



Project: RIC-30-16.42
 Subject: Final Tracings
 Task: Estimated Quantities
 Job #: 10441140

Computed: JTW/GDS Date: 11/19/25
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Estimated Quantities

User_Input

Yellow Highlight

Checks

Light-Blue Highlight

Results

Boxed

Objective: Determine estimated quantities in order to generate a cost estimate.

Assumptions: As stated throughout the calculation file.

Note: " := " Defines a variable
 " = " Recalls a variable

Item 202E11203 - Portions of Structure Removed, Over 20 ft Span, APP

Total Item Quantity:

$Q_{202_str} := \text{"LS"}$

Item 509E20001 - Concrete Reinforcement, Replacement of Existing Concrete Reinforcement, APP

Ex. Top Transverse Bar Weight (#6):

$wt_{ex_top_t} := 1.502 \text{ plf}$

Number of Ex. Top Transverse Bars:

$n_{ex_top_t} := 5$

(2.75' repair / 7"spa)

Ex. Bottom Transverse Bar Weight (#6):

$wt_{ex_bot_t} := 1.502 \text{ plf}$

Number of Ex. Bottom Transverse Bars:

$n_{ex_bot_t} := 4$

(2.75' repair / 9"spa)

Length of Bars to be Salvaged:

$L_{salv_t} := 1 \text{ ft} + 8 \text{ in}$

Ex. Top Longitudinal Bar Weight (#4):

$wt_{ex_top_l} := 0.668 \text{ plf}$

Number of Ex. Top Longitudinal Bars:

$n_{ex_top_l} := 3$

Ex. Bottom Longitudinal Bar Weight (#5):

$wt_{ex_bot_l} := 1.043 \text{ plf}$

Number of Ex. Bottom Longitudinal Bars:

$n_{ex_bot_l} := 1$

Length of Bars to be Salvaged:

$L_{salv_l} := 2 \text{ ft} + 9 \text{ in}$

Weight of Deck Resteel to be Salvaged:

$WT_{salv_deck} := (L_{salv_t} \cdot (n_{ex_top_t} \cdot wt_{ex_top_t} + n_{ex_bot_t} \cdot wt_{ex_bot_t})) \downarrow + (L_{salv_l} \cdot (n_{ex_top_l} \cdot wt_{ex_top_l} + n_{ex_bot_l} \cdot wt_{ex_bot_l})) \downarrow = 30.909 \text{ lbf}$

Ex. Top long. & Trans. Railing Bars Weight (#5):

$wt_{ex_top_r} := 1.043 \text{ plf}$

Number of Ex. Top Long. Bars:

$n_{ex_top_r} := 4$

Ex. Bottom Long. Railing Bar Weight (#4):

$wt_{ex_bot_r} := 0.668 \text{ plf}$

Number of Ex. Bottom Long. Bars:

$n_{ex_bot_r} := 5$

Number of Ex. Trans. Bars:

$n_{ex_r_t} := 14$

(20' repair / 1.5'spa)



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Item 509E20001 - Concrete Reinforcement, Replacement of Existing Concrete Reinforcement, APP (Continued)

Length of Long. Bars to be Salvaged: $L_{salv_r_l} := 20 \text{ ft} + 0 \text{ in}$

Length of Trans. Bars to be Salvaged: $L_{salv_r_t} := 12 \text{ ft} + 2 \text{ in}$ (Assume X501 thru X504 bar lengths)

Assumed % of Replacement Reinforcing: $per_{salv} := 10\%$

Weight of Railing Resteel to be Salvaged: $WT_{salv_rail} := (L_{salv_r_l} \cdot (n_{ex_top_r} \cdot wt_{ex_top_r} + n_{ex_bot_r} \cdot wt_{ex_bot_r})) + (L_{salv_r_t} \cdot n_{ex_r_t} \cdot wt_{ex_top_r}) \uparrow = 327.898 \text{ lbf}$

Weight of Replacement Reinforcing: $resteel_{rep} := \text{Ceil} (per_{salv} \cdot (WT_{salv_deck} + WT_{salv_rail}), 10 \text{ lbf}) = 40 \text{ lbf}$

