Element Data Collection Manual

2007

NOTES

ACKNOWLEDGEMENTS

Additional elements and comments have been added to assist inspectors in coding conditions observed in the field. These comments and elements were based on Virginia's experience and were collected from Central Office and District bridge personnel.

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[V] Denotes Virginia specific elements.
[S] Denotes Virginia sub-elements.

ELEMENT TABLE (element number)

SUPERSTRUCTURE

	Units	STEEL UNCOAT	STEEL COATED	P/S CONC	REINF. CONC	TIMBER	OTHER
Closed Web/Box Girder	LF	101	102	104	105		
Open Girder/Stringer	LF	106	107	109	110	111	
Open Girder/stringer with timber deck	LF	108	108				
Stringer (stringer/floorbeam system)	LF	112	113	115	116	117	
Thru Truss (Bottom Chord)	LF	120	121				
Thru Truss (Excluding Bottom Chord)	LF	125	126				
Deck Truss	LF	130	131				
Timber Truss/Arch	LF					135	
Arch	LF	140	141	143	144		145
Cable (not embedded in concrete)	EA	146	147				
Floor Beam	LF	151	152	154	155	156	
Pin and Hanger Assembly	EA	160	161				

SUBSTRUCTURE

	Units	STEEL UNCOAT	STEEL COATED	P/S CONC	REINF. CONC	TIMBER	OTHER
Column or Pile Extension	EA	201	202	204	205	206	
Pier Wall	LF				210		211
Abutment	LF				215	216	217
Wingwall	LF				295	296	297
Submerged Pile Cap/Footing	EA				220		
Submerged Pile	EA	225		226	227	228	
Cap	LF	230	231	233	234	235	
Culvert	LF	240			241	242	243

OTHER SUPER / SUB

	Units	METAL UNCOAT	METAL COATED	P/S CONC.	REINF. CONC.	TIMBER	OTHER
Strip Seal Expansion Joint	LF						300
Pourable Joint Seal	LF						301
Compression Joint Seal	LF						302
Assembly Joint/Seal (Modular)	LF						303
Open Expansion Joint	LF						304
Elastomeric Bearing	EA						310
Movable Bearing (roller, sliding, etc.)	EA						311
Enclosed/Concealed Bearing	EA						312
Fixed Bearing	EA						313
Pot Bearing	EA						314
Disk Bearing	EA						315
Approach Slab	EA			320	321		
Bridge Railing	LF	330	334		331	332	333
Sidewalk	LF		98		92	94	

(continued)

ELEMENT TABLE (element number). (continued)

DECKS/SLABS

	Units	DECKS	SLABS
Concrete (Bare)	EA	12	38
Concrete Covered with Fill	EA		738
Concrete Unprotected w/AC	EA	13	39
Concrete Protected w/AC Overlay	EA	14	40
Concrete w/Thin Overlay	EA	18	44
Concrete w/Rigid Overlay	EA	22	48
Concrete w/Coated Bars	EA	26	52
Concrete w/Cathodic Protection	EA	27	53
Open Grid - Steel	EA	28	
Concrete Filled Grid - Steel	EA	29	
Corrugated/Orthotropic/Etc.	EA	30	
Timber (Bare)	EA	31	54
Timber w/AC Overlay	EA	32	55

SMART FLAGS

	Units	
Slope - Protected	EA	285
Slope - Unprotected	EA	286
Culvert Endwall/Headwall	EA	298
Culvert Wingwall	EA	299
Steel Fatigue	EA	356
Pack Rust	EA	357
Deck Cracking	EA	358
Soffit of Deck	EA	359
Settlement	EA	360
Scour	EA	361
Traffic Impact	EA	362
Section Loss	EA	363
Utilities	EA	701
Drains	EA	702
Lighting	EA	703
Roadway over Culvert	EA	704
Underside of Overhang	EA	706
Soffit w/ SIP Forms	EA	707
Debris in Channel	EA	708
Structure Replacemenrt	EA	709
Deck Replacement	EA	710

OTHER	Units	
MSE Abutment	LF	444
MSE Wingwall/Retaining Wall	LF	445

INTRODUCTION TO BRIDGE MANAGEMENT SYSTEMS AND PONTIS

BRIDGE MANAGEMENT SYSTEM

Why are Bridge Management Systems Needed

Available funding is insufficient to address all the bridge needs. Wise management of the bridge inventory is required to ensure the best use of limited resources. A key bridge management system concept is that the best action for an individual bridge may not be the best action for the entire inventory when faced with limited resources. Bridge failures cannot be tolerated. However, safety, preservation of investment and uninterrupted service must be included in any management decision process. A bridge management system (BMS) provides the tools to consider where and when to best spend funds.

A Brief History of Bridge Management

In the late 1960s/early 1970s, the National Bridge Inventory (NBI) was created and the National Bridge Inspection Standards (NBIS) were introduced. To assist the states in meeting this goal, a *Recording and Coding Guide for the Structure Inventory and Appraisal of the Nation's Bridges* was written. Since then, the requirements for bridge inspections have basically remained unchanged. The Federal Highway Administration (FHWA) continues to use the data collected during bridge safety inspections to determine the extent of a state's eligibility for federal funding for its bridge programs.

In the 1980s, concerns were raised about whether use of the NBI was resulting in the most economically realistic needs in view of the limited funds available. In 1985, the FHWA initiated a two-phase demonstration project to refine the concept of BMS. Phase one called for a review of existing state BMS practices and a synthesis of fundamental elements of a national BMS. Phase two developed a computer tool that any state could use to manage its bridge inventory. This tool eventually was called Pontis.

The Needs of a Bridge Management System (BMS)

A good BMS is a comprehensive database of bridge, traffic, cost and safety data and an ongoing program for data collection and an analytical tool to systematically yield a network-level analysis and optimization of bridge data. Unlike the way engineers handled the bridge program in the past, we now need to look at network and project level programs. The major difference is that network-level analysis deals with the entire bridge inventory whereas project-level analysis looks at single bridges. Network analysis is geared at overcoming the traditional practice of examining projects one at a time, in isolation from one another. It provides an initial indication of the best action to take for each bridge to promote the health of the network.

Using a bridge management system, a transportation agency should be able to:

(1) predict deterioration with and without intervening actions;
(2) identify feasible actions to improve condition, safety, or the ability of an element to function as intended;
(3) estimate costs and savings;
(4) determine maintenance strategies;
(5) optimize a program over a specified period with limited funds; and
(6) generate reports quantifying bridge needs for use by legislative budget makers.

NBI Compatibility

The adoption of BMS does not change the federal requirements to submit NBI data. The FHWA has no plans to change the NBI or the way in which federal funding is allocated. Therefore, all NBI data are still required.

The Role of Bridge Inspectors

A good bridge database and a functional bridge management system are entirely dependent on good bridge inspection data. A bridge inspector needs to be familiar with the concept of breaking a bridge down into its component elements and assigning a condition state to each element based generally on visual observations and the condition state language provided in this manual.

PONTIS

Pontis is a database containing bridge condition data, traffic needs, accident data, maintenance, improvement and replacement costs, available money, etc. From all this data, a prioritized list of bridge needs can be produced that optimizes the limited funds available. Pontis, from the Latin *pons* (bridge), differs from the existing NBI inspection program and the system for prioritizing bridge needs currently being used. The description of the condition of the individual bridge components is more detailed and the Pontis program will analyze all the related data with respect to the entire network, or family, of bridges in the inventory.

Information is collected on elements that have predictable deterioration rates that are important for the deterioration models used in Pontis.

Element Level Data Inspection

Under the NBI inspection program, bridge components or items are coded with an inspection rating of ‘0’ (worst) through ‘9’ (best). The guidelines of the NBIS require inspectors to give an **average** rating to provide an overall indication of the general condition of the **entire** component being rated. Pontis looks at things differently with ‘1’ being the best and 3’, 4’, or ‘5’ being the worst depending on the particular element. Then, rather than an average rating, bridge elements are rated in quantitative units so that an inspector rates the entire element for the NBIS and subdivides it into various condition states for Pontis.

An element is a major component of a bridge (such as abutments, girders, piles, caps, etc.) that can be further subdivided by material type (such as prestressed concrete, timber, weathering steel, etc.). Elements have defined deterioration rates and units that are descriptive and easily measured. Each bridge will not have **all** the possible elements, and more likely will have under a dozen. Each element has a set of defined condition states. There are at least three states and at most five states for each element. These states range from “new” to “badly deteriorated.” Condition state language is **not** an attempt to define an element as good, fair or poor.

In addition to the condition of a bridge element, its environment, the effects of traffic and the effects of aging govern its rate of deterioration. To relate these environmental effects, each element of a bridge is placed in one of four categories:

- **Benign** - Neither environmental factors nor operating practices are likely to change the condition of the element over time.
- **Low** - Environmental factors or operating practices do not adversely affect condition of the element.
- **Moderate** - Changes in element condition are normal as measured against environmental factors and/or operating practices.
- **Severe** - Environmental factors or operating practices contribute to the rapid decline in the condition of the element.

It is reasonable that an element can have multiple condition states. A good example of this is beam-ends. Assume there are 4 girders, each 100 feet long (a total of 400 LF) and only the beam-ends have advanced deterioration due to joint leakage. The entire 400 LF would not be coded in condition state 4 but only a portion of the total amount under the open joint. Also, the deterioration does not have to be on every beam or at each end. Importantly, **a rating quantity of less than 1% of the total quantity should not be recorded. Pontis does not track a quantity less than 1% of the total amount for an element**.

Commonly Recognized (CoRe) Elements

CoRe elements are those that are common to bridges nationwide. CoRe elements have consistent definitions, condition state language, and units of measure, and contribute to the NBI condition ratings (if the translator is used).

A task force of 6 states (Minnesota, Oregon, Colorado, California, Virginia, and Washington) along with the FHWA developed the idea of using common bridge elements so data can be shared or reported nationally. In June 1993, the task force issued its final report. In it, they defined CoRe elements, sub-elements and smart flags. The FHWA has chosen to use this report as interim guidance for element level inspection.

CoRe elements will be consistent nationwide for condition state language, units of measure and relationship to the NBI. These are a standard list of bridge elements, units of measure, condition states and feasible actions which would facilitate data sharing for costs and deterioration rates and patterns.

A translator program has been issued by FHWA that converts appropriate Pontis CoRe element level data to the corresponding NBIS condition ratings. The University of Colorado and FHWA developed this conversion program to simplify the transition from Pontis to NBIS ratings. The FHWA translator program accesses the Pontis database and uses CoRe elements, sub-elements, and Smart Flags. At this time Virginia does not use the translator program.

Sub-Elements

A transportation agency can choose to add sub-elements. However, sub-elements must relate directly to a specific CoRe element. In order to be considered a sub-element, the following criteria must be met:

(1) the condition state language and feasible actions must remain the same as the parent CoRe element

(2) the units of measure must remain the same as its parent CoRe element. Sub-elements are used in the NBIS translator program and are treated as CoRe elements. Sub-elements may be used if the physical size, location and environment are different, or if there are expected differences in deterioration rates or Maintenance, Repair & Rehabilitation (MR&R) costs within the parent CoRe element.

Smart Flags

Smart flags are another feature of Pontis that is different from the NBI program. These "flags" look and operate like an element. They can be used to model specific problems or areas that do **not** exhibit a logical pattern of deterioration. Smart Flags do not have feasible actions associated with them. Therefore, they have no impact on the MR&R optimization models run by Pontis. However, Smart Flags are necessary for accurate NBI translation. Smart Flags are to be used to track distresses not included in the CoRe condition state language. When reading over the condition state language of any element in the manual, it should be noted that it is written for a specific type of deterioration. For example, look at Element No. 334 "Coated Metal Bridge Railing" in the manual. Note the condition state language is concerned with the condition of the coating system but does not address other problems with the rail system.

The descriptions and condition state language for Smart Flags can be found in this manual. Currently eight Smart Flags (units: each) have been established for national use:

- Steel fatigue
- Pack rust
- Deck cracking
- Soffit (underside of deck)
- Settlement
- Scour
- Traffic impact
- Section loss

Non-CoRe Elements

Non-CoRe elements are items that a transportation agency can add to its Pontis database for conditions or situations that are unique to its bridges or to a specific bridge. Also, this type of element is used for other non-major components of any bridge. Non-CoRe elements have condition state language and units of measure just as CoRe elements do. However, they are not used in the NBIS translator program.

Examples of non-CoRe elements used in Virginia include:

- Slope protection
- Wingwalls
- Sidewalks

In addition, Virginia has added the following smart flags:

- Utilities
- Drains
- Lighting
- Roadway over Culvert
- Underside of deck overhang
- Soffit for use with stay in place forms
- Debris in Channel
- Structure Replacement

Element Level Rating Examples

Example No. 1

Description of Bridge

This is a two-span, simply supported, rolled steel multi-beam bridge, with each span consisting of six beams. Two abutments and one pier support two spans constructed of reinforced concrete. The bridge has a deck width of 24 ft., no skew and structure length of 144 ft. This structure carries two lanes of traffic on Beaver Creek Road over the tributary to Beaver Creek.

Calculating the Quantities

Beams
144 ft. x 6 beams = 864 LF

Deck
144 ft. (span) x 24 c/c = 3,456 SF

Expansion Bearings
12 EA

Bridge Railings
144 ft. x 2 = 288 LF

Fixed Bearings
12 EA

Pier
24 LF

Abutments
26 ft. x 2 Abutments = 52 LF

Joints
3 joints x 24 ft = 72 LF

Summary of Condition States

- Top of the deck has delaminated concrete and several spalls with exposed rebar covering approximately 13% of the deck surface.
- Bridge railing is in good condition with no deficiencies.
- Expansion joints are clean and functional.
- Bottom of deck shows random areas of hairline cracking with rust stains and efflorescence.
- Minor pitting to a depth of 1/16 inch and paint scaling typical on all bottom flanges of the beams. Top flanges are in good condition with the exception of areas near the end diaphragm connections where approximately 6 inches on each side of the connection from top to bottom exhibits 1/16 inch section loss.
- Cover plate end welds at three locations exhibited 4 inch long hairline cracks.
- End diaphragms are showing pitting up to 1/16 inch depth. All diaphragms exhibit heavy corrosion with steel flaking with no significant section loss.
- Bearings are in fair condition with a minor build-up of pigeon droppings around the base plates causing a failure of the paint system.
- Abutment A has a full height vertical crack between beams No. 3 and No. 4. This crack varies in width from 1/16 inch to 1/8 inch.
- Abutment B is in good condition, with no deficiencies.
- Pier is in good condition, with no deficiencies.
- Abutment B has scour along the breastwall 28 feet long, 7 feet wide and 4 feet deep.
- Upstream end of pier - build-up of sediment and debris 40 feet wide by 4 feet high.

Using the descriptions provided above and the condition state language for each appropriate element, data is recorded on a form such as the one shown below.

BMS FIELD INSPECTION FORM

ELEM DESCRIPTION	Env	QUANTITY	Units	COND STATE QUANTITY				
CoRe/Non-CoRe Elements				1	2	3	4	5
#12 - Concrete Deck	3	1 (3456 sf)	EA				1 (3456)	
#107 - Coated Stl Girder	3	864	LF				864	
#210 - R.C. Pier Wall	3	24	LF	24				
#215 - R.C Abutment	3	52	LF	51	1			
#301 - Pourable Joint	3	72	LF	72				
#311 - Movable Brgs.	3	12	EA		12			
#313 - Fixed Brgs.	3	12	EA		12			
#330 - Metal Railing	3	288	LF	288				
Smart Flags								
#356 - Steel Fatigue	3	1	EA		1			
#359 - Soffit	3	1	EA				1	
#361 - Scour	3	1	EA		1			

In the above example, a quantity was recorded in condition state 1 where appropriate. If condition state 1 is left blank, Pontis will assume the quantity to be the portion not assigned to other condition states. In other words, Pontis will subtract any quantities coded in condition states 2 through 5 from the total quantity and put any remaining quantity in condition state 1.

Example No. 2

Description of Bridge

This is a single span adjacent box beam bridge with a span length of 38 feet, a clear deck width of 26 feet and no skew. The cross section consists of seven beams and measures 28 feet out-to-out. The top flanges of the boxes are exposed as there is no applied wearing surface.

