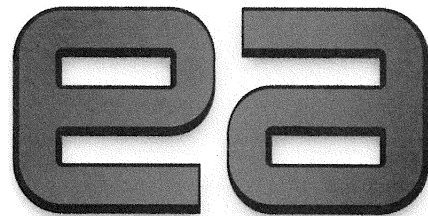


# **STRUCTURE ESTIMATED QUANTITY CALCULATIONS**

**BRIDGE NO. RIC-30-1219  
OVER ASHLAND RAILWAY**

**STRUCTURE FILE NO. 7001232**

**RIC-30-9.26**



**PREPARED BY  
ENGINEERING ASSOCIATES, INC.**

**SEPTEMBER 2019**

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**BRIDGE NO. RIC-30-1219 OVER ASHLAND RAILWAY**

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PROJECT RIC-30-9.26 PROJ. NO. 17-074 PG. 1 OF 32  
COMP. BY HK DATE 6-19-19 CHKD. BY TC DATE 6-29-19  
SUBJECT RIC-30-1219 O/ASHLAND RAILWAY  
ESTIMATED QUANTITIES

SFN: 7001232

ITEM 202-11203: PORTIONS OF STRUCTURE REMOVED,  
OVER 20 FOOT SPAN, AS PER PLAN

LUMP

ITEM 202-22900: APPROACH SLAB REMOVED, SY

$$\text{REAR} \sim 0.5(37.5 + 35.33)2.0(25.0) = 1820.83 \text{ sq'}$$

$$\text{FWD} \sim 2.0(37.5)25.0 = 1875.00$$
$$\underline{3695.83 \text{ sq'}}$$

$$\text{TOTAL} = 3695.83 \div 9 = 410.65 \text{ SY}$$

411 SY

ITEM 202-23500: WEARING COURSE REMOVED, SY

$$\text{REAR} \sim 0.5(37.5 + 35.33)2.0(25.0) = 1820.83 \text{ sq'}$$

$$\text{FWD} \sim 2.0(37.5)25.0 = 1875.00$$
$$\underline{3695.83 \text{ sq'}}$$

$$\text{TOTAL} = 3695.83 \div 9 = 410.65 \text{ SY}$$

USE 411 SY

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PROJECT RIC-30-9.26 PROJ. NO. 17-074 PG. 2 OF 32  
 COMP. BY HK DATE 6-19-19 CHKD. BY TC DATE 6-29-19  
 SUBJECT RIC-30-1219 0/ ASHLAND RAILWAY  
ESTIMATED QUANTITIES

SFN: 7001232

ITEM SPECIAL-20365000: SETTLEMENT PLATFORM,  
EACH

4.0 EACH

ITEM 503-11101: COFFERDAMS AND EXCAVATION BRACING,  
AS PER PLAN, LUMP SUM

LUMP

ITEM 503-21100: UNCLASSIFIED EXCAVATION, CY

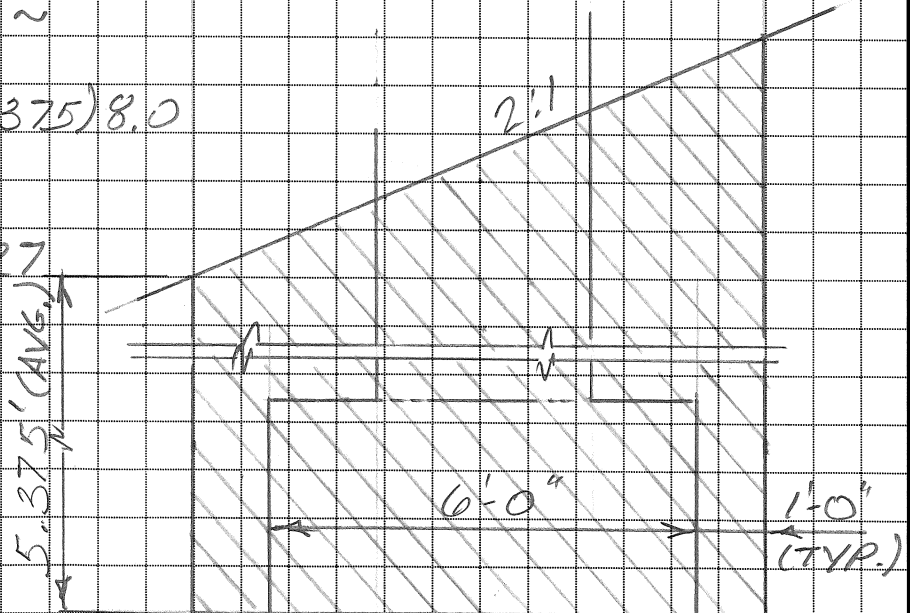
REAR ABUTMENT ~

$$\text{AREA} = 0.5(5.375 + 9.375) 8.0$$

$$= 59.0 \text{ ft}^2$$

$$\text{VOL} = 59.0(153.0) \div 27$$

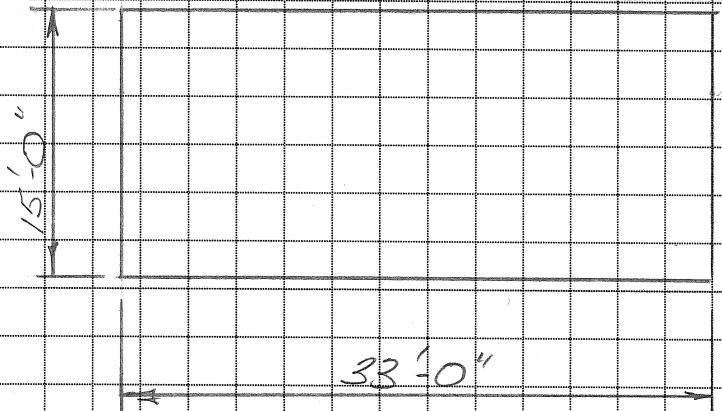
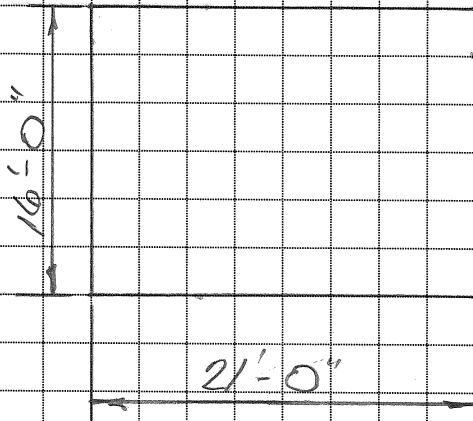
$$= 334.33 \text{ CY}$$



SFN: 7001232

ITEM 503-21100: UNCLASSIFIED EXCAVATION, CONT.  
 CY

PIER FOOTINGS: ~



$$\text{PIER N}^{\circ} 1: 8.5(3.0)(18.0)(23.0) + 8.5(17.0)(35.0) = 15,614.5 \text{ FT}^3$$

$$\text{PIER N}^{\circ} 2: 8.5(3.0)(18.0)(23.0) + 8.5(17.0)(35.0) = 15,614.50 \text{ FT}^3$$

