

Substructure Element Index

201 -4- Steel - Column or Pile Extension - Unpainted
202 -5- Steel - Column or Pile Extension - Painted
204 -4- P/S Concrete - Column or Pile Extension
205 -4- Concrete - Column or Pile Extension
206 -4- Timber - Column or Pile Extension
210 -4- Concrete - Pier Wall
211 -4- Other - Pier Wall
215 -4- Concrete - Abutment
216 -4- Timber - Abutment
217 -4- Other - Abutment
220 -4- Concrete - Submerged Pile Cap/Footing
221*-4- Concrete - Pile Cap/Footing
225 -4- Steel - Submerged Pile - Unpainted
226 -4- P/S Concrete - Submerged Pile
227 -4- Concrete - Submerged Pile
228 -4- Timber - Submerged Pile
230 -4- Steel - Cap - Unpainted
231 -5- Steel - Cap - Painted
233 -4- P/S Concrete - Cap
234 -4- Concrete - Cap
235 -4- Timber - Cap

The following SmartFlags may be used in conjunction with Substructure elements:

360 -3- Settlement
361 -3- Scour
370*-3- Traffic Impact (Substructure)
372*-3- False Bent/Temporary Support
373*-4- Pack Rust (Substructure)
399*-5- Alkali-Silica Reactivity (ASR)

This page intentionally left blank.

Units: Each

This element defines only those columns or pile extensions that are unpainted or are constructed of weathering steel. ~~and are exposed to variable conditions (these elements are either partially submerged or are seasonally submerged).~~ Report the number of columns or pile extensions in each of Condition States 2 through 4. The number of columns/pile extensions in Condition State 1 will be the total number of columns/pile extensions in the bridge less those reported in Condition States 2 through 4.

CDOT SUGGESTED CONDITION STATES FOR CORROSION ON UNPAINTED STEEL ELEMENTS		
	Description	CS
R1	Pitting or surface rust, etc. No measurable section loss	2
R2	Flaking, minor section loss ($\leq 10\%$ thickness loss)	3
R3	Flaking, swelling, mod. section loss ($10\% < \text{thickness loss} \leq 30\%$) structural analysis is not warranted.	3
R3	Flaking, swelling, mod. section loss ($10\% < \text{thickness loss} \leq 30\%$) structural analysis is warranted due to location of corrosion on the member.	4
R4	Heavy section loss ($> 30\%$ thickness loss), may have holes through base metal.	4

Condition State 1 **There is little or no corrosion** of the unpainted steel. The weathering steel is coating uniformly and remains in excellent condition.

Feasible actions: 1) DN

Condition State 2 **Surface rust, surface pitting, has formed or is forming** on the unpainted steel. The weathering steel has not corroded beyond design limits. Weathering steel color is yellow orange to light brown.

Feasible actions: 1) DN
2) Clean & paint

Condition State 3 **Steel has measurable section loss due to corrosion but does not warrant structural analysis.** Weathering steel is dark brown or black.

Feasible actions: 1) DN
2) Clean & paint

Condition State 4 Corrosion is advanced. **Section loss is sufficient to warrant structural analysis** to ascertain the impact on the ultimate strength and/or serviceability of either the element or the bridge.

Feasible actions: 1) DN
2) Rehab unit
3) Replace unit

Units: Each

This element defines only those columns or pile extensions that are painted. ~~and are exposed to variable conditions (these elements are either partially submerged or are seasonally submerged).~~ Report the number of columns or pile extensions in each of Condition States 2 through 5. The number of columns/pile extensions in Condition State 1 will be the total number of columns/pile extensions in the bridge less those reported in Condition States 2 through 5.

CDOT SUGGESTED CONDITION STATES FOR CORROSION ON PAINTED STEEL ELEMENTS		
	Description	CS
Light R1	Slight peeling of the paint, pitting, or surface rust, etc. No measurable section loss	2
R1	Peeling of the paint, pitting, surface rust, etc. No measurable section loss	3
R2	Flaking, minor section loss ($\leq 10\%$ thickness loss)	4
R3	Flaking, swelling, mod. section loss ($10\% < \text{thickness loss} \leq 30\%$) structural analysis is not warranted.	4
R3	Flaking, swelling, mod. section loss ($10\% < \text{thickness loss} \leq 30\%$) structural analysis is warranted due to location of corrosion on the member.	5
R4	Heavy section loss ($> 30\%$ thickness loss), may have holes through base metal	5

Condition State 1 There is no evidence of active corrosion and the paint system is sound and functioning as intended to protect the metal surface.

Feasible actions: 1) DN
2) Surface clean

Condition State 2 **There is little or no active corrosion.** Surface or freckled rust has formed or is forming. The paint system may be chalking, peeling, curling or showing other early evidence of paint system distress but **there is no exposure of metal.**

Feasible actions: 1) DN
2) Surface clean
3) Surface clean & restore top coat

Condition State 3 **Surface or freckled rust is prevalent.** The paint system is no longer effective. **There may be exposed metal** but there is no active corrosion which is causing loss of section.

Feasible actions: 1) DN
2) Spot blast, clean & paint

Condition State 4 **The paint system has failed. Surface pitting may be present** but any section loss due to active corrosion does not yet warrant structural analysis of either the element or the bridge.

Feasible actions: 1) DN
2) Spot blast, clean & paint
3) Replace paint system

Condition State 5 **Corrosion has caused section loss and is sufficient to warrant structural analysis** to ascertain the impact on the ultimate strength and/or serviceability of either the element or the bridge.

Feasible actions: 1) DN
2) Major rehab unit
3) Replace unit

Units: Each

This element defines prestressed concrete columns or pile extensions. Report the number of columns or pile extensions in each of Condition States 2 through 4. The number of columns/pile extensions in Condition State 1 will be the total number of columns/pile extensions at the bridge less those reported in Condition States 2 through 4.

