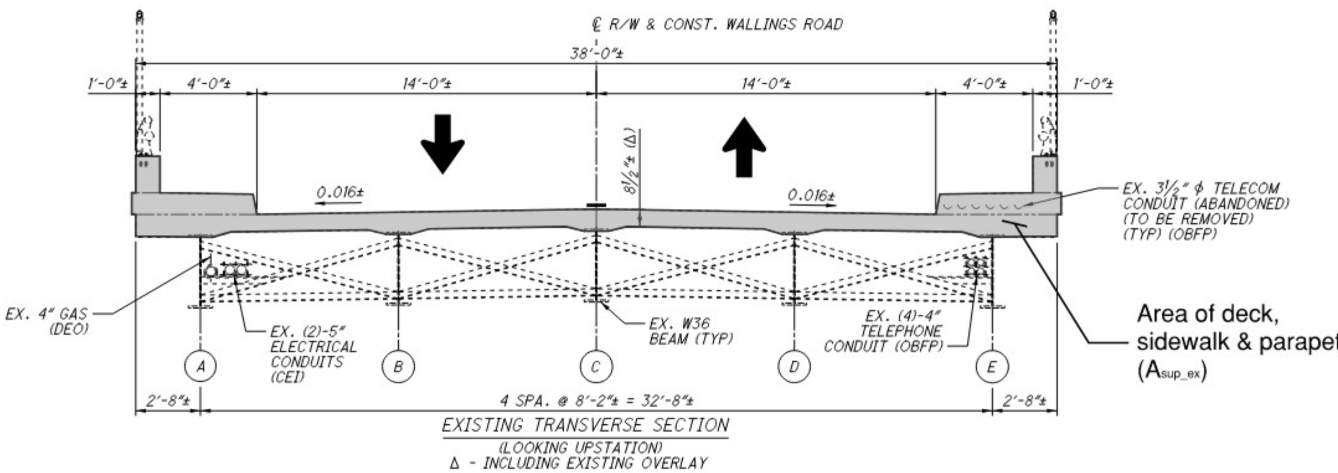
Item 202 – PORTIONS OF STRUCTURE REMOVED, OVER 20 FOOT SPAN, AS PER PLAN (LUMP SUM)

Below calculations performed for use in Estimated Quantities Form (D-2), not itemized in project plans.

Existing Concrete Deck, Sidewalk & parapet area (CAD) (SF); $A_{sup\_ex} = 41.5$
Existing Deck limits (ft); $L_{sup\_ex} = 280.67$



Existing backwall area removed (CAD) (SF); $A_{back\_ex} = 190.5 + 189 = \mathbf{379.500}$
Existing backwall thickness (ft); $t_{back\_ex} = 1.75$

Existing breastwall area removed (CAD) (SF); $A_{brstwall\_ex} = 58 + 52.5 = \mathbf{110.500}$
Existing breastwall thickness (ft); $t_{brstwall\_ex} = 3.75$

Existing wingwall area removed (CAD) (SF); $A_{ww\_ex} = 2 \times (49 + 54.5) = \mathbf{207.000}$
Existing wingwall thickness (ft); $t_{ww\_ex} = 1.5$

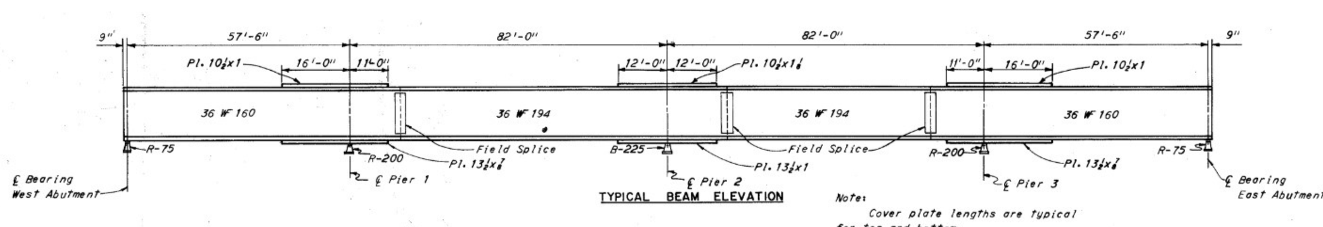
Existing sidewalk & parapet over wingwall area (CAD) (SF); $A_{walk\_ex} = 10$
Existing sidewalk length outside abutment limits (ft); $L_{walk\_ex} = 4 \times 13.75 = \mathbf{55.000}$

Total volume of concrete removed (CY); $\mathbf{T_{202\_conc} = ceiling((A_{sup\_ex} \times L_{sup\_ex} + A_{back\_ex} \times t_{back\_ex} + A_{brstwall\_ex} \times t_{brstwall\_ex} + A_{ww\_ex} \times t_{ww\_ex}) / 27,1) = 483.000}$

Existing steel beam removed weight (lb); $W_{stl\_ex} = 5 \times (160 \times 71.25 \times 2 + 194 \times 138) = \mathbf{247860.000}$

Unit weight of steel plates (lb/ft^3); $W_{stl} = 490$

Existing moment plates removed weight (lb); $W_{pl\_ex} = 5 \times W_{stl} \times (2 \times 10.5 \times 1 \times 27 + 2 \times 13.5 \times .875 \times 27 + 10.5 \times 1.125 \times 24 + 13.5 \times 1 \times 24) / 144 = \mathbf{30835.547}$



Existing crossframe removed weight (L3x3x5/16 + 5% increase for bolts, utility supports, etc.) (lb);
$W_{CF\_ex} = 1.05 \times 20 \times (6.1 \times (2 \times 8.4 + 8.1) + 7.2 \times 3) = \mathbf{3643.290}$

Total weight of steel removed (LB); $T_{202\_stl} = \text{ceiling}(W_{stl\_ex} + W_{pl\_ex} + W_{CF\_ex},1) = 282339.000$

Pipe removal (1-DEO, 2-CEI, 10-AT&T) (ft); $T_{202\_pipe} = \text{ceiling}(L_{sup\_ex} \times (1 + 2 + 10), 1) = 3649.000$

Fence & railing removal (both sides) (ft); $T_{202\_fence} = \text{ceiling}((L_{sup\_ex} + 2 \times 15.17) \times 2,1) = 623.000$

Tekla Tedds Osborn Engineering 1100 Superior Avenue - Suite 300 Cleveland, Ohio 44114	Project CUY-77-04.79 PID 106239			Job Ref. J20170056.000	
	Section Structure Estimated Quantities			Sheet no./rev. 3	
	Calc. by EIW	Date 03/22/24	Chk'd by PJW/SMK	Date 03/22/24	App'd by	Date

Item 202 – Approach Slab Removed

Existing Approach slab width (ft); $W_{ex\_app} = 28$

Existing approach slab length (ft); $L_{ex\_app} = 25$

Total Area of 202 (SY); $\mathbf{T_{ex\_app}} = \textbf{ceiling}(\mathbf{2} \times W_{ex\_app} \times L_{ex\_app} / 9, 1) = \mathbf{156.000}$

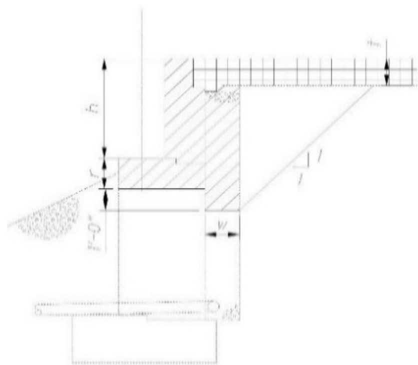
PLAN SPLITS:

02/SAF/BR – 156 SY

04/NFP/BR – DOMINION ENERGY OHIO 0 SY

Item 503 – Unclassified Excavation

*Unclassified excavation includes areas required to be excavated for the removal of backwalls and excavation required for new, widened abutments and pier column footings.



Excavation for removal of existing backwalls & beam seats (no shale)

Offset for new porous backfill (ft); $w_{PB} = 2$

Existing approach slab thickness (ft); $t_{ex\_app} = 1.0833$

Average existing backwall height – RA (ft); $h_{avg\_RAex} = 4.88$

Average existing seat removal – RA (ft); $r_{seat\_RAex} = 1.52$

Average existing backwall height – FA (ft); $h_{avg\_FAex} = 4.82$

Average existing seat removal – FA (ft); $r_{seat\_FAex} = 1.37$

Existing Abutment length (ft); $L_{abut\_ex} = 37.67$

Abutment width between wiingwalls (ft); $L_{abut\_wtw} = 34.67$

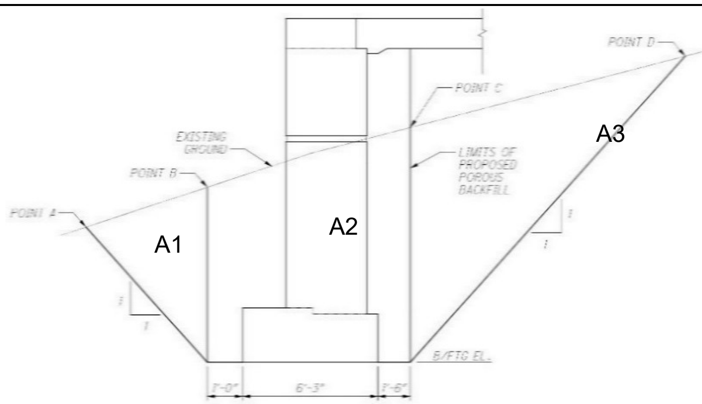
Area of 503 at rear abutment (sq ft); $A_{503\_RAbw} = (w_{PB} \times (h_{avg\_RAex} + r_{seat\_RAex} + 1 - t_{ex\_app})) + 0.5 \times (h_{avg\_RAex} + r_{seat\_RAex} + 1 - t_{ex\_app})^2 = \mathbf{32.584}$

Area of 503 at forward abutment (sq ft); $A_{503\_FAbw} = (w_{PB} \times (h_{avg\_FAex} + r_{seat\_FAex} + 1 - t_{ex\_app})) + 0.5 \times (h_{avg\_FAex} + r_{seat\_FAex} + 1 - t_{ex\_app})^2 = \mathbf{30.859}$

TOTAL VOLUME backwalls & seats (CY);; $T_{503\_bw} = \text{ceiling}((A_{503\_RAbw} + A_{503\_FAbw}) \times L_{abut\_wtw} / 27,1) = \mathbf{82.000}$

Excavation for widened abutments and wingwalls:

Includes shale excavation at RA based on t/rock elevation of 1074.50 at Boring B-1. See revised calculation below for volume of shale anticipated at RA.



