts severely corroded. There may be moderate to severe crushing or splitting in the packer between the girder and the corbel (if present).

Component 23S Through truss Steel

Units of measurement: Lineal Metres

This item includes all steel (or wrought iron) trusses that are above the deck level of the roadway. The element includes all truss chords (top and bottom), verticals, cross-braces, wind-bracing or arch-braces. This element does not include the floor-beams supporting the roadway.

Condition State 1

The steelwork is in good condition with no rust spotting of the paint system, though there may be minor chalking, peeling or curling. All welds, bolts and rivets are in good condition with no corrosion, cracking or looseness. There is no accident damage to the trusses or bracing.

Condition State 2

Rust spotting of the paint system is occurring and the paint system is no longer effective. No corrosion or section loss has occurred. All welds or bolts are in good condition with no cracking, corrosion or loose bolts. Minor accident damage is of no consequence.

Condition State 3

The paint system has completely broken down with surface pitting present in a number of locations. Active corrosion is occurring in isolated areas, but no significant loss of section is occurring to affect the strength of the member as a whole.

Nuts and bolts may be corroding but are still tight and no cracking of welds has occurred. Accident damage to truss or overhead bracing has a minor effect on the stiffness of the trusses. Minor distortion of members is evident.

Condition State 4

Corrosion is well advanced and some loss of section has definitely occurred which may have a detrimental effect on the strength of the member; that is, flanges, webs or gussets are badly corroded over much of its length. Welds may be cracked. Nuts or bolts are severely corroded and possibly no longer functioning to full capacity. Splice joint bolts may be loose (can be loosened by a spanner). Accident damage to trusses is of major concern, affecting the strength of the trusses. There may be gross distortion of webs, flanges, stiffeners, gussets, and so on as a result of overstressing due to loss of member or connector section or as a result of accident damage.

Component 24S Deck truss Steel

Units of measurement: Lineal Metres

This item includes all steel or wrought iron trusses that are below the deck level of the roadway. The element includes all truss chords, verticals, cross-braces and wind-bracing. This item does not include crossbeams or floor-beams supporting the roadway.

Condition State 1

The paint system is generally sound with minor chalking, peeling or curling but no exposure of the metal. All welds or bolts are in good condition with no corrosion, cracking or loose bolts.

Condition State 2

Rust spotting of the paint system is occurring and the paint system is no longer effective. No corrosion or section loss has occurred. All welds or bolts are in good condition with no cracking, corrosion or loose bolts.

Condition State 3

The paint system has completely broken down with surface pitting present in a number of locations. Active corrosion is occurring in isolated areas, but no loss of section is occurring that will affect the strength of the member as a whole. Nuts and bolts may be corroding but are still tight and no cracking of welds has occurred.

Condition State 4

Corrosion is well advanced and some loss of section has definitely occurred which may have a detrimental effect on the strength of the member; that is, a flange is badly corroded over much of its length. Welds may be cracked. Nuts or bolts are severely corroded and possibly no longer functioning to full capacity. Splice joint bolts may be loose (can be loosened by a spanner).

Component 25S Arches Steel

Units of measurement: Lineal Metres

This item includes all large corrugated multi-plate arches, Superspans, Nova spans or multi-plate underpasses used to pass road or rail traffic through. Smaller units or units used specifically to allow water or cattle traffic through shall be considered as culverts.

Condition State 1

The element shows no corrosion of the metal. Any concrete at the base of the arch is in good condition with no cracking or spalling. There is no evidence of plate buckling or seam shearing. All bolts connecting the multi-plates are in good condition and are tight. No distortion of arch shapes with attendant change in dimensions is evident. There is no damage to the element from vehicular traffic.

Condition State 2

The element may show minor spot rusting. All bolts are tight with no movement of the plates. There is no evidence of plate buckling or seam shearing. There is no damage to the element from vehicular impact. Any concrete at the base of the arch may have minor cracking or spalling due to corroding reinforcement but there should be no cracking due to settlement of the foundations. No distortion of the arch shape is discernible; however, there may be a minor change in dimensions.

Condition State 3

The element may show rusting and areas of minor corrosion. Some bolts may be a little loose and some plates may have slipped slightly. The plate around some bolts may be damaged or torn, allowing distortion to occur. The arch may be developing a small discernible flat spot due to movement of a footing. The arch span may have increased by more than 25 mm since last inspection. If cover is small, then there may be a deflection at the crown under live load. Plates adjacent to thrust blocks have buckled or compressed and connections are shearing the plates. Accident damage from vehicles is minor and does not affect the structure. Any concrete at the bottom of the arch may have moderate cracking and spalling due to corroding reinforcement or it may have minor cracking due to minor differential settlement of the foundations.

Condition State 4

The element may have heavy rusting and corrosion. Some bolts may have pulled loose and plates have moved or bolts have pulled through the plates. Plates may have crinkled at the bolt line or may have bulged due to earth pressures. The arch span may have increased by more than 50 mm since the last inspection and gross distortion of the arch shape is evident. The arch may have a large flat spot at the top due to movement of a footing. Plates adjacent to thrust blocks are badly buckled and compressed and the connections have sheared. Accident damage may be severe and have a definite effect on the structure.

Concrete at the base of the arch may have severe cracking and spalling due to corroding reinforcement or moderate cracking due to differential settlement.

Component 25P Arches Precast concrete

Units of measurement: Lineal Metres

This item includes precast concrete arches such as Bebo, Techspan, Humes and other three pinned arches.

Condition State 1

The element shows little or no deterioration with only minor efflorescence or minor fine superficial cracking of no consequence. Shape, line and level of the arch units is good and straight. The concrete footing and base slab are in good condition with no cracking or spalling.

Condition State 2

Minor cracking and spalling may be evident due to corroding reinforcement in isolated areas. There may be minor cracking or moisture penetration around the hinge areas with moderate efflorescence powder visible. Shape, line and level of the arch units should be good and straight. The footing may have minor cracking and spalling due to corroding reinforcement, but no cracking due to movement or differential settlement.

Condition State 3

Moderate cracking due to structural mechanisms, or moderate to severe cracking and spalling due to non-structural actions such as corrosion of the reinforcement may be evident, with up to 20% loss of section of exposed reinforcement. The shape and line of the arch may show some deviation due to movement or differential settlement, with minor spalling at the hinge points. The footing may show fine cracking due to movement pressures or differential settlement.

A cracked component shall be rated in Condition State 3 on the basis of the following criteria:

- a crack width exceeds 0.3 mm in concrete located in a non-aggressive environment (Exposure Rating 1 or 2) or
- a crack width exceeds 0.15 mm in concrete located in an aggressive environment (Exposure Rating 3 or 4).

Condition State 4

Severe cracking due to structural mechanisms or advanced corrosion of the reinforcement may be evident, with loss of section of reinforcement greater than 20% and associated cracking and spalling, with large delaminated areas. The shape and line of the arch may show a dip due to movements and differential settlements with medium to heavy spalling around the hinge points. The footing may have moderate cracking due to movement pressures or differential settlement.

Component 25C Arches Cast insitu

Units of measurement: Lineal Metres

This item includes all cast insitu reinforced concrete arches and small portal bridges built pre-1950. Large freeway 'portal' bridges may be considered as monolithic structures built according to their superstructure type; that is, flat slab, box girder or voided slab bridges.

Condition State 1

The element shows only minor superficial cracking, scaling or efflorescence having no effect on strength.

Condition State 2

The element may have minor cracking and spalling due to corroding reinforcement, or there may be a fine horizontal crack in the portal wall at the thickening, due to earth pressures on the walls or simply a construction joint opening up. Scaling of the concrete surface may be in larger patches with an increase in white efflorescence powder on the surface.

Condition State 3

The element may have moderate to severe cracking and spalling due to corroding reinforcement, with loss of section of reinforcement no greater than 20%. There may be a medium size horizontal crack in the portal wall at the thickening. In arches, there may be leakage, staining and spalling at the arch/side wall joint due to wet fill inside the arch. Scaling and efflorescence may be prevalent. The arch may be beginning to lose shape with a flat spot at the top due to movement of a footing, or there may be cracking due to slight differential movement of the foundations.

A cracked component shall be rated in Condition State 3 on the basis of the following criteria:

- a crack width exceeds 0.3 mm in concrete located in a non-aggressive environment (Exposure Rating 1 or 2) or
- a crack width exceeds 0.15 mm in concrete located in an aggressive environment (Exposure Rating 3 or 4).

Condition State 4

There may be severe horizontal cracking in the portal wall at the thickening. Corrosion of the reinforcement may be severe, with loss of section of the reinforcement in excess of 20% and associated cracking, spalling and delamination. Scaling and efflorescence may be prevalent and leakage at the arch/side wall joint may be excessive. The arch may have lost shape with a large flat spot due to movement of a footing, or there may be severe cracking due to differential settlement of the foundations. Accident damage may be severe and having a definite effect on the structure.

Component 25O Arches Other

Units of measurement: Lineal Metres

This item includes all arch bridges constructed of masonry which have earth fill inside. The condition of the road surface should be considered under Component No. 1 and is not included as part of this item. The arch sidewalls, however, should be included as part of this item.

Condition State 1

The element shows little or no deterioration with no cracking of mortar or loss of mortar between the blocks. There may be small areas of dampness and efflorescence.

Condition State 2

There may be minor cracking of the mortar or minor loss of mortar between the blocks, but not sufficient to affect the strength of the arch. The shape of the arch is still good and there is no cracking or bulging of the sidewalls. There may be large areas of dampness and efflorescence.

Condition State 3

There may be moderate cracking or loss of mortar between blocks which has a minor effect on the strength of the arch. Some soffit blocks may have slipped slightly due to the loss of mortar. Minor settlements, movements, loss of arch shape, or cracking and minor bulging of the sidewalls may be present, but not of sufficient magnitude to cause concern.

Condition State 4

There may be severe cracking or loss of mortar between blocks which has a significant effect on the strength of the arch. Some soffit blocks may have slipped significantly and some blocks may have cracked through or edges broken off. Abutments or piers may have settled or moved significantly, causing a loss of shape of the arch. Differential settlement of the foundations may have also caused severe cracking along the arch soffit. Earth pressure on the sidewall may have caused severe cracking, movement or large bulging of the blocks to occur.

Component 26S Cables/Hangers Steel

Units of measurement: Each

This item includes all steel cables or hangers used to support the deck. The cables may be galvanised, painted, coated or wrapped in grease with a protective outer wrapper, but are not embedded in concrete.

Condition State 1

There is no evidence of rusting or corrosion and any paint system or protective wrapping is in good condition. There are no signs of distress at anchors, sockets or saddles.

Condition State 2

The cables or hangers may show signs of rust or the protective wrapping may be broken or in poor condition. There are no signs of distress at anchors or sockets but the saddles may be rusty and in need of lubrication.

Condition State 3

The cables or hangers may be rusty with signs of minor corrosion. Any paint system, coating or protective wrapping has been lost or is in very poor condition. Anchors may have minor cracking, sockets may be a little loose or saddles may have fine cracks in the metal. The cables may have slackened off slightly or the hangers are slipping on the cable. Cables may be beginning to abrade but there are no wire breakages.

Condition State 4

The cables or hangers are badly corroded or the hangers are loose and are sliding along the cables. The cables may have slackened noticeably. Anchorages may have severely cracked or anchorages have moved or slipped. Sockets may have loosened or saddles are badly damaged. Cables may be severely abraded with a number of broken wires.

Component 27C Corbels Reinforced concrete

Units of measurement: Each

This item covers discrete reinforced concrete corbels built out from reinforced concrete substructures to support timber girders.

Condition State 1

The corbel is in good condition with minimal deterioration and no cracking. Bolted connections to girders are tight.

Condition State 2

Minor cracking and minor spalling may be evident as a result of edge loading or corrosion of the reinforcement. There is no significant loss of bearing area. Bolted connections to girders may be slightly loose or corroded.

Condition State 3

A significant loss of bearing area may be evident. Moderate spalling and cracking as a result of edge loading, or moderate to severe cracking and spalling due to corrosion of the reinforcement, may have occurred, with loss of section of reinforcement up to 20%. Rust staining is evident in the cracks and under connections. Bolted connections to girders are loose and girders move slightly under load. Bolts may have lost up to 20% of their sectional area as a result of corrosion.

A cracked component shall be rated in Condition State 3 on the basis of the following criteria:

- a crack width exceeds 0.3 mm in concrete located in a non-aggressive environment (Exposure Rating 1 or 2) or
- a crack width exceeds 0.15 mm in concrete located in an aggressive environment (Exposure Rating 3 or 4).

Condition State 4

Corbels are severely cracked and spalled as a result of edge loading or impact loading caused by loose connections to the girders which move markedly under load. Severe corrosion of the reinforcement may have occurred, with loss of section of the reinforcement greater than 20% and associated cracking, spalling and delamination. Bolted connections may have lost more than 20% of their sectional area. The bearing area is significantly reduced and the capacity of the corbel is significantly compromised.

Component 27T Corbels Timber

Units of measurement: Each

This item includes all timber corbels, whether they be round or octagonal hewn or sawn log, or sawn timber blocks.

Note:

Pipe rot is quoted as a percentage of the diameter of the member, while snipe depth is quoted as a percentage of the depth of the corbel (which is essentially the diameter of the corbel minus the depth of the contact flat or 'benching' on the upper face of the corbel).

Members with pipe rot/termite attack/snipes in excess of the values shown in Condition State 4 are critical and should be replaced immediately.

Once a defect has been strengthened/rectified, it may be considered as not being present for the purpose of rating the member at all future inspections, provided that the repair is intact and operating as required.

Snipes treated in accordance with the recommendations of the *Timber Bridge Maintenance Manual* and relevant Advice Notes may be ignored for the purpose of rating the member (but their presence should be noted on the *Timber Drilling Survey Report*). If the treatment is not performing as desired, the member must be repaired or replaced.

The requirements for strengthening in response to rot/section loss are as follows:

- It is only possible to repair 'defects' no greater than the relevant Condition State 4 criteria (for example, girders with up to 50% loss of section at the support or corbels or piles with up to 50% pipe rot).
- For the specified repair techniques for girders and piles, the last two bolts must be located within Condition State 2 material (refer to the *Timber Bridge Maintenance Manual* and relevant Advice Notes).
- The repair may be considered to be effective, and the defect rectified as long as:
  - the % of defects observed do not exceed the Condition State 4 criteria following
  - the Condition State 2 portion of the girder/pile (that is, the portion with the bolts as specified previously) remains in Condition State 2 and
  - the repair remains intact, in good condition and continues to function as intended.
- Drill records are still to be recorded and entered in the *Timber Drilling Survey Report* form, Appendix A (A2/5) as normal, but on the *Condition Inspection Report* form, Appendix A (A2/2), the component may be rated lower, with comments describing the remedial works as justification for the improved condition state as compared to automatically generated values in the *Timber Drilling Survey Report* form, Appendix A (A2/5).
- If the defect is found to exceed Condition State 4 at a subsequent inspection, the component must be replaced within three to six months, depending on the severity of the defects.

For installation of new components, the snipe guidelines in Figures 8.1(c) and 8.1(d) of the *Timber Bridge Maintenance Manual* should be followed. The condition state criteria described in this *manual* should be considered as indicating the following for sniped components:

- Condition State 2: OK in current configuration
- Condition State 3: Monitoring required at subsequent inspections, but no action required at this stage
- Condition State 4: Strengthening/treatment of snipes required.

New components which are sniped up to the Condition State 3 limits, as shown in the *Structures Inspection Manual*, should still be recorded as Condition State 3. This is an issue resulting from historical work practices with round logs and the necessity of sniping them prior to installation to provide an adequate bearing area compared to the effect that the snipe has on the ultimate capacity of the member, which had not been previously considered. In this situation, rating all of the sniped components as Condition State 3 in the *Condition Inspection Report* form, Appendix A (A2/2), and then rating the entire structure as Condition State 2 (subject to no other defects affecting overall condition state), with sufficient detail in the inspector comments about the sniping, is considered to be a reasonable approach when inspecting these structures.

Condition State 1

The corbels are in good condition with no termite attack or decay, though there may be minor splits or checks having no effect on strength. The ends of the corbels show no pipe rot and connections to the substructure and girders are tight. Depth of snipes may be up to 5% of the depth of the corbel. Where packers have been installed between the girder and corbel, there must be continuous contact between girder, packer and corbel along the entire length of the girder/corbel interface. The packer must be fixed in place to prevent loss/displacement under vehicle loading. No crushing or splitting of the packer is evident.

Condition State 2

The corbels may have minor termite attack, decay, splitting, checking or crushing but not of sufficient magnitude to affect their strength. The corbels may have up to 20% pipe rot at the ends. Connections to the substructure or girders may be slightly loose. Depth of snipes may range from 6% to 10% of the depth of the corbel. Where packers have been installed between the girder and corbel, there must be continuous contact between girder, packer and corbel along the entire length of the girder/corbel interface. The packer must be fixed in place to prevent loss/displacement under vehicle loading. There may be minor splitting of the packer.

Condition State 3

Corbels may have moderate termite attack, rot or decay, splitting, checking or crushing which may have a minor effect on strength. Corbels may have up to 35% pipe rot at the ends.

Connections to the substructure or girders may be quite loose and the corbels may rock slightly under load. Depth of snipes may range from 11% to 18% of the depth of the corbel. Bolts may be moderately corroded. Where packers have been installed between the girder and corbel, there must be continuous contact between girder, packer and corbel along the entire length of the girder/corbel interface. The packer must be fixed in place to prevent loss/displacement under vehicle loading. There may be moderate splitting or minor crushing of the packer.

Condition State 4

Heavy rot, termite attack, decay, splitting, or crushing have a marked effect on the strength and serviceability of the corbel. Corbels may have up to 50% pipe rot at the ends. Connections to the substructure or girders are very loose and the corbels rock noticeably under load. Depth of snipes may range from 19% to 25% of the depth of the corbel. Bolts may be severely corroded. Where installed, there may be moderate to severe splitting or crushing of the packer between the girder and the corbel or continuous contact between girder, packer and corbel along the entire length of the girder/corbel interface has not been provided.

Component 28S Crossbeams/Floor-beams Steel

Units of measurement: Each

This item includes all steel crossbeams or truss floor-beams whether painted, galvanised or unpainted.

Condition State 1

The paint system is generally sound with only minor chalking, peeling or curling with no exposure of the metal. All welds or bolts are in good condition.

Condition State 2

Rust spotting is occurring and the paint system is no longer effective, though corrosion has not yet commenced. All welds or bolts are in good condition, though a few of the bolts may be slightly loose. All member lines are true.

Condition State 3

The paint system has completely broken down and minor corrosion and pitting is occurring but the member strength is not affected. Minor deviations in member line may be occurring. There may be some evidence of girder deflection or movement under load. Nuts and bolts may be corroded and may be loose. Welds to RSJs are in good condition.

Condition State 4

Corrosion is well advanced with significant loss of section which may affect member strength. Webs, flanges or stiffeners may be buckled or distorted. Girders may be exhibiting excessive deflection or movement under load. Nuts and bolts may be heavily corroded and no longer functioning properly. Bolts may also be very loose or welds may be cracked.

Component 28T Crossbeams/Floor-beams Timber

Units of measurement: Each

This item includes all crossbeams or floor-beams constructed using sawn timber sections which do not include the centre of the original log (that is, no pipe rot).

Condition State 1

The timber is in good condition with only minor splits or checks having no effect on strength. All bolted connections are tight and in good condition.

Condition State 2

The timber shows signs of minor decay, splitting and checks but does not affect the strength of the members. The tops of the member may have some moisture ingress and be wet and slightly spongy. Bolted connections may be slightly loose.

Condition State 3

Medium decay, splitting and checking may be present. Moisture ingress into the top of the member has caused a softness with indentations and slight bulging from the deck planks. The strength of the member has been affected to a minor extent. Bolted connections may be loose, allowing the member to move excessively when loaded.

The member may have cracked due to overloading, ineffective support, or supports being too far apart or crossbeams being non-continuous, that is, only two supports.

Condition State 4

The member is heavily decayed, split or rotted, with large indentations at the top along with excessive bulging due to the top being very wet and spongy. Bolted connections are very loose and the member is moving excessively when loaded, causing deterioration of the member. The member may be cracked through due to overloading, ineffective support or crossbeams being non-continuous. The strength of the member has been significantly affected.

Component 29P Deck planks Precast

Units of measurement: Each

This item covers precast concrete deck planks which are placed transversely over girders. Distributor members which connect the planks are also covered.

Condition State 1

The units are in good condition with only minor faint cracking or minor edge chipping of the units. Minor efflorescence powder may be visible. Distributor members are connected tightly.

Condition State 2

Minor cracks or spalls may be present with only minor reinforcement corrosion. Some of the hold down bolts for the precast deck slabs may be loose. Edge spalling of the units may have exposed some reinforcement. Distributor members may be slightly loose or held down at the ends only, and decking surfacing at joints is mostly intact.

Condition State 3

Moderate cracking and spalling may be present, with up to 20% loss of section of the non-prestressed reinforcement in areas or minor loss of stressing strand due to corrosion. Many of the hold down bolts are loose or missing and the units are moving when loaded, causing edge spalling of the units. There may be moderate edge spalling due to stones and debris in the joints. Distributor members may be deteriorated with possible loss of section or member connections may be loose, allowing minor movement under traffic and resulting in cracking of the surfacing at decking joints.

A cracked component shall be rated in Condition State 3 on the basis of the following criteria:

- a crack width exceeds 0.3 mm in concrete located in a non-aggressive environment (Exposure Rating 1 or 2) or
- a crack width exceeds 0.15 mm in concrete located in an aggressive environment (Exposure Rating 3 or 4).

Condition State 4

Severe cracking, heavy spalling and advanced corrosion may be present, or the precast deck units are completely loose and moving excessively under load. Heavy edge spalling or delaminated concrete may be present. There may be advanced corrosion of non-prestressing reinforcement over large areas. Stressing strands may be broken or have lost up to 20% of section due to corrosion. Distributor members are missing, or have not been installed. Where present, distributor members are broken or have experienced complete loss of section, and members may be moving significantly under traffic, resulting in significant cracking of the surfacing at decking joints or flexural/torsional cracking of the deck planks.

Component 29T Deck planks Timber

Units of measurement: Square Metres

This item includes both transverse deck planks and the less common longitudinal deck planks with or without thin longitudinal running planks on top or distributor planks on the underside. Spiking planks, which are used at the abutment ends of skewed decks to act as trimming beams, are also included in this item. The cross members supporting longitudinal decking are listed under Component No. 28T *Crossbeams*.

Condition State 1

The timber is in good condition with minor splits, checks or weathering which have no effect on strength.

Transverse planks are securely spiked to outer spiking planks and kerb fasteners are tight. The cambering of the internal girders is tight with no deterioration evident at the interface.

On skewed decks, the bevelled ends of transverse planks are securely bolted or screwed to the end spiking planks.

Running planks and/or distributor planks are tight.

Longitudinal decking planks are tightly bolted at the ends and at each alternate crossbeam and are continuous over at least three crossbeams.

Condition State 2

The timber shows minor signs of decay, weathering, splitting or checks, having no effect on member strength. There may be active termite presence at interfaces, but only minor apparent damage.

Transverse planking may be slightly loose as a result of decay of the spiking planks, kerbs, cambering wedges or at the interface between the internal girders and the planks. Running planks/distributor planks may be slightly loose or held down at ends only.

Bolted connections to longitudinal planks may be slightly loose or only held down at the ends.

Bolted or screwed connections to end spiking planks on skewed decks may be slightly loose.

Condition State 3

The timber shows moderate decay, weathering, splitting or checks, which affect the strength of the member to a minor extent. There may be moderate termite damage, whether from active or past infestation.

Transverse planking may be loose as a result of loss of fixity at the outer girders/kerb and/or loss of cambering of the internal girders. Planks may be rocking or deflecting vertically over internal girders under traffic. Planks may be rotting under the kerbs or running planks.

Running and distributor planks may be split with sections broken away or planks split in half. Bolts are loose, allowing planks to move under traffic. Bolted connections to longitudinal planks may be loose or the planks may only have two supports.

On skewed decks, the connectors to the end spiking plank may have loosened sufficiently to allow movement of the supported end of the deck planks under traffic.

Condition State 4

The members are severely damaged, weathered, split or rotted, which significantly affects the strength. There may be severe termite damage, whether from active or past infestation.