Condition State 1 The element **show no deterioration**. There **may be discoloration, efflorescence, and/or superficial cracking** but without effect on strength and/or serviceability.

Feasible actions: 1) DN

Condition State 2 **Minor cracks and spalls** may be present and there **may be exposed reinforcing with no evidence of corrosion**. There is no exposure of the prestress system.

Feasible actions: 1) DN
2) Seal cracks minor patch

Condition State 3 Some **delaminations and/or spalls may be present**. There may be **minor exposure but no deterioration of the prestress system**. **Corrosion of non-prestressed reinforcement may be present** but loss of section is incidental and does not significantly affect the strength and/or serviceability of either the element or the bridge.

Feasible actions: 1) DN
2) Clean steel & patch, (&/or seal)

Condition State 4 **Delaminations, spalls and corrosion on non-prestressed reinforcement are prevalent**. There may also be **exposure and deterioration of the prestress system** (manifested by **loss of bond, broken strands or wire, failed anchorages, etc**). There is sufficient concern to warrant an analysis to ascertain the impact on the strength and/or serviceability of either the element or the bridge.

Feasible actions: 1) DN
2) Rehab unit
3) Replace unit

Units: Each

This element defines reinforced concrete columns or pile extensions. Report the number of columns or pile extensions in each of Condition States 2 through 5. The number of columns/pile extensions in Condition State 1 will be the total number of columns/pile extension at the bridge less those reported in Condition States 2 through 4.

CDOT Notes: Comments concerning debris walls and crash walls should be included with this element.

GCD06 - Pier Columns and Pier Walls: Vertical substructure units less than 6' wide are considered columns. Vertical substructure units 6' and wider are considered walls (including 6' diameter and wider cylindrical shapes). Variable width walls shall be measured at the widest portion as determined by the plans, excluding the cap.

GCD17 - Use Element 205 Concrete Column or Pile Extension for spill-through abutments when 3' of the column is exposed beneath the bottom of the abutment. Spill-through abutments on columns are to be reported as Element 215 Concrete - Abutment. If sheet piling, backing planks, or other materials have been added to retain the approach roadway after construction, mention it in the comments for the abutment.

GCD20 - Delineated columns on piers should be coded as columns unless the delineated column width is greater than 6'. The delineated cap on a pier should be coded as a cap.

For exposed footings/pile caps, see Element 220 Concrete - Submerged Pile Cap/Footing or Element 221 Concrete Pile Cap/Footing.

Condition State 1 The element shows no deterioration. There **may be discoloration, efflorescence, and/or superficial cracking** but without effect on strength and/or serviceability.

Feasible actions: 1) DN

Condition State 2 **Minor cracks & spalls may be present** but there is **no exposed reinforcing or surface evidence of rebar corrosion.**

Feasible actions: 1) DN
2) Seal cracks minor patch

Condition State 3 **Some delaminations and/or spalls may be present and some reinforcing may be exposed. Corrosion of rebar may be present but loss of section is incidental** and does not significantly affect the strength and/or serviceability of either the element or the bridge.

Feasible actions: 1) DN
2) Clean rebar & patch, (and/or seal)

Condition State 4 Advanced deterioration. **Corrosion of reinforcement and/or loss of concrete section is sufficient to warrant analysis** to ascertain the impact on the strength and/or serviceability of either the element or the bridge.

Feasible actions: 1) DN
2) Rehab unit
3) Replace unit

Units: Each

This element defines columns or pile extensions of timber construction. Report the number of columns or pile extensions in each of Condition States 2 through 4. The number of columns/pile extensions in Condition State 1 will be the total number of columns/pile extensions at the bridge less those reported in Condition States 2 through 4.

CDOT SUGGESTED CONDITION STATES FOR TIMBER PILES ONLY		
Splits < 3 ft long or checks (1/2" < check depth < 1") = CS 2	Splits ≥ 3 ft long = CS 4	Any stress related cracked or broken pile = CS 4
Checks > 1" deep = CS 3		
Checks > 1" deep and/or core rot = CS 4		

CDOT Note: Includes timber abutment piles but not wingwall or sub-abutment piles.

Condition State 1 Investigation indicates **no decay**. There may be **superficial cracks, splits and checks** having no effect on strength or serviceability.

Feasible actions: 1) DN

Condition State 2 **Decay, insect infestation/marine borer infestation, abrasion, splitting, cracking, checking or crushing may exist** but none is sufficiently advanced to affect serviceability of the element.

Feasible actions: 1) DN
2) Rehab &/or protect unit

Condition State 3 **Decay, insect infestation, abrasion, splitting, cracking or crushing** has produced **loss of strength of the element but not of a sufficient magnitude** to affect the serviceability of the bridge.

Feasible actions: 1) DN
2) Rehab unit
3) Replace unit

Condition State 4 Advanced deterioration. **Decay, insect infestation, abrasion, splits, cracks or crushing** has produced **loss of strength** that affects the serviceability of the bridge.

Feasible actions: 1) DN
2) Rehab unit
3) Replace unit

Units: LF

This element defines reinforced concrete pier walls. Report the estimated lineal feet of pier walls in each of Condition States 2 through 4. The number of units in Condition State 1 will be the remainder of the units after deducting those reported in Condition States 2 through 4.

CDOT SUGGESTED CONDITION STATES FOR PERCENT LOSS OF BEARING AREA			
LOSS OF BEARING AREA(%)			
PERCENT LOSS	≤ 10%	10 < % ≤ 20	> 20%
CONDITION STATES	2	3	4

CDOT Notes: GCD06 - Pier Columns and Pier Walls: Vertical substructure units less than 6' wide are considered columns. Vertical substructure units 6' and wider are considered walls (including 6' diameter and wider cylindrical shapes). Variable width walls shall be measured at the widest portion as determined by the plans, excluding the cap.