$$31,229.00 \text{ FT}^3$$

$$\text{TOTAL} = 31,229 \div 27 = 1,156.63 \text{ CY}$$

FORWARD ABUTMENT ~

$$\text{AREA}_1 = 0.5(5.45 + 9.45)8.0 = 59.6 \text{ ft}^2$$

$$\text{VOLUME}_1 = 59.6(112.06) = 6678.92 \text{ FT}^3$$

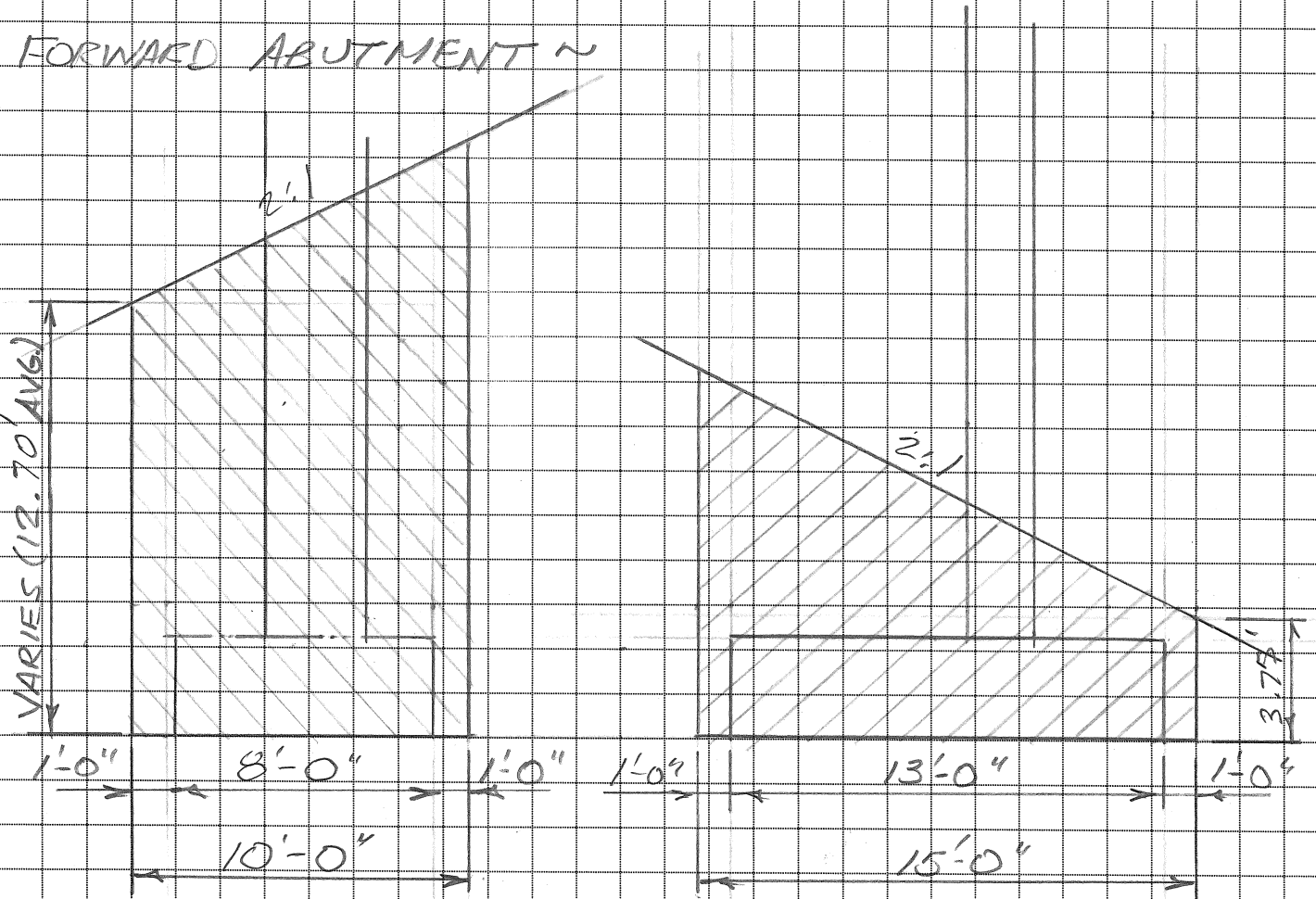
$$\text{AREA}_2 = 0.5(12.7 + 17.7)10.0 = 152.0 \text{ ft}^2$$

$$\text{VOLUME}_2 = 152.0(20.5) - 10.0((2.50)^2) + 0.5(3.0)^2 + 2.5(15.5) + 2.5(10.0) + (3.0)(4.0) = 2251.0 \text{ FT}^3$$

SFN: 7001232

ITEM 503 - 21100: UNCLASSIFIED EXCAVATION, CONT.  
 CY

FORWARD ABUTMENT ~



$$AREA_3 = 0.5(3.75 + 11.25)15.0 = 112.5 \text{ ft}^2$$

$$VOLUME_3 = 112.5(34.88) = 3924.6 \text{ FT}^3$$

$$TOTAL = (6678.92 + 2251.0 + 3924.16) \div 27 = 476.08 \text{ CY}$$

$$TOTAL \Rightarrow \text{ABUTMENT} = 334.33 + 476.08 = 810.4 \text{ CY}$$

$$TOTAL \Rightarrow \text{PIER} = \frac{1156.63 \text{ CY}}{1967.04 \text{ CY}}$$

USE 1967 CY

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PROJECT RIC-30-9.26 PROJ. NO. 17-074 PG. 5 OF 32  
 COMP. BY HK DATE 6-19-19 CHKD. BY TC DATE 6-29-19  
 SUBJECT RIC-30-1219 O/ASHLAND RAILWAY  
ESTIMATED QUANTITIES

SFN: 7001232

<u>ITEM 505-11100: PILE DRIVING EQUIPMENT MOBILIZATION, LUMP SUM</u>	
	<u>LUMP</u>
<u>ITEM 506-11100: STATIC LOAD TEST, LUMP SUM</u>	
	<u>LUMP</u>
<u>ITEM 507-00500: 12" CAST-IN-PLACE REINFORCED CONCRETE PILES, DRIVEN, FT</u>	
REAR ABUT. ~ 31 @ 60.0' = 1860.0 FT	
FWD ABUT. ~ 42 @ 60.0' = 2520.0 FT	
	<u>4380.0 FT</u>
<u>ITEM 507-00550: 12" CAST-IN-PLACE REINFORCED CONCRETE PILES, FURNISHED, FT</u>	
REAR ABUT. ~ 31(60.0 + 5.0) = 2015.0 FT	
FWD ABUT. ~ 42(60.0 + 5.0) = 2730.0 FT	
	<u>4745.0 FT</u>



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PROJECT RIC-30-9.26 PROJ. NO. 17-074 PG. 6 OF 32  
COMP. BY HK DATE 6-19-19 CHKD. BY TC DATE 6-29-19  
SUBJECT RIC-30-1219 OF ASHLAND RAILWAY  
ESTIMATED QUANTITIES

SFN: 7001232

ITEM 507-00700: 16" CAST-IN-PLACE REINFORCED  
CONCRETE PILES, DRIVEN, FT

$$\text{PIER N}^{\circ} 1 \sim 66 @ 70.0' = 4620.0 \text{ FT}$$

$$\text{PIER N}^{\circ} 2 \sim 66 @ 75.0' = 4950.0 \text{ FT}$$

$$\underline{9570.0 \text{ FT}}$$

9570.0 FT

ITEM 507-00750: 16" CAST-IN-PLACE REINFORCED  
CONCRETE PILES, FURNISHED, FT

$$\text{PIER N}^{\circ} 1 \sim 66 (70.0 + 5.0) = 4950.0 \text{ FT}$$

$$\text{PIER N}^{\circ} 2 \sim 66 (75.0 + 5.0) = 5280.0 \text{ FT}$$

$$\underline{10,230.0 \text{ FT}}$$

10,230.0 FT

SFN: 7001232

ITEM 509-10000: EPOXY COATED REINFORCING STEEL  
LB

ABUTMENTS ~ 42,869 LB

PIERS ~ 136,266 LB

SUPERSTRUCTURE ~ 232,058 LB

TOTAL ~ 411,193 LB

ITEM 511-21523: CLASS QC2 CONCRETE WITH QC/QA,  
SUPERSTRUCTURE, AS PER PLAN, CY

ABUTMENT DIAPHRAGM:

AREA = 59.0 (36.0) ÷ 144 = 14.75 sq'

APPROACH SLAB SEAT = 6.0 (15.0) ÷ 144 = 0.625

EB (RIGHT) ~ 2.0 (14.75) 72.406 - 2.0 (0.625) 70.501  
 = 2047.851 FT<sup>3</sup>

WB (LEFT) ~ 2.0 (14.75) 58.253 - 2.0 (0.625) 56.346  
 = 1648.002 FT<sup>3</sup>

HAUNCH:

EB (RIGHT) ~ W40X167:  $b_f = 11\frac{3}{4} \times 1$ ,  $d = 38\frac{5}{8}$  (2 $\frac{9}{16}$ )  
 W40X235:  $b_f = 11\frac{7}{8} \times 1\frac{3}{16}$ ,  $d = 39\frac{3}{4}$  (2.0)  
 W40X211:  $b_f = 11\frac{3}{4} \times 1\frac{1}{16}$ ,  $d = 39\frac{3}{8}$  (2 $\frac{3}{16}$ )

167 ~ 2.5625 (11.75) ÷ 144 = 0.209 sq'

235 ~ 2.0 (11.875) ÷ 144 = 0.165 sq'

211 ~ 2.1875 (11.75) ÷ 144 = 0.178 sq'

SFN: 7001232

ITEM 511-21523: CLASS QC2 CONCRETE WITH QC/PA,  
 SUPERSTRUCTURE, AS PER PLAN, CY, CONT.