Transverse planking is excessively loose and rotates or flaps or deflects vertically over internal girders readily under traffic as a result of loss of fixing at the outer girders/kerbs or loss of cambering. Kerbs, spiking planks, bolts and cambering wedges may have deteriorated markedly. Planks are rotted at these interfaces and under running planks.

Running and distributor planks are split, broken or completely loose. Planks may be flapping up and down under traffic.

Ends of longitudinal planks may be in poor condition and bolting may be completely loose, allowing members to flap up and down when loaded. Cross decking under the planks may be rotted or completely loose.

On skewed decks, the old spiking plank may have rotted and connections loosened, resulting in lack of vertical support and excessive movement of the supported end of the deck planks under traffic.

Component 30S Steel decking Steel

Units of measurement: Square Metres

The most common form adopted is heavy gauge steel corrugated decking units spanning transversely over steel or timber girders. Infill material includes weak cast insitu concrete, asphalt and more recently reinforced concrete. Decking sheets have also been placed longitudinally over crossbeams with similar infills. This element also includes a number of deck support plates made of steel or wrought iron. Included are buckle plates, usually held to the beams and braces by riveted connections, with a weak concrete and asphalt seal placed on top or light gauge steel trough decking, generally with asphalt infill. Not included in this item are corrugated iron sheets which are only used as formwork support and not as a structural element.

The infill or decking material should be included with this item as it greatly influences the action and rate of deterioration of the steel decking.

Condition State 1

The steel is in good condition with only minor rusting at the joints. The surfacing or infill is in good condition with no cracking, rutting or potholes. The decking units are well bolted to the support, or all rivets are good and tight. Connections between the units are in good condition with no separation.

Condition State 2

There is rusting and minor corrosion at the joints but all bolting, tap screw connections, welds or rivets are good and tight. There may be minor cracking and rutting of the asphalt surface.

Condition State 3

Medium corrosion is occurring at the joints. Buckle plates show moderate leakage at the joints with small stalactites forming. With trough decking, the welds between the units may have minor cracking or some tap screws may be loose or sheared off with minor separation of the units. The hold down connections of the units may be slightly loose, allowing too much flexing of the sections. The asphalt surface may have moderate cracking, rutting, small broken-up areas or small potholes. Concrete infill may be breaking up, allowing excessive moisture penetration.

Condition State 4

Heavy corrosion is occurring, with holes appearing in the trough decking and concrete or asphalt fill above. Trough decking units may be separating, with many of the joining tap screws broken or missing. Hold down bolts may be completely loose and the sections are flexing up and down under load. The asphalt surfacing is severely cracked, rutted, or has large badly broken areas and potholes. Rivets holding the buckle plates in position may have sheared or the edge material of the buckle plates may have sheared. The buckle plates may have severely corroded with holes appearing. Large stalactite growths indicates excessive moisture penetration of the severely cracked weak concrete above. Deck troughing may be cracked transversely to the ribs. Holding down bolts and/or channels may be severely corroded.

Component 31S	Diaphragms/Bracing (Cross girders)	Steel
Units of measurement:	**Each**	

This item includes all stiffening devices for the ends of the deck and between steel girders and includes wind bracing of large girder bridges. The diaphragms may have stud connectors into the deck to support and stiffen the ends of the deck. Bracing may be simple steel rods, straps or small angles crossing between the girders, or be heavy channel connectors between the beam webs. Wind bracing may be by steel angles or steel rods.

Condition State 1

The paintwork is generally sound with only minor chalking, peeling or curling, but no exposure of the metal. All welds, bolts and rivets are in good condition. Distance between bracing is no more than 5 m unless the RSJs have a composite reinforced concrete deck.

Condition State 2

Spot rusting of the paint system is occurring and the system is no longer effective. No corrosion has occurred as yet. No cracking of welds has occurred, but there may be some minor rusting of nuts or bolts. Bracing may be too far apart to adequately stiffen girders, or bracing may be too light if deck is not solid.

Condition State 3

The paint system has completely broken down with corrosion and pitting in areas. Nuts and bolts may be corroded with minor loss of tension in bolt. Welds may be cracked with minor loss of effectiveness. Bracing is far too light or inadequate, offering little effect in stiffening of the superstructure, especially if deck is not concrete. Lateral bowing of girders may be evident under load.

Condition State 4

Corrosion is well advanced, having a definite detrimental effect on the strength of the element. Braces are inadequate or have broken loose or buckled and the girders are bowing noticeably under load. There may be no transverse distribution of wheel loads and the girders are acting independently. Bolts or rivets may be missing. Splice joint bolts may be loose (can be loosened by a spanner).

Component 31C Diaphragms/Bracing Cast insitu concrete

Units of measurement: Each

This item includes cast insitu reinforced concrete end of deck stiffening and deep diaphragms between girders. In monolithic cast insitu flat slab bridges, this element includes the deck thickening beam at the pier supports.

Condition State 1

The elements are in good condition with only very minor cracking visible. There may be minor dampness or efflorescence powder visible in a few locations.

Condition State 2

There may be a few minor cracks or spalls due to corroding reinforcement. End of deck stiffener may be damp and stained, due to excessive moisture penetration of the deck joints, and efflorescence powder may be visible in numerous areas. In monolithic structures, there may be cracking of the tops of the columns or at the bearing areas of expansion type piers.

Condition State 3

There may be moderate cracking caused by structural mechanisms. Moderate to severe cracking and spalling may be present, along with possible delaminated areas due to non-structural mechanisms, such as corrosion of reinforcement or ASR. Exposed reinforcement may have section loss up to 20% in isolated areas. Local spalling or cracking may have occurred as a result of obstructions being trapped in expansion joint gaps or insufficient gap provision for free expansion. In monolithic structures, there may be moderate cracking or spalling in the bearing areas of expansion type piers, or at the column/diaphragm joint of fixed type piers.

A cracked component shall be rated in Condition State 3 on the basis of the following criteria:

- a crack width exceeds 0.3 mm in concrete located in a non-aggressive environment (Exposure Rating 1 or 2) or
- a crack width exceeds 0.15 mm in concrete located in an aggressive environment (Exposure Rating 3 or 4).

Condition State 4

There may be severe cracking caused by structural mechanisms. Heavily corroded steel may be visible, with loss of section of reinforcement in excess of 20% and associated cracking, spalling and delamination of concrete. Entire sections of end diaphragms may have spalled as a result of obstructions trapped in expansion joint gaps or insufficient gaps for free expansion. Monolithic structures may have heavy spalling in the bearing areas with loss of bearing area greater than 40%.

Component 32C	Load bearing diaphragms	Cast insitu
Units of measurement:	**Each**	

This item defines those load bearing diaphragms constructed using reinforced or pre-stressed concrete which are integral with the superstructure beams and visible to the inspector. These diaphragms are used as a means of joining precast beams to provide continuity over the pier supports, and the diaphragm is used to support the beams on the pier or columns below. Those load bearing diaphragms built into box girders or voided slab bridges, and not visible, should be considered as part of the superstructure and are not to be included in this item.

Condition State 1

The load bearing diaphragm is in good condition with only minor cracking due to corroding reinforcement. The crossheads should have no moment or shear cracking.

Condition State 2

The load bearing diaphragms may have minor cracking and spalling due to corroding reinforcement. There may be some very fine moment or shear cracks. No stressing strands should be exposed. Minor cracking at prestressing anchorages may be evident.

Condition State 3

There may be moderate cracking caused by structural mechanisms. Moderate to severe sized cracks, spalls and possible delamination may be present, with exposed reinforcement being corroded with up to 20% section loss. Stressing strands may be exposed with only minor corrosion. Moment cracking may be medium sized but shear cracks should only be fine. Moderate cracking or spalling may be evident at prestressing anchorages.

A cracked component shall be rated in Condition State 3 on the basis of the following criteria:

- a crack width exceeds 0.3 mm in concrete located in a non-aggressive environment (Exposure Rating 1 or 2) or
- a crack width exceeds 0.15 mm in concrete located in an aggressive environment (Exposure Rating 3 or 4).

Condition State 4

Reinforcement may be heavily corroded with loss of section greater than 20% and associated cracking, spalling and delamination of concrete. Moment cracking may be severe but shear cracks should only be of moderate size. Exposed stressing strands may have up to 10% section loss. Anchorage efficiency is materially compromised by severe cracking and spalling.

Component 33T Spiking planks Timber

Units of measurement: Lineal Metres

This item defines the spiking planks that are seated on the outer girders and to which transverse decking is spiked.

Condition State 1

The timber is in good condition and firmly bolted in place. There is little or no evidence of rot or decay. Minor splits and cracks may be evident; however, these will have no effect on member strength.

For spans up to 7.6 m, the spiking plank shall be the full length of the span. For longer spans, the spiking plank may be butt joined adjacent to the piers. No joints are permitted in the middle third of the span.

Condition State 2

Minor decay, splitting or cracking may be present but not sufficient to affect the serviceability of the member.

Condition State 3

Medium decay, splitting, crushing or termite attack may be present, affecting the component's serviceability. Attachment bolts to the girders may have loosened due to rotting of member and deck planks may have started to loosen.

Condition State 4

Heavy decay, splitting, crushing or termite attack may be present, affecting the serviceability of the component. Decking may be loose due to rotting and crushing of the member.

Component 40O Fixed bearings Other

Units of measurement: Each

This item defines those bearings that may provide for deflection or rotation and includes steel plates bearing on concrete with or without locating pins or lugs, concrete bearing on malthoid, lead sheet or a bond breaking layer of colourless grease.

Condition State 1

The element shows minimal deterioration, with the paint system in good condition protecting the steel plates, and any material allowing minor movements is in good condition and functioning properly.

Condition State 2

Minor movement may have caused faint cracking in the ends of the beams due to pressure on the locating dowels. Protective paint systems may be failing, allowing rusting of the metal plates. Malthoid or lead sheets may be deteriorating or beginning to be squeezed out from beneath the beams. Bearing support may be cracked but still basically sound.

Condition State 3

Moderate movement may have caused moderate cracking or minor spalling of the ends of the beams. Protective paint systems may have failed, causing medium corrosion of the metal plates. Malthoid or lead sheets may well be deteriorated or up to 50% extruded from beneath the beams. Bearing supports may show severe cracking, crumbling of mortar or have sizeable spalling with some reduction of bearing support area.

Condition State 4

Large movements may have caused heavy spalling of the ends of the beams. Steel plates may be heavily corroded due to complete loss of protective paint. Malthoid or lead sheets may be totally deteriorated or almost completely extruded beneath the beams. Bearing supports may have badly crumbled mortar or heavily spalled concrete with extensive reduction in bearing support area with possible cracking having occurred.

Component 41O Sliding bearings Other

Units of measurement: Each

This item defines those bearings that provide for movement by the use of a sliding mechanism. They also may have thin elastomer strips which will allow for some deflection and rotation, but the main mechanism is to allow for sliding of one surface over another with the use of copper or phosphor bronze plates, Teflon (PTFE) discs or coated sliding plates. The bearing may simply be greased surfaces with the sliding plate moving between guides in a steel base plate.

Condition State 1

The element is in good condition with minimal deterioration. The paint system is in good condition and sliding elements are in their correct positions and appear to be working as normal. There is minimal debris in the bearing. Bearing support is sound with mortar or concrete uncracked and in good condition.

Condition State 2

Protective paint systems may be failing, allowing rusting of the metal plates. Sliding elements may have moved excessively but the joint is still moving correctly. Debris in the bearing or corrosion may be having a minor effect on the movement capabilities of the bearing. Bearing support may be cracked but still basically sound.

Condition State 3

Protective paint systems may have failed, causing medium corrosion of the metal plates. Sliding elements may have moved excessively and are being extruded between the steel plates. The PTFE coating is delaminating from its base plate and is buckled and being destroyed. The lubricating system may have failed and the joint is failing to operate normally. Bearing support may show severe cracking, crumbling of mortar or sizeable spalling with some reduction of bearing support area.

Condition State 4

Steel plates may be heavily corroded due to complete loss of protective paint. Sliding elements may have slipped out and are no longer functional or the PTFE coating has completely delaminated, buckled and destroyed. The lubricating system may have failed and the joint has seized and is no longer functional. Bearing support may have badly crumbled mortar or heavily spalled concrete with extensive reduction in bearing support area, with possible crushing having occurred.

Component 42O	**Elastomeric/Pot bearings**	**Other**
Units of measurement:	**Each**	

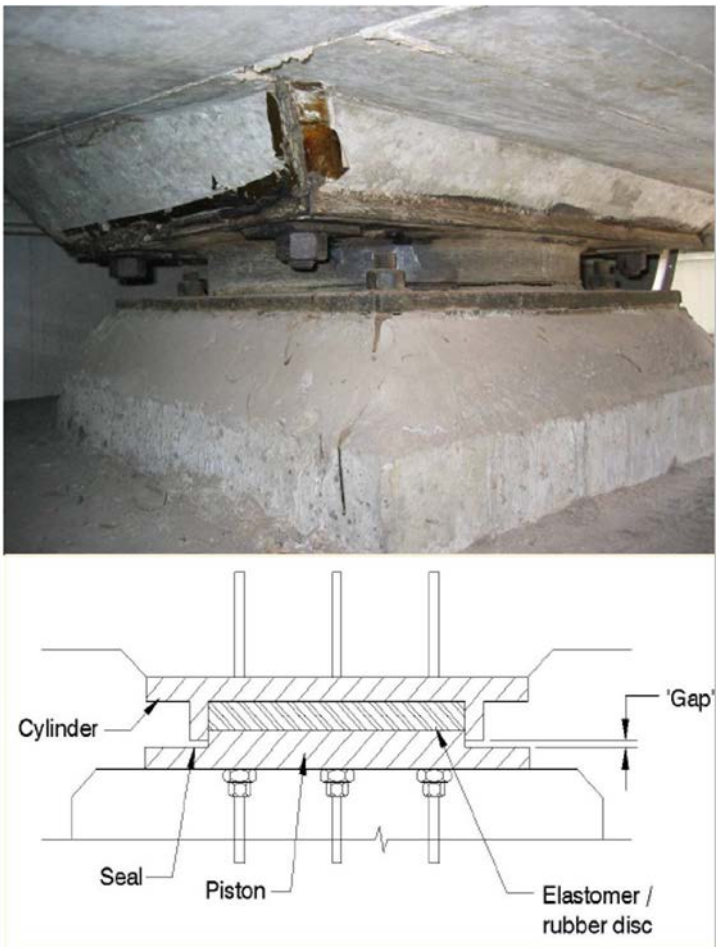
This item defines those bridge bearings constructed primarily of elastomers, with or without metal shims reinforcing the elastomer. The bearings may be free to move or have anti-sliding containment or be fully contained in pot bearings.

Fixed Pot Bearings

These consist of an elastomeric/rubber disc seated on a steel piston and covered with a steel cylinder (refer Figure 1). This bearing type is also shown in Figure C22 of Appendix C.

The 'gap' shown is the dimension which inspectors should be measuring in order to ascertain the condition of the bearing. Ideally, the inspector should be marking permanent reference points on the piston and cylinder (at the 3, 6, 9 and 12 o'clock positions) and measuring the 'gap' at these locations as part of every level 2 inspection. The inspector should also record time of day and ambient temperature at the time of measurement.

Figure 1 – Fixed pot bearing



Typical defects associated with fixed pot bearings include:

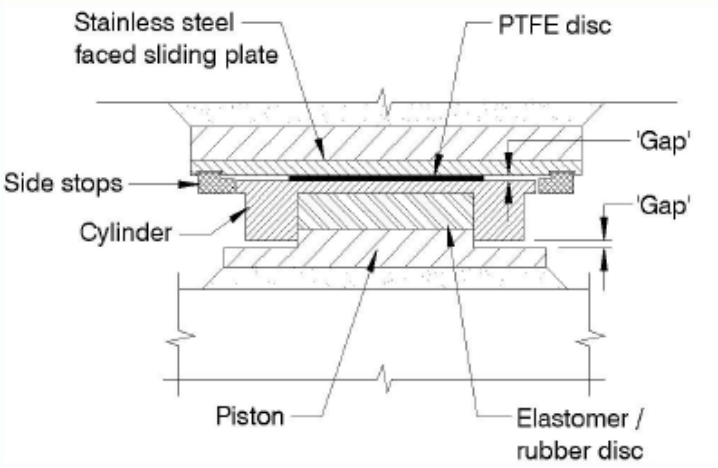
- excessive rotation, indicated by significant variation in the 'gap' dimensions taken about the bearing
- uplift/separation of the piston and cylinder, indicated by an increase in the 'gap' dimension and/or exposure of the elastomer/rubber material
- heavily spalled or crushed concrete at the bearing support
- cracking of the steel cylinder, with subsequent extrusion of the elastomer/rubber through the cracks
- internal deterioration of the elastomer/rubber, with subsequent discharge of the disc material through the gap between the piston and the cylinder.

Sliding Pot Bearings

The base unit is similar in nature to a fixed bearing, consisting of an elastomer/rubber disc seated on a steel piston and covered with a steel cylinder; however, a thin PTFE sheet is adhered to the top of the cylinder (refer Figure 2). The upper portion of the bearing consists of a steel plate with a stainless steel sliding surface that is seated directly onto the PTFE sheet. In some cases, side stops are also installed to ensure that the bearing is only permitted to slide in certain directions. This bearing type is also shown in Figure C22 of Appendix C.

The 'gaps' shown are the dimension between the top of the cylinder and the stainless steel sliding surface, and the gap between the cylinder and piston. These dimensions should be measured using the same methodology as described previously for fixed bearings, the only exception being the permanent reference points for the additional gap should be located on the cylinder and the stainless steel-faced sliding plate.

Figure 2 – Sliding pot bearing



Typical defects include:

- excessive rotation, indicated by significant variations in the 'gap' dimensions taken between the cylinder and piston
- excessive displacement of stainless steel-faced sliding plate. Where side stops are not installed, this displacement should be measured in both the longitudinal and transverse directions.
- uplift/separation of the PTFE sheet and stainless steel sliding surface, indicated by an increase in the upper 'gap' dimension. Inspectors should confirm that this is the case by inserting a thin strip of material (that is, a folded piece of paper) into the gap to determine the degree of separation. If the material is making contact at a uniform distance (normally 40–60 mm) around the bearing, then the sliding surface is seated on the PTFE. If there is no contact, then assume the sliding surface has lifted off the PTFE sheet.
- Squashing/delamination/deformation of the PTFE sheet, normally indicated by part or all of the sheet being pushed or extruded out of the gap

- heavily spalled or crushed concrete at the bearing support
- cracking of the steel cylinder, with subsequent extrusion of the elastomer/rubber through the cracks.

In order to reduce the uncertainty in measuring displacement of these bearings, a permanent reference marker should be fastened to the base plate/cylinder. The marker should also be in contact with the underside of the sliding surface (ensuring that installation of the marker takes place when the sliding surface is in the as-installed position).

Figure 3 illustrates the suggested pro forma for recording pot bearing deformation.

Figure 3 – Pro forma for pot bearing deformation

Bridge ID: **Bridge Name:**

BEARING			MEASUREMENTS																
			VERTICAL								PLAN**				FIXITY				
															TOP			#	
PIER/ABUT #	#	TYPE	VL1`	VL2`	VT1`	VT2`	UL1*	UL2*	UT1*	UT2*	L1+	L2+	T1+	T2+	# MISSING NUTS	SLOT / ROUND	DRG	MISSING NUTS BOT PL	PLATE CLASH

Note:
` Only record all when there is a variation otherwise record only 1 dimension
* Only applies to uplift
** dimensions relative to top plate
+ Applies only to sliding or floating bearings

Once installed, corresponding measurement points should be established on the marker and the sliding surface. At subsequent inspections, the longitudinal and transverse gap between these points may be measured and recorded. Any vertical gap between the marker and the sliding surface should also be recorded.

The marker should be made of a durable material, such as an aluminium strip or rigid plastic sheeting, and should be small enough so as to not impede inspection or movement of the bearings.

Condition State 1

The element shows minimal deterioration. Shear deformations are correct for the temperatures and structural movements. Bearing support surfaces are flat and sound with no cracking of the mortar or concrete.

Condition State 2

The element may have faint cracking, splitting or signs of weathering. Shear deformations may be large but not excessive, and the bearing is functioning normally. Stainless steel and PTFE components may show signs of movement.

Bearing support surfaces may not be flat but the bearing is in contact with both surfaces. The bearing support may have minor cracking (< 0.3 mm wide) but is still basically sound.

Pot bearings may have light surface corrosion. Pot bearings may have evidence of reflective crack in pot. Pot bearings may exhibit extruding elastomer.

The piston is in contact with the pot on one edge.

There are no more than two fixing bolts (top or bottom plates) missing (includes missing nut) or loose.

There is < 2 mm change in pot bearing measurements since last inspection.

Condition State 3

The bearing may have slight bulges between the shims and the elastomer may have minor cracking or splitting. Rotation or shear deformations may be excessive with rollover of the edges of the bearing. The bearing is still functioning but is being overstressed.

Bearing support may have moderate cracking (> 0.3 mm wide) and/or minor spalling.

A gap exists between the bearing and either bearing surface over 30% of the bearing area.

Pot bearings may have moderate surface corrosion. Pot bearings may have faint cracking of the container. Bearings may have large rotation or sliding elements are showing large movements. There may be excessive extrusion of elastomer from the top of the container. Stainless steel and PTFE components have been dislodged.

The piston is in contact with the pot over 30% of the perimeter.

There are up to three fixing bolts (top or bottom plates) missing (includes missing nut) or loose.

There may be up to 5 mm change in pot bearing measurements since last inspection.

Condition State 4

The bearing may have excessive bulging with cracking or splitting at the shims which have delaminated from the elastomer. Shear or rotation deformations may be excessive with a reduction in the bearing contact surface area and load transfer properties.

A gap exists between the bearing and either bearing surface over 50% of the bearing area.

Bearing support may have heavily spalled concrete with some crushing possible.

Pot bearings may have severe, flaky surface corrosion. The pot bearing container may be cracked. There may be excessive elastomer being extruded from cracks in the pot or through the top of the container. Bearings may show excessive rotation or sliding elements may have excessive movement and no longer be functioning correctly. Stainless steel and PTFE components are being ejected.

The piston is in contact with the pot over 75% of the perimeter.

Up to four fixing bolts (top or bottom plates) may be missing (includes missing nut) or loose.

There may be more than 5 mm change in pot bearing measurements since last inspection.

Component 43S Rockers/Rollers Steel

Units of measurement: Each

This item defines those bearings that may provide for rotation and movement by means of steel rollers or rocker mechanisms.

Condition State 1

The element shows minimal deterioration. The paint system is in good condition with the bearing well lubricated and functioning correctly. Bearing support is sound with no cracking of the mortar or concrete.

Condition State 2

Protective paint systems may be failing, allowing rusting of the metal. Debris has lodged in the bearing, hampering the movement or rotation of the bearing. The rocker has rotated correctly, but not excessively, for the temperature and movements of the bridge. Bearing support may be cracked but still basically sound.

Condition State 3

Protective paint systems may have failed, causing medium corrosion of the metal. Debris is preventing the movement of the bearing and its correct operation. Rockers may have rotated to their tolerance limits. Bearing support may show severe cracking, crumbling of mortar or sizeable spalling with some reduction of the bearing support area.

Condition State 4

The steel may be heavily corroded due to complete loss of protective paint. Lubrication systems have completely failed and excessive debris has seized the bearing. Rockers may have rotated to their tolerance limit and the shear key may have cracked off. Bearing support may show badly crumbled or heavily spalled concrete with extensive rotation in bearing support areas, with possible crushing having occurred.

Component 42O	Mortar pads/High bearing pedestals	Other
Units of measurement:	**Each**	

This item defines those bearings consisting entirely of dry pack or wet boxed mortar, or high concrete pedestals greater than the nominal 50 mm thickness, unreinforced or reinforced with distribution steel. This section does not cover the packing mortar placed under a steel bearing base plate. That mortar is covered under the relevant bearing on top of the base plate.

Condition State 1

The element is in good condition with minimal deterioration and no cracking.

Condition State 2

The mortar pads may show signs of minor dampness and leaching. The pedestals may have some minor cracking due to bearing movement or edge loading, but the strength of the bearing has not been affected.