GCD20 - Delineated columns on piers should be coded as columns unless the delineated column width is greater than 6'. The delineated cap on a pier should be coded as a cap.

If piles are exposed greater than 3' under a concrete footing or pier wall, see Elements 201, 204, 205, 206, 225, 226, 227, or 228. Document piles which are exposed less than 3' in the comments for this element.

For exposed footings/pile caps, see Element 220 Concrete - Submerged Pile Cap/Footing or Element 221 Concrete Pile Cap/Footing.

Condition State 1 The element shows no deterioration. There may be **discoloration, efflorescence, and/or superficial cracking** but without effect on strength and/or serviceability.

Feasible actions: 1) DN

Condition State 2 **Minor cracks & spalls may be present** but there is **no exposed reinforcing or surface evidence of rebar corrosion**.

Feasible actions: 1) DN
2) Seal cracks minor patch

Condition State 3 **Some delaminations and/or spalls may be present** and **some reinforcing may be exposed**. **Corrosion of rebar may be present** but **loss of section is incidental** and does not significantly affect the strength and/or serviceability of either the element or the bridge.

Feasible actions: 1) DN
2) Clean rebar & patch (and/or seal)

Condition State 4 Advanced deterioration. **Corrosion of reinforcement and/or loss of concrete section is sufficient to warrant analysis** to ascertain the impact on the strength and/or serviceability of either the element or the bridge.

Feasible actions: 1) DN
2) Rehab unit
3) Replace unit

Units: LF

This element defines only those pier walls constructed of material other than reinforced concrete. This includes masonry pier walls.

CDOT SUGGESTED CONDITION STATES FOR PERCENT LOSS OF BEARING AREA			
LOSS OF BEARING AREA(%)			
PERCENT LOSS	≤ 10%	10 < % ≤ 20	> 20%
CONDITION STATES	2	3	4

Condition State 1 There is **little or no deterioration**. Surface defects only are in evidence.

Feasible actions: 1) DN

Condition State 2 There may be **minor deterioration, cracking and weathering**. **Mortar** in the **joints** may show **minor deterioration**.

Feasible actions: 1) DN
2) Rehab unit

Condition State 3 **Moderate to major** deterioration and cracking. **Major** deterioration of the joints.

Feasible actions: 1) DN
2) Rehab unit

Condition State 4 **Major deterioration, splitting, or cracking** of materials may be **affecting the structural capacity** of the element.

Feasible actions: 1) DN
2) Rehab unit
3) Replace unit

Units: LF

This element defines reinforced concrete abutments. Report the estimated lineal feet of abutments in each of Condition States 1 through 4.

CDOT SUGGESTED CONDITION STATES FOR PERCENT LOSS OF BEARING AREA			
LOSS OF BEARING AREA(%)			
PERCENT LOSS	≤ 10%	10 < % ≤ 20	> 20%
CONDITION STATES	2	3	4

CDOT Notes: Abutment length is to be measured to the out-to-out of the deck and along the abutment skew. I-70 bridges located on Vail Pass and in Glenwood Canyon have had the abutment lengths calculated from the plans.

GCD17 - Use Element 205 Concrete Column or Pile Extension for spill-through abutments when 3' of the column is exposed beneath the bottom of the abutment. Spill-through abutments on columns are to be reported as Element 215 Concrete - Abutment. If sheet piling, backing planks, or other materials have been added to retain the approach roadway after construction, mention it in the comments for the abutment.

If the concrete footing is exposed, see Element 220 Concrete - Submerged Pile Cap/Footing or Element 221 Concrete - Pile Cap/Footing.

If piles are exposed under concrete footing, see Elements 201, 204, 205, 206, 225, 226, 227, or 228.

Condition State 1 The element shows no deterioration. There may be **discoloration, efflorescence, and/or superficial cracking** but without effect on strength and/or serviceability.

Feasible actions: 1) DN

Condition State 2 **Minor cracks & spalls may be present** but there is **no exposed reinforcing or surface evidence of rebar corrosion**.

Feasible actions: 1) DN
2) Seal cracks minor patch

Condition State 3 **Some delaminations and/or spalls may be present** and **some reinforcing may be exposed**. Corrosion of rebar may be present but **loss of section is incidental** and does not significantly affect the strength and/or serviceability of either the element or the bridge.

Feasible actions: 1) DN
2) Clean rebar & patch,(and/or seal)

Condition State 4 Advanced deterioration. **Corrosion of reinforcement and/or loss of concrete section is sufficient to warrant analysis** to ascertain the impact on the strength and/or serviceability of either the element or the bridge.

Feasible actions: 1) DN
2) Rehab unit
3) Replace unit

Units: LF

This element defines abutments of timber construction. Report the estimated lineal feet of abutments in each of Condition States 1 through 4.

CDOT Notes: Abutment length is to be measured to the out-to-out of the deck along the abutment skew.

Include timber piling or caps with their respective elements. The timber abutment element includes only the backing planks.

Condition State 1 Investigation indicates **no decay**. There may be **superficial cracks, splits and checks** having no effect on strength or serviceability.

Feasible actions: 1) DN

Condition State 2 **Decay, insect infestation/marine borer infestation, abrasion, splitting, cracking, checking or crushing may exist** but none is sufficiently advanced to affect serviceability of the element.

Feasible actions: 1) DN
2) Rehab &/or protect unit

Condition State 3 **Decay, insect infestation, abrasion, splitting, cracking or crushing** has produced **loss of strength of the element but not of a sufficient magnitude** to affect the serviceability of the bridge.

Feasible actions: 1) DN
2) Rehab unit
3) Replace unit

Condition State 4 Advanced deterioration. **Decay, insect infestation, abrasion, splits, cracks or crushing** has produced **loss of strength** that affects their serviceability of the bridge.