HAUNCH: EB (RIGHT)

$$7.0(2.0(41.200)(0.209) + 2.0(35.833)(0.165) + 54.667(0.178)) \\ = 271.440 \text{ FT}^3$$

$$\text{OVERHANG: } 208.734((0.1875)2.635 + 0.1875(2.427)) \\ = 198.115 \text{ FT}^3 \\ \underline{469.555 \text{ FT}^3}$$

WB (LEFT) ~ W40 x 167: bf = 11<sup>3</sup>/<sub>4</sub>" x 1" d = 38<sup>5</sup>/<sub>8</sub>" (2<sup>3</sup>/<sub>8</sub>"  
 W40 x 249: bf = 15<sup>3</sup>/<sub>4</sub>" x 1<sup>1</sup>/<sub>16</sub>" d = 39<sup>3</sup>/<sub>8</sub>" (2.0)  
 W40 x 199: bf = 15<sup>3</sup>/<sub>4</sub>" x 1<sup>1</sup>/<sub>16</sub>" d = 38<sup>5</sup>/<sub>8</sub>" (2<sup>3</sup>/<sub>8</sub>"

$$167 \sim 2.375(11.75) \div 144 = 0.194 \text{ ft}^3$$

$$249 \sim 2.0(15.75) \div 144 = 0.2188 \text{ ft}^3$$

$$199 \sim 2.375(15.75) \div 144 = 0.260 \text{ ft}^3$$

$$5.0(2.0(41.200)(0.194) + 2.0(35.833)(0.2188) + 54.667(0.260)) \\ = 229.40 \text{ FT}^3$$

OVERHANG: BARRIER

MEDIAN

$$167 \Rightarrow 30.125(2.375) \div 144 = 0.497 \text{ ft}^3 \quad 29.125(2.375) \div 144 = 0.480 \text{ ft}^3$$

$$249 \Rightarrow 28.125(2.0) \div 144 = 0.391 \text{ ft}^3 \quad 27.125(2.0) \div 144 = 0.377 \text{ ft}^3$$

$$199 \Rightarrow 28.125(2.375) \div 144 = 0.464 \text{ ft}^3 \quad 27.125(2.375) \div 144 = 0.447 \text{ ft}^3$$

$$2.0(41.200)(0.497 + 0.480) + 2.0(35.833)(0.391 + 0.377) \\ + 54.667(0.464 + 0.447) = 185.346 \text{ FT}^3 \\ \underline{414.746 \text{ FT}^3}$$

SFN: 7001232

ITEM 511-21523: CLASS QC2 CONCRETE WITH QC/QA,  
 SUPERSTRUCTURE, AS PER PLAN, CY, CONT.

DECK SLAB:

EB (RIGHT)  $\sim 0.75(66.417)208.734 = 10,397.615 \text{ FT}^3$

WB (LEFT)  $\sim 0.75(53.417)208.734 = 8362.458 \text{ FT}^3$

PARAPET:

EB (RIGHT)  $\sim 1.82(27.0) + 200.625(588.0 + 144) = 868.359 \text{ FT}^3$

WB (LEFT)  $\sim 2(1.82)27.0 + 186.625(588.0 + 144) = 860.332 \text{ FT}^3$

MEDIAN:

EB (RIGHT)  $\sim 0.5(12.32)214.177 = 1319.330 \text{ FT}^3$

WB (LEFT)  $\sim 0.5(12.32)214.177 = 1319.330 \text{ FT}^3$

	EASTBOUND	WESTBOUND
DIAPHRAGM	2047.851 FT <sup>3</sup>	1648.002 FT <sup>3</sup>
HAUNCH	418.555 FT <sup>3</sup>	414.746 FT <sup>3</sup>
DECK	10,397.615 FT <sup>3</sup>	8362.458 FT <sup>3</sup>
PARAPET	868.359 FT <sup>3</sup>	860.332 FT <sup>3</sup>
MEDIAN	1319.330 FT <sup>3</sup>	1319.330 FT <sup>3</sup>
TOTAL	15,102.71 FT <sup>3</sup>	12,604.868 FT <sup>3</sup>

$\text{Vol} = (15,102.71 + 12,604.868) \div 27 = 1026.21 \text{ CY} \quad 1026.0 \text{ CY}$

SFN: 7001232

ITEM 511-33500: SEMI-INTEGRAL DIAPHRAGM GUIDE  
 EACH

4.0 EACH

ITEM 511-41012: CLASS QCI CONCRETE WITH QC/QA,  
 PIER ABOVE FOOTINGS, CY

EB (RIGHT)

$$\text{CAP: } 8.0(22.50)3.0 - (5.75)4.0(3.0) = 471.0 \text{ FT}^3$$

$$8.0(41.67)3.0 - (10.333)4.0(3.0) = 864.0 \text{ FT}^3$$

$$\text{COLUMN AREA: } 3.0(11.0) = 33.0 \text{ FT}^2$$

$$3.0(20.5) = 61.5 \text{ FT}^2$$

$$\text{PIER \#1} = 471.0 + 3.0(15.0)0.28 + 3.0(7.5)0.29$$

$$+ 33.0(21.08) + 864.0 + 3.0(34.083)0.28$$

$$+ 3.0(25.083)0.29 + 3.0(16.083)0.29$$

$$+ 3.0(7.083)0.29 + 61.5(19.64) = 3328.23 \text{ FT}^3$$

$$\text{PIER \#2} = 471.0 + 3.0(15.0)0.29 + 3.0(7.5)0.29$$

$$+ 33.0(20.88) + 864.0 + 3.0(34.083)0.29$$

$$+ 3.0(25.083)0.29 + 3.0(16.083)0.29$$

$$+ 3.0(7.083)0.28 + 61.5(19.44) = 3310.59 \text{ FT}^3$$

WB (LEFT)

$$\text{CAP: } 8.0(24.333)3.0 - 6.167(4.0)3.0 = 510.0 \text{ FT}^3$$

$$\text{COLUMN AREA} = 3.0(12.0) = 36.0 \text{ FT}^2$$

$$\text{PIER \#1} = 2(510.0) + 36.0(21.83 + 21.79) = 2590.32 \text{ FT}^3$$

SFN: 7001232

ITEM 511-41012: CLASS QCI CONCRETE WITH QC/QA,  
 PIER ABOVE FOOTINGS, CY

WB (LEFT)

$$\text{PIER N}^{\circ} 2 = 2(510.0) + 36.0(21.63 + 21.59) = 2575.92 \text{ FT}^3$$

	EASTBOUND	WESTBOUND
PIER N <sup>o</sup> 1	3328.23 FT <sup>3</sup>	2590.32 FT <sup>3</sup>
PIER N <sup>o</sup> 2	3310.59 FT <sup>3</sup>	2575.92 FT <sup>3</sup>
	<u>6638.82 FT<sup>3</sup></u>	<u>5166.24 FT<sup>3</sup></u>

$$\text{VOL} = (6638.82 + 5166.24) \div 27 = 437.22 \text{ CY}$$

**437.0 CY**

ITEM 511-4112: CLASS QCI CONCRETE WITH QC/QA,  
 ABUTMENT NOT INCLUDING FOOTINGS, CY

WB (LEFT): REAR

$$\begin{aligned} \text{STUB} &\sim 3.0(5.33)58.161 + 0.18(2.5)5.33 = 932.412 \text{ FT}^3 \\ \text{WING WALL} &\sim 2.5(9.818)10.6 - 0.5(6.917)3.85 = 226.839 \text{ FT}^3 \\ &\underline{1159.301 \text{ FT}^3} \end{aligned}$$

FB (RIGHT): REAR

$$\begin{aligned} \text{STUB} &\sim 3.0(4.21)72.316 + 0.18(2.5)4.21 = 915.261 \text{ FT}^3 \\ \text{WING WALL} &\sim 2.5(10.151)8.4 - 0.5(7.25)3.65 = 180.093 \text{ FT}^3 \\ &\underline{1095.354 \text{ FT}^3} \end{aligned}$$

WB (LEFT) FWD

$$\begin{aligned} \text{STUB} &\sim 3.0(5.39)58.161 + 0.18(2.5)5.39 = 942.908 \text{ FT}^3 \\ \text{WING WALL} &\sim 2.5(11.380)10.75 - 0.5(8.479)4.25 = 260.793 \text{ FT}^3 \\ &\underline{1203.701 \text{ FT}^3} \end{aligned}$$

SFN: 7001232

ITEM 511-44112: CLASS QCI CONCRETE WITH QC/QA,  
 ABUTMENT NOT INCLUDING FOOTING, CY

EB (RIGHT) FWD

$$\begin{aligned} \text{STUB} &\sim 3.0(4.565)50.555 = 692.351 \text{ FT}^3 \\ \text{STEM} &\sim 2.0(3.0)3.84 + 3.0(2.307)19.771 + 0.5(1.0)^2(19.124) \\ &\quad + 2.0((3.0(3.5) + 5.5(5.5) + 8.0(10.771))) \\ &\quad + 0.5(1.0)^2(3.0) + 0.5(2.0)^2(11.02) + 1.25(0.25)21.771 \\ &= 453.617 \text{ FT}^3 \\ &\quad \underline{1145.968 \text{ FT}^3} \end{aligned}$$