Total Item Quantity: $Q_{509} := resteel_{rep} = 40 \text{ lbf}$

$$Q_{509} = 40 \text{ lbf}$$

Item 510E10001 - Dowel Holes with Nonshrink, Nonmetallic Grout, As Per Plan

Bridge Railing Reinforcing: $NO_{dowels} := 8 \cdot 4 = 32$

Total Item Quantity: $Q_{510_Dowels} := NO_{dowels}$

$$Q_{510_Dowels} = 32$$

Item 511E34445 - Class QC2 Concrete, Bridge Deck, As Per Plan

Proposed Deck Repair Width: $W_{deck} := 1 \text{ ft} + 8 \text{ in}$

Proposed Deck Repair Length: $L_{deck} := 2 \text{ ft} + 9 \text{ in}$

Proposed Deck Thickness: $t_{deck} := 9.1875 \text{ in}$

Note: no proposed haunch is provided above beams to match the existing beams.

Number of Repairs: $N_{deck_repairs} := 2$

Total Item Quantity: $Q_{511_deck} := \text{Ceil} (L_{deck} \cdot W_{deck} \cdot t_{deck} \cdot N_{deck_repairs}, 0.5 \text{ yd}^3) = 13.50 \text{ ft}^3$

$$Q_{511_deck} = 0.5 \text{ yd}^3$$



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Item 511E34448 - Class QC2 Concrete, Bridge Deck (Parapet)

Existing Railing Area: $A_{railing} := 465 \text{ in}^2 = 3.229 \text{ ft}^2$ (See Existing Plans)

Proposed Repair Length: $L_{railing} := 10 \text{ ft}$ (Per repair)

Number of Railing Repairs: $N_{railing_repairs} := 2$

Total Item Quantity: $Q_{511_rail} := \text{Ceil} (A_{railing} \cdot L_{railing} \cdot N_{railing_repairs}, 1 \text{ yd}^3) = 81.00 \text{ ft}^3$

$$Q_{511_rail} = 3 \text{ yd}^3$$

Item 512E10101 - Sealing of Concrete Surfaces (Epoxy-Urethane), As Per Plan

Determine area of concrete surface sealing along the bridge railings based on information detailed in the plans:

Railing Sealing Perimeter: $P_{rail} := 2 \text{ in} + \sqrt{(13 \text{ in})^2 + (9 \text{ in})^2} + \sqrt{(17 \text{ in})^2 + (3 \text{ in})^2} + 9 \text{ in} \downarrow = 6.673 \text{ ft}$
 $+ 32 \text{ in} + 2 \text{ in} + 2 \cdot \text{in}$

Proposed Deck Length: $L_{railing} = 10 \text{ ft}$

Number of Railing Repairs: $N_{railing_repairs} = 2$

Total Sealing Area of Bridge Railings: $A_{seal_rail} := N_{railing_repairs} \cdot L_{railing} \cdot P_{rail} = 133.46 \text{ ft}^2$

Additional Percentage Allowance: $per_{inc} := 5\%$ (To account for field deviation)

Total Item Quantity: $Q_{512_seal} := \text{Ceil} ((1 + per_{inc}) \cdot (A_{seal_rail}), 5 \text{ yd}^2) = 180.00 \text{ ft}^2$

$$Q_{512_seal} = 20 \text{ yd}^2$$

Item 512E10600 - Concrete Repair By Epoxy Injection

This is only limits of epoxy crack injection. Epoxy grout is included with Item 511:

Lengths of existing beams receiving injection: $L_{epoxy_inj.} := 19.25 \text{ ft} + 37.25 \text{ ft} + 89 \text{ ft} = 145.5 \text{ ft}$

Number of Sides with Epoxy Injection: $S_{epoxy_inj.} := 2$

Additional Percentage Allowance: $per_{inc} := 5\%$ (To account for field deviation)

Total Item Quantity: $Q_{512_epoxy_inj} := \text{Ceil} ((1 + per_{inc}) \cdot (L_{epoxy_inj.}) \cdot (S_{epoxy_inj.}), 1 \text{ ft}) = 306.00 \text{ ft}$

$$Q_{512_epoxy_inj} = 306 \text{ ft}$$



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Item 513E10261 - Structural Steel Members, Level 3, As Per Plan