Calculating the Quantities

Deck
38 ft. (span) x 26 ft. c/c = 988 SF

Bridge Rail
38 ft. span x 2 = 76 LF

Beams
38 ft. span x 7 beams = 266 LF

Abutments
28 ft. x 2 Abutments = 56 LF

Summary of Condition States

- Full width hairline transverse cracks can be found in the exposed top flange of Beam no. 6 for its full length as follows: Beam no. 3 for 4 LF from Abutment B, Beam no. 2 for 6 LF from Abutment B and Beam no. 4 for 3 LF from Abutment A. Typical crack spacing is 18 inches. The entire surface exhibits scaling less than 1/8" deep. Joint spaces between the beams were filled with road dirt.
- The metal bridge rail exhibits one 6 LF section which is partially detached from the support post.
- Full width hairline transverse flexure cracks can be found in the center 6 feet at the bottom flange of box beams no. 2 thru 5. The joints between the box beams leak, but there is no sign of rust stains or reinforcement damage.
- There is a 3/8 inch wide longitudinal crack in the bottom flange of Beam no. 6. The crack extends from Abutment A for 15 LF toward midspan. There is 15 SF of spalling around the longitudinal crack.
- The bearing seat under Beam no. 3 at Abutment A is spalled 4 inches deep for the full width of the beam. There is no reinforcing steel exposed. There is 15% loss of bearing in this area.
- The masonry stems and wingwalls are generally solid and intact with all joint mortar in place. One three foot stone in the stem of Abutment A exhibits hairline cracking and is weathered on the exposed surface. Abutment B stem exhibits a full-height, 1/16 inch wide crack under Beam #3, which extends through the masonry and concrete apron.
- Approximately 5 LF of the downstream corner of Abutment B exhibits a scour hole 10 feet in diameter and 3 feet deep which extends beneath the footing apron and approximately 1 foot of the abutment footing. The apron along the downstream wing exhibits a 1 inch wide crack due to settlement of the corner masonry of 1/16 inch.

BMS FIELD INSPECTION FORM

ELEM DESCRIPTION	Env	QUANTITY	Units	COND STATE QUANTITY				
CoRe/Non-CoRe Elements				1	2	3	4	5
#12 - Concrete Deck	3	1 (988 sf)	EA	1 (988)				
#330 - Metal Railing	3	76	LF	70			6	
#104 - P/S Concrete Closed Web Box Girder	3	266	LF	191	24	15		
#217 - Other Abutment	3	56	LF	50	4		2	
Smart Flags								
#358 - Deck Cracking	3	1	EA	1				
#360 - Settlement	3	1	EA		1			
#361 - Scour	3	1	EA		1			

Uncoated Steel/Metal - Elements

ELEMENT DESCRIPTION

101 Steel Closed Web/Box Girder - Uncoated (LF)

106 Steel Open Girder - Uncoated (LF)
Includes two girder systems as well as rolled beams on multiple beam spans.

108[V] Steel Open Girder with Timber Deck – Coated and Uncoated (LF)
Includes two girder systems as well as rolled beams on multiple beam spans.
This Element includes both coated and uncoated steel.

112 Steel Stringer - Uncoated (LF)
Stringers are those elements that support the deck in a stringer-floor beam system.

120 Steel Bottom Chord of Through Truss - Uncoated (LF)
Includes Pony trusses.

125 Steel Through Truss excluding bottom chord - Uncoated (LF)
Includes Pony trusses.

130 Steel Deck Truss - Uncoated (LF)
All members as well as the bottom chord.

140 Steel Arch - Uncoated (LF)
All members of steel arches.

146 Steel Cable - Uncoated (not embedded in concrete) (EA)
Post-tensioned structures, stays and suspension bridges.

151 Steel Floor Beam - Uncoated (LF)

160 Steel Pin and/or Pin & Hanger Assembly - Uncoated (EA)
Steel pin and hanger assemblies not coated or constructed of weathering steel or stainless steel.

201 Steel Column or Pile Extension - Uncoated (EA)

225 Steel Submerged Pile (EA)
Elements continuously submerged and are visible for inspection. The exposure may be intentional or caused by scour.

230 Steel Pier Cap - Uncoated (LF)

330 Metal Bridge Railing - Uncoated (LF)
All types and shapes of metal bridge railing that is neither painted nor coated (steel, aluminum, metal beam, rolled shapes, etc.).

NOTES:

a) The term ‘Steel’ above also applies to all metal i.e. wrought iron, cast iron, aluminum, etc.
b) Uncoated steel includes those elements constructed of weathering steel.
c) Weathering steel elements that have been completely coated should be coded as the appropriate coated steel element.
d) If only one side and/or just the ends of a weathering steel element are coated (e.g., the exterior face of a girder), the element should be considered uncoated steel.
e) Galvanized or metallized steel shall be considered coated steel.
f) See the back of this manual for definitions and guidance on coding ‘Steel Diaphragms/Cross Frames’ that are a part of a curved girder system.

(continued)

Uncoated Steel/Metal - Elements

NOTES: (continued)

g) When backwalls or bearing seats consist of a material different from the primary material of the substructure unit, the condition of the backwall or the bearing seat will not be tracked using a Pontis element or smart flag.
h) For Steel Open Girders with a Timber Deck use Element 108 which is for both coated and uncoated steel
i) See the back of this manual for definitions and guidance on quantity.

Uncoated Steel/Metal - Condition States

CONDITION STATE DESCRIPTIONS

1 There is little or no corrosion of the uncoated steel.
Weathering steel is coated uniformly and remains in excellent condition.
Oxide film of weathering steel is tightly adhered.
For uncoated cables, the strand and anchor sockets show no signs of distress.

2 Surface rust or surface pitting has formed or is forming on the uncoated steel.
However, the weathering steel has not corroded beyond design limits.
Weathering steel color is yellow orange to light brown.
Oxide film has a dusty to granular texture.
For uncoated cables, the strand and anchor sockets show no signs of distress.

3 Steel has measurable section loss due to corrosion but does not warrant structural analysis.
Weathering steel is dark brown or black.
Oxide film is flaking.
For uncoated cables, the cable banding, if any, may show some loosening or slipping.
For uncoated cables, the cable anchor devices may be loosening.

4 Corrosion is advanced.
Oxide film has a laminar texture with thin sheets of rust.
For uncoated cables, the cable strands or wires may be broken or severely abraded.
For uncoated cables, the anchors may show signs of slippage.
Section loss is sufficient to warrant structural analysis.
Also code Element 363 (Section Loss).

NOTES:

a) If a Steel Pin and/or Pin and Hanger Assembly has a catcher beam, the catcher beam should not influence the condition state selected for the pin and/or pin and hanger assembly.

b) If the ability of the bridge railing to function as intended is affected by damaged posts or unsupported rail, code as Condition State 4. Record the lineal feet of bridge rail affected by defective or missing post(s).

Coated Steel/Metal - Elements

ELEMENT DESCRIPTION

98[V] Steel Sidewalk, Open Grid - Coated (LF)
Sidewalks protected with coating, galvanizing, etc., which are 3' wide or greater. This 3' dimension distinguishes the sidewalk from the safety curb.

102 Steel Closed Web/Box Girder - Coated (LF)

107 Steel Open Girder - Coated (LF)
Includes two girder systems as well as rolled beams on multiple beam spans.

108[V] Steel Open Girder with Timber Deck – Coated and Uncoated (LF)
Includes two girder systems as well as rolled beams on multiple beam spans. This Element includes both coated and uncoated steel.

113 Steel Stringer - Coated (LF)
Stringers are those elements that support the deck in a stringer-floor beam system.

121 Steel Bottom Chord of Through Truss - Coated (LF)
Includes Pony trusses.

126 Steel Through Truss excluding bottom chord - Coated (LF)
Includes Pony trusses.

131 Steel Deck Truss - Coated (LF)
Includes all members as well as the bottom chord.

141 Steel Arch - Coated (LF)
Includes all members of steel arches.

147 Steel Cable (not embedded in concrete) - Coated (EA)

152 Steel Floor Beam - Coated (LF)

161 Steel Pin and/or Pin & Hanger Assembly - Coated (EA)

202 Steel Column or Pile Extension - Coated (EA)

231 Steel Pier Cap - Coated (LF)

334 Metal Bridge Railing - Coated (LF)
All types and shapes of metal bridge railing (steel, aluminum, metal beam, rolled shapes, etc.) that is coated with paint or protected with galvanizing or some other coating.

NOTES:

a) The term 'Steel' above also applies to all metal i.e. wrought iron, cast iron, aluminum, etc.
b) Weathering steel elements that have been completely coated should be coded as the appropriate coated steel element.
c) If only one side and/or just the ends of a weathering steel element are coated (e.g., the exterior face of a girder), the element should be considered uncoated steel.
d) Galvanized or metallized steel shall be considered coated steel.
e) See the back of this manual for guidance on coding 'Steel Frames'.
f) See the back of this manual for definitions and guidance on coding 'Steel Diaphragms/Cross Frames' that are a part of a curved girder system.
g) See the back of this manual for definitions and guidance on quantity.
h) When backwalls or bearing seats consist of a material different from the primary material of the substructure unit, the condition of the backwall or the bearing seat will not be tracked using a Pontis element or smart flag.

Coated Steel/Metal - Condition States

CONDITION STATE DESCRIPTIONS

1 There is no evidence of active corrosion and the coating system is sound and functioning as intended.
For coated cables, the protective coating is sound and functioning as intended,
For coated cables, the strand and anchor sockets show no signs of distress.

2 There is little or no active corrosion.
Surface or freckled rust has formed or is forming.
The coating system may be chalking, peeling, curling or showing other early evidence of coating system distress but there is no exposure of metal.
For coated cables, the strand and anchor sockets show no signs of distress.

3 Surface or freckled rust is prevalent.
There may be exposed metal but there is no measurable section loss caused by active corrosion.
For coated cables, protective system is no longer effective.
For coated cables, the strand and anchor sockets show no signs of distress.

4 Corrosion is present.
Section loss due to active corrosion does not warrant structural analysis.
For coated cables, the cable banding, if any, may show some loosening or slippage.
For coated cables, the cable anchor devices may be loosening.
Also code Element 363 (Section Loss).

5 Corrosion is advanced.
Section loss due to active corrosion is sufficient to warrant structural analysis.
For coated cables, the cable strands or wires may be broken or severely abraded.
For coated cables, the anchors may show signs of slippage.
Also code Element 363 (Section Loss).

NOTES:

a) If the steel was pitted but was thoroughly cleaned and recoated, and the coating is holding up well, the condition code **shall be increased** to a better code. This is due to the fact the condition state rates, for the most part, the protective system. Element 363 - 'Section Loss' will require coding.
b) If the ability of the bridge railing to function as intended is affected by damaged posts or unsupported rail, code as Condition State 5. Record the lineal feet of bridge rail affected by defective or missing post(s).
c) Poor condition coating on one portion of a girder (such as the bottom flange) means that the entire linear feet of beam in that area can be rated to the condition of the worst portion.
d) If a Steel Pin and/or Pin and Hanger Assembly has a catcher beam, the catcher beam should not influence the condition state selected for the pin and/or pin and hanger assembly.

Prestressed (P/S) Concrete - Elements

ELEMENT DESCRIPTION

104 P/S Concrete Voided and Unvoided Closed Web/Box Girder (LF)
Note that a deck element must be coded anytime Element 104 is used.

109 P/S Concrete Open Girder (LF)

115 P/S Concrete Stringer (LF)
Stringers are those elements that support the deck in a stringer-floor beam system.

143 P/S Concrete Arch (LF)
All members of P/S concrete arches.

154 P/S Concrete Floor Beam (LF)

204 P/S Concrete Column or Pile Extension (EA)

226 P/S Concrete Submerged Pile (EA)
Elements continuously submerged and are visible for inspection. The exposure may be intentional or caused by scour.

233 P/S Concrete Pier Cap (LF)

NOTE:

a) See the back of this manual for definitions and guidance on quantity.

b) When backwalls or bearing seats consist of a material different from the primary material of the substructure unit, the condition of the backwall or the bearing seat will not be tracked using a Pontis element or smart flag. For example: A timber backwall or a timber bearing seat on a concrete abutment will not be tracked using a Pontis element or a smart flag.

Prestressed (P/S) Concrete - Condition States

CONDITION STATE DESCRIPTIONS

1 Little or no deterioration.
There may be discoloration, efflorescence, and/or superficial cracking but without affect on strength and/or affecting the ability of the element to function as intended.

2 Minor deterioration.
Hairline cracks & spalls may be present and there may be exposed reinforcing with no evidence of corrosion.
There is no exposure of the prestressed system.

3 Moderate deterioration.
Some delaminations and/or spalls may be present.
There may be minor exposure but no deterioration of the prestressed system.
Corrosion of non-prestressed reinforcement may be present but loss of section is incidental and does not warrant structural analysis.

4 Advanced deterioration.
Delaminations, spalls and corrosion of non-prestressed reinforcement are prevalent.
There may also be exposure and deterioration of the prestressed system (manifested by loss of bond, broken strands or wire, failed anchorages, etc).
There is sufficient concern to warrant structural analysis.

NOTES:
a) Any cracks should be carefully measured and their location, length, and width documented.

Reinforced Concrete - Elements

ELEMENT DESCRIPTION

92[V] Reinforced Concrete Sidewalk (LF)
Sidewalks that are 3 feet wide or greater. This dimension distinguishes the sidewalk from the safety curb.

105 Reinforced Concrete Voided and Unvoided Closed Web/Box Girder (LF)
Note that a deck element must be coded anytime Element 105 is used.

110 Reinforced Concrete Open Girder (LF)
Includes deck girders, T-girders and Through girders.

116 Reinforced Concrete Stringer (LF)
Stringers are those elements that support the deck in a stringer-floor beam system.

144 Reinforced Concrete Arch (LF)
All members of concrete arches. See examples in the back of this manual.

155 Reinforced Concrete Floor Beam (LF)

205 Reinforced Concrete Column or Pile Extension (EA)

210 Reinforced Concrete Pier Wall (LF)
Use this element anytime the pier supporting member is 10' feet or greater in width.

215 Reinforced Concrete Abutment (LF)
There are special considerations that must be followed when calculating the quantity of an abutment with integral and non-integral wings. See examples in the back of this manual.

220 Reinforced Concrete Submerged Pile Cap/Footing (EA)
Elements continuously submerged and are visible for inspection. The exposure may be intentional or caused by scour.

227 Reinforced Concrete Submerged Pile (EA)
Elements continuously submerged and are visible for inspection. The exposure may be intentional or caused by scour.

234 Reinforced Concrete Pier Cap (LF)

295[V] Reinforced Concrete Wingwalls (LF)
Wingwall(s) on a bridge abutment.
There are special considerations that must be followed when calculating the quantity of integral and non-integral wings. See examples in the back of this manual.

331 Reinforced Concrete Bridge Railing (LF)

NOTE:

a) All non-reinforced concrete should be coded using the appropriate reinforced element.
b) Concrete Frames - See the back of this manual for guidance on this type of structure.
c) See the back of this manual for definitions and guidance on quantity.
d) When backwalls or bearing seats consist of a material different from the primary material of the substructure unit, the condition of the backwall or the bearing seat will not be tracked using a Pontis element or smart flag. For example: A timber backwall or a timber bearing seat on a concrete abutment will not be tracked using a Pontis element or a smart flag.

Reinforced Concrete - Condition States

CONDITION STATE DESCRIPTIONS

1 Little or no deterioration.
There may be discoloration, efflorescence, and/or superficial cracking without affect on strength and/or ability to function as intended.

2 Minor deterioration.
Minor cracks, and spalls may be present but there is no exposed reinforcing or surface evidence of rebar corrosion.
Some movement or tilt of the wingwall(s) has occurred but does not affect the stability of the slope.

3 Moderate deterioration.
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 warrant structural analysis.
Some movement or tilt of the wingwall(s) has occurred and the stability of the slope or the wingwall is being compromised.

4 Advanced deterioration.
Corrosion of reinforcement and/or loss of concrete section are sufficient to warrant structural analysis.
Significant movement or tilt of the wingwall(s) has occurred and the stability of the slope or the wingwall is compromised.

NOTES:
a) If the ability of the bridge railing to function as intended is affected by damaged posts or unsupported rail, code as Condition State 4. Record the lineal feet of bridge rail affected by defective or missing post(s).

Timber - Elements

ELEMENT DESCRIPTION

94[V] Timber Sidewalk (LF)
Sidewalks that are 3 feet wide or greater. This dimension distinguishes the sidewalk from the safety curb.

111 Timber Open Girder (LF)

117 Timber Stringer (LF)
Stringers are those elements that support the deck in a stringer-floor beam system.

135 Timber Truss or Arch (LF)

156 Timber Floor Beam (LF)

206 Timber Column or Pile Extension (EA)
This item includes soldier piles used as wings.

216 Timber Abutment (LF)
There are special considerations that must be followed when calculating the quantity of an abutment with integral and non-integral wings. See examples in the back of this manual.

228 Timber Submerged Pile (EA)
Elements that are continuously submerged and are visible for inspection. The exposure may be intentional or caused by scour.