Condition State 3

Heavy leaching due to excessive dampness is exhibited by the mortar pads. The pads may also show cracking, crumbling or minor crushing of the mortar, with minor loss of bearing area.

Condition State 4

The mortar is crushing or has been lost with large subsequent loss of bearing area. The high concrete pedestals may have severe cracking with large spalls and subsequent loss of bearing area.

Component 45O/S Restraint angles Steel/Other

Units of measurement: Each/Per girder

This item includes the restraint angles, holding down bolts and anchor blocks used to locate and secure precast concrete girders.

Condition State 1

The steelwork is in good condition with no rust spotting of the protective coating. Angles have been installed correctly to the correct level and location and there is sufficient travel in the slotted holes to permit free thermal movement of the structure. All bolts and welds are in good condition with no signs of corrosion, cracking or looseness.

Concrete anchor blocks are in good condition with only minor cracking due to corrosion.

Condition State 2

The protective system is no longer effective and rust spotting may be occurring. No corrosion or section loss of the parent metal has occurred. All welds and bolts are in good condition with no signs of corrosion, cracking and looseness. The installation may be imperfect or there may be minor bending of angles but the system is still fit for purpose and there is no restriction to thermal movements.

Concrete anchor blocks may have minor cracking and spalling due to corrosion or girders bearing directly on the blocks.

Condition State 3

The protective system may have broken down and there is surface pitting in a number of locations. Active corrosion may be occurring but there is no significant loss of section that affects the strength of the member. Nuts and bolts may be corroding but they are still tight and no cracking of welds has occurred. There may be lack of fit, distortion of angles or anchor bolts against end of slotted holes due to faulty installation or overstressing and there is some loss of function and/or strength; however, there is no consequential damage to girders or the bearing shelf as a result of the movement being restricted.

Anchor blocks may be moderately cracked and/or spalled as a consequence of corrosion of the reinforcement or girders bearing on the blocks.

Condition State 4

Corrosion is well advanced and some loss of section has occurred which may affect the strength of the members. Welds may be cracked and nuts or bolts may be severely corroded and possibly no longer functioning to full capacity. There may be a lack of fit with gross distortion of angles and anchor bolts may be bearing hard against end of slotted holes due to faulty installation or excessive movements of the structure.

The ends of girders, bearing shelf and anchor blocks may be severely cracked and spalled as a consequence of these movements.

Component 50C Abutments Cast insitu

Units of measurement: Each

This item includes all abutments constructed of reinforced concrete and includes the short integral return walls which support the barrier end posts or terminals, ballast walls and side keeper walls. Wingwalls, whether integral, attached or independent, are considered separately as part of Component No. 51. Damage to seating areas caused by faulty bearings is covered under the bearing items.

Condition State 1

The abutment and ballast walls are in good condition with only minor cracking due to corroding reinforcement. There is no flexural cracking due to earth pressures or differential settlement of foundations. The bearing shelf/headstock are reasonably dry and clean. No movement of abutment should be discernible; that is, bearings shearing towards ballast wall or subsidence of the road surface behind the abutment.

Condition State 2

The abutment wall may have minor cracking and spalling due to corroding reinforcement, earth pressure, beam friction on differential movements. The bearing shelf/headstock should be reasonably clean and dry. Movement of the wall is less than 10 mm. Headstocks may have fine moment, ASR or shear cracking. The ballast wall may be cracked or spalled as a result of earth pressure, girders bearing on it or corrosion of reinforcement. Minor subsidence of the road surface may be evident behind the abutment.

Condition State 3

Moderate cracking and spalling may be visible due to earth pressure, beam friction, edge bearing or differential movements. Reinforcement may be corroded, with loss of section up to 20% and associated moderate to severe cracking, spalling and delamination of concrete. The bearing shelf/headstock may be damp but there is no heavy staining or evidence of water being retained on the shelf. Movement of the abutment is less than 20 mm. Headstocks may have medium ASR or moment cracks or fine shear cracks. The ballast wall may be severely cracked or spalled. The road surface behind the bridge has subsided noticeably.

A cracked component shall be rated in Condition State 3 on the basis of the following criteria:

- a crack width exceeds 0.3 mm in concrete located in a non-aggressive environment (Exposure Rating 1 or 2) or
- a crack width exceeds 0.15 mm in concrete located in an aggressive environment (Exposure Rating 3 or 4).

Condition State 4

Severe cracking and spalling due to structural mechanisms is evident in abutment and ballast walls. Corrosion of the reinforcement is well advanced with section loss in excess of 20%. The bearing shelf/headstock may be very wet, heavily stained or have excessive water resting on top. Severe moment cracks or moderate shear cracks may be evident. The ballast wall has failed, is bearing against the girders and embankment material is being lost. Movement of the abutment wall is in excess of 20 mm. There may be severe subsidence of the road surface behind the abutment.

Component 50O Abutments Other

Units of measurement: Each

This item describes all abutment types other than concrete or timber, and includes stone masonry walls, red brick walls or grouted rubble walls. The item does not include any reinforced concrete cap on top of the walls. If masonry blocks are used to cap the walls, the sill cap should be considered as part of this element. Foundations, if visible, should be considered as part of this element.

Condition State 1

The wall is in good condition with only minor fine cracks in the mortar between bricks, stones or masonry blocks. There should be no cracking due to differential settlement of the foundations, or bulging due to earth pressures on the walls. There should be no loss of mortar between the blocks. The wall and sill cap should be reasonably dry with no staining.

Condition State 2

The wall may have a number of fine cracks in the mortar but no cracking of the blocks. There may be minor loss of mortar which is of no concern. Fine cracks may exist due to differential settlement of the foundations or minor bulging due to earth pressures. The wall and sill cap should be reasonably dry. Minor subsidence of the road surface may be evident behind the abutment.

Condition State 3

Moderate cracking of the mortar or moderate mortar loss may be occurring due to water wash. There should be only minor mortar loss beneath any masonry sill caps. Moderate cracking may exist due to differential settlement of the foundations. Abutment walls may have moderate bulging due to earth pressure. Moderate subsidence of the road surface may be evident behind the abutment.

Condition State 4

Severe cracking of the mortar or heavy loss of mortar may be occurring in the wall. There may be medium loss of mortar beneath the masonry sill caps. Severe cracking may exist due to differential settlement of the foundations or bulging of the walls due to earth pressures. Moderate subsidence of the road surface may be evident behind the abutment.

Component 51S	Wingwalls/Retaining walls	Steel
Units of measurement:	**Square Metres**	

This item includes all wingwalls and retaining walls where the main embankment support material consists of corrugated steel/iron sheeting or steel sheet piles between the wing piles. Culvert wingwalls greater than 2 m in height are also covered in this item.

Condition State 1

The steel is in good condition with only minor rusting at the ends of streets. Soil retention is effective and there is no bulging of sheets between supports.

Condition State 2

There is minor corrosion at the sheet ends but no corrosion of the main body of the sheeting. Soil retention is substantially effective and there is only minor bulging of sheets between supports.

Condition State 3

Moderate corrosion is evident in the sheeting, bulging of sheets between supports is significant and some of the joints between sheets may have sprung. Soil retention has been compromised and there may be evidence of subsidence of the road surface behind the abutment.

Condition State 4

Severe corrosion is evident in the sheeting, bulging of sheets is excessive and joints in the sheeting have sprung.

Loss of embankment fill or wingwall fill is occurring, due to earth pressure, or the material is being lost due to water wash at the base of the wingwalls. Severe subsidence of the road surface in the vicinity of the wingwall or retaining wall may be evident.

Component 51P	Wingwalls/Retaining walls	Precast concrete
Units of measurement:	**Each**	

This item includes all bridge wingwalls and retaining walls constructed using precast reinforced concrete, and covers elements such as precast RC sheeting planks, precast RC earth retaining walls, precast RC facing panels for reinforced soil walls and precast RC crib walls. Culvert wingwalls greater than two metres in height are also covered in this item.

Condition State 1

The elements are in good condition with only minor cracking or spalling noticed. There should be no movement or moment cracking in the wingwalls. There should be no settlement of the elements or gaps between elements allowing loss of embankment fill to occur. Where the elements form retaining walls, they must be securely positioned and have no bulging due to earth pressure.

Condition State 2

There may be minor cracking and spalling due to corroding reinforcement or due to earth pressures. Retaining walls may be showing signs of minor rotation or movements of up to 10 mm which are of no consequence. There may be minor bulging or settlement of elements but allowing only minor loss of embankment fill from behind.

Condition State 3

There may be moderate cracking and spalling due to corroding reinforcement, ASR, or due to earth pressures. There may be loss of section of reinforcement due to corrosion of up to 20%. Retaining walls may be showing signs of moderate rotation or movements of up to 40 mm but having little effect on serviceability. Moderate bulging, settlement or separation of the elements may be allowing medium loss of embankment fill.

A cracked component shall be rated in Condition State 3 on the basis of the following criteria:

- a crack width exceeds 0.3 mm in concrete located in a non-aggressive environment (Exposure Rating 1 or 2) or
- a crack width exceeds 0.15 mm in concrete located in an aggressive environment (Exposure Rating 3 or 4).

Condition State 4

There may be severe cracking or spalling due to corroding reinforcement or due to earth pressures. There may be loss of section of reinforcement due to corrosion greater than 20% (and the resultant cracking and spalling this may cause). Retaining walls may be showing signs of large rotation or movements in excess of 40 mm or may be leaning due to earth pressure on them, with possible loss of embankment fill behind. Excessive bulging, settlement or separation of the elements may be allowing heavy loss of embankment fill.

Component 51C	Wingwalls/Retaining walls	Cast insitu concrete
Units of measurement:	**Each**	

This item includes all bridge wingwalls and retaining walls constructed using cast insitu reinforced or plain concrete. Wingwalls, whether integral, attached or independent, are included. Culvert wingwalls greater than 2 m in height are also covered in this item.

Condition State 1

The wall is in good condition with no cracking, spalling, rotation, movement or moment cracking. Independent wingwalls are hard up against the abutment walls.

Condition State 2

There may be some minor cracking or spalling due to corroding reinforcement or earth pressures. Any joint with the abutment may be cracked as a result of differential movement. Independent walls may be rotating or moving forward by up to 10 mm but there is no loss of embankment material.

Condition State 3

There may be moderate cracking or spalling due to corroding reinforcement, ASR or earth pressures. There may be loss of section of reinforcement due to corrosion of up to 20%. Any joints with the abutment may be cracked and spalling of the adjoining edges may be evident. Retaining walls and independent wingwalls may show moderate rotations or movements of up to 40 mm. There is some loss of fill but little effect on serviceability as a result of differential movements.

A cracked component shall be rated in Condition State 3 on the basis of the following criteria:

- a crack width exceeds 0.3 mm in concrete located in a non-aggressive environment (Exposure Rating 1 or 2) or
- a crack width exceeds 0.15 mm in concrete located in an aggressive environment (Exposure Rating 3 or 4).

Condition State 4

There may be heavy cracking or spalling due to corroding reinforcement or earth pressures. There may be loss of section of reinforcement due to corrosion greater than 20% (and the resultant cracking and spalling this may cause). This may include any joint with the abutment that is cracked and badly spalled as a result of differential movements. The water bar may be torn and fill escaping through the gap. Retaining walls and independent wingwalls may show large rotations or movements in excess of 40 mm due to earth pressure causing excessive loss of fill material from behind.

Component 51T	Wingwalls/Retaining walls	Timber
Units of measurement:	**Each**	

This item includes all bridge wingwalls and retaining walls consisting of timber sheeting spanning between the wing piles. Note that wing piles should be covered under Component No. 60T. Culvert wingwalls greater than 2 m in height are also covered in this item.

Condition State 1

The timber may have minor decay, splits or checks but is generally in good condition.

Condition State 2

Timber units may have moderate decay, splits or checks, but are generally in good condition.

Condition State 3

Timber units may be heavily decayed with sheeting planks rotted out or attacked by white ants. Settlement of sheeting units may be occurring or a loss of fill may be occurring due to water wash beneath the sheeting or due to sheeting rotting out, and subsidence of the embankment may be evident.

Condition State 4

Timber units may be severely decayed and whole areas may have rotted out or been eaten out by white ants. Loss of embankment fill or wingwall fill is occurring due to earth pressure or the material is being lost due to water wash at the base of the wingwalls, and severe subsidence may be evident.

Component 51O	Wingwalls/Retaining walls	Other
Units of measurement:	**Each**	

This item includes all bridge wingwalls and retaining walls constructed using ashlar blocks, rubble masonry or brickwork. Culvert wingwalls greater than 2 m in height are also covered in this item.

Condition State 1

The wall is in good condition with only fine cracks in the mortar joints. There should be no cracking due to differential settlement of foundations or bulging due to earth pressure. There should be no loss of mortar between blocks, the wall should be dry and no forward rotation or movement is evident.

Condition State 2

There may be a number of fine cracks in the mortar joints but no cracking of the blocks or there may be minor loss of mortar of no concern. Fine cracks may exist due to differential settlement of the foundations or minor bulging due to earth pressures. The wall is reasonably dry and there is only a slight forward movement or rotation but no loss of fill.

Condition State 3

Moderate cracking of mortar or loss of mortar may be evident. Moderate cracking due to differential footing settlement and moderate bulging due to earth pressure may be seen. Walls have rotated or moved forward by up to 40 mm, causing some loss of fill material.

Condition State 4

Severe cracking or loss of mortar is occurring. Severe cracking is evident as a result of differential settlement or bulging due to earth pressures. Walls have rotated or moved forward in excess of 40 mm, causing excessive loss of fill material from behind.

Component 52S	Abutment sheeting/Infill panels	Steel

Units of measurement: **Square Metres**

This item includes abutments where the main embankment support material consists of corrugated steel/iron sheeting or steel sheet piles between the piles or acting as a ballast wall. Wingwalls and retaining walls are covered by Component No. 51S.

Condition State 1

The steel is in good condition with only minor rusting at the ends of sheets. Soil retention is effective and there is no bulging of sheets between supports.

Condition State 2

There is minor corrosion at the sheet ends but no corrosion of the main body of the sheeting. Soil retention is substantially effective and there is only minor bulging of sheets between supports.

Condition State 3

Moderate corrosion is evident in the sheeting, bulging of sheets between supports is significant and some of the joints between sheets may have sprung. Soil retention has been compromised and there may be evidence of subsidence of the road surface behind the abutment.

Condition State 4

Severe corrosion is evident in the sheeting, bulging of sheets is excessive and joints in the sheeting have sprung.

Loss of embankment fill is occurring due to earth pressure or the material is being lost due to water wash at the base of the abutment. Severe subsidence of the road surface behind the abutment may be evident.

Component 52P	Abutment sheeting/Infill panels	Precast concrete
Units of measurement:	**Square Metres**	

This item describes all precast concrete elements used in abutments. Included in this item are precast RC sheeting planks, precast RC earth retaining slabs, precast RC facing panels for reinforced soil walls and precast RC crib walls. Wingwalls and retaining walls are covered by Component No. 51P.

Condition State 1

The units are in good condition with only minor cracking of no consequence. There should be no settlement of units or gaps between units allowing loss of embankment fill to occur.

Condition State 2

There may be minor cracking or minor spalling of the units due to corroding reinforcement or earth pressure. There may be minor bulging or settlement of units but allowing only minor loss of embankment fill from behind. Minor subsidence of the road surface may be evident behind the abutment.

Condition State 3

There may be moderate cracking or spalling of the units due to corroding reinforcement, ASR or earth pressures. There may be loss of section of reinforcement due to corrosion of up to 20%. Moderate bulging, settlement or separation of units may be allowing medium loss of the embankment fill. The road surface behind the abutment may have settled noticeably.

A cracked component shall be rated in Condition State 3 on the basis of the following criteria:

- a crack width exceeds 0.3 mm in concrete located in a non-aggressive environment (Exposure Rating 1 or 2) or
- a crack width exceeds 0.15 mm in concrete located in an aggressive environment (Exposure Rating 3 or 4).

Condition State 4

Severe cracking and spalling of the units may be occurring due to reinforcement corrosion or earth pressure. There may be loss of section of reinforcement due to corrosion greater than 20% (and the resultant cracking and spalling this may cause). Excessive bulging, settlement or separation of the units may be allowing heavy loss of embankment fill. There may be severe subsidence of the road surface behind the abutment.

Component 52C	Abutment sheeting/Infill panels	Cast in situ concrete

Units of measurement: **Square Metres**

This item includes abutments where the main embankment support material consists of mass concrete wall panels between the piles and/or acting as a ballast wall. Wingwalls and retaining walls are covered by Component No. 51C.

Condition State 1

The panels are in good condition with only minor cracking of no consequence. There should be no discernible settlement or forward rotation of the panels or gaps at the substructure interfaces which would permit the loss of fine material from the retained fill. The movement of the panels should be isolated from the substructure by compressible filler interfaces and there should be no evidence of any cracking or spalling thereof. Sufficient weepholes have been provided and are all functioning correctly.

Condition State 2

There may be minor cracking or spalling of the panels at the joint interfaces and/or some minor degree of settlement or forward rotation of the panels as a consequence of earth pressure and/or inadequate foundation capacity. Marginal gaps may have opened at the substructure interfaces, allowing a minor loss of the retained fill. Minor subsidence of the road surface behind the abutment of less than 20 mm may also be evident. Some weepholes may be blocked but otherwise drainage is adequately provided for.

Condition State 3

There may be moderate cracking or spalling of units at the joint interfaces and/or there may be significant settlement or forward rotation of the panels as a consequence of earth pressure and/or inadequate foundation capacity. Moderate to severe cracking due to non-structural mechanisms, such as corrosion of reinforcement or ASR, or loss of section of reinforcement due to corrosion of up to 20%. Significant gaps (10–25 mm wide) may have opened at substructure interfaces, allowing the loss of retained embankment material. Panels may be heavily stained as a consequence. Moderate subsidence of road surface behind the abutment of up to 30 mm may be evident. Weepholes may be blocked or inadequate.

A cracked component shall be rated in Condition State 3 on the basis of the following criteria:

- a crack width exceeds 0.3 mm in concrete located in a non-aggressive environment (Exposure Rating 1 or 2) or
- a crack width exceeds 0.15 mm in concrete located in an aggressive environment (Exposure Rating 3 or 4).

Condition State 4

Severe cracking or spalling may be occurring at joint interfaces and/or there may be excessive settlement or forward rotation of the panels as a consequence of earth pressure and/or inadequate foundation capacity. There may be loss of section of reinforcement due to corrosion greater than 20% (and the resultant cracking and spalling this may cause). Gaps in excess of 25 mm wide may have opened at the substructure interfaces, allowing severe loss of the retained fill material. Significant

subsidence of the road surface behind the abutment in excess of 30 mm may be evident. Weepholes have either not been provided or have ceased to function.

Component 52T	Abutment sheeting/Infill panels	Timber

Units of measurement: **Square Metres**

This item includes abutments where the main embankment support material consists of timber sheeting between the piles or acting as a ballast wall. Timber piles and headstocks at timber abutments will be considered under other substructure elements because of their uniqueness. Timber sill beams resting on a concrete footing may be considered in this item as well as timber bed logs embedded in the embankment. Wingwalls and retaining walls are covered by Component No. 51T.

Condition State 1

The timber may have minor decay, splits or checks but is generally in good condition.

Condition State 2

Timber units may have moderate decay, splits or checks, but are generally in good condition.

Condition State 3

Timber units may be heavily decayed with sheeting planks rotted out or attacked by termites. Settlement of sheeting units may be occurring or a loss of fill may be occurring due to water wash beneath the sheeting or due to sheeting rotting out. Subsidence of the road surface behind the abutment may be evident.

Condition State 4

Timber units may be severely decayed and whole areas may have rotted out or been eaten out by termites. Loss of embankment fill is occurring due to earth pressure or the material is being lost due to water wash at the base of the abutment. Severe subsidence of the road surface behind the abutment may be evident.

Component 52O	Abutment sheeting/Infill panels	Other

Units of measurement: **Square Metres**

This item includes abutments where the main embankment support material consists of (grouted or ungrouted) rock or stone or rock filled cages such as gabions. Wingwalls and retaining walls are covered by Component No. 51O.

Condition State 1

The infill protection is in good condition with no damage, differential settlement or gaps which would allow the loss of embankment fill to occur.

Condition State 2

There may be minor cracking of the infill due to a build-up of earth pressure. There may be minor bulging or settlement of the infill but allowing only minor loss of embankment fill from behind. Minor subsidence of the road surface may be evident.

Condition State 3

There may be moderate cracking in the case of the grouted rock infill while, for the gabions, wire cages may be broken, resulting in the consequential loss of the infill material. Moderate bulging and settlement may be allowing medium loss of the embankment fill and subsidence of the road surface.

Condition State 4

Severe cracking of the rock infill may be occurring due to earth pressures. Excessive bulging or settlement may be allowing for the heavy loss of embankment material. Severe subsidence of the road surface may be occurring behind the abutment.

Component 53P Batter protection Precast concrete

Units of measurement: Square Metres

This item defines those bridge abutment batters protected by precast concrete units placed either separately or locked together to prevent loss of embankment fill. Small walls at the toe of the batter may be included in this item, even if constructed of a different material, but high vertical or near vertical walls with an abutment on top or behind should be included under the item for abutments. The area of batter protection shall normally be the actual area; however, in cases where protection extends considerably beyond the abutments at approaches, then the extent of the component should generally be no more than 20 m behind the abutment. The actual length considered shall be noted in the comments field for this item.

Condition State 1

The precast concrete units are in good condition with no damage, differential settlement between units or scour beneath the toe of the units.

Condition State 2

There may be local minor damage to units or minor differential movement between units. Minor local scour may be beginning to uncover the toe of the batter protection, most likely at the upstream corner of the abutment due to the acceleration of flow at these locations.

Condition State 3

Local damage is beginning to be more pronounced and spreading to larger areas. Differential settlement between units is more pronounced with possible loss of batter fill material from between the units. Scouring is beginning to become a problem, with the toe of the batter being eroded over a reasonable length – most likely at the upstream corner of the abutment protection and extending downstream under the bridge over a sizeable length – and with some possible loss of batter material from beneath the batter units. A few units may have been lost or severely damaged.

Condition State 4

Failure of the units, extensive differential movement between units or scour of the toe of the batter has resulted in loss of whole areas of the protection. Severe scour has undermined the toe of the protection and batter fill has eroded away from beneath the units.

Component 53C Batter protection Cast insitu concrete

Units of measurement: Square Metres

This item defines those bridge abutment batters protected by cast insitu concrete. Concrete may be cast in forms, pumped into a nylon fabric mattress, or sprayed on the batter with or without anchorage rods into the fill material. Small retaining walls may be used at the toe of the batter and these should be considered as part of the batter protection. The area of batter protection shall normally be the actual area; however, in cases where protection extends considerably beyond the abutments at approaches, then the extent of the component should generally be no more than 20 m behind the abutment. The actual length considered shall be noted in the 'comments' field for this item.

Condition State 1

The batter is in good condition with no cracking or spalling noticed. The embedded toe of the batter is in good condition with no scouring.

Condition State 2

Minor local cracking or spalling may have occurred or separation or movement at casting joints. Minor local scour may be beginning to uncover the toe of the batter protection, most likely at the upstream corner of the abutment protection due to the acceleration of flow at these locations.

Condition State 3

Local cracking and spalling is more pronounced with small areas broken and possibly missing. Movement at casting joints is more pronounced with possible loss of batter material from beneath the concrete. Scouring is becoming a problem with the toe of the batter being eroded over a reasonable length, most likely at the upstream corner of the abutment protection and extending downstream under the bridge over a sizeable length, and possible erosion of batter material beneath the toe.

Condition State 4

Severe cracking and spalling with large broken areas or areas of missing concrete are providing erosion of batter material from beneath the concrete batter. Movements at the casting joints are excessive and batter material has been eroded away. Severe erosion has undermined the toe of the batter with loss of batter material below the concrete.

Component 53O Batter protection Other

Units of measurement: Square Metres

This item includes those batters either unprotected, grassed, protected with stone or rocks (grouted or ungrouted), stone filled cages or mattresses, stone with reinforcing mesh tied down on top, or placed fabric tied down by light wire mesh. Small retaining walls may be used at the toe of the batter and these should be included as part of the batter protection. The area of batter protection shall normally be the actual area; however, in cases where protection extends considerably beyond the abutments at approaches, then the extent of the component should generally be no more than 20 m behind the abutment. The actual length considered shall be noted in the 'comments' field for this item.