Number of Proposed Beams:	$N_{beam} := 1$
Length of Proposed Beams:	$L_{beam} := 54 \text{ ft} = 54 \text{ ft}$
Unit Weight of Beams:	$uw_{beam} := 263 \text{ plf}$ (W33x263)
Total Beam Weight:	$WT_{beam} := N_{beam} \cdot L_{beam} \cdot uw_{beam} = 14202.00 \text{ lbf}$
Number of Intermediate Crossframes:	$N_{int_xframe} := 6$
Length of Crossframe Horizontal:	$L_{int_horiz} := 8 \text{ ft} + 6 \text{ in}$ (Conservative)
Length of Crossframe Diagonal:	$L_{int_diag} := \sqrt{(L_{int_horiz})^2 + (21 \text{ in})^2} = 8.678 \text{ ft}$ (Conservative)
Unit Weight of Crossframe Members:	$uw_{int_xframe} := 6.1 \text{ plf}$ (L3x3x5/16)
Weight of Connection Plate:	$wt_{conn_pl} := 490 \text{ pcf} \cdot 0.375 \text{ in} \cdot 6.5 \text{ in} \cdot 34 \text{ in} = 23.5 \text{ lbf}$ (Conservative)
Total Intermediate X-frame Weight:	$WT_{int_xframe} := N_{int_xframe} \cdot ((L_{int_horiz} + 2 \cdot L_{int_diag}) \cdot uw_{int_xframe} + 2 \cdot wt_{conn_pl}) = 1228.36 \text{ lbf}$
Number of Field Splices 2A:	$N_{splice_2A} := 1$ Field Splice 2A
Weight of Web Splice Plate:	$wt_{web_spl_2A} := 490 \text{ pcf} \cdot 0.5 \text{ in} \cdot 14.25 \text{ in} \cdot 26.5 \text{ in} = 53.541 \text{ lbf}$
Weight of Outer Flange Splice Plate:	$wt_{of_spl_2A} := 490 \text{ pcf} \cdot 0.625 \text{ in} \cdot 15.75 \text{ in} \cdot 26.25 \text{ in} = 73.273 \text{ lbf}$
Weight of Inner Flange Splice Plate:	$wt_{if_spl_2A} := 490 \text{ pcf} \cdot 1.0 \text{ in} \cdot 6.25 \text{ in} \cdot 26.25 \text{ in} = 46.522 \text{ lbf}$
Weight of Web Filler Plate:	$wt_{web_fill_2A} := 490 \text{ pcf} \cdot 0.125 \text{ in} \cdot 7.0 \text{ in} \cdot 26.5 \text{ in} = 6.575 \text{ lbf}$
Weight of Outer Flange Filler Plate:	$wt_{of_fill_2A} := 490 \text{ pcf} \cdot 0.6875 \text{ in} \cdot 15.75 \text{ in} \cdot 13.0 \text{ in} = 39.916 \text{ lbf}$
Weight of Inner Flange Filler Plate:	$wt_{if_fill_2A} := 490 \text{ pcf} \cdot 1.0 \text{ in} \cdot 6.25 \text{ in} \cdot 13.0 \text{ in} = 23.04 \text{ lbf}$
Total Field Splice 2A Weight:	$WT_{splice_2A} := N_{splice_2A} \cdot (2 \cdot wt_{web_spl_2A} + 2 \cdot wt_{of_spl_2A} + 4 \cdot wt_{if_spl_2A} + wt_{web_fill_2A} + 2 \cdot wt_{of_fill_2A} + 4 \cdot wt_{if_fill_2A}) = 618.28 \text{ lbf}$
Number of Field Splice 3:	$N_{splice_3} := 1$ Field Splice 3
Weight of Web Splice Plate:	$wt_{web_spl_3} := 490 \text{ pcf} \cdot 0.5 \text{ in} \cdot 14.0 \text{ in} \cdot 25.0 \text{ in} = 49.624 \text{ lbf}$
Weight of Outer Flange Splice Plate:	$wt_{of_spl_3} := 490 \text{ pcf} \cdot 0.5 \text{ in} \cdot 11 \text{ in} \cdot 29 \text{ in} = 45.229 \text{ lbf}$
Weight of Inner Flange Splice Plate:	$wt_{if_spl_3} := 490 \text{ pcf} \cdot 0.625 \text{ in} \cdot 4.0 \text{ in} \cdot 29 \text{ in} = 20.558 \text{ lbf}$
Weight of Web Filler Plate:	$wt_{web_fill_3} := 490 \text{ pcf} \cdot 0.125 \text{ in} \cdot 7.0 \text{ in} \cdot 25.0 \text{ in} = 6.203 \text{ lbf}$
Weight of Outer Flange Filler Plate:	$wt_{of_fill_3} := 490 \text{ pcf} \cdot 0.5 \text{ in} \cdot 11.0 \text{ in} \cdot 14.375 \text{ in} = 22.419 \text{ lbf}$
Weight of Inner Flange Filler Plate:	$wt_{if_fill_3} := 490 \text{ pcf} \cdot 1.3125 \text{ in} \cdot 4.0 \text{ in} \cdot 14.5 \text{ in} = 21.586 \text{ lbf}$