235 Timber Pier Cap (LF)

296[V] Timber Wingwalls (LF)
Wingwall(s) on a bridge abutment.
There are special considerations that must be followed when calculating the quantity of integral and non-integral wings. See examples in the back of this manual.

332 Timber Bridge Railing (LF)

NOTES:

a) These elements are inclusive of all timber elements including but not limited to solid, glue-laminated, stress-laminated and nail-laminated timbers.
b) See the back of this manual for definitions and guidance on quantity.
c) When backwalls or bearing seats consist of a material different from the primary material of the substructure unit, the condition of the backwall or the bearing seat will not be tracked using a Pontis element or smart flag. For example: A timber backwall or a timber bearing seat on a concrete abutment will not be tracked using a Pontis element or a smart flag.

Timber - Condition States

CONDITION STATE DESCRIPTIONS

1 No decay detected.
There may be superficial defects having no affect on strength or the ability of the element to function as intended.

2 Minor deterioration.
Decay, insect/marine borer infestation, crushing or other defect may exist but none is sufficiently advanced to affect strength of the element or the ability of the element to function as intended.

3 Moderate deterioration.
Decay, insect/marine borer infestation, crushing or other defect has produced loss of strength or deflection but is incidental and does not warrant structural analysis.
For Timber Bridge Railing, the defects and/or damage have produced loss of strength that may affect the ability of the element to function as intended.

4 Advanced deterioration.
Decay, insect/marine borer infestation, crushing or other defect has produced loss of strength or deflection that is sufficient to warrant structural analysis.
This condition state does not apply to Timber Bridge Railing.

NOTES:
a) If the ability of the Timber Bridge Rail to function as intended is affected by damaged posts or unsupported rail, code as Condition State 3. Record the lineal feet of rail affected by the defective or missing post(s).

Other Material - Elements

ELEMENT DESCRIPTION

145 Other Material Arch (LF)
All members of an arch.

211 Other Material Pier Wall (LF)
Use the pier wall element anytime the pier supporting member is 10' feet or greater in width.

217 Other Material Abutment (LF)
There are special considerations that must be followed when calculating the quantity of an abutment with integral and non-integral wings. See examples in the back of this manual.

297[V] Other Material Wingwalls (LF)
Wingwall(s) on a bridge abutment.
There are special considerations that must be followed when calculating the quantity of integral and non-integral wings. See examples in the back of this manual.

333 Combination/Miscellaneous Bridge Railing (LF)
All bridge railing composed of combinations of metal, concrete or timber. This also covers other single material rails not previously defined.

NOTES:

a) This section covers those materials not previously defined i.e. stone masonry, reinforced fiber polymer (RFP), etc.
b) See the back of this manual for definitions and guidance on quantity.
c) When backwalls or bearing seats consist of a material different from the primary material of the substructure unit, the condition of the backwall or the bearing seat will not be tracked using a Pontis element or smart flag. For example: A timber backwall or a timber bearing seat on a concrete abutment will not be tracked using a Pontis element or a smart flag.

Other Material - Condition States

CONDITION STATE DESCRIPTIONS

1 There is little or no deterioration.

2 Minor deterioration.
There may be minor deterioration, cracking, corrosion, decay and weathering.
Mortar in joints may show minor deterioration.
Some movement, tilt or bulging of wingwall(s) may have occurred with little or no affect on the slope or the backfill material.

3 Moderate deterioration.
For Miscellaneous Bridge Railing
Advanced deterioration, defects and/ or damage is sufficient to warrant analysis.
For all other Elements in this section
Moderate to major deterioration but is incidental and does not warrant structural analysis.
Major deterioration of joints that may be causing Individual mortared elements (rocks, bricks, etc.,) to be loose.

Moderate to major deterioration and cracking and/or major deterioration of joints. The wingwall(s) may have moved or tilted. Some fill may have washed from behind or under the wingwall(s). There may be signs of bulging, and some fill may have seeped through. Individual mortared elements (rocks, bricks, etc.,) are loose because of missing mortar from joint.

4 Advanced deterioration.
Major deterioration, or other defect, has produced loss of strength that is sufficient to warrant structural analysis.
This condition state does not apply to Miscellaneous Bridge Railing.
Individual mortared elements are missing leaving voids.

Major deterioration, splitting, or cracking of materials may be affecting the structural capacity of the element. Significant movement or tilt may have occurred. The integrity of the slope(s) or the wingwall(s) is compromised. Bulging may be advanced. Individual mortared elements are missing leaving voids in the wingwall(s).

NOTES:
a) If the ability of the Miscellaneous Bridge Railing to function as intended is affected by damaged posts or unsupported rail, code as Condition State 3. Record the lineal feet of rail affected by the defective or missing post(s).

Mechanically Stabilized Earth - Elements

ELEMENT DESCRIPTION

444 Mechanically Stabilized Earth - Abutment (LF)
Includes a facing type and employs various combinations of geotechnical materials and reinforcement materials.

445 Mechanically Stabilized Earth - Wingwall/Retaining Wall (LF)
Includes a facing type and employs various combinations of geotechnical materials and reinforcement materials.

NOTES:

Mechanically Stabilized Earth - Condition States

CONDITION STATE DESCRIPTIONS

1. **There is little or no deterioration.**

2. **Minor to moderate deterioration:**
   There may be minor bulging, joint opening and movement of panels, caps separation from panels, cracking, spalls, and evidence of water infiltration through joints or cracks.

3. **Advanced deterioration:**
   There may be major bulging, major joint opening and separation of panels, settlement and or tilting of wall, approach roadway shoulder settlement, buckling or misalignment of facing, Rust markings from corrosion of metallic reinforcement, deterioration of foundation, loss of slope at base of wall, heavy water infiltration and exfiltration of backfill material.

Concrete Deck and Concrete Slab - Elements

ELEMENT DESCRIPTION

12 Concrete Deck - Bare - with Uncoated Reinforcement (EA)
No surface protection of any type and constructed with uncoated reinforcement bars.

13 Concrete Deck - with asphaltic concrete (AC) Overlay - w/o Membrane (EA)
No surface protection of any type and deck is covered with an (AC) overlay.

14 Concrete Deck - with AC Overlay - with Membrane (EA)
Decks protected with a membrane and the membrane is covered with (AC) overlay.

18 Concrete Deck - Thin Overlay (less than 1") - no AC Overlay (EA)
Decks with a thin (<1") overlay (portland cement, epoxy, resin, etc.)

22 Concrete Deck - Rigid Overlay (greater than 1") - no AC Overlay (EA)
Decks with a rigid (>1") overlay (low slump portland cement, epoxy, resin, etc.)

26 Concrete Deck - Bare - with Coated Reinforcement (EA)
Decks with coated (epoxy, galvanized, stainless steel, RFP, etc.) reinforcement bars.

27 Concrete Deck - with Cathodic Protection (EA)

38 Concrete Slab - Bare - with Uncoated Reinforcement (EA)
Slabs with no surface protection of any type and constructed with uncoated reinforcement bars.

39 Concrete Slab - with AC Overlay - w/o Membrane (EA)
No surface protection of any type and the deck is covered with (AC) overlay.

40 Concrete Slab - with AC Overlay - with Membrane (EA)
Slabs protected with a membrane and the membrane is covered with (AC) overlay.

44 Concrete Slab - Thin Overlay (less than 1") - no AC Overlay (EA)
Slabs with a thin (<1") overlay (portland cement, epoxy, resin, etc.)

48 Concrete Slab - Rigid Overlay (greater than 1") - no AC Overlay (EA)
Slabs with a rigid (>1") overlay (low slump portland cement, epoxy, resin, etc.)

52 Concrete Slab - Bare - with Coated Reinforcement (EA)
Slabs with coated (epoxy, galvanized, stainless steel, RFP, etc.) reinforcement bars.

53 Concrete Slab - with Cathodic Protection (EA)
Slabs protected with a cathodic system.

738^{VS} Concrete Slab - Covered with Fill (EA)
Slabs covered with fill.

NOTES:

a) Any deck or slab that has an asphaltic overlay, even if it has coated reinforcement or a thin or rigid overlay below the asphaltic overlay, shall be coded as Element no. 13 or 14 or Element no. 39 or 40.
b) A deck or slab with both uncoated and coated reinforcement bars shall be considered as a deck or slab with uncoated reinforcement.
c) Smart Flag 358 should **only** be used with Elements no. 12, 26, 27, 38, 52, or 53 (Concrete Decks or Slabs without overlays) and Elements no. 18, 22, 44 and 48 (Decks with thin/rigid overlays).
d) Concrete Frames - See the back of this manual for guidance on this type of structure.
e) See the back of this manual for definitions and guidance on quantity.

Concrete Deck and Concrete Slab - Condition States

CONDITION STATE DESCRIPTIONS

1 This element exhibits no patched areas and/or deficiencies such as spalling, delamination, etc.

2 Patched areas, spalling/delamination and/or potholes exist. Their combined area is 10% or less of the total deck area.

3 Patched areas, spalling/delamination and/or potholes exist. Their combined area is more than 10% but 25% or less of the total deck area.

4 Patched areas, spalling/delamination and/or potholes exist. Their combined area is more than 25% but less than 50% of the total deck area.

5 Patched areas, spalling/delamination and/or potholes exist. Their combined area is 50% or more of the total deck area.

NOTES:

a) When determining the correct condition state for a deck or slab, consider the condition of both the top and the bottom of the element. Care must be taken when determining the percentage of the deck/slab affected. The inspector should not count overlapping areas of spalling/delamination and/or potholes on the top and the bottom twice.
b) The condition of the bottom of the deck or slab shall also be covered using the appropriate Smart Flag (359 and/or 707^{V}).
c) If Element 738 is used its condition state shall be coded the same as the condition state for Smart Flag 359.
d) All known defects, whether visible or not, shall be counted; such as, known defects covered with an overlay or defects discovered as a result of a deck or slab evaluation.
e) Overlapping areas of patching, spalls/delamination of concrete or AC shall only be counted once.
f) Cracking of the top of the deck or slab shall also be covered using Smart Flag 358.
g) A patched area will be considered a temporary fix for rideability such as an asphalt patch. A repaired area will be considered a permanent fix. Patched areas cannot be returned to condition state 1. Repaired areas can be returned to condition state 1.
h) For decks that need to be replaced due to constant patching and/or repair also use Smart Flag 710.

Metal Deck - Elements

ELEMENT DESCRIPTION

28 Steel Deck - Open Grid (EA)
Decks that are constructed of steel grids that are open and unfilled.

29 Steel Deck - Concrete Filled Grid (EA)
Decks that are constructed of steel grids with either all of the openings or just those in the wheel tracks filled with concrete.

30 Metal Deck - Corrugated/Orthotropic, Etc. (EA)
Decks that are constructed of corrugated metal filled with Portland Cement Concrete or asphaltic concrete or an orthotropic steel deck.

NOTES:

a) Element 30 is NOT for decks designed with stay-in-place forms. It is intended for steel corrugated decks with an asphalt or concrete riding surface. As a general rule, a stay-in-place form could be removed and the concrete deck would remain. If the metal deck is removed, and the riding surface would not remain, then it is appropriate to use this element.

b) See the back of this manual for definitions and guidance on quantity.

Metal Deck - Condition States

CONDITION STATE DESCRIPTIONS

1 No corrosion.
Coating system, if any, is sound.
Connectors (welds, rivets, etc.) are sound.
Concrete filler is sound.
Surfacing on a corrugated/orthotropic/etc. deck has no repaired areas or potholes.

2 Little or no corrosion.
Coating system, if any, may be showing early signs of distress.
Connectors are still sound.
Concrete filler is sound.
Potholes or minor cracking in surfacing of a corrugated/orthotropic/etc. deck.

3 Surface or freckled rust has formed.
Coating system is no longer fully effective.
No loss of section.
Connectors starting to show signs of distress - cracked welds or broken rivets.
Concrete filler may have broken out at scattered locations.
Potholes and significant cracking in surfacing of a corrugated/orthotropic/etc. deck .

4 Corrosion is moderate.
Surface pitting may be present but any section loss is incidental.
Numerous connectors are failing at scattered locations.
Section loss and/or connectivity are not sufficient to warrant structural analysis.
Large potholes exist exposing metal decking of a corrugated/orthotropic/etc. deck.

5 Corrosion is advanced.
Numerous connectors have failed.
Section loss and/or connectivity are sufficient to warrant structural analysis.
Much of the concrete filler is missing.
Surfacing of a corrugated/orthotropic/etc. deck has failed.

Timber Deck - Elements

ELEMENT DESCRIPTION

31 Timber Deck - (EA)
Decks that are constructed of timber and are not overlaid.

32 Timber Deck - with asphaltic concrete (AC) Overlay (EA)
Includes timber decks that are constructed of timber and are overlaid with tar and gravel surface treatment.

54 Timber Slab - (EA)
Slabs that are constructed of timber and are not overlaid.

55 Timber Slab - with asphaltic concrete (AC) Overlay (EA)

NOTES:

a) See the back of this manual for definitions and guidance on quantity.

Timber Deck - Condition States

CONDITION STATE DESCRIPTIONS

1 There is no decay. There may be cracks, splits and checks having no effect on strength or the ability of this element to function as intended. The surfacing, if any, has no potholes.

2 Decay, insect infestation, splitting, cracking or crushing may exist but none is sufficiently advanced to affect strength or the ability of this element to function as intended. If surfacing exists, there may be minor potholes or delamination of the surfacing.

3 Decay, insect infestation, splitting, cracking or crushing has produced loss of strength or deflection of the element but is not sufficient to warrant structural analysis. If surfacing exists, there may be major potholes or delamination of the surfacing.

4 Advanced deterioration. Decay, insect infestation, splits, cracks or crushing has produced loss of strength or deflection that is sufficient to warrant structural analysis.

Culvert - Elements

ELEMENT DESCRIPTION

240 Metal Culvert (LF along length of barrel)
Includes all metal (steel, aluminum, galvanized) culverts, including arches, round or elliptical pipes, etc.

241 Concrete Culvert (LF along length of barrel)
Includes precast and cast-in-place (conventional or prestressed) concrete arch, pipe and box culverts.

242 Timber Culvert (LF along length of barrel)

243 Other Culvert (LF along length of barrel)
All culverts not included under steel, concrete or timber culverts. It will include masonry and combinations of other materials.

NOTES:

a) Wing walls and headwalls/endwalls are not included in any culvert element but should be coded separately. Smart Flags 298 (Culvert Endwall/Headwall) and 299 (Culvert Wingwall) may be applicable with any culvert element.
b) Smart flags for top and bottom of deck/slab cracking are not applicable for culverts.
c) See the back of this manual for definitions and guidance on quantity.

Culvert - Condition States

CONDITION STATE DESCRIPTIONS

1 The element shows little or no deterioration.
Only surface defects are evident.
Some discoloration or surface corrosion may exist but there is no metal pitting.
Little or no separation of joints or seams
No misalignment problems are evident.
Superficial cracks and spalls may be present, but there is no exposed reinforcing or evidence of rebar corrosion.
Timber and fasteners are in sound condition.

2 In metal culverts, corrosion and minor pitting may have begun especially in the invert.
In timber culverts, corrosion at fasteners and connections may have begun.
Deterioration, decay, weathering, minor chloride contamination, abrasion, cracking and/or leaching may have begun.
Little or no distortion and/or deflection exist.
Minor separation of joints or seams.

3 In metal culverts, corrosion, deep pitting and/or some holes in the invert may exist.
In timber culverts, significant decay, weathering and warped or broken timbers.
In timber culverts, significant decay and corrosion at fasteners and connections may be evident.
Moderate to major deterioration, abrasion, extensive cracking and/or leaching and large areas of spalls.
Minor to moderate distortion, or misalignment may have occurred.
Minor cracking or abrasion of the metal may exist.
There may be considerable separation of joints or seams.

4 In metal culverts, corrosion, extreme pitting and/or holes in the barrel may exist.
In timber culverts, major decay and many warped, broken or missing timbers exist.
In timber culverts, major decay and corrosion at fasteners and connections exist.
Major deterioration, abrasion, spalling, cracking, major distortion, deflection, or misalignment of the barrel may be in evidence.
Major cracking or abrasion of the metal may exist.
Major separation of joints or seams may have occurred.
Holes may exist in floors and walls.

Note: If there is settlement or tilt use Element 360 Settlement.

Slope Protection - Elements and Condition States

285[V] Slope - Protected (EA)

ELEMENT DESCRIPTION
Slopes under a bridge that are protected by a erosion resistant material such as stone, concrete, masonry, timber, or some combination.