Condition State 1

The batters and protective elements are in good condition with no damage, differential settlement or movements, and no scour beneath the toe of the protection.

Condition State 2

There may be local damage to the protective system or minor differential settlement or movement of cages or mattresses. Some wires may be damaged or broken with minor loss of the stone filling. Minor local scour may be beginning to uncover the toe of the batter protection, most likely at the upstream corner of the abutment protection due to acceleration of flow at these locations.

Condition State 3

Damage to the protection is more pronounced and spreading to larger areas. Wire cages are broken and heavy loss of stone filling is occurring. The batter material is being eroded from beneath the protective system or unprotected banks are beginning to be eroded away. The toe of the protection is exposed over a reasonable distance, most likely at the upstream corner of the abutment protection and extending downstream under the bridge over a sizeable length, and with some possible loss of the batter material occurring.

Condition State 4

Failure of the protection has allowed erosion and scouring of the banks to occur. Severe scour has undermined the toe of the protection and batter fill material is being eroded away. Settlement or movement of the protection has exposed the underside of the abutments with loss of fill material in the road embankment.

Component 54S Headstocks Steel

Units of measurement: Each

This item includes all pier headstocks which are constructed of steel and are separate from the superstructure above. The steel may be painted or galvanised.

Condition State 1

The headstock has sufficient size to adequately carry the load of the superstructure and distribute it to the supporting piles or columns. Painted surfaces should be generally sound with only minor chalking, peeling or curling, but no exposure of metal. All welds, bolts or rivets are in good condition. No movement of headstock should be discernible; that is, bearings shearing towards ballast wall or subsidence of the road surface behind the abutment.

Condition State 2

Spot rusting is occurring and the paint system is no longer effective but no corrosion has occurred as yet. Welds are in good condition but there may be minor rusting of nuts or bolts. Any movement of headstock is less than 10 mm.

Condition State 3

The paint system has completely broken down, and minor pitting corrosion is occurring. Nuts and bolts may be corroded with only minor loss of tension in the bolt. Welds may have faint cracking with only minor loss of effectiveness. Headstocks may be too light to carry the loads imposed on them and may have minor bows or buckles in them. Movement of the headstock is less than 20 mm.

Where no spreader plate has been installed or alternatively no web stiffener plates have been provided.

Condition State 4

Corrosion is well advanced, having a definite detrimental effect on the strength of the element. Connecting bolts or nuts may have corroded severely, broken loose or are missing. Headstocks' size may be inadequate with large bows or buckling occurring.

This condition state applies for headstocks supporting timber corbels where no spreader plate has been installed or the spreader plate provided is less than the required length specified in the *Timber Bridge Maintenance Manual* and there are obvious signs of distress/movement at the headstock/corbel interface.

Movement of the headstock is in excess of 20 mm.

Where no spreader plate has been installed or alternatively no web stiffener plates have been provided and there is evidence of warping or deformation of the channel section.

Component 54P Heastocks Precast concrete

Units of measurement: Each

This item includes all precast reinforced or prestressed concrete pier headstocks which are independent of the superstructure. The headstocks will have blockouts above the columns to allow for cast insitu full connections for transfer of load and moment to the columns or piles beneath. Damage to bearing support areas by faulty bearings will be covered under the bearing items.

Condition State 1

There is no deterioration of the elements except for very minor fine cracks around the cast insitu connections. No movement of headstock should be discernible; that is, bearings shearing towards ballast wall or subsidence of the road surface behind the abutment.

Condition State 2

The crossheads may have a few minor fine cracks or minor spalls due to corroding reinforcement. No stressing strands should be exposed in any spall. There should be no moment cracking in the stressed crossheads. Reinforced headstocks may have fine moment cracking. Any movement of headstock is less than 10 mm.

Condition State 3

There may be moderate cracking caused by structural mechanisms. Moderate to severe cracking or spalling as the result of non-structural mechanisms may exist and there may be some rust staining in the cracks. Exposed reinforcement may have up to 20% section loss in isolated areas. Exposed stressing strands may have only minor corrosion. Stressed headstocks may have fine flexural cracking but not shear cracking. Movement of the headstock is less than 20 mm. Reinforced headstocks may have moderate flexural cracks and/or fine shear cracks.

A cracked component shall be rated in Condition State 3 on the basis of the following criteria:

- a crack width exceeds 0.3 mm in concrete located in a non-aggressive environment (Exposure Rating 1 or 2) or
- a crack width exceeds 0.15 mm in concrete located in an aggressive environment (Exposure Rating 3 or 4).

Condition State 4

Corrosion of the reinforcement is at an advanced state, with loss of section of reinforcement greater than 20% (and any spalling or cracking associated with it). Stressing strands may have loss of section of up to 10%. Flexural cracking in reinforced headstocks may be heavy but in stressed headstocks the flexural cracking should only be moderate. Shear cracks may be of moderate size in reinforced headstocks, or fine in stressed headstocks. Movement of the headstock is in excess of 20 mm.

Component 54C Headstocks Cast insitu concrete

Units of measurement: Each

This item defines those pier headstocks constructed of cast insitu concrete and includes the concrete capping on top of masonry or brick walls at both piers and abutments. Damage to bearing support areas caused by faulty bearings will be covered under the bearing items.

Condition State 1

The headstocks are in good condition with only minor cracking due to shrinkage or reinforcement corrosion. The headstocks should have no moment or shear cracking. No movement of headstock should be discernible; that is, bearings shearing towards ballast wall or subsidence of the road surface behind the abutment.

Condition State 2

The headstocks may have minor spalling due to corroding reinforcement or due to beam friction or the girder bearing directly on the headstock edges. Some minor fine cracks due to moment or shear may exist. Any movement of headstock is less than 10 mm.

Condition State 3

Moderate sized cracks caused by structural mechanisms, or moderate to severe cracking or spalls and possible delamination may exist as the result of non-structural mechanisms, with exposed corroding reinforcement having up to 20% loss of section. Movement of the headstock is less than 20 mm. Moment cracking may be moderate sized but any shear cracks should only be fine.

A cracked component shall be rated in Condition State 3 on the basis of the following criteria:

- a crack width exceeds 0.3 mm in concrete located in a non-aggressive environment (Exposure Rating 1 or 2) or
- a crack width exceeds 0.15 mm in concrete located in an aggressive environment (Exposure Rating 3 or 4).

Condition State 4

There may be severe cracking due to structural mechanisms or advanced corrosion of the steel bars, with loss of section of reinforcement greater than 20% (and any spalling or cracking associated with it). Moment cracking may be heavy whilst shear cracks may be moderate sized. Movement of the headstock is in excess of 20 mm.

Component 54T **Headstocks** **Timber**

Units of measurement: **Each**

This item includes those headstocks constructed of sawn timber sections which do not include the centre, pipe rot affected area of the original log. Timber headstocks at the abutments should also be included in this item due to their importance and susceptibility to deterioration. Note that members with pipe rot/termite attack in excess of the values shown in Component No. 4 are critical and should be replaced immediately.

The following rules shall apply when rating a timber headstock:

- If any part of the headstock has a Condition State 4 defect, then the entire member is rated as Condition State 4 (that is, a Condition State 4 defect at one end of a headstock = entire headstock rated as Condition State 4).
- If three or more Condition State 3 defects are found within the same area of a member, then the area (and therefore the member) shall be rated as being Condition State 4.
- The inspector may still deem an area with two defects of Condition State 3 to be of sufficiently poor condition to rate the area (and member) as Condition State 4 – this shall be left to the discretion of the inspector.

Deterioration factors that shall be considered in addition to ‘rot’ when determining the condition state of a timber headstock, are:

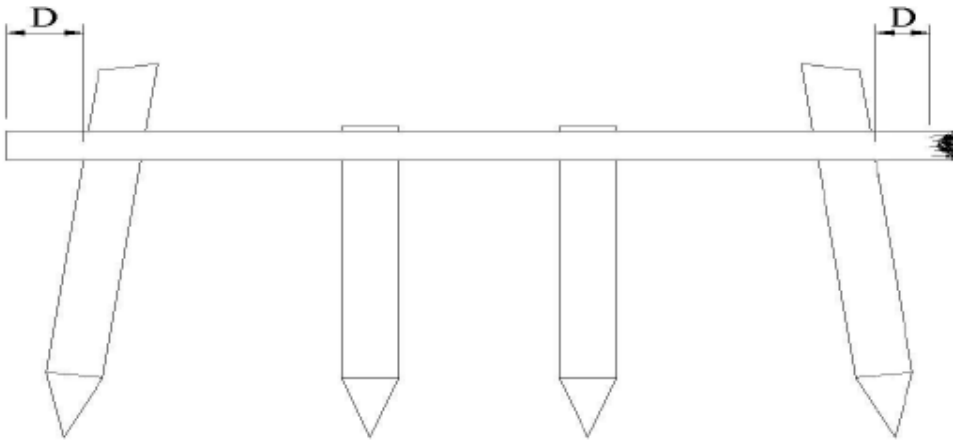
- termite attack
- crushing at supports
- moderate splitting over supports or in ends – the *Timber Bridge Maintenance Manual* says if the split over a bearing support is half-depth of the member, its capacity is reduced by 50%
- sagging beneath girders with minor moment cracks
- loose bolted connections – no need to replace – simply tighten
- corrosion of bolts
- no bearing support (on pile) – hanging off the bolts
- oversized bolt holes
- condition of pile heads – little support to bolted connections
- headstock splice in poor condition – pulling apart
- up to 10% loss of section – caused by weathering or notching or rot at pile interface
- preservative treatment ineffective
- headstocks sagging or moving under load at pile locations.

The determination of condition state for timber headstocks with rot or defects in the ends of the headstock will depend on the dimension ‘D’, which refers to the length of ‘defect-free’ headstock (free from rot, splits and other defects) measured from the outer face of the outer pile (refer Figure 4):

- where the end of the headstock is completely free of rot or other defects, it shall have no bearing on the condition state of the member

- where defects are present, but ‘D’ is greater than 100 mm, the headstock end (and thus the entire headstock) shall be rated as Condition State 3
- where defects are present, and ‘D’ is less than or equal to 100 mm, the headstock shall be rated as Condition State 4.

Figure 4 – Timber headstock decay



A Condition State 3 defect may be repaired by cutting off the defective portion of the headstock and treating the exposed end with a suitable preservative and covering with a tin cap and nail plate, as per the ‘Routine Maintenance’ specified in the *Timber Bridge Maintenance Manual*.

Condition State 1

The headstocks are in good condition with only minor weathering, splits or cheeks having no effect on strength. All bolted connections are tight and in good condition, with at least half the headstock having good bearing support on the piles

Condition State 2

The headstocks show signs of minor decay, weathering, splits and checks not affecting member strength. There may be minor sags in the headstocks beneath loaded girders. Bolted connections may be slightly loose or the headstock may have less than half-width bearing on the piles. Headstocks may have rot/termite attack, resulting in up to 5% external loss of section or an internal pipe no greater than 45 mm in diameter. There may be evidence of termite activity, but no damage evident. Preservative treatment of headstock ends may be ineffective.

Condition State 3

The headstock may have moderate decay, weathering, termite attack or crushing at supports, which may have a minor effect on member strength. There may be moderate splitting present, particularly over supports or within the ends of the headstock. The headstocks may be sagged beneath the girders with minor moment cracks. Bolted connections may be loose and there may be minor corrosion of bolts. Headstocks may have no bearing support at the piles. Bolt holes are oversized, and may be up to 50% larger than standard. The top of the piles may be severely rotted, offering little bearing support to the headstock bolted connections, and the headstocks may be pulling off piles. Headstocks may be spliced and the splice is in poor condition and pulling apart. Significant rot/termite attack has resulted in up to 10% external loss of section or an internal pipe no greater than 65 mm in

diameter. Preservative treatment of headstock ends may be ineffective. Headstocks may be sagging or moving under load at pile locations. Defects are present within the ends of the headstock, but the length of the defect-free portion beyond the outer face of the outer pile is greater than 100 mm.

Condition State 4

The headstocks may be heavily decayed, weathered, termite damaged or cracked, and may have crushing at the supports. There may be severe splitting present, particularly over supports or within the ends of the headstock. Large sagging may be evident under girders and the headstock may have moment cracking. Bolted connections may be completely loose and bolts may be badly corroded or missing. Headstocks may have pulled off or almost pulled off the supporting piles. Bolt holes are significantly oversized, and may be up to 100% larger than standard. Headstock splices may have broken apart with loading on the unsupported cantilever headstock section. Excessive rot/termite attack has resulted in up to 20% external loss of section or an internal pipe no greater than 90 mm in diameter. There may be a significant sag or movement under load at pile locations. Defects are present within the ends of the headstock, and the length of the defect-free portion beyond the outer face of the outer pile is 100 mm or less.

Component 55C Headstocks (integral) Cast insitu concrete

Units of measurement: Each

This item defines those pier headstocks using reinforced concrete cast insitu which is integral with both the superstructure beams and with the substructure walls or columns, especially in old monolithic 'T' beam bridges and the built-in RSJs on old steel girder bridges.

Condition State 1

The element is in good condition with only very minor cracking visible. There may be minor dampness or efflorescence powder visible in a few locations.

Condition State 2

There may be a few minor cracks or spalls due to corroding reinforcement but no structural cracking is visible. There may be fine cracks at the construction joints at the undersides of the beams.

Condition State 3

Moderate cracking due to structural mechanisms or moderate to severe cracking and spalling may exist as a result of non-structural mechanisms, such as corrosion of reinforcement and ASR, and there may be minor cracking beneath supported beams. There may be loss of section of reinforcement due to corrosion of up to 20%. Minor cracking may exist at the headstock/deck or headstock/girder joints with moisture, staining and/or efflorescence visible.

A cracked component shall be rated in Condition State 3 on the basis of the following criteria:

- a crack width exceeds 0.3 mm in concrete located in a non-aggressive environment (Exposure Rating 1 or 2) or
- a crack width exceeds 0.15 mm in concrete located in an aggressive environment (Exposure Rating 3 or 4).

Condition State 4

Reinforcement may be heavily corroded, with loss of section of up to 20% (and any spalling or cracking associated with it). Medium sized cracking may exist beneath supported beams. Medium or heavy cracks may exist at the deck/crosshead joint due to lack of moment steel, and heavy moisture staining and efflorescence may be visible.

Component 56S Columns or piles Steel

Units of measurement: Each

This item includes all columns or protruding piles manufactured from steel at either abutments or piers. The steel may be painted, galvanised or unpainted and should encompass ties and braces which may be used to stiffen the columns or piles and to distribute loads.

Condition State 1

The paintwork is generally in good condition with only minor chalking, curling or peeling, but no metal exposure. The piles are adequately braced and all connections are in good condition. The difference between soundings measured to the stream bed in successive inspections is less than 0.2 m. Overall depth of localised scour holes is less than 0.5 m.

Condition State 2

Painted steelwork has spot rusting and the protective coating is no longer effective. The piles or columns may not be effectively braced or the connections may be slightly loose or corroded. Unpainted steel piles may be rusted. The difference between soundings measured to the stream bed in successive inspections is between 0.2 m and 0.49 m. Overall depth of localised scour holes ranges from 0.5 m to 1.99 m.

Condition State 3

Steelwork has medium corrosion and the paint system has completely failed. Surface pitting may be evident but section loss is less than 10%. Bracing may be ineffective or non-existent and connections may be heavily corroded or loose. The difference between soundings measured to the stream bed in successive inspections is between 0.5 m and 0.99 m. Overall depth of localised scour holes ranges from 2 m to 4 m.

Condition State 4

Steelwork is heavily corroded with up to 20% loss of section. Connections may be very loose or bracing may be missing or totally ineffective. The difference between soundings measured to the stream bed in successive inspections is 1 m or greater. Overall depth of localised scour hole is in excess of 4 m.

Component 56P Columns or piles Precast concrete

Units of measurement: Each

This item includes all columns or protruding piles manufactured from precast concrete at either abutments or piers. The precast units may be prestressed or reinforced concrete, and the element should encompass ties and braces which may be used to stiffen the columns or piles and to distribute the load. Prestressed concrete piles may exhibit longitudinal cracking as result of ASR from around ground level to the standing water mark.

Condition State 1

The piles or columns are in good condition with only minor cracking due to reinforcement corrosion. There should be no moment cracking in the piles or columns. The piles are adequately braced with unsupported height less than 3.5 m. The difference between soundings measured to the stream bed in successive inspections is less than 0.2 m. Overall depth of localised scour holes is less than 0.5 m.

Condition State 2

The piles or columns have minor cracking or spalling due to corroding reinforcement. Fine moment cracking may be visible. Stressing strands should not be exposed and the piles or columns may not be effectively braced. Prestressed piles may have fine longitudinal cracks caused by ASR. The difference between soundings measured to the stream bed in successive inspections is between 0.2 m and 0.49 m. Overall depth of localised scour holes ranges from 0.5 m to 1.99 m.

Condition State 3

There may be moderate cracking caused by structural mechanisms, or moderate to severe cracking and spalling due to non-structural actions such as corroding reinforcement, with up to 20% loss of section of the bars. Exposed stressing strands should only have minor surface corrosion. Flexural cracking may be medium-sized especially if bracing or ties are ineffective or non-existent. Prestressed piles may have moderate to severe longitudinal cracking caused by ASR. The difference between soundings measured to the stream bed in successive inspections is between 0.5 m and 0.99 m. Overall depth of localised scour holes ranges from 2 m to 4 m.

A cracked component shall be rated in Condition State 3 on the basis of the following criteria:

- a crack width exceeds 0.3 mm in concrete located in a non-aggressive environment (Exposure Rating 1 or 2) or
- a crack width exceeds 0.15 mm in concrete located in an aggressive environment (Exposure Rating 3 or 4).

Condition State 4

There may be severe cracking caused by structural mechanisms, or advanced corrosion of the reinforcement with loss of section greater than 20% (and any spalling and cracking associated with it). Any exposed stressing strands may have up to 10% section loss. Flexural cracking may be heavy, with bracing or ties totally ineffective or missing. The difference between soundings measured to the stream bed in successive inspections is 1 m or greater. Overall depth of localised scour holes is in excess of 4 m.

Component 56C Columns or piles Cast insitue concrete

Units of measurement: Each

This item includes all cast insitu columns or cast insitu extensions on top of driven piles, and reinforced concrete pile encasements. This item should also encompass ties and braces which may be used to stiffen the columns or piles and to distribute loads.

Condition State 1

The piles, columns or encasements show only minor cracking due to reinforcement corrosion. There should be no moment cracking in the piles or columns. The piles are adequately braced with unsupported height less than 3.5 m. The difference between soundings measured to the stream bed in successive inspections is less than 0.2 m. Overall depth of localised scour holes is less than 0.5 m.

Condition State 2

The piles, columns or encasements have minor cracking or spalling due to corroding reinforcement. Fine moment cracking may be visible and the piles or columns may not be effectively braced. The difference between soundings measured to the stream bed in successive inspections is between 0.2 m and 0.49 m at the pile cap. Overall depth of localised scour holes ranges from 0.5 m to 1.99 m.

Condition State 3

The piles, columns or encasements have moderate cracking caused by structural mechanisms, or moderate to severe cracking due to non-structural actions such as corrosion of reinforcement and ASR, with up to 20% loss of section in the steel bars. Flexural cracking may be medium-sized, especially if the bracing or ties are ineffective or non-existent. The difference between soundings measured to the stream bed in successive inspections is between 0.5 m and 0.99 m at the pile cap. Overall depth of localised scour holes ranges from 2 m to 4 m.

A cracked component shall be rated in Condition State 3 on the basis of the following criteria:

- a crack width exceeds 0.3 mm in concrete located in a non-aggressive environment (Exposure Rating 1 or 2) or
- a crack width exceeds 0.15 mm in concrete located in an aggressive environment (Exposure Rating 3 or 4).

Condition State 4

There may be severe cracking due to structural mechanisms or advanced corrosion of the steel bars, with loss of section of reinforcement greater than 20% (and any spalling or cracking associated with it). Flexural cracking may be heavy with bracing or ties totally ineffective or missing. The difference between soundings measured to the stream bed in successive inspections is 1 m or greater at the pile cap. Overall depth of localised scour holes is in excess of 4 m.

Component 56T Columns or piles Timber

Units of measurement: Each

This item includes all potted timber piles or columns as well as driven timber piles at both piers and abutments. Bracing and fender piles are also included in this item. If the abutment piles have been relieved by props or potted piles, then these supports should be rated rather than the original piles.

Members with pipe rot/termite attack/snipes in excess of the values shown in Condition State 4 are critical and should be replaced immediately.

When the amount of headstock seating on the pile is less than the standard amount, the chance of vertical splitting occurring below the seating area and subsequent failure is increased. The following criteria shall be used to determine the Condition State of the piles based on the amount of headstock seating:

- Where the following criteria are satisfied, the width of the headstock seating will have no bearing on the Condition State rating for the pile:
  - for 17" diameter piles, where the width of the headstock seating is 70% of the width of the headstock or greater
  - for 16" diameter piles, where the width of the headstock seating is 60% of the width of the headstock or greater.
- Where the width of the headstock seating is within the following bands, the pile seating shall be rated as Condition State 3:
  - for 17" diameter piles, where the width varies from 50%–69%
  - for 16" diameter piles, where the width varies from 50%–59%.
- Where the width of seating at the pile is less than 50% of the width of the headstock, this is deemed as insufficient headstock seating and the pile seating shall be rated as Condition State 4.

Condition State 1

The piles or props are in good condition with little or no pipe rot, termite attack or decay, though they may have minor cracks, splits or checks having no effect on the strength of the element. Relieving props are well braced and have wedges or other systems of adjustment to account for any settlement of the bedding or footing. This is required, especially on soft ground, to provide full support to the superstructure. Pier piles over 3 m high are to be well braced and all connections in good condition. The difference between soundings measured to the stream bed in successive inspections is less than 0.2 m. Overall depth of localised scour holes is less than 0.5 m.

Condition State 2

Piles or props are in good condition though they may have pipe rot of up to 20% of the diameter. They may also have medium decay, termite attack, splitting or checking but not of sufficient magnitude to affect the strength of the member. Relieving props may be in good condition but are poorly braced or have settled slightly from beneath the beams. Pier piles may be in good condition but may have ineffective braces or the connections may be slightly loose. The difference between soundings

measured to the stream bed in successive inspections is between 0.2 m and 0.49 m at the pile cap. Overall depth of localised scour holes ranges from 0.5 m to 1.99 m.

Condition State 3

Piles or props have a reasonable amount of pipe rot up to 35% of the diameter. They may also have large splits, especially under load bearing areas, heavy decay, termite attacks or checks which may cause a reduction in strength of the member. For 17” (432 mm) diameter piles, the width of the headstock seating is between 50% to 69% of the width of the headstock. For 16” (407 mm) diameter piles, the width of the headstock seating is between 50% to 59% of the width of the headstock. Relieving props may be completely unbraced and subject to being knocked out easily, or they may have settled well away from the beam they are supposed to be supporting, with load being still carried by the original pile or crosshead until very heavily loaded. Bracing connections may be heavily corroded or be reasonably loose, having little effectiveness. The difference between soundings measured to the stream bed in successive inspections is between 0.5 m and 0.99 m at the pile cap. Overall depth of localised scour holes ranges from 2 m to 4 m.

Condition State 4

Piles or props have heavy pipe rot up to 50% of the diameter. Splitting, termite attack or decay may be severe with a definite reduction in the strength of the member. Relieving props may be completely ineffective and offer no resistance, even under heavy load. The width of the headstock seating is less than 50% of the width of the headstock. Bracing may be missing or totally ineffective due to very loose connections. The difference between soundings measured to the stream bed in successive inspections is 1.0 m or greater at the pile cap. Overall depth of localised scour hole is in excess of 4 m.

Component 56O Columns or piles Other

Units of measurement: Each

This item includes all pile encasements constructed using composite materials, such as fibreglass-coated and/or carbon fibre wraps.

Condition State 1

The encasements are in good condition, with no splits, bulges or other obvious defects in the encasement material. The fastenings are in good condition. There may be some discolouration of the surface material due to ultraviolet light. Joints and seams are all tight with no signs of separation.

