RICHLAND ENGINEERING LIMITED
29 North Park Street, Mansfield, Ohio 44902
419/524-0074 • FAX 419/524-1812

FINAL QUANTITIES

CALCULATION SHEET

JOB NO. 113072 SHEET NO. 1 OF 10
SUBJECT H16-138-27.24 Quantities
CALCULATED BY RWC DATE 7/16/2015
CHECKED BY JLS DATE 4/21/15
REVISED BY _____ DATE _____

Item: 202-11203 - Portions of Structure Removed, > 20 foot A.P.P. [LUMP]

General: LUMP SUM

Item: 202-22900 - Approach Slab Removed [SY]

25 ft × 20 ft × 2 = 1000 ft²
1000 ft²/9 = 111.1 yd²

General: 112 SY

Item: 202-23500 - Wearing Course Removed [SY]

28 ft (F/F Curb) × 279 ft = 7812 ft² 7812 ft²/9 = 868 yd²

Bridge deck: 868 yd²
Approach: 112 yd²
980 yd²

General: 980 SY

Item: 503-11100 - Cofferdams and Excavation Bracing [LUMP]

General: LUMP SUM

CHANGES IN RED BY D09

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CALCULATION SHEET

JOB NO. 113072 SHEET NO. 2 OF 10
SUBJECT HIG-138 EST. QTY'S
CALCULATED BY JLS DATE 7/20/15
CHECKED BY KAK DATE 7/22/15
REVISED BY _____ DATE _____

ITEM 503-UNCLASSIFIED EXCAVATION

R.A. $(42.92' \times 7.75' \times 6.85' \text{ AVG.}) + (17.75' \times 4.5' \times 5.29' \text{ AVG.}) +$
$(37.67' \times 1.0' \times 8.17' \text{ AVG.}) + (37.67' \times 12.25' \times 8.17' \times 1/2) +$
$(37.67' \times 17.50' \times 1.0') = 5553.10 \text{ FT}^2$

F.A. $(42.92' \times 7.75' \times 6.75' \text{ AVG.}) + (17.75' \times 4.5' \times 5.19' \text{ AVG.}) +$
$(37.67' \times 1.0' \times 8.02' \text{ AVG.}) + (37.67' \times 12.02' \times 8.02' \text{ AVG.} \times 1/2) +$
$(37.67' \times 17.5' \times 1.0') = 5436.84 \text{ FT}^2$

TOTAL = $10,989.94 \div 27 = \underline{407.03 \text{ C.Y.}}$

ADD FOR LOW SLUMP MORTAR AREAS @ WINGWALLS

R.A. = $\left[(63.08 \text{ FT}^2 \times 1.0') + (12.25' \times 63.08 \text{ FT}^2 \times 1/2)\right] 2 = \underline{898.89 \text{ FT}^2}$

F.A. $\left[(61.63' \text{ FT}^2 \times 1.0') + (12.02' \times 61.63 \text{ FT}^2 \times 1/2)\right] 2 = \underline{864.05 \text{ FT}^2}$

GRAND TOTAL = $10,989.94 + 1762.94 =$
$12,752.88 \div 27 = 472.32 = \underline{473 \text{ C.Y.}}$

473 C.Y.

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CALCULATION SHEET

JOB NO. 113072 SHEET NO. 3 OF 10
SUBJECT H16-138-27.24 Quantities
CALCULATED BY RVC DATE 7/16/15
CHECKED BY JLB DATE 4/21/15
REVISED BY _____ DATE _____

Item: 509 - 10000 - Epoxy Coated Reinforcing Steel [LB]

Super : ~~103,406~~ 103,063 lb
Abt. : 11,662 lb
Pier : 6,447 lb
GENERAL: 1,894
~~121,515~~ 123,066 lb

Superstructure : ~~103,406 LB~~ 103,063
Abutment : 11,662 LB
Pier : 6,447 LB
GENERAL: 1,894
Total : ~~121,515 LB~~ 123,066

Item: 509 - 20001 - Reinforcing Steel, Replacment of Existing Reinforcment Steel, A.P.P. [LB]