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Item 513E10261 - Structural Steel Members, Level 3, As Per Plan (Continued)

Total Field Splice 3 Weight: $WT_{splice_3} := N_{splice_3} \cdot \left(2 \cdot wt_{web_spl_3} + 2 \cdot wt_{of_spl_3} + 4 \cdot wt_{if_spl_3} \downarrow + 2 \cdot wt_{web_fill_3} + 2 \cdot wt_{of_fill_3} + 4 \cdot wt_{if_fill_3} \right) = 415.53 \text{ lbf}$

Additional Weight Allowance: $add_{per} := 10\%$ (To account for misc. items and web tear)

Total Item Quantity: $Q_{513_L3} := \text{Ceil} \left((1 + add_{per}) \cdot (WT_{beam} + WT_{int_xframe} + WT_{splice_2A} + WT_{splice_3}) \right), 100 \text{ lbf}$
 $Q_{513_L3} = 18200 \text{ lbf}$

Item 514E00050 - Surface Preparation of Existing Structural Steel

Crossframe connection plate repair

Depth of Existing Beam Webs: $d_{web} := 35.55 \text{ in} - 2 \cdot 0.794 \text{ in} = 33.962 \text{ in}$ (W36x135 for max web depth)

Flange Widths of Existing Beams: $b_{f_ex} := 16.471 \text{ in}$ (W36x230 for max flange width)

of Typical Paint Repair Locations: $N_{repair_1} := 6$ (at intermediate crossframe connection)

Length of Typical Paint Repair: $L_{repair_1} := 4 \text{ ft} + 0 \text{ in}$

Heat Straightening repair

Depth of Existing Beam: $d_{beam} := 35.88 \text{ in}$ (W36x230 for max beam depth)

Flange Widths of Existing Beams: $b_{f_ex} := 16.471 \text{ in}$ (W36x230 for max flange width)

of Typical Paint Repair Locations: $N_{repair_2} := 2$

Length of Paint Repair: $L_{repair_2} := 12 \text{ ft} + 6 \text{ in}$

Total Item Quantity: $Q_{514_prep} := \text{Ceil} \left(N_{repair_1} \cdot (d_{web} + b_{f_ex}) \cdot L_{repair_1} \downarrow + N_{repair_2} \cdot (2 \cdot d_{beam} + 3 \cdot b_{f_ex}) \cdot L_{repair_2} \right), 10 \text{ ft}^2 \right) = 360.00 \text{ ft}^2$
 $Q_{514_prep} = 360 \text{ ft}^2$

Item 514E00056 - Field Painting of Existing Structural Steel, Prime Coat

Additional SF Allowance: $add_{per} := 7\%$ (To account for misc. & field welded connection plates that may not be shop primed)

Total Item Quantity: $Q_{514_prime} := Q_{514_prep} \cdot (1 + add_{per}) = 385.20 \text{ ft}^2$

$Q_{514_prime} = 385 \text{ ft}^2$

(Plans allow for not priming behind the field splices but are left in calc to be conservative)



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Item 514E00060 - Field Painting Structural Steel, Intermediate Coat

Increase area by 10% to account for overspray etc.