WALL

$$\begin{aligned} \text{STEM} &\sim 1.5(16.71)30.615 + 0.25(13/25)30.615 \\ &\quad + 0.5(0.5625)9.0(26.115) + (0.5(0.25)^2 + 0.25(2.167)) \\ &\quad (16.71) + 0.875(0.75)14.96 = 862.906 \text{ FT}^3 \end{aligned}$$

	EASTBOUND	WESTBOUND
REAR	1095.354 FT <sup>3</sup>	1159.301 FT <sup>3</sup>
FWD	1145.968 FT <sup>3</sup>	1203.701 FT <sup>3</sup>
WALL	<u>862.906 FT<sup>3</sup></u>	<u>—</u>
	3104.228 FT <sup>3</sup>	2363.002 FT <sup>3</sup>

$$\text{VOL} = (3104.228 + 2363.002) \div 27 = 202.49 \text{ CY}$$

USE 203.0 CY

SFN: 7001232

ITEM 511-46512: CLASS PC1 CONCRETE WITH QC/QA FOOTING, CY

$$\text{PIER NO. 1: } 2(3.5)19.0(11.0) + 3.5(11.0)(19.0 + 27.0) \\ = 3234.0 \text{ FT}^3$$

$$\text{PIER NO. 2: } 2(3.5)19.0(11.0) + 3.5(11.0)(19.0 + 27.0) \\ = 3234.0 \text{ FT}^3$$

$$\text{TOTAL} = 2(3234.0) \div 27 = 239.56 \text{ CY}$$

240.0 CY

$$\text{REAR ABUT. : } 3.0(6.0)151.0 = 2718.0 \text{ FT}^3$$

$$\begin{aligned} \text{FWD ABUT. : } & 3.0(6.0)111.063 = 1999.134 \text{ FT}^3 \\ & 3.0(8.0)20.5 + 0.25(3.75)20.5 \\ & + 10.5(3.0)^2 + (2.5)^2 + 3.0(3.0) + 3.5(2.5) \\ & + 2.5(2.5)18.0 = 789.219 \text{ FT}^3 \\ & (33.948(14.0) - 0.5(1.0)^2 - 1.0(20.844) \\ & + 0.5(8.0)3.446 - 0.5(7.667)3.302)3.0 \\ & + 0.25(4.583)30.614 + 5.5(0.25)3.333 \\ & + 0.5(0.25)3.0(1.292) + 0.25(3.75)11.417 \\ & = 1416.008 \text{ FT}^3 \\ & \underline{4204.361 \text{ FT}^3} \end{aligned}$$

$$\text{VOL} = (2718 + 4204.361) \div 27 = 256.383 \text{ CY}$$

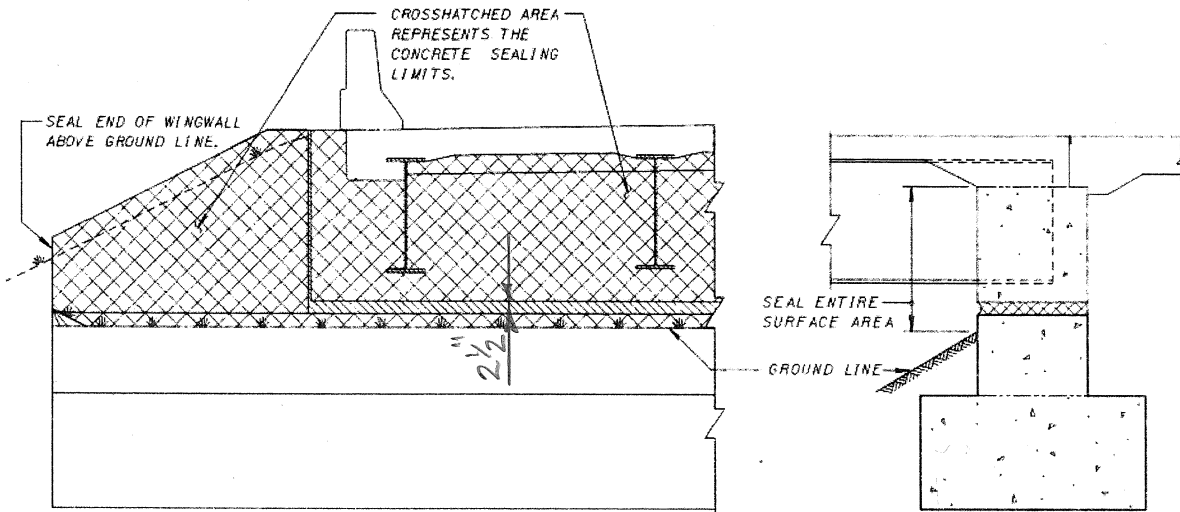
256.0 CY



SFN: 7001232

ITEM 512-10100: SEALING OF CONCRETE SURFACES  
(EPOXY-URETHANE), SY

ABUTMENT:



$$\text{REAR} \sim 4.947(58.161) - [0.75(58.161) + 5.0(10.194) + 0.497 + 0.48] \div 0.9184 = 241.982 \text{ sq'}$$

$$4.922(72.315) - [0.75(72.315) + 7.0(0.209) + 0.494 + 0.455] \div 0.9184 = 298.455 \text{ sq'}$$

$$1.08(58.161) + 5.6(9.281) - 0.5(6.917)3.85 + 2.5((2.364 + 3.438) \div 2 + ((6.917)^2 + (3.85)^2)^{1/2} + 0.5) + 0.5(3.438 + 7.916) = 135.442 \text{ sq'}$$

$$1.14(72.315) + 5.65(10.688) - 0.5(7.25)3.65 + 2.5((2.364 + 3.438) \div 2 + ((7.25)^2 + (3.65)^2)^{1/2} + 0.5) + 0.5(2.364 + 8.117) = 163.630 \text{ sq'}$$

$$\underline{\underline{839.509 \text{ sq'}}}$$

SFN: 7001232

ITEM 512-10100: SEALING OF CONCRETE SURFACES  
(EPOXY-URETHANE), SY - CONT.

$$\text{FORWARD} \sim 4.947(58.161) - [0.75(58.161) + (5.0(0.194) + 0.497 + 0.48) \div 0.9184] = 241.982 \square'$$

$$4.927(72.315) - [0.75(72.315) + (7.0(0.209) + 0.494 + 0.455) \div 0.9184] = 298.455 \square'$$

$$1.11(58.161) + 5.70(11.917) - 0.5(8.479) 4.25 + 2.5((2.364 + 3.438) \div 2 + ((8.479)^2 + (4.25)^2)^{1/2} + 0.5) + 0.5(2.364 + 9.484) = 152.606 \square'$$

$$1.12(72.315) + 0.5(7.43) 4.86 + 1.667(8.1) - 0.5(1.667) 0.833 + 1.5(5.08) = 156.626 \square'$$

$$\text{WING WALL} \sim 1.5(30.615) + 0.5(0.25)^2 + 0.25(2.167) + ((13.18 + 12.95) \div 2) 30.615 = 446.48 \square'$$

$$1296.149 \square'$$

$$\text{ABUT. AREA} = (839.509 + 1296.149) \div 9 = 237.295 \text{ SY}$$

PIER: (WB) LEFT

$$\text{CAP AREA} = 2.0(24.333(8.0) - 4.0(6.167) + 3.0(4.0) + 7.35(3.0)) = 408.092 \square'$$

$$\text{COLUMN CIRC.} = 2.0(12.0 + 3.0) = 30.0'$$

$$\text{PIER N}^\circ 1 \Rightarrow 2(408.092) + 30.0(18.84 + 18.8) = 1945.384 \square'$$

$$\text{PIER N}^\circ 2 \Rightarrow 2(408.092) + 30.0(19.89 + 19.85) = 2008.334 \square'$$

$$3953.768 \square'$$

SFN: 7001232

ITEM 512-10100 SEALING OF CONCRETE SURFACES  
 (EPOXY-URETHANE), SY - CONT.

