SKANSKA	Washington State Department of Transportation I-405, Brickyard to SR 527 Improvement Project Contract No. 009727	Doc Type: SUB REV#: 0 SPEC SECTION: 2.13 DATE: 11/12/2025 CRE #: BY-CRE-03898

To: Washington State Dept. of Transportation
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Suite 800
Bellevue, WA 98004

From: Skanska USA Civil West
1995 Agua Mansa Road
Riverside, CA 92509

Submittal: BY-CRE-03898_009727_SUB_18.05_Load Rating Report - NW-12 Culvert

SKA REFERENCE DOCUMENTS

Subcontractor/Supplier: AECOM

SKA Title and Description: Load Rating Report - NW-12 Culvert

Due Date: 11/26/2025

ADDITIONAL REMARKS

Approved by ______________________________

Patrick Prendergast, Vice President - Operations

DCS

Calculation Cover Page

Q2[DCS]-351-FM5

Project	**Job No.**
WSDOT I-405 Brickyard	60713342
Client	**Department/Discipline**
Skanska	Structures
Software	
Microsoft Excel, Mathcad, CSiBridge	

Calculation Objective:
This calculation is to provide an independent load rating and evaluation for NW-12 existing culvert.

Calculation Methodology:

1. The geometry, rebar and concrete strength of the existing culvert are as per Bridge Inspection Report, Field Inspection and Existing Box Culvert Evaluation by 4M engineering.
2. Calculate weight of earth fill and wearing surface loading and distribute all vehicles through both maximum (6') and minimum (4') fill depths as per AASHTO LRFD 3.6.1.2.
3. Use CSiBridge to get demands. Since top slab is of interest, two CSiBridge models are analyzed to account for both upper and lower boundary conditions: pinned and fixed all base supports. The final demand values will be taken as the envelope of results from these two boundary conditions.
4. Use CSiBridge built-in feature Section Designer to calculate moment capacity using the strain compatibility approach per AASHTO LRFD section 5.6.3.2.5 and shear capacity in accordance with AASHTO LRFD section 5.12.7.3.
5. Following BDM 13.1.1, calculate LRFR rating factors.
6. In addition, evaluate demand vs capacity, using HL-93, to meet temporary structure requirements as per BDM. Conservatively used 100% of HL-93.

References / Inputs/ Field Data: Previous reports - Traffic Shift onto Existing Box Culvert Calc_7-23-25 ZL

Assumptions: (Include comments on need to revise calculations after more data is collected/confirmed and/or after assumptions have been verified.)
See above.

Conclusions:
The load rating summary is presented on Page 2.

This calculation is complete and ready for Discipline Review:
Yes

Allie Pollack	allie Pollack	10/23/2025
Originator Name	**Signature**	**Date**

WASHINGTON DEPARTMENT OF TRANSPORTATION
I-405 BRICKYARD TO SR527 IMPROVEMENT PROJECT

NW-12 CULVERT INDEPENDENT CHECK

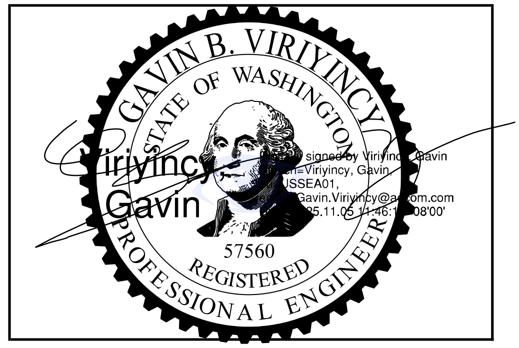
Calculation Index

WASHINGTON DEPARTMENT OF TRANSPORTATION
I-405 BRICKYARD TO SR527 IMPROVEMENT PROJECT

NW-12 CULVERT INDEPENDENT CHECK

1. LOAD RATING SUMMARY

LRFR BRIDGE RATING SUMMARY



11/5/2025

Bridge Name:	NW12 Culvert
Bridge Number:	405/102.5DV
SID Number:	
Span Types:	N/A
Bridge Length:	285 ft
Design Load:	HL-93
Rated By:	Allie Pollack
Checked By:	Gavin Viriyincy
Date:	10/23/2025

