Road Structures Inspection Manual

Appendix B: Standard Component Schedule

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Government of South Australia
Department of Planning, Transport and Infrastructure

Road Structures Inspection Manual

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Department of Planning, Transport and Infrastructure, South Australia

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Disclaimer
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STRUCTURE COMPONENT SCHEDULE

Bridge and other structure components. The Component Number represents the order of the components as listed in Part 4: Condition State Guidelines and Photographs for the component. The number in the Material columns shows the condition state guidelines to be used for the component.

Table B-1: Schedule of component measurements and materials

Structure Type				Material				
	Component Number							
		Category/Component	Measurement Unit	Precast Concrete (P)	Cast-in-situ Concrete (C)	Steel (S)	Timber (T)	Other (O)
Bridge								
	Approach							
	1	Approach	Each					1O
	2	Approach Road	Each					2O
	3	Approach Barrier	Lin m	3C	3C	3S		
	4	Approach Slab	m^2		4C			
	Abutment							
	5	Abutment	m^2	5P	5C	5S	5T	5O
	6	Batter Protection	m^2	6P	6C			6O
	7	Footing	m^2		7C			
	8	Pile Cap	m^2		8C			
	9	Reinforced Earth	m^2	9P				9O
	10	Wingwalls / Retaining Walls	m^2	10P	10C	10S	10T	10O
	11	Lateral Restraint Blocks	m^2		11C			

Structure Type				Material				
	Component Number							
		Category/Component	Measurement Unit	Precast Concrete (P)	Cast-in-situ Concrete (C)	Steel (S)	Timber (T)	Other (O)
	Span							
	12	Deck / Slab	m^2	12P	12C	12S	12T	
	13	Longdecking / Crossdecking	m^2				13T	
	14	Girders – Closed Web / Box Girder	m^2	14P	14C	14S		
	15	Open Girders / Stringers	m^2	15P	15C	15S		
	16	Deck Truss	m^2			16S		
	17	Arches	m^2	17P	17C	17S		17O
	18	Diaphragms / Bracing	m^2		18C	18S		
	19	Load Bearing Diaphragms	m^2		19C	19S		
	20	Propping	Each			20S	20T	20O
	Pier							
	21	Crossheads (Non Integral with Superstructure)	m^2	21P	21C	21S		
	22	Crossheads (Integral with Superstructure)	m^2		22C			
	23	Column or Pile Extensions	m^2	23P	23C	23S		
	24	Pier Wall	m^2		24C			24O
	25	Lateral Restraint Blocks	m^2		25C			
	26	Pier Protection	m^2	26P		26S	26T	

Structure Type				Material				
	Component Number							
		Category/Component	Measurement Unit	Precast Concrete (P)	Cast-in-situ Concrete (C)	Steel (S)	Timber (T)	Other (O)
	Deck							
	27	Through Truss	m^2			27S		
	28	Cable / Hangers (Not Embedded in Concrete)	Each			28S		
	29	Traffic Barrier	Lin m	29C	29C	29S		29O
	30	Pedestrian Barrier / Fence	Lin m			30S	30T	30O
	31	Other Barriers and Screens	Lin m					31O
	32	Bridge Kerb	Lin m	32C	32C	32S	32T	
	33	Footpaths	Lin m	33C	33C	33S	33T	33O
	34	Traffic Surface	m^2		34C			34O
	Deck Joints							
	35	Pourable Joint Seals	Lin m					35O
	36	Compression Joint Seals	Lin m					36O
	37	Assembly Joint Seal	Lin m					37O
	38	Open Expansion Joint	Lin m			38S		38O
	39	Sliding Joint	Lin m			39S		
	40	Fixed Joint	Lin m					40O
	Bearings							
	41	Fixed Bearings	Each					41O
	42	Sliding Bearings	Each					42O
	43	Elastomeric / Pot Bearings	Each					430
	44	Rockers / Rollers	Each			44S		
	45	Mortar Pads / High Bearing Pedestals	Each		45C			

Structure Type	Component Number			Material				
		Category/Component	Measurement Unit	Precast Concrete (P)	Cast-in-situ Concrete (C)	Steel (S)	Timber (T)	Other (O)
Bridge								
	46	Waterway	Each					46O
	47	Channel Protection	Each		47C			44O
	48	Base Slab	m^2		48C			48O
	49	External Strengthening / Post Tensioning	Each			49S		49O
	50	Additional Elements	Each					50O
	51	Drainage System	Each					51O
Culverts and Pedestrian Subways								
	60	Pipe Culverts	m^2	60P		60S		60O
	61	Box Culverts	m^2	61P	61C			61O
	62	Arch Culverts	m^2	62P	62C			62O
	63	Headwalls / Wingwalls	m^2	63P	63C			63O
	64	Culvert Base Slab / Steel Pipe Invert	m^2		64C			64O
	65	Waterway	Each					43O
	66	Channel Protection	Each		44C			44O
	67	Traffic Barrier	Lin m	26C	26C	26S		26O

