ITEM 202 – PORTIONS OF STRUCTURE REMOVED, OVER 20 FOOT SPAN, AS PER PLAN

- Include portions expansion joints, any steel assemblies and/or miscellaneous appurtenances to complete work

LUMP SUM

ITEM 509 – EPOXY COATED REINFORCING STEEL

TOTAL REINFORCING STEEL (LB); T_{509} **= 3006**

ITEM 510 – DOWEL HOLES WITH NONSHRINK, NONMETALLIC GROUT

TOTAL DOWEL HOLES (EA); $T_{510} = 680$

ITEM 511 – CLASS QC1 CONCRETE, SUBSTRUCTURE, AS PER PLAN

Area of backwall replacement (SF); $A_{BW\_RPL} = (1.1667 \times 1.25) + 0.5 =$ **1.958**

Width of backwall (b/w cheekwalls) (FT); $W_{BW\_REAR} = 174.38$

$W_{BW\_FWD} = 174.93$

TOTAL AREA CONCRETE (CY); $\mathbf{T_{512\_RAIL} = ceiling(A_{BW\_RPL} \times (W_{BW\_REAR} + W_{BW\_FWD})/ 27, 1) = 26.000}$

ITEM 512 – SEALING OF CONCRETE SURFACES (EPOXY-URETHANE), AS PER PLAN

Patched Railings/Cheekwalls:

Total patched area, from 519 quantities (SF); A_{rail} = **117.000**

Quantity for overlap & finish (10%) (SF); $A'_{rail} = 1.1 \times A_{rail}$ = **128.700**

TOTAL Area at railings (SY); $\mathbf{T_{512\_RAIL} = ceiling((A'_{rail})/ 9, 1) = 15.000}$

Backwalls:

Top - avg BL elevation; EL_{REAR_top} = 658.79

EL_{FWD_top} = 660.19

Seat – avg elevation; EL_{REAR_seat} = 654.75

EL_{FWD_seat} = 655.60

Sealing offset below armor (ft); H_{armor} = 0.58

Width of backwall (btwn cheekwalls); W_{BW_REAR} = 174.38

W_{BW_FWD} = 174.93

TOTAL Area – REAR (SF); $BW_{REAR} = (EL_{REAR\_top} - H_{armor} - EL_{REAR\_seat}) \times W_{BW\_REAR}$ = **603.355**

TOTAL Area – FWD (SF); $BW_{FWD} = (EL_{FWD\_top} - H_{armor} - EL_{FWD\_seat}) \times W_{BW\_FWD}$ = **701.469**

TOTAL Area at backwalls (SY); $\mathbf{T_{512\_BW} = ceiling((BW_{REAR} + BW_{FWD}) / 9, 1) = 145.000}$

Breastwalls:

Place coating to surface of the slope protection (SL). Average elevations used.

Top SL - REAR; EL_{SL_REAR} = 652.70

Top SL - FWD; EL_{SL_FWD} = 654.10

Width of breastwall; W_{BRW_REAR} = 176.93

W_{BRW_FWD} = 176.93

Seat – avg elevation; EL_{REAR_seat} = 654.75

EL_{FWD_seat} = 655.60

TOTAL Area – REAR (SF); $BRW_{REAR} = (EL_{REAR\_seat} - EL_{SL\_REAR}) \times W_{BRW\_REAR}$ = **362.706**

TOTAL Area – FWD (SF); $BRW_{FWD} = (EL_{FWD\_seat} - EL_{SL\_FWD}) \times W_{BRW\_FWD}$ = **265.395**

TOTAL Area at breastwalls (SY); $\mathbf{T_{512\_BRW} = ceiling((BRW_{REAR} + BRW_{FWD}) / 9, 1) = 70.000}$

TOTAL QUANTITY OF SEALING (SY); $\mathbf{T_{512} = T_{512\_RAIL} + T_{512\_BW} + T_{512\_BRW} = 230.000}$

ITEM SPECIAL – URETHANE TOP COAT SEALER

*Per PN 519 – on those areas that receive glass or carbon fiber wrap.

Length of pier cap; L_{PC} = **172.750**

Height (avg) of pier cap (ft); h_{PC1} = **3.90** h_{PC2-4} = **3.80**

Width of pier cap (ft); W_{PC} = **3. 00**

Column area (SF) C_A = **7. 10**

NOTE: Discount faces where caps have only ~4" clearance between.