Proposed B/Ftg RA (ft); EL_{ftg_RA} = 1071.35
Proposed B/Ftg FA (ft); EL_{ftg_FA} = 1062.95

*Avg elevations below taken from CAD at 3 pts along abutments
Avg. elevation Point A at RA (ft); EL_{ptA_RA} = 1075.50
Avg. elevation Point A at FA (ft); EL_{ptA_FA} = (1069.74 + 1067.74 + 1067.62)/3 = **1068.367**
Avg. elevation Point B at RA (ft); EL_{ptB_RA} = 1078.00
Avg. elevation Point B at FA (ft); EL_{ptB_FA} = 1071.00
Avg. elevation Point C at RA (ft); EL_{ptC_RA} = 1081.50
Avg. elevation Point C at FA (ft); EL_{ptC_FA} = 1073.00
Avg. elevation at Point D at RA (ft); EL_{ptD_RA} = (1084.11 + 1086 + 1084.02) /3 =**1084.710**
Avg. elevation at Point D at FA (ft); EL_{ptD_FA} = (1073 + 1075 + 1074.95)/3 = **1074.317**

Limit of excavation behind RA (ft); $X_{RA} = (EL_{ptD\_RA} - EL_{ftg\_RA})$ = **13.360**
Limit of excavation behind FA (Ft); $X_{FA} = (EL_{ptD\_FA} - EL_{ftg\_FA})$ = **11.367**
Limit of excavation front RA (ft); $f_{RA} = (EL_{ptA\_RA} - EL_{ftg\_RA})$ = **4.150**
Limit of excavation front FA (Ft); $f_{FA} = (EL_{ptA\_FA} - EL_{ftg\_FA})$ = **5.417**
Excavation limit behind abutment footing (ft); e_{behind} = 1.5
Excavation limit in front abutment footing (ft); e_{front} = 1.0
Abutment footing width (ft); W_{foot}= 6.25

Excavation area RA - (sq ft); $A_{503\_RA} = (0.5 \times (EL_{ptB\_RA} - EL_{ftg\_RA}) \times f_{RA}) + ((e_{behind} + e_{front} + W_{foot}) \times ((EL_{ptB\_RA} + EL_{ptC\_RA})/2 - EL_{ftg\_RA})) + (X_{RA} \times ((EL_{ptB\_RA} + EL_{ptC\_RA})/2 - EL_{ftg\_RA}) - 0.5 \times X_{RA} \times (EL_{ptB\_RA} - EL_{ftg\_RA}))$ = **155.101**

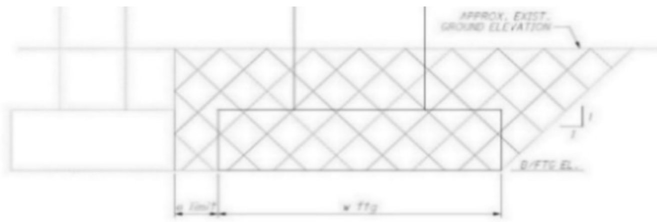
Excavation area FA - trapezoid (sq ft); $A_{503\_FA} = (0.5 \times (EL_{ptB\_FA} - EL_{ftg\_FA}) \times f_{FA}) + ((e_{behind} + e_{front} + W_{foot}) \times ((EL_{ptB\_FA} + EL_{ptC\_FA})/2 - EL_{ftg\_FA})) + (X_{FA} \times ((EL_{ptB\_FA} + EL_{ptC\_FA})/2 - EL_{ftg\_FA}) - 0.5 \times X_{FA} \times (EL_{ptB\_FA} - EL_{ftg\_FA}))$ = **158.107**

Length of new abutment RA (ft); L_{abut_RA} = **ceiling**(28.67 + 12.33, 1) = **41.000**
Length of new abutment FA (ft); L_{abut_FA} = **ceiling**(25.67 + 12.33, 1) = **38.000**

TOTAL VOLUME new abutments (CY); T_{503_abut} = **ceiling(((** $A_{503\_RA} \times L_{abut\_RA}$ **) + (** $A_{503\_FA} \times L_{abut\_FA}$ **)) / 27,1) = 459.000**
(including shale)

Tekla Tedds Osborn Engineering 1100 Superior Avenue - Suite 300 Cleveland, Ohio 44114	Project CUY-77-04.79 PID 106239				Job Ref. J20170056.000	
	Section Structure Estimated Quantities				Sheet no./rev. 6	
	Calc. by EIW	Date 03/22/24	Chk'd by PJW/SMK	Date 03/22/24	App'd by	Date

Excavation for new piers:



Proposed B/Ftg P1 (ft); EL_{ftg_P1} = 1056.35

Proposed B/Ftg P2 (ft); EL_{ftg_P2} = 1057.85

Proposed B/Ftg P3 (ft); EL_{ftg_P3} = 1052.35

Avg. existing ground elevation at P1 (ft); EL_{GL_P1} = 1060.32

Avg. existing ground elevation at P2 (ft); EL_{GL_P2} = 1060.90

Avg. existing ground elevation at P3 (ft); EL_{GL_P3} = 1055.76

T/Rock @ P1 (ft); EL_{TR_P1} = 1057.2

T/Rock @ P2 (ft)(*assumed 1.1' above b/ftg); $EL_{TR\_P2} = EL_{ftg\_P2} + 1.1$ = **1058.950**

T/Rock @ P3 (ft); EL_{TR_P3} = 1053.7

Excavation limit to existing pier footing at P1 (ft); e_{limit_P1} = 2.5

Excavation limit to existing pier footing at P2 (ft); e_{limit_P2} = 3.25

Excavation limit to existing pier footing at P3 (ft); e_{limit_P3} = 2.5

Footing length at P1 (|| CL road) (ft);; L_{P1_ftg} = 10

Footing width at P1 (ft);; W_{P1_ftg} = 12

Footing length at P2 (ft);; L_{P2_ftg} = 10

Footing width at P2 (ft);; W_{P2_ftg} = 12

Footing length at P3 (ft);; L_{P3_ftg} = 10

Footing width at P3 (ft);; W_{P3_ftg} = 12

Total Excavation Area:

Cross-section Area at P1 (sq ft); $A_{CS\_P1} = ((W_{P1\_ftg} + e_{limit\_P1}) \times (EL_{GL\_P1} - EL_{ftg\_P1})) + (0.5 \times (EL_{GL\_P1} - EL_{ftg\_P1})^2) =$ **65.445**

Add'l Area at P1 along width (sq ft); $A_{width\_P1} = 2 \times 0.5 \times (EL_{GL\_P1} - EL_{ftg\_P1})^2 =$ **15.761**

Volume at P1 (cu ft); $V_{503\_P1} = (A_{CS\_P1} \times L_{P1\_ftg}) + (A_{width\_P1} \times W_{P1\_ftg}) =$ **843.585**

Cross-section Area at P2 (sq ft); $A_{CS\_P2} = ((W_{P2\_ftg} + e_{limit\_P2}) \times (EL_{GL\_P2} - EL_{ftg\_P2})) + (0.5 \times (EL_{GL\_P2} - EL_{ftg\_P2})^2) =$ **51.164**

Add'l Area at P2 along width (sq ft); $A_{width\_P2} = 2 \times 0.5 \times (EL_{GL\_P2} - EL_{ftg\_P2})^2 =$ **9.303**

Volume at P2 (cu ft); $V_{503\_P2} = (A_{CS\_P2} \times L_{P2\_ftg}) + (A_{width\_P2} \times W_{P2\_ftg}) =$ **623.268**

Cross-section Area at P3 (sq ft); $A_{CS\_P3} = ((W_{P3\_ftg} + e_{limit\_P3}) \times (EL_{GL\_P3} - EL_{ftg\_P3})) + (0.5 \times (EL_{GL\_P3} - EL_{ftg\_P3})^2) =$ **55.259**

Add'l Area at P3 along width (sq ft); $A_{width\_P3} = 2 \times 0.5 \times (EL_{GL\_P3} - EL_{ftg\_P3})^2 =$ **11.628**

Volume at P3 (cu ft); $V_{503\_P3} = (A_{CS\_P3} \times L_{P3\_ftg}) + (A_{width\_P3} \times W_{P3\_ftg}) =$ **692.128**

Shale Excavation Area:

Volume at P1 (cu ft); $V_{503\_P1R} = W_{P1\_ftg} \times L_{P1\_ftg} \times (EL_{TR\_P1} - EL_{ftg\_P1}) =$ **102.000**

Volume at P2 (cu ft); $V_{503\_P2R} = W_{P2\_ftg} \times L_{P2\_ftg} \times (EL_{TR\_P2} - EL_{ftg\_P2}) =$ **132.000**

Volume at P3 (cu ft); $V_{503\_P3R} = W_{P3\_ftg} \times L_{P3\_ftg} \times (EL_{TR\_P3} - EL_{ftg\_P3}) =$ **162.000**

TOTAL VOLUME OF SHALE at piers (CY);; $T_{503\_pier\_SHALE}$ = ceiling(($V_{503\_P1R} + V_{503\_P2R} + V_{503\_P3R}$)/ 27,1) = **15.000**

TOTAL VOLUME OF SHALE at rear abutment (CY) (See below); $T_{503\_RA\_SHALE}$ = 57 CY

TOTAL VOLUME OF OTHER EXCAVATION at piers (CY);; T_{503_pier} = ceiling(($V_{503\_P1} + V_{503\_P2} + V_{503\_P3}$)/ 27 - $T_{503\_pier\_SHALE}$,1) = **65.000**

TOTAL VOLUME OF SHALE EXCAVATION (rev) (CY); $T_{503\_SHALE} = T_{503\_PIER\_SHALE} + T_{503\_RA\_SHALE}$ = 72 CY

TOTAL VOLUME OF OTHER EXCAVATION (rev) (CY); $T_{503\_OTHER} = T_{503\_pier} + (T_{503\_abut} - T_{503\_RA\_SHALE}) + T_{503\_bw}$ = 549 CY

PLAN SPLITS:

02/SAF/BR – 459 + 65 +82 - 57 = 549 CY OTHER EXCAVATION

72 CY SHALE EXCAV.

04/NFP/BR – DOMINION ENERGY OHIO 0 SY

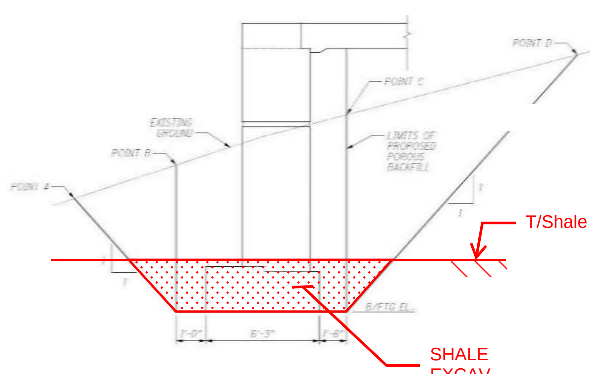
Shale Excavation Quantity Revision at Rear Abutment - 8/23/24:

At Rear Abutment - T/Rock El. = 1074.5
B/Footing El. = 1071.35

Shale Excavation Area = (1.5' + 6.25' + 1.0') x (1074.5 - 1071.35) + (2) x 0.5 x $(1074.5 - 1071.35)^2$
= 37.5 SF

Length of new abutment RA (ft); L_{abut_RA} = 41.00'

Volume of shale excavation (cu yd);
$T_{503\_RA\_SHALE}$ = 37.5 sf x 41 ' / 27 = 57 CY



Excavation limit behind abutment footing (ft); e_{behind} = 1.5
Excavation limit in front abutment footing (ft); e_{front} = 1.0
Abutment footing width (ft); W_{foot}= 6.25

ITEM 509 – EXPOXY-COATED REINFORCING STEEL, AS PER PLAN (rev. 06/2024)

Abutments

Abutment & wingwall rebar total (lb); $T_{509\_abut} = 8125$

Piers

Pier rebar (lb); $T_{509\_pier} = 16552$

Superstructure

Deck & diaphragm (lb); $T_{509\_super} = 142347$

Parapet

Parapet rebar (lb); $T_{509\_par} = 13076$

TOTAL WEIGHT OF REINFORCING STEEL (LB); $T_{509} = \text{ceiling}(T_{509\_abut} + T_{509\_pier} + T_{509\_super} + T_{509\_par}, 1) = 180100.00$

PLAN SPLITS:

02/SAF/BR – 180100 LB

04/NFP/BR – DOMINION ENERGY OHIO 0 LB

ITEM 509 – REINFORCING STEEL, REPLACEMENT OF EXISTING REINFORCING STEEL, AS PER PLAN

TOTAL WEIGHT OF REPLACEMENT STEEL (LB) = 500 LB

PLAN SPLITS:

02/SAF/BR –	500 LB
04/NFP/BR – DOMINION ENERGY OHIO	0 LB

ITEM 510 – DOWEL HOLES WITH NON-SHRINK, NONMETALLIC GROUT

Abutments

Bar Marks doweled: A501, A503, A504, A509, A510, A511, A512, A530, A540, A602, A604, A605

Total Abutment dowels (each); T_{510_abut} = 12 + 6+6+16+4+144+40+8+4+8+4+4 = **256.000**