Inspection Report Date:	3/13/2025
Rating Method:	LRFR
Overlay Thickness:	N/A

Substructure Condition	N/A
Deck Condition	N/A
Superstructure Condition	N/A

Truck	**RF**	**γ**	**Controlling Point**
AASHTO 1 (Type 3)	1.52	2.00	Positive moment @ midspan
AASHTO 2 (Type 3S2)	1.65	2.00	Positive moment @ midspan
AASHTO 3 (Type 3-3)	1.81	2.00	Positive moment @ midspan
NRL	2.04	2.00	Positive moment @ midspan
EV2	1.82	1.30	Positive moment @ midspan
EV3	1.59	1.30	Positive moment @ midspan
OL-1	2.19	1.20	Positive moment @ midspan
OL-2	2.23	1.20	Positive moment @ midspan

NBI Rating	**RF**	**γ**	**Controlling Point**
Inventory (HL-93)	1.31	1.75	Positive moment @ midspan
Operating (HL-93)	1.70	1.35	Positive moment @ midspan

Remarks:

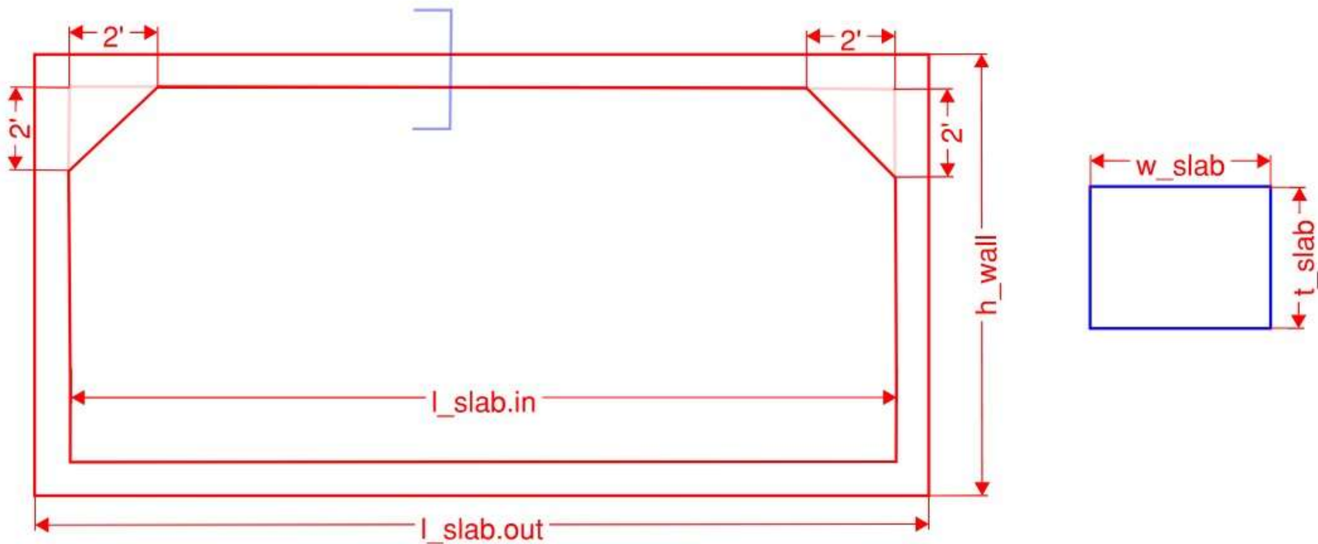
Minimum Fill Case controls for all vehicles.

NW-12 CULVERT INDEPENDENT CHECK

2. GEOMETRY

1.0 Culvert Geometry

- Reinforcement:
  - Top Slab - Interior: #6 bars at 5" o.c. transverse and #5 bars at 12" o.c. longitudinal
  - Top Slab – Exterior: #6 bars at 5" o.c. transverse and #5 bars at 12" o.c. longitudinal
  - Wall – Interior: #5 bars at 5" o.c. vertical with #5 bars at 10" o.c. horizontal
  - Wall – Exterior: #6 bars at 5" o.c. vertical with #5 bars at 10" o.c. horizontal



$h_{wall} := 10\ ft + 8\ in = 128\ in$ — wall height

$l_{slab.in} := 21\ ft + 8\ in - 10\ in - 10\ in = 240\ in$ — inner slab length

$l_{slab.out} := 21\ ft + 8\ in = 260\ in$ — outer slab length

$t_{slab} := 10\ in$ — thickness of slab

$w_{slab} := 12\ in$ — analyzed width of slab

$spa_{\#6} := 5\ in$ — spacing of #6 in slab

$No_{\#6} := \frac{w_{slab}}{spa_{\#6}} = 2.4$ — no. of #6 bars per analyzed width