Feasible actions: 1) DN
2) Rehab unit
3) Replace unit

Units: LF

This element defines only those abutments constructed of material other than reinforced concrete or timber. This includes masonry abutments.

CDOT SUGGESTED CONDITION STATES FOR PERCENT LOSS OF BEARING AREA			
LOSS OF BEARING AREA (%)			
PERCENT LOSS	≤ 10%	10 < % ≤ 20	> 20%
CONDITION STATES	2	3	4

CDOT Note: Abutment length is to be measured to the out-to-out of the deck and along the abutment skew.

Condition State 1 There is **little or no deterioration**. Surface defects only are in evidence.

Feasible actions: 1) DN

Condition State 2 There may be **minor deterioration, cracking and weathering**. Mortar in joints may show **minor deterioration**.

Feasible actions: 1) DN
2) Rehab unit

Condition State 3 **Moderate to major** deterioration and cracking. **Major** deterioration of joints.

Feasible actions: 1) DN
2) Rehab unit

Condition State 4 **Major deterioration, splitting, or cracking** of materials may be **affecting the structural capacity** of the element.

Feasible actions: 1) DN
2) Rehab unit
3) Replace unit

Units: Each

This element defines only those reinforced concrete pile caps and/or footings that are **continuously submerged and are visible for inspection**. The exposure may be intentional or caused by scour. **This element is not to be confused with elements in a variable wet situation**. Report the number of submerged pile caps and/or footings in each of Condition States 2 through 4. The number of submerged pile cap/footings in condition state 1 will be the total number of submerged pile cap/footings at the bridge less those reported in Condition States 2 through 4.

SUGGESTED CONDITION STATES FOR CRACKS IN MILDLY REINFORCED CONCRETE GIRDERS						
WIDTH (W) in millimeters (inches)						
TYPE OF CRACK	NONE	≤ 0.8 mm (≤ 1/32 in)	0.8 < W ≤ 2 (1/32)(1/16)	2 < W ≤ 2.5 (1/16)(3/32)	2.5 < W ≤ 3 (3/32)(1/8)	W > 3 mm (> 1/8 in)
SHEAR	1	2	2	3	4	4
FLEXURE	1	1	2	3	4	4
DIAGONAL	1	2	2	3	3	4

Condition State 1 The element shows no deterioration. There **may be discoloration, efflorescence, and/or superficial cracking** but without effect on strength and/or serviceability.

Feasible actions: 1) DN

Condition State 2 **Minor cracks & spalls may be present** but there is **no exposed reinforcing or surface evidence of rebar corrosion**.

Feasible actions: 1) DN
2) Seal cracks minor patch

Condition State 3 **Some delaminations and/or spalls may be present** and **some reinforcing may be exposed**. **Corrosion of rebar may be present but loss of section is incidental** and does not significantly affect the strength and/or serviceability of either the element or the bridge.

Feasible actions: 1) DN
2) Clean rebar & patch, (and/or seal)

Condition State 4 Advanced deterioration. **Corrosion of reinforcement and/or loss of concrete section is sufficient to warrant analysis** to ascertain the impact on the strength and/or serviceability of either the element or the bridge.

Feasible actions: 1) DN
2) Rehab unit
3) Replace unit

Units: Each

This element defines only those reinforced concrete pile caps and/or footings that are visible for inspection. The exposure may be intentional or caused by scour. Report the number of pile caps and/or footings in each of Condition States 2 through 4. The number of pile cap/footings in Condition State 1 will be the total number of pile cap/footings at the bridge less those reported in Condition States 2 through 4.

SUGGESTED CONDITION STATES FOR CRACKS IN MILDLY REINFORCED CONCRETE GIRDERS						
WIDTH (W) in millimeters (inches)						
TYPE OF CRACK	NONE	≤ 0.8 mm (≤ 1/32 in)	0.8 < W ≤ 2 (1/32)(1/16)	2 < W ≤ 2.5 (1/16)(3/32)	2.5 < W ≤ 3 (3/32)(1/8)	W > 3 mm (> 1/8 in)
SHEAR	1	2	2	3	4	4
FLEXURE	1	1	2	3	4	4
DIAGONAL	1	2	2	3	3	4

Condition State 1 The element shows no deterioration. There may be discoloration, efflorescence, and/or superficial cracking but without effect on strength and/or serviceability.

Feasible actions: 1) DN

Condition State 2 Minor cracks & spalls may be present but there is no exposed reinforcing or surface evidence of rebar corrosion.

Feasible actions: 1) DN
2) Seal cracks minor patch

Condition State 3 Some delaminations and/or spalls may be present and some reinforcing may be exposed. Corrosion of rebar may be present but loss of section is incidental and does not significantly affect the strength and/or serviceability of either the element or the bridge.

Feasible actions: 1) DN
2) Clean rebar & patch, (and/or seal)

Condition State 4 Advanced deterioration. Corrosion of reinforcement and/or loss of concrete section is sufficient to warrant analysis to ascertain the impact on the strength and/or serviceability of either the element or the bridge.

Feasible actions: 1) DN
2) Rehab unit
3) Replace unit

Units: Each

This element defines only those unpainted steel piles that are **continuously and totally submerged and are visible for inspection**. The exposure may be intentional or caused by scour. **This element is not to be confused with piles in a variable wet situation**. Report the number of submerged piles in each of Condition States 2 through 4. The number of submerged piles in Condition State 1 will be the total number of submerged piles at the bridge less those reported in Condition States 2 through 4.