Piers

Bar Marks doweled: P501, P502, P503

Pier dowels (each); T_{510_pier} = 68 + 48 +88 = **204.000**

TOTAL NUMBER OF DOWELS (EACH); $\mathbf{T_{510} = T_{510\_abut} + T_{510\_pier}}$ **= 460.000**

PLAN SPLITS:

02/SAF/BR – 460 EACH

04/NFP/BR – DOMINION ENERGY OHIO 0 EACH

ITEM 511 – SEMI-INTEGRAL DIAPHRAGM GUIDE

* 2 per abutment

TOTAL NUMBER OF DIAPHRAGM GUIDES (EACH); **$T_{511guide}$ = 4**

PLAN SPLITS:

02/SAF/BR – 4 EACH

04/NFP/BR – DOMINION ENERGY OHIO 0 EACH

Tekla Tedds Osborn Engineering 1100 Superior Avenue - Suite 300 Cleveland, Ohio 44114	Project CUY-77-04.79 PID 106239			Job Ref. J20170056.000	
	Section Structure Estimated Quantities			Sheet no./rev. 12	
	Calc. by EIW	Date 03/22/24	Chk'd by PJW/SMK	Date 03/22/24	App'd by	Date

ITEM 511 – CLASS QC2 CONCRETE WITH QC/QA, BRIDGE DECK, AS PER PLAN **REV. 12/12/2022**

Primary Deck

Proposed deck width (ft); w_{deck} = 54.3333

Proposed bridge limits (ft); L_{deck} = 283.17

Proposed deck thickness (in); t_{deck} = 8.5

Volume of primary deck (cu ft); $V_{deck} = (w_{deck} \times L_{deck} \times t_{deck} / 12)$ = **10898.105**

Sidewalk

Sidewalk width (ft); w_{walk} = 6

Parapet width (including formliner) (ft); w_{bar} = 1.16667

Sidewalk overhang (ft); over = 2/12 = **0.167**

Curb height (ft); curb = 8/12=**0.667**

Sidewalk cross-slope (ft/ft); $cross_{walk}$ = 0.02

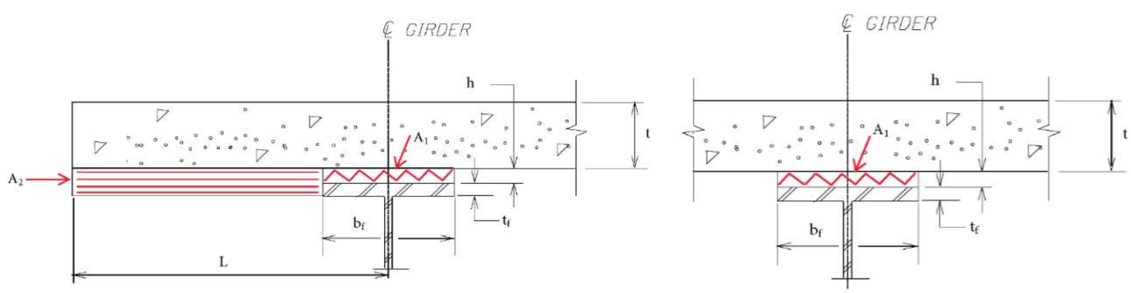
Average walk thickness (ft); $t_{walk\_avg} = curb + cross_{walk} \times w_{walk} / 2$ = **0.727**

Walk thickness under parapet (ft); $t_{walk\_bar} = curb + cross_{walk} \times w_{walk}$ = **0.787**

Volume of sidewalk (cu ft); $V_{walk} = 2 \times L_{deck} \times (t_{walk\_avg} \times w_{walk} + t_{walk\_bar} \times (w_{bar} + over))$ = **3063.272**

Haunches

Average haunch (all beams) (in); h_{avg} = 2.09



Average flange width (ft); b_f = 1.01

Average flange thickness (weighted over length) (in); $t_f = ((1.18 \times (71.813+71.823)) + (1.57 \times (86.0625+49.969))) / (279.668)$ = **1.370**

Fascia overhang (ft); L_{fascia} = 2.6667

Number of interior beams (each);; N_{int} = 5

Number of fascia beams (each); N_{ext} = 2

Haunch volume – interior beams [A1] (cu ft); $V_{haunch\_int} = b_f \times (h_{avg}/12) \times L_{deck} \times N_{int}$ = **249.060**

Haunch volume – fascia beams [A1+A2] (cu ft); $V_{haunch\_ext} = L_{deck} \times N_{ext} \times ((b_f \times h_{avg}/12) + (L_{fascia} - b_f / 2) \times (h_{avg} + t_f)/12)$ = **452.587**

Abutment Diaphragms

Proposed abutment stem width (ft); W_{stem} = **3.750**

Abutment length (ft); L_{abut} = 54.67

W36x182 beam CS Area (sq ft / ft); A_{36x182} = 53.6/144 = **0.372**

W36x182 beam height (ft); h_{36x182} = 36.3/12 = **3.025**

Beam length into diaphragm (ft); L_{diaph_stl} = 2

Proposed approach slab thickness (ft); t_{app} = 15/12 = **1.250**

Haunch at abutments (in); h_{h_abut} = 2.39

Average diaphragm height (ft); $h_{diaph} = (t_{deck} + h_{h\_abut})/12 + h_{36x182} + (13.471-4.471)/12$ = **4.683**

Diaphragm Volume (not including deck concrete) (cu ft); $V_{diaph} = 2 \times (W_{stem} \times (h_{diaph} - (t_{deck} + h_{avg})/12) \times L_{abut} - A_{36x182} \times L_{diaph\_stl} \times (N_{int} + N_{ext}))$ = **1547.673**

TOTAL VOLUME OF CONCRETE (CU YD); T_{deck} **= ceiling((**$V_{deck} + V_{walk} + V_{haunch\_int} + V_{haunch\_ext} + V_{diaph}$**)/ 27, 1) = 601.000**

PLAN SPLITS:

02/SAF/BR – **601 CY**

04/NFP/BR – DOMINION ENERGY OHIO 0 CY

Tekla Tedds Osborn Engineering 1100 Superior Avenue - Suite 300 Cleveland, Ohio 44114	Project CUY-77-04.79 PID 106239			Job Ref. J20170056.000	
	Section Structure Estimated Quantities			Sheet no./rev. 14	
	Calc. by EIW	Date 03/22/24	Chk'd by PJW/SMK	Date 03/22/24	App'd by	Date

ITEM 511 – CLASS QC2 CONCRETE WITH QC/QA, BRIDGE DECK (PARAPET)

Proposed bridge limits (ft);; L_{deck} = **283.170**

Parapet length past limits (ft);; $L_{parapet}$ = 12

Parapet width (ft);; w_{bar} = **1.167**

Parapet height (ft);; h_{bar} = 2 +8/12 = **2.667**

Parapet area (sq ft);; $A_{bar} = w_{bar} \times h_{bar}$ = **3.111**

TOTAL VOLUME OF CONCRETE (CU YD);; **T_{bar} = ceiling($A_{bar} \times ((2 \times L_{deck}) + (L_{parapet} \times 4))$ / 27, 1) = 71.000**

PLAN SPLITS:

02/SAF/BR; **T_{bar} = 71.000**

04/NFP/BR – DOMINION ENERGY OHIO; 0 CY

ITEM 511 – CLASS QC1 CONCRETE WITH QC/QA, ABUTMENT INCLUDING FOOTING **REV. 12/2/2022**

Footings

Footing width (ft); $W_{abut\_foot} = 6.25$

Average footing height (ft); $H_{abut\_foot} = 2.13$

Total footing length (ft); $L_{abut\_foot} = 21.667 + 5.333 + 12.333 + 25.667 = \mathbf{65.000}$

Vol for footing (cu ft); $V_{abut\_foot} = W_{abut\_foot} \times H_{abut\_foot} \times L_{abut\_foot} = \mathbf{865.313}$

Abutment – Stem

Stem width (ft); $W_{stem} = \mathbf{3.750}$

Full height stem area RA (CAD) (sf); $A_{FHstem\_RA} = 112.7$

Seat modified stem area RA (CAD) (sf); $A_{SMstem\_RA} = 53.4$

Full height stem area FA (CAD) (sf); $A_{FHstem\_FA} = 77.2$

Seat modified stem area FA (CAD) (sf); $A_{SMstem\_FA} = 51.0$

Vol for stem (cu ft); $V_{stem} = W_{stem} \times (A_{FHstem\_RA} + A_{SMstem\_RA} + A_{FHstem\_FA} + A_{SMstem\_FA}) = \mathbf{1103.625}$

Wingwalls

Wingwall width (ft); $W_{wingwall} = 3.25$

NW WW Area (CAD) (sf); $A_{NW\_ww} = 132.2$

SW WW Area (CAD) (sf); $A_{SW\_ww} = 129.8$

NE WW Area (CAD) (sf); $A_{NE\_ww} = 97.6$

SE WW Area (CAD) (sf); $A_{SE\_ww} = 87.8$

Vol for NW wingwall (cu ft); $V_{nw} = W_{wingwall} \times A_{NW\_ww} = \mathbf{429.650}$

Vol for NE wingwall (cu ft); $V_{ne} = W_{wingwall} \times A_{NE\_ww} = \mathbf{317.200}$

Vol for SW wingwall (cu ft); $V_{sw} = W_{wingwall} \times A_{SW\_ww} = \mathbf{421.850}$

Vol for SE wingwall (cu ft); $V_{se} = W_{wingwall} \times A_{SE\_ww} = \mathbf{285.350}$

Vol of concrete for abutments (CY); $T_{abut} = \text{ceiling}((V_{abut\_foot} + V_{stem} + V_{sw} + V_{se} + V_{nw} + V_{ne})/ 27, 1) = \mathbf{127.000}$

Contingency for fill of over-excavation at abutment footings:

*Estimated quantity if needed if rock is lower than existing footings. Estimate uses difference in t/rock boring elevations and b/footing elevations per existing plans over full area of proposed footings at abutments.

Abutment footing extension area (including wingwalls) RA (sf); $A_{ftg\_RA} = W_{abut\_foot} \times (21.667 + 5.333) = \mathbf{168.750}$

Abutment footing extension area (including wingwalls) FA (sf); $A_{ftg\_FA} = W_{abut\_foot} \times (12.333 + 25.667) = \mathbf{237.500}$

Difference in B/Ftg and T/Rock Elevations:

RA; $\Delta_{RA} = 0$

FA; $\Delta_{FA} = 1062.95 – 1060.50 = \mathbf{2.450}$

Total Concrete Contingency – Abutments (CY); $T_{contin\_abut} = \text{ceiling}((A_{ftg\_RA} \times \Delta_{RA} + A_{ftg\_FA} \times \Delta_{FA})/27,1) = \mathbf{22.000}$

Total Concrete Volume at abutments (CY); $T_{abut\_tot} = T_{abut} + T_{contin\_abut} = \mathbf{149.000}$

PLAN SPLITS:

02/SAF/BR –; T_{abut_tot} = **149.000**

04/NFP/BR – DOMINION ENERGY OHIO 0 CY

ITEM 511 – CLASS QC1 CONCRETE WITH QC/QA, PIER ABOVE FOOTINGS

Existing Cap Modifications

Cap plan area (CAD) (sf); $A_{plan\_cap} = 105.0$

Avg. seat modification thickness (P1) (ft); $t_{seat\_P1} = 0.99$

Avg. seat modification thickness (P2) (ft); $t_{seat\_P2} = 1.15$

Avg. seat modification thickness (P3) (ft); $t_{seat\_P3} = 1.15$

Vol for cap seat modifications (cu ft); $V_{cap\_seat} = A_{plan\_cap} \times (t_{seat\_P1} \times t_{seat\_P2} \times t_{seat\_P3}) =$ **137.474**

New Pier

Column – capsule shaped

Column radius (ft); $r_{col} = 1.5$

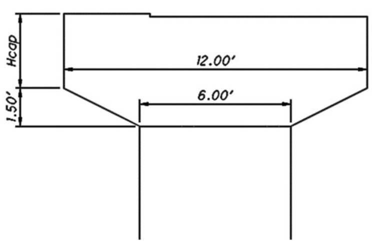
Column straight length (ft); $a_{col} = 3$