Structure Type	Component Number			Material				
		Category/Component	Measurement Unit	Precast Concrete (P)	Cast-in-situ Concrete (C)	Steel (S)	Timber (T)	Other (O)
Gantries								
	70	Footings / Support Systems	Each	70P	70C	70S		
	71	Columns / Mast	Each	71P		71S		
	72	Cantilever Arms or Gantry Beams	Lin m			72S		
	73	Gantry Truss	Lin m			73S		
	74	Hold Down Bolts and Fittings	Each			74S		
	75	Base Plates, Fittings and Mortar Pad	Each		75C	75S		
	76	Sign Face Support Structure	Each			76S		
	77	Ancillaries (Walkways, Cable Trays, Ladders)	Each			77S		
Retaining Walls								
	80	Wall Facing / Panels	m^2	80P	80C	80S	80T	80O
	81	Columns	Each	81P	81C	81S	81T	81O
	82	Barriers	Lin m	82P		82S		
	83	Connections and Horizontal Supports	Each			83S	83T	
	84	Drainage System	Each					84O
Noise and Visual Screen Walls								
	90	Wall Facing / Panels	m^2	90P	90C	90S	90T	90O
	91	Column Supports	Each	91P		91S	91T	
	92	Foundation	Lin m	92C	92C	92S		
	93	Hold Down Bolts, Base Plates and Fittings	Each			93S		
	94	Mortar Pad	Each		94C			

Structure Type	Component Number		Measurement Unit	Material				
		Category/Component		Precast Concrete (P)	Cast-in-situ Concrete (C)	Steel (S)	Timber (T)	Other (O)
Ferry Ramps								
	100	Ramp Slab	m^2		100C			
	101	Ramp Shoulder	m^2		101C			101O
	102	Deadmen	Each		102C			
	103	Ramp Joints	Lin m					103O
	104	Traffic Barrier	Lin m			26S		
Cattle Grids								
	110	Abutment Wall	m^2		110C			
	111	Pier Wall	m^2		110C			
	112	Grid Base Slab	m^2		112C			
	113	Wingwall	m^2		113C			
	114	Grid Baffle Plates	Lin m			114S		
	115	Grid Girders	Lin m			115S		
	116	Grid Packers	Each			116S		
	117	Grid Rails	Lin m			117S		
	118	Fence	Each					118O
	119	Boundary Fence Connection	Each					119O
	120	Approach	Each					1O
	121	Approach Road	Each					2O

Structure Type	Component Number		Measurement Unit	Material				
		Category/Component		Precast Concrete (P)	Cast-in-situ Concrete (C)	Steel (S)	Timber (T)	Other (O)
Busway Track								
	130	Busway Track	m^2	130P				
	131	Busway Sleepers	Each	131P				
	132	Busway Piles	Each		132C			
	133	Busway Guide Rails	Lin m			133S		
	134	Busway Sump Busters	Each			134S		
Tunnels								
	140	Tunnel Wall	m^2	140C	140C	140S		
	141	Tunnel Portal	m^2	141C	141C			
	142	Tunnel Roof	m^2	142C	142C			
	143	Approach	Each					1O
	143	Approach Road	Each					2O
	143	Approach Barrier	Lin m	3C	3C	3S		
	144	Traffic Surface	m^2		31C			31O
	145	Base Slab	m^2					45O
	146	Construction Joint	Lin m					146O
	147	Additional Elements	Each					147O
	148	Drainage System	Each					48O

INSPECTION GROUP – STRUCTURE CLASS MATRIX

Inspection groups have been allocated to the various structure classes as outlined in the following table.

Table B-2: Allocation of inspection groups to structure classes

Structure Class	Inspection Group															
	Approach	Abutment	Deck	Span	Pier	Bridge	Cell	Culvert	Subway	Town Side Far Side	Gantry	Cattle Grid	Noise Wall	Retaining Wall	Busway Track	Tunnel
	AP1,2	A1,2	D	S_n	P_n	B	C	CV	SY	TS / FS	G	CG	NW	RW	RW	T
Bridge	✓	✓	✓	✓	✓	✓										
Busway Track	✓														✓	
Culvert	✓		✓				✓	✓								
Cattle Grid	✓		✓									✓				
Footbridge	✓	✓	✓	✓	✓	✓										
Ferry Ramp										✓						
Gantry											✓					
Noise Wall													✓			
Pedestrian Subway	✓	✓	✓				✓		✓							
Retaining Wall														✓		
Tunnel	✓	✓	✓													✓

INSPECTION GROUP – COMPONENT MATRIX

Components are allocated to inspection groups as outlined in the following table.