Pier Caps: 50 lb / Pier Cap
= 100 lb

Pier : 100 LB

Item: 511 - 33500 - Semi-Integral Diaphragm Guide [EACH]

1 per abutment = 2

Superstructure: 2 EACH

Item 509 - No. 4 deformed GFRP reinforcement

SUPERSTRUCTURE: 8,656 LBS

TRANSITIONS: 1,494 LBS

TOTAL: 10,150 LBS

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CALCULATION SHEET

JOB NO. 113072 SHEET NO. 4 OF 10
SUBJECT H16-138-27.24 Quantities
CALCULATED BY RWC DATE 7/16/15
CHECKED BY JLS DATE 4/21/15
REVISED BY _____ DATE _____

Item: 511-34446 - Class QC2 Concrete W/ QC/QA, Bridge Deck [CY]

Slab: $[35.33 \times (\frac{8.75}{12}) \times 279] + [35.33 \times (\frac{15-8.75}{12}) \times 3.5] \times 2$
$+ [\frac{3.125}{12} \times \frac{18}{12} \times (279-7)] \times 3 + [\frac{9}{12} \times \frac{3.125}{12} \times (279-7)] \times 3$
$+ [\frac{2.938}{12} \times (3.66) \times (279-7)] \times 2 + [1 \times 7.15 \times \frac{6.25}{12}]$

Deck + @ Semi Integral + Haunch + Haunch taper + overlap haunch + Semi-IB haunch

$= 7188.12 + 128.82 + 318.75 + 159.38 + 488.28 + 3.72 = 8287.07\ ft^3$

Semi Integral Block: $4.00 \times [(852 - 845.51 - \frac{4.547}{12} - 1.25) \times 35.33 + \frac{.25 \times 32}{2}] \times 2 = 1405.94\ ft^3$

Embeded Plates: $-[[(2 + 60.25 \times 2 + 61.5) \times \frac{18}{12} \times \frac{.875}{12}] + [(2 \times 46.5) \times \frac{18}{12} \times \frac{1.125}{12}]] \times 4 = -132.8\ ft^3$

$9560.21\ ft^3$

$9560.21\ ft^3 / 27\ ft^3/yd^3 = 354.08$

use 354

Superstructure: **354 CY**

Item: 511-34450 - Class QC2 Concrete W/ QC/QA, Bridge Deck (Parapet) [CY]

$(.833 \times 3.5) + (\frac{.666 \times 3.5}{2}) = 4.083\ ft^2$

$4.083\ ft^2 \times (2 \times 279) = 2278.5\ ft^3$

$2278.5\ ft^3 / 27\ ft^3/yd^3 = 84.39\ yd^3$

~~85 CY~~

4.0833 sf x 11 ft x 4 transitions = 179.67 CF / 27 = 6.65 CY

From SCD SBR-1-20 = 1.82 CF x 4 transitions = 7.28 CY

6.65 CY + 7.28 CY = 13.93 CY use 14 CY

85 CY + 14 CY = 99 CY

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CALCULATION SHEET

JOB NO. 113072 SHEET NO. 5 OF 10
SUBJECT H16-138-27.24 Quantities
CALCULATED BY RWC DATE 7/16/15
CHECKED BY JLS DATE 4/21/15
REVISED BY _____ DATE _____

Item: 511-43212 - Class QC1 Concrete W/ QC/QA, Pier [CY]

Pier 1: (4.620 × 31) = 143.22
Pier 2: (4.563 × 31) = 141.45
284.67

284.67 + (3.5 × 14 × 2) + (8.5 × 3.5 × 2) × 3
= 1326.45

1326.45/27 = 49.1 yd³ ≈ 50 CY

50 CY

Item: 511-43512 - Class QC1 Concrete W/ QC/QA, Abutment Including Footing [CY]

Rear: Abutment: [845.51 − (838.71 + 3.0)] × 35.66 × 4.0 = 542.13 ft³

Wingwalls: [852.0 − (838.46 + 3.0)] × 11.5 × 2.5 − $\left(\frac{9 \times 4.5 \times 2.5}{2}\right)$ = 245.2
245.2 × 2 = 490.42 ft³

