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

LUMP SUM

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ITEM 202 – APPROACH SLAB REMOVED

Existing Approach Slab Length (ft);

$$L_{EX_APP} = 20$$

Existing Approach Slab Width (ft);


$$W_{EX_APP} = 40$$

Existing Approach Slab Area (ft);

$$A_{EX_APP} = L_{EX_APP} \times W_{EX_APP} = 800.000$$

TOTAL APPROACH SLAB REMOVED (SY);

$$T_{ASR} = \text{ceiling}(2 \times A_{EX_APP} / 9, 1) = 178.000$$

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ITEM 202 – WEARING COURSE REMOVED

On both approach slabs and bridge area

Bridge Limits (ft);

$$L_{EX_BR} = 56.34$$

Existing approach slab length (ft);

$$L_{EX_APP} = \mathbf{20.000}$$

Existing bridge width (ft);

$$W_{EX_BR} = 40$$

Existing wearing course area (bridge) (SY);


$$A_{EX_BR} = \mathbf{ceiling((L_{EX_BR} \times W_{EX_BR})/9,1) = 251.000}$$

Existing wearing course area (approach) (SY);

$$A_{EX_APP} = \mathbf{ceiling(2 \times W_{EX_APP} \times L_{EX_APP})/9,1) = 178.000}$$

TOTAL WEARING COURSE REMOVED (SY);

$$T_{wcr} = \mathbf{ceiling(A_{EX_BR} + A_{EX_APP},1) = 429.000}$$


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ITEM 509 – EPOXY COATED STEEL REINFORCEMENT, AS PER PLAN

Deck Slab/ Diaphragm

Superstructure Reinforcing Steel (lb); $S_{509} = 11132$

TOTAL REINFORCING STEEL (LBS); $T_{509} = \text{ceiling}(S_{509}, 1) = 11132.000$


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ITEM 509 – UNCOATED STEEL REINFORCEMENT

Deck Slab/ Diaphragm

Abutment Reinforcing Steel (lb); $A_{509} = 195$

TOTAL REINFORCING STEEL (LBS); $T_{509} = \text{ceiling}(A_{509}, 1) = 195.000$

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ITEM 510 – DOWEL HOLES WITH NONSHRINK, NONMETALLIC GROUT

TOTAL DOWEL HOLES (EACH);

$$T_{510} = 2 \times 2 \times 13 = 52.000$$



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ITEM 511 – CLASS QC2 CONCRETE, SUPERSTRUCTURE, AS PER PLAN

Deck

Average deck thickness (ft);

$$T_{D_AVG} = 7.37/12 = \mathbf{0.614}$$

Bridge Limits (ft);

$$L_{BR} = 58.46$$

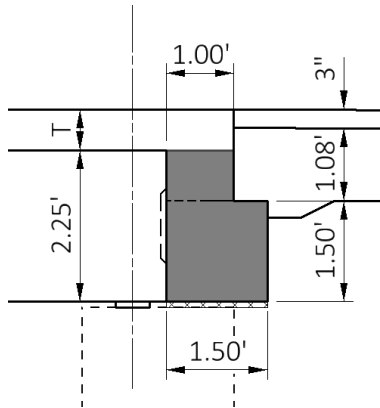
Bridge Width (ft);

$$W_{BR} = 40$$

Volume of deck concrete (ft³);

$$V_{deck} = T_{D_AVG} \times L_{BR} \times W_{BR} = \mathbf{1436.167}$$

Diaphragm (behind box beam)



Approach Slab Thickness (ft);

$$T_{APP} = 13/12 = \mathbf{1.083}$$

Pavement Thickness (ft);

$$T_{PAV} = 3/12 = \mathbf{0.250}$$

CB-27 Beam Depth (ft);

$$CB_{27} = 27/12 = \mathbf{2.250}$$

Deck thickness at abutment (ft);

$$T_{D_END} = 7.68/12 = \mathbf{0.640}$$

Skew (deg);

$$\text{skew} = 30$$

Dia. section cut area (ft²);

$$A_{dia} = 1 \times (T_{APP} + T_{PAV} - T_{D_END}) + (1.5 \times 1.5) = \mathbf{2.943}$$