Table B-3: Allocation of components to inspection groups

Category/ Component	Inspection Group															
	Approach	Abutment	Deck	Span	Pier	Bridge	Cell	Culvert	Subway	Town Side Far Side	Gantry	Cattle Grid	Noise Wall	Retaining Wall	Busway Track	Tunnel
	AP1,2	A1,2	D	S_n	P_n	B	C	CV	SY	TS / FS	G	CG	NW	RW	BT	T
Abutment		✓						✓						✓		✓
Abutment wall												✓				
Additional elements						✓		✓	✓		✓			✓		✓
Anti-throw screen			✓						✓	✓						
Approach	✓															
Approach barrier	✓															
Approach road	✓															
Approach slab	✓															
Apron						✓										
Barriers			✓							✓	✓			✓		
Base plates, fittings & hold down bolts											✓					
Base slab						✓	✓									✓
Batter protection		✓														
Bearings		✓			✓											✓
Boundary fence connection												✓				
Bracing				✓												
Bridge kerb			✓													
Busway guide rails															✓	
Busway piles															✓	
Busway sleepers															✓	
Busway sump busters															✓	

Category/ Component	Inspection Group															
	Approach	Abutment	Deck	Span	Pier	Bridge	Cell	Culvert	Subway	Town Side Far Side	Gantry	Cattle Grid	Noise Wall	Retaining Wall	Busway Track	Tunnel
	AP1,2	A1,2	D	S_n	P_n	B	C	CV	SY	TS / FS	G	CG	NW	RW	BT	T
Busway track															✓	
Cantilever arms											✓					
Channel protection						✓		✓								
Columns											✓					
Deadmen										✓						
Deck				✓			✓								✓	
Diaphragms				✓												
Footing		✓			✓		✓				✓			✓		
Footpaths (shared)			✓						✓							✓
Gantry beams											✓					
Girders				✓												
Grid baffle plates			✓													
Grid base slab												✓				
Grid girders			✓													
Grid packers			✓													
Grid rails			✓													
Gutter			✓						✓		✓					
Headwall			✓													
Horizontal members											✓					
Joints			✓				✓									
Lateral Restraint Block		✓			✓											
Mounted devices											✓					
Noise wall													✓			
Other barriers and screens			✓						✓	✓						
Pedestrian barrier			✓						✓	✓						
Pedestrian fence			✓						✓	✓						

Category/ Component	Inspection Group															
	Approach	Abutment	Deck	Span	Pier	Bridge	Cell	Culvert	Subway	Town Side Far Side	Gantry	Cattle Grid	Noise Wall	Retaining Wall	Busway Track	Tunnel
	AP1,2	A1,2	D	S_n	P_n	B	C	CV	SY	TS / FS	G	CG	NW	RW	BT	T
Pier					✓		✓									
Pier protection					✓		✓									
Pier wall												✓				
Pile cap		✓			✓											
Propping				✓			✓									
Ramp joints										✓						
Ramp shoulder										✓						
Ramp slab										✓						
Reinforced earth		✓														
Retaining wall		✓												✓		
Sidewall									✓							
Sign face support structure											✓					
Stringer				✓												
Substructure						✓										
Subway base slab							✓									
Superstructure						✓										
Traffic barrier			✓						✓	✓						
Traffic surface			✓												✓	✓
Trestle wind bracing					✓											
Tunnel portal																✓
Tunnel roof																✓
Tunnel wall																✓
Waterway						✓		✓								
Wingwall		✓						✓				✓				

ELEMENT QUANTITY CALCULATIONS

Table B-4 describes how to calculate dimensions (length, width, height) and quantities for the various types of elements. In general, dimensions can be obtained from structural drawings, however, these values should be verified in the field (e.g. kerb height may have been reduced after a resurfacing operation). It should be noted that the quantity calculation is approximate in some cases (e.g. surface area of a girder), but is accurate enough to be used in element condition assessment. In general, quantities are calculated for one element (e.g. girder) and then the Total Quantity is calculated by multiplying the quantity by the number of that type of element (Count).

For elements that are partially buried, quantities should be calculated for the part of the element that is visible above the ground (e.g. piers). For all other elements, the quantity shall be based on the total area of the element as shown on the plans. (e.g. abutment wall). When inspecting an element that is partially hidden (e.g. abutment backwall), the quantity of material defects should be estimated based on the portion that is visible.