Footing: [40.917 × 5.75 × 3] = 705.81 ft³

Forward: Abutment: [845.36 − (838.71 + 3.0)] × 35.66 × 4.0 = 520.73 ft³

Wingwall: [851.85 − (838.46 + 3.0)] × 11.5 × 2.5 − $\left(\frac{9 \times 4.5 \times 2.5}{2}\right)$ = 228.23
228.23 × 2 = 456.45 ft³

Footing: [40.917 × 5.75 × 3] = 705.81 ft³

3421.37 ft³

3421.37 ft³ / 27 ft³/yd³ = 126.72 ≈ 127

127 CY

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CALCULATION SHEET

JOB NO. 113072 SHEET NO. 6 OF 10
SUBJECT H16-138-27.24 Estimated Quantities
CALCULATED BY RWC DATE 5/21/2015
CHECKED BY JLS DATE 4/21/15
REVISED BY _____ DATE _____

Item: 512 - Sealing of Concrete Surfaces (epoxy-urethane) (SY)

Super: $(2.916 + 11.5/12 + 2/12 + 3.5 + 10/12 + \sqrt{(.666)^2+(3.5)^2}) = 11.938$ ft

Parapet $(11.938 \times 279 \times 2) - (2.5 \times 10 \times 4) = 6651.36$ ft²

Semi-Integral $(852 - 845.51) - 1.25 + .25/2 = 3.79 = 4.99$

$(35.33 \times 4.99) \times 2 = 352.35$

$\Sigma = 6651.36 + 352.35 = 7003.7/9 = \boxed{779 \text{ SY}}$

Abutments: $[(845.51 - 845) + (845.36 - 844.9)] \times 35.33 = 34.27$

Vw $= (852 - 845.56) \times 11.5 - \left(\frac{9 \times 4.5}{2}\right) + 2.5^2 + \left[\sqrt{(9)^2+(4.5)^2} \times (2.5 + .5)\right] +$
$(6.44 - 4.5) \times 2.5 - \frac{2.5 \times 1.25}{2} = 90.31$

$\Sigma = 34.27 + 90.31 \times 4 = 395.51$ ft² $= 43.9$ SY

$\boxed{44 \text{ SY}}$

Piers: Caps PI: $(4.620 \times (31 \times 2 + 3 \times 2)) + (3.5 \times (14 + 8.5) \times 2$
$+ (\sqrt{8.5^2 + 3.5^2} \times 3) \times 2 + (12.333 \times .15 \times 2) + 9 - 1.5\pi^2 = 532.43$

$PI = PI - .0625 \times (68') = 528.18$

Columns: $(838.4 - 810.35) \times (22 + \pi 3) + \left[\frac{(\pi \times 3 + \pi \times 3.4)}{2} + 22\right] \times (810.35 - 804.4)$

$= 881.5 + 190.7 = 1072.2$ ft²/column $\Rightarrow$ 2144.4

$\Sigma = 539.14 + 534.81 + 2144.4 = 3218.48/9$

$= 357.6$

$\boxed{358 \text{ SY}}$

total = 1181

$\boxed{1181 \text{ SY}}$ ok

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CALCULATION SHEET

JOB NO. 113072 SHEET NO. 7 OF 10
SUBJECT H16-138
CALCULATED BY RWC DATE 4/21/2015
CHECKED BY dht DATE 4/21/15
REVISED BY _____ DATE _____

Item: 512-33000 - Type 2 Waterproofing [SY]

$$\left[35.33 \times 9.87\right] \times 2 + \left[(11.5 \times 10.54) - \left(\frac{9 \times 4.5}{2}\right) - \frac{\sqrt{9^2 + 4.5^2}}{2}\right] \times 4$$

$$= 662.15 + 383.72 = 1045.86 \text{ sf} = 116.2 \text{ yd}^3$$

1175 SY

Item: 513-10280 - Structural Steel Members, Lvl 4 [LB]