$A_{s\_\#6} := 0.44\ in^2$ — area of #6 bar

$d_{\#6} := 0.75\ in$ — diameter of #6 bar

$A_s := No_{\#6} \cdot A_{s\_\#6} = 1.06\ in^2$ — area of steel for slab per unit length

$A_{s\_csi} := \frac{A_s}{3} = 0.35\ in^2$ — area of steel per bar in CSi

$cc := 2\ in$ — clear cover to bar in slab

$cc_{slab} := \frac{t_{slab}}{2} - cc - \frac{d_{\#6}}{2} = 2.63\ in$ — distance from center of slab to center of bar

NW-12 CULVERT INDEPENDENT CHECK

3. LOADING

NW-12 CULVERT INDEPENDENT CHECK

3.1 DW, EV & EH

NW-12 CULVERT INDEPENDENT CHECK

3.1.1 MAXIMUM FILL (6')

2.0 DW, EV & EH Definitions

$\gamma_{HMA} := .140 \frac{kip}{ft^3}$	assumed HMA unit weight
$\gamma_{soil} := .125 \frac{kip}{ft^3}$	assumed soil unit weight
$d_{total.fill} := 6\ ft$	maximum cover depth
$d_{HMA} := 6\ in$	HMA depth
$DW := \gamma_{HMA} \cdot d_{HMA} \cdot w_{slab} = 0.07 \frac{kip}{ft}$	HMA load per unit length
$EV := \gamma_{soil} \cdot \left(d_{total.fill} - d_{HMA}\right) \cdot w_{slab} = 0.69 \frac{kip}{ft}$	Soil load per unit length
$K_{0.min} := 0.25$	minimum coefficient of at-rest earth pressure (MBE 6A10.10.2b)
$K_{0.max} := 0.5$	maximum coefficient of at-rest earth pressure (MBE 6A10.10.2b)
$EH_{top.min} := K_{0.min} \cdot (DW + EV) = 0.189 \frac{kip}{ft}$	minimum top horizontal earth pressure
$EH_{bot.min} := EH_{top.min} + K_{0.min} \cdot \gamma_{soil} \cdot h_{wall} \cdot w_{slab} = 0.523 \frac{kip}{ft}$	minimum bottom horizontal earth pressure
$EH_{top.max} := K_{0.max} \cdot (DW + EV) = 0.379 \frac{kip}{ft}$	maximum top horizontal earth pressure
$EH_{bot.max} := EH_{top.max} + K_{0.max} \cdot \gamma_{soil} \cdot h_{wall} \cdot w_{slab} = 1.045 \frac{kip}{ft}$	maximum bottom horizontal earth pressure

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NW-12 CULVERT INDEPENDENT CHECK

3.1.2 MINIMUM FILL (4')

2.0 DW, EV & EH Definitions

$\gamma_{HMA} := .140 \frac{kip}{ft^3}$	assumed HMA unit weight
$\gamma_{soil} := .125 \frac{kip}{ft^3}$	assumed soil unit weight
$d_{total.fill} := 4\ ft$	maximum cover depth
$d_{HMA} := 6\ in$	HMA depth
$DW := \gamma_{HMA} \cdot d_{HMA} \cdot w_{slab} = 0.07 \frac{kip}{ft}$	HMA load per unit length
$EV := \gamma_{soil} \cdot \left(d_{total.fill} - d_{HMA}\right) \cdot w_{slab} = 0.44 \frac{kip}{ft}$	Soil load per unit length
$K_{0.min} := 0.25$	minimum coefficient of at-rest earth pressure (MBE 6A10.10.2b)
$K_{0.max} := 0.5$	maximum coefficient of at-rest earth pressure (MBE 6A10.10.2b)
$EH_{top.min} := K_{0.min} \cdot \left(DW + EV\right) = 0.127 \frac{kip}{ft}$	minimum top horizontal earth pressure
$EH_{bot.min} := EH_{top.min} + K_{0.min} \cdot \gamma_{soil} \cdot h_{wall} \cdot w_{slab} = 0.46 \frac{kip}{ft}$	minimum bottom horizontal earth pressure
$EH_{top.max} := K_{0.max} \cdot \left(DW + EV\right) = 0.254 \frac{kip}{ft}$	maximum top horizontal earth pressure
$EH_{bot.max} := EH_{top.max} + K_{0.max} \cdot \gamma_{soil} \cdot h_{wall} \cdot w_{slab} = 0.92 \frac{kip}{ft}$	maximum bottom horizontal earth pressure