Abutment Length (ft);


$$L_{abut} = W_{BR} / \cos(\text{skew}) = \mathbf{46.188}$$

Dia. volume (ft³);

$$V_{dia} = 2 \times A_{dia} \times L_{abut} = \mathbf{271.893}$$

TOTAL VOLUME OF SUPERSTRUCTURE (CU YD);

$$T_{super} = \text{ceiling}((V_{deck} + V_{dia})/27, 1) = \mathbf{64.000}$$

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ITEM 511 – CLASS QC1 CONCRETE, ABUTMENT

Wingwall Thickness (ft); $T_{WW} = 1.5$

Rear - RT, Forward – LT

Average Length at Level Height (ft.); $L_{L1} = (2.56 + 1.70) / 2 = \mathbf{2.130}$

Average Height at Level Height (ft.); $H_{L1} = (2.97 + 2.95) / 2 = \mathbf{2.960}$

Length of Sloped Height (ft.); $L_{S1} = 0.76$

Average Height at Sloped Height (ft.); $H_{S1} = 2.81$

Volume Wingwall 1 (cu. ft.); $V_{WW1} = T_{WW} \times [(L_{L1} \times H_{L1}) + (L_{S1} \times H_{S1})] = \mathbf{12.661}$

Rear - LT, Forward – RT

Average Length at Level Height (ft.); $L_{L2} = (1.08 + 1.95) / 2 = \mathbf{1.515}$


Average Height at Level Height (ft.); $H_{L2} = (2.98 + 2.96) / 2 = \mathbf{2.970}$

Average Length at Sloped Height (ft.); $L_{S2} = 0.76$

Average Height at Sloped Height (ft.); $H_{S2} = 2.81$

Volume Wingwall 2 (cu. ft.); $V_{WW2} = T_{WW} \times [(L_{L2} \times H_{L2}) + (L_{S2} \times H_{S2})] = \mathbf{9.953}$

TOTAL VOLUME OF SUBSTRUCTURE (CU YD); $T_{sub} = \text{ceiling}(2 \times (V_{WW1} + V_{WW2}) / 27, 1) = \mathbf{2.000}$

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ITEM 512 – SEALING OF CONCRETE SURFACES (EPOXY-URETHANE)

At Abutment

T/ RCP EL. at RA; $EL_{RCP_RA} = 814.49$

T/ RCP EL. at FA; $EL_{RCP_FA} = 814.59$

T/ abut. seat avg EL. at RA; $EL_{TS_RA} = 816.25$

T/ abut. seat avg EL. at FA; $EL_{TS_FA} = 816.35$

Sealing Height at RA (ft); $H_{S_RA} = (EL_{TS_RA} - EL_{RCP_RA}) = 1.760$

Sealing Height at FA (ft); $H_{S_FA} = (EL_{TS_RA} - EL_{RCP_FA}) = 1.660$

Sealing Area at Abutment (SY); $AS_{abut} = \text{ceiling}((L_{abut} \times (H_{S_RA} + H_{S_FA}))/9, 1) = 18.000$

At Wingwalls

T/ WW EL. at SE (ft); $EL_{WW_SE} = 818.86$

T/ WW EL. at SW (ft); $EL_{WW_SW} = 818.94$

T/ WW EL. at NW (ft); $EL_{WW_NW} = 818.96$

T/ WW EL. at NE (ft); $EL_{WW_NE} = 818.98$

WW to Groundline (back of wall) (ft); $H_{ground} = 0.5$

Wingwall Width (ft); $T_{WW} = 1.500$

WW Length at SE front (ft); $L_{WW_SE} = 8.65$

WW Length at SW front (ft); $L_{WW_SW} = 7.17$

WW Length at NW front (ft); $L_{WW_NW} = 8.65$

WW Length at NE front (ft); $L_{WW_NE} = 7.17$

WW Sealing at SE (ft²); $AWW_{SE} = L_{WW_SE} \times (H_{ground} + T_{WW} + (EL_{WW_SE} - EL_{TS_RA})) = 39.877$