Girder web: $\frac{[52" \times .5625"]}{144} \times (61.25 + 46.25 + 61.5 + 46.25 + 61.25) = 56.164 \text{ ft}^3$

Flanges: $\left[\frac{18 \times .875}{144} \times (61.25 \times 2 + 61.5) + \frac{18" \times 1.125"}{144} \times (46.25 \times 2)\right] \times 2 = 66.27 \text{ ft}^3$

Bearing Stiffner: $[1 \times 7 \times 52 \times 8 / 1728 = 1.685 \text{ ft}^3$

Splice plates $\left[\frac{(7.5 \times .5625 \times 43)}{1728} \times 4 + \frac{(18 \times .6625 \times 43)}{1728} \times 2 + \frac{(46 \times 20 \times .4375)}{1728} \times 2\right] \times 4 = 5.56 \text{ ft}^3$

Bolts: $\left(\frac{116 \text{ lb}}{100}\right) \times (78 + 64) \times 4 = 659 \text{ lb/beam}$

Fillplate: $\frac{.25 \times 18 \times 21.5}{1728} \times 8 = .448 \text{ ft}^3$

130.12 ft^3

$130.12 \times 490 + 659 = 64,418 \times 4 = 257,674 \text{ lb}$

Diaphragms

1 Diafragm ⇒ Stiffners: $\left(\frac{52 \times 5 \times .375}{1728} \times 2\right) = .1806 \times 490 =$ 88.5 lb

Bottom ⇒ 5×5×½ ⇒ $\frac{(112 - .5625 - 6.5 + 3)}{12} \times 16.2 \text{ lb/ft}$ (9 ft.) = 145.8 lb

Crossframes ⇒ $\left[\frac{\sqrt{(107.93)^2 + (52 - 3.75 \times 2 - 4.5)^2}}{12} \times 12.8 \text{ lb/ft}\right] \times 2 =$ 304.6 lb (9.4 ft. x 16.2 lb/ft. x 2 diagonals)

Plates = $\left[\frac{5 \times .375 \times 12}{1728}\right] \times 490 =$ 12.12 lb (6 / 19)

Bolts $\left[\frac{37.4}{100} \times 6\right] \times$ = 2.24 lb

455.2 lb/Crossframe

553.3 lb/Crossframe

553.3 $\times (18 \times 3) =$ 29,862 lb

$\Sigma = 29,862 + 257,674.4 =$ 287,536.4 lb

Round to 287,600 lb

287,600 lb

287,300 LB

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CALCULATION SHEET

JOB NO. 113072 SHEET NO. 8 OF 10
SUBJECT H16-138-27.24 Quantities
CALCULATED BY RWC DATE 4/9/2015
CHECKED BY dht DATE 7/10/2015
REVISED BY _____ DATE _____

Item: 513-20000 - Welded Stud Shear Connectors [EACH]

$[(77+1)\times 3] + [(15+1)\times 2] + [(81+1)\times 3] + [(15+1)\times 2] + [(77+1)\times 3] = 778/\text{Beam}$

778 × 4 Beams = 3112 studs

Superstructure: 3112 EACH

Item: 514-00061 - Field Painting Structural Steel, Intermediate Coat A.P.P. [SF]

First ~~10 FT~~ 3.25 FT and last ~~10 FT~~ 3.25 FT of each girder

$(52\times 2)+(18\times 4)+(7/8\times 4)-(9/16\times 2) = 178.37/\text{ft} = 14.86$ ft P

14.86 ft P × ~~10 ft~~ 3.25 FT = ~~148.64 ft²~~ 45.28 SF

$\frac{(52\times 4\times 7)+(52\times 9/16)+(18\times 1.125\times 2)}{144} = 10.59$ ft²

~~159.24 ft²~~ 55.87 SF

55.87 SF
~~159.24 ft²~~ × 4 beams × 2 sides = ~~1273.9 ft²~~ 446.96 SF

Superstructure: ~~1274 SF~~ 447 SF

Item: 514-00067 - Field Painting Structural Steel, Finnish Coat A.P.P. [SF]