Column height pier 1 (ft); $H_{col1} = 14.79$

Column height pier 2 (ft); $H_{col2} = 10.18$

Column height pier 3 (ft); $H_{col3} = 12.64$

Hammerhead pier cap



Cap width (ft); $W_{cap\_new} = 3$

Cap length (ft); $L_{cap\_new} = 12$

New cap area P1 (CAD) (ft); $A_{cap1} = 49.7$

New cap area P2 (CAD) (ft); $A_{cap2} = 49.7$

New cap area P3 (CAD) (ft); $A_{cap3} = 49.7$

Vol for 3 hammerhead caps (cu ft); $V_{cap\_new} = W_{cap\_new} \times (A_{cap1} + A_{cap2} + A_{cap3}) =$ **447.300**

Vol for 3 columns (cu ft); $V_{col} = (\pi \times r_{col}^2 + 2 \times r_{col} \times a_{col}) \times (H_{col1} + H_{col2} + H_{col3}) =$ **604.339**

Total Vol of concrete for piers above footings (CY);; T_{piers} **= ceiling(**($V_{cap\_seat} + V_{cap\_new} + V_{col}$)/ 27, 1) = **45.000**

PLAN SPLITS:

02/SAF/BR – BRIDGE WIDENING; T_{piers} = **45.000**

04/NFP/BR – DOMINION ENERGY OHIO 0 CY

ITEM 511 – CLASS QC1 CONCRETE WITH QC/QA, FOOTING **REV. 12/2/2022**

New Pier

Footing

Footing area P1 (sq ft); $A_{foot\_P1} = 12 \times 10 =$ **120.000**

Footing area P2 (sq ft); $A_{foot\_P2} = 12 \times 10 =$ **120.000**

Footing area P3 (sq ft); $A_{foot\_P3} = 12 \times 10 =$ **120.000**

Footing height (ft); $H_{pier\_foot} = 3$

Vol for 3 footings (cu ft); $V_{pier\_foot} = H_{pier\_foot} \times (A_{foot\_P1} + A_{foot\_P2} + A_{foot\_P3}) =$ **1080.000**

Total Vol of concrete for pier footings (CY);; $T_{piers\_footing}$ **= ceiling(**(V_{pier_foot})/ 27, 1) = **40.000**

Contingency for fill of over-excavation at pier footings:

*Estimated quantity if needed if rock is lower than existing footings. Estimate uses difference in t/rock boring elevations and b/footing elevations per existing plans over full area of proposed footings at piers.

New Footing area P1 (sq ft); $A_{foot\_P1} =$ **120.000**

New Footing area P2 (sq ft); $A_{foot\_P2} =$ **120.000**

New Footing area P3 (sq ft); $A_{foot\_P3} =$ **120.000**

Difference in B/Ftg and T/Rock Elevations:

P1; $\Delta_{P1} = 0$

P2; $\Delta_{P2} = 1057.85 – 1054.20 =$ **3.650**

P3; $\Delta_{P3} = 0$

Total Contingency Volume – Piers (CY); $T_{contin\_piers} = \text{ceiling}((A_{foot\_P1} \times \Delta_{P1} + A_{foot\_P2} \times \Delta_{P2} + A_{foot\_P3} \times \Delta_{P3})/27,1) =$ **17.000**

Total Concrete Volume – Pier Footing (CY); $T_{footing\_total} = T_{piers\_footing} + T_{contin\_piers} =$ **57.000**

ITEM 511 – CONCRETE MISC.: 8" PVC CASING PIPE, 748.02

***Casing pipe sleeve for Dominion gas line through abutment diaphragm & under approach slab.*

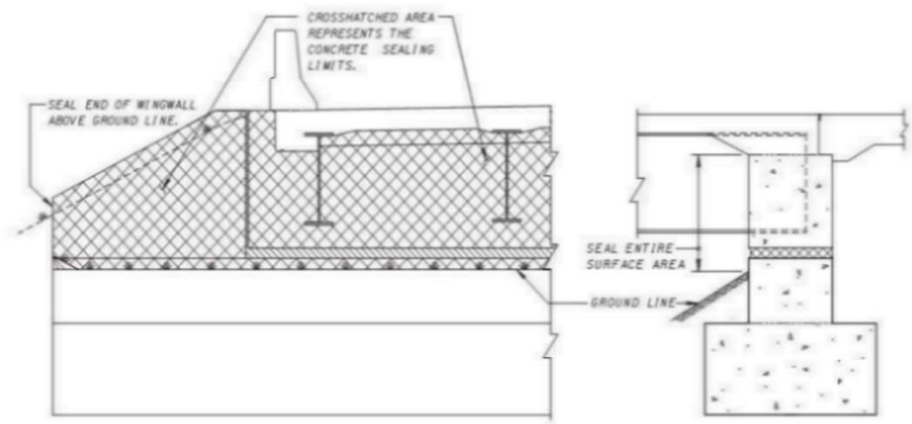
Total Length of Casing Pipe (ft); T_{pipe} **= ceiling(2 × (1.5 + 3.75 + 25 + 2), 1) = 65.000**

PLAN SPLITS:

02/SAF/BR;	**0**
04/NFP/BR DOMINION ENERGY OHIO;	T_{pipe} **= 65.000**

ITEM 512 – SEALING CONCRETE SURFACES (EPOXY-URETHANE)

Abutments



ABUTMENT SEALING LIMITS
(FOR SEMI-INTEGRAL ABUTMENT STEEL BEAM BRIDGE)

Diaphragm height (ft); h_{diaph} = **4.700**

Bearing height (ft); h_{brg} = 4.297 / 12 = **0.358**

Proposed approach slab thickness (ft); t_{app} = **1.250**

T/ Slope RA (ft); EL_{SP_RA} = 1079.73

T/ Slope FA (ft); EL_{SP_FA} = 1069.24

RA average beam seat elevation (ft); EL_{BS_RA} = 1080.43

FA average beam seat elevation (ft); EL_{BS_FA} = 1069.94

Beam seat-to-ground clearance RA (ft); $h_{clr\_RA} = (EL_{BS\_RA} - EL_{SP\_RA})$ = **0.700**

Beam seat-to-ground clearance FA (ft); $h_{clr\_FA} = (EL_{BS\_FA} - EL_{SP\_FA})$ = **0.700**

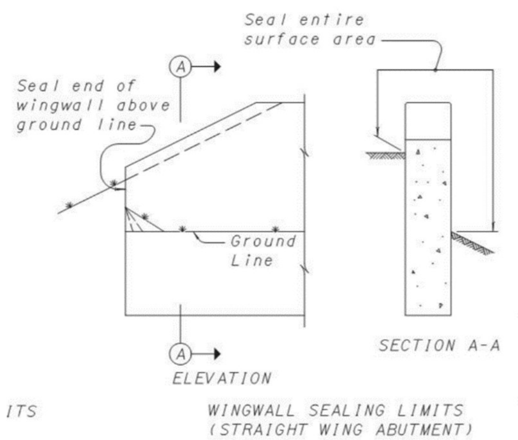
Abutment sealed height RA (ft); $H_{512\_A\_RA} = h_{diaph} - t_{app} + h_{brg} + h_{clr\_RA}$ = **4.508**

Abutment sealed height FA (ft); $H_{512\_A\_FA} = h_{diaph} - t_{app} + h_{brg} + h_{clr\_FA}$ = **4.508**

Abutment length (ft); L_{abut} = **54.670**

Total abutment area (sq ft); $A_{512\_abut} = (H_{512\_A\_RA} + H_{512\_A\_FA}) \times L_{abut}$ = **492.877**

__Wingwalls__



*Wingwall sealing areas measured in CAD. Generally equation is as follows:

Area = Highway side face + Embankment side face + Top area + End Area

SW Wingwall elevation area (CAD) (sq ft); A_{512_SW} = 52.0 + 11.8 + 46.7 + 3.7 = **114.200**

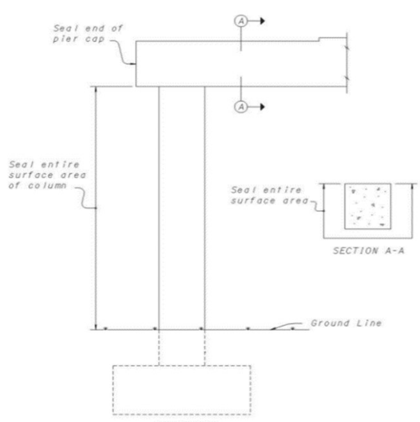
SE Wingwall elevation area (CAD) (sq ft); A_{512_SE} = 38.0 + 6.5 + 30.0 + 4.3 = **78.800**

NW Wingwall elevation area (CAD) (sq ft); A_{512_NW} = 53.57 + 11.9 + 46.7 + 3.7 = **115.870**

NE Wingwall elevation area (CAD) (sq ft); A_{512_NE} = 49.4 + 12.4 + 43.8 + 3.8 = **109.400**

Total wingwall area (sq ft); $A_{512\_ww} = A_{512\_SW} + A_{512\_SE} + A_{512\_NW} + A_{512\_NE}$ = **418.270**

__Piers__



__Sealing of existing piers:__

Ex pier cap length (ft); L_{cap_ex} = 35.667

Ex. Cap width (ft); W_{cap_ex} = 3

Ex. Column diameter (ft); D_{col_ex} = 3

Pier 1:

Existing Pier -

Ex P1 Cap area between end radii (CAD) (sf); $A_{EP1\_cap1} = 150.6$

Avg. P1 cap height @ ends (ft); $H_{cap\_EP1} = 4.54$

P1 Cap end areas (sf); $A_{EP1\_cap2} = H_{cap\_EP1} \times \pi \times D_{col\_ex} = \mathbf{42.788}$

Bottom of Pier cap area (CAD) (sf); $A_{excap\_bott} = 83.9$

Average column height (to ground) (ft); $H_{excol1\_seal} = 13.9$

Total column area (sf); $A_{P1\_excol} = 3 \times \pi \times D_{col\_ex} \times H_{excol1\_seal} = \mathbf{393.013}$

Total area ex. Pier 1 (sf); $A_{P1\_ex} = A_{EP1\_cap1} + A_{EP1\_cap2} + A_{excap\_bott} + A_{P1\_excol} = \mathbf{670.302}$

New Pier -

Extended cap height pier 1 (ft); $H_{cap1} = \mathbf{2.880}$

Cap elevation area (sq ft); $A_{cap1} = \mathbf{49.700}$

Cap end area (sq ft); $A_{end1} = H_{cap1} \times W_{cap\_new} = \mathbf{8.640}$

Cap underneath area (sq ft); $A_{under1} = (\sqrt{(1.5^2 + 3^2)}) \times W_{cap\_new} = \mathbf{10.062}$

Total cap area (sq ft); $A_{P1\_cap} = 2 \times (A_{cap1} + A_{end1} + A_{under1}) = \mathbf{136.805}$

Average column height (to ground) (ft); $H_{col1\_seal} = 13.8$

Total column area (sq ft); $A_{P1\_col} = (2 \times \pi \times r_{col} + (2 \times a_{col})) \times H_{col1\_seal} = \mathbf{212.862}$

Total area new Pier 1 (sq ft); $A_{P1\_new} = A_{P1\_cap} + A_{P1\_col} = \mathbf{349.667}$

Pier 2:

Existing Pier -

Ex P2 Cap area between end radii (CAD) (sf); $A_{EP2\_cap1} = 153.9$

Avg. P2 cap height @ ends (ft); $H_{cap\_EP2} = 4.64$

P2 Cap end areas (sf); $A_{EP2\_cap2} = H_{cap\_EP2} \times \pi \times D_{col\_ex} = \mathbf{43.731}$

Bottom of Pier cap area (CAD) (sf); $A_{excap\_bott} = \mathbf{83.900}$

Average column height (to ground) (ft); $H_{excol2\_seal} = 10.2$

Total column area (sf); $A_{P2\_excol} = 3 \times \pi \times D_{col\_ex} \times H_{excol2\_seal} = \mathbf{288.398}$