Some parts of this section have been compiled based on material sourced from:

- **Ontario Ministry of Transportation, *Ontario Structure Inspection Manual***
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  <https://www.library.mto.gov.on.ca/SydneyPLUS/Sydney/Portal/default.aspx?component=AAAAIY&record=2cc7e50c-3d41-4468-90f1-0788368ce945> licensed under the Open Government Licence – Ontario
  <https://www.ontario.ca/page/open-government-licence-ontario>
- **Transport for New South Wales (Roads and Maritime Services), *Bridge Inspection Procedure Manual***
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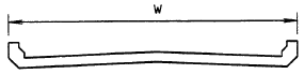
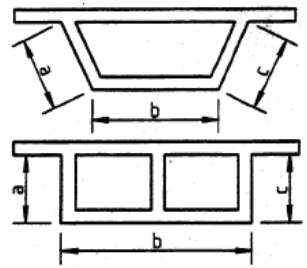
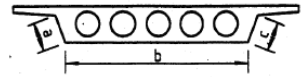
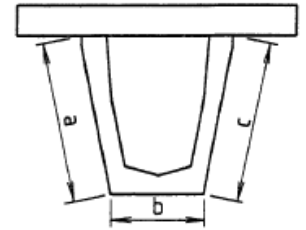
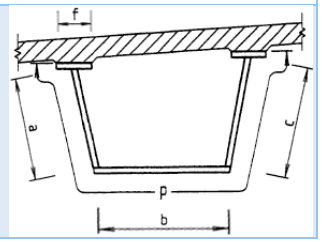
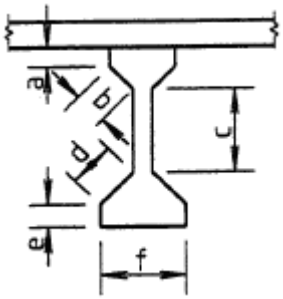
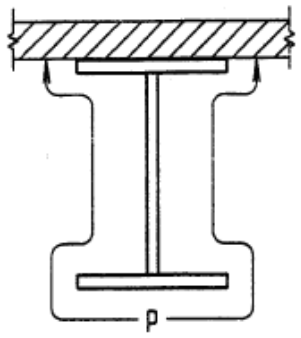
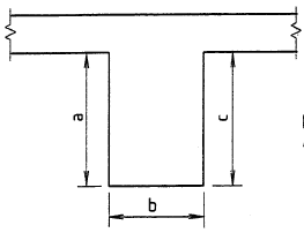
  <https://www.rms.nsw.gov.au/documents/business-industry/partners-and-suppliers/lgr/p0_bipm_common.pdf>

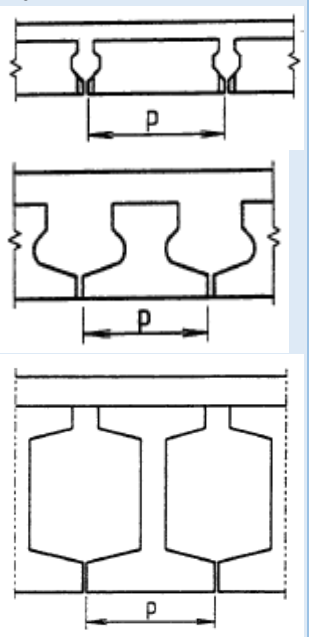
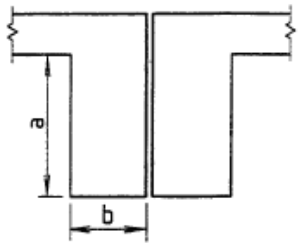
Table B-4: Procedures for computing element dimensions and quantities

Element Group	Element Name	Measure	Length (m)	Width (m)	Height (m)	Count	Quantity (m^2)	Comments
Approach	Approach	Each	n/a	n/a	n/a	n/a	Count (Units are Each)	Settlement of approach
	Approach Road	Each	n/a	n/a	n/a	n/a	Count (Units are Each)	Delineation
	Approach Barrier	Lin m	Generally no more than 20m	n/a	n/a	# of sides (typically 2)	Count x Length (Units are m)	
	Approach Slab	m^2	Typically approx. 5m	Generally road width	n/a	1 at each approach	Length x Width	Only applicable if slab is visible and able to be inspected.
Abutment	Abutment	m^2	n/a	Average width of abutment from wingwall to wingwall	Abutment wall: Height from bearing seat to ground level + bearing seat width Ballast wall (Abutment backwall): *For decks without exp. joints:* Height from underside of deck to bearing seat *For decks with exp. joints:* Height from top of deck to bearing seat	n/a	Width x Height **Total quantity = Quantity Abutment wall + Quantity Ballast wall (unless Abutment sill wall and Abutment back wall are entered as separate elements in which case their separate quantities should be entered)**	Separate measurements for abutments at each end of bridge. Does not include batter protection below abutment wall / sill. Abutment wall: Includes bearing seat width Ballast wall (Abutment backwall): Includes entire ballast wall even if some areas are not visible due to diaphragms