WW Sealing at SW (ft²); $AWW_{SW} = L_{WW_SW} \times (H_{ground} + T_{WW} + (EL_{WW_SW} - EL_{TS_RA})) = 33.627$

WW Sealing at NW (ft²); $AWW_{NW} = L_{WW_NW} \times (H_{ground} + T_{WW} + (EL_{WW_NW} - EL_{TS_FA})) = 39.877$

WW Sealing at NE (ft²); $AWW_{NE} = L_{WW_NE} \times (H_{ground} + T_{WW} + (EL_{WW_NE} - EL_{TS_FA})) = 33.197$

Sealing Area at WW (SY); $AS_{WW} = \text{ceiling}((AWW_{SE} + AWW_{SW} + AWW_{NW} + AWW_{NE})/9, 1) = 17.000$

Superstructure

Length F/F Wingwalls (ft); $L_{FcWW} = 55$

Sealed width under beam (ft); $W_{SEAL} = 0.5$


CB-27 Beam Depth (ft); $CB_{27} = 2.250$

Average deck thickness (ft); $T_{D_AVG} = 0.614$

Superstructure Sealing Perimeter (ft); $PS_{super} = 2 \times (T_{D_AVG} + CB_{27} + W_{SEAL}) = 6.728$


Area Sealing at Superstructure (SY); $AS_{super} = \text{ceiling}((L_{FcWW} \times PS_{super})/9, 1) = 42.000$

TOTAL EU SEALING (SY); $T_{SEALING} = \text{ceiling}((AS_{abut} + AS_{WW} + AS_{super}), 1) = 77.000$

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ITEM 512 – CONCRETE REPAIR BY EPOXY INJECTION

CONTINGENCY INCLUDED: 10 FT

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ITEM 512 – TYPE 2 WATERPROOFING

At wingwall horizontal construction joint

Width of waterproofing (ft);	$W_{WP} = 3$
Proposed WW Length at SE back face (ft);	$L_{P_W_SE} = 2.46$
Proposed WW Length at SW back face (ft);	$L_{P_W_SW} = 2.71$
Proposed WW Length at NW back face (ft);	$L_{P_W_NW} = 2.46$
Proposed WW Length at NE back face (ft);	$L_{P_W_NE} = 2.71$

Total length of wingwalls (ft);	$L_{T_WW} = L_{P_W_SE} + L_{P_W_SW} + L_{P_W_NW} + L_{P_W_NE} = 10.340$
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Total Area of Type 2 Waterproofing (SY);	$A_{WP} = \text{ceiling}((L_{T_WW} \times W_{WP}) / 9, 1) = 4.000$
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ITEM 512 – REMOVAL OF EXISTING COATINGS FROM CONCRETE SURFACES

At Abutment

Sealing Removal Area at Abutment (SY); $AS_{rem_abut} = AS_{abut} = \mathbf{18.000}$

At Wingwalls


Avg. wingwall Sealing Height (ft); $HS_{rem} = 0.5 \times ((EL_{WW_SW} - EL_{TS_RA}) + (EL_{WW_NE} - EL_{TS_FA})) = \mathbf{2.660}$

Avg. length sealer to be removed per WW (ft); $LS_{WW} = HS_{rem} + H_{ground} + T_{WW} = \mathbf{4.660}$

Total length of wingwalls (ft); $LT_{WW} = L_{WW_SE} + L_{WW_SW} + L_{WW_NW} + L_{WW_NE} = \mathbf{31.640}$