(C&MS 514.23)

Number of Proposed Beams: $N_{beam} = 1$

Length of Proposed Beams: $L_{beam} = 54 \text{ ft}$

Total Depth of Proposed Beams: $d_{beam} := 34.5 \text{ in}$ (W33x263)

Flange Widths of Proposed Beams: $b_f := 15.8 \text{ in}$ (W33x263)

Total Beam Quantity: $Q_{514_beam} := (N_{beam} \cdot L_{beam} \cdot (2 \cdot d_{beam} + 3 \cdot b_f) + Q_{514_prime}) = 909.00 \text{ ft}^2$

Beam 1 Web Depth: $d_{web_1} := 31.375 \text{ in}$ (W33x263)

Beam 2 Web Depth: $d_{web_2} := 33.5 \text{ in}$ (36WF230)

Area of 1 side of connection plate A: $A_{plate_A} := 6.5 \text{ in} \cdot d_{web_1} - (2.5 \text{ in} \cdot 1.5 \text{ in}) = 1.39 \text{ ft}^2$

Area of 1 side of connection plate B: $A_{plate_B} := 6.5 \text{ in} \cdot d_{web_2} - (2.5 \text{ in} \cdot 1.5 \text{ in}) = 1.486 \text{ ft}^2$

Connection Plate Sides: $N_{con_sides} := 2$

Number of Connection Plates: $N_{con_plates} := 6$ (Per Beam)

Connection Plate Thickness: $T_{con_plates} := \frac{3}{8} \text{ in}$

Total Connection Plate Quantity: $Q_{514_con_plate} := (A_{plate_A} \cdot N_{con_sides} \cdot N_{con_plates}) \downarrow + (A_{plate_B} \cdot N_{con_sides} \cdot N_{con_plates}) \downarrow + T_{con_plates} \cdot (d_{web_1} + d_{web_2}) \cdot N_{con_plates} = 35.53 \text{ ft}^2$

Cross Frame Angle Perimeter: $P_{cross_frame} := 3 \text{ in} \cdot 2 + 3 \text{ in} \cdot 2 = 1 \text{ ft}$ (L3x3x5/16)

Horz. Cross Frame Length: $L_{Horz_Cross_frame} := 8 \text{ ft} + 6 \text{ in} - 1 \text{ in} \cdot 2 = 8.333 \text{ ft}$

Diagonal. Cross Frame Length: $L_{Diag_Cross_frame} := \left((8 \text{ ft} + 6 \text{ in} - 1 \text{ in} \cdot 2)^2 \downarrow + (d_{web_2} - 2 \cdot 1 \text{ in} - 3 \text{ in} - 2 \text{ in} - 2 \text{ in})^2 \right)^{.5} = 8.58 \text{ ft}$

Number of Diagonal. Angles: $N_{Diag_Cross_frame} := 2 \cdot 6 = 12$

Number of Horz. Angles: $N_{Horz_Cross_frame} := 6$

Total Item Quantity: $Q_{514_cross_frame} := P_{cross_frame} \cdot (L_{Horz_Cross_frame} \cdot N_{Horz_Cross_frame} \downarrow + L_{Diag_Cross_frame} \cdot N_{Diag_Cross_frame}) = 152.96 \text{ ft}^2$

Total Item Quantity: $Q_{514_int} := \text{Ceil} (1.10 \cdot (Q_{514_beam} + Q_{514_con_plate} + Q_{514_cross_frame}), 10 \text{ ft}^2) = 1210.00 \text{ ft}^2$

$Q_{514_int} = 1210 \text{ ft}^2$



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Item 514E00067 - Field Painting Structural Steel, Finish Coat, APP

Total Item Quantity: $Q_{514_finish} := Q_{514_int} = 1210.00 \text{ ft}^2$

$$Q_{514_finish} = 1210 \text{ ft}^2$$

Item 514E00504 - Grinding Fins, Tears, Slivers on Existing Structural Steel

Length of Surface Prep: $L_{prep} := N_{repair_1} \cdot L_{repair_1} + N_{repair_2} \cdot L_{repair_2} = 49 \text{ ft}$

Estimated Grinding Time: $Grind := 1 \text{ min/ft}$ (Per ODOT BDM, Section 404.1.11)

Total Item Quantity: $Q_{514_grind} := \text{Ceil} \left(\left(\frac{L_{prep}}{\text{ft}} \right) \cdot Grind \cdot \frac{1}{60}, 1 \right)$ $Q_{514_grind} = 1$ MNHR

Item 514E10000 - Final Inspection Repair

Number of Proposed Beams: $N_{beam} = 1$

Length of Proposed Beams: $L_{beam} = 54 \text{ ft}$

When determining number of final inspection locations along the beam, consider the 300 foot increment presented in the C&MS to be per each side of beam. Therefore, divide the 300 foot increment by two.