CDOT SUGGESTED CONDITION STATES FOR CORROSION ON UNPAINTED STEEL ELEMENTS		
	Description	CS
R1	Pitting or surface rust, etc. No section measurable loss	2
R2	Flaking, minor section loss ($\leq 10\%$ thickness loss)	3
R3	Flaking, swelling, mod. section loss ($10\% < \text{thickness loss} \leq 30\%$) structural analysis is not warranted.	3
R3	Flaking, swelling, mod. section loss ($10\% < \text{thickness loss} \leq 30\%$) structural analysis is warranted due to location of corrosion on the member.	4
R4	Heavy section loss ($> 30\%$ thickness loss), may have holes through base metal.	4

Condition State 1 **There is little or no corrosion** of the unpainted steel. The weathering steel is coating uniformly and remains in excellent condition.

Feasible actions: 1) DN

Condition State 2 **Surface rust, surface pitting, has formed or is forming** on the unpainted steel. The weathering steel has not corroded beyond design limits. Weathering steel color is yellow orange to light brown.

Feasible actions: 1) DN
2) Clean & paint

Condition State 3 **Steel has measurable section loss due to corrosion but does not warrant structural analysis**. Weathering steel is dark brown or black.

Feasible actions: 1) DN
2) Clean & paint

Condition State 4 Corrosion is advanced. **Section loss is sufficient to warrant structural analysis** to ascertain the impact on the ultimate strength and/or serviceability of either the element or the bridge.

Feasible actions: 1) DN
2) Rehab unit
3) Replace unit

Units: Each

This element defines only those prestressed concrete piles that are **continuously submerged and are visible for inspection**. The exposure may be intentional or caused by scour. **This element is not to be confused with piles in a variable wet situation**. Report the number of piles in each of Condition States 2 through 4. The number of submerged piles in Condition State 1 will be the total number of submerged piles at the bridge less those reported in Condition States 2 through 4.

Condition State 1 The element **show no deterioration**. There **may be discoloration, efflorescence, and/or superficial cracking** but without effect on strength and/or serviceability.

Feasible actions: 1) DN

Condition State 2 **Minor cracks and spalls** may be present and there **may be exposed reinforcing with no evidence of corrosion**. There is no exposure of the prestress system.

Feasible actions: 1) DN
2) Seal cracks minor patch

Condition State 3 Some **delaminations and/or spalls may be present**. There may be **minor exposure but no deterioration of the prestress system**. **Corrosion of non-prestressed reinforcement may be present** but loss of section is incidental and does not significantly affect the strength and/or serviceability of either the element or the bridge.

Feasible actions: 1) DN
2) Clean steel & patch, (&/or seal)

Condition State 4 **Delaminations, spalls and corrosion or non-prestressed reinforcement are prevalent**. There may also be **exposure and deterioration of the prestress system** (manifested by **loss of bond, broken strands or wire, failed anchorages, etc**). There is sufficient concern to warrant an analysis to ascertain the impact on the strength and/or serviceability of either the element or the bridge.

Feasible actions: 1) DN
2) Rehab unit
3) Replace unit

Units: Each

This element defines only those reinforced concrete piles that are **continuously submerged and are visible for inspection**. The exposure may be intentional or caused by scour. **This element is not to be confused with piles in a variable wet situation**. Report the number of submerged piles in each of Condition States 2 through 4. The number of submerged piles in Condition State 1 will be the total number of submerged piles at the bridge less those reported in Condition States 2 through 4.

Condition State 1 The element shows no deterioration. There **may be discoloration, efflorescence, and/or superficial cracking** but without effect on strength and/or serviceability.

Feasible actions: 1) DN

Condition State 2 **Minor cracks & spalls may be present** but there is **no exposed reinforcing or surface evidence of rebar corrosion**.

Feasible actions: 1) DN
2) Seal cracks minor patch

Condition State 3 **Some delaminations and/or spalls may be present** and **some reinforcing may be exposed**. **Corrosion of rebar may be present but loss of section is incidental** and does not significantly affect the strength and/or serviceability of either the element or the bridge.

Feasible actions: 1) DN
2) Clean rebar & patch, (and/or seal)

Condition State 4 Advanced deterioration. **Corrosion of reinforcement and/or loss of concrete section is sufficient to warrant analysis** to ascertain the impact on the strength and/or serviceability of either the element or the bridge.

Feasible actions: 1) DN
2) Rehab unit
3) Replace unit

Units: Each

This element defines only timber piles that are **continuously submerged and are visible for inspection**. The exposure may be intentional or caused by scour. **This element is not to be confused with piles in a variable wet situation**. Report the number of piles in each of Condition States 2 through 4. The number of submerged piles in Condition State 1 will be the total number of submerged piles at the bridge less those reported in Condition States 2 through 4.

CDOT SUGGESTED CONDITION STATES FOR TIMBER PILES ONLY		
Splits < 3 ft long or checks (1/2" < check depth < 1") = CS 2	Splits ≥ 3 ft long = CS 4	Any stress related cracked or broken pile = CS 4
Checks > 1" deep = CS 3		
Checks > 1" deep and/or core rot = CS 4		

Condition State 1 Investigation indicates **no decay**. There may be **superficial cracks, splits and checks** having no effect on strength or serviceability.

Feasible actions: 1) DN

Condition State 2 **Decay, insect infestation/marine borer infestation, abrasion, splitting, cracking, checking or crushing may exist** but none is sufficiently advanced to affect serviceability of the element.

Feasible actions: 1) DN
2) Rehab &/or protect unit

Condition State 3 **Decay, insect infestation, abrasion, splitting, cracking or crushing** has produced **loss of strength of the element but not of a sufficient magnitude** to affect the serviceability of the bridge.

Feasible actions: 1) DN
2) Rehab unit
3) Replace unit

Condition State 4 Advanced deterioration. **Decay, insect infestation, abrasion, splits, cracks or crushing** has produced **loss of strength** that affects the serviceability of the bridge.

Feasible actions: 1) DN
2) Rehab unit
3) Replace unit

Units: LF

This element defines all unpainted steel caps or those constructed of weathering steel. Report the estimated lineal feet Condition States 2 through 4. The number of units in Condition State 1 will be the remainder of the units after deducting those reported in Condition States 2 through 4.