See Calculations for "Item 514-00061"

Superstructure: ~~1274 SF~~ 447 SF

Item: 516-13900 - 2" Preformed Expansion Joint Filler [SF]

Abutment: 6.01 ft × 2.5 ft × 4 wingwalls = 60.15 ft²

Abutment: 61 SF

Item: 516-14020 - Semi-Integral Abutment Expansion Joint Seal [FT]

$[35.67\text{ ft} + (1.5\text{ ft}\times 2)] + 2\times(852-845.53-.33+1.5)$

$= 53.95 \times 2\text{ abt.} = 107.9$

108 SF

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CALCULATION SHEET

JOB NO. 113072 SHEET NO. 9 OF 10
SUBJECT H16138-27.24 Quantities
CALCULATED BY RWC DATE 4/9/2015
CHECKED BY dht DATE 4/21/15
REVISED BY _____ DATE _____

Item: 516-31010 - 2" Deep Joint Sealer [FT]

32' per Approach = 64'

General: 64 FT

Item: 516-44301 - Elastomeric Bearing W/ Internal Laminates & Load Plates (Neoprene): (4.547"×15"×17.5" PAD, 1½"×13"×19" Plate, 1½"×16"×18½" Plate & HP10×42 Section), A.P.P. [EACH]

4 × Zabutments = 8

Superstructure: 8 EACH

Item: 516-44301 - Elastomeric Bearing W/ Internal Laminates & Load Plates (Neoprene) (4.687"×16.5"×21.25" PAD & 2"×17½"×22¼" Plate), APP [EACH]

4 × 2 Piers = 8

Superstructure: 8 EACH

Item: 518-21200 - Porous Backfill W/ ~~Filter Fabric~~ Geotextile Fabric [CY]

RA: $[852.13 - (838.71+3) - 1.25] \times 35.66 \times 2 = 653.77\ ft^3$

$5' \times [852.13 - (838.71+3) - 0.75] \times 2 = 96.65\ ft^3$

$[18' \times (852.13 - (838.71+3) - .75) - (4.5 \times 9)] \times 2 = 266.94\ ft^3$

FA: $[851.98 - (838.71+3) - 1.25] \times 35.66 \times 2 = 643.07\ ft^3$

$5' \times [851.98 - (838.71+3) - .75] \times 2 = 95.15\ ft^3$

$[18' \times (851.98 - (838.71+3) - .75) - (4.5 \times 9)] \times 2 = 261.54\ ft^3$

$2017.12\ ft^3$

$2017.12 / 27 = 74.71\ yd^3$

75 CY

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CALCULATION SHEET

JOB NO. 118072 SHEET NO. 10 OF 10
SUBJECT HIG-138-27.24 Quantities
CALCULATED BY RWC DATE 4/17/15
CHECKED BY dht DATE 4/21/15
REVISED BY _____ DATE _____

Item: 518-40000 - 6" Perforated Corrugated Plastic Pipe [FT]

Abt: 58.66 x 2 abutments = 117.33 ft

118 FT

Item: 518-40010 - 6" Non-Perforated Corrugated Plastic Pipe, Including Specials [FT]

RA: 7.75 x 2 = 15.5 ft
FA: 7.42 x 2 = 14.8 ft
30.3 ft

31 FT

Item: 519-11100 - Patching Concrete Structure [SF]

40 S.F.

NO SPALLING OR DELAMINATION EVIDENT AS February 2016.
USE The estimated projected AREA of 40 SF per the plans.

Item: 526-25011 - Reinforced Concrete Approach Slabs W/ QC/QA (T=15") ~~A.P.P~~ [SY]

25 x 35.33 = 883.3 ft² /approach slab
883.3 x 2 = 1766.6 ft²
1766.6/9 = 196.3

197 SY

Item: 611-99710 - Precast Reinforced Concrete Outlet [EACH]

2 per abutment = 4

4 EACH

ITEM 846 - POLYMER MODIFIED ASPHALT EXPANSION JOINT SYSTEM

32 FT x 1.667 FT x 0.25 FT x 2 Joints = 27 CF