CONDITION STATE DESCRIPTIONS

1 The slope shows little or no deterioration.

2 Minor cracks, spalls, splitting, settlement or joint deterioration may be present, but there is no evidence of undermining of the protected slope.

3 Moderate deterioration of slope protection.
Minor undermining and/or settlement may be present but erosion due to road run-off is still controlled by slope protection.

4 Advanced deterioration (misalignment, crushing and/or settlement).
Undermining of slope protection renders protection largely ineffective.

NOTES:
a) See the back of this manual for definitions and guidance on quantity.

286[V] Slope - Unprotected (EA)

ELEMENT DESCRIPTION
Slopes under bridges that are NOT protected by an erosion resistant material.

CONDITION STATE DESCRIPTIONS

1 The element shows little or no erosion.

2 Minor erosion may have occurred.
There is no undermining or exposed piles.
There has been no erosion that has exposed the bottom of the substructure elements.

3 Moderate erosion of slope is present but is incidental and does not adversely affect the ability of this element to function as intended.
The bottom of the substructure elements may be exposed for insignificant lengths with no undermining or exposed piles.

4 Advanced erosion of slope is present and/or the slope has failed.
The slope is no longer functioning as intended.
The bottom of the substructure elements is exposed for significant lengths.
Piles may be exposed.
Substructure elements may be undermined.

NOTES:
a) See the back of this manual for definitions and guidance on quantity.

Expansion Joint - Elements

ELEMENT DESCRIPTION

300 Strip Seal Expansion Joint (LF)
Expansion joint devices that utilize a neoprene type waterproof gland with steel extrusion to anchor the gland.
This element may be appropriate in cases where State Item 18 is coded “01 - Dam” in HTRIS.

301 Pourable Joint Seal (LF)
Joints that have been sealed with a hot poured or a silicon sealer.
This element may be appropriate in cases where State Item 18 is coded “05 - Strip Sealer” or “07 -- Dow Corning 902” in HTRIS.

302 Compression Joint Seal (LF)
Joints filled with a pre-formed compression type seal.
This element may be appropriate in cases where State Item 18 is coded “04 - Compression Sealer” in HTRIS.

303 Assembly Joint/Seal (LF)
Joints filled with an assembly mechanism that may or may not have a seal.
Use this element for all sliding plate roadway devices and modular joints.
This element may be appropriate in cases where State Item 18 is coded “02 - Tooth Joint” or “03 - Sliding Plate” in HTRIS.

304 Open Expansion Joint (LF)
Joints that are open and not sealed and were not designed to be waterproof.
This element may be appropriate in cases where State Item 18 is coded “06 - Armored Joint” in HTRIS.

NOTES:

a) Approach slab expansion joints are included in these elements.
b) If the joint seal material is missing code the joint element according to the original material and place in Condition State 3.

Expansion Joint - Condition States

CONDITION STATE DESCRIPTIONS

1 The element shows minimal deterioration.
The seal shows no leakage at any point along the joint.
Gland is secure and has no defects.
Debris in joint is not causing any problems.
The adjacent deck and/or header are sound.
The armored joint anchorage shows no signs of looseness.
Fingers are not broken or misaligned.
Welds exhibit no problems.
The coating system is functioning as intended.

2 The element shows moderate deterioration and/or minor cohesion failures.
The seal shows signs of leakage along the joint.
Gland shows signs of abrasion or minor tearing or is partially pulled out of the extrusion.
Significant debris is in all or part of the joint and is affecting joint performance.
The adjacent deck and/or header exhibit no spalls.
The armored joint anchorage is loose.
Fingers are bent or misaligned.
Welds exhibit minor cracking.
The coating system is beginning to fail with the element beginning to corrode.

3 The element has failed.
The seal shows signs of leakage along the joint.
Gland has failed from abrasion or tearing or has pulled out of the extrusion.
The adjacent deck and/or header exhibit spalls.
The armored joint anchorage has failed.
Fingers are missing or broken.
Welds are failing.
The coating system has failed with the element exhibiting advanced corrosion.

NOTES:

a) See the back of this manual for definitions and guidance on quantity.
b) If the joint seal material is completely missing, place in Condition State 2 or 3 depending on the condition of the adjacent deck and/or header and code the joint element according to the original material.
c) Evidence of mechanism failure such as loose or broken springs, bolts, or support bars shall be coded as Condition State 3.

Bearing - Elements

ELEMENT DESCRIPTION

310 Elastomeric Bearing (EA)
Expansion bridge bearings that are constructed primarily of elastomers, with or without fabric or metal reinforcement.

311 Moveable Bearing (Roller, sliding, etc.) (EA)

312 Enclosed/Concealed Bearing or Bearing System (EA)
Bridge bearings that are enclosed so that they are not open for detailed inspection.

313 Fixed Bearing (EA)
Bridge bearings that provide for deflection and do not allow for longitudinal movement.

314 Pot Bearing (EA)
High load bearings with confined elastomer. The bearing may be fixed against horizontal movement, guided to allow movement in one direction, or floating to allow sliding in any direction.

315 Disk Bearing (EA)
High load bearings with a hard plastic disk. The bearing may be fixed against horizontal movement, guided to allow movement in one direction, or floating to allow sliding in any direction.

NOTES:

a) If it cannot be determined if a bearing is fixed or expansion, it should be coded as an expansion bearing until a correct determination can be made.

b) Element 310 (Elastomeric Bearing) is for expansion bearings. If the bearing is constructed to prevent thermal movement, it should not be coded as an elastomeric bearing. In some cases, small elastomeric pads (less than 0.5" thick) are used with fixed bearings. In these cases, the elastomeric pad should be ignored and the bearing coded as Element 313 - (Fixed Bearing).

c) Element 313 (Fixed Bearing) includes those fixed bearings with small elastomeric pads (usually less than 0.5" thick).

Bearing - Condition States

CONDITION STATE DESCRIPTIONS

1 The element shows little or no deterioration and has minimal debris and corrosion.
The coating system, if present, is sound and functioning as intended.
Vertical and horizontal alignments are within limits. For elastomeric bearings the vertical slope is 0 - 30 degrees.
Bearing support member is sound. There is no cracking of support members.
Any lubrication system is functioning properly.
The supported member is stable under traffic.

2 The coating system, if present, has failed and exposed metal may show moderate to heavy corrosion with some pitting but still functioning as intended.
The assemblies have moved causing minor cracking in the supporting concrete.
Debris buildup is affecting bearing movement.
Bearing alignment and/or load carrying capacity is still tolerable.
FOR ELASTOMERIC BEARINGS
Minor cracking, splitting or other deterioration may be present.
Shear deformation may be slightly excessive.
Strength and/or the ability of this element to function as intended are not affected (the vertical slope is 30 - 45 degrees.)
FOR ENCLOSED/CONCEALED BEARINGS OR BEARING SYSTEMS.
Both vertical and horizontal offsets are within the capability of the bearings.
The supported member may exhibit minimal vertical movement under traffic.
Cracking of support members is not yet significant.
There may be insignificant reduction of bearing due to superstructure shortening.

3 Section loss sufficient to warrant supplemental supports or load restrictions.
Bearing alignment may be beyond tolerable limits.
Shear keys and the lubrication system, if any, may have failed.
FOR ELASTOMERIC BEARINGS
Shear deformations may be excessive.
Top and bottom surfaces may no longer be parallel.
Loss of bearing may be imminent. (The vertical slope is greater than 45 degrees.)
FOR ENCLOSED/CONCEALED BEARINGS OR BEARING SYSTEMS.
Vertical and/or horizontal offsets are significant indicating bearing failures.
There may be significant vertical movement under traffic.
Cracking of the support members may be significant.
There may be significant reduction of bearing due to superstructure shortening.
FOR POT BEARINGS
Elastomer may be actively extruding from the device.

NOTES:
a) See the back of this manual for definitions and guidance on quantity.

Approach Slab – Elements and Condition States

320 Prestressed Concrete Approach Slab (EA)

321 Reinforced Concrete Approach Slab (EA)

ELEMENT DESCRIPTION
None

CONDITION STATE DESCRIPTIONS

1 The slab has not settled and shows no sign of deterioration other than superficial surface cracks.

2 Minor cracking, spalls may be present but they do not affect the ability of the slab to carry traffic.
Settlement may be occurring which increases the traffic impact on the bridge.

3 Cracks may extend completely through the slab cross-section, but the slab does not act as if it is broken.
Spalls may be heavy but they do not affect the structural integrity of the slab.
Settlement may be occurring which increases the traffic impact on the bridge.

4 The slab is broken or rocks under traffic loads.
Settlement is excessive and cannot be corrected without increasing the size of the slab.

NOTES:

Smart Flags

ELEMENT DESCRIPTION

298[V] Culvert Endwall/Headwall (EA)
To be used for endwalls/headwalls of any material.
If there is settlement or tilt use Element 360 Settlement.

299[V] Culvert Wingwall (EA)
To be used for wingwalls of any material.
If there is settlement or tilt use Element 360 Settlement

356 Steel Fatigue (EA)
This should not be applied until fatigue damage to steel becomes apparent.

357 Pack Rust (EA)
Use for rust packing in connections and built-up steel members.
This Smart Flag should not be used for corrosion of the top flange.

358 Deck Cracking (EA)
Use for concrete deck/slab elements that exhibit cracking on the top of deck/slab. This Smart Flag is to be used **only** with Elements no. 12, 18, 22, 26, 27, 38, 44, 48, 52, or 53 (Concrete Decks or Slabs without asphaltic overlays).

359 Soffit of Concrete Decks/Slabs (EA)
Represents entire soffit of a deck/slab, **not** the soffit of an overhang.
For undersurface of overhang use Smart Flag 706[V].

360 Settlement (EA)
Use when the substructure exhibits any distress due to settlement.

361 Scour (EA)
Use for scour/undermining evident during inspections of any structure including culverts and pipes.

362 Traffic Impact Damage (EA)
This flag should be used for superstructure impact damage.

363 Section Loss (EA)
This flag should be used when a steel element reaches condition state 4 or for elements that have section loss that has been cleaned and painted over. This flag should be used for both coated and uncoated elements.

701[V] Utilities (EA)
Use for utilities mounted to the structure. Groups of similar utilities in the same assembly and performing the same function should be evaluated as one utility. For dissimilar utilities, use a separate smart flag for each dissimilar utility.

702[V] Drains (EA)
Does not apply to drainage off the end of a bridge.
The quantity will always be one, even if there are dissimilar drainage types.

703[V] Lighting (EA)
The quantity will always be one, even if there are dissimilar lighting types.

704[V] Roadway Over Culverts (EA)

(continued)

Smart Flags

ELEMENT DESCRIPTION (continued**)**

706[V] Soffit of Overhang of Concrete Decks/Slabs (EA)
Represents the entire undersurface of the overhang. For slabs this will be approximately the first 1 foot of the bottom of the slab measured from the exterior edge of the deck. For undersurface of decks/slabs use Smart Flag 359.

707[V] Soffit of Concrete Decks/Slabs with SIP Forms (EA)
Represents entire soffit of a deck/slab, **not** the soffit of an overhang. For undersurface of overhang use Smart Flag 706.

708[V] Debris in Channel (EA)
This smart flag is used for classifying debris (sediment, vegetation, trash, etc.) restricting the channel under a structure.

709[V] Structure Replacement (EA)
This smart flag is used to indicate those structures where it would be practical to replace the structure rather than repair the structure. The only money that should be spent on this type of structure would be for repairs that protect the safety of the traveling public.

710[V] Deck Replacement (EA)
This smart flag is used to indicate those structures where it would be practical to replace the deck even though patching and/or repair of the deck have continued to keep the condition state of the deck at a '1'.

NOTES:

a) The quantity for each Smart Flag will always be one (1) and will represent **all** occurrences of that Smart Flag on the bridge. Unless otherwise stated, do **not** count each occurrence of an individual Smart Flag separately.
b) See the back of this manual for definitions and guidance on coding 'Steel Diaphragms/Cross Frames' that are a part of a curved girder system.

Smart Flags - Condition States

298[V] Culvert Endwall/Headwall (EA)

CONDITION STATE DESCRIPTIONS

1 Little or no deterioration/decay.

There may be superficial defects such as discoloration, efflorescence, surface rust and/or superficial cracking without affect on strength and/or ability to function as intended.

2 Minor deterioration.

Minor deterioration, cracking, corrosion, decay and weathering may exist but none is sufficiently advanced to affect strength of the element or the ability of the element to function as intended.

Spalling may be present but there is no exposed reinforcing or surface evidence of rebar corrosion.

Minor insect/marine borer infestation, crushing, checking, splitting or other defect may exist.

Joints may show minor deterioration or separation.

Some movement (i.e. sliding) or bulging may have occurred with little or no affect on the slope or fill.

3 Moderate deterioration.

Moderate to major deterioration cracking, section loss due to corrosion, decay and/or weathering or other defect exists but does not warrant structural analysis.

Decay, insect/marine borer infestation, crushing or other defect may have produced some loss of strength or deflection.

Some delaminations and/or spalls may be present and some reinforcing may be exposed.

Corrosion of rebar may be present.

Major deterioration of joints may be causing individual elements (rocks, bricks, bagged riprap, etc.) to be loose.

Some movement (i.e. sliding) has occurred and the stability of the slope is being compromised. Some fill may have washed from behind headwall/endwall(s).

There may be signs of bulging, and some fill may have seeped through.

4 Advanced deterioration.

Major deterioration, splitting, cracking, corrosion, holes, loss of section, decay and/or weathering or other defect has produced loss of strength that is sufficient to warrant structural analysis.

Significant movement (i.e. sliding) has occurred and the stability of the slope or the headwall/endwall is compromised.

Decay, insect/marine borer infestation, crushing or other defect has produced loss of strength or deflection.

Individual elements are missing/collapsed leaving voids.

Bulging may be advanced.

299[V] Culvert Wingwall (EA)

CONDITION STATE DESCRIPTIONS

1 Little or no deterioration/decay.

There may be superficial defects such as discoloration, efflorescence, surface rust and/or superficial cracking without affect on strength and/or ability to function as intended.

2 Minor deterioration.

Minor deterioration, cracking, corrosion, decay and weathering may exist but none is sufficiently advanced to affect strength of the element or the ability of the element to function as intended.

Spalling may be present but there is no exposed reinforcing or surface evidence of rebar corrosion.

Minor insect/marine borer infestation, crushing, checking, splitting or other defect may exist.

Joints may show minor deterioration or separation.

Some movement (i.e. sliding or tilting) or bulging may have occurred with little or no affect on the slope or fill.

3 Moderate deterioration.

Moderate to major deterioration cracking, section loss due to corrosion, decay and/or weathering or other defect exists but does not warrant structural analysis.

Decay, insect/marine borer infestation, crushing or other defect may have produced some loss of strength or deflection.

Some delaminations and/or spalls may be present and some reinforcing may be exposed.

Corrosion of rebar may be present.

Major deterioration of joints may be causing individual elements (rocks, bricks, bagged riprap, etc.) to be loose.

Some movement (i.e. sliding or tilting) has occurred and the stability of the slope is being compromised. Some fill may have washed from behind wingwall(s).

There may be signs of bulging, and some fill may have seeped through.

4 Advanced deterioration.

Major deterioration, splitting, cracking, corrosion, holes, loss of section, decay and/or weathering or other defect has produced loss of strength that is sufficient to warrant structural analysis.

Significant movement (i.e. sliding or tilting) has occurred and the stability of the slope or the wingwall is compromised.

Decay, insect/marine borer infestation, crushing or other defect has produced loss of strength or deflection.

Individual elements are missing/collapsed leaving voids.

Bulging may be advanced.

356 Steel Fatigue (EA)

CONDITION STATE DESCRIPTIONS

1 Fatigue damage to the bridge has been repaired or arrested.
The bridge may still be fatigue prone.

2 Fatigue damage exists which is not arrested.

3 Fatigue damage exists which is sufficient to warrant structural analysis.

357 Pack Rust (EA)

CONDITION STATE DESCRIPTIONS

1 The connection is showing signs of rusting between the plates.
Seams of the connections exhibit rust staining.
No swelling exists.

2 Rusting between plates is beginning to distress the connection.
Minor swelling exists.

3 Rusting between plates has caused serious distress to the connection.
The plates may be badly distorted, however all connectors (rivets/bolts) are still functioning.

4 Rusting between plates has caused serious distress to the connection sufficient to warrant structural analysis.
Some rivets or other connectors may have popped or are no longer effective.

358 Deck Cracking (EA)

CONDITION STATE DESCRIPTIONS

1 The surface of the deck is cracked, but the cracks are either filled/sealed or insignificant in size and density (cracks less than 1/16 inch in width and spaced greater than 10 feet apart).