Condition State 2

Joints and seams are in good condition with only minor separation of edges. Small air bubbles may be visible between layers. The surface may have a roughened appearance due to abrasion.

Condition State 3

The FRP wrap system may show signs of moderate surface defects or imperfections comprising abrasion weathering or pitting of the surface layer. Moderate separation of the wrap from the pile may have occurred due to adhesion loss. The defects do not extend through the depth of the encasement to the outer surface of the original pile. The wrap displays no evidence of bulging or splitting.

Condition State 4

The wrap shows observable defects which suggest extensive breakdown of the protective barrier has occurred. Bulging or splitting of the wrap is likely to have occurred. The wrap may have separated from the pile, allowing ingress of water and other contaminants. The loss of sections of the wrap coating may have occurred. The damage may be localised or more widespread.

Component 57S Pile bracing/Wales Steel

Units of measurement: Each

This item includes all bracing and wales constructed using cast iron, wrought iron or steel. The bracing may comprise rolled or plate sections, or simple steel rods. Metal may be painted, unpainted or galvanised.

Condition State 1

The paintwork is generally sound, with only minor chalking, peeling or curling, but no exposure of the metal. All welds, bolts and rivets are in good condition.

Condition State 2

Spot rusting of the paint system is occurring and the system is no longer effective. No corrosion has occurred as yet. No cracking of the welds has occurred, but there may be some minor rusting of nuts or bolts.

Condition State 3

The paint system has completely broken down with corrosion and pitting in areas. Nuts and bolts may be corroded with minor loss of tension in bolts. Welds may be cracked with minor loss of effectiveness.

Condition State 4

Corrosion is well advanced, having a detrimental effect on the strength of the element. Braces have broken loose or bolts and rivets are missing. Rivets or bolts may be severely corroded and no longer carrying full load or functioning as intended. In some instances, the braces may have broken loose.

Component 57C Pile bracing/Wales Cast insitu concrete

Units of measurement: Each

This item includes all cast insitu reinforced concrete bracing members constructed between piles or columns to provide resistance to lateral forces and/or buckling of the vertical members.

Condition State 1

The elements are in good condition with only very minor cracking visible due to corroding reinforcement. The braces should have no flexural or shear cracking.

Condition State 2

There may be a few minor cracks or spalls due to corroding reinforcement and there may be some minor flexural cracking.

Condition State 3

Structural cracking should be of minor to moderate severity. Moderate to severe non-structural cracking, spalls and possible delamination may be present with exposed reinforcement being moderately corroded with up to 20% section loss.

A cracked component shall be rated in Condition State 3 on the basis of the following criteria:

- a crack width exceeds 0.3 mm in concrete located in a non-aggressive environment (Exposure Rating 1 or 2) or
- a crack width exceeds 0.15 mm in concrete located in an aggressive environment (Exposure Rating 3 or 4).

Condition State 4

Flexural cracking may be severe and shear cracking may be evident. Reinforcement may be heavily corroded with section loss in excess of 20%, with associated cracking, spalling or delamination of concrete.

Component 57T Pile bracing/Wales Timber

Units of measurement: Each

This item includes all bracing and wales constructed using sawn timber sections which do not include the centre of the original log (that is, no pipe rot).

Condition State 1

The timber is in good condition with only minor weathering splits or checks having no effect on strength. All bolted connections are tight and in good condition.

Condition State 2

The timber shows signs of minor weathering, decay, splitting and checking but does not affect the strength of the members. All bolts are in good condition, though a few bolts may be slightly loose.

Condition State 3

Moderate weathering, decay, splitting and checking may be present and the strength of the member has been affected to a minor extent. Bolted connections may be loose, allowing the member to move excessively when loaded. The member may have cracked due to overloading or ineffective support or connections.

Condition State 4

The member is severely decayed, split or cracked and the strength of the member has been significantly reduced. Bolted connections are very loose and the member is moving excessively when loaded, causing further deterioration of the member.

Component 58C Pier wall Cast insitu

Units of measurement: Square Metres

This item describes pier walls constructed using cast insitu concrete and includes any thickening at the top of the wall to accommodate the superstructure bearings. If, however, this thickening cantilevers out from the walls, it shall be considered under the item for headstocks. If the pier is of a hammerhead type with large overhangs, the wall shall be considered as a column and included under that item. Damage to bearing support areas caused by faulty bearings is covered under the bearing items. Piers which have thin infill panels between columns are not considered under this item. These piers shall be considered as headstock and column as the infill panels serve no structural purpose.

Condition State 1

The wall is in good condition with only minor cracking due to corroding reinforcement. There is no cracking due to differential settlement of the foundations.

Condition State 2

The wall may have minor cracking and spalling due to corroding reinforcement. Tops of the walls may have minor cracking due to friction or edge loading of beams. The wall may have minor cracking due to differential settlement of the foundations.

Condition State 3

Moderate to severe non-structural cracking and spalling may be visible, with loss of reinforcement section up to 20%. The top of walls may have moderate cracking or spalling due to friction or edge loading of beams. The walls may have moderate cracking due to differential settlement of the foundations. Moderate structural cracking may be evident.

A cracked component shall be rated in Condition State 3 on the basis of the following criteria:

- a crack width exceeds 0.3 mm in concrete located in a non-aggressive environment (Exposure Rating 1 or 2) or
- a crack width exceeds 0.15 mm in concrete located in an aggressive environment (Exposure Rating 3 or 4).

Condition State 4

Severe structural cracking may be visible. Advanced corrosion of the reinforcement may have occurred, with loss of section greater than 20% and associated cracking, spalling or delamination. Tops of walls may have severe cracking and spalling due to friction or edge loading of the beams. The walls may have severe cracking due to differential settlement of the foundations.

Component 58O Pier wall Other

Units of measurement: Square Metres

This item describes all wall types other than concrete and includes stone masonry walls, red brick walls or grouted rubble walls. The item does not include any reinforced concrete cap on top of the walls. If masonry blocks are used to cap the walls, those blocks can be considered in this element. Foundations, if visible, should be included in this item.

Condition State 1

The wall is in good condition with only a few very minor fine cracks in the mortar between the bricks, stones or blocks. There is no cracking due to differential settlement of the foundations. There should be no loss of mortar between the blocks.

Condition State 2

The wall may have a number of fine cracks in the mortar between brick or blocks, but no cracking of the masonry. There may be minor loss of mortar of no concern. There may be minor cracking due to differential settlement of the foundations.

Condition State 3

Moderate cracking of the mortar between the blocks may be occurring or moderate mortar loss may be occurring due to water wash. There should be, however, only minor mortar loss beneath any masonry capping blocks. Moderate cracking may exist due to differential settlement of the foundations.

Condition State 4

The mortar and blocks may have severe cracking through them. Mortar loss may be severe, requiring pressure repointing. Loss of mortar below masonry capping blocks may be moderate. Differential settlement of the foundations may have caused severe cracking.

Component 59C Footing/Pile cap Cast insitu concrete

Units of measurement: Each

This item covers all foundations constructed in cast insitu concrete such as pile caps and spread footings. It also covers the concrete pedestal footings used to support timber pile bases at piers and abutments.

Spread footings

Condition State 1

The footing is in good condition with only minor cracking due to shrinkage or corroding reinforcement. There is no cracking due to differential settlement of footings or scouring under spread footings.

Condition State 2

There is minor cracking or spalling due to corroding reinforcement or differential settlement of footings. There is no scour beneath the spread footing base.

Condition State 3

Moderate cracking or spalling due to differential settlement or log impact may have occurred. Moderate to severe cracking or spalling due to corroding reinforcement or ASR may be evident. There is up to 20% loss of reinforcement section. There is no scour beneath the spread footing base.

A cracked component shall be rated in Condition State 3 on the basis of the following criteria:

- a crack width exceeds 0.3 mm in concrete located in a non-aggressive environment (Exposure Rating 1 or 2) or
- a crack width exceeds 0.15 mm in concrete located in an aggressive environment (Exposure Rating 3 or 4).

Condition State 4

Footings are severely cracked and spalled due to differential settlement of foundations or log impact. There may be advanced reinforcement corrosion, with loss of section in excess of 20% and associated cracking and spalling. Spread footings may have been undercut by scour action.

Pile caps

Condition State 1

The pile cap is in good condition with only minor cracking due to shrinkage or corroding reinforcement. There is no cracking due to differential settlement of piles and the difference between soundings measured to the stream bed in successive inspections is less than 0.2 m at the pile cap. Overall depth of scour holes is less than 0.5 m.

Condition State 2

There is minor cracking or spalling due to corroding reinforcement or differential settlement of piles. Piles have adequate edge clearances and have been placed within the specified tolerances. The difference between soundings measured to the stream bed in successive inspections is between 0.2 m and 0.49 m at the pile cap. Overall depth of localised scour holes ranges from 0.5 m to 1.99 m.

Condition State 3

Moderate cracking or spalling due to log impact or differential settlement may have occurred. Moderate to severe cracking and spalling due to corrosion of reinforcement or ASR may be evident. There is up to 20% loss of reinforcement section due to corrosion. Piles have been driven significantly out of positional tolerance but the structural strength and serviceability are adequate. The difference between soundings measured to the stream bed in successive inspections is between 0.5 m and 0.99 m at the pile cap. Overall depth of localised scour holes ranges from 2 m to 4 m.

A cracked component shall be rated in Condition State 3 on the basis of the following criteria:

- a crack width exceeds 0.3 mm in concrete located in a non-aggressive environment (Exposure Rating 1 or 2) or
- a crack width exceeds 0.15 mm in concrete located in an aggressive environment (Exposure Rating 3 or 4).

Condition State 4

Pile caps are heavily cracked and spalled due to differential settlement of foundations or log impact. There may be advanced reinforcement corrosion, with loss of section in excess of 20% and associated cracking and spalling. Edges of pile caps may be spalling due to lack of edge clearance of piles. The difference between soundings measured to the stream bed in successive inspections is 1 m or greater at the pile cap. Depth of localised scour holes is in excess of 4 m.

Component 59T Sill logs Timber

Units of measurement: Each

This item includes timber sill logs used to support timber pile bases at piers and abutments.

Condition State 1

The sill log is in good condition with little or no pipe rot or decay. There may be minor splits or checks having no effect on member strength.

Scouring of the stream bed has not caused any exposure of the member.

Condition State 2

The sill log is in good condition and may have minor decay, splitting, checking or crushing but not of sufficient magnitude to affect the strength of the member.

Scouring of the stream bed has not caused any exposure of the member.

Condition State 3

The sill log has a reasonable amount of pipe rot or decay and may have large splits or checks which may reduce the strength or serviceability of the member. Splits may be separating under load, causing crushing of the member, or crushing may be due to water ingress softening the load bearing areas of the timber.

Scouring of the foundation has occurred and the sill log is visible but there is still adequate support for the sill log.

Condition State 4

The sill log may have excessive pipe rot or decay, accompanied by severe splitting or crushing. Strength and serviceability of the member has been severely affected and may have significant crushing at the pile support area, resulting in settlement of the bridge structure.

Scour of the foundations has undermined the sill log, resulting in settlement of the bridge.

Bolted connections on the outer upstream and downstream piles may be severely corroded.

Component 60S Wing piles Steel

Units of measurement: Each

This item includes all columns or protruding piles manufactured from steel at abutment wingwalls. The steel may be painted or unpainted.

Condition State 1

The paintwork is generally in good condition with only minor chalking, curling or peeling, but no metal exposure. All connections are in good condition. The difference between soundings measured to the stream bed/embankment in successive inspections is less than 0.2 m. Overall depth of localised scour holes is less than 0.5 m.

Condition State 2

Painted steelwork has spot rusting and the protective coating is no longer effective. The connections may be slightly loose or corroded. Unpainted steel piles may be rusted. The difference between soundings measured to the stream bed/embankment in successive inspections is between 0.2 m and 0.49 m. Overall depth of localised scour holes ranges from 0.5 m to 1.99 m.

Condition State 3

Steelwork has medium corrosion and the paint system has completely failed. Surface pitting may be evident but section loss is less than 10%. Connections may be heavily corroded or loose. The difference between soundings measured to the stream bed/embankment in successive inspections is between 0.5 m and 0.99 m. Overall depth of localised scour holes ranges from 2 m to 4 m.

Condition State 4

Steelwork is heavily corroded with up to 20% loss of section. Connections may be very loose. The difference between soundings measured to the stream bed/embankment in successive inspections is 1 m or greater. Overall depth of localised scour holes is in excess of 4 m.

Component 60P Wing piles Precast concrete

Units of measurement: Each

This item includes all protruding piles manufactured from precast concrete at abutment wingwalls. The precast units may be prestressed or reinforced concrete. Prestressed concrete piles may exhibit longitudinal cracking as result of ASR from around ground level to the standing water mark.

Condition State 1

The piles are in good condition with only minor cracking due to reinforcement corrosion. There should be no moment cracking in the piles. The difference between soundings measured to the stream bed/embankment in successive inspections is less than 0.2 m. Overall depth of localised scour holes is less than 0.5 m.

Condition State 2

The piles have minor cracking or spalling due to corroding reinforcement. Fine moment cracking may be visible. Stressing strands should not be exposed and the piles may not be effectively braced. Prestressed piles may have fine longitudinal cracks caused by ASR. The difference between soundings measured to the stream bed/embankment in successive inspections is between 0.2 m and 0.49 m. Overall depth of localised scour holes ranges from 0.5 m to 1.99 m.

Condition State 3

There may be moderate cracking caused by structural mechanisms, or moderate to severe cracking and spalling due to non-structural actions such as corroding reinforcement and ASR, with up to 20% loss of section of the bars. Exposed stressing strands should only have minor surface corrosion. Flexural cracking may be medium-sized. Prestressed piles may have moderate to severe longitudinal cracking caused by ASR. The difference between soundings measured to the stream bed/embankment in successive inspections is between 0.5 m and 0.99 m. Overall depth of localised scour holes ranges from 2 m to 4 m.

A cracked component shall be rated in Condition State 3 on the basis of the following criteria:

- a crack width exceeds 0.3 mm in concrete located in a non-aggressive environment (Exposure Rating 1 or 2) or
- a crack width exceeds 0.15 mm in concrete located in an aggressive environment (Exposure Rating 3 or 4).

Condition State 4

There may be severe cracking caused by structural mechanisms, or advanced corrosion of the reinforcement with loss of section greater than 20% (and any spalling and cracking associated with it). Any exposed stressing strands may have up to 10% section loss. Flexural cracking may be heavy. The difference between soundings measured to the stream bed/embankment in successive inspections is 1 m or greater. Overall depth of localised scour holes is in excess of 4 m.

Component 60C Wing piles Cast insitu concrete

Units of measurement: Each

This item includes all cast insitu columns or cast insitu extensions on top of driven piles, and reinforced concrete pile encasements. This item should also encompass ties and braces which may be used to stiffen the columns or piles and to distribute loads.

Condition State 1

The piles, columns or encasements show only minor cracking due to reinforcement corrosion. There should be no moment cracking in the piles or columns. The piles are adequately braced with unsupported height less than 3.5 m. The difference between soundings measured to the stream bed in successive inspections is less than 0.2 m. Overall depth of localised scour holes is less than 0.5 m.

Condition State 2

The piles, columns or encasements have minor cracking or spalling due to corroding reinforcement. Fine moment cracking may be visible and the piles or columns may not be effectively braced. The difference between soundings measured to the stream bed in successive inspections is between 0.2 m and 0.49 m at the pile cap. Overall depth of localised scour holes ranges from 0.5 m to 1.99 m.

Condition State 3

The piles, columns or encasements have moderate cracking caused by structural mechanisms, or moderate to severe cracking due to non-structural actions such as corrosion of reinforcement and ASR, with up to 20% loss of section in the steel bars. Flexural cracking may be medium-sized, especially if the bracing or ties are ineffective or non-existent. The difference between soundings measured to the stream bed in successive inspections is between 0.5 m and 0.99 m at the pile cap. Overall depth of localised scour holes ranges from 2 m to 4 m.

A cracked component shall be rated in Condition State 3 on the basis of the following criteria:

- a crack width exceeds 0.3 mm in concrete located in a non-aggressive environment (Exposure Rating 1 or 2) or
- a crack width exceeds 0.15 mm in concrete located in an aggressive environment (Exposure Rating 3 or 4).

Condition State 4

There may be severe cracking due to structural mechanisms or advanced corrosion of the steel bars, with loss of section of reinforcement greater than 20% (and any spalling or cracking associated with it). Flexural cracking may be heavy with bracing or ties totally ineffective or missing. The difference between soundings measured to the stream bed in successive inspections is 1 m or greater at the pile cap. Overall depth of localised scour holes is in excess of 4 m.

Component 60T Wing piles Timber

Units of measurement: Each

This item includes all potted or driven timber piles at abutment wingwalls.

Condition State 1

The piles are in good condition with little or no pipe rot, termite attack or decay, though they may have minor cracks, splits or checks having no effect on the strength of the element. The difference between soundings measured to the stream bed/embankment in successive inspections is less than 0.2 m. Overall depth of localised scour holes is less than 0.5 m.

Condition State 2

Piles are in good condition, though they may have up to 20% pipe rot of the diameter. They may also have medium decay, termite attack, splitting or checking but not of sufficient magnitude to affect the strength of the member. The difference between soundings measured to the stream bed/embankment in successive inspections is between 0.2 m and 0.49 m. Overall depth of localised scour holes ranges from 0.5 m to 1.99 m.

Condition State 3

Piles have a reasonable amount of pipe rot up to 35% of the diameter. They may also have large splits, heavy decay, termite attacks or checks which may have a reduction in strength of the member. The piles may be leaning slightly forward due to earth pressure. The difference between soundings measured to the stream bed/embankment in successive inspections is between 0.5 m and 0.99 m. Overall depth of localised scour holes ranges from 2 m to 4 m.

Condition State 4

Piles have heavy pipe rot up to 50% of the diameter. Splitting, termite attack or decay may be severe with a definite reduction in the strength of the member. Piles may be leaning forward excessively as a result of earth pressure. The difference between soundings measured to the stream bed/embankment in successive inspections is 1 m or greater. Overall depth of localised scour holes is in excess of 4 m.

Component 70O Approaches Other

Units of measurement: Each

This item defines the carriageway immediately behind the abutments/structure and includes such items as wearing surface on the approach pavement, relieving slabs and drainage. The length of approach considered shall be at the discretion of the inspector but generally should be no more than 20 m. The actual length considered should be noted in the 'comments' field for the item.

Condition State 1

The pavement surface is in good condition with no cracking, potholes, rutting, bumps or depressions and the transition between the road and bridge is smooth with a level difference of less than 10 mm. The relieving slabs are in good condition and have not settled. The pavement surface has adequate crossfall and gradient to efficiently drain surface water to drainage outlets which are well clear of the bridge and fully functional.

Condition State 2

There may be minor rutting, cracking, bumps and depressions or minor depressions due to embankment movement which are marginally hindering pavement drainage. The approaches may have settled slightly (as a result of embankment settlement/consolidation or loss of material through substructure) but transition is generally smooth with a level difference less than 20 mm. Settling relieving slabs have caused a small height difference and opened up the expansion joint slightly. Drainage outlets may be blocked or badly positioned, causing water to discharge too close to the bridge abutment, but erosion is insignificant.

Condition State 3

Pavement surface defects are trapping surface water and/or allowing it to penetrate into the fill. Potholes may be forming in cracked areas. Rutting, bumps and potholes are affecting rideability and settlement of approaches is advancing with a level difference of up to 30 mm. Relieving slabs may have settled substantially and rotated, causing an opening of the abutment expansion joints but without failure of joint. Surface water outlets may be blocked, inadequate or badly positioned, causing water to discharge over the embankment face to close to the bridge. There may be significant erosion of the embankment face or abutment spill-through but the stability of the road on bridge has not been compromised.

Condition State 4

Potholing, cracking, rutting, bumps or depressions are having a marked effect on the drainage and rideability of the approaches. Settlement of the approaches is pronounced, with a drop in level in excess of 30 mm. These surface irregularities greatly increase the dynamic wheel loading on the bridge and the deck surface may also show signs of deterioration. Relieving slabs may have settled dramatically, causing rotation at the expansion joint sufficient to cause total failure at the joint. Surface water drainage outlets may be inadequate, blocked or badly positioned and the embankment faces, and abutment spill-through, are severely eroded with deep gulleys evident on those faces. Footings of the abutment or wingwalls may be exposed and batter drains undercut. Fill material may have been lost from the embankment behind the abutment. Immediate action may be required to maintain embankment or structural stability.

Component 71C Waterway Cast insitu concrete

Units of measurement: Each

This item defines the condition of stream or channel banks and/or bed in the vicinity of the structure which have been lined with cast insitu reinforced concrete or mortar pumped into a nylon mattress. This includes inlet and outlet aprons. The element shall be given a single rating only, and this rating should report the worst condition state applicable to the span.

Condition State 1

There is little or no change in channel shape or bed level at the site. The reinforced concrete channel or aprons are undamaged with no differential settlement between slabs.

Condition State 2

Channel shape and bed level is unchanged but there may be cracking of the concrete or minor differential movement between the slabs.

There may be accumulated debris or bed deposits representing up to 10% of the designed waterway area in any span.

Condition State 3

Differential settlement or movements have caused concrete edges to break away, allowing water behind the concrete. Some loss of fill material may have occurred.

There may be accumulated debris or bed deposits representing up to 20% of the designed waterway area in any span.

Condition State 4

Large settlements or movements have severely damaged the concrete, allowing large washouts beneath the concrete banks or bed.

There may be accumulated debris or bed deposits representing in excess of 20% of the designed waterway area in any span.

Component 71O Waterway Other

Units of measurement: Each

This item defines the condition of unprotected or protected stream banks and bed in the vicinity of the structure. Protected banks and bed may be constructed of brick, masonry, stone filled cages or mattresses, a geotextile layer with grass, or rocks held down by wire mesh. The item should be given a single rating only, and this rating should report the worst condition state applicable to the span.

Condition State 1

There is little or no change in the stream shape and the difference between soundings measured to the stream bed in successive inspections is less than 0.2 m. Overall depth of localised scour holes is less than 0.5 m. Protective works (if any) are in good condition with no damage visible.

Condition State 2

Minor scour has only a minor effect on the stream shape and the difference between soundings measured to the stream bed in successive inspections is between 0.2 m and 0.49 m. Overall depth of localised scour holes ranges from 0.5 m to 1.99 m. Minor settlement may have occurred or there may be minor cracking of the mortar between stones. Rock gabions or mattresses may have lost their shape slightly but only minor loss of rock fill may have occurred. There may be accumulated flood debris or bed deposits representing up to 10% of the designed waterway area in any span.

Condition State 3

Scour of the banks has altered the stream shape and the difference between soundings measured to the stream bed in successive inspections is between 0.5 m and 0.99 m. Overall depth of localised scour holes ranges from 2 m to 4 m. Settlement may have badly cracked mortar between blocks and a few blocks may be missing with possible loss of fill material. Gabions or mattresses may be badly distorted with some wires broken and a moderate loss of rock filling may have occurred. There may be accumulated flood debris or bed deposits representing up to 20% of the designed waterway area in any span.

Condition State 4

Large settlements or movements may have severely damaged the protection with loss of large areas of rocks. Gabions or mattresses may be completely broken with almost total loss of rock filling. Unprotected banks and beds may be severely scoured with loss of approach embankment occurring, and the difference between soundings measured to the stream bed in successive inspections is 1 m or greater. Overall depth of localised scour holes is in excess of 4 m. There may be accumulated flood debris or bed deposits representing in excess of 20% of the designed waterway area in any span.

Component 72S Guardrails/Barriers Steel

Units of measurement: Each

This item defines any approach guardrails or barriers leading up to the bridge endposts and/or bridge railing, including pedestrian barriers.

Condition State 1

The approach railing is in good condition with no accident damage, and is well connected to the endpost or bridge railing. Where there is no bridge barrier present, the ends of the guardrail have been treated with an approved end treatment. The height and post spacings are in accordance with the requirements of the standard drawing.

Condition State 2

The approach railing is generally in good condition with only minor rusting and/or minor accident damage. The railing is well connected to the endposts or bridge railing. The end treatment may show minor signs of wear and tear, but is still functioning as required. The guardrail has sufficient strength; that is, post spacings are in accordance with the current standard drawings.