Element Group	Element Name	Measure	Length (m)	Width (m)	Height (m)	Count	Quantity (m^2)	Comments
	Batter Protection	m^2	Total length of batter protection	n/a	Average height from abutment to base level of protection	n/a	Length x Height	Separate measurements for each abutment
	Footing	m^2	Length of footing	Width of footing	Height of exposed edge of footing	# of footings	Count x [(2 x Width x Height) + (2 x Length x Height) + (Length x Width)]	Underside of footing not included as generally not visible
	Pile Cap	m^2	Thickness or length of caps parallel to length of bridge	Width of cap	Depth or height of cap	# of caps	Count x [(2 x Width x Height) + (2 x Length x Height) + (Length x Width)]	Underside of pile cap not included as generally not visible
	Reinforced Earth	m^2	n/a	Average width of abutment from wingwall to wingwall	Wall height	n/a	Width x Height	Reinforced earth (MSE) abutment walls Separate measurements for each abutment
	Wingwalls / Retaining Walls	m^2	Length of wall	n/a	Average height of wall	# of walls	Length x Height x Count	
	Lateral Restraint Block	m^2	Thickness parallel to bridge length	Width of block between girders	Height of block above sill beam	# of blocks per abutment = 1 usually	Count x [(2 x Width x Height) + (Length x Width)]	
Span	Deck / Slab	m^2	Span length	Bridge width including overhangs	n/a	n/a	Length x Width	
	Longdecking / Crossdecking	m^2	Length of planks	Width of planks	n/a	# of planks	Length x Width x Count	

Element Group	Element Name	Measure	Length (m)	Width (m)	Height (m)	Count	Quantity (m^2)	Comments
	Girders – Closed Web / Box Girder (Concrete)	m^2	Exposed length of girder (**l**)	Bottom flange width (**b**)	Girder depth (**a** + **c**)	# of girders (in span)	Length x (Height + Width) x Count	Box Girder:  Voided Slab:  Trough Girder: 
	Girders – Closed Web / Box Girder (Steel)	m^2	Exposed length of girder (**l**)	Bottom flange width (**b**) + Top flange width (**f**)	Girder depth (**a** + **c**)	# of girders (in span)	Length x Perimeter	
				Perimeter (**p**) = Height + Width				

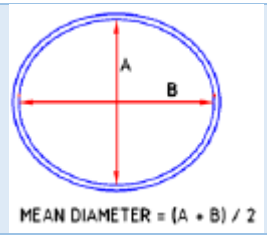
Element Group	Element Name	Measure	Length (m)	Width (m)	Height (m)	Count	Quantity (m^2)	Comments
	Open Girders / Stringers / Diaphragms (I Beams) (Concrete)	m^2	Exposed length of girder (**l**)	Bottom flange width (**f**)	Girder depth (**a** + **b** + **c** + **d** + **e**)	# of girders (in span)	Length x (Height x 2 + Width) x Count	
	Open Girders / Stringers / Diaphragms (I Beams) (Steel)	m^2	Exposed length of girder (**l**)	Average width of flanges	Depth of web	# of girders (in span)	Length x Perimeter	
				Perimeter (**p**) = (Width x 3) + Height				
	Open Girders / Diaphragms (Beams/Arches) (Concrete)	m^2	Exposed length of girder (**l**)	Bottom flange width (**b**)	Girder depth (**a** + **c**)	# of girders (in span)	Length x (Height + Width) x Count	

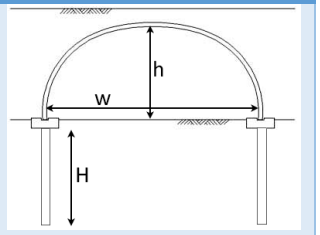
Element Group	Element Name	Measure	Length (m)	Width (m)	Height (m)	Count	Quantity (m^2)	Comments
	Open Girders (Planks) (Concrete)	m^2	Exposed length of girder (**l**)	Bottom flange width (**p**)	n/a	# of girders (in span)	Length x Width x Count	Plank: 
	Cross Girders / Diaphragms (Beams) (Concrete)	m^2	Exposed length of girder (**l**)	Bottom flange width (**b**)	Girder depth (**a**)	# of girders (in span)	Length x (Height + Width) x Count	

Element Group	Element Name	Measure	Length (m)	Width (m)	Height (m)	Count	Quantity (m^2)	Comments
	Deck Truss	m^2	Bottom chords Total length of bottom chord (all panels) Top chords Total length of top chord (all panels) Verticals / Diagonals Average length of diagonals	Average flange width	Depth of section	Bottom / Top chords # of chords per side = 2 usually Verticals / Diagonals # verticals / diagonals for all sides	*For I Sections:* Quantity = Count x Length x (Height x 2 + 4 x Width) *For T or L Sections* Quantity = Count x Length x (Height x 2 + 2 x Width)	Calculate quantities for Bottom chords, Top chords and Verticals / Diagonals separately. **Total quantity = Quantity Bottom chords + Quantity Top chords + Quantity Verticals / Diagonals**.
	Diaphragms / Bracing (Steel)	m^2	Girder spacing or for cross or "K" bracing: total length of all bracing members measured along the length of the member	Average width of flanges	Depth of section	# of individual diaphragm segments	Length x (Height x 2 + Width) x Count	
	Propping	Each	n/a	n/a	n/a	n/a	Count (Units are Each)	
Pier	Crossheads	m^2	Thickness of crosshead parallel to length of bridge	Width of crosshead	Depth or height of crosshead	# of crossheads (in pier inspection group)	Count x 2 x [(Width x Height) + (Length x Height) + (Length x Width)]	