PIER: (EB) RIGHT

$$\text{CAP AREA}_1 = 2.0(22.5(8.0) - 5.75(4.0) + 3.0(4.0) \\ + 7.004(3.0) + 15.0(0.29) + 7.5(0.29) \\ + 3.0(0.29 + 0.29)) = 394.814 \text{ sq'}$$

$$\text{CAP AREA}_2 = 2.0(41.167(8.0) - 10.333(4.0) + 3.0(4.0) \\ + 11.081(3.0) + 0.29(34.083) + 0.29(25.083) \\ + 0.29(16.083) + 0.28(7.083)) + 3.0(0.29(3) + 0.28) \\ = 717.555 \text{ sq'}$$

$$\text{COLUMN CIRC.}_1 = 2.0(11.0 + 3.0) = 28.0'$$

$$\text{COLUMN CIRC.}_2 = 2.0(20.5 + 3.0) = 47.0'$$

$$\text{PIER N}^\circ 1 \Rightarrow 394.814 + 717.555 + 28.0(18.12) + 47.0(16.68) \\ = 2403.689 \text{ sq'}$$

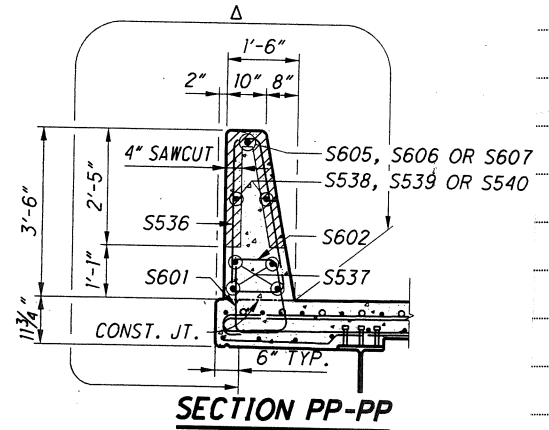
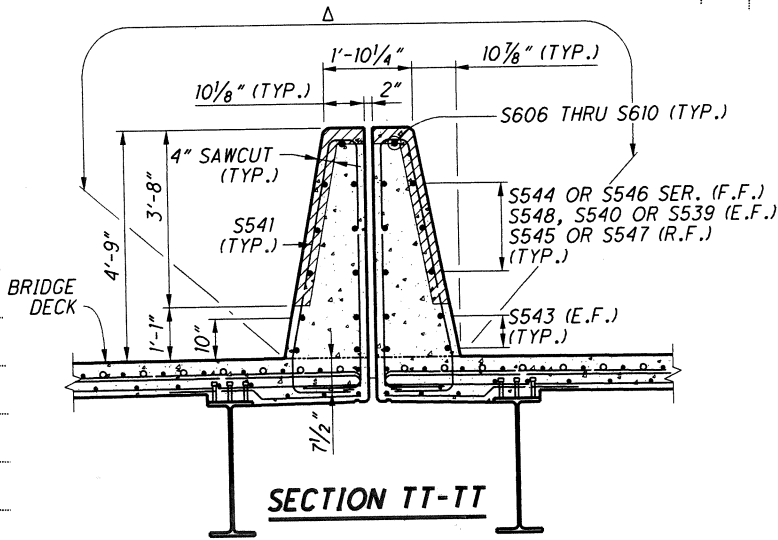
$$\text{PIER N}^\circ 2 \Rightarrow 394.814 + 717.555 + 28.0(19.17) + 47.0(17.73) \\ = 2482.439 \text{ sq'}$$

$$\underline{4896.128 \text{ sq'}}$$

$$\text{PIER AREA} = (3953.768 + 4896.128) \div 9 = 982.211 \text{ SY}$$

SFN: 7001232

ITEM 512 - 10100: SEALING OF CONCRETE SURFACES  
(EPOXY-URETHANE) SY



**LEGEND**

Δ - LIMITS FOR SEALING CONCRETE SURFACES (EPOXY-URETHANE) TYP.

SUPERSTRUCTURE:

①  $\sim L_1 = 42.755 + 10.0 + 42.0 + 2 = 96.755 \Rightarrow 8.063'$

②  $\sim L_2 = 11.75 + 6.0 = 17.75 \Rightarrow 1.479'$

③  $\sim L_3 = 58.028 + 10.125 = 68.153 \Rightarrow 5.679'$

(WB) LEFT  $\sim 1.479(208.734) + 8.063(214.625) + 5.679(214.177) = 3255.550 \square'$

APPROACH SLAB  $\sim 2(5.679)27.786 = 315.593 \square'$

SFN: 7001232

ITEM 512-10/00: SEALING OF CONCRETE SURFACES  
(EPOXY - URETHANE), SY - CONT.

SUPERSTRUCTURE:

$$(EB) \text{ RIGHT} \sim 1.479(208.734) + 8.063(214.625) \\ + 5.679(214.177) = 3255.560 \text{ sq'}$$

$$\text{APPROACH SLAB} \sim 2(5.679)27.786 = 315.593 \text{ sq'}$$
$$8.063(24.917 + 1.938) = 216.532 \text{ sq'}$$
$$\underline{532.125 \text{ sq'}}$$

$$\text{TOTAL AREA SUPER} = 2(3255.55) \div 9.0 = 723.456 \text{ SY}$$

$$\text{TOTAL AREA APPROACH SLAB} = (315.593 + 532.125) \div 9 = 94.191 \text{ SY}$$

$$\text{ABUTMENT} = 237.295 \text{ SY}$$

$$\text{PIER} = 982.211 \text{ SY}$$

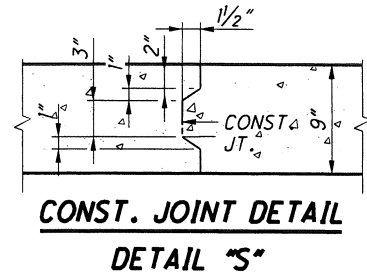
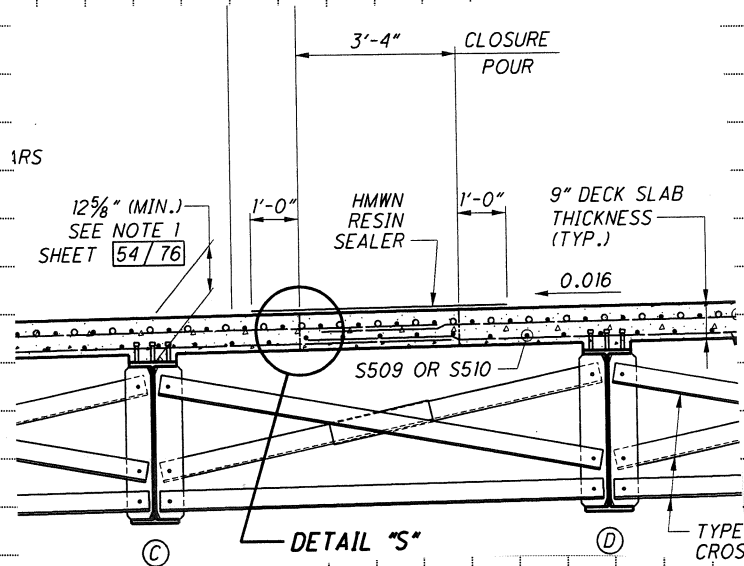
$$\text{SUPERSTRUCTURE} = 723.456 \text{ SY}$$

$$\text{GENERAL} = 94.191 \text{ SY}$$
$$\underline{2037.153 \text{ SY}}$$

2037.0 SY

SFN: 7001232

ITEM 512-10300: SEALING CONCRETE BRIDGE DECKS WITH  
 HMWM RESIN, SY



(WB) LEFT:  $2.0(5.333)214.177 \div 9 = 253.824$  SY

APPROACH SLAB:  $4.0(2.0)25.0 \div 9 = 22.222$  SY

(RB) RIGHT:  $1.0(5.333)214.177 \div 9 = 126.912$  SY

APPROACH SLAB:  $2.0(2.0)25.0 \div 9 = 11.111$  SY

TOTAL DECK =  $253.824 + 126.111 = 380.735$  SY

TOTAL APPR. SLAB =  $22.222 + 11.111 = 33.333$  SY  
 $414.069$  SY

414.059

SFN: 7001232

ITEM 512-33000: TYPE 2 WATERPROOFING, SY

(WB) LEFT:

REAR ABUT. A - 0

$$E - 4(3.0)(3.905 + 1.5) = 64.86 \square'$$

$$F - 2(3.0)(5.33 + 1.5) = 40.98 \square'$$

FWD ABUT. A - 0

$$E - 4(3.0)(3.905 + 1.5) = 64.86 \square'$$

$$F - 2(3.0)(5.39 + 1.5) = 41.34 \square'$$

(EB) RIGHT:

REAR ABUT. A - 1(3.0)8.43 = 25.29  $\square'$

$$E - 1(3.96 + 1.5)3.0 = 16.38 \square'$$

F - 0

FWD ABUT. A - 0

$$E - 2(3.0)(3.78 + 1.5) = 31.68 \square'$$

$$F - 3.0(2(1.5) + 4.71 + 6.84) = 43.65 \square'$$

WALL

$$A - 3.0(15.57) = 46.71 \square'$$

$$\underline{375.75 \square'}$$

$$\text{TOTAL AREA} = 375.75 \div 9 = 41.75 \text{ SY}$$

42.0 SY

SFN: 7001232

ITEM 513-10260: STRUCTURAL STEEL MEMBERS, LEVEL 3,  
 AISC CATEGORY Mbr., LB

MEMBERS: W40X167 W40X235 L5X5X1/2 ~ 16.2 LB  
 W40X199 W40X249  
 W40X211 L 3/8 X 7 X 4 ~ 13.6 LB

PLATE: 3/8 X 6" X 1'-6" ⇒ X-FRAME FILL PL ~ 11.475 LB  
 3/8 X 10 3/4" X 36 1/2" X-FRAME CONN. PL ~ 41.671 LB  
 3/8 X 6" X 36 1/2" X-FRAME CONN. PL ~ 23.269 LB