Total area ex. Pier 2 (sf); $A_{P2\_ex} = A_{EP2\_cap1} + A_{EP2\_cap2} + A_{excap\_bott} + A_{P2\_excol} = \mathbf{569.929}$

New Pier -

Extended cap height pier 2 (ft); $H_{cap2} = \mathbf{2.880}$

Cap elevation area (sq ft); $A_{cap2} = \mathbf{49.700}$

Cap end area (sq ft); $A_{end2} = H_{cap2} \times W_{cap\_new} = \mathbf{8.640}$

Cap underneath area (sq ft); $A_{under2} = (\sqrt{(1.5^2 + 3^2)}) \times W_{cap\_new} = \mathbf{10.062}$

Total cap area (sq ft); $A_{P2\_cap} = 2 \times (A_{cap2} + A_{end2} + A_{under2}) = \mathbf{136.805}$

Average column height (to top of footing) (ft); $H_{col2\_seal} = 10.2$

Total column area (sq ft); $A_{P2\_col} = (2 \times \pi \times r_{col} + (2 \times a_{col})) \times H_{col2\_seal} = \mathbf{157.333}$

Total area new Pier 2 (sq ft); $A_{P2\_new} = A_{P2\_cap} + A_{P2\_col} = \mathbf{294.137}$

Pier 3:

Existing Pier -

Ex P3 Cap area between end radii (CAD) (sf); $A_{EP3\_cap1} = 154.2$

Avg. P2 cap height @ ends (ft); $H_{cap\_EP3} = 4.65$

P3 Cap end areas (sf); $A_{EP3\_cap2} = H_{cap\_EP3} \times \pi \times D_{col\_ex} = \mathbf{43.825}$

Bottom of Pier cap area (CAD) (sf); A_{excap_bott} = **83.900**

Average column height (to ground) (ft); H_{excol3_seal} = 12.3

Total column area (sf); $A_{P3\_excol} = 3 \times \pi \times D_{col\_ex} \times H_{excol3\_seal}$ = **347.774**

Total area ex. Pier 3 (sf); $A_{P3\_ex} = A_{EP3\_cap1} + A_{EP3\_cap2} + A_{excap\_bott} + A_{P3\_excol}$ = **629.700**

New Pier -

Extended cap height pier 3 (ft); H_{cap3} = **2.880**

Cap elevation area (sq ft); A_{cap3} = **49.700**

Cap end area (sq ft); $A_{end3} = H_{cap3} \times W_{cap\_new}$ = **8.640**

Cap underneath area (sq ft); $A_{under3} = (\sqrt{}(1.5^2 + 3^2)) \times W_{cap\_new}$ = **10.062**

Total cap area (sq ft); $A_{P3\_cap} = 2 \times (A_{cap3} + A_{end3} + A_{under3})$ = **136.805**

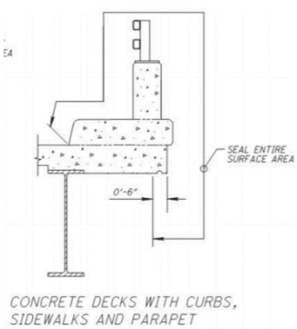
Average column height (to top of footing) (ft); H_{col3_seal} = 12.25

Total column area (sq ft); $A_{P3\_col} = (2\times\pi \times r_{col} + (2\times a_{col})) \times H_{col3\_seal}$ = **188.954**

Total area new Pier 3 (sq ft); $A_{P3\_new} = A_{P3\_cap} + A_{P3\_col}$ = **325.758**

Total pier area (sq ft); $A_{512\_pier} = A_{P1\_ex} + A_{P1\_new} + A_{P2\_ex} + A_{P2\_new} + A_{P3\_ex} + A_{P3\_new}$ = **2839.492**

Deck and Parapet (on bridge deck)



**** ODOT D12 preference is to seal to the edge of the beam flange *****

**** Sideralk is calculated separately for non-epoxy sealer ****

Parapet height (ft);; h_{bar} = **2.667**

Parapet width (ft);; w_{bar} = **1.167**

Proposed bridge limits (ft);; L_{deck} = **283.170**

Parapet perimeter (ft);; $perim_{bar} = h_{bar} \times 2 + w_{bar}$ = **6.500**

Average haunch (all beams) (in);; h_{avg} = **2.150**

Average flange thickness (weighted over length) (in);; t_f = **1.231**

Width of deck overhang sealed (ft);; $w_{fascia} = (L_{fascia} - b_f / 2)$ = **2.161**

Sealing perimeter (ft);; $P_{deck} = perim_{bar} + over + t_{walk\_bar} + over + (h_{avg} + t_f + t_{deck}) / 12 + w_{fascia}$ = **10.771**

Total sealing area on bridge deck (sq ft);; $A_{512\_deck} = P_{deck} \times L_{deck} \times 2$ = **6099.856**

Parapets (on approach slabs)

*Parapet and walk perimeter only

Perimeter of parapet (ft);; $perim_{bar}$ = **6.500**

Thickness of sidewalk at barrier; t_{walk_bar} = **0.787**

Length of parapet on approach slabs (ft);; $L_{parapet}$ = **12.000**

End area of parapet transition (sq ft);; $A_{par\_end} = w_{bar} \times h_{bar}$ = **3.111**

Total sealing area of parapets on approaches (sq ft);; $A_{512\_par} = 4 \times (A_{par\_end} + (perim_{bar} + t_{walk\_bar}) \times L_{parapet})$ = **362.205**

TOTAL AREA OF SEALING (SY);; T_{512} **= ceiling((**A_{512_abut} **+** A_{512_ww} **+** A_{512_pier} **+** A_{512_deck} + A_{512_par}**) / 9, 1) = 1135.000**

PLAN SPLITS:

02/SAF/BR –; T_{512} **= 1135.000**

04/NFP/BR – DOMINION ENERGY OHIO None

ITEM 512 – SEALING CONCRETE SURFACES (NON-EPOXY)

Sealing perimeter with parapet (ft); P_{walk_bar} = curb + w_{walk} =**6.667**
Length of parapet on approach slabs (ft);; $L_{parapet}$ = **12.000**

Sealing perimeter without parapet (ft); P_{walk_nobar} = curb + w_{walk} + w_{bar} + over + t_{walk_bar} = **8.787**
Length of approach slabs (ft); L_{app} = 25

Total sealing area on bridge deck (SF); $A_{nonepoxy\_deck} = P_{walk\_bar} \times L_{deck} \times 2$ = **3775.600**
Total sealing area on approach slabs (SF); $A_{nonepoxy\_AS} = 4\times(P_{walk\_bar} \times L_{parapet})+(P_{walk\_nobar} \times (L_{app} - L_{parapet}))$ =
434.227

TOTAL AREA OF SEALING (SY); **T_{512_NON} = ceiling(($A_{nonepoxy\_deck}$ + $A_{nonepoxy\_AS}$) / 9, 1) = 468.000**

PLAN SPLITS:

02/SAF/BR –; **T_{512_NON} = 468.000**
04/NFP/BR – DOMINION ENERGY OHIO 0 SY

ITEM 512 – TYPE 2 WATERPROOFING **REV. 06/2024**

*3'-0" wide at vertical and horizontal new-to-existing abutment stem joints, vertical construction joints in diaphragms, construction joints at wingwalls.

Width of waterproofing (ft); $W_{Type2} = 3$

Total joint lengths at new-to-existing stems (RA) (ft); $L_{joint\_RA} = 49.3 + 1.0 + 1.0 =$ **51.300**

Total joint lengths at new-to-existing stems (FA) (ft); $L_{joint\_FA} = 45.2 + 1.0 + 0.9 =$ **47.100**

Total joint lengths at wingwalls (ft); $L_{joint\_WW} = (13+13+12+9) =$ **47.000**

Total Area of Type 2 Waterproofing (SY); $A_{Type2} = \text{ceiling}(W_{Type2} \times (L_{joint\_RA} + L_{joint\_FA} + L_{joint\_WW}) / 9, 1) = 49.000$

PLAN SPLITS:

02/SAF/BR –; $A_{Type2} = 49.000$

04/NFP/BR – DOMINION ENERGY OHIO 0 SY

ITEM 513 – STRUCTURAL STEEL MEMBERS, LEVEL 3 **REV. 1/5/2023**

Main Steel Members

Length from CL brg to first field splice (ft); $L_{sp1} = 71.8125$

Length from splice to splice (ft); $L_{sp2} = 86.0625$

Length from splice to splice (ft); $L_{sp3} = 49.97$

Length from splice to CL brg (ft); $L_{sp4} = 71.83$

Number of interior beams (each); $N_{int} = \mathbf{5.000}$

Number of fascia beams (each); $N_{ext} = \mathbf{2.000}$

Total Number of beams (each); $N_{beams} = N_{int} + N_{ext} = \mathbf{7.000}$

Unit Weight of W36x232 (lb/ft); $W_{36x232} = 232$

Unit Weight of W36x182 (lb/ft); $W_{36x182} = 182$

Unit weight of field splice 232 to 182 (lb/splice); $W_{splice\_1} = 740$

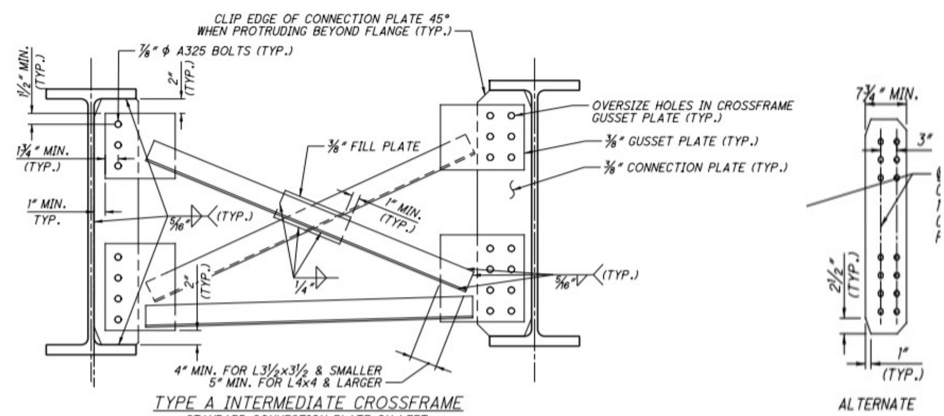
Unit weight of field splice 232 to 232 (lb/splice); $W_{splice\_2} = 1010$

Total Weight of Main Steel Members (lb); $W_{stl\_main} = N_{beams} \times (2 \times W_{splice\_1} + W_{splice\_2} + W_{36x232} \times (L_{sp2} + L_{sp3}) + W_{36x182} \times (L_{sp1} + L_{sp4} + 2.5)) = \mathbf{424532.325}$

Standard Crossframes

**Per GSD-1-19 Designer Supplement, estimated quantities are to assume the use of Type A Crossframes*

**For 2'-8" overhang and 8'-2" beam spacing, angles will be L4x4x7/16 and the alternate connection plates will be used.*



Gusset & Connection plate thickness (in); $t_{pl} = 0.375$

Connection plate width (in); $w_{conn} = 7.75$

Unit weight of L4x4x7/16 angles (lb/ft); $W_{4x4} = 11.3$

Leg length of angles (in); $l_a = 4$

Typical clear distance (in); $clr = 1$

Typical bolt spacing (in); $spa_b = 3$

Bolt horizontal edge distance (in); $edge_h = 1.75$

Bolt vertical edge distance (in); $edge_v = 1.5$

Unit weight of steel plates (lb/ft^3); $W_{stl} = 490$

Beam spacing (ft); $S_{bm} = 8.1667$

Tekla Tedds Osborn Engineering 1100 Superior Avenue - Suite 300 Cleveland, Ohio 44114	Project CUY-77-04.79 PID 106239				Job Ref. J20170056.000	
	Section Structure Estimated Quantities				Sheet no./rev. 28	
	Calc. by EIW	Date 03/22/24	Chk'd by PJW/SMK	Date 03/22/24	App'd by	Date