Element Group	Element Name	Measure	Length (m)	Width (m)	Height (m)	Count	Quantity (m^2)	Comments
	Column or Pile Extensions	m^2	For Rectangular Shaft or Column: Thickness parallel to bridge length For Round Columns, Pipe Piles or Timber Piles: Diameter (**L**)	For Rectangular Shaft or Column: Average width of column For Round Columns, Pipe Piles or Timber Piles: Diameter (**W**)	Height from bearing seat / bottom of crosshead to ground level (if under water use stream bed elevation) + bearing seat width + visible part of footing	# of columns or # of piles	For Rectangular Shaft or Column: 2 x (Length + Width) x Height x Count For Round Columns, Pipe Piles or Timber Piles: Count x [2 x π x (M/2) x Height]	Includes bearing seat width and top of footing (if visible)
			Mean diameter (**M**) = (**L** + **W**)/2					
	Pier Wall	m^2	Thickness parallel to bridge length	Average width of wall	Depth or height of wall	# of piers in inspection group	Count x 2 x [(Width x Height) + (Length x Height) + (Length x Width)]	
	Lateral Restraint Block	m^2	Thickness parallel to bridge length	Width of block between girders	Height of block above crosshead	# of blocks per pier = 1 usually	Count x [(2 x Width x Height) + (Length x Width)]	
	Pier Protection	m^2	Total length of barrier	n/a	Height of barrier	# protected piers in inspection group	Count x Length x Height	

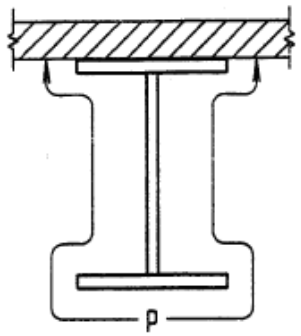
Element Group	Element Name	Measure	Length (m)	Width (m)	Height (m)	Count	Quantity (m^2)	Comments
Deck	Through Truss	m^2	<u>Bottom chords</u> Total length of bottom chord (all panels) <u>Top chords</u> Total length of top chord (all panels) <u>Verticals / Diagonals</u> Average length of diagonals	Average flange width	Depth of section	<u>Bottom / Top chords</u> # of chords per side = 2 usually <u>Verticals / Diagonals</u> # verticals / diagonals for all sides	*<u>For I Sections:</u>* Quantity = Count x Length x (Height x 2 + 4 x Width) *<u>For T or L Sections</u>* Quantity = Count x Length x (Height x 2 + 2 x Width)	Calculate quantities for Bottom chords, Top chords and Verticals / Diagonals separately. **Total quantity = Quantity Bottom chords + Quantity Top chords + Quantity Verticals / Diagonals**.
	Cable / Hangers (Not Embedded in Concrete)	Each	n/a	n/a	n/a	n/a	Count (Units are Each)	
	All Barrier Types	Lin m	Total length of barrier excluding approach barriers	n/a	n/a	Typically 1 - refer comments May be 2 if Median barriers	Count x Length (Units are m)	Separate measurements for Right/Left/Median (where applic)
	Bridge Kerb	Lin m	Total length of kerb excluding approaches	n/a	n/a	# of kerbs (typically 2)	Count x Length (Units are m)	
	Footpaths	Lin m	Total length of footpath excluding approaches	n/a	n/a	# of footpaths	Count x Length (Units are m)	
	Traffic Surface	m^2	Total length of bridge excluding approaches	Kerb to kerb width	n/a	n/a	Length x Width	