CDOT SUGGESTED CONDITION STATES FOR CORROSION ON UNPAINTED STEEL ELEMENTS		
	Description	CS
R1	Pitting or surface rust, etc. No measurable section loss	2
R2	Flaking, minor section loss ($\leq 10\%$ thickness loss)	3
R3	Flaking, swelling, mod. section loss ($10\% < \text{thickness loss} \leq 30\%$) structural analysis is not warranted.	3
R3	Flaking, swelling, mod. section loss ($10\% < \text{thickness loss} \leq 30\%$) structural analysis is warranted due to location of corrosion on the member.	4
R4	Heavy section loss ($> 30\%$ thickness loss), may have holes through base metal.	4

CDOT Note: This element may include abutment caps.

Condition State 1 **There is little or no corrosion** of the unpainted steel. The weathering steel is coating uniformly and remains in excellent condition.

Feasible actions: 1) DN

Condition State 2 **Surface rust, surface pitting, has formed or is forming** on the unpainted steel. The weathering steel has not corroded beyond design limits. Weathering steel color is yellow orange to light brown.

Feasible actions: 1) DN
2) Clean & paint

Condition State 3 **Steel has measurable section loss due to corrosion but does not warrant structural analysis.** Weathering steel is dark brown or black.

Feasible actions: 1) DN
2) Clean & paint

Condition State 4 Corrosion is advanced. **Section loss is sufficient to warrant structural analysis** to ascertain the impact on the ultimate strength and/or serviceability of either the element or the bridge.

Feasible actions: 1) DN
2) Rehab unit
3) Replace unit

Units: LF

This element defines all steel caps that are painted. Report the estimated lineal feet in each of Condition States 2 through 5. The number of units in Condition State 1 will be remainder of the units after deducting those reported in Condition States 2 through 4.

CDOT SUGGESTED CONDITION STATES FOR CORROSION ON PAINTED STEEL ELEMENTS		
	Description	CS
Light R1	Slight peeling of the paint, pitting, or surface rust, etc. No measurable section loss	2
R1	Peeling of the paint, pitting, surface rust, etc. No measurable section loss	3
R2	Flaking, minor section loss ($\leq 10\%$ thickness loss)	4
R3	Flaking, swelling, mod. section loss ($10\% < \text{thickness loss} \leq 30\%$) structural analysis is not warranted.	4
R3	Flaking, swelling, mod. section loss ($10\% < \text{thickness loss} \leq 30\%$) structural analysis is warranted due to location of corrosion on the member.	5
R4	Heavy section loss ($> 30\%$ thickness loss), may have holes through base metal	5

CDOT Note: This element may include abutment caps.

Condition State 1 There is no evidence of active corrosion and the paint system is sound and functioning as intended to protect the metal surface.

- Feasible actions: 1) DN
2) Surface clean

Condition State 2 **There is little or no active corrosion.** Surface or freckled rust has formed or is forming. The paint system may be chalking, peeling, curling or showing other early evidence of paint system distress but **there is no exposure of metal.**

- Feasible actions: 1) DN
2) Surface clean
3) Surface clean & restore top coat

Condition State 3 **Surface or freckled rust is prevalent.** The paint system is no longer effective. **There may be exposed metal** but there is no active corrosion which is causing loss of section.

- Feasible actions: 1) DN
2) Spot blast, clean & paint

Condition State 4 The **paint system has failed.** **Surface pitting may be present** but any section loss due to active corrosion does not yet warrant structural analysis of either the element or the bridge.

- Feasible actions: 1) DN
2) Spot blast, clean & paint
3) Replace paint system

Condition State 5 **Corrosion has caused section loss and is sufficient to warrant structural analysis** to ascertain the impact on the ultimate strength and/or serviceability of either the element or the bridge.

- Feasible actions: 1) DN
2) Major rehab unit
3) Replace unit

Units: LF

This element defines only those caps constructed of prestressed concrete. Report the estimated lineal feet in each of Condition States 2 through 4. The number of units in Condition State 1 will be the remainder of the units after deducting those reported in Condition States 2 through 4.

CDOT SUGGESTED CONDITION STATES FOR CRACKS IN PRESTRESSED CONCRETE GIRDERS			
CS1	CS2	CS3	CS4
≤ 0.10 mm (≤ 0.004 in)	$0.10 < W \leq 0.25$ (0.004 in)(0.009 in)	$0.25 < W \leq 0.76$ (0.009 in) (0.030 in)	$W > 0.76$ mm (> 0.030 in)

CDOT SUGGESTED CONDITION STATES FOR PERCENT LOSS OF BEARING AREA			
LOSS OF BEARING AREA(%)			
PERCENT LOSS	$\leq 10\%$	$10 < \% \leq 20$	$> 20\%$
CONDITION STATES	2	3	4

Condition State 1 The element **show no deterioration**. There **may be discoloration, efflorescence, and/or superficial cracking** but without effect on strength and/or serviceability.

Feasible actions: 1) DN

Condition State 2 **Minor cracks and spalls** may be present and there **may be exposed reinforcing with no evidence of corrosion**. There is no exposure of the prestress system.

Feasible actions: 1) DN
2) Seal cracks minor patch

Condition State 3 Some **delaminations and/or spalls may be present**. There may be **minor exposure but no deterioration of the prestress system**. **Corrosion of non-prestressed reinforcement may be present** but loss of section is incidental and does not significantly affect the strength and/or serviceability of either the element or the bridge.

Feasible actions: 1) DN
2) Clean steel & patch, (&/or seal)

Condition State 4 **Delaminations, spalls and corrosion on non-prestressed reinforcement are prevalent**. There may also be **exposure and deterioration of the prestress system** (manifested by **loss of bond, broken strands or wire, failed anchorages, etc**). There is sufficient concern to warrant an analysis to ascertain the impact on the strength and/or serviceability of either the element or the bridge.