2 Unsealed cracks exist which are of moderate size OR density (cracks greater than or equal to 1/16 inch and less than 3/16 inch in width OR where cracks are spaced 5 feet to 10 feet apart).

3 Unsealed cracks exist in the deck that are of moderate size AND density (cracks greater than or equal to 1/16 inch and less than 3/16 inch in width AND where cracks are spaced 5 feet to 10 feet apart).

4 Unsealed cracks exist in the deck that are of severe size AND/OR density (cracks greater than 3/16 inch in width AND/OR are spaced less than 5 feet apart).

359 Soffit of Concrete Decks/Slabs (EA)

CONDITION STATE DESCRIPTIONS

1 There are little or no symptoms of distress and any cracking or efflorescence is less than 2% of the total underside area.

2 Cracking and/or efflorescence is light any the combined distressed area is 2% to 10% of the soffit.

3 Moderate efflorescence and/or cracking (cracks greater than or equal to 1/16 inch and less than 3/16 inch in width OR where cracks are spaced 5 feet to 10 feet apart) and the combined distressed area is greater than 10% but 25% or less of the soffit.

4 Light to moderate rust staining and/or delamination/spalling and heavy cracking (cracks greater than or equal to 1/16 inch and less than 3/16 inch in width AND where cracks are spaced 5 feet to 10 feet apart) and/or efflorescence and the combined distressed area is more than 25% but less than 50% of the soffit.

5 Heavy to severe rust staining and/or delamination/spalling and severe cracking (cracks greater than 3/16 inch in width AND/OR are spaced less than 5 feet apart) and/or efflorescence and the combined distressed area is 50% or more of the soffit.

360 Settlement (EA)

CONDITION STATE DESCRIPTIONS

1 Some of the bridge supporting or culvert elements are showing signs of visible settlement or rotation but due to earlier repairs or other signs, the settlement appears to have stabilized.

2 Settlement or rotation of the bridge supporting or culvert elements shows signs of continuing and if left unarrested could cause adverse impacts to the bridge.

3 Settlement or rotation of the bridge supporting or culvert elements is sufficient to warrant structural analysis.

361 Scour (EA)

CONDITION STATE DESCRIPTIONS

1 Scour exists at the bridge or culvert site but is of little concern to the structural integrity of the bridge or culvert.

2 Scour exists at the bridge or culvert site and if left unchecked could adversely impact the structural integrity of the bridge or culvert.

3 Scour is significant enough to warrant analysis of the bridge or culvert.

NOTES:

a) Substructure elements should not be assigned a lower condition state because of scour.

362 Traffic Impact Damage (EA)

CONDITION STATE DESCRIPTIONS

1 Impact damage has occurred and has been repaired.
Prestressing system is covered by patch concrete.
Steel has been straightened or repaired.

2 Impact damage has occurred.
Prestressing system is exposed, but is not impaired.
Steel condition does not threaten the ability of the bridge to function as intended.

3 Impact damage has occurred and strength of the member is impaired.
Impact damage is sufficient to warrant structural analysis.

363 Section Loss (EA)

CONDITION STATE DESCRIPTIONS

1 Section loss has been repaired or cleaned and coated over.

2 Section loss exists and has not been repaired or coated over. Structural analysis is not yet warranted.

3 Section loss exists which is sufficient to warrant structural analysis or an analysis has determined that the ability of the bridge to function as intended has not been affected i.e. there is no reduction in the posted capacity or a non-posted structure does not require posting.

4 Section loss has affected the load carrying capacity or the ability of the bridge to function as intended i.e. there is a reduction in the posted capacity. (Code this condition state only after a structural analysis.)

701^{V} Utilities (EA)

CONDITION STATE DESCRIPTIONS

1 The supporting elements, and their attachment to the structure, are in good condition and functioning as designed.
There is little or no deterioration of the supports, attachments, or the utility itself.

2 The supporting elements, and their attachment to the structure, are in sound condition and functioning as designed.
There are signs of deterioration (e.g., flaking coating, active corrosion), and the utility may have loose joints but no exposed wires or leaks.

3 The supporting elements or their attachments to the structure shows signs of active deterioration (e.g., some section loss, breakdown of protective coating).
Some supporting elements may be loose or missing, but the utility is adequately supported.
The utility may have cracks in the conduit or joints exposing wires or allowing leaks not affecting the superstructure or substructure elements and not affecting the safety of the public.

4 The supporting elements or their attachments to the structure show advanced deterioration with supporting elements loose or missing.
The utility sags or moves freely and support is no longer adequate.
Sections of the conduit are broken or missing, allowing access to the wires or major (or numerous) leaks.
Wires may be accessible to the public, leaks may be onto roadways, pedestrian trails, or affect the superstructure, substructure, or the slope.

702^{V} Drains (EA)

CONDITION STATE DESCRIPTIONS

1 Grating over scuppers or drains is intact and is functioning as intended.
Bridge drainage and/or down spouting is adequately terminated.
No signs of ponding occurring on the deck as a result of drainage problems.

2 Scuppers and/or downspouts are clogged, however, there are no signs of ponding on the deck.
Down spouting is inadequately terminated.

3 Scuppers and/or downspouts are clogged and there are signs of ponding on the deck but does not extend into the normal traffic lane.

4 Broken or missing grates/drainage assembly may pose a hazard to vehicular or pedestrian traffic.
Scuppers and/or downspouts are clogged and there are signs of ponding on the deck that extends into the normal traffic lane.

NOTES:

a) If more than one condition problem exists assign the worst condition state. For example: Down spouting is inadequately terminated (condition state 2) and clogged drains cause ponding on the deck (condition state 3). For this example assign condition state 3.

703[V] Lighting (EA)

CONDITION STATE DESCRIPTIONS

1 Lighting standards and supports are properly anchored.
There are no indications of fatigue damage.
There are no missing or broken luminares or exposed wires.

2 Lighting standards and supports are properly anchored.
There are no indications of fatigue damage.
There may be some missing or broken luminares, but there are no exposed wires.

3 Lighting standards and supports are properly anchored.
There may be some indications of fatigue damage.
Luminares may be missing or broken, but there are no exposed wires.

4 Lighting standards and supports may be improperly anchored.
There may be indications of fatigue damage.
Luminares may be missing or broken, or there may be exposed wires.

704^{V} Roadway Over Culverts (EA)

CONDITION STATE DESCRIPTIONS

1 The roadway over the culvert is smooth.
No indication of settlement.

2 Roadway shows minor signs of deterioration (e.g., cracking).
The roadway over the culvert is settled however no reduction in speed is required to safely negotiate this section of roadway over the culvert.

3 The roadway over the culvert is significantly deteriorated and/or the roadway over the culvert is settled and a minor reduction in speed is required to safely negotiate this section of roadway over the culvert.

4 Roadway may have cracks, voids, and areas of erosion that may pose a traffic hazard and/or the roadway over the culvert is settled and a substantial reduction in speed is required to safely negotiate this section of roadway over the culvert.

706^{V} Soffit of Overhang of Concrete Decks/Slabs (EA)

CONDITION STATE DESCRIPTIONS

1 There are little or no symptoms of distress.

2 Cracking and/or efflorescence is light.

3 Cracking and/or efflorescence are moderate (cracks greater than or equal to 1/16 inch and less than 3/16 inch in width OR where cracks are spaced 5 feet to 10 feet apart).

4 Light to moderate rust staining and/or delamination/spalling and/or heavy cracking and/or efflorescence (cracks greater than or equal to 1/16 inch and less than 3/16 inch in width AND where cracks are spaced 5 feet to 10 feet apart).

5 Heavy to severe rust staining and/or delamination/spalling and/or severe cracking and/or efflorescence (cracks greater than 3/16 inch in width AND/OR are spaced less than 5 feet apart).

707^{V} Soffit of Concrete Decks/Slabs with SIP Forms (EA)

CONDITION STATE DESCRIPTIONS

1 There are no symptoms of distress.

2 Any evidence of moisture or efflorescence is minor and widely scattered.
Metal Forms - surface or spot rust is present.
Concrete Forms - there may be minor hairline cracks.

3 Moisture and efflorescence are present at the construction joints.
Rust stains can be attributed to corrosion of deck reinforcing.
Metal Forms - severe rust with pitting or minor section loss.
Concrete Forms - cracks are greater than hairline with moisture, efflorescence, and/or rust stains.

4 There are areas of spalling and/or cracks, with rust stains that can be attributed to deck reinforcing.
Metal Forms - Corrosion is advanced. Some forms may have holes, be loose, or missing (because of deterioration).
Concrete Forms - have open cracks with delaminations/spalls. Moisture and efflorescence is heavy and widespread at the joints.
The combined distressed area is greater than 10% but 25% or less of the soffit.

5 Metal Forms - have failed, exposing the bottom of the deck.
Concrete Forms - have spalls for full depth of forms and exposed reinforcing may have severe rust with measurable section loss.
The bottom of the deck has delaminations/spalls with exposed deck reinforcing.
The combined distressed area is greater than 25% of the soffit.

708[V] Debris in Channel (EA)

CONDITION STATE DESCRIPTIONS

1 Minor amount of debris in channel.
Less than 10% of the opening is blocked.
Debris is not detrimental to the structure and no action is required.

2 Moderate amount of debris in channel.
10% to 25% of the opening is blocked.
Debris is not detrimental to the structure but should be removed as soon as practicable to prevent damage/additional accumulation.

3 Large amount of debris in the channel.
More than 25% of the opening is blocked.
Debris is detrimental to the structure (causing excessive drag forces, turbulence near substructure units, redirecting flow to substructures and/or embankments, etc.) and should be removed right away.

709[V] Structure Replacement (EA)

CONDITION STATE DESCRIPTIONS

1 Engineering analysis (see below) indicates replacement is the most economical action for the structure. However, if funding is constrained, maintenance on the structure is still feasible.

2 Bridge is scheduled for replacement within an improvement plan but the ad date is greater than 24 months out.

3 Bridge is scheduled for major rehabilitation or replacement within the next 24 months.

4 Engineering analysis confirms the structure is "non-maintainable". Maintenance of the existing structure is not practical with the only feasible actions being replacement or closure.

NOTES:
a) The smart flag is only to be used as directed by the district person directly responsible for Bridge Management.
b) Analysis shall be documented and maintained for future reference within the Bridge Management System.

710^{V} Deck Replacement (EA)

CONDITION STATE DESCRIPTIONS

1 Patched/repaired areas, spalling/delamination and/or potholes exist. Their combined area is 25% or less of the total deck area. The deck soffit exhibits moderate efflorescence and/or cracking and the combined distressed area is less than 25% of the soffit area.

2 Patched/repaired areas, spalling/delamination and/or potholes exist. Their combined area is more than 25% but less than 50% of the total deck area. The deck soffit exhibits light to moderate discoloration and/or delamination/spalling and heavy cracking and/or efflorescence and the combined distressed area is more than 25% but less than 50% of the soffit area.

3 Patched/repaired areas, spalling/delamination and/or potholes exist. Their combined area is 50% or more of the total deck area. The deck soffit exhibits heavy to severe discoloration and/or delamination/spalling and severe cracking and/or map-cracking and/or efflorescence and the combined distressed area is 50% or more of the soffit area. Deck should be replaced rather than repaired.

4 Engineering analysis indicates that deck should be replaced rather than repaired.

NOTES:

a) The smart flag is only to be used as directed by the district person directly responsible for Bridge Management.
b) To determine the correct condition state for a deck, consider the condition of both the top and the bottom of the element. Care must be taken when determining the percentage area of the deck affected. Do not count overlapping areas of patches/repairs, spalling/delamination and/or potholes on the top and/or the bottom twice.
c) All known defects, whether visible or not, shall be counted such as known defects covered with an overlay or defects discovered as a result of a deck or slab evaluation.
d) Cracking of the top of the deck shall also be covered using Smart Flag 358.
e) Engineering analysis noted in Condition state ‘4’ shall be documented and maintained for future reference within the Bridge Management System.

DEFINITIONS AND GUIDANCE FOR DETERMINING ELEMENTS AND QUANTITIES

GENERAL NOTES

Certain elements should be coded regardless of condition. Examples are (but are not limited to):

- Smart Flag 359 (soffit)
- Element 701 (utilities)
- Element 702 (drains)
- Element 703 (lighting)
- Smart Flag 704 (roadway over culvert)
- Smart Flag 706 (underside of overhang)
- Smart Flag 707 (soffit with sip)
- Element 738 (slab covered with fill)

Any item placed to provide support until permanent repairs can be made is not to be entered into Pontis. This includes but is not limited to steel or timber bents.

When backwalls or bearing seats consist of a material different from the primary material of the substructure unit, the condition of the backwall or the bearing seat will not be tracked using a Pontis element or smart flag.

FOOTBRIDGES AND PEDESTRIAN BRIDGES

Footbridges and Pedestrian bridges will be placed in Pontis and NBI ratings are required. However, no elements for either type of structure are required. If the structure can be modeled using Pontis elements the district can elect to place elements in Pontis and treat them as Non-Element inspections.

DECK ELEMENTS

The quantity for all deck elements are measured in square feet. However, the entire quantity can only be placed in one condition state.

Deck Area

Deck area shall be calculate based on the out-to-out width of the slab and the total length of the bridge (back-to-back of backwalls or end-to-end of slab)

Decks and Slabs

Deck Elements and Slab Elements are defined separately. Care should be taken to define these elements correctly. Slab Elements are stand-alone structures such as slab spans. Primary structural members, such as steel beams or prestressed beams, support Deck Elements.

Decks - Multiple

A bridge may be composed of several deck elements i.e. Element 12 - Concrete Deck (Bare) and Element 28 - Steel Deck, Open Grid. For this example, both elements shall

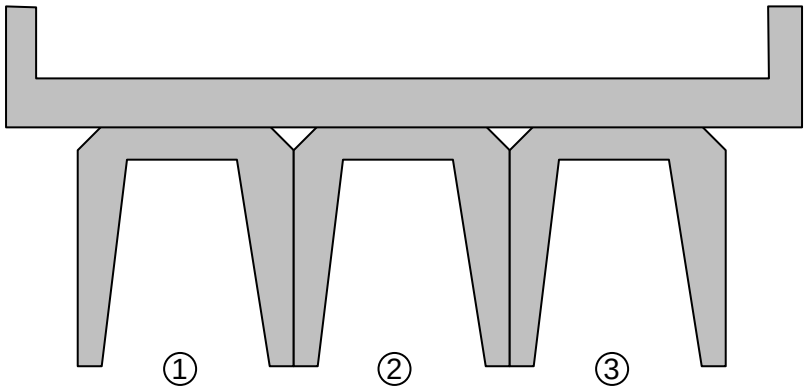
be coded and the entire quantity for each deck element shall be placed in one condition state.

SUPERSTRUCTURE ELEMENTS

Determining quantities

This convention applies to all girders, channels, and box girders. The quantity is NOT dependent on the number of visible pairs of girder faces but is determined by the length of the bridge multiplied by the number of girders, beams, channels or box girders.

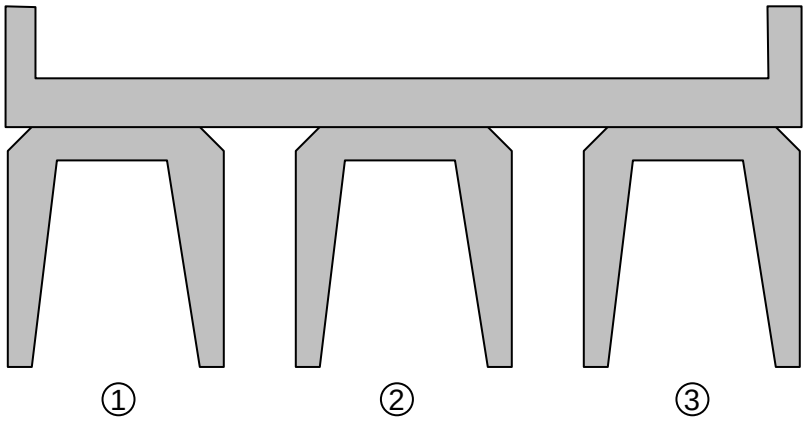
Example 1:
Reinforced Channels (Adjacent)



Since there are three (3) channel beams, the quantity should be the length of the bridge multiplied by 3. For the above figure a bridge that is 25 feet in length and 30 feet wide, the total girder quantity should be 75 feet.