Condition State 3

The approach railing may be moderately damaged due to vehicular impact or the guardrail is poorly connected to the end posts of the bridge barrier. Where no bridge barrier is present, the guardrail end treatments may be defective. The railing may be heavily rusted or the guardrail may not have insufficient strength; that is, post spaces may be greater than 1 m immediately prior to the end posts.

Condition State 4

The approach railing has been severely damaged or demolished. Where a substantial bridge barrier is present, the guardrail is not tied into the bridge barrier. Where there is only a nominal bridge barrier (such as timber posts and rails) or no bridge barrier is present, there may be no end treatment applied to the bridge end of the guardrail. The guardrail may have insufficient strength with post spacings greater than those required under the current standard or may be rusted through due to corrosion of the metal. The height of the guardrail is more than 100 mm below the current standard. The guardrail barriers may have significant corrosion resulting in loss of section.

Component 72P Guardrail/Barriers Precast concrete

Units of measurement: Each

This item defines all types and shapes of approach barriers where the principal component is precast concrete. It includes any RC terminals, steel safety rails or traffic barriers mounted on top and holding down bolts. Inspectors should use the state descriptions for Component No. 72C *Cast insitu concrete barriers* in addition to the descriptions given here for the fasteners. The length of the approach barrier is at the discretion of the inspector but generally should be no more than 20 m. The actual length considered should be noted in the 'comments' field for the item.

Condition State 1

Mortar seating is continuous and sound and there is no evidence of moisture ingress into the base joint. Alignment is true to line and level and all bolts are tight.

Condition State 2

Mortar seating is substantially intact with a few isolated failures. Some moisture may be penetrating the bedding joint but there is no rust staining evident. There are visible discontinuities in alignment of panels but barrier is fit for purpose.

Condition State 3

Moderate cracking and spalling is evident, with in excess of 20% loss of reinforcement area. Mortar seating is missing or crumbling out of significant portions of the bedding joint and surface water run-off is freely passing through some sections of the joint. Rust stains are evident on the kerb/plinth and anchor bolts may show signs of active corrosion. There may be visible discontinuities in alignment of panels but the containment capacity is substantially intact.

A cracked component shall be rated in Condition State 3 on the basis of the following criteria:

- a crack width exceeds 0.3 mm in concrete located in a non-aggressive environment (Exposure Rating 1 or 2) or
- a crack width exceeds 0.15 mm in concrete located in an aggressive environment (Exposure Rating 3 or 4).

Condition State 4

There may be loss of section of reinforcement due to corrosion greater than 20% (and the resultant cracking and spalling this may cause). The mortar seating may be missing over large areas and the anchor bolts are significantly corroded, such that the containment capacity has been significantly reduced. Severe rust staining and leakage through the joint is evident.

Component 72C Guardrails/Barriers Cast insitu concrete

Units of measurement: Each

This item defines all cast insitu concrete bridge approach barriers and includes terminals and any steel safety rails or traffic barriers mounted on top. The item also includes cast insitu concrete portion constructed to join precast concrete parapets to the deck. The length of the approach barrier is at the discretion of the inspector but generally should be no more than 20 m. The actual length considered should be noted in the 'comments' field for the item.

Condition State 1

The barrier is in good condition with only minor cracking due to shrinkage or corrosion of reinforcement. The correct traffic face profile has been constructed. Steel rails are in good condition with no rust spotting and bolted and welded connection show no signs of deterioration. No accident damage or rotation of the barriers is evident.

Condition State 2

There is minor cracking and spalling due to corrosion of the reinforcement. The correct traffic face profile has been constructed with no overlays affecting the upstand. Steel railings on top of the parapet may have rust spotting and bolted connections are tight and in good condition. There are no cracked welds. Accident damage is slight and of no consequence. The barrier may have rotated slightly on the footing with the resultant movement of the top edges not exceeding 20 mm.

Condition State 3

Moderate cracking and spalling is evident with in excess of 20% loss of reinforcement area. The steel barrier may be pitted on the surface and connections slightly loose. Post anchorages may have minor cracking due to vehicle impact. The traffic face profile may have been constructed incorrectly or a surfacing overlay placed which reduces the height of the vertical upstand and barrier. Accident damage has only a minor effect on strength and serviceability. The barrier may have rotated moderately on the footing with resulting movement of the top edges not exceeding 40 mm.

A cracked component shall be rated in Condition State 3 on the basis of the following criteria:

- a crack width exceeds 0.3 mm in concrete located in a non-aggressive environment (Exposure Rating 1 or 2) or
- a crack width exceeds 0.15 mm in concrete located in an aggressive environment (Exposure Rating 3 or 4).

Condition State 4

Severe cracking may be visible due to advanced corrosion of the reinforcement which may have lost in excess of 20% of its sectional area. Corrosion may be well advanced in the steel barrier, bolts may be loose or rails may have broken free from their mountings. The anchorage area of the steel barrier posts may be cracked and spalled. Strength and serviceability of the barrier is adversely affected. The traffic face profile may have been constructed incorrectly on surfacing overlays placed, such that the upstand height is significantly reduced. Accident damage may be severe with serious cracking and spalling of the concrete barrier or loss of sections of the railing. The barrier has rotated excessively on the footing with the resultant movement of the top edges exceeding 40 mm.

Component 72T Guardrails/Barriers Timber

Units of measurement: Each

This item defines those rails constructed using timber either from a sawn section or glued laminated sections. This item includes also the supporting posts.

Timber railing is considered to be inappropriate and represents a significant hazard to road users. The presence of barriers of this type are to be noted in the 'comments' field in the 'overall rating' section of the *Bridge Condition Inspection Report – Form B2/1*.

Condition State 1

The element shows only minor deterioration and all the bolting is tight. No accident damage is visible.

Condition State 2

The element shows signs of minor decay, splitting or cracking but does not affect the strength or serviceability. Bolting of the posts and guardrails is generally tight. Accident damage is only minor with no effect on strength or serviceability.

Condition State 3

Medium decay, splitting, cracking or crushing may be present, affecting the strength and serviceability of the railing to a minor extent. Bolting may be loose in a number of areas. Accident damage may have a minor effect on the strength or serviceability of the guardrail.

Condition State 4

Heavy decay, splitting, cracking or crushing may be present, affecting the strength and serviceability of the guardrail. Bolting may be quite loose, affecting the strength of the guardrail. The guardrail may not be connected to the bridge end posts. Major accident damage is affecting the serviceability of the guardrail.

Component 72O Guardrails/Barriers Other

Units of measurement: Each

This item defines all types of shapes and barrier materials other than those already covered. Included in this item are masonry parapets, aluminium rails with steel tensioning cables inside, GWI pipe, post and rails, wire mesh fencing panels, wire or chain cables. The item covers any posts required to support the railing system or cables. The length of the approach barrier is at the discretion of the inspector but generally should be no more than 20 m. The actual length considered should be noted in the 'comments' field for the item.

No Barriers

In the event that no barriers have been constructed, this is considered as a serious deficiency and a note should be added to the 'comments' field in the 'overall rating' section of the *Bridge Condition Inspection Report – Form B2/1*.

Condition State 1

The element shows only minor signs of deterioration with minor cracking between masonry blocks or rusting of steel work. No accident damage or rotation of the barriers is evident.

Condition State 2

Minor cracking, spalling, loss of mortar between masonry blocks, surface or spot rusting has occurred but having little or no effect on strength or serviceability. Accident damage is very minor with no effect on strength or serviceability. The barrier may have rotated slightly on the footing with resultant movement of the top edges not exceeding 20 mm.

Condition State 3

Moderate cracking, spalling, loss of mortar between masonry block, or corrosion of metal is occurring but having a minor effect on strength or serviceability. Accident damage may have a minor effect on the strength or serviceability of the railing. The barrier may have rotated moderately on the footing with resultant movement of the top edges not exceeding 40 mm.

Condition State 4

Severe cracking, spalling, loss of mortar or corrosion has a large effect on rail strength or serviceability. Accident damage is major, affecting the strength or serviceability of the railing. The barrier has rotated excessively on the footing with resultant movement of the top edges exceeding 40 mm.

Component 73S/O ID number display Steel/Other

Units of measurement: Each

The item includes all identification plates of steel, aluminium or bronze or stencilled permanent markings or welded numbers.

Condition State 1

There is good legible identification number on the structure at the following locations:

- bridges – top face of left hand side kerb at Abutment A
- culvert – top face of left hand side headwall at Abutment A plus annotated marker post
- retaining walls – each end of wall at eye level
- large traffic management signs – left hand side column on approach face at eye level. On portal structures the ID shall be marked on both approach faces at eye level.

Condition State 2

The ID is in position but is difficult to read.

Condition State 3

The ID is illegible or badly damaged or in a position difficult to read.

Condition State 4

The ID is missing.

Component 74S	External strengthening/Post-tensioning	Steel

Units of measurement: **Each**

The item includes all steel bars/tendons, anchorages and associated supports used to strengthen another component through the application of external strengthening/post-tensioning. The bars/tendons may be painted, coated, wrapped in grease with a protective outer wrapper or embedded in grout within a conduit.

Condition State 1

There is no evidence of rust and any protective coating system is in good condition. There are no signs of distress at anchors or associated supports.

Condition State 2

The bars or tendons may show signs of rust or the protective coating system may be broken or in poor condition. There are no signs of distress at anchors but the supports may be corroded and in need of lubrication.

Condition State 3

The bars or tendons may exhibit minor corrosion. Any protective coating system has been lost or is in very poor condition. The conduit is in poor condition, grout may be visible through the damaged conduit and may be exhibiting signs of distress. Anchors and associated supports may have minor deformations. Tendons may be beginning to abrade but there are no wire breakages. Bars may be beginning to abrade but there is no loss of section.

Condition State 4

The bars or tendons are badly corroded, or have slackened noticeably. Anchorages may have severe deformations or anchorages have moved or slipped. Associated supports are badly damaged. Tendons may be severely abraded with a number of broken wires. Bars may be severely abraded with loss of section.

Component 74O	External strengthening/Post-tensioning	Other

Units of measurement: **Each**

This item includes all external strengthening systems constructed using composite materials, such as fibreglass-coated and/or carbon fibre strips.

Strengthening relies entirely on the anchorage and bond of the material to the base component and the following areas should be inspected during a site inspection:

- the ends of the strengthened area for signs of the strips peeling from the epoxy resin or the resin debonding from the concrete base
- the concrete base at the strengthening boundary for signs of any cracking or spalling which could affect the bonding of the FRP to the member
- delamination of the strengthening from the base concrete in other areas, or kinks in the material, air bubbles, bulging or waviness
- tears, cuts or crazing of the FRP material.

Condition State 1

The system is in good condition, with no signs of distress in either the substrate, the bonding resin or the strengthening material.

Condition State 2

There may be small areas of delamination (< 5% of the laminate area). There may be evidence of minor initial breakdown of the system (that is, a fine crack across the end of the laminate or fine cracks in the resin or substrate).

Condition State 3

The system exhibits delamination (> 5% of the laminate area). The end of the laminate has begun to peel or the laminate and epoxy are separating from the substrate. Cracking is more pronounced along the substrate/epoxy resin interface or along the laminate/epoxy resin interface.

Condition State 4

There is widespread delamination evident. Cracking along the interface between laminate, resin or concrete substrate is severe. Cracking may be evident in the base concrete in the vicinity of the strengthening system.

Component 80S Pipe culverts Steel

Units of measurement: Lineal Metres

This item includes all steel or aluminium pipes – painted or galvanised, circular, elongated or elliptical.

Where the culvert barrel is aluminium, the inspector shall confirm that the correct material type (aluminium) has been selected in the inventory data form and update as required.

Condition State 1

There is no evidence of rust or corrosion and the paintwork or galvanising is in good condition. The line and invert of the pipe is straight with no water being retained in the pipe.

Condition State 2

Surface or spot rusting may be evident and the paint system is no longer effective. There is no corrosion of the metal occurring. The line of the pipe is straight, but minor settlement may be allowing some water to be retained in the pipe. There may be a minor and insignificant change in pipe dimensions.

Condition State 3

The paint system has failed and pitting corrosion is prominent, especially at normal water level. Loss of section has occurred but there is still adequate section left to not affect serviceability of the pipe. There may be some deviation of the line of the pipes due to local buckling, or moderate settlement of the pipe may be allowing a significant amount of water to be retained in the pipe. There may be apparent distortion of the barrel profile. Where distortion is suspected, sufficient survey/measurement points shall be established and measurements taken to establish the barrel profile. A record of the measurements shall be included as a sketch in the inspection record.

Condition State 4

Heavy corrosion is occurring and the pipe may have corroded out in areas, particularly at the invert or the normal water level. There may be large deviation of line of the pipe due to buckling of plates or plates may have crinkled at the bolt line in large diameter pipes. An excessive amount of water may be retained in the pipe. Bolts may have torn through the plates or split the plate edges, allowing differential movement and buckling of plates. A measurement of survey/measurement points previously established to monitor distortion of the barrel profile indicates ongoing movement.

Component 80P Pipe culverts Precast concrete

Units of measurement: Lineal Metres

This item includes all precast concrete pipes and includes the jointing arrangements between them.

Condition State 1

The element may show only minor superficial cracking of no consequence. The line and invert of the pipe is straight with no water being retained within the pipe.

Condition State 2

The element may show minor cracking or spalling due to corroding reinforcement in isolated areas. The line of the pipe is straight but minor settlement of some units may be allowing a minor pool of water to be retained in the pipe.

Condition State 3

Moderate cracking, spalling or delaminated areas due to non-structural mechanisms, such as corrosion of reinforcement or ASR, may be present, having a minor effect on strength and serviceability of the pipe. Deviation of the line of the pipes may be occurring or moderate separation and settlement of units may be allowing a significant amount of water to be retained in the pipe or to leak out at the separated joints. A minor amount of surrounding fill material may have been lost at separated joints.

A cracked component shall be rated in Condition State 3 on the basis of the following criteria:

- a crack width exceeds 0.3 mm in concrete located in a non-aggressive environment (Exposure Rating 1 or 2) or
- a crack width exceeds 0.15 mm in concrete located in an aggressive environment (Exposure Rating 3 or 4).

Condition State 4

Severe cracking, spalling or delaminated areas may be present, having a pronounced effect on the strength and serviceability of the pipe. There may be loss of section of reinforcement due to corrosion greater than 20% (and the resultant cracking and spalling this may cause). Pipe line deviation, separation or settlement may be excessive, allowing a significant amount of water to be retained in the pipe, or to leak out at separated joints. A significant amount of surrounding fill material may have been lost at separated joints.

Component 80O	**Pipe culverts**	**Other**
Units of measurement:	**Lineal Metres**	

This item includes all pipes of circular or elliptical construction consisting of masonry, red bricks or plastic.

Condition State 1

The element shows little or no deterioration with only minor areas of dampness or efflorescence. There is no cracking or loss of mortar between the blocks. Pipe shape, line and invert level are good and straight. No water is retained in the pipe.

Condition State 2

There may be minor cracking or loss of mortar between blocks but not sufficient to affect the strength of the pipe. Minor cracking or spalling of the brickwork/blocks may be evident. The plastic may have a few superficial splits of no importance. Shape of the pipe is good and the line of the pipe is straight. Minor settlement of the pipe may be allowing a small pool of water to be retained in the pipe.

Condition State 3

Moderate cracking or loss of mortar between the blocks may have occurred. Moderate cracking or spalling of the brickwork/blocks may be evident, but not of a sufficient magnitude to affect the strength of the pipe. Minor loss of pipe shape or bulging of the walls may have occurred, with splitting of the plastic. The line of the pipe may have minor deviations, or moderate settling may be allowing a significant amount of water to be retained in the pipe.

Condition State 4

Severe cracking or loss of mortar has occurred between blocks and some blocks may have slipped. Severe cracking or spalling of the brickwork/blocks may have occurred, having a pronounced effect on the strength of the pipe. Loss of shape, bulging of walls, splitting of plastic, deviation of pipe line or settlement of the invert are excessive and are affecting the strength and serviceability of the pipe. An excessive amount of water is retained in the pipe or is leaking out through the joints.

Component 81P Box culverts Precast concrete

Units of measurement: Lineal Metres (per cell)

This item includes box culverts, crown units and link slabs between crown units. Wingwalls, aprons and headwalls are generally classified under Component No. 84; however, inspectors may cover large wingwalls (greater than 2 metres in height) under Component No. 51. Base slabs are to be covered under Component No. 85. Modular culverts, such as the 'Lincrete' system, are covered under Component No. 82.

Condition State 1

The element shows little or no deterioration with only a few fine superficial cracks of no importance. There may be minor efflorescence, especially on the soffit of the roof slab or near the joints. The culvert has been well-constructed, structure lines are true, joints between legs have been plugged, joints between units taped, weepholes installed in the headwalls and shoulders sealed. Restraint bolting is complete and intact.

Condition State 2

Minor cracking and spalling may be evident in legs and roof at joints, along with moderate efflorescence and damp stains due to ingress of moisture through the joints. There may be minor level differentials of up to 5 mm between units in the inverts. Shrinkage cracks may be evident in the legs and roofs.

Condition State 3

Moderate cracking and spalling may be particularly evident in legs and roof edges at joints along with damp patches and rust stains. Lime deposits may be evident in cracks. Active corrosion is occurring in the reinforcement at these locations and up to 20% of the bar area may have been lost. Minor cracking and spalling is evident elsewhere. Edge spalling of units may be more prominent and level differentials may be up to 10 mm in inverts. The structure may have been poorly constructed with; misaligned panels; leaking joints; partly plugged joints between abutment legs; weepholes in headwalls omitted; and unsealed shoulders. The serviceability of the structure has been compromised but strength/stability is holding. A minor amount of surrounding fill material may have been lost at separated joints.

A cracked component shall be rated in Condition State 3 on the basis of the following criteria:

- a crack width exceeds 0.3 mm in concrete located in a non-aggressive environment (Exposure Rating 1 or 2) or
- a crack width exceeds 0.15 mm in concrete located in an aggressive environment (Exposure Rating 3 or 4).

Condition State 4

Severe cracking and spalling may be evident with the delamination of large areas of cover concrete. The reinforcement is severely corroded, having lost more than 20% of its section. Edge spalling may be severe as well as large differential settlement between box units. There is a substantial reduction in capacity. The structure may have been extremely poorly constructed with unplugged joints between abutment legs; untaped roof joints; omitted or blocked weepholes; and unsealed shoulders. If cut-off walls are not constructed at each end of the base slab, then erosion of the sub-base material may

have occurred with some flow beneath the base slab. In this case, the base slab may sound hollow when struck with a hammer or piece of timber. A significant amount of surrounding fill material may have been lost at separated joints.

Component 81C Box culverts Cast insitu concrete

Units of measurement: Lineal Metres

This item includes all monolithic cast insitu reinforced concrete box culverts usually built pre-1950. Wingwalls, aprons and headwalls are generally classified under Component No. 84; however, inspectors may cover large wingwalls (greater than 2 metres in height) under Component No. 51. Base slabs are to be covered under Component No. 85.

Cast insitu culverts in which the piers, abutments and deck are made up of distinctly separate elements are classified as slab deck culverts, and should be covered in accordance with Figure C6 in Appendix C.

Condition State 1

The element shows little or no deterioration with a few minor fine superficial cracks and minor efflorescence.

Condition State 2

Minor cracking and spalling may be evident, along with a moderate amount of efflorescence in areas. Construction joints at the top of the walls may be opening up slightly or weathering at the joint.

Condition State 3

There may be moderate cracking caused by structural mechanisms. Moderate cracking and spalling may be evident due to non-structural mechanisms, such as corrosion of reinforcement or ASR. Excessive efflorescence may be noticed with areas of delamination of the concrete cover in the underside of roof or outer walls especially. Corroded steel may have up to 20% section loss in areas.

A cracked component shall be rated in Condition State 3 on the basis of the following criteria:

- a crack width exceeds 0.3 mm in concrete located in a non-aggressive environment (Exposure Rating 1 or 2) or
- a crack width exceeds 0.15 mm in concrete located in an aggressive environment (Exposure Rating 3 or 4).

Condition State 4

Severe cracking and spalling may be evident with large areas of delamination. There may be loss of section of reinforcement due to corrosion greater than 20% (and the resultant cracking and spalling this may cause). If cut-off walls are not constructed at each end of the base slab, then erosion of the sub-base material may have occurred with some flow beneath the base slab. In this case, the base slab may sound hollow when struck with a hammer or piece of timber.

Component 82P Modular culverts Precast concrete

Units of measurement: Lineal Metres (per cell)

This item covers precast modular culverts such as the 'Lincrete System'. These systems comprise precast concrete flat panels which are bolted together using proprietary mechanical jointing systems. Wingwalls, aprons and headwalls are generally classified under Component No. 84; however, inspectors may cover large wingwalls (greater than 2 metres in height) under Component No. 51. Base slabs are to be covered under Component No. 85.

Condition State 1

The culvert has been constructed within the manufacturer's tolerances and all joints are tight with no evidence of overstressing of the surrounding concrete. There is little or no deterioration with only minor efflorescence or minor fine superficial cracking.

Condition State 2

There is some lack of fit of units and there may be some cracking or spalling around joints as a result. Some moisture penetration and efflorescence powder may be evident at these locations. Minor cracking and spalling may be evident in the panels due to corrosion of the reinforcement. The serviceability of the structure is acceptable.

Condition State 3

There is a significant lack of fit between units and there is moderate cracking and spalling of the concrete surrounding the mechanical joints. Some bolts may have been omitted or only partly installed due to the lack of fit. Water and rust staining may be evident at these locations. Moderate cracking and spalling may have occurred in the panels with up to 20% loss of section of the exposed reinforcement. The serviceability is severely compromised but the strength/stability is adequate.

A cracked component shall be rated in Condition State 3 on the basis of the following criteria:

- a crack width exceeds 0.3 mm in concrete located in a non-aggressive environment (Exposure Rating 1 or 2) or
- a crack width exceeds 0.15 mm in concrete located in an aggressive environment (Exposure Rating 3 or 4).

Condition State 4

Construction tolerances may be unacceptable with many missing bolts in the mechanical joints, misaligned panels and the severe cracking and spalling of the concrete surrounding the joints. The joints may be heavily water or rust stained. Severe cracking and spalling may be evident with large delaminated areas. There may be loss of section of reinforcement due to corrosion greater than 20% (and the resultant cracking and spalling this may cause). Concrete sounds hollow when struck with a hammer or piece of timber. The stability of the structure is in question.

Component 83S Arch culverts Steel

Units of measurement: Lineal Metres (per cell)

This item includes all arches used for stream flow or cattle underpasses and constructed of galvanised steel or aluminium with concrete strip footings. If a cast insitu concrete floor has been constructed, it should be considered as part of this item. Wingwalls, aprons and headwalls are generally classified under Component No. 84; however, inspectors may cover large wingwalls (greater than 2 metres in height) under Component No. 51. Base slabs in large culverts may be covered under Component No. 85.

Where the culvert barrel is aluminium, the inspector shall confirm that the correct material type (aluminium) has been selected in the inventory data form and update as required.

Condition State 1

The element shows no sign of deterioration of the metal or galvanising. Bolts connecting the multi-plates are tight and in good condition. The concrete at the base of the arch is in good condition with no cracking or spalling. Shape, line and level of the arch are good.

Condition State 2

Spot rust may be occurring but all connecting bolts are tight and in good condition. Concrete footing may have minor cracking or spalling of no concern, though there should be no cracking due to differential settlement of the footing. Shape, line and level of the arch are good.

Condition State 3

Rusting and minor corrosion may be occurring in areas, having only a minor effect on the strength or serviceability of the member. The plate around some bolts may be damaged or torn, allowing some looseness in the bolts. The arch may have developed a small flat spot due to movement or differential settlement of the foundations. Foundations may have moderate cracking and spalling due to corroding reinforcement or have cracking due to movement or settlement of the footing.

Condition State 4

Heavy rusting and corrosion may be occurring to the extent they are having an effect on the strength or serviceability of the arch, especially at the joint to the foundations. Plates may have moved and bolts may have torn or pulled through the plates. Plates may have crinkled at the bolt line or badly bulged due to earth pressure, with the shape of the arch badly distorted. The concrete footings may have severe cracking and spalling due to corroding reinforcement or may have moderate cracking due to movement or differential settlement.