(WB) LEFT:

SPLICE N<sup>o</sup> 184 (2) 1/2 X 11 1/2 X 3'-1" 2(60.433) = 120.867 LB  
 54 BOLTS-WEB (4) 3/4 X 4" X 3'-1" 4(31.45) = 125.8 LB  
 40 BOLTS-FLANGE (4) 3/16 X 11 1/2 X 1'-6 1/2 4(11.3) = 45.20 LB  
 (2) 5/8 X 1'-10 1/2 X 2'-9" 2(131.45) = 262.9 LB  
554.767 LB

SPLICE N<sup>o</sup> 283 (2) 1/2 X 15 1/2 X 4'-3" 2(112.2) = 224.4 LB  
 72 BOLTS-WEB (4) 1/16 X 6" X 4'-3" 4(59.5) = 238.0 LB  
 56 BOLTS-FLANGE (4) 3/16 X 15 1/2 X 2'-1 1/2 4(21.0) = 84.0 LB  
 (2) 5/8 X 2'-5 1/4 X 2'-9" 2(170.869) = 341.74 LB  
888.14 LB

(EB) RIGHT:

SPLICE N<sup>o</sup> 184 (2) 1/2 X 11 1/2 X 3'-1" 2(60.433) = 120.867 LB  
 54 BOLTS-WEB (4) 3/4 X 4" X 3'-1" 4(31.45) = 125.8 LB  
 40 BOLTS-FLANGE (4) 1/4 X 11 1/2 X 1'-6 1/2 4(15.078) = 60.31 LB  
 (2) 5/8 X 1'-10 1/2 X 2'-9" (2) 131.45 = 262.9 LB  
 (2) 1/8 X 11 1/4 X 2'-9" (2) 13.131 = 26.263 LB  
596.14 LB



SFN: 7001232

ITEM 513-10260: STRUCTURAL STEEL MEMBERS, LEVEL 3,  
 AISC CATEGORY Mbr, LB, CONT.

(EB) RIGHT:

SPLICE N <sup>o</sup> 293	(2)	5/8" X 11 1/2" X 3'-8"	2(89.467)	= 178.933 LB
72 BOLTS-WEB	(4)	7/8" X 4" X 3'-8"	4(43.633)	= 174.533 LB
48 BOLT-FLANGE	(2)	5/8" X 2'-5 1/4" X 2'-9"	(2)(178.869)	= 341.74 LB
				<u>695.206 LB</u>

BOLTS: 1 1/8" DIA. GRIP = 1 1/2"

BOLT WEIGHT = 148 LB/100

ROUND WASHERS = 11.3 LB/100

$$\frac{159.3 \text{ LB}}{100} \Rightarrow 1.593/\text{BOLT}$$

(WB) LEFT:

$$\text{SPLICE N}^{\circ} 184 \Rightarrow 554.767 + 1.593(54 + 40) = 704.509 \text{ LB}$$

$$\text{SPLICE N}^{\circ} 293 \Rightarrow 888.14 + 1.593(72 + 56) = 1092.044 \text{ LB}$$

(EB) RIGHT:

$$\text{SPLICE N}^{\circ} 184 \Rightarrow 596.14 + 1.593(54 + 40) = 745.882 \text{ LB}$$

$$\text{SPLICE N}^{\circ} 293 \Rightarrow 695.206 + 1.593(72 + 48) = 886.366 \text{ LB}$$

(WB) LEFT:

$$\text{BEAM} \sim 6.0(2(167.0)43.375 + 2(249.0)35.933 + 54.467(199.0)) = 259,265.50 \text{ LB}$$

$$\text{SPLICES} \sim 6.0(2(704.509) + 2(1092.044)) = 21,558.636 \text{ LB}$$

SEN: 7001232

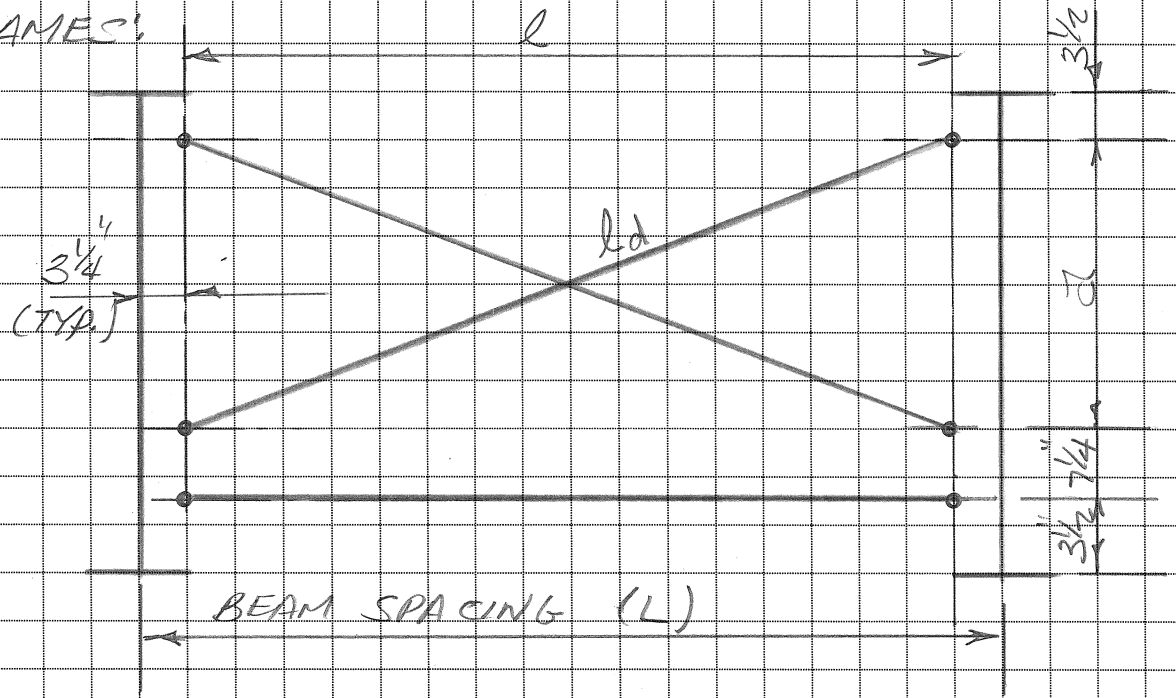
ITEM 513-10260: STRUCTURAL STEEL MEMBERS, LEVEL 3,  
 AISC CATEGORY Mbr, LB; CONT.

(EB) RIGHT:

$$\text{BEAM} \sim 8.0(2(167.0)43.375 + 2(235.0)35.833 + 54.467(211.0)) = 342,908.667 \text{ LB}$$

$$\text{SPICES} \sim 8.0(2(745.882) + 2(886.366)) = 26,115.968 \text{ LB}$$

CROSSFRAMES:



$$L = 9'-6''$$

$$l = 9.5(12) - 2(3.25) = 107.5''$$

$$d = 36.5 - 2(3.5) - 7.25 = 22.25''$$

$$ld = ((107.5)^2 + (22.25)^2)^{1/2} = 109.778''$$

$$\text{FILL PL} = 11.475 \text{ LB}$$

SFN: 7001232

ITEM 513-10260: STRUCTURAL STEEL MEMBERS,  
 LEVEL 3, AISC CATEGORY Mb, LB, CONT.