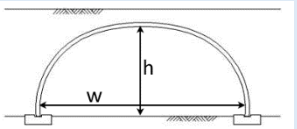
Element Group	Element Name	Measure	Length (m)	Width (m)	Height (m)	Count	Quantity (m^2)	Comments
Deck Joints	All Joint Types	Lin m	Kerb to kerb width	n/a	n/a	# of joints	Count x Length (Units are m)	# per Inspection Group
Bearings	All Bearing Types	Each	n/a	n/a	n/a	# of bearings	Count (Units are Each)	# bearings per Inspection Group
Bridge	Waterway	Each	n/a	n/a	n/a	n/a	Count (Units are Each)	
	Channel Protection	Each	n/a	n/a	n/a	n/a	Count (Units are Each)	
	Base Slab	m^2	Length of slab parallel to length of bridge	Width of slab	n/a	n/a	Length x Width	
	External Strengthening / Post Tensioning	Each	n/a	n/a	n/a	# of element	Count (Units are Each)	
	Additional Elements	Each	n/a	n/a	n/a	# of element	Count (Units are Each)	
	Drainage System	Each	n/a	n/a	n/a	n/a	Count (Units are Each)	
Culverts and Pedestrian Subways	Pipe Culverts	m^2	Length of culvert	Diameter of culvert (**W**)	Diameter of culvert (**H**)	Typically 1 per Cell inspection group	Length x 2 x π x (M/2)	
				Mean diameter (**M**) = (**W** + **H**)/2				
	Box Culverts	m^2	Length of culvert	Width of box deck slab	Height of box wall	Typically 1 per Cell inspection group	Length x [Width + (Height x 2)]	

Element Group	Element Name	Measure	Length (m)	Width (m)	Height (m)	Count	Quantity (m^2)	Comments
	Arch Culverts	m^2	Length of culvert	Arch only: Width at base of culvert (**w**) Side walls: n/a	Arch only: Height at middle of culvert (**h**) Side walls: Height of wall (**H**)	Typically 1 per Cell inspection group	Arch only (assume w = 2 x h)* Length x π x h If culvert also has side walls, add: Length x 2 x H	 * If w ≠ 2 x h, then refer to established mathematical formulae to calculate surface area.
	Headwalls / Wingwalls	m^2	Length of wall	n/a	Average height of wall	Headwalls: # of headwalls Wingwalls: # of wingwalls	Headwalls: Length x Height x Count Wingwalls: Length x Height x Count	If walls are different sizes: Calculate separately and sum Separate calculations for headwalls and wingwalls.
	Culvert Base Slab/ Steel Pipe Invert	m^2	Length of culvert	Width of base of culvert / invert	n/a	Typically 1 per Cell inspection group	Length x Width x Count	
	Waterway	Each	n/a	n/a	n/a	n/a	Count (Units are Each)	
	Channel Protection	Each	n/a	n/a	n/a	n/a	Count (Units are Each)	
	Traffic Barrier	Lin m	Total length of barrier	n/a	n/a	Typically 2	Count x Length (Units are m)	
Gantries	Footings / Support	Each	n/a	n/a	n/a	n/a	Count (Units are Each)	
	Columns / Mast	Each	n/a	n/a	n/a	n/a	Count (Units are Each)	
	Cantilever Arms or Gantry Beams	Lin m	Length of beam	n/a	n/a	# of beams	Count x Length (Units are m)	

Element Group	Element Name	Measure	Length (m)	Width (m)	Height (m)	Count	Quantity (m^2)	Comments
	Gantry Truss	Lin m	Length of horizontal members + length of diagonals / verticals	n/a	n/a	# of trusses	Count x Length (Units are m)	
	Hold Down Bolts and Fittings	Each	n/a	n/a	n/a	n/a	Count (Units are Each)	
	Base Plates, Fittings and Mortar Pad	Each	n/a	n/a	n/a	n/a	Count (Units are Each)	
	Sign Face Support Structure	Each	n/a	n/a	n/a	n/a	Count (Units are Each)	
	Ancillaries (Walkways, Cable Trays, Ladders)	Each	n/a	n/a	n/a	n/a	Count (Units are Each)	
Retaining Walls	Wall Facing / Panels	m^2	Length of wall	n/a	Average height of wall	# of walls	Length x Height x Count	
	Columns	Each	n/a	n/a	n/a	n/a	Count (Units are Each)	
	Barriers	Lin m	Total length of barrier	n/a	n/a	Typically 1	Count x Length (Units are m)	
	Connections and Horizontal Supports	Each	n/a	n/a	n/a	n/a	Count (Units are Each)	
	Drainage System	Each	n/a	n/a	n/a	n/a	Count (Units are Each)	
Noise and Visual Screen Walls	Wall Facing / Panels	m^2	Length of wall	n/a	Average height of wall panels	n/a	Length x Height	
	Column Supports	Each	n/a	n/a	n/a	n/a	Count (Units are Each)	