Area P1 of Carbon fiber wrap (SF); $A_{CF1} = 2(h_{PC1} \times L_{PC}) + 2(W_{PC} \times L_{PC}) + 4(W_{PC} \times h_{PC1})$ = **2431. 00**

Area P2 of Carbon fiber wrap (SF); $A_{CF2} = 2(h_{PC2-4} \times L_{PC}) + 2(W_{PC} \times L_{PC}) + 4(W_{PC} \times h_{PC2-4})$ = **2395. 00**

Area P2 = P3 = P4

Total area of urethane top coat (SF); 2431 – 18(7.1) + 3(2395 – 18(7.1)) = 9104.80

TOTAL AREA OF URETHANE TOP COAT (SY); T_{512_UR} = ceiling(9104.80) / 9, 1) = 1012.00

ITEM 513 – STRUCTURAL STEEL MEMBERS, LEVEL UF, AS PER PLAN

Intermediate Crossframe

Intermediate crossframe (L 3x3x5/16) (lbs/ft); $W_{INT} = 6.10$

Length/complete interior replaced (ft); $L_{INT} = 8.333 + (2 \times \sqrt{(2.333^2 + 8.333^2)}) =$ **25.640**

Number complete interior replaced; $N_{INT} = 4$

Weight of steel (lbs); $W_{ST} = N_{INT} \times W_{INT} \times L_{INT} =$ **625.612**

Total weight of intermediate steel (lbs); $W_{T\_INT} = \text{ceiling}(W_{ST}, 1) =$ **626.000**

End Crossframe

Gusset PLs – end crossframes: (3) 8" x 10" x ⅜" plates;

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

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

Connection plate area (in^2); $A_{pl} = 80$

Connection plate weight (lbs); $W_{GP} = 3 \times W_{stl} \times ((A_{pl} \times t_{pl})/1728) =$ **25.521**

End crossframe (L 4x4x5/16) (lbs/ft); $W_{EXT} = 8.20$

Length/complete end replaced (ft); $L_{EXT} = 8.333 + (2 \times \sqrt{(2.333^2 + 2.75^2)}) + (2 \times \sqrt{(2.333^2 + 1.333^2)}) =$ **20.920**

Number complete exterior replaced; $N_{EXT} = 4$

Weight of steel (lbs); $W_{T\_EXT} = W_{GP} + (N_{EXT} \times W_{EXT} \times L_{EXT}) =$ **711.681**

TOTAL WEIGHT OF STRUCTURAL STEEL (lbs); $W_{513} = \text{ceiling}(W_{T\_INT} + W_{T\_EXT}, 1) =$ **1338.000**

ITEM 516 – PREFORMED ELASTOMERIC COMPRESSION JOINT SEAL, AS PER PLAN

Length of SLOPE at FWD (ft); L_{FWD} = **177.50**

Length of SLOPE at REAR (ft); L_{REAR} = **177.00**

TOTAL SLOPE PROTECTION SEAL (LF); $T_{SLOPE} = L_{FWD} + L_{REAR} =$ **355.00**

ITEM 516 – STRUCTURAL EXPANSION JOINT INCLUDING ELASTOMERIC STRIP SEAL, AS PER PLAN

Length of EXP JT (ft); L_{EXP} = 142.33 / COS 36.57 = **177.22**

TOTAL EXPANSION JOINT (LF); $T_{EXP} = 2 \times L_{EXP} =$ **355.00**

ITEM 516 – REFURBISH BEARING DEVICE, AS PER PLAN

REAR ABUTMENT (EA); $R_{RA} = 7$

P1 (EA); $R_{P1} = 0$

P2 (EA); $R_{P2} = 0$

P3 (EA); $R_{P3} = 0$

P4 (EA); $R_{P4} = 0$

FWD ABUTMENT (EA); $R_{FA} = 6$

TOTAL NUMBER REFURBISHED ROCKERS (EA); $R_{REF} = \text{ceiling}(R_{RA} + R_{FA} + R_{P1} + R_{P2} + R_{P3} + R_{P4}, 1) = \underline{13.00}$

ITEM 516 – BEARING DEVICE, ROCKER

REAR ABUTMENT (EA); $E_{RA} = 4$

P1 (EA); $E_{P1} = 0$

P2 – P4 (EA); $E_{P2} = E_{P3} = E_{P4} = 0$

FWD ABUTMENT (EA); $E_{FA} = 5$

TOTAL NUMBER OF ROCKERS (EA); $\mathbf{R_{REPL} = ceiling(}E_{RA} + E_{FA} + E_{P1} + E_{P2} + E_{P3} + E_{P4}\mathbf{, 1) = \underline{9.00}}$

ITEM 516 – RESET BEARING

REAR ABUTMENT (EA); $S_{RA} = 0$

P1 (EA); $S_{P1} = 5$

P2 (EA); $S_{P2} = 1$

P3 (EA); $S_{P3} = 0$

P4 (EA); $S_{P4} = 0$

FWD ABUTMENT (EA); $S_{FA} = 3$

TOTAL NUMBER RESET ROCKERS (EA); $R_{RES} = \text{ceiling}(S_{RA} + S_{FA} + S_{P1} + S_{P2} + S_{P3} + S_{P4}, 1) = \underline{9.00}$

ITEM 516 – JACKING AND TEMPORARY SUPPORT OF SUPERSTRUCTURE, AS PER PLAN

LUMP SUM

ITEM 519 – COMPOSITE FIBER WRAP SYSTEM

*Per PN 519 – on pier caps as required.

COMPOSITE FIBER WRAP SYSTEM: CARBON (CFRP)

Length of pier cap; $L_{PC} = 172.75$

Height (avg) of pier cap (ft); $h_{PC1} = 3.9$

$h_{PC2} = 3.8$

Width of pier cap (ft); $W_{PC} = 3$

Column area (SF); $C_A = 7.1$

NOTE: Discount faces where caps have only ~4" clearance between.