W36x232 beam height (ft); h_{36x232} = 37.1/12 = **3.092**

W36X232 flange width (ft); b_{f_36x232} = 12.1/12 = **1.008**

W36x232 flange thickness (ft); t_{f_36x232} = 1.57/12 = **0.131**

W36x232 web thickness (ft); t_{w_36x232} = 0.87/12 = **0.073**

W36x182 beam height (ft); h_{36x182} = **3.025**

W36X182 flange width (ft); b_{f_36x182} = 12.1/12 = **1.008**

W36x182 flange thickness (ft); t_{f_36x182} = 1.18/12 = **0.098**

W36x182 web thickness (ft); t_{w_36x182} = 0.725/12 = **0.060**

Gusset plate area extend horizontally 6" past connection plate to achieve 5" weld on bottom horizontal angle

Bottom gusset plate area (sq ft); $A_{bg} = (6+w_{conn} - clr) \times ((3\times spa_b)+2 \times edge_v) / 144$ = **1.063**

Top gusset plate area (sq ft); $A_{tg} = (6+w_{conn} - clr) \times ((2\times spa_b)+2\times edge_v) / 144$ = **0.797**

Connection plate area (sq ft); $A_{conn} = w_{conn} / 12 \times (h_{36x232} - 2 \times t_{f\_36x232})$ = **1.828**

Horizontal angle length (ft); $L_{a\_h} = S_{bm} - t_{w\_36x232} - 2 \times (w_{conn} + clr)/12$ = **6.636**

Diagonal angle vertical dimension (ft); $vert_{dia} = h_{36x232} - 2\times t_{f\_36x232} - (2 + clr + l_a + clr)/12 - (2 + clr + l_a)/12$ = **1.580**

Diagonal angle length (ft); $L_{a\_dia} = \sqrt{(L_{a\_h}^2 + vert_{dia}^2)}$ = **6.821**

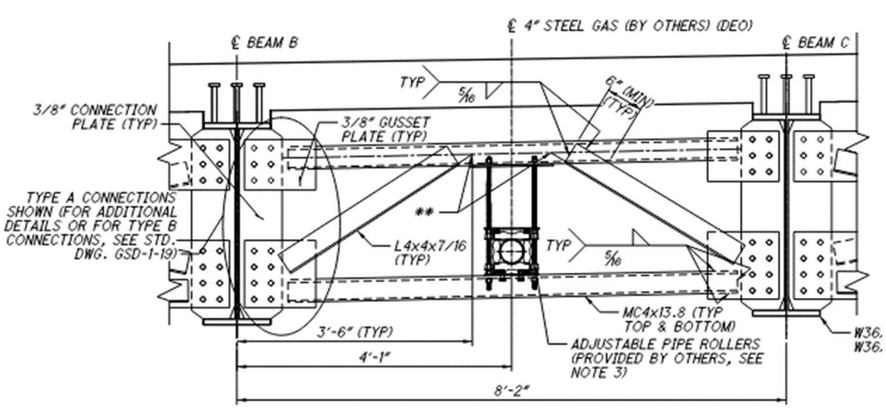
Weight per standard cross-frame (lb); $W_{cf} = 1.05 \times (W_{4x4} \times (L_{a\_h} + 2\times L_{a\_dia}) + 2 \times W_{stl} \times t_{pl} \times (A_{bg} + A_{tg} + A_{conn}) / 12)$ = **359.169**

(*includes 5% for fill plate and bolts*)

Total number of standard crossframes; $N_{scf} = 19 \times 4$ = **76.000**

Total standard crossframe weight (lb); $W_{stl\_scf} = N_{scf} \times W_{cf}$ = **27296.807**

Special Utility Crossframe Type 1



SPECIAL UTILITY CROSSFRAME TYPE 1 DETAIL

** - WORK POINT

Unit weight MC4x13.8; W_{MC4} = 13.8

Bottom gusset plate area (sq ft); A_{bg1} = (6+w_{conn} - clr) × ((3×spa_b)+2×$edge_v$) / 144 = **1.063**

Top gusset plate area (sq ft); A_{tg1} = (6+w_{conn} - clr) × ((2×spa_b)+2×$edge_v$) / 144 = **0.797**

Connection plate area (sq ft); A_{conn1} = w_{conn} / 12 × (h_{36x232} – 2 × t_{f_36x232}) = **1.828**

Horizontal channel length (ft); L_{c_h} = S_{bm} – t_{w_36x232} - 2 × (w_{conn} + clr)/12 = **6.636**

Diagonal angle length (ft) (CAD); L_{a_dia1} = 3

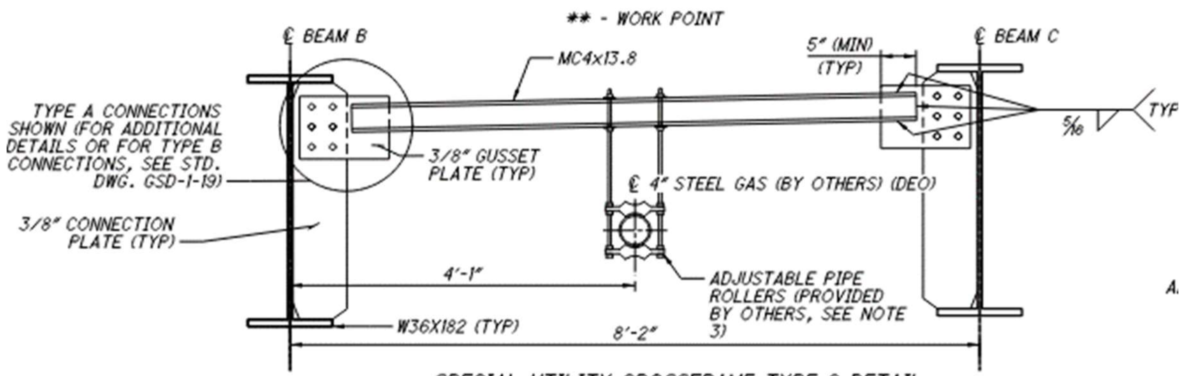
Weight per utility cross-frame Type 1 (lb); W_{ucf1} = 1.05 × (W_{4x4} × (2×L_{a_dia1}) + 2 × W_{MC4} × L_{c_h} + 2 × W_{stl} × t_{pl} × (A_{bg1} + A_{tg1} + A_{conn1}) / 12) = **382.060**
(*includes 5% for fill plate and bolts*)

Total number of Utility Type 1 crossframes; N_{ucf1} = 19 × (1) = **19.000**

Total Utility Type 1 crossframes weight (lb); W_{stl_ucf1} = N_{ucf1} × W_{ucf1} = **7259.144**

Special Utility Crossframe Type 2

**Similar to standard crossframe, except only a horizontal MC4x13.8 member*



SPECIAL UTILITY CROSSFRAME TYPE 2 DETAIL

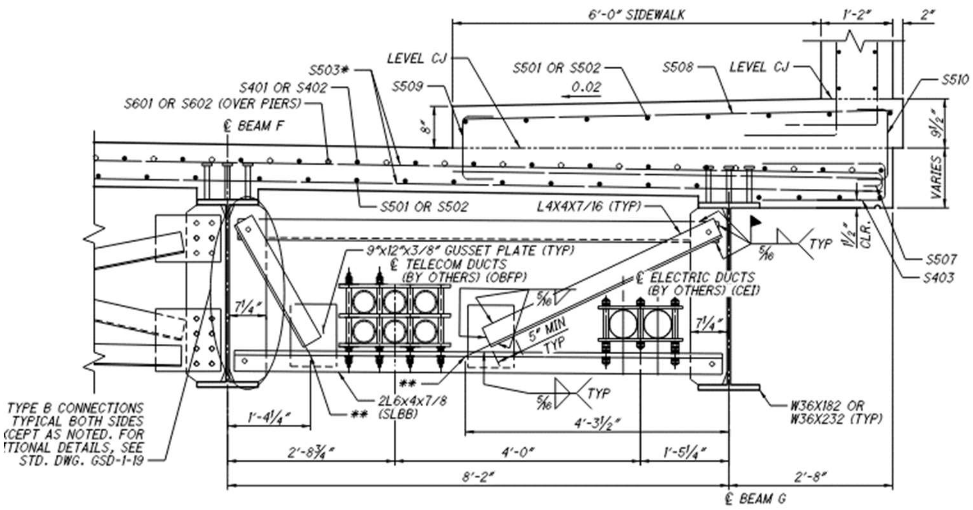
Weight per utility cross-frame Type 2 (lb); W_{ucf2} = 1.05 × (W_{MC4} × L_{c_h} + 2 × W_{stl} × t_{pl} × (A_{tg1} + A_{conn1}) / 12) = **180.550**

Total number of Utility Type 2 crossframes; N_{ucf2} = 2

Total Utility Type 2 crossframes weight (lb); W_{stl_ucf2} = N_{ucf2} × W_{ucf2} = **361.101**

Tekla Tedds Osborn Engineering 1100 Superior Avenue - Suite 300 Cleveland, Ohio 44114	Project CUY-77-04.79 PID 106239			Job Ref. J20170056.000	
	Section Structure Estimated Quantities			Sheet no./rev. 30	
	Calc. by EIW	Date 03/22/24	Chk'd by PJW/SMK	Date 03/22/24	App'd by	Date

Special Utility Crossframe Type 3



SIDEWALK AND SPECIAL UTILITY CROSSFRAME TYPE 3 DETAIL

** - WORK POINT

Gusset & Connection plate thickness (in);	t_{pl} = **0.375**
Connection plate width (in);	$w_{conn3} = 7.25$
Bottom gusset plate area 1(sq ft);	$A_{bg3} = (9\times12) / 144 =$ **0.750**
Connection plate area (sq ft);	$A_{conn3} = w_{conn3} / 12 \times (h_{36x232} - 2\times t_{f\_36x232}) =$ **1.710**
Unit weight 2L6x4x7/8 (lb/ft);	$W_{2L} = 54.4$
Horizontal member length (ft);	$L_{a\_h3} = S_{bm} - t_{w\_36x232} - 2 \times clr / 12 =$ **7.928**
Left diagonal length (CAD) (ft);	$L_{diag3\_lt} = 2.25$
Right diagonal length (CAD) (ft);	$L_{diag3\_rt} = 4.16$

Weight per Utility Type 3 cross-frame (lb); $W_{ucf3} = 1.05 \times (W_{4x4} \times (L_{a\_h3} + L_{diag3\_lt} + L_{diag3\_rt}) + W_{2L} \times L_{a\_h3} + 2 \times W_{stl} \times t_{pl} \times (A_{bg3} + A_{conn3}) / 12) =$ **702.033**

(*includes 5% for fill plate and bolts*)

Total number of Special Type 3 crossframes; $N_{ucf3} = 19 \times (1) =$ **19.000**

Total Utility Type 3 crossframes weight (lb); $W_{stl\_ucf3} = N_{ucf3} \times W_{ucf3} =$ **13338.631**

TOTAL WEIGHT OF STEEL (LB); $T_{513} = \text{ceiling}(W_{stl\_main} + W_{stl\_scf} + W_{stl\_ucf1} + W_{stl\_ucf2} + W_{stl\_ucf3}, 1) =$ **472789.000**

PLAN SPLITS:

02/SAF/BR –; $T_{513} - W_{stl\_ucf2} =$ **472427.899**

04/NFP/BR – DOMINION ENERGY OHIO

*Includes Special Utility Support crossframes (Type 2)

; $W_{stl\_ucf2} =$ **361.101**

Tekla Tedds Osborn Engineering 1100 Superior Avenue - Suite 300 Cleveland, Ohio 44114	Project CUY-77-04.79 PID 106239			Job Ref. J20170056.000	
	Section Structure Estimated Quantities			Sheet no./rev. 31	
	Calc. by EIW	Date 03/22/24	Chk'd by PJW/SMK	Date 03/22/24	App'd by	Date