Feasible actions: 1) DN
2) Rehab unit
3) Replace unit

Units: LF

This element defines only those caps constructed of reinforced concrete. Report the estimated lineal feet in each of Condition States 2 through 4. The number of units in Condition State 1 will be the remainder of the units after deducting those reported in Condition States 2 through 4.

SUGGESTED CONDITION STATES FOR CRACKS IN MILDLY REINFORCED CONCRETE GIRDERS						
WIDTH (W) in millimeters (inches)						
TYPE OF CRACK	NONE	≤ 0.8 mm (≤ 1/32 in)	0.8 < W ≤ 2 (1/32)(1/16)	2 < W ≤ 2.5 (1/16)(3/32)	2.5 < W ≤ 3 (3/32)(1/8)	W > 3 mm (> 1/8 in)
SHEAR	1	2	2	3	4	4
FLEXURE	1	1	2	3	4	4
DIAGONAL	1	2	2	3	3	4

CDOT SUGGESTED CONDITION STATES FOR PERCENT LOSS OF BEARING AREA			
LOSS OF BEARING AREA(%)			
PERCENT LOSS	≤ 10%	10 < % ≤ 20	> 20%
CONDITION STATES	2	3	4

CDOT Note: GCD20 - Delineated columns on piers should be coded as columns unless the delineated column width is greater than 6'. The delineated cap on a pier should be coded as a cap.

Condition State 1 The element shows no deterioration. There may be **discoloration, efflorescence, and/or superficial cracking** but without effect on strength and/or serviceability.

Feasible actions: 1) DN

Condition State 2 **Minor cracks & spalls may be present** but there is **no exposed reinforcing or surface evidence of rebar corrosion.**

Feasible actions: 1) DN
2) Seal cracks minor patch

Condition State 3 **Some delaminations and/or spalls may be present and some reinforcing may be exposed.** Corrosion of rebar may be present but **loss of section is incidental** and does not significantly affect the strength and/or serviceability of either the element or the bridge.

Feasible actions: 1) DN
2) Clean rebar & patch,(and/or seal)

Condition State 4 Advanced deterioration. **Corrosion of reinforcement and/or loss of concrete section is sufficient to warrant analysis** to ascertain the impact on the strength and/or serviceability of either the element or the bridge.

Feasible actions: 1) DN
2) Rehab unit
3) Replace unit

Units: LF

This element defines only those caps of timber construction. Report the estimated lineal feet in each of Condition States 2 through 4. The number of units in Condition State 1 will be the remainder of the units after deducting those reported in Condition States 2 through 4.

CDOT SUGGESTED CONDITION STATES FOR TIMBER GIRDERS, STRINGERS, CAPS AND FLOORBEAMS		
Splits < 3 ft long or checks > 1" deep = CS 2	Splits ≥ 3 ft long = CS 4	Any stress related full width crack (thickness of the section) = CS 4

CDOT Notes: This element may include abutment caps.

Do not report the entire cap length in the worst condition state.

Condition State 1 Investigation indicates **no decay**. There may be **superficial cracks, splits and checks** having no effect on strength or serviceability.

Feasible actions: 1) DN

Condition State 2 **Decay, insect infestation/marine borer infestation, abrasion, splitting, cracking, checking or crushing may exist** but none is sufficiently advanced to affect serviceability of the element.

Feasible actions: 1) DN
2) Rehab &/or protect unit

Condition State 3 **Decay, insect infestation, abrasion, splitting, cracking or crushing** has produced **loss of strength of the element but not of a sufficient magnitude** to affect the serviceability of the bridge.

Feasible actions: 1) DN
2) Rehab unit
3) Replace unit

Condition State 4 Advanced deterioration. **Decay, insect infestation, abrasion, splits, cracks or crushing** has produced **loss of strength** that affects the serviceability of the bridge.

Feasible actions: 1) DN
2) Rehab unit
3) Replace unit

This page intentionally left blank.

Culvert Element Index

240 -4- Steel - Culvert
241 -4- Concrete - Culvert
242 -4- Timber - Culvert
243 -4- Other - Culvert

This page intentionally left blank.

Units: LF of Culvert

This element defines all metal (steel, aluminum, **galvanized**, etc.) culverts, including arches, round or elliptical pipes, etc. Report the estimated number of linear feet in each of Condition States 2 through 4. The number of units in Condition State 1 will be the remainder of the units after deducting those in Condition States 2 through 4.

CDOT SUGGESTED CONDITION STATES FOR CORROSION ON UNPAINTED STEEL ELEMENTS		
	Description	CS
R1	Pitting or surface rust, etc. No measurable section loss	2
R2	Flaking, minor section loss ($\leq 10\%$ thickness loss)	3
R3	Flaking, swelling, mod. section loss ($10\% < \text{thickness loss} \leq 30\%$) structural analysis is not warranted.	3
R3	Flaking, swelling, mod. section loss ($10\% < \text{thickness loss} \leq 30\%$) structural analysis is warranted due to location of corrosion on the member.	4
R4	Heavy section loss ($> 30\%$ thickness loss), may have holes through base metal.	4

CDOT Notes: All measurements are linear feet along the length of each cell of a CBC, pipe, or arch, not along the center line of the roadway. The length of pipes shall include end sections.

GCD24 - The length of culvert inspected and reported shall be to the ROW boundary or other known limits of CDOT or entity ownership.

GCD25 - Report the height of fill on bridges and culverts and write it on the inventory sheet so NBI Item66T can be appropriately coded.

Condition State 1 The element show little or no deterioration. **Some discoloration or surface corrosion may exist** but there is no metal pitting.