Sealing Removal Area at WW (SY); $AS_{rem_ww} = (LT_{WW} \times LS_{WW}) / 9 = \mathbf{16.382}$

TOTAL SEALING REMOVAL (SY); $TS_{REM} = \text{ceiling}((AS_{rem_abut} + AS_{rem_ww}), 1) = \mathbf{35.000}$

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ITEM 515 – PRESTRESSED CONCRETE COMPOSITE BOX BEAM BRIDGE MEMBERS, LEVEL I, CB27-48 (BEAM LENGTH = 56'-1⁷/₈")

Total CB-27-48 Box Beam (EACH); N_{CB48} = 10

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ITEM 516 – 2" PREFORMED EXPANSION JOINT FILLER

Wingwall Thickness (ft);

$$T_{WW} = \mathbf{1.500}$$

PEJF Length (ft);

$$L_{PEJF} = T_{WW} / \cos(\text{skew}) = \mathbf{1.732}$$

T/ abut. seat avg EL. at RA;

$$EL_{TS_RA} = \mathbf{816.250}$$

T/ abut. seat avg EL. at FA;

$$EL_{TS_FA} = \mathbf{816.350}$$

T/ wingwall avg EL. at RA;

$$EL_{WW_RA} = 0.5 \times (EL_{WW_SE} + EL_{WW_SW}) = \mathbf{818.900}$$

T/ wingwall avg EL. at FA;

$$EL_{WW_FA} = 0.5 \times (EL_{WW_NE} + EL_{WW_NW}) = \mathbf{818.970}$$

PEJF Height RA (ft);

$$H_{PEJF_RA} = EL_{WW_RA} - EL_{TS_RA} = \mathbf{2.650}$$

PEJF Height FA (ft);


$$H_{PEJF_FA} = EL_{WW_FA} - EL_{TS_FA} = \mathbf{2.620}$$

PEJF Area (ft²);

$$A_{PEJF} = 2 \times (L_{PEJF} \times H_{PEJF_RA}) + 2 \times (L_{PEJF} \times H_{PEJF_FA}) = \mathbf{18.256}$$

TOTAL 2" PEJF (SF);

$$T_{PEJF} = \text{ceiling}(A_{PEJF}, 1) = \mathbf{19.000}$$


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ITEM 516 – INTEGRAL ABUTMENT EXPANSION JOINT SEAL

Abutment Length (ft); $L_{abut} = 46.188$

Neoprene overhang, each end (ft); $L_o = 1.5$

TOTAL LENGTH OF SEAL (FT); $L_{INT} = \text{ceiling}(2 \times (L_{abut} + (2 \times L_o)), 1) = 99.000$


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ITEM 516 – 1/8” PREFORMED BEARING PAD, TYPE CDP

Generally, half as many preformed bearing pads should be specified as the number of bearings. (BDM C306.4.2.1)

Total number of bearings; **$T_{BRG} = 40.000$**

TOTAL QUANTITY OF BRG PADS (EA); $T_{BRG_P} = T_{BRG} / 2 = 20.000$


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ITEM 516 – ELASTOMERIC BEARING WITH INTERNAL LAMINATES (NEOPRENE) (8"X 10"X 1")

Number of Beam Lines; $N_{BL} = N_{CB48} = \mathbf{10.000}$

Number of bearings per beam; $N_{BRG} = 2$

TOTAL NUMBER OF BEARINGS (EA); $T_{BRG} = 2 \times N_{BL} \times N_{BRG} = 40.000$


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ITEM 517 – RAILING (THREE STEEL TUBE BRIDGE RAILING)

Typical Rail Spacing (ft); $S_{RAIL} = 8$
 No. of Spaces from Post #10 to Post #10; $N_{SPA} = 8$

Railing Length East (ft); $L_{RAIL_E} = S_{RAIL} \times N_{SPA} = \mathbf{64.000}$
 Railing Length West (ft); $L_{RAIL_W} = S_{RAIL} \times N_{SPA} = \mathbf{64.000}$