ITEM 513 – WELDED SHEAR STUD CONNECTORS

Studs per location; $stud = 3$

Studs per beam; $N_{stud} = 378$

Number of interior beams (each); $N_{int} =$ **5.000**

Number of fascia beams (each); $N_{ext} =$ **2.000**

TOTAL NUMBER OF SHEAR STUDS (EA); $\mathbf{T_{stud} = stud \times N_{stud} \times (N_{int} + N_{ext}) = 7938.000}$

PLAN SPLITS:

02/SAF/BR –; $T_{stud} =$ **7938.000**

04/NFP/BR – DOMINION ENERGY OHIO 0 each

ITEM 514 – FIELD PAINTING STRUCTURAL STEEL, INTERMEDIATE COAT **REV. 12/2/2022**

ITEM 514 – FIELD PAINTING STRUCTURAL STEEL, FINISH COAT **REV. 12/2/2022**

Number of interior beams (each);; N_{int} = **5.000**
Number of fascia beams (each);; N_{ext} = **2.000**
W36x182 beam height (ft);; h_{36x182} = **3.025**
W36X182 flange width (ft);; b_{f_36x182} = **1.008**
W36x182 flange thickness (ft);; t_{f_36x182} = **0.098**
W36x182 web thickness (ft);; t_{w_36x182} = **0.060**

W36x232 beam height (ft);; h_{36x232} = **3.092**
W36X232 flange width (ft);; b_{f_36x232} = **1.008**
W36x232 flange thickness (ft);; t_{f_36x232} = **0.131**
W36x232 web thickness (ft);; t_{w_36x232} = **0.073**

Length from CL brg to first field splice (ft);; L_{sp1} = **71.813**
Length from splice to splice (ft);; L_{sp2} = **86.063**
Length from splice to splice (ft);; L_{sp3} = **49.970**
Length from splice to CL brg (ft);; L_{sp4} = **71.830**

W36x182 Beam Section

Length of W36x182 between abutment diaphragms per beam line (ft);; $L_{36x182} = L_{sp1} + L_{sp4} - 2\times1.5 =$ **140.642**
W36x182 perimeter (ft);; $P_{36x182} = 3 \times b_{f\_36x182} + 2\times h_{36x182} =$ **9.075**

W36x232 Beam Section

Length of W36x232 between splices per beam line (ft);; $L_{36x232} = L_{sp2} + L_{sp3} =$ **136.033**
W36x232 perimeter (ft);; $P_{36x232} = 3 \times b_{f\_36x232} + 2\times h_{36x232} =$ **9.208**

Total Painting – main steel members (sq ft);; $T_{514\_main} = N_{beams} \times (P_{36x232} \times L_{36x232} + P_{36x182} \times L_{36x182}) =$ **17702.743**

Standard Crossframes

From Steel weight calc

Bottom gusset plate area (sq ft);; A_{bg} = **1.063**
Top gusset plate area (sq ft);; A_{tg} = **0.797**
Connection plate area (sq ft);; A_{conn} = **1.828**
Gusset & Connection plate thickness (in);; t_{pl} = **0.375**
Leg length of angles (in);; l_a = **4.000**
Horizontal angle length (ft);; L_{a_h} = **6.636**
Diagonal angle length (ft);; L_{a_dia} = **6.821**
Total number of standard crossframes;; N_{scf} = **76.000**

Perimeter of L4x4x7/16 angles (ft);; $P_{4x4} = (4+4+0.4375+3.5625+3.5625+0.4375) / 12 =$ **1.333**

Assumes ½ of the front face of each connection plate and half the back face of gusset plates are overlaping, overlap of angle and gusset plate not considered, plate edge thickness not considered

Painted area of crossframe gusset and connection plates (sq ft); $A_{514\_pl} = 2 \times 1.5 \times A_{conn} + 1.5 \times 2 \times A_{bg} + 1.5 \times 2 \times A_{tg} =$ **11.061**

Painted area of crossframe angle members (sq ft); $A_{514\_a} = P_{4x4} \times (L_{a\_h} + 2 \times L_{a\_dia}) - 6 \times l_a \times 5 / 144 =$ **26.205**

Total Painting – standard crossframe members (sq ft); $T_{514\_scf} = N_{scf} \times (A_{514\_pl} + A_{514\_a}) =$ **2832.221**

Type 1 Utility Crossframes

From Steel weight calc

Total number of Type 1 utility crossframes; N_{ucf1} = **19.000**

Bottom gusset plate area (sq ft); A_{bg1} = **1.063**

Top gusset plate area (sq ft); A_{tg1} = **0.797**

Connection plate area (sq ft); A_{conn} = **1.828**

Horizontal channel length (ft); L_{c_h} = **6.636**

Diagonal angle length (ft) (CAD); L_{a_dia1} = **3.000**

Perimeter of L4x4x7/16 angles (ft);; $P_{4x4} = (4+4+0.4375+3.5625+3.5625+0.4375) / 12 =$ **1.333**

Perimeter of MC4x13.2 (ft); $P_{MC4} = (2.5+4+2.5+.5+2+3+2+0.5)/12=$**1.417**

Assumes ½ of the front face of each connection plate and half the back face of gusset plates are overlapping, overlap of angle and gusset plate not considered, plate edge thickness not considered

Painted area of crossframe gusset and connection plates (sq ft); $A_{514\_pl1} = 2 \times 1.5 \times A_{conn} + 1.5 \times 2 \times A_{bg1} + 1.5 \times 2 \times A_{tg1} =$ **11.061**

Painted area of crossframe angle & channel members (sq ft); $A_{514\_a1} = P_{4x4} \times (2 \times L_{a\_dia1}) + 2 \times P_{MC4} \times L_{c\_h} - 2 \times l_a \times 5 / 144 - 4 \times 4 \times 5 /144=$ **25.968**

Total Painting – Type 1 utility crossframe members (sq ft); $T_{514\_ucf1} = N_{ucf1} \times (A_{514\_pl} + A_{514\_a1}) =$ **703.561**

Type 2 Utility Crossframes

From Steel weight calc

Total number of Type 2 utility crossframes;; N_{ucf2} = **2.000**

Painted area of crossframe gusset and connection plates (sq ft); $A_{514\_pl2} = 4 \times A_{conn} + 0.5 \times 2 \times A_{tg} =$ **8.108**

Painted area of crossframe angle members (sq ft); $A_{514\_a2} = P_{MC4} \times L_{c\_h} - 2 \times 4 \times 5 / 144 =$ **9.123**

Total Painting – Type 2 utility crossframe members (sq ft); $T_{514\_ucf2} = N_{ucf2} \times (A_{514\_pl2} + A_{514\_a2}) =$ **34.461**

Type 3 Utility Crossframes

From Steel weight calc

Bottom gusset plate area (sq ft);; A_{bg3} = **0.750**

Connection plate area (sq ft);; A_{conn3} = **1.710**

Horizontal member length (ft); $L_{a\_h3} = S_{bm} - t_{w\_36x232} - 2 \times clr / 12 =$ **7.928**

Left diagonal length (CAD) (ft); $L_{diag3\_lt} = 2.25$

Right diagonal length (CAD) (ft); $L_{diag3\_rt} = 4.16$

Total number of Type 3 crossframes;; $N_{ucf3} =$ **19.000**

Perimeter of L4x4x7/16 angles (ft);; $P_{4x4} =$ **1.333**

Exposed Perimeter of 2L6x4x7/8 (ft); $P_{2L} = 2.667$

Overlap of angle and gusset plate not considered, plate edge thickness not considered

Painted area of crossframe gusset and connection plates (sq ft); $A_{514\_pl3} = 4 \times A_{conn3} + 4 \times A_{bg3} =$ **9.839**

Painted area of crossframe angle members (sq ft); $A_{514\_a3} = P_{4x4} \times (L_{a\_h3} + L_{diag3\_lt} + L_{diag3\_rt}) + P_{2L} \times L_{a\_h3} - 8 \times l_a \times 5 / 144 =$ **39.148**

Total Painting – Type 3 crossframe members (sq ft); $T_{514\_ucf3} = N_{ucf3} \times (A_{514\_pl3} + A_{514\_a3}) =$ **930.762**

TOTAL AREA OF PAINTING (SQ FT); $T_{514} =$ **ceiling(**$T_{514\_main} + T_{514\_scf} + T_{514\_ucf1} + T_{514\_ucf2} + T_{514\_ucf3}$**, 1) = 22204.000**

PLAN SPLITS:

02/SAF/BR –; $T_{514} =$ **22204.000**

04/NFP/BR – DOMINION ENERGY OHIO 0 SF

ITEM 514 – FINAL INSPECTION REPAIR

*Per CMS, one location per 150 linear foot of girder

Length of beams (ft); $L_{beam} = L_{sp1} + L_{sp2} + L_{sp3} + L_{sp4} = \mathbf{279.675}$

Number of interior beams (each); $N_{int} = \mathbf{5.000}$

Number of fascia beams (each); $N_{ext} = \mathbf{2.000}$

Number of locations per beam line (each); $N_{inspec} = \text{ceiling}(L_{beam} / 150, 1) = \mathbf{2.000}$

TOTAL NUMBER OF INSPECTION LOCATIONS (EA); $\mathbf{T_{insp} = (N_{int} + N_{ext}) \times N_{inspec} = 14.000}$

PLAN SPLITS:

02/SAF/BR –; $\mathbf{T_{insp} = 14.000}$

04/NFP/BR – DOMINION ENERGY OHIO 0 SF

ITEM 516 – ARMORLESS PREFORMED JOINT SEAL

**Measured as length of sleeper slab along the bridge skew.*

Width of approach slabs at ends (ft); W_{app} = (40 + 2×(7.1667 + 2/12)) = **54.667**

Bridge skew; Θ = 0

Seal length along skew (ft); PJS = W_{app} / cos(Θ) = **54.667**

TOTAL SEAL LENGTH (FT); **L_{SEAL} = ceiling(2 × PJS, 1) = 110.000**

PLAN SPLITS:

02/SAF/BR –; **L_{SEAL} = 110.000**

04/NFP/BR – DOMINION ENERGY OHIO 0 FT

ITEM 516 – 1” PREFORMED EXPANSION JOINT FILLER

**Located between approach and bridge-mounted parapet*

Typical parapet section area (sq ft); A_{par} = **3.111**

Bridge skew; Θ = **0.000**

Parapet area along skew (ft); $A_{par\_skew} = A_{par} / \cos(\Theta)$ = **3.111**

TOTAL PEJF AREA (SQ FT); $\mathbf{L_{PEJF\_1} = ceiling(A_{par\_skew} \times 4, 1) = 13.000}$

PLAN SPLITS:

02/SAF/BR –; $\mathbf{L_{PEJF\_1} = 13.000}$

04/NFP/BR – DOMINION ENERGY OHIO 0 FT

ITEM 516 – 2" PREFORMED EXPANSION JOINT FILLER

**Located between wingwall and abutment diaphragm*

Width of wingwall (ft); $W_{wingwall}$ = **3.250**

Bridge skew; Θ = **0.000**

Wingwall width along skew (ft); $W_{WW\_skew} = W_{wingwall} / \cos(\Theta)$ = **3.250**

NW WW El. PEJF (Ft); EL_{pejf_NW} = 1086.27

NE WW El. at PEJF (Ft); EL_{pejf_NE} = 1075.79

SW WW El. at PEJF (Ft); EL_{pejf_SW} = 1086.08

SE WW El. at PEJF (Ft); EL_{pejf_SE} = 1075.59

Beam seat at NW WW elevation (ft); EL_{BS_NW} = 1080.42

Beam seat at NE WW elevation (ft); EL_{BS_NE} = 1069.94

Beam seat at SW WW elevation (ft); EL_{BS_SW} = 1080.23

Beam seat at SE WW elevation (ft); EL_{BS_SE} = 1069.74

NW WW height at PEJF (Ft); $h_{pejf\_NW} = EL_{pejf\_NW} - EL_{BS\_NW}$ = **5.850**