Element Group	Element Name	Measure	Length (m)	Width (m)	Height (m)	Count	Quantity (m^2)	Comments
	Foundation	Lin m	Length of foundations supporting the wall	n/a	n/a	Typically 1	Count x Length (Units are m)	
	Hold Down Bolts, Base Plates and Fittings	Each	n/a	n/a	n/a	n/a	Count (Units are Each)	
	Mortar Pad	Each	n/a	n/a	n/a	n/a	Count (Units are Each)	
Ferry Ramps	Ramp Slab	m^2	Ramp length	Ramp width	n/a	1	Length x Width	Separate measurements for Town Side and Far Side
	Ramp Shoulder	m^2	Ramp length	Average shoulder width	n/a	Typically 2	Length x Width	Separate measurements for Town Side and Far Side
	Deadmen	Each	n/a	n/a	n/a	n/a	Count (Units are Each)	
	Ramp Joints	Lin m	Ramp width	n/a	n/a	# of joints	Count x Length (Units are m)	
	Traffic Barrier	Lin m	Total length of barrier	n/a	n/a	Typically 2	Count x Length (Units are m)	May have separate measurements for Right and Left barriers
Cattle Grids	Abutment Wall	m^2	n/a	Average width of abutment from wingwall to wingwall	Height of abutment + width of steel cast in plate	2	Width x Height x Count	Includes steel cast in plate
	Pier Wall	m^2	n/a	Width of pier	2 x height of pier + width of steel cast in plate	# of piers	Width x Height x Count	Includes steel cast in plate
	Grid Base Slab	m^2	Distance between abutments	Average width of base from wingwall to wingwall	n/a	n/a	Length x Width	
	Wingwall	m^2	Average length of wall	n/a	Average height of wall	# of walls	Length x Height x Count	

Element Group	Element Name	Measure	Length (m)	Width (m)	Height (m)	Count	Quantity (m^2)	Comments
	Grid Baffle Plates	Lin m	n/a	Distance between girders	Height from steel cast in plate to bottom of grid rails	# of baffle plates	Width x Height x Count	
	Grid Girders	Lin m	Length of girder	Average width of flanges	Depth of web	# of girders (in span)	Length x Perimeter	
				Perimeter (**p**) = (Width x 3) + Height				
	Grid Packers	Each	n/a	n/a	n/a	n/a	Count (Units are Each)	
	Grid Rails	Lin m	Length of rails across the road	n/a	n/a	# of rails	Count x Length (Units are m)	
	Fence	Each	n/a	n/a	n/a	n/a	Count (Units are Each)	
	Boundary Fence Connection	Each	n/a	n/a	n/a	n/a	Count (Units are Each)	
Busway Track	Busway Track	m^2	<u>Track:</u> Length of track <u>Entry / Exit Ramps:</u> Length of ramp	<u>Track:</u> Width of track <u>Entry / Exit Ramps:</u> Width of ramp	n/a	<u>Track:</u> Typically 4 <u>Entry / Exit Ramps:</u> Calculated separately	<u>Track:</u> Length x Width x Count <u>Entry / Exit Ramps:</u> Length x Width (repeated for each ramp) **Total quantity = Quantity Track + Quantity Ramps**	

Element Group	Element Name	Measure	Length (m)	Width (m)	Height (m)	Count	Quantity (m^2)	Comments
	Busway Sleepers	Each	n/a	n/a	n/a	n/a	Count (Units are Each)	
	Busway Piles	Each	n/a	n/a	n/a	n/a	Count (Units are Each)	
	Busway Guide Rails	Lin m	Total length of rail	n/a	n/a	Typically 2	Count x Length (Units are m)	May have separate measurements for Right/Left/Median (where applic)
	Busway Sump Busters	Each	n/a	n/a	n/a	n/a	Count (Units are Each)	
Tunnels	Tunnel Wall	m^2	Length of wall from portal to portal	n/a	Average height of wall	Typically 2	Length x Height x Count	
	Tunnel Portal	m^2	Length of portal wall	n/a	Average height of wall	# of portal walls	Length x Height x Count	
	Tunnel Roof	m^2	Length of roof	Flat Roof: Average width of roof from wall to wall Arch Roof: Width a top of walls (**w**)	Flat Roof: n/a Arch Roof: Height at middle of tunnel, from top of walls to roof (**h**)	n/a	Flat Roof: Length x Width Arch Roof: (assume w = 2 x h)* Length x π x h	Arch Roof:  * If w ≠ 2 x h, then refer to established mathematical formulae to calculate surface area.
	Approach Barrier	Lin m	Generally no more than 20m	n/a	n/a	# of sides (typically 2)	Count x Length (Units are m)	
	Traffic Surface	m^2	Total length of tunnel excluding approaches	Kerb to kerb width	n/a	n/a	Length x Width	
	Base Slab	m^2	Length of slab through tunnel	Width of slab	n/a	n/a	Length x Width	

Element Group	Element Name	Measure	Length (m)	Width (m)	Height (m)	Count	Quantity (m^2)	Comments
	Construction Joint	Lin m	Length of joint (may be transverse or longitudinal)	n/a	n/a	# of joints	Sum of joint lengths (Units are m)	
	Additional Elements	Each	n/a	n/a	n/a	n/a	Count (Units are Each)	
	Drainage System	Each	n/a	n/a	n/a	n/a	Count (Units are Each)	

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