Element #	Element Name	Quantity
110	Reinforced Concrete Open Girder/Stringer	75 LF (3 X 25)
12	Concrete Deck - Bare (EA)	750 SF (30 x 25)

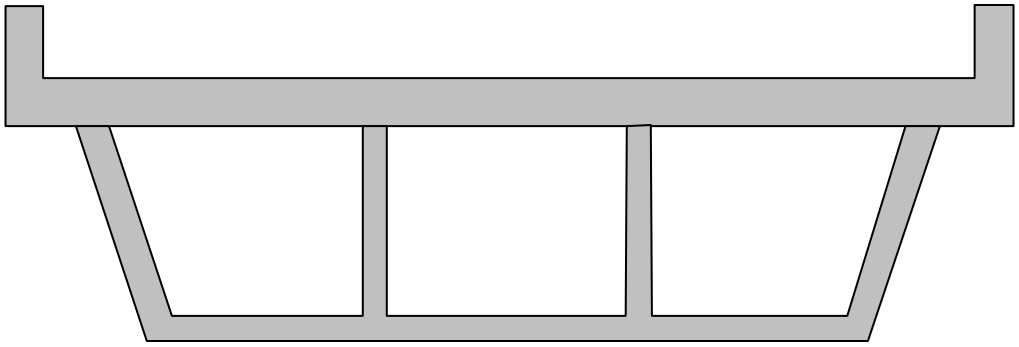
Example 2:
Reinforced Channels (Spread)



Since there are three (3) channel beams, the quantity should be the length of the bridge multiplied by 3. For the above figure a bridge that is 25 feet in length and 30 feet wide, the total girder quantity should be 75 feet.

Element #	Element Name	Quantity
110	Reinforced Concrete Open Girder/Stringer	75 LF (3 X 25)
12	Concrete Deck - Bare (EA)	750 SF (30 x 25)

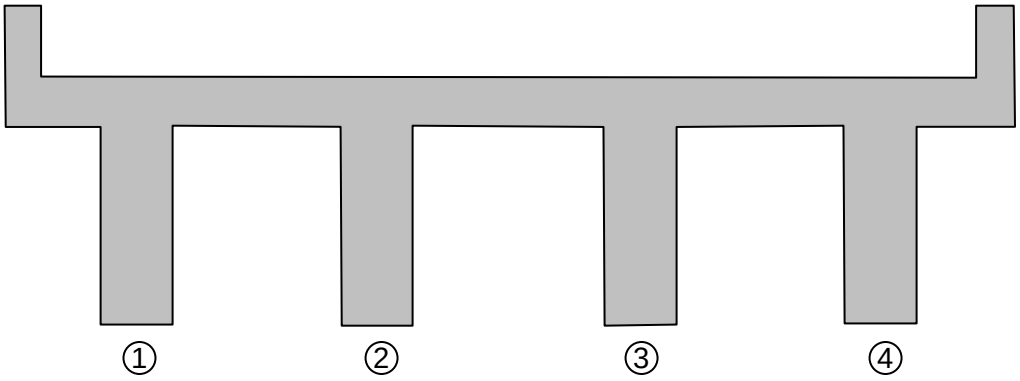
Example 3:
Cast-in-Place Concrete Multi-cell Box Girders



Elements for both the girder and the deck are necessary, even though the unit is integral. A multi-cell box girder is considered to be one girder. For the above figure a bridge that is 25 feet in length and 30 feet wide, the total girder quantity should be 25 feet.

Element #	Element Name	Quantity
105	Reinforced Concrete Closed Web/Box Girder	25 LF (1 X 25)
12	Concrete Deck - Bare (EA)	750 SF (30 x 25)

Example 4:
Cast-in-Place Concrete Tee Beam

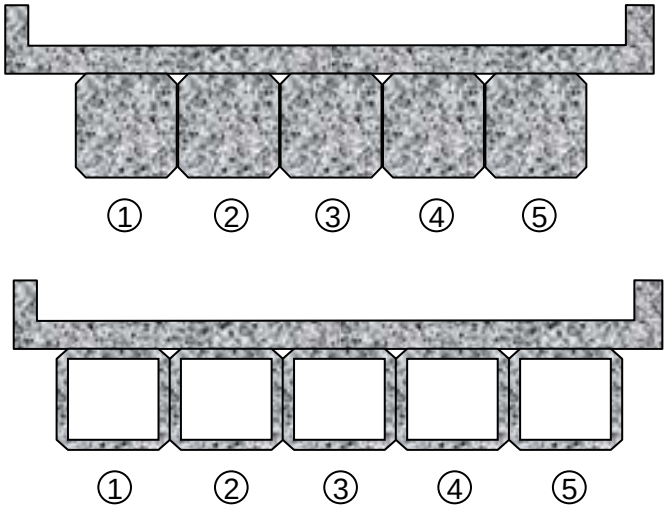


Elements for both the girder and the deck are necessary, even though the unit is integral. The quantity is the length of the bridge multiplied by 4. For the above figure a bridge that is 25 feet in length and 30 feet wide, the total girder quantity should be 100 feet.

Element #	Element Name	Quantity
110	Reinforced Concrete Open Girder/Stringer	100 LF (4 X 25)
12	Concrete Deck - Bare (EA)	750 SF (30 x 25)

Example 5:
Reinforced Concrete Voided and Unvoided Closed Web/Box Girder (Adjacent)

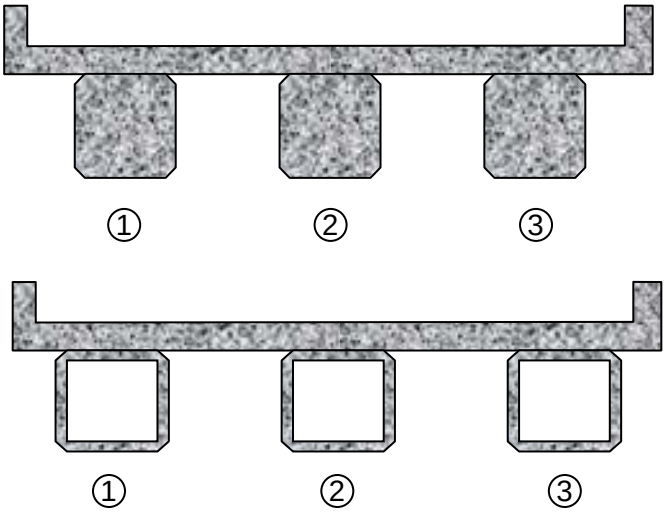
The quantity for box girders is based on the number of girders. A deck element should also be coded.



For each of the above figures a bridge that is 25 feet in length and 30 feet wide, the total girder quantity should be 125 feet.

Element #	Element Name	Quantity
105	Reinforced Concrete Voided and Unvoided Closed Web/Box Girder	125 LF (5 x 25)
12	Concrete Deck - Bare (EA)	750 SF (30 x 25)

Example 6:
Reinforced Concrete Voided and Unvoided Closed Web/Box Girder (Spread)

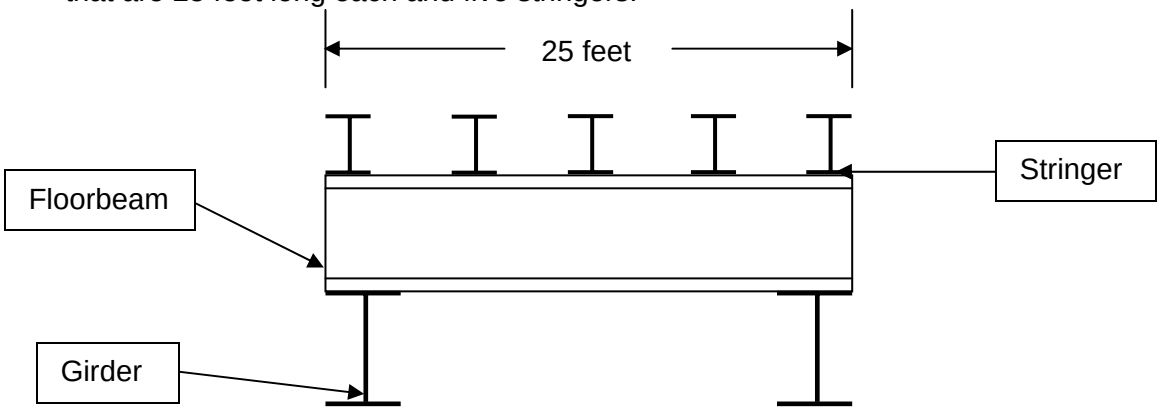


The quantity should be the length of the bridge multiplied by 3. For the above a bridge that is 25 feet in length and 30 feet wide, the total girder quantity should be 75 feet.

Element #	Element Name	Quantity
105	Reinforced Concrete Voided and Unvoided Closed Web/Box Girder	75 LF (3 X 25)
12	Concrete Deck - Bare (EA)	750 SF (30 x 25)

Example 7:
Stringers/Floor Beams/Girders

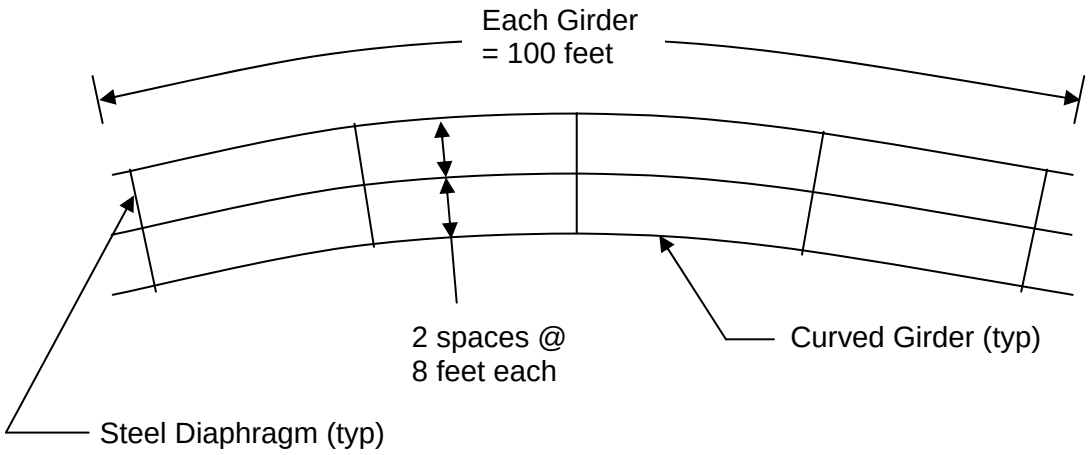
The figure below shows a two-girder bridge that is 50 feet long with three floorbeams that are 25 feet long each and five stringers.



Element #	Element Name	Quantity
107	Steel Open Girder - Coated	100 LF (2 x 50)
113	Steel Stringer - Coated	250 LF (5 x 50)
152	Steel Floor Beam - Coated	75 LF (3 x 25)

Example 8:
Steel Diaphragms/Cross Frames that are a part of a curved girder system.

Steel diaphragms or steel cross frames are primary structural members when they are part of a curved girder system. Therefore, the length of these members must be captured as shown below.



Element #	Element Name	Quantity
107	Steel Open Girder - Coated	380 LF (3 x 100) + (10 x 8)

SUBSTRUCTURE ELEMENTS

Abutments - General

For the purposes of element-level inspections, the condition of backwall, bearing seats, breast wall, weep holes, and footings are to be considered as a part of the abutment.

Gravity abutments should be coded as reinforced concrete abutments.

Wingwalls - Non-Integral and Integral

Wingwalls should not be included with substructure/culvert elements regardless of being integral or non-integral with the substructure/culvert element. Wing length will be measured beginning at the wing tip and ending at one of the following locations:

- first vertical joint adjacent to the substructure/culvert proper
- break of the wing
- edge of the deck slab

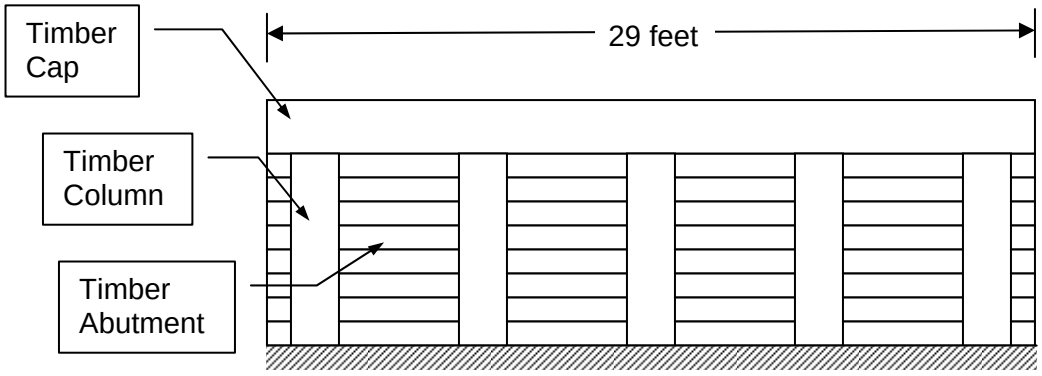
In cases where more than one of the above locations is present on a substructure/culvert element the measurement of the wing shall be made beginning at

the wing tip and ending at the first location reached in the order of the locations shown above.

Timber Abutments/Bents/Piers/Pile Bents, Etc.

General
The condition of all diagonal/cross bracing on substructure units should be considered in rating the condition of the appropriate substructure unit (columns, piles, etc.). In the event that the bracing is deteriorated, deteriorated section of bracing should be considered to be part of the nearest appropriate substructure unit (columns, piles, etc.). Considering the Timber Bent shown below, if there was no decay of the piles, but there was decay of the cross bracing with no loss of strength or indication of deflection, then the element 'Timber Column or Pile Extension' should be placed in condition state 2.

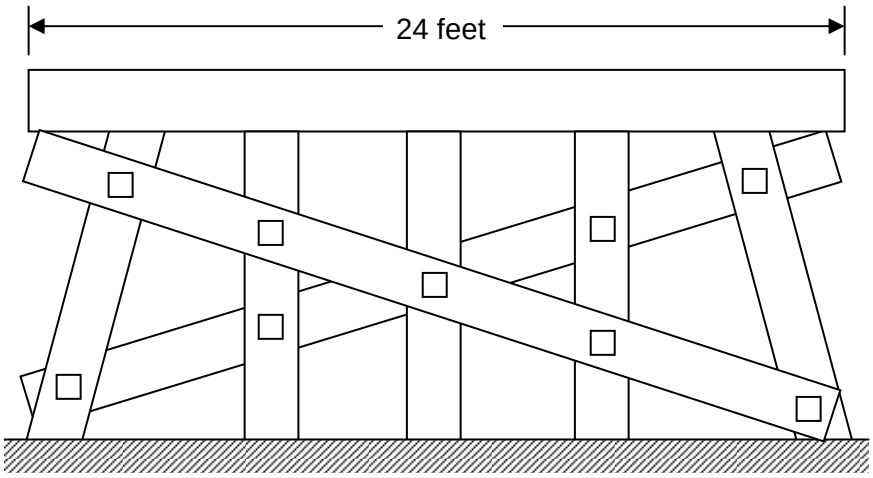
Timber abutments are typically coded as 3 different elements: a timber cap, timber columns, and a timber abutment. The timber abutment in these cases will consist only of the timber lagging of the abutment.



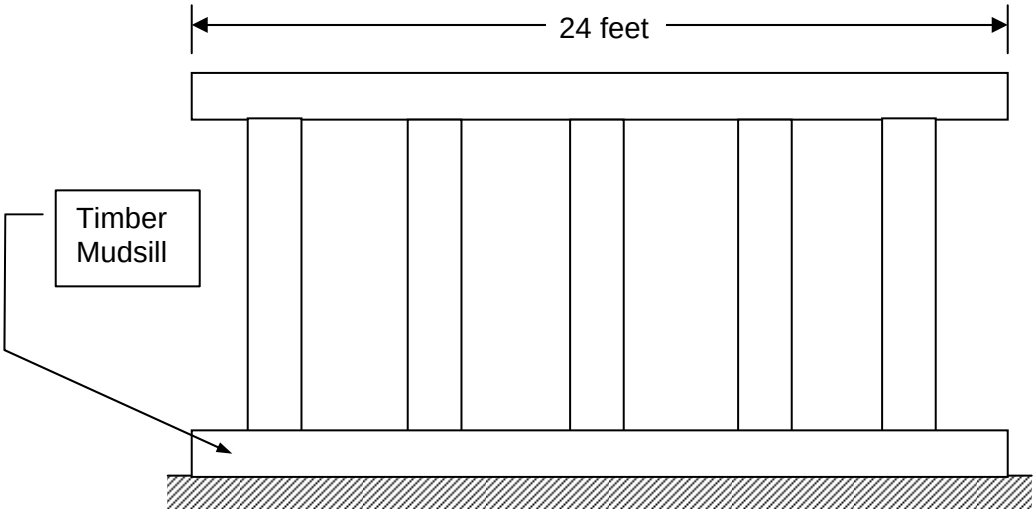
Element #	Element Name	Quantity
235	Timber Cap	29 LF
206	Timber Column or Pile Extension	5 EA
216	Timber Abutment	29 LF

Timber Bent

Timber mudsills will be considered with the element ‘Timber Pier Cap and counted separately. In the example below, if a mudsill existed that was 24 feet wide, the quantity for the element ‘Timber Pier Cap’ would be 48 feet.