NE WW height at PEJF (Ft); $h_{pejf\_NE} = EL_{pejf\_NE} - EL_{BS\_NE}$ = **5.850**

SW WW height at PEJF (Ft); $h_{pejf\_SW} = EL_{pejf\_SW} - EL_{BS\_SW}$ = **5.850**

SE WW height at PEJF (Ft); $h_{pejf\_SE} = EL_{pejf\_SE} - EL_{BS\_SE}$ = **5.850**

TOTAL PEJF AREA (SQ FT); $L_{PEJF\_2} = \text{ceiling}(W_{WW\_skew} \times (h_{pejf\_NW} + h_{pejf\_NE} + h_{pejf\_SW} + h_{pejf\_SE}), 1)$ =
77.000

PLAN SPLITS:

02/SAF/BR –; L_{PEJF_2} = **77.000**

04/NFP/BR – DOMINION ENERGY OHIO 0 FT

ITEM 516 – SEMI-INTEGRAL EXPANSION JOINT SEAL

Abutment length (ft); L_{abut} = **54.670**

Length of seal (ft); $L_{exp\_jt\_seal} = L_{abut} + 4/12 + 3 =$ **58.003**

Total Length of Semi-integral expansion joint seal (FT);

$L_{jt\_seal} = \text{ceiling}(2 \times L_{exp\_jt\_seal}, 1) =$ **117.000**

PLAN SPLITS:

02/SAF/BR –; L_{jt_seal} = **117.000**

04/NFP/BR – DOMINION ENERGY OHIO 0 FT

ITEM 516 – ELASTOMERIC BEARING WITH INTERNAL LAMINATES AND LOAD PLATE (NEOPRENE)

Total Number of beams (each); N_{beams} = **7.000**

TOTAL NUMBER OF ABUTMENT BEARINGS(EA); $T_{BRG\_abut} = N_{beams} \times 2 = 14.000$

TOTAL NUMBER OF PIER BEARINGS(EA); $T_{BRG\_pier} = N_{beams} \times 3 = 21.000$

PLAN SPLITS:

02/SAF/BR –

ABUTMENT; T_{BRG_abut} = **14.000**

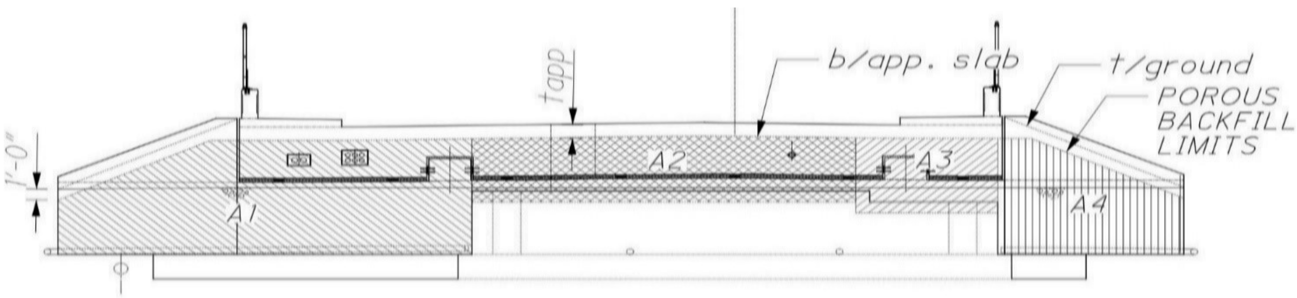
PIER; T_{BRG_pier} = **21.000**

04/NFP/BR – DOMINION ENERGY OHIO 0 SF

Tekla Tedds Osborn Engineering 1100 Superior Avenue - Suite 300 Cleveland, Ohio 44114	Project CUY-77-04.79 PID 106239	Job Ref. J20170056.000
	Section Structure Estimated Quantities	Sheet no./rev. 41
	Calc. by: EIW / Date: 03/22/24 / Chk'd by: PJW/SMK / Date: 03/22/24	App'd by / Date

ITEM 518 – POROUS BACKFILL WITH GEOTEXTILE FABRIC

* Item includes 2'-0" thick porous backfill behind backwalls and wingwalls
* New porous backfill behind existing abutment to remain extends 1' below construction joint
* New porouse backfill behind new abutment sections extends to top of footing.



Proposed approach slab thickness (ft);	t_{app} = **1.250**
Porous backfill thickness (ft);	t_{518} = 2

Rear Abutment

Area 1 (CAD) (sf);	$A1_{RA}$ = 280.6
Area 2 (CAD) (sf);	$A2_{RA}$ = 162.9
Area 3 (CAD) (sf);	$A3_{RA}$ = 69.5
Area 4 (CAD) (sf);	$A4_{RA}$ = 111.9

Fwd Abutment

Area 1 (CAD) (sf);	$A1_{FA}$ = 208.4
Area 2 (CAD) (sf);	$A2_{FA}$ = 161.6
Area 3 (CAD) (sf);	$A3_{FA}$ = 69.0
Area 4 (CAD) (sf);	$A4_{FA}$ = 77.3

New porous backfill vol behind RA (cu ft);	$V_{518\_RA} = t_{518} \times (A1_{RA} + A2_{RA} + A3_{RA} + A4_{RA})$= **1249.800**
New porous backfill vol behind ex FA (cu ft);	$V_{518\_FA} = t_{518} \times (A1_{FA} + A2_{FA} + A3_{FA} + A4_{FA})$= **1032.600**

TOTAL VOL POROUS BACKFILL (CY); **T_{518} = ceiling(($V_{518\_RA} + V_{518\_FA}$) / 27, 1) = 85.000**

PLAN SPLITS:

02/SAF/BR –;	**T_{518} = 85.000**
04/NFP/BR – DOMINION ENERGY OHIO	0 CY

ITEM 518 – 6" PERFORATED CORRUGATED PLASTIC PIPE

*To run behind abutments and wingwalls

New full height stem length (ft); L_{stem} = **16.833**

SE wingwall length (ft); L_{se} = **5.833**

SW wingwall length (ft); L_{sw} = **12.833**

NE wingwall length (ft); L_{ne} = **11.833**

NW wingwall length (ft); L_{nw} = **12.833**

TOTAL LENGTH PCPP (FT); $T_{PCPP} = \text{ceiling}(2 \times L_{stem} + L_{se} + L_{sw} + L_{ne} + L_{nw}, 1) = 77.000$

PLAN SPLITS:

02/SAF/BR –; T_{PCPP} = **77.000**

04/NFP/BR – DOMINION ENERGY OHIO 0 FT

ITEM 518 – 6” NON-PERFORATED CORRUGATED PLASTIC PIPE, INCLUDING SPECIALS

*From ends of wingwalls to outlet in slope.

NW Wingwall (ft); NP_{nw} = 14.34
NE Wingwall (ft); NP_{ne} = 15.49
SW Wingwall (ft); NP_{sw} = 14.91
SE Wingwall (ft); NP_{se} = 23.42

TOTAL LENGTH NPCPP (FT); $T_{NPCPP} = \text{ceiling}(NP_{nw} + NP_{ne} + NP_{sw} + NP_{se}, 5) = 70.000$

PLAN SPLITS:

02/SAF/BR –; **T_{NPCPP} = 70.000**
04/NFP/BR – DOMINION ENERGY OHIO 0 FT

ITEM 519 – PATCHING CONCRETE STRUCTURE, AS PER PLAN

*From repair plan

TOTAL PATCHING AREA (SF); T_{patch} = 10

PLAN SPLITS:

02/SAF/BR –; T_{patch} = **10.000**

04/NFP/BR – DOMINION ENERGY OHIO 0 SF

Osborn Engineering 1100 Superior Avenue - Suite 300 Cleveland, Ohio 44114	Project CUY-77-04.79 PID 106239			Job Ref. J20170056.000	
	Section Structure Estimated Quantities			Sheet no./rev. 45	
	Calc. by EIW	Date 03/22/24	Chk'd by PJW/SMK	Date 03/22/24	App'd by	Date

ITEM 526 – REINFORCED CONCRETE APPROACH SLABS WITH QC/QA (T=15"), AS PER PLAN

*Approach slabs with integral sidewalk

Length of approach slabs (ft); $L_{app} = 25$

Proposed approach slab width (ft); $w_{app} = 54.667$

TOTAL APPROACH SLAB AREA (SQ YD); $A_{app} = \text{ceiling}(2 \times (L_{app} \times w_{app}) / 9, 1) = \mathbf{304.000}$

PLAN SPLITS:

02/SAF/BR –; $A_{app} = \mathbf{304.000}$

04/NFP/BR – DOMINION ENERGY OHIO 0 FT

Osborn Engineering 1100 Superior Avenue - Suite 300 Cleveland, Ohio 44114	Project CUY-77-04.79 PID 106239			Job Ref. J20170056.000	
	Section Structure Estimated Quantities			Sheet no./rev. 46	
	Calc. by EIW	Date 03/22/24	Chk'd by PJW/SMK	Date 03/22/24	App'd by	Date

ITEM 526 – TYPE C INSTALLATION, AS PER PLAN

*See calculation for Item 516 – Armorless Preformed Joint Seal

TOTAL INSTALLATION LENGTH (FT); $L_{install} = L_{SEAL} = 110.000$

PLAN SPLITS:

02/SAF/BR –; $L_{install} = 110.000$

04/NFP/BR – DOMINION ENERGY OHIO 0 FT

Tekla Tedds Osborn Engineering 1100 Superior Avenue - Suite 300 Cleveland, Ohio 44114	Project CUY-77-04.79 PID 106239			Job Ref. J20170056.000	
	Section Structure Estimated Quantities			Sheet no./rev. 47	
	Calc. by EIW	Date 03/22/24	Chk'd by PJW/SMK	Date 03/22/24	App'd by	Date

ITEM 601 – CRUSHED AGGREGATE SLOPE PROTECTION

*Areas from Bridge Site Plan taken on a 2:1 slope at RA and 3:1 slope at FA

Rear Abutment Plan Area (SF); $A_{601\_RA\_plan} = (48.5 \times 3 + 43.33 \times 19.5) =$ **990.435**

Rear Abutment Adjusted Area (SF); $A_{601\_RA} = \sqrt{(A_{601\_RA\_plan}^2 + (A_{601\_RA\_plan} / 2)^2)} =$ **1107.340**

Fwd Abutment Plan Area (SF); $A_{601\_FA\_plan} = (44.67 \times 3 + 46.67 \times 19.5) =$ **1044.075**

Fwd Abutment Adjusted Area (SF); $A_{601\_FA} = \sqrt{(A_{601\_FA\_plan}^2 + (A_{601\_FA\_plan} / 3)^2)} =$ **1100.552**

Total Area of Crushed Aggregate Slope Protection (SY); $A_{601\_TOTAL} = \text{ceiling}((A_{601\_RA} + A_{601\_FA}) / 9, 1) =$ **246.000**

Tekla Tedds Osborn Engineering 1100 Superior Avenue - Suite 300 Cleveland, Ohio 44114	Project CUY-77-04.79 PID 106239			Job Ref. J20170056.000	
	Section Structure Estimated Quantities			Sheet no./rev. 48	
	Calc. by EIW	Date 03/22/24	Chk'd by PJW/SMK	Date 03/22/24	App'd by	Date

ITEM 607 – VANDAL PROTECTION FENCE, 6' STRAIGHT, COATED FABRIC, AS PER PLAN

*Measured from end fence post to end fence post. See deck plan.

Proposed fence limit (ft); L_{fence} = 10 + 2.67 + 2.33 +135 + 2.54 + 2.46 +135+2.33+2.67+10 = **305.000**

TOTAL LENGTH OF FENCE (FT); T_{VPF} **= ceiling(**$2 \times L_{fence}$**, 1) = 610.000**

PLAN SPLITS:

02/SAF/BR –; **T_{VPF} = 610.000**

04/NFP/BR – DOMINION ENERGY OHIO 0 FT