$$L 5 \times 5 \times \frac{1}{2}: 16.2(2(109.778) + 107.5) / 12 = 441.527 \text{ LB}$$

$$\text{CONN PL} \sim 2(23.269) = 46.538 \text{ LB}$$

$$\underline{499.54 \text{ LB} - \text{TYPE B}}$$

$$\text{CONN PL} \sim 2(41.671) = 83.342 \text{ LB}$$

$$\underline{536.344 \text{ LB} - \text{TYPE C}}$$

$$L = 8' - 7\frac{1}{2}"$$

$$d = 8.625(12) - 2(3.25) = 97.0"$$

$$a = 36.5 - 2(3.5) - 7.25 = 22.25"$$

$$L_d = ((97.0^2 + (22.25)^2)^{1/2} = 99.519"$$

$$\text{FILL PL} = 11.475 \text{ LB}$$

$$L 5 \times 5 \times \frac{1}{2}: 16.2(2(99.519) + 97.0) / 12 = 399.651 \text{ LB}$$

$$\text{CONN PL} = 46.538 \text{ LB}$$

$$\underline{457.664 \text{ LB}}$$

$$\text{(WB) LEFT BRIDGE BEAM} = 259,265.50 \text{ LB}$$

$$L 7 \times 4 \times \frac{3}{8} \times 2'-9 = 374 \text{ LB SPLICES} = 21,558.636 \text{ LB}$$

$$\text{CONN. PL} = 23.269 \text{ LB}$$

$$\text{diff} = 14.131 \text{ LB} \quad \text{X-FRAMES} = 499.54(3(18) + 19)$$

$$+ 536.344(18)$$

$$L 0 C = 8 \quad + 113,048 = 46,233.66 \text{ LB}$$

$$B(14.131) = 113,048 \text{ LB} \quad \underline{327,057.796 \text{ LB}}$$

**ENGINEERING ASSOCIATES, INC.**  
**CONSULTING ENGINEERS**  
1935 EAGLE PASS · WOOSTER, OH 44691  
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FAX: (330) 345-8077

PROJECT RIC-30-9.26 PROJ. NO. 17-074 PG. 25 OF 32  
COMP. BY HK DATE 6-25-19 CHKD BY TC DATE 6-29-19  
SUBJECT RIC-30-1219 OF ASHLAND RAILWAY  
ESTIMATED QUANTITIES

SFN: 7001232

ITEM 513-10260: STRUCTURAL STEEL MEMBERS, LEVEL 3,  
AISC CATEGORY Mbr, LB, CONT.

(EB) RIGHT BRIDGE BEAM = 342,908.667 LB

diff = 14.131 LB

SPLICE = 26,115.968 LB

LOC = 7

7(14.131) = 98.917 LB

X-FRAMES = 457,664 (6(18) + 19)

+ 98.917 = 58,222.245 LB

427,246.88 LB

TOTAL = 327,057.796 + 427,246.88 = 754,304.676 LB

754,305.0 LB

ITEM 513-20000

WELDED STUD SHEAR CONNECTORS, EACH

NUMBER = 3(2.0(59.0 + 47.0) + 69) = 843 EACH

= 3(2.0(59.0 + 47.0) + 68) = 840 EACH

(WB) LEFT: 6(843) = 5058 EACH

(EB) RIGHT: 8(840) = 6720 EACH

11,778 EACH

11,778 EACH

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PROJECT RIC-30-9.26 PROJ. NO. 17-074 PG. 26 OF 32  
COMP. BY HK DATE 6-26-19 CHKD. BY TC DATE 6-29-19  
SUBJECT RIC-30-1219 O/ASHLAND RAILWAY  
ESTIMATED QUANTITIES

SFN: 7001232

ITEM 514-10000: FINAL INSPECTION REPAIR, EACH

NUMBER:  $(8+6)(213,083) \div 150 = 19.889$  EACH

X-FRAMES =  $0.05(2(19) + 10(18)) = 10.9$  EACH  
30.789 EACH

$(17 + 14 = 31$  EACH)

USE 31 EACH

ITEM 514-30011: SHOP PAINTING AND FIELD TOUCH-UP OF STRUCTURAL STEEL, AS PER PLAN

754,305 LB

SFN: 7001232

ITEM 516-10010: ARMORLESS PREFORMED JOINT SEAL, FT

$$(WB) LEFT: 2(54.441 + 0.75) = 110.382'$$

$$(EB) RIGHT: \begin{array}{r} 68.596 + 0.75 = 69.346' \\ 68.596 + 1.0 = 69.596' \\ \hline 249.324' \end{array}$$

249.0 FT

ITEM 516-13600: 1" PREFORMED EXPANSION JOINT FILLER  
SF

$$AREA = 15.57(1.75) = 27.248 \square'$$

$$= 2(588 \div 144) + 1.5(0.75) = 19.292 \square'$$

$$= 2(13.41 + 0.862) = 28.543 \square'$$

$$\underline{75.083 \square'}$$

75.0 SF

ITEM 516-13900: 2" PREFORMED EXPANSION JOINT FILLER  
SF

$$AREA_R = 2.722(5.27 + 5.2) + 3.266(5.33 + 5.148 + 4.75) + 4(2) + 2(3)^2 = 122.362 \square'$$

$$AREA_F = 2.722(5.36 + 5.08) + 3.266(5.39 + 5.148 + 4.75) + 4(2) + 2(3)^2 = 122.476 \square'$$

$$\underline{244.838 \square'}$$

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PROJECT RIC-30-9.26 PROJ. NO. 17-074 PG. 28 OF 32  
 COMP. BY HK DATE 6-26-19 CHKD. BY TL DATE 6-29-19  
 SUBJECT RIC-30-1719 O/ASHLAND RAILWAY  
ESTIMATED QUANTITIES

SFN: 7001232

ITEM 516-13900: 2" PREFORMED EXPANSION JOINT FILLED SF

$$\text{AREA}_{\text{AS}} = 1.25(25.0) + 2(28.158)6.0 + 2(13.112 + 3.667(0.75))$$

$$= 400.871 \text{ sq'}$$

$$\text{TOTAL} = 244.838 + 400.871 = 645.709 \text{ sq'}$$

646.0 SF

ITEM 516-14020: SEMI-INTEGRAL ABUTMENT EXPANSION JOINT SEAL, FT

$$\text{REAR} \sim (120.0 \div 0.9184) + 2(1.5) + 5.27 + 5.2 - 2(1.25)$$

$$+ 2(1.5) + 5.33 = 149.958 \text{ FT}$$

$$\text{FWD} \sim (120.0 \div 0.9184) + 2(1.5) + 5.36 + 5.08 - 2(1.25)$$

$$+ 2(1.5) + 5.39 = 149.988 \text{ FT}$$

$$\underline{299.946}$$

USE

300.0 FT

ITEM 516-44101: ELASTOMERIC BEARING WITH INTERNAL LAMINATES AND LOAD PLATE (NEOPRENE), AS PER PLAN, 3 1/8" X 1'-4" X 1'-7" WITH 2 3/8" (AVG) X 1'-5" X 1'-8" BEVELED LOAD PLATE, EACH

28 EACH

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PROJECT RIC-30-9.26 PROJ. NO. 17-074 PG. 29 OF 32  
 COMP. BY HK DATE 6-26-19 CHKD. BY TC DATE 6-29-19  
 SUBJECT RIC-30-1219 O/ASHLAND RAILWAY  
ESTIMATED QUANTITIES

SFN: 7001232

ITEM 516-44101: ELASTOMERIC BEARING WITH INTERNAL LAMINATES AND LOAD PLATE (NEOPRENE), AS PER PLAN, 2 1/2" X 1'-0" X 1'-2" WITH 1 3/4" (AVG.) X 1'-1" X 1'-3" BEVELED LOAD PLATE, EACH

28.0 EACH

ITEM 518-21200: POROUS BACKFILL WITH GEOTEXTILE FABRIC, CY

$$\text{REAR} \sim 2.0(58.433(10.485) - 1.25(56.982) + 10.354(10.6) - 1.5(10.354) - 0.5(6.917)3.85) = 1244.697 \text{ FT}^3$$

$$2.0(72.588(9.33) - 1.25(71.136) + 9.615(8.4) - 1.5(9.615) - 0.5(7.25)3.65) = 1282.976 \text{ FT}^3$$

$$\underline{2527.573 \text{ FT}^3}$$

$$\text{END} \sim 2.0(58.433(10.545) - 1.25(56.982) + 10.833(10.75) - 1.5(10.833) - 0.5(8.469)4.25) = 1254.314 \text{ FT}^3$$

$$2.0(72.588(9.395) - 1.25(71.136) + 8.0(20.694) - 5.5(2.25 + 4.75)) = 1440.193 \text{ FT}^3$$

$$\text{WALL} \sim 2.0(16.96 - 1.25)27.348 = 859.274 \text{ FT}^3$$

$$\underline{3553.781 \text{ FT}^3}$$

$$\text{VOL} = (2527.573 + 3553.781) \div 27 = 225.235 \text{ CY}$$

225.0 CY



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PROJECT RIC-30-9.26 PROJ. NO. 17-074 PG. 30 OF 32  
COMP. BY HK DATE 6-26-19 CHKD. BY TL DATE 6-29-19  
SUBJECT RIC-30-1219 O/ASHLAND RAILWAY  
ESTIMATED QUANTITIES