Area P1 of Carbon fiber wrap (SF); $A_{CF1} = 2\times (h_{PC1} \times L_{PC}) + 2\times (W_{PC} \times L_{PC}) + 4\times (W_{PC} \times h_{PC1})$ = **2430.750**

Area P2, P3, P4 of Carbon fiber wrap (SF); $A_{CF2} = 2\times (h_{PC2} \times L_{PC}) + 2\times (W_{PC} \times L_{PC}) + 4\times (W_{PC} \times h_{PC2})$ = **2395.000**

Total area of composite carbon fiber wrap (SF); $A_{CARBON} = 2431 - 18\times 7.1 + 3\times(2395 - (18\times 7.1))$ = **9104.800**

TOTAL AREA OF COMPOSITE CARBON FIBER WRAP (SF); $T_{519\_CARBON} = ceiling(A_{CARBON}, 1) = 9105.000$

COMPOSITE FIBER WRAP SYSTEM: E-GLASS (EGFRP)

*Per PN 519 – on columns as required.

P2-C4 and P4-C3 are only columns requiring additional salt-spray protection.

P2-C4 Height (avg) of pier (ft); $h_{P2C4} = 11.1$

P4-C3 Height (avg) of pier (ft); $h_{P4C3} = 11.4$

Column area (SF); C_A = **7.100**

Area P2-C4 of E-glass fiber wrap (SF); $A_{P2} = (h_{P2C4} \times C_A)$ = **78.810**

Area P4-C3 of E-glass fiber wrap (SF); $A_{P4} = (h_{P4C3} \times C_A)$ = **80.940**

Total area of composite E-glass fiber wrap (SF); $A_{GLASS} = 78.81 + 80.94$ = **159.750**

TOTAL AREA OF COMPOSITE E-GLASS FIBER WRAP (SF); $T_{519\_GLASS} = ceiling(A_{GLASS}, 1) = 160.000$

TOTAL AREA OF COMPOSITE FIBER WRAP (SF); $T_{519\_FIBER} = ceiling((T_{519\_CARBON} + T_{519\_GLASS}) , 1) = 9265.000$

ITEM 519 – PATCHING CONCRETE STRUCTURE, AS PER PLAN

Include railings, abutments, wingwalls, backwalls, piers, cheekwalls.

Per BDM C405.2.1 – add 25% to all quantities for final.

Area of railing repairs (SF); A_{rail} = 117 x 1.25 = 148

Area of abutment repairs (SF); A_{abut} = 38 + 43+32+72 = **185.000** x 1.25 = 232

Area of pier repairs (SF); A_{Piers} = 159 x 1.25 = 200

TOTAL CONCRETE PATCHING (SF); **P_{CONC} = ceiling(A_{rail} + A_{abut}+ A_{Piers}, 1) = 580.00**

ITEM 519 – PATCHING CONCRETE BRIDGE DECK – TYPE B

Per BDM C405.2.1 – add 25% to all quantities for final.

Area of deck repairs – field measured (ft); A_{deck} = 49 x 1.25 = 62

Length along exp joint (FT); W_{BW_REAR} = 174.38

W_{BW_FWD} = 174.93

$W = W_{BW\_REAR} + W_{BW\_FWD}$ = 350.0

Area of deck patch at joint (SF); A_{DECK_JNT} = (.25 × W) = **87.50** x 1.25 = 110

TOTAL PATCHING BRIDGE DECK (SY); **P_{BR} = ceiling(**($A_{deck} + A_{DECK\_JNT}$) / 9**, 1) = 20.00**

ITEM 530 – SPECIAL STRUCTURE, MISC.: BRIDGE CLEANING

LUMP SUM

UNDER LIGHTING QUANTITIES:

ITEM 625 – LUMINAIRE, UNDERPASS, SOLID STATE (LED)

Underpass lights that are malfunctioning or currently not working (per email correspondence with city of Euclid) – as required on all piers –

TOTAL NUMBER UNDERPASS LUMINAIRES (EA); **R_L = ceiling(2, 1) = 12.00**

ITEM 625 – REMOVAL OF LUMINAIRE AND REERECTION, AS PER PLAN

Item shall include all luminaires (below bridge adjacent to East 260th Street), conduit, adjacent junction boxes, supports, clamps and all appurtenances required to complete item.

P2: 2 FACES @ 7 EACH = 14
P3: 2 FACES @ 7 EACH = 14
P4: 1 FACE @ 7 EACH = 7

TOTAL NUMBER LUMINAIRES (EA); R_L **= ceiling(2, 1) = 35.00**

ITEM 631 – REMOVAL, MISC.: SIGNAL FLASHER ASSEMBLY

Shall include removal and replacement after completion of fiber wrap system.

Flasher assembly located as follows:
(1) NORTH END OF P3
(1) SOUTH END OF P3

TOTAL NUMBER FLASHER ASSEMBLY (EA); R_L **= ceiling(2, 1) = 2.00**