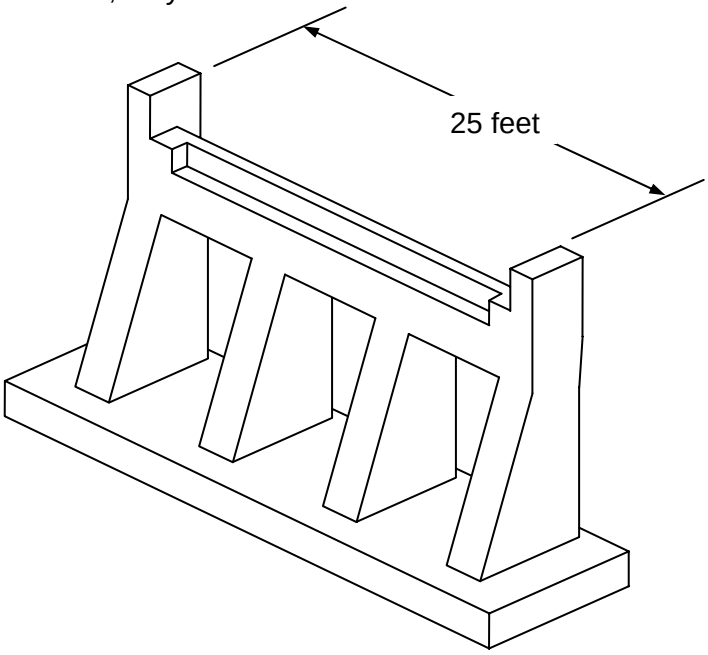
Element #	Element Name	Quantity
206	Timber Column or Pile Extension	5 EA
235	Timber Pier Cap	24 FT



Element #	Element Name	Quantity
206	Timber Column or Pile Extension	5 EA
235	Timber Pier Cap	48 FT (2 x 24)

Spill-Through Abutments

If the columns are visible, the abutment should be coded as indicated below. If the columns are not visible, they should not be identified.

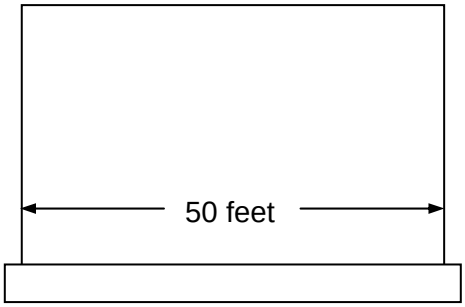


Element #	Element Name	Quantity
234	Reinforced Concrete Pier Cap	25 LF
205	Reinforced Concrete Column or Pile Extension	4 EA

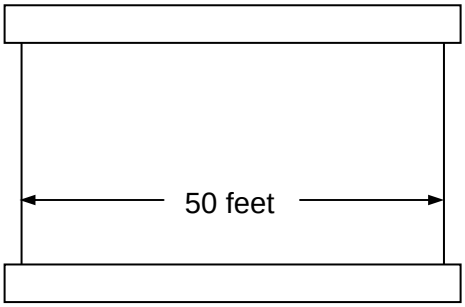
Piers - General

The following piers will have two elements consisting of a cap and either columns/piles or pier walls.

Where there is no clear distinction between the column/pier wall and a cap there is no cap.



PIER WALL -NO CAP



PIER WALL -WITH CAP

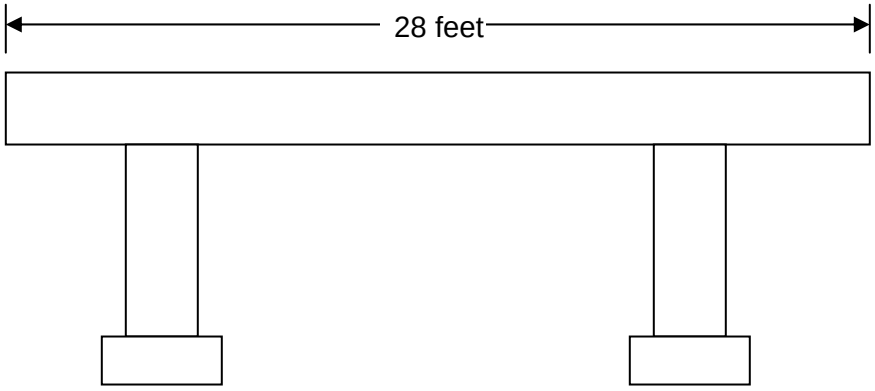
Example on right

Element #	Element Name	Quantity
210	Reinforced Concrete Pier Wall	50 LF
234	Reinforced Concrete Cap	52 LF

Example on left

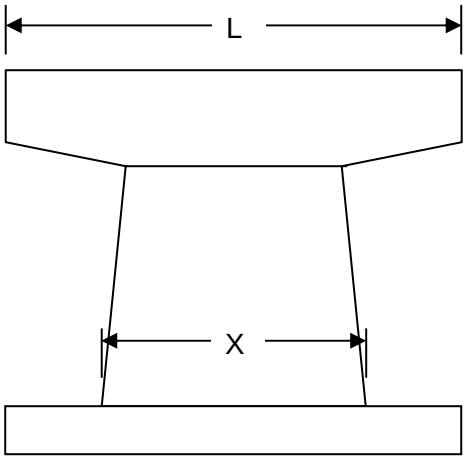
Element #	Element Name	Quantity
210	Reinforced Concrete Pier Wall	50 LF

Column Bent



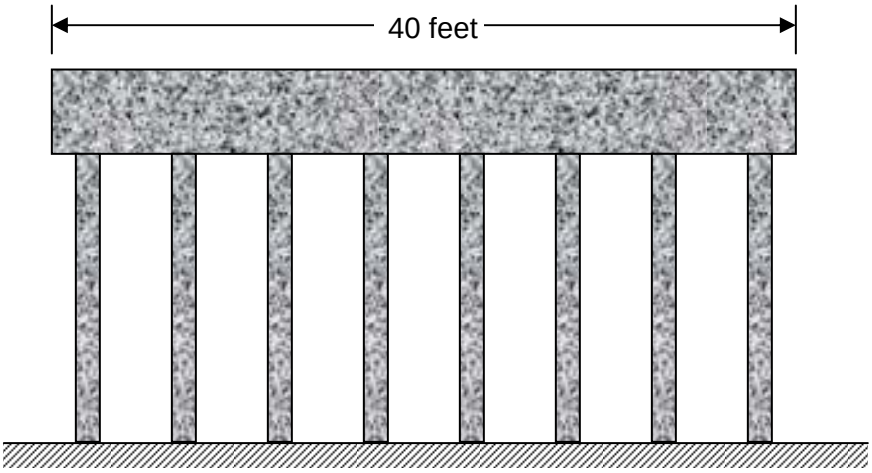
Element #	Element Name	Quantity
205	Reinforced Column or Pile Extension	2 EA
234	Reinforced Concrete Cap	28 LF

Hammer Head Pier



Element #	Element Name	Quantity
234	Reinforced Concrete Pier Cap	L FT
205	Reinforced Concrete Column or Pile Extension (If X is less than 10 feet)	1 EA
210	Reinforced Concrete Pier Wall (If X is equal to or greater than 10 feet)	L FT

Pile Bent

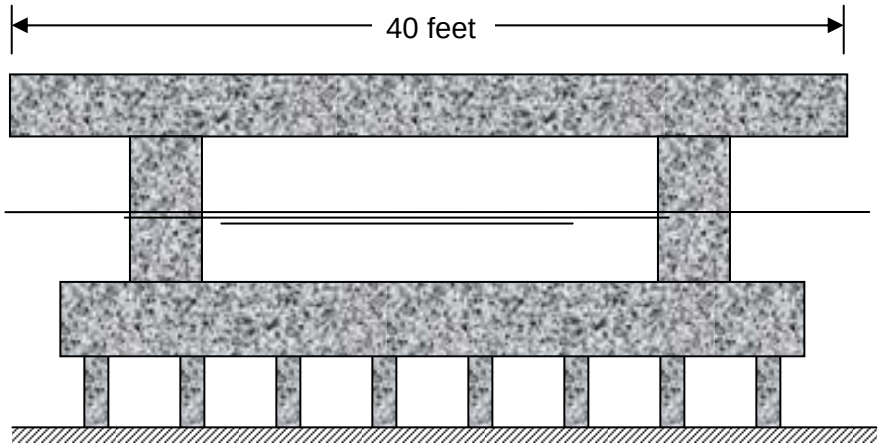


Element #	Element Name	Quantity
234	Reinforced Concrete Cap	40 LF
205	Reinforced Column or Pile Extension	8 EA

Column Bent With Submerged Pile Cap

As shown below there can be cases where reinforced concrete pile caps are submerged. In these cases they should be coded using Element 220.

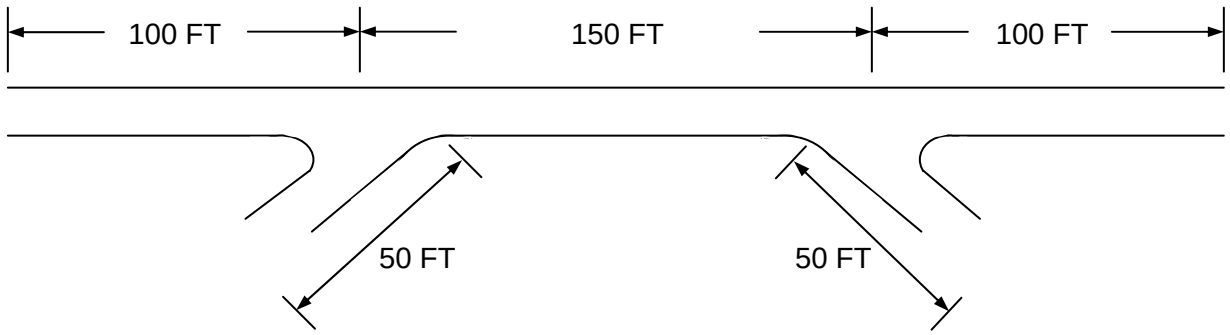
Where an element is intermittently submerged, code as if it were submerged constantly, 'Intermittently submerged' applies to submersion due to tidal action and does not necessarily apply to submersion caused by the occasional flood.



Element #	Element Name	Quantity
234	Reinforced Concrete Cap	40 LF
205	Reinforced Column or Pile Extension	2 EA
220	Reinforced Concrete Submerged Pile Cap/Footing	1 EA
227	Reinforced Concrete Submerged Pile	8 EA

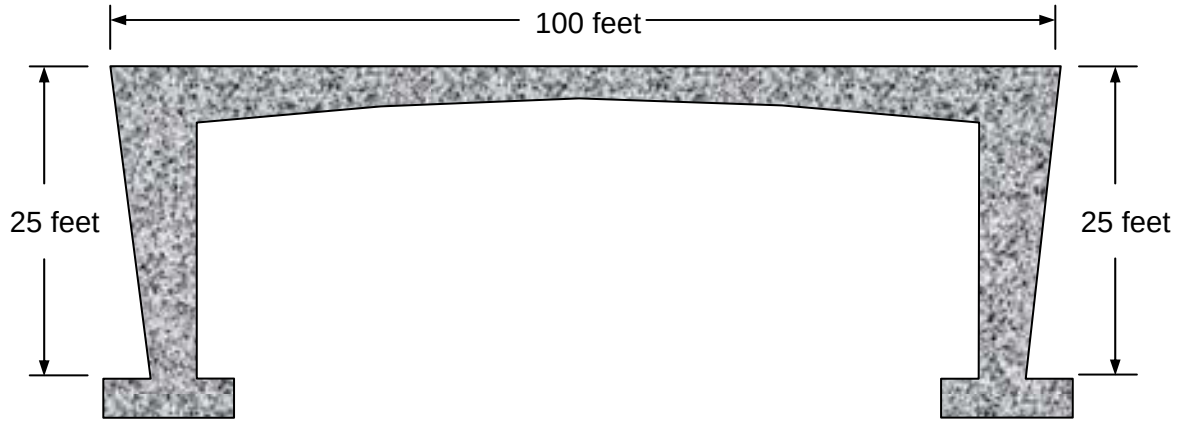
RIGID FRAMES AND THREE SIDED STRUCTURES

Steel (Frame)



Element #	Element Name	Quantity
107	Steel Open Girder - Coated	450 LF (per girder line)

Concrete (Three Sided Structure)



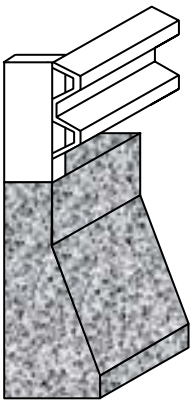
Abutment A - 50 feet wide

Abutment B - 50 feet wide

Element #	Element Name	Quantity
215	Reinforced Concrete Abutment	100 LF
38	Concrete Slab - Bare	5000 SF (50 x 100)

BRIDGE RAILING, CURBS, SIDEWALKS, MEDIANS AND TERMINAL WALLS

- Rather than code each component of a combination rail separately Use Element 333 Combination/Miscellaneous Bridge Railing.
- The quantity for bridge railing, curbing, sidewalks, medians and terminal walls are measured from backwall to backwall. Rail posts are not to be included in this quantity.
- If a structure has concrete terminal walls, they should be included in the element 'Concrete Bridge Railing'. The part of the terminal wall past the backwall is not included in this element.
- Non-mountable medians regardless of width shall be coded as concrete railings. This includes Jersey barriers.
- Sidewalks are defined as being 3 feet wide or greater. This dimension distinguishes the sidewalk from the safety curb.
- Mountable medians 3 feet wide or greater should be coded as a sidewalk and measured in linear feet along the centerline of the bridge.
- Sidewalks/curbs measuring less than 3 feet in width be considered a curb and shall be included with the appropriate railing element.
- Mountable medians less than 3 feet in width should be coded as concrete railing and measured in linear feet along the centerline of the bridge.
- Chain link pedestrian fencing used as safety fence on a structure shall be included with the linear feet of any other steel railing in place. If no other steel railing is in place it shall be coded as a separate steel railing. For example, if a 100 foot long structure has steel railing and a chain link pedestrian fence on each side of the structure, 200 linear feet shall be coded for element 330 (Metal Bridge Railing). If no other steel railing is in place and there is a chain link pedestrian fence and a concrete bridge railing on each side of the structure, 200 linear feet shall be coded for element 330 and 200 linear feet shall be coded for element 331 (Concrete Bridge Railing).