SFN: 7001232

ITEM 518-40000: 6" PERFORATED CORRUGATED PLASTIC PIPE, FT

$$\text{REAR} \sim 68.722 + 81.277 = 149.999'$$

$$\begin{aligned} \text{FWD} \sim & 68.350 + 53.212 + 2(7.0) + 7.447 + 27.378 \\ & = 170.387 \\ & \underline{320.386 \text{ FT}} \end{aligned}$$

320.0 FT

ITEM 518-40010: 6" NON-PERFORATED CORRUGATED PLASTIC PIPE, INCLUDING SPECIALS, FT

$$\text{REAR} \sim 12.5 + 8.0 = 20.5'$$

$$\begin{aligned} \text{FWD} \sim & 2(2.178) + 13.5 + 4.5 + 1.833 = 24.189' \\ & \underline{44.689'} \end{aligned}$$

45.0 FT

ITEM 523-20000: DYNAMIC LOAD TESTING, EACH

ABUTMENTS  $\Rightarrow$  1 EACH

PIER  $\Rightarrow$   $\frac{2 \text{ EACH}}{3 \text{ EACH}}$

3.0 EACH

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PROJECT RIC-30-9.26 PROJ. NO. 17-074 PG. 31 OF 32  
COMP. BY HK DATE 6-27-19 CHKD. BY TC DATE 6-29-19  
SUBJECT RIC-30-1219 O/ASHLAND RAILWAY  
ESTIMATED QUANTITIES

SFN: 7001232

ITEM 523-20500: RESTRIKE, EACH

PIERS  $\Rightarrow$  2 EACH

2.0 EACH

ITEM 526-25001: REINFORCED CONCRETE APPROACH  
SLABS (T=15"), AS PER PLAN, SY

$$\text{REAR} \sim 25.0(117.667) \div 9 = 326.853 \text{ SY}$$

$$\text{FWD} \sim 25.0(118.833) \div 9 = 330.092 \text{ SY}$$
$$\underline{\hspace{10em}} \\ 656.945 \text{ SY}$$

657.0 SY

ITEM 526-90030: TYPE C INSTALLATION, FT

$$\text{(WB) LEFT: } 2(56.982) = 113.964'$$

$$\text{(RB) RIGHT: } 71.136 + 72.406 = 143.542'$$
$$\underline{\hspace{10em}} \\ 257.506'$$

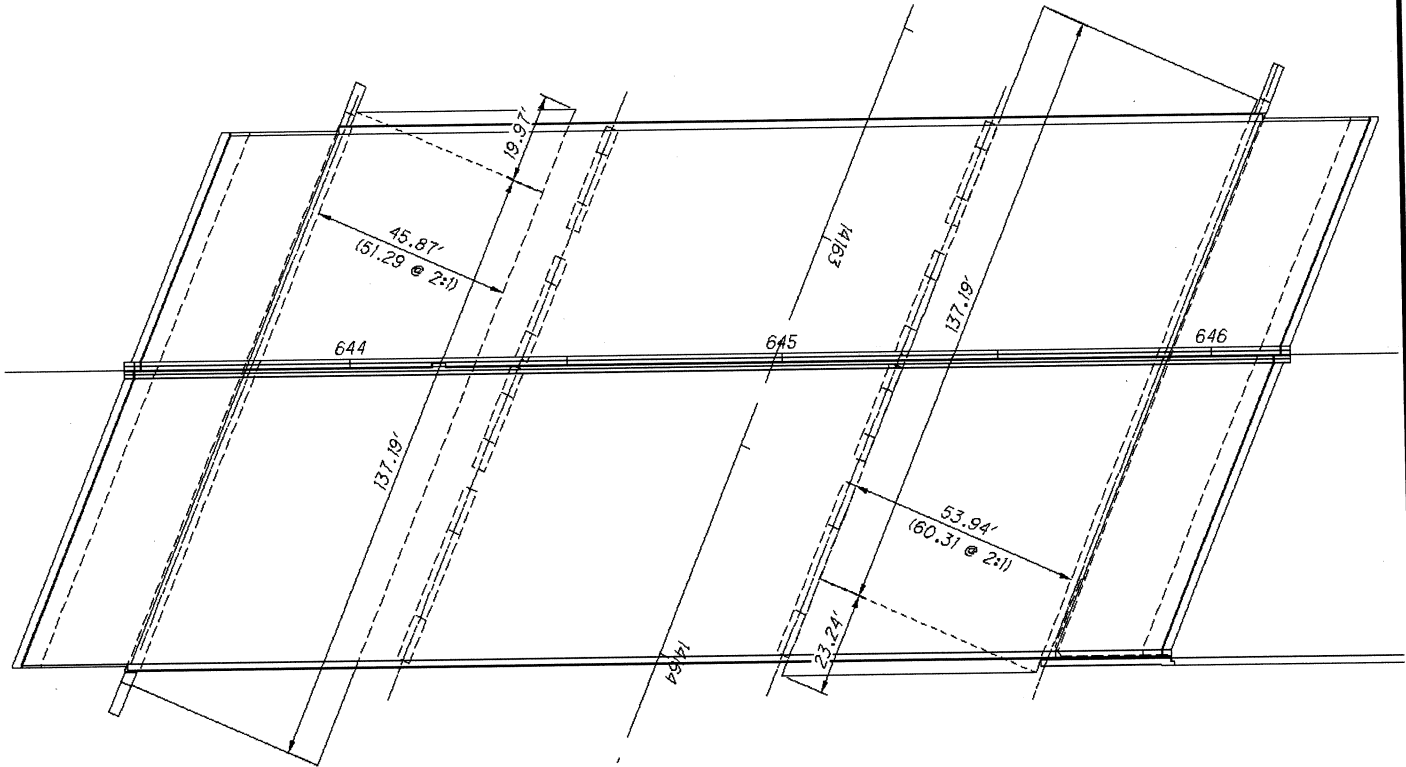
258.0 FT

**ENGINEERING ASSOCIATES, INC.  
CONSULTING ENGINEERS**

1935 EAGLE PASS - WOOSTER, OHIO 44691  
TELEPHONE: (330) 345-6556  
FAX: (330) 345-8077

PROJECT: RIC-30-9.26 PROJ. NO.: 15074 PG.: 32/32  
COMP. BY: TAC DATE: 9/22/19 CHKD. BY: AK DATE: 6/19  
SUBJECT: BRIDGE NO. RIC-30-1219 OVER ASHLAND RAILWAY  
ESTIMATED QUANTITIES SFN: 7001232

**ITEM 601 21010 CRUSHED AGGREGATE SLOPE PROTECTION (12")**



**REAR ABUTMENT**

$137.19 \times 51.29 \times 1.0 =$	7036.48
$(19.97 \times 51.29 \times 1.0) \times 1/2 =$	512.13
<hr/>	<hr/>
	7548.61

**FORWARD ABUTMENT**

$137.19 \times 60.31 \times 1.0 =$	8273.929
$(23.24 \times 60.31 \times 1.0) \times 1/2 =$	700.80
<hr/>	<hr/>
	8974.73

$7548.61 \times 1/27 = 279.58 \text{ CY}$

$8974.73 \times 1/27 = 332.40 \text{ CY}$

$279.58 + 332.40 = 611.98 \text{ CY}$

**612 CY**

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PROJECT RIC-30-9.26 PROJ. NO. 17-074 PG.      OF       
 COMP. BY HK DATE 6-27-19 CHKD. BY TC DATE 6-29-19  
 SUBJECT RIC-30-12/9 O/ASHLAND RAILWAY  
ESTIMATED QUANTITIES

ITEM 514-00800: FIELD PAINTING STRUCTURAL STEEL

$$W40 \times 167: P = (11.75 + 4(1) + 2(36.625) + 4(5.5625)) \div 12 = 9.2708'$$

$$W40 \times 199: P = (15.75 + 4(1.0625) + 2(36.5) + 4(7.5625)) \div 12 = 10.2708'$$

$$W40 \times 211: P = (11.75 + 4(1.4375) + 2(36.5) + 4(5.5)) \div 12 = 9.375'$$

$$W40 \times 235: P = (11.875 + 4(1.5625) + 2(36.625) + 4(5.53125)) \div 12 = 9.458'$$

$$W40 \times 249: P = (15.75 + 4(1.4375) + 2(36.5) + 4(7.5)) \div 12 = 10.375'$$

$$(WB) LEFT \sim 6(2(43.375)9.2708 + 2(35.833)10.375 + 54.667(10.2708)) = 12,655.503 \text{ sq'}$$

$$(EB) RIGHT \sim 8(2(43.375)9.2708 + 2(35.833)9.458 + 54.667(9.375)) = 15,956.496 \text{ sq'}$$

$$\underline{28,611.999 \text{ sq'}}$$

$$TOTAL = 1.20(28,611.999) = 34,334.4 \text{ sq'}$$

34,334.05F