Inspection per Lineal Ft of Beam: $n_{inspect} := 150 \text{ ft}$ (Per ODOT C&MS, Section 514.21)

Number of Proposed Cross-frames: $N_{x_frame} := 6$

% of Cross-frames to be Inspected: $per_{inspect} := 2.5\%$ (Per ODOT C&MS, Section 514.21)

Total Item Quantity: $Q_{514_ins} := \text{Ceil} \left(\left(N_{beam} \cdot L_{beam} \right) \div n_{inspect}, 1 \right) + \text{Ceil} \left(N_{x_frame} \cdot per_{inspect}, 1 \right)$ $Q_{514_ins} = 2$ EA

Item 516E47001 - Jacking and Temporary Support of Superstructure, As Per Plan

Total Item Quantity: $Q_{516_jack} := \text{"LS"}$

Item 849E10000 - Damage Assessment

Total Item Quantity: $Q_{849_dmg} := \text{"LS"}$



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Item 849E10600 - Repairing Damaged Members by Grinding

Number of Repairs: $N_{repair_2} = 2$

Length of Heat Straightening: $L_{repair_2} = 12.5 \text{ ft}$

Length of Repair: $L_{grind} := N_{repair_2} \cdot L_{repair_2} = 25 \text{ ft}$

Estimated Grinding Time: $Grind := .10 \text{ hr/ft}$ (Per Designer Comments in SS849)

Total Item Quantity: $Q_{849_grind} := \frac{L_{grind}}{ft} \cdot Grind = 2.50$

$Q_{849_grind} = 2.5$ MNHR

Item 849E10700 - Straightening Damaged Members

Total Item Quantity: $Q_{849_straight} := \text{"LS"}$



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Summary of Quantities:

	<u>Estimated Quantity</u>
Item 202E11203 - Portions of Structure Removed...	$Q_{202_str} = \text{"LS"}$
Item 509E20001 - Concrete Reinforcement, Replacement of Existing Concrete....., APP	$Q_{509} = 40 \text{ lbf}$
Item 510E10001 - Dowel Holes with Nonshrink, Nonmetallic Grout, APP	$Q_{510_Dowels} = 32$
Item 511E34445 - Class QC2 Concrete, Bridge Deck, APP	$Q_{511_deck} = 1 \text{ yd}^3$
Item 511E34448 - Class QC2 Concrete, Bridge Deck (Parapet)	$Q_{511_rail} = 3 \text{ yd}^3$
Item 512E10101 - Sealing of Concrete Surfaces (Epoxy-Urethane), APP	$Q_{512_seal} = 20 \text{ yd}^2$
Item 512E10600 - Concrete Repair By Epoxy Injection	$Q_{512_epoxy_inj} = 306 \text{ ft}$
Item 513E10261 - Structural Steel Members, Level 3, APP	$Q_{513_L3} = 18200 \text{ lbf}$
Item 514E00050 - Surface Preparation of Existing Structural Steel	$Q_{514_prep} = 360 \text{ ft}^2$
Item 514E00056 - Field Painting of Existing Structural Steel, Prime Coat	$Q_{514_prime} = 385 \text{ ft}^2$
Item 514E00060 - Field Painting Structural Steel, Intermediate Coat	$Q_{514_int} = 1210 \text{ ft}^2$
Item 514E00067 - Field Painting Structural Steel, Finish Coat, APP	$Q_{514_finish} = 1210 \text{ ft}^2$
Item 514E00504 - Grinding Fins, Tears, Slivers on Existing Structural Steel	$Q_{514_grind} = 1$ MNHR
Item 514E10000 - Final Inspection Repair	$Q_{514_ins} = 2$ EA
Item 516E47001 - Jack and Temporary Support of Superstructure, As Per Plan	$Q_{516_jack} = \text{"LS"}$
Item 849E10000 - Damage Assessment	$Q_{849_dmg} = \text{"LS"}$
Item 849E10600 - Repairing Damaged Members by Grinding	$Q_{849_grind} = 2.5$ MNHR
Item 849E10700 - Straightening Damaged Members	$Q_{849_straight} = \text{"LS"}$