Component 83P Arch culverts Precast concrete

Units of measurement: Lineal Metres (per cell)

This item includes precast concrete arches such as Bebo arches, Techspan and other three-hinged arches. If cast insitu concrete floors have been constructed, they should be considered as part of this item. Wingwalls, aprons and headwalls are generally classified under Component No. 84; however, inspectors may cover large wingwalls (greater than 2 metres in height) under Component No. 51. Base slabs in large culverts may be covered under Component No. 85.

Condition State 1

The element shows little or no deterioration with only minor efflorescence or minor fine superficial cracking of no consequence. Shape, line and level of the arch units is good and straight. The concrete footing and base slab are in good condition with no cracking or spalling.

Condition State 2

Minor cracking and spalling may be evident due to corroding reinforcement in isolated areas. There may be minor cracking or moisture penetration around the hinge areas with moderate efflorescence powder visible. Shape, line and level of the arch units should be good and straight. The footing may have minor cracking and spalling due to corroding reinforcement, but no cracking due to movement or differential settlement.

Condition State 3

There may be moderate cracking caused by structural mechanisms. Moderate cracking and spalling due to non-structural mechanisms, such as corrosion of reinforcement or ASR, may be evident with up to 20% loss of section of exposed reinforcement. The shape and line of the arch may show some deviation due to movement or differential settlement, with minor spalling at the hinge points. The footing may show fine cracking due to movement pressures or differential settlement.

A cracked component shall be rated in Condition State 3 on the basis of the following criteria:

- a crack width exceeds 0.3 mm in concrete located in a non-aggressive environment (Exposure Rating 1 or 2) or
- a crack width exceeds 0.15 mm in concrete located in an aggressive environment (Exposure Rating 3 or 4).

Condition State 4

Severe cracking and spalling may be evident with large delaminated areas. There may be loss of section of reinforcement due to corrosion greater than 20% (and the resultant cracking and spalling this may cause). The shape and line of the arch may show a dip due to movements and differential settlements with medium to heavy spalling around the hinge points. The footing may have moderate cracking due to movement pressures or differential settlement.

Component 83C Arch culverts Cast insitu concrete

Units of measurement: Lineal Metres (per cell)

This item includes all cast insitu concrete arches and includes the footings and any concrete floor in the culvert. Wingwalls, aprons and headwalls are generally classified under Component No. 84; however, inspectors may cover large wingwalls (greater than 2 metres in height) under Component No. 51. Base slabs in large culverts may be covered under Component No. 85.

Condition State 1

The element shows little or no deterioration with only minor fine superficial cracks and minor areas of efflorescence. Shape, line and level of the arch units are good and straight. The concrete footing and base slab have no cracking or spalling.

Condition State 2

Minor cracking and spalling may be evident due to corroding reinforcement, along with moderate efflorescence due to moisture penetration of the concrete. Shape, line and level of the arch should be good and straight. The footing should have no cracking due to movement or differential settlement.

Condition State 3

There may be moderate cracking caused by structural mechanisms. Moderate cracking and spalling may be evident due to corroding reinforcement or ASR with up to 20% loss of steel section in isolated areas. Efflorescence and scaling of the concrete surface may be prevalent, along with small delaminated areas. The shape and line of the arch may show some deviation due to movement of differential settlement. The footing may have minor cracking due to movement or differential settlement.

A cracked component shall be rated in Condition State 3 on the basis of the following criteria:

- a crack width exceeds 0.3 mm in concrete located in a non-aggressive environment (Exposure Rating 1 or 2) or
- a crack width exceeds 0.15 mm in concrete located in an aggressive environment (Exposure Rating 3 or 4).

Condition State 4

Severe cracking and spalling is evident with large delaminated areas. There may be loss of section of reinforcement due to corrosion greater than 20% (and the resultant cracking and spalling this may cause). Heavy scaling of the concrete surface and efflorescence may be noticed. The shape and line of the arch may show a dip and the footing may have moderate cracking due to movement pressures or differential settlement.

Component 83O Arch culverts Other

Units of measurement: Lineal Metres (per cell)

This item includes those arch culverts constructed using brick or masonry, with or without a base slab which should be considered as part of the item. Wingwalls, aprons and headwalls are generally classified under Component No. 84; however, inspectors may cover large wingwalls (greater than 2 metres in height) under Component No. 51. Base slabs in large culverts may be covered under Component No. 85.

Condition State 1

The element show little or no deterioration with no cracking or loss of mortar. There may be small areas of dampness or efflorescence. The shape, line and invert of the arch are good and straight.

Condition State 2

There may be minor loss of mortar or cracking of the mortar between the blocks. Minor cracking or spalling of the brickwork/blocks may be evident. The shape, line and invert of the arch should be in good condition. Large areas of dampness and efflorescence may be present. There should be no differential settlement of the arch footings.

Condition State 3

There may be moderate loss of mortar or cracking of the mortar between the blocks. There may also be cracking due to minor differential settlement of the foundations and some blocks may have slipped slightly due to the movement and loss of mortar. Moderate cracking or spalling of the brickwork/blocks may be evident, but not of a sufficient magnitude to affect the strength of the arch. There may be some minor loss of arch shape, line or level, but not of sufficient magnitude to cause concern for the strength or serviceability of the culvert.

Condition State 4

There may be heavy loss of mortar and/or cracking between and through the blocks, with some blocks having slipped significantly. Severe cracking or spalling of the brickwork/blocks may have occurred, having a pronounced effect on the strength of the pipe. There may be moderate cracking due to differential settlement of the foundations, with significant loss of shape, line and level of the arch, causing some concern as to the strength or serviceability of the culvert.

Component 84P Headwalls/Wingwalls Precast concrete

Units of measurement: Each

This item includes all culvert headwalls and wingwalls (of less than or equal to 2 metres in height) associated with culverts and constructed using precast reinforced concrete.

Condition State 1

The elements are in good condition with no cracking or spalling noticed. There should be no movement or movement cracking in the headwalls or wingwalls.

Condition State 2

There may be minor cracking and spalling due to corroding reinforcement or due to earth pressures. The headwalls or wingwalls may show minor movements of up to 10 mm which are of no consequence.

Condition State 3

There may be moderate cracking and spalling due to corroding reinforcement, ASR or due to earth pressures. Thre may be loss of section of reinforcement due to corrosion of up to 20%. The headwalls or wingwalls may show moderate movements of up to 40 mm but having little effect on serviceability.

A cracked component shall be rated in Condition State 3 on the basis of the following criteria:

- a crack width exceeds 0.3 mm in concrete located in a non-aggressive environment (Exposure Rating 1 or 2) or
- a crack width exceeds 0.15 mm in concrete located in an aggressive environment (Exposure Rating 3 or 4).

Condition State 4

There may be severe cracking or spalling due to corroding reinforcement, ASR or due to earth pressures. There may be loss of section of reinforcement due to corrosion greater than 20% (and the resultant cracking and spalling this may cause). The headwalls or wingwalls may show large movements or the wingwalls may be leaning due to earth pressure on them, with possible loss of embankment fill behind.

Component 84C Headwalls/Wingwalls Cast insitu concrete

Units of measurement: Each

This item includes all culvert wingwalls (of less than or equal to 2 metres in height) and headwalls associated with the culverts and constructed using cast insitu reinforced or mass concrete.

Condition State 1

The elements are in good condition with no cracking, spalling, movement or movement cracking in the headwalls or wingwalls.

Condition State 2

There may be minor cracking and spalling due to corroding reinforcement or due to earth pressures. The headwalls or wingwalls may show cracking or movements up to 10 mm which are of no consequence.

Condition State 3

There may be moderate cracking and spalling due to corroding reinforcement, ASR or due to earth pressures. There may be loss of section of reinforcement due to corrosion of up to 20%. The headwalls or wingwalls may show moderate movements of up to 40 mm but having little effect on serviceability.

A cracked component shall be rated in Condition State 3 on the basis of the following criteria:

- a crack width exceeds 0.3 mm in concrete located in a non-aggressive environment (Exposure Rating 1 or 2) or
- a crack width exceeds 0.15 mm in concrete located in an aggressive environment (Exposure Rating 3 or 4).

Condition State 4

There may be severe cracking and spalling due to corroding reinforcement, ASR or due to earth pressures. There may be loss of section of reinforcement due to corrosion greater than 20% (and the resultant cracking and spalling this may cause). The headwalls or wingwall may show large movements or may be leaning over due to earth pressure on them, resulting in loss of embankment fill from behind.

Component 84O Headwalls/Wingwalls Other

Units of measurement: Each

This item includes all culvert wingwalls (of less than or equal to 2 metres in height) and headwalls associated with the culverts and constructed using masonry, rubble, brick, or rock filled cages.

Condition State 1

The elements are in good condition with little or no deterioration. There is no movement of the headwall or wingwalls.

Condition State 2

There may be minor cracking of the mortar between blocks due to slight movements of up to 10 mm, or earth pressure. Ungrouted masonry or rubble should be well stacked and quite stable with only minor movements of the stones. Rock filled cages may have minor settlement or loss of stone or a few broken wires.

Condition State 3

There may be moderate cracking of the mortar due to movement of up to 40 mm or due to earth pressure. Ungrouted masonry or rubble may have moved with loss of some stones and minor loss of embankment fill. Rock filled cages may have distorted with moderate loss of stone and broken or corroded wires.

Condition State 4

There may be severe cracking of the mortar due to excessive movements or earth pressure, with loss of embankment fill. Ungrouted masonry or rubble walls may have moved appreciably, lost numerous rocks or generally be in a very poor condition. Rock filled cages may be badly corroded, lost substantial filling or have numerous broken wires.

Component 85C	Culvert base slab/Steel pipe invert	Cast insitu concrete
Units of measurement:	**Square Metres**	

This item includes the following components:

- all reinforced concrete culvert base slabs
- all reinforced concrete inverts for steel pipe culverts (both structural and non-structural inverts – it is crucial that the inspector knows which type of invert is present prior to undertaking the inspection).

Please note that this does not include the protection of waterway beds and banks with a reinforced concrete lining or concrete aprons – such elements should be rated under Component No. 71C.

Condition State 1

The slab/invert shows little or no deterioration with only a few fine superficial cracks of no importance. Minor cracking due to corroding reinforcement may be present. The seal between the invert and the pipe is intact, with no visible gaps.

Condition State 2

Minor cracking and spalling may be present with small areas of corroding reinforcement visible. Dampness patches and efflorescence powder may be more prominent. Shrinkage cracking is fine and dry. Non-structural inverts may have separated/lifted from the steel pipe in a few locations but the pipe material beneath the invert shows no evidence of corrosion.

Condition State 3

There may be moderate cracking due to structural mechanisms, or moderate to severe cracking and spalling due to non-structural actions such as reinforcement corrosion, with loss of section up to 20% in areas. The slab/invert has extensive crazed cracking but no differential movement between sections. Non-structural inverts may have separated/lifted up from the steel pipe in several places, providing access for moisture, and minor surface corrosion of the pipe material has commenced. Structural inverts display moderate cracking/spalling or minor corrosion of exposed reinforcement at the invert/pipe interface with little or no separation from the pipe.

Condition State 4

There may be severe cracking due to structural mechanisms or advanced corrosion of reinforcement over large areas with loss of section of reinforcement greater than 20% (along with associated cracking/spalling). Differential movement between sections is evident. Non-structural inverts may be cracked/broken in numerous locations and may have separated/lifted from the pipe invert in several places, providing access for moisture and significant corrosion of the pipe material is evident. Structural inverts display severe cracking/spalling or corrosion of exposed reinforcement at the invert/pipe interface.

Component 85O	Culvert base slab/Steel pipe invert	Other
Units of measurement:	**Square Metres**	

This item includes the following components:

- all grouted stone pitched floors in RCCs
- all plum concrete floors in RCCs.

Please note that this does not include the protection of waterway beds with masonry or rocks – such elements should be rated under Component No. 71O.

Condition State 1

The floor shows little or no deterioration, with a very few minor fine cracks in the mortar between the stones or in the unreinforced concrete. There should be no loss of mortar between the stones and the seal between the floor and the abutments/pier walls is intact with no visible gaps.

Condition State 2

There may be minor cracking in the mortar between the stones or in the unreinforced concrete due to minor settlement. There may be minor loss of mortar of no concern. The floor may have separated from concrete abutments/pier walls in a few locations but there is no settlement or movement occurring.

Condition State 3

Moderate cracking has occurred in the mortar between the stones or in the unreinforced concrete and stones may be missing. The floor may have separated from the abutments/pier walls in several places, providing access for moisture and there may be minor settlement or movement occurring.

Condition State 4

Severe cracking has occurred in the mortar between the stones and large areas of stones may be missing. The unreinforced concrete may be severely cracked and broken in numerous areas. The floor may have separated from the abutments/pier walls in many places, providing access for moisture and significant settlement or movement is occurring.

Component 91C Footings Cast insitu concrete

Units of measurement: Each

This item covers the foundations (constructed in cast insitu concrete such as pile caps and spread footings) for all structures that support signs over traffic lanes such as gantries, cantilevers and butterflies (cruciform) along with tall light masts and large signs with truss supports in close proximity to the traffic lanes. This item defines the condition of the footings and should be included based on the compilation of the inspection inventory from the drawings.

Condition State 1

The footing is in good condition with only minor cracking due to shrinkage or corroding reinforcement. There is no cracking due to differential settlement of footings or any cracking around the hold-down bolts. There is no evidence of scouring adjacent to or under the spread footings.

Condition State 2

There is minor cracking or spalling due to corroding reinforcement or differential settlement of footings. There is no scour beneath the spread footing base. There may be some fine cracking around the hold-down bolts due to forces transferred through the bolts.

Condition State 3

Moderate cracking or spalling due to differential settlement or impact may have occurred. Moderate to severe cracking or spalling due to corroding reinforcement may be evident. There is up to 20% loss of reinforcement section. Structural cracking around the hold-down bolts is fine but there may also be some minor spalling associated with the bolt forces. There may be some minor loss of bearing support. There is no scour beneath the spread footing base.

Condition State 4

Footings are severely cracked and spalled due to differential settlement of foundations or impact. There may be advanced reinforcement corrosion, with loss of section in excess of 20% and associated cracking and spalling. Structural cracking and spalling around the hold-down bolts, associated with the transferred bolt forces, is medium. There may be substantial loss of bearing.

Spread footings may have been undercut by scour action.

Component 92S	Base plates, fittings and hold-down bolts	Steel
Units of measurement:	**Each**	

This item describes the connections of the columns to the reinforced concrete footings for all structures that support signs over traffic lanes such as gantries, cantilevers and butterflies (cruciform) along with tall light masts and large signs with truss supports in close proximity to the traffic lanes. It includes all hold-down bolts and arrangements, including the base and connecting plates. This also covers the attachments of '97S-Sign Face Support Structures' to bridge structures. Steelwork may be painted or galvanised for protection.

Condition State 1

The grout pad, if specified, is contiguous and supports the entire base plate. There is no evidence of cracks or voids. The grout pad is finished off flush with the underside of the base plate, and the structure is completely supported on the grout pad under the base plate

Base plate protective coating is generally in good condition with only minor chalking, curling or peeling, but no metal exposure. There are no plate or weld cracks and no visible warping. Bolt holes in plate are the nominal size and unmodified.

Hold-down bolts, washers and nuts are all present and bolts are fully engaged with the nuts with 3 mm protruding. All bolts are plumb and connections are tight and in good condition.

Condition State 2

The grout pad may exhibit some minor cracks away from the hold-down bolts but is substantially intact under the entire base plate with no visible voids.

The base plate protective coating is no longer fully effective and there may be rust spotting to 5% of the surface area but no loss of section. There may be minor deformation of the plate that does not affect structural performance but no cracks in the plate or welds. Bolt holes in the plate are the nominal size and unmodified

Hold-down bolts, washers and nuts are all present and bolts are fully engaged with the nuts and at least flush with the nut head. All bolts are plumb and connections are tight and in good condition. The protective coating may no longer be effective with some rust spotting but no section loss.

Condition State 3

Steelwork has medium corrosion and the paint system has failed, with up to 10% of the surface area rusted. Surface pitting may be evident but section loss is less than 10%. The connections may be moderately corroded, loose or only half-threaded.

The grout pad may exhibit some moderate cracks and voiding but at least 80% of the bearing area is contiguous and intact. The grout pad has been finished off flush with the top surface of the base plate, with the sides of the base plate covered by the grout.

The base plate protective coating has failed and there may be pitting to 10% of the surface area with up to 10% loss of section. There may be minor deformation of the plate that does not affect structural performance but no cracks in the plate or welds. Bolt holes in the plate may be up to 10% oversized but they have been evenly drilled.

Hold-down bolts, washers and nuts and bolts are all present and at least 90% engaged with the nuts. Some bolts may be out of plumb and up to 20% of the nuts are slipping. The protective coating is no longer effective with heavy pitting and up to 10% section loss.

Condition State 4

Steelwork is heavily corroded with up to 20% loss of section. The paint system has completely failed, requiring cleaning back to bright metal and repainting. Connections may be very loose, missing or heavily corroded.

The grout pad is heavily cracked and voided and less than 80% of the bearing area is contiguous and intact. The structure may be supported on the levelling nuts or packers instead of the grout pad.

The base plate protective coating has failed and the plate is heavily corroded with greater than 10% loss of section. The plate may be deformed and there are tears or cracks between bolt holes or edge of plate. Cracks may be evident in the welds. Bolt holes in the plate may be greater than 10% oversized and/or have been unevenly drilled or oxy cut.

Hold-down bolts, washers and nuts and bolts may be missing or less than 80% of the nut is engaged. Some bolts may be out of plumb more than 20% of the nuts are slipping. The protective coating is no longer effective with heavy pitting and more than10% section loss.

Component 93S Columns Steel

Units of measurement: Each

This item includes all columns (manufactured from steel plates, tubes or sections) of structures that support signs over traffic lanes such as gantries, cantilevers and butterflies (cruciform) along with tall light masts and large signs with truss supports in close proximity to the traffic lanes. The steel may be painted or galvanised and should encompass ties and braces which may be used to stiffen the columns and to distribute loads

Condition State 1

The protective coating is generally in good condition with only minor chalking, curling or peeling, but no metal exposure. The piles are adequately braced and all connections are in good condition. All welds or bolts are in good condition with no corrosion, cracking or loose bolts.

Bolted splices have no gaps between the splice plate and contact surface is in full contact.

Condition State 2

The protective coating has failed and the steelwork has spot rusting to 5% of the surface but no loss of section. The columns may not be effectively braced or the connections may be slightly loose or corroded. All welds or bolts are in good condition with no corrosion, cracking or loose bolts.

Bolted splices may have a gap between the splice plate and the contact surface of up to 0.5 mm, and the portion of the splice plate in full contact with the member is greater than 70% of the design area.

Condition State 3

Steelwork has medium corrosion and the protective coating system has completely failed. Surface pitting may be evident but section loss is less than 10%. Active corrosion is occurring in isolated areas, but no loss of section is occurring that will affect the strength of the member as a whole. Nuts and bolts may be corroding but are still tight and no cracking of welds has occurred. Bracing may be ineffective or non-existent and connections may be heavily corroded or loose. Surface damage due to collision impact may be evident but there is no deformation of the section.

Bolted splices may have a gap between the splice plate and contact surface of up to 0.5 mm, and the portion of the splice plate in full contact with the member is 65% to 70% of the design area.

Condition State 4

Steelwork is heavily corroded with up to 20% loss of section. Corrosion is well-advanced and some loss of section has definitely occurred which may have a detrimental effect on the strength of the member; that is, a flange badly corroded over much of its length. Welds may be cracked. Nuts or bolts are severely corroded and possibly no longer functioning to full capacity. Connections may be very loose or bracing may be missing or totally ineffective. Deformation of section due to collision impact damage is evident.

Bolted splices may have a gap between the splice plate and contact surface of more than 0.5 mm, and the portion of the splice plate in full contact with the member is less than 65% of the design area.

Component 94S Truss columns Steel

Units of measurement: Each

This item includes all truss columns (manufactured from steel plates, tubes or sections) of structures that support signs over traffic lanes such as gantries, cantilevers and butterflies (cruciform) along with tall light masts and large signs with truss supports in close proximity to the traffic lanes. The steel may be painted or galvanised and should encompass ties and braces which may be used to stiffen the columns and to distribute loads.

Condition State 1

The protective coating is generally in good condition with only minor chalking, curling or peeling, but no metal exposure. The piles are adequately braced and all connections are in good condition. All welds or bolts are in good condition with no corrosion, cracking or loose bolts.

Bolted splices have no gaps between the splice plate and contact surface is in full contact.

Condition State 2

The protective coating has failed and the steelwork has spot rusting to 5% of the surface but no loss of section. The columns may not be effectively braced or the connections may be slightly loose or corroded. All welds or bolts are in good condition with no corrosion, cracking or loose bolts.

Bolted splices may have a gap between the splice plate and the contact surface of up to 0.5 mm, and the portion of the splice plate in full contact with the member is greater than 70% of the design area.

Condition State 3

Steelwork has medium corrosion and the protective coating system has completely failed. Surface pitting may be evident but section loss is less than 10%. Active corrosion is occurring in isolated areas, but no loss of section is occurring that will affect the strength of the member as a whole. Nuts and bolts may be corroding but are still tight and no cracking of welds has occurred. Bracing may be ineffective and connections may be heavily corroded or loose. Surface damage due to collision impact may be evident but there is no deformation of the section.

Bolted splices may have a gap between the splice plate and contact surface of up to 0.5 mm, and the portion of the splice plate in full contact with the member is 65% to 70% of the design area.

Condition State 4

Steelwork is heavily corroded with up to 20% loss of section. Corrosion is well advanced and some loss of section has definitely occurred which may have a detrimental effect on the strength of the member; that is, a flange badly corroded over much of its length. Welds may be cracked. Nuts or bolts are severely corroded and possibly no longer functioning to full capacity. Connections may be very loose or bracing may be missing or totally ineffective. Deformation of section due to collision impact damage is evident.

Bolted splices may have a gap between the splice plate and contact surface greater than 0.5 mm, and the portion of the splice plate in full contact with the member is less than 65% of the design area.

Component 95S	Cantilever arms or gantry beams	Steel
Units of measurement:	**Each**	

This item includes all the structural steelwork to support structures that support signs over traffic lanes such as gantries, cantilevers and butterflies (cruciform) along with large signs with truss supports in close proximity to the traffic lanes. The members could be constructed using plates, tubes or sections and include all bracing and stiffeners. The connections to the columns should also be considered as part of this item. The steelwork may be painted or galvanised for protection.

Condition State 1

The paint or galvanising system is generally sound with only minor chalking, peeling or curling, but with no exposure of metal. All welds, bolts or rivets are in good condition with no movement of plates or sections in the element. If the sign has dual arms, they are adequately braced or stiffened and all connections are in good condition. There is adequate clearance to highway.

Bolted splices have no gaps between the splice plate and contact surface is in full contact.

Condition State 2

Spot rusting of the paint or galvanising system is occurring and the protective coating system is no longer effective. Rust spotting may have occurred over 5% of the section but no loss of the section has occurred. All member lines are true. All welds, bolts or rivets are in good condition with no movement of plates or sections in the element. The arms may not be effectively braced or the connections may be slightly loose or corroded. Connection bolts may be tight but too short and not fully threaded. There is adequate clearance to the highway.

Bolted splices may have a gap between the splice plate and the contact surface of up to 0.5 mm, and the portion of the splice plate in full contact with the member is greater than 70% of the design area.

Condition State 3

Steelwork has moderate corrosion and the protective coating system has completely failed. Surface pitting may be evident but section loss is less than 10%. Active corrosion is occurring in isolated areas, but no loss of section is occurring that will affect the strength of the member as a whole. Nuts and bolts may be corroding but more than 90% are still tight and no cracking of welds has occurred. Bracing may not be fully effective and connections may be heavily corroded with isolated loose bolts. There may be minor deviations in the member line and evidence of excessive deflection or movement under dead load or uncomfortable deflections when walking on the walkway. Surface damage due to collision impact may be evident but there is no deformation of the section. There may be inadequate clearance to the highway and/or the clearance sign may be missing. Minor surface corrosion is evident around the vent holes.

Bolted splices may have a gap between the splice plate and contact surface of up to 0.5 mm, and the portion of the splice plate in full contact with the member is 65% to 70% of the design area.