Feasible actions: 1) DN

Condition State 2 There may be **minor to moderate corrosion and pitting**, especially at the barrel invert. **Little or no distortion** exists.

Feasible actions: 1) DN
2) Rehab unit

Condition State 3 **Significant corrosion, deep pitting or some holes in the invert** may exist. Significant scour or erosion may be affecting structural integrity. **Minor to moderate distortion and deflection** may exist. There is little or no roadway settlement.

Feasible actions: 1) DN
2) Rehab unit

Condition State 4 **Major corrosion, extreme pitting or holes** in the barrel may exist. **Major distortion, deflection, or settlement** may be evident. **Minor to major roadway settlement** may be evident.

Feasible actions: 1) DN
2) Rehab unit
3) Replace unit

Units:LF of Culvert

This element defines all precast and cast-in-place (conventional or prestressed) concrete arch, pipe and box culverts. Report the estimated number of linear feet in each of Condition States 2 through 4. If a joint determines the controlling element, report the number of linear feet of one culvert section at the appropriate condition state. The number of units in Condition State 1 will be the remainder of the units after deducting those in Condition States 2 through 4.

CDOT Notes: All measurements are linear feet along the length of each cell of a CBC, pipe, or arch, not along the center line of the roadway.

GCD10 - Concrete Box Culverts will always have a bottom slab (floor).

GCD18 - Count each culvert longitudinal crack with efflorescence as 1' in Condition State 2 and those with rust as 1' in Condition State 3.

GCD19 - Comments for culvert aprons shall be included in Element 502 Channel Protection Material and Condition.

GCD24 - The length of culvert inspected and reported shall be to the ROW boundary or other known limits of CDOT or entity ownership.

GCD25 - Report the height of fill on bridges and culverts and write it on the inventory sheet so NBI Item66T can be appropriately coded.

Comments concerning scour should be included in SmartFlag 361 Scour.

Condition State 1 **Superficial cracks & spalls** may be present, but there is **no exposed reinforcing or evidence of rebar corrosion**. There is **little or no deterioration or separation of joints**.

Feasible actions: 1) DN

Condition State 2 Deterioration, **minor chloride contamination, minor cracking and/or leaching** may have begun. There **may be** deterioration and **separation of joints**.

Feasible actions: 1) DN
2) Rehab unit

Condition State 3 There may be moderate to major deterioration, **extensive cracking and/or leaching** and **large** areas of **spalls**. **Minor to moderate distortion, settlement, or misalignment** may have occurred. There **may be considerable** deterioration and **separation of joints** and/or **minor roadway settlement**.

Feasible actions: 1) DN
2) Rehab unit

Condition State 4 **Major** deterioration, **spalling, cracking, major distortion, deflection settlement, or misalignment of the barrel** may be in evidence. **Major separation of joints** may have occurred. **Holes may exist in floors and walls. Settlement of roadway** may have occurred.

Feasible actions: 1) DN
2) Rehab unit
3) Replace unit

Units: LF of Culvert

This element defines all timber box culverts. Report the estimated number of linear feet in each of Condition States 2 through 4. If fasteners are the controlling element, estimate the percentage of connections in each condition state and use the corresponding percentage of total linear feet for measurement. The number of units in Condition State 1 will be the remainder of the units after deducting those in Condition States 2 through 4.

CDOT Notes: All measurements are linear feet along the length of each cell of a CBC, pipe, or arch, not along the center line of the roadway.

GCD24 - The length of culvert inspected and reported shall be to the ROW boundary or other known limits of CDOT or entity ownership.

GCD25 - Report the height of fill on bridges and culverts and write it on the inventory sheet so NBI Item66T can be appropriately coded.

Condition State 1 The timber and fasteners are in sound condition.

Feasible actions: 1) DN

Condition State 2 There may be **minor decay and weathering. Corrosion at fasteners and connections may have begun.** There is little or no distortion and/or deflection.

Feasible actions: 1) DN
2) Rehab unit

Condition State 3 There may be **significant decay, weathering and warped or broken timbers. Significant decay and corrosion at fasteners and connections** may be evident. **Minor to moderate distortion** of the culvert may exist. There is little or no roadway settlement.

Feasible actions: 1) DN
2) Rehab unit

Condition State 4 There may be **major decay and many warped, broken or missing timbers.** There is **major decay and corrosion at fasteners and connections. Major distortion or deflection** of the culvert may exist. There may be minor to major roadway settlement.

Feasible actions: 1) DN
2) Rehab unit
3) Replace unit

Units: LF of Culvert

This element defines all culverts not included under the metal, concrete or timber culvert elements. It will include masonry construction and combinations of other materials. Report the estimated number of linear feet in each of Condition States 2 through 4. The number of units in Condition State 1 will be the remainder of the units after deducting those in Condition States 2 through 4.

CDOT Notes: All measurements are linear feet along the length of each cell of a CBC, pipe, or arch, not along the center line of the roadway.

GCD24 - The length of culvert inspected and reported shall be to the ROW boundary or other known limits of CDOT or entity ownership.

GCD25 - Report the height of fill on bridges and culverts and write it on the inventory sheet so NBI Item66T can be appropriately coded.

Condition State 1 There is little or no deterioration. **Surface defects only** are in evidence. There are no scour or misalignment problems.

Feasible actions: 1) DN

Condition State 2 There may be **minor deterioration, cracking and misalignment.**

Feasible actions: 1) DN
2) Rehab unit

Condition State 3 **Moderate to major** deterioration and **cracking and/or minor to moderate distortion** or deflection has occurred. There is little or no roadway settlement.

Feasible actions: 1) DN
2) Rehab unit

Condition State 4 **Major distortion, deflection, settlement or misalignment and/or major deterioration affecting structural integrity** may have occurred. Settlement of roadway has occurred.

Feasible actions: 1) DN
2) Rehab unit
3) Replace unit