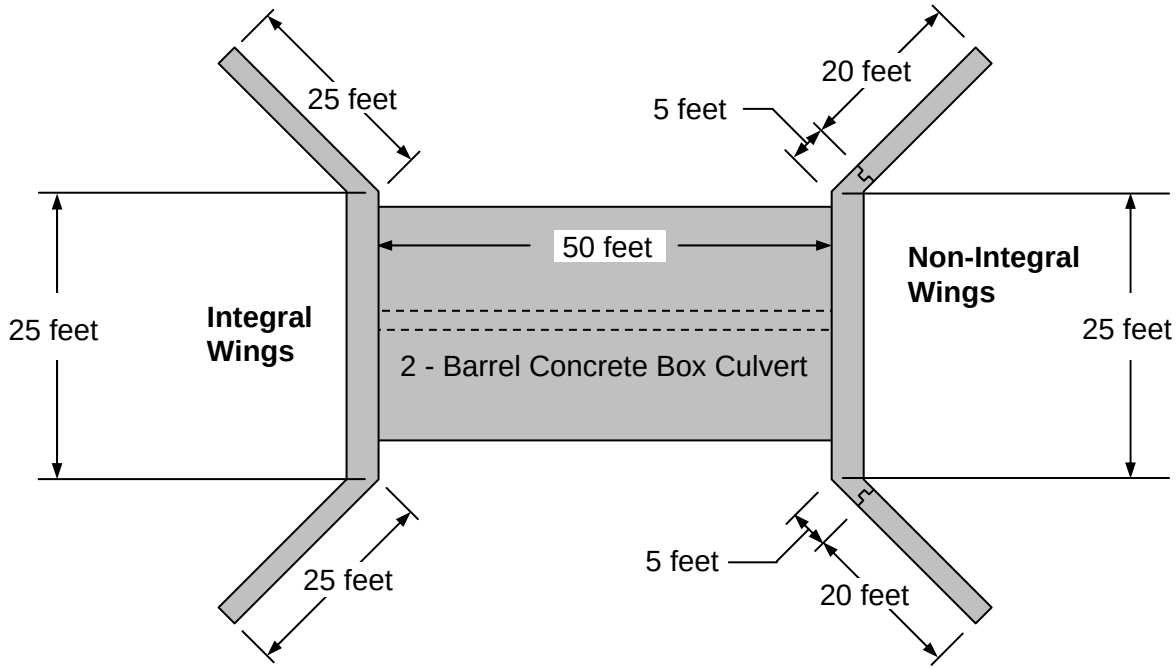


Element #	Element Name	Quantity
333	Combination/Miscellaneous Bridge Railing	70 LF

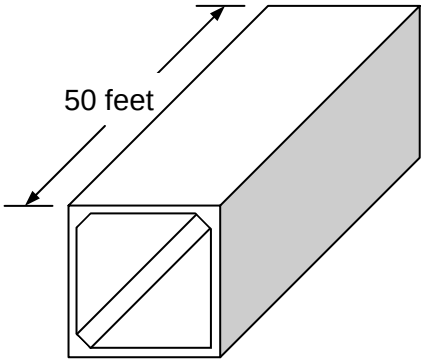
CULVERTS

Wingwalls/Endwalls

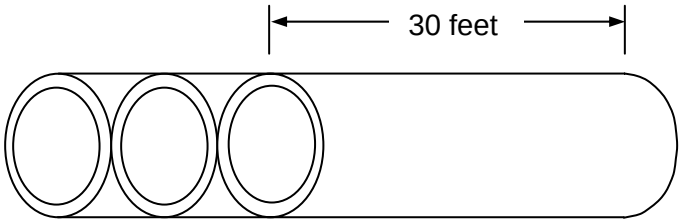
Element 295 shall not be used with culverts. Instead use Smart Flag 298 – Endwalls/Headwalls and Smart Flag 299 - Wingwalls



Element #	Element Name	Quantity
241	Reinforced Concrete Culvert	2 x 50 feet = 100 LF
Smart Flags		
298	Endwalls/Headwalls	Each
299	Wingwalls	Each



R/C Box Culvert



Metal Pipe Culvert

For Reinforced Concrete (R/C) Box Culvert

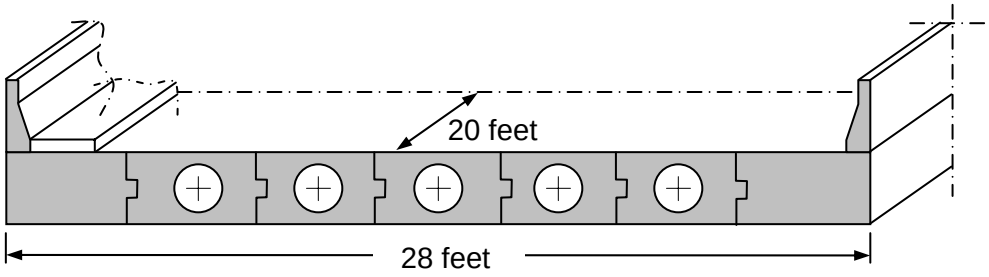
Element #	Element Name	Quantity
241	Reinforced Concrete Culvert	50 LF

For Multiple Metal Pipe Culverts

Element #	Element Name	Quantity
240	Metal Culvert	3 x 30 = 90 LF

PRESTRESSED CONCRETE SLABS - VOIDED AND UNVOIDED

These slabs should be coded as Element 104 - Prestressed Closed Web/Box Girders. A deck element, based on riding surface, must also be coded so the riding surface can be assessed.



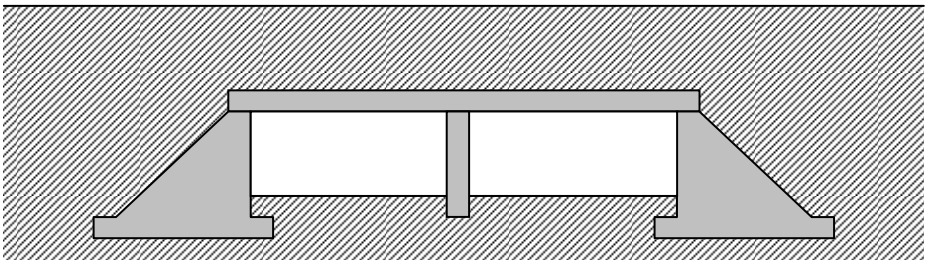
Element #	Element Name	Quantity
104	P/S Concrete Voided and Unvoided Closed Web/Box Girder	140 LF (7 x 20)
12	Concrete Deck—Bare	560 SF (20 x 28)
92^{V}	Sidewalk - Reinforced Concrete	20 LF (1 x 20)

REINFORCED FIBER POLYMER (RFP)

Due to the limited use of superstructures that are made of Reinforced Fiber Polymer (RFP), those types of superstructures will not require a Pontis level inspection. However, a Pontis level inspection will be required on the remaining portion of the structure that is not constructed of RFP.

SLAB SPANS COVERED WITH FILL

This element also applies to Concrete Deck Arches covered with fill.
Even though these structures are covered with fill, deck, superstructure, and substructure elements should be defined as appropriate. Because the top surface of the deck is not visible, smart flag 359 should be used to report the condition of the soffit. This will insure consistency with the coding for the National Bridge Inventory.

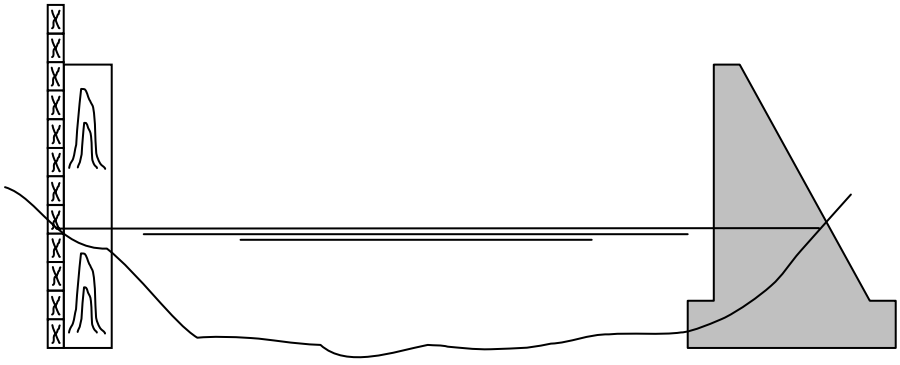


Element #	Element Name	Quantity
738	Concrete Slab covered with fill	1 EA (square feet)
359	Soffit Smart Flag	1 EA
215	Reinforced Concrete Abutment	?? LF
210	Reinforced Concrete Pier Wall	?? LF

SLOPE ELEMENTS

The slope at each abutment should be considered as a separate unit. Therefore, the quantity for slope will typically be '2'.

For the example shown below where the stream extends to the substructure there will be no slope element.



TRUSSES

Determining Quantities

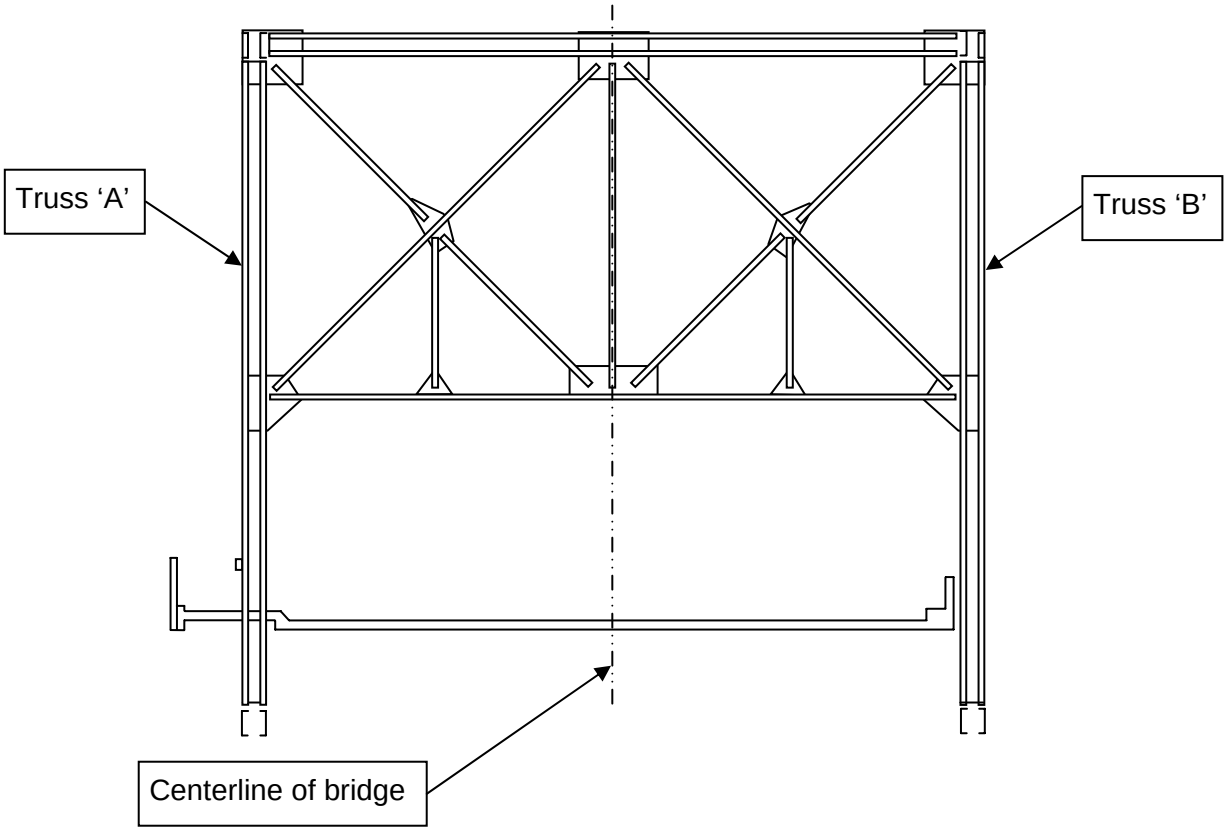
The superstructure of a truss bridge usually consists of two parallel trusses. The quantity is determined by calculating the combined length in linear feet of the parallel trusses. Diagonals, verticals, or cross bracing are not counted as additional quantities.

Total Length

The overall quantity is determined by the length of the bridge multiplied by the number of trusses in each span. See example below.

Through Truss (includes Pony Trusses)

The following example is a coated steel through truss. The bottom chord is a separate element for through trusses.

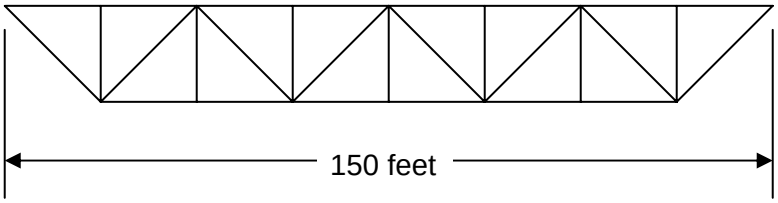


Assuming Truss 'A' and Truss 'B' are each 150 feet long and coated.

Element #	Element Name	Quantity
126	Coated Steel Through Truss Excluding Bottom Chord	300 LF (2 x150)
121	Coated Steel Bottom Chord of Through Truss	300 LF (2 x150)

Deck Truss

The following example is a coated steel deck truss. The bottom chord is not a separate element for deck trusses.



Element #	Element Name	Quantity
131	Coated Steel Deck Truss	300 LF (2 x 150)

Deterioration

All deterioration is measured along the length of the bridge.

Diagonals

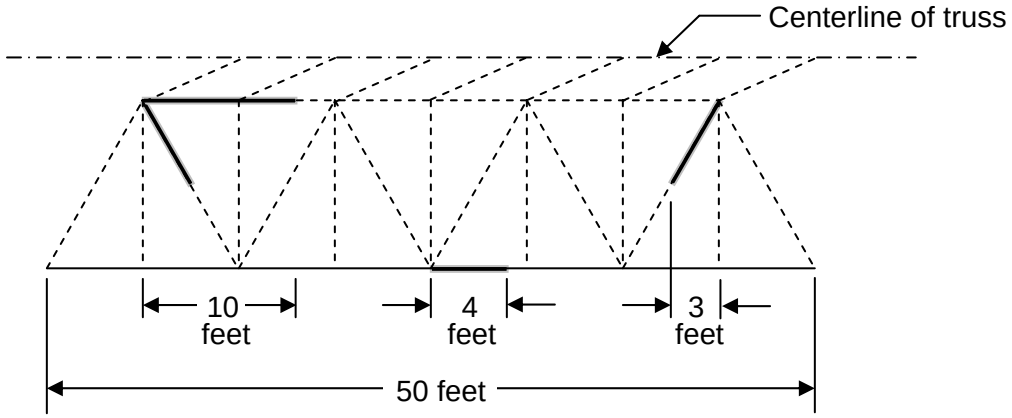
Deterioration of a diagonal member is measured along the length of the bridge and not along the diagonal. The quantity of a deteriorated section in diagonals and verticals that overlap deteriorated section(s) in other parts of the truss should not be double-counted. See example below.

Portals/Bracing

The quantities of deterioration of portals/bracing should be counted with the appropriate truss element. The quantity of deterioration of portals/bracing is determined by splitting the truss down the centerline of the roadway and associating the portal/bracing with the appropriate side of the truss. The quantity of a deteriorated section in portals/bracing that overlap a deteriorated section(s) in other parts of the truss, with which it has been associated, should not be double-counted. See example below.

Through Truss (includes Pony Trusses)

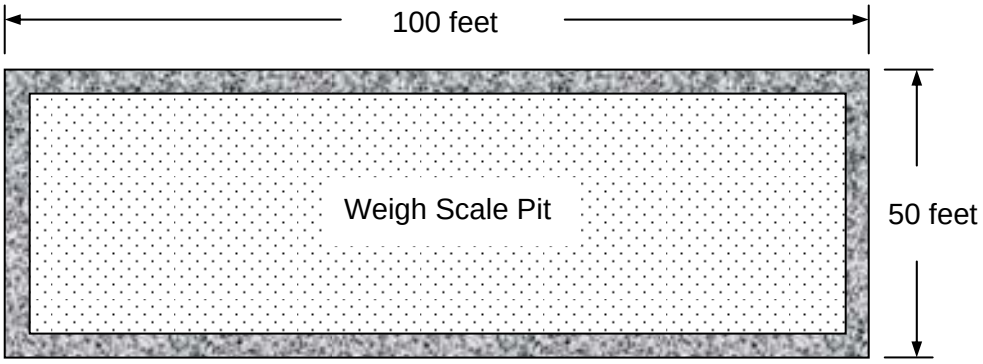
The following example is a coated steel through truss. Quantities of deterioration should include both the left and right side trusses. Note that the deterioration should be measured along the horizontal projection. The severity of the deterioration is indicated by using the appropriate condition state. The quantities listed are the deteriorated portions of the truss.



Element #	Element Name	Quantity	Deterioration
126	Coated Steel - Through Truss Excluding Bottom Chord	100 Feet (2 x 50)	13 LF (10 + 3)
121	Coated Steel - Through Truss Bottom Chord	100 Feet (2 x 50)	4 LF

WEIGH SCALE PITS

For the purposes of element-level inspections, consider the walls of the scale pit to be the abutment.



Element #	Element Name	Quantity
215	Concrete Abutment	300 LF

ARCHES

For Elements 135, 140, 141, 143 and 144 the quantity is measured along the span length from spring-line to spring-line. It is not measured along the length of the barrel.

Concrete Deck Arches – Covered With Fill
(See 'Slab Spans - covered with fill')

WEARING SURFACE

For something to be called a wearing surface, it must be placed separately from the time the deck is placed. This is the first and most important test. Therefore, monolithically place concrete (the ½" that designers call a wearing surface) is not a wearing surface. The following <u>are</u> examples of wearing surfaces: asphaltic concrete overlays, cementitious overlays and epoxy overlays. There are others not mentioned here.

EXCEPTIONS - as defined above for something to be called a wearing surface, it must be placed separately from the time the deck is placed. However, if an application is placed separately from the time the deck is placed and if the designer and the analyzer consider it in the capacity (strength) of the structure, it will not be considered an overlay. Therefore, reinforced cementitious overlays, the concrete placed over prestressed deck panels, and other similar applications are not wearing surfaces and are to be considered part of the deck.

While this is in conflict with some of the wording of the Bridge Inspector's Reference Manual (BIRM), the above definitions best suit Virginia's need for this information and will reduce or eliminate coding disparities.

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