Condition State 4

Corrosion is well advanced and more than 10% loss of section has occurred, having a detrimental effect on the strength of the member – that is, severe corrosion of webs or top flange over supports or bottom flange at midspan. Bracing may be ineffective or missing, forcing the girder to visibly bow

under dead loading or deflect noticeably when walking on the walkway. Permanent bowing of girders or buckling or distortion of webs, flanges or stiffeners may be evident. Gross deformation of members as a result of impact damage may have occurred.

There may be some cracking of the welds between the plates or tearing of bolt holes. Cracking is present on the fillet weld connecting the vertical member to the main horizontal member of VMS cantilever gantry structures. Bolts may be severely corroded and no longer carrying full load or functioning as intended. Splice bolts may be only finger tight or missing. Moderate to heavy surface corrosion is evident around the vent holes.

Bolted splices may have a gap between the splice plate and contact surface of more than 0.5 mm, and the portion of the splice plate in full contact with the member is less than 65% of the design area.

There may be inadequate clearance to the highway and/or the clearance sign may be missing.

Component 96S Gantry truss Steel

Units of measurement: Each

This item describes all steel trusses and includes all truss chords, verticals, diagonals, cross-braces and wind-bracing of structures that support signs over traffic lanes such as gantries, cantilevers and butterflies (cruciform) along with tall light masts and large signs with truss supports in close proximity to the traffic lanes. The item will also include the metal floor grillage for personnel to access the signs and the connections to the columns. The steelwork may be painted or galvanised for protection.

Condition State 1

The paint or galvanising system is generally sound with only minor chalking, peeling or curling, but with no exposure of metal. All welds, bolts or rivets are in good condition with no movement of plates or sections in the element. If the sign has dual arms, they are adequately braced or stiffened and all connections are in good condition. There is adequate clearance to the highway.

Bolted splices have no gaps between the splice plate and contact surface is in full contact.

Condition State 2

Spot rusting of the paint or galvanising system is occurring and the protective coating system is no longer effective. Rust spotting may have occurred over 5% of the section but no loss of the section has occurred. All member lines are true. All welds, bolts or rivets are in good condition with no movement of plates or sections in the element. The arms may not be effectively braced or the connections may be slightly loose or corroded. Connection bolts may be tight but too short and not fully threaded. There is adequate clearance to the highway.

Bolted splices may have a gap between the splice plate and the contact surface of up to 0.5 mm, and the portion of the splice plate in full contact with the member is greater than 70% of the design area.

Condition State 3

Steelwork has moderate corrosion and the protective coating system has completely failed. Surface pitting may be evident but section loss is less than 10%. Active corrosion is occurring in isolated areas, but no loss of section is occurring that will affect the strength of the member as a whole. Nuts and bolts may be corroding but more than 90% are still tight and no cracking of welds has occurred. Bracing may not be fully effective and connections may be heavily corroded with isolated loose bolts. There may be minor deviations in the member line and evidence of excessive deflection or movement under dead load or uncomfortable deflections when walking on the walkway. Surface damage due to collision impact may be evident but there is no deformation of the section. There may be inadequate clearance to the highway and/or the clearance sign may be missing. Minor surface corrosion is evident around the vent holes.

Bolted splices may have a gap between the splice plate and contact surface of up to 0.5 mm, and the portion of the splice plate in full contact with the member is 65% to 70% of the design area.

Condition State 4

Corrosion is well advanced and more than 10% loss of section has occurred, having a detrimental effect on the strength of the member – that is, severe corrosion of webs or top flange over supports or bottom flange at midspan. Bracing may be ineffective or missing, forcing the girder to visibly bow under dead loading or deflect noticeably when walking on the walkway. Permanent bowing of girders

or buckling or distortion of webs, flanges or stiffeners may be evident. Gross deformation of members as a result of impact damage may have occurred.

There may be some cracking of the welds between the plates or tearing of bolt holes. Bolts may be severely corroded and no longer carrying full load or functioning as intended. Splice bolts may be missing. Moderate to heavy surface corrosion is evident around the vent holes.

Bolted splices may have a gap between the splice plate and contact surface of more than 0.5 mm, and the portion of the splice plate in full contact with the member is less than 65% of the design area.

There may be inadequate clearance to the highway and/or the clearance sign may be missing.

Component 97S	Sign face support structure	Steel
Units of measurement:	**Each**	

This item describes the connections of the sign face to the primary structural members and includes all hangers, framing and bracing. Steelwork may be painted or galvanised for protection.

Note:

Component No. 92S *Base plates, fittings and hold-down bolts* should be used for the connection of a sign face support structure to a bridge structure.

Condition State 1

The paint or galvanising system is generally sound with only minor chalking, peeling or curling, but with no exposure of metal. All welds, bolts or rivets are in good condition with no movement of plates or sections in the element. There is adequate clearance to the highway.

Bolted splices have no gaps between the splice plate and contact surface is in full contact.

Condition State 2

Spot rusting of the paint or galvanising system is occurring and the protective coating system is no longer effective. Rust spotting may have occurred over 5% of the section but no loss of the section has occurred. All member lines are true. All welds, bolts or rivets are in good condition with no movement of plates or sections in the element. Connection bolts may be tight but too short and not fully threaded. There is adequate clearance to the highway.

Bolted splices may have a gap between the splice plate and the contact surface of up to 0.5 mm, and the portion of the splice plate in full contact with the member is greater than 70% of the design area.

Condition State 3

Steelwork has moderate corrosion and the protective coating system has completely failed. Surface pitting may be evident but section loss is less than 10%. Active corrosion is occurring in isolated areas, but no loss of section is occurring that will affect the strength of the member as a whole. Nuts and bolts may be corroding but more than 90% are still tight and no cracking of welds has occurred. Bracing may not be fully effective and connections may be heavily corroded with isolated loose bolts. There may be minor deviations in the member line and evidence of excessive deflection or movement under dead load or wind loading. Surface damage due to collision impact may be evident but there is no deformation of the section. There may be inadequate clearance to the highway and/or the clearance sign may be missing. Minor surface corrosion is evident around the vent holes.

Bolted splices may have a gap between the splice plate and contact surface of up to 0.5 mm, and the portion of the splice plate in full contact with the member is 65% to 70% of the design area.

Condition State 4

Corrosion is well advanced and more than 10% loss of section has occurred, having a detrimental effect on the strength of the member. Bracing may be ineffective or missing, allowing the support structure or sections thereof to visibly bow under dead loading or deflect noticeably under wind loads. Permanent deflection of members or buckling or distortion of webs, flanges or stiffeners may be

evident. Gross deformation of members as a result of impact damage may have occurred. Moderate to heavy surface corrosion is evident around the vent holes.

Bolted splices may have a gap between the splice plate and contact surface of more than 0.5 mm, and the portion of the splice plate in full contact with the member is less than 65% of the design area.

Component 98S	Ancillaries (walkways, cable trays, ladders)	Steel

Units of measurement: **Each**

This item describes the ancillaries provided on the structure for access and security. Steelwork may be painted or galvanized for protection.

Note:

Inspectors shall not use access equipment to conduct an inspection unless it has been certified and labelled.

Condition State 1

The paintwork is generally in good condition with only minor chalking, curling or peeling, but no metal exposure. All connections are tight and in good condition. Access equipment has been certified and is clearly labelled. There are no tripping hazards, components are fully operational and all locking pins are in place and functional. The equipment is secure and there is no evidence of unauthorised access such as graffiti or other vandalism.

Condition State 2

Painted steelwork may have rust spotting to 5% of the surface area and the protective coating is no longer effective. The connections may be slightly loose or beginning to corrode. Connection bolts may be tight but too short and not fully threaded. Access equipment has been certified and is clearly labelled. There are no tripping hazards, components are fully operational and all locking pins are in place and functional. The equipment is secure and there is no evidence of unauthorised access such as graffiti or other vandalism.

Condition State 3

Steelwork has medium corrosion and the paint system has failed with up to 10% surface area rusted. Surface pitting may be evident but section loss is less than 10%. The connections may be moderately corroded, loose or only half threaded. There are no tripping hazards, components are fully operational and all locking pins are in place and functional. The equipment is secure and there is no evidence of unauthorised access such as graffiti or other vandalism.

Condition State 4

Steelwork is heavily corroded with more than 10% loss of section. The paint system has completely failed, requiring cleaning back to bright metal and repainting. Connections may be very loose, missing or heavily corroded. Equipment is unsafe, uncertified, insecure or damaged by vandalism or impact.

Component 99O	Large Traffic Mounted Signs (LTMS)	Other
Units of measurement:	**Each**	

This item describes the devices that are mounted on the structure of Large Traffic Management Signs (LTMS). The inspector is required to record details of any operational faults, environmental damage, impact damage or vandalism. It is essential that the regional Network Operations Manager (NOM) be advised of any recorded defects at the earliest opportunity and that a hard copy of the inspection report is provided to the regional NOM on return to base (NOM to advise if reflectivity testing is required).

Condition State 1

All devices appear to be fully functional and the sign legends are legible. All connections to structure are tight and in good condition. There is no evidence of impact damage, environmental damage or vandalism.

Condition State 2

All devices appear to be fully functional and the sign legends are legible. The connections may be slightly loose or beginning to corrode. Connection bolts may be tight but too short and not fully threaded. Up to 5% of the device surface area may be compromised by environmental damage, impact damage or vandalism; however, these damaged areas must not compromise the legibility of the sign.

Condition State 3

All devices appear to be fully functional and the sign legends are legible. The connections may be moderately corroded, loose or only half threaded. Up to 10% of the device surface area may be compromised by environmental damage, impact damage or vandalism; however, these damaged areas must not compromise the legibility of the sign.

Condition State 4

Devices appear to be malfunctioning and all or part of the sign legend is no longer legible and thus compromising the delivery of the correct information or instruction to the road user. Connections may be very loose, missing or heavily corroded. Up to 20% of the device surface area may be compromised by environmental damage, impact damage or vandalism.

There may be sub-standard stiffener connection straps such as Signfix stainless steel channel clip (conforming strap is typically 50 mm wide while the Signfix clips are normally 20 mm wide).

Component 100S Wall facing panels Steel

Units of measurement: Each

This item includes all facing and bracing systems of retaining walls manufactured from steel sections including rolled sections, rail lines, plates and similar. The steel may be painted, galvanised or uncoated and include any stiffeners between the columns.

Condition State 1

The paint system is generally sound with only minor chalking, peeling or curling, but with no exposure of metal.

Any connections are in good condition with no displacement of the facing components relative to the supporting columns.

Condition State 2

Spot rusting of the paint system to 5% surface area is occurring and the paint system is no longer effective. No corrosion of the facing components has occurred.

Any connections are in good condition with no displacement of the facing components relative to the supporting columns.

Condition State 3

Some surface pitting may be present with active corrosion occurring in isolated areas but no loss of section area has occurred which would affect the strength of the members.

The paint system has broken down with rust spotting to 10%, or there is no painting system, and there is surface pitting of the members

Any connections may be corroded but are still tight and effective.

There may be minor rotation or settlement of the members relative to the supporting columns.

Condition State 4

Corrosion is well advanced and loss of section has occurred, having a detrimental effect on the strength of the members; that is, a flange may be badly corroded over a sizeable length.

Any connections may be severely corroded, no longer carrying full load or functioning as intended.

There may be excessive settlement or rotation of the members relative to the supporting columns

The paint system has completely broken down or there is no painting system.

Component 100P Wall facing/Panels Precast concrete

Units of measurement: Square Metres

This item includes all precast concrete wall units used to retain earth fill, walls on ramps to bridges and similar. The precast panels may be for aesthetic purposes only with the true retaining structure hidden behind in the form of soil anchors.

Condition State 1

The elements are in good condition with no damage visible. There may be minor dampness or efflorescence powder visible in a few locations. No separation or relative movement between units is apparent.

Condition State 2

There may be a few minor cracks or spalls due to corroding reinforcement. Dampness or efflorescence may be a little more prevalent. There is no separation or relative movement between units.

Condition State 3

Medium cracking or spalling may be present due to corroding reinforcement or pressure on the units at the support corners. Exposed reinforcement may have section loss up to 20% in isolated areas. Dampness or efflorescence may be quite prevalent. There is only minor separation or relative movement between units up to 20 mm. Connections may be slightly loose or there may be partial separation from the supporting column.

A cracked component shall be rated in Condition State 3 on the basis of the following criteria:

- a crack width exceeds 0.3 mm in concrete located in a non-aggressive environment (Exposure Rating 1 or 2) or
- a crack width exceeds 0.15 mm in concrete located in an aggressive environment (Exposure Rating 3 or 4).

Condition State 4

Heavy cracking or spalling may be present due to corroding reinforcement or pressure on the units at the support corners. Exposed reinforcement may have section loss greater than 20% in isolated areas. Dampness or efflorescence may be quite prevalent. There is moderate separation or relative movement between units of greater than 20 mm. Connections may be completely loose with separation from the supporting column.

Component 100C Wall facing/Panels Cast insitu concrete

Units of measurement: Square Metres

This item includes all cast insitu concrete walls used to retain earth fill, walls on ramps to bridges and similar. The walls may consist of soil anchors with sprayed concrete.

Condition State 1

The elements are in good condition with no damage visible. There may be minor dampness or efflorescence powder visible in a few locations. Wall slopes are true to line with no separation of the cast sections.

Condition State 2

There may be a few minor cracks or spalls due to corroding reinforcement. Dampness or efflorescence may be a little more prevalent. There is no separation or relative movement between cast sections.

Condition State 3

Medium cracking or spalling may be present due to corroding reinforcement. Exposed reinforcement may have section loss up to 20% in isolated areas. Dampness or efflorescence may be quite prevalent. There is only minor separation or relative movement between cast sections up to 20 mm.

A cracked component shall be rated in Condition State 3 on the basis of the following criteria:

- a crack width exceeds 0.3 mm in concrete located in a non-aggressive environment (Exposure Rating 1 or 2) or
- a crack width exceeds 0.15 mm in concrete located in an aggressive environment (Exposure Rating 3 or 4).

Condition State 4

Heavy cracking or spalling may be present due to corroding reinforcement. Exposed reinforcement may have section loss greater than 20% in isolated areas. Dampness or efflorescence may be quite prevalent. There is moderate separation or relative movement between cast sections of greater than 20 mm.

Component 100T Wall facing/Panels Timber

Units of measurement: Square Metres

This item includes all timber sleeper walls and timber log walls used to retain earth fill, walls on ramps to bridges and similar.

Condition State 1

The timber sleepers or logs are in good condition with no or only minor weathering at the edges or minor damage elsewhere. Connections to the columns are tight and adequate to transfer all loads due to wind or soil pressure.

Condition State 2

The walls are in good condition with only minor weathering at the edges but away from the connections, or minor damage elsewhere. Minor settlement or slope changes may be present. Connections may be slightly loose but having little or no effect on the panel support.

Condition State 3

The walls are in fair condition with medium settlement or slope changes present. The timber components may have moderate weathering beginning to affect the connections, or have moderate damage elsewhere. Connections may be loose, allowing movement of the components away from the supports.

Condition State 4

The walls are in poor condition with extensive settlement or slope changes present. The timber components may have extensive weathering affecting the connections, or have significant damage elsewhere. Connections may be lost or completely loose, allowing excessive movement of the timber components away from the supports or to be free at one end.

Component 100O Wall facing/Panels Other

Units of measurement: Square Metres

This item includes all walls used to retain earth fill, walls on ramps to bridges and similar. Walls could consist of brick masonry, stone masonry or rock gabions.

Condition State 1

The walls are in good condition with no cracking, no loss of mortar, bricks or stones, and have maintained their slope and level.

Condition State 2

The walls are in good condition but have minor cracking or loss of mortar. Minor settlement or slope changes may be present.

Condition State 3

The walls are in fair condition with medium cracking or loss of mortar. Medium settlement or slope changes may be present. Minor loss of bricks or stones may have occurred which are of no consequence.

Condition State 4

The walls are in poor condition with heavy cracking or loss of mortar. Extensive settlement or slope changes may be present. Loss of bricks or stones may have occurred which accentuate the other damage.

Component 101S Column supports Steel

Units of measurement: Each

This item includes all steel sheet piling and steel piles or columns, driven or bolted in place, to support the wall panels. Steelwork may be painted or galvanised for protection.

Condition State 1

The steel columns are in good condition with no loss of paintwork or corrosion evident. There is no change in the slope of the columns due to differential movement, and the wall panels are securely held in place.

Condition State 2

The steel columns are in good condition with only minor loss of paintwork and up to 5% rust spotting of the surface area. Minor corrosion may be visible on the flanges. There is no change in the slope of the columns due to differential movement, and the wall panels are securely held in place.

Condition State 3

The steel columns are in fair condition with loss of paintwork and up to 10% rust spotting of the surface area. Medium corrosion may be visible on the flanges. There is only minor change in the slope of the columns due to differential movement, and the wall panels are securely held in place.

Condition State 4

The steel columns are in poor condition with loss of paintwork greater than 10% of the surface area. Heavy corrosion may be visible on the flanges. There are substantial changes in the slope of the columns due to differential movement, and the wall panels may be slipping out from the columns.

Component 101P Column supports Precast concrete

Units of measurement: Each

This item includes all precast reinforced concrete piles or columns, driven or bolted in place, to support the wall panels.

Condition State 1

The columns are in good condition with no cracking or spalling. There is no change in the slope of the columns due to differential movement, and the wall panels are securely held in place.

Condition State 2

The columns are in good condition with only minor cracking or spalling of no consequence. There is no change in the slope of the columns due to differential movement, and the wall panels are securely held in place.

Condition State 3

The columns are in fair condition with medium cracking and spalling due to corroding reinforcement. Exposed reinforcement may have section loss up to 20% in isolated areas. There is only minor change in the slope of the columns due to differential movement, and the wall panels are securely held in place.

A cracked component shall be rated in Condition State 3 on the basis of the following criteria:

- a crack width exceeds 0.3 mm in concrete located in a non-aggressive environment (Exposure Rating 1 or 2) or
- a crack width exceeds 0.15 mm in concrete located in an aggressive environment (Exposure Rating 3 or 4).

Condition State 4

The columns are in poor condition with heavy cracking or spalling present due to corroding reinforcement. Exposed reinforcement may have section loss greater than 20% in isolated areas. There may be substantial changes in the slope of the columns due to differential movement, and the wall panels may be slipping out from the columns.

Component 101C Column supports Cast insitu concrete

Units of measurement: Each

This item includes all bored piles including soldier piles and similar used to form a retaining wall or to support the wall panels or similar. These piles are installed and then exposed by excavation.

Condition State 1

The columns are in good condition with no cracking or spalling. There is no change in the slope of the columns due to differential movement, and any wall panels are securely held in place.

Condition State 2

The columns are in good condition with only minor cracking or spalling of no consequence. There is no change in the slope of the columns due to differential movement, and any wall panels are securely held in place.

Condition State 3

The columns are in fair condition with medium cracking and spalling due to corroding reinforcement. Exposed reinforcement may have section loss up to 20% in isolated areas. There is only minor change in the slope of the columns due to differential movement, and any wall panels are securely held in place.

A cracked component shall be rated in Condition State 3 on the basis of the following criteria:

- a crack width exceeds 0.3 mm in concrete located in a non-aggressive environment (Exposure Rating 1 or 2) or
- a crack width exceeds 0.15 mm in concrete located in an aggressive environment (Exposure Rating 3 or 4).

Condition State 4

The columns are in poor condition with heavy cracking or spalling present due to corroding reinforcement. Exposed reinforcement may have section loss greater than 20% in isolated areas. There may be substantial changes in the slope of the columns due to differential movement, and any wall panels may be slipping out from the columns.

Component 101T Column supports Timber

Units of measurement: Each

This item includes all timber piles or columns, driven or bolted in place, to support the wall panels.

Condition State 1

The columns are in good condition with no splitting or edge rot. There is no change in the slope of the columns due to differential movement, and the wall panels are securely held in place.

Condition State 2

The columns are in good condition with only minor splitting or edge rot, but the columns are sound with no pipe rot. There is no change in the slope of the columns due to differential movement, and the wall panels are securely held in place.

Condition State 3

The columns are in fair condition with moderate splitting and edge rot. They may have some minor pipe rot up to 35% but the strength of the member is not significantly affected. There may be minor slope difference between columns but the wall panels are securely held in place.

Condition State 4

The columns are in poor condition with extensive splitting, pipe rot and edge rot significantly affecting the strength of the member. There may be substantial changes in the slope of the columns due to differential movement, and the wall panels may be slipping out from the columns.

Component 101O Column supports Other

Units of measurement: Each

This item includes all mortared masonry or stone columns and buttresses supporting the retaining wall facing panels.

Condition State 1

The column is in good condition with no cracking, no loss of mortar, bricks or stones, and has maintained its slope and level.

Condition State 2

The column is in good condition but has minor cracking or loss of mortar. Minor settlement or slope changes may be present.

Condition State 3

The column is in fair condition with medium cracking or loss of mortar. Medium settlement or slope changes may be present. Minor loss of bricks or stones may have occurred which are of no consequence.

Condition State 4

The column is in poor condition with heavy cracking or loss of mortar. Extensive settlement or slope changes may be present. Loss of bricks or stones may have occurred which accentuate the other damage. The column may no longer be providing adequate support to the facing panels.

Component 102P Foundation Precast concrete

Units of measurement: Linear Metres

This item includes all precast reinforced concrete barrier walls which support or protect the retaining walls.

Condition State 1

The barrier walls are in good condition with no cracking or spalling. There are no indications of settlement of the foundations.

Condition State 2

The barrier walls are in good condition with only minor cracking or spalling of no consequence. There are no indications of settlement of the foundations.

Condition State 3

The barrier walls are in fair condition with medium cracking and spalling due to corroding reinforcement. Exposed reinforcement may have section loss up to 20% in isolated areas. There may be signs of minor settlement of the foundations.

A cracked component shall be rated in Condition State 3 on the basis of the following criteria:

- a crack width exceeds 0.3 mm in concrete located in a non-aggressive environment (Exposure Rating 1 or 2) or
- a crack width exceeds 0.15 mm in concrete located in an aggressive environment (Exposure Rating 3 or 4).

Condition State 4

The barrier walls are in poor condition with heavy cracking or spalling present due to corroding reinforcement.

Exposed reinforcement may have section loss greater than 20% in isolated areas. There may be significant settlement of the foundations.

Component 102C Foundation Cast insitu concrete

Units of measurement: Linear Metres

This item includes all cast insitu reinforced concrete foundations or barrier walls which support or protect the retaining walls. If the foundation is hidden below fill then this item should not be used.

Condition State 1

The foundations or barrier walls are in good condition with no cracking or spalling. There are no indications of settlement of the foundations.

Condition State 2

The foundations or barrier walls are in good condition with only minor cracking or spalling of no consequence. There are no indications of settlement of the foundations.

Condition State 3

The foundations or barrier walls are in fair condition with medium cracking and spalling due to corroding reinforcement. Exposed reinforcement may have section loss up to 20% in isolated areas. There may be signs of minor settlement of the foundations.

A cracked component shall be rated in Condition State 3 on the basis of the following criteria:

- a crack width exceeds 0.3 mm in concrete located in a non-aggressive environment (Exposure Rating 1 or 2) or
- a crack width exceeds 0.15 mm in concrete located in an aggressive environment (Exposure Rating 3 or 4).

Condition State 4

The foundations or barrier walls are in poor condition with heavy cracking or spalling present due to corroding reinforcement. Exposed reinforcement may have section loss greater than 20% in isolated areas. There may be significant settlement of the foundations.

Component 103S Connections Steel

Units of measurement: Each

This item describes the connections of the walls or columns to the foundations and includes all hold down bolts and arrangements, including base and connecting plates. Steelwork may be painted or galvanized for protection.

Condition State 1

The paintwork is in good condition with no metal exposure. All connections are tight and in good condition.

Condition State 2

Painted steelwork may have rust spotting to 5% of the surface area and the protective coating is no longer effective. The connections may be slightly loose or beginning to corrode.

Condition State 3

Steelwork has medium corrosion and the paintwork has failed with up to 10% surface area rusted. Some surface pitting may be evident but section loss is minimal. Connections may be moderately corroded or loose.

Condition State 4

Steelwork is heavily corroded with significant section loss and the paint system has completely failed. Connections may be very loose or heavily corroded.