TOTAL RAILING LENGTH (FT); $T_{517} = \mathbf{ceiling(L_{RAIL_E} + L_{RAIL_W}, 1) = 128.000}$

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ITEM 518 – POROUS BACKFILL WITH GEOTEXTILE FABRIC


At abutment

Porous Backfill thickness (ft); $T_{PB} = 1.5$
 Porous Backfill height (ft); $H_{PB_abut} = 2$
 Abutment Length (ft); $L_{abut} = \mathbf{46.188}$
 Volume at abutment (ft³); $V_{PB_abut} = 2 \times T_{PB} \times H_{PB_abut} \times L_{abut} = \mathbf{277.128}$

At wingwalls


Porous Backfill height (ft); $H_{PB_WW} = 1.75$
 Total length of wingwalls (ft); $L_{T_WW} = \mathbf{10.320}$
 Volume at wingwalls (ft³); $V_{PB_WW} = 2 \times T_{PB} \times H_{PB_WW} \times L_{T_WW} = \mathbf{54.180}$

TOTAL VOL POROUS BACKFILL (CY); $T_{518} = \text{ceiling}((V_{PB_abut} + V_{PB_WW}) / 27, 1) = \mathbf{13.000}$

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ITEM SPECIAL – STEEL DRIP STRIP

Length F/F Wingwalls (ft);	$L_{FWW} = 55$
Number TST-2-21 posts per side;	$N_{PST} = 7$
Length of upper steel drip strip (ft);	$L_{USDS} = 2$
TOTAL LENGTH DRIP STRIP (ft);	$T_{DRIP} = 2 \times (L_{FWW} + (N_{PST} \times L_{USDS})) = 138.000$

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ITEM 519 – PATCHING CONCRETE STRUCTURE


CONTINGENCY INCLUDED: 30 SF

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ITEM 526 – REINFORCED CONCRETE APPROACH SLABS (T=13")

Length of approach slabs (ft); $L_{APP} = 20$
Width of approach slabs (ft); $W_{APP} = 40$

TOTAL APPROACH SLAB AREA (SQ YD); $A_{app} = \text{ceiling}(2 \times (L_{APP} \times W_{APP}) / 9, 1) = 178.000$

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ITEM 526 – TYPE B INSTALLATION


Area of reinforcement on joint

Type B Installation Length (ft); $L_{INT_B} = W_{APP} / \cos(\text{skew}) = \mathbf{46.188}$

Type B Reinforcement width (ft); $W_{INT_B} = 5$

Type B Reinforcement area (ft²); $A_{INT_B} = L_{INT_B} \times W_{INT_B} = \mathbf{230.940}$

TOTAL TYPE B LENGTH (SY); $A_{app} = \text{ceiling}(2 \times A_{INT_B}/9, 1) = \mathbf{52.000}$

 OSBORN ENGINEERING	Project				Job Ref.	
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	Calc. by	Date	Chk'd by	Date	App'd by	Date
	MJD	12-2025	PJW	12-2025		

ITEM 601 – ROCK CHANNEL PROTECTION TYPE B WITHOUT FILTER


RCP Area RA (TRU-534-22.36) (yd³); RCP_{RA_1} = 30

RCP Area FA (TRU-534-22.36) (yd³); RCP_{FA_1} = 25

RCP Area RA (TRU-534-26.04) (yd³); RCP_{RA_2} = 75

RCP Area FA (TRU-534-26.04) (yd³); RCP_{FA_2} = 20

TOTAL VOLUME OF RCP (CU YD); **T₆₀₁ = ceiling(RCP_{RA_1} + RCP_{FA_1} + RCP_{RA_2} + RCP_{FA_2}, 1) = 150.000**

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ITEM 625 – STRUCTURE GROUNDING SYSTEM

1 EACH