NW-12 CULVERT INDEPENDENT CHECK

3.2 LL DISTRIBUTION THROUGH FILL

NW-12 CULVERT INDEPENDENT CHECK

3.2.1 HL-93

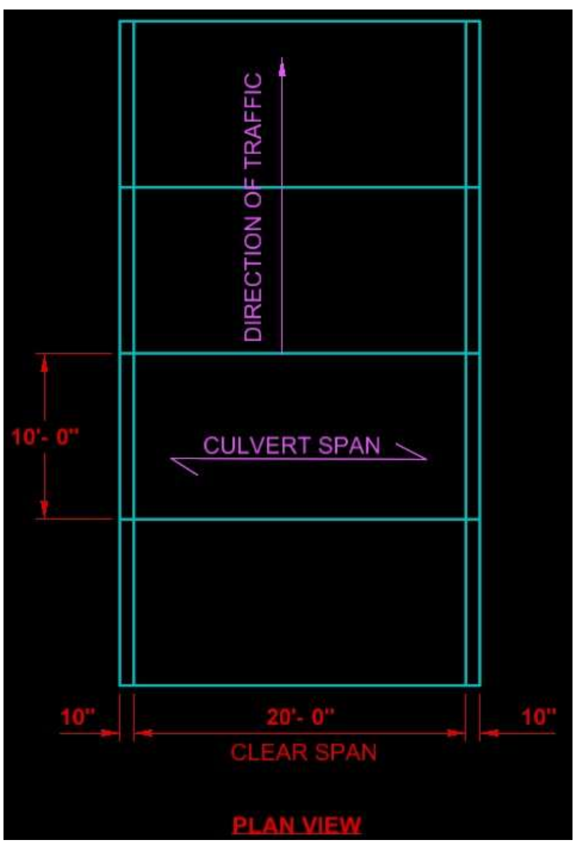
NW-12 CULVERT INDEPENDENT CHECK

3.2.1.1 MAXIMUM FILL (6')

3.0 Live Load Distribution Through Earth Fill

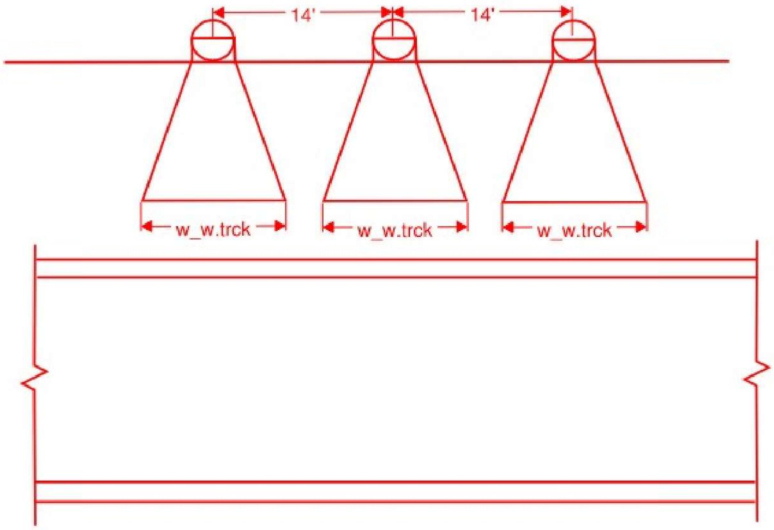
$l_t := 10\ in$	tire patch length, LRFD 3.6.1.2.5
$s_w := 6\ ft$	wheel spacing, LRFD Fig. 3.6.1.2.2-1 & 3.6.1.2.3
$s_{a.trck} := 14\ ft$	axle spacing on HL-93 truck
$s_{a.tand} := 4\ ft$	axle spacing of tandem
$s_2 := 4\ ft$	spacing of the two HL-93/tandems on span (MBE 6A.2.3.2)
$w_t := 20\ in$	tire patch width, LRFD 3.6.1.2.5
$D_i := 20\ ft$	inside diameter/clear span of culvert
$H_s := d_{total.fill} = 6\ ft$	design depth for live load interaction depth
$LLDF := 1.15$	live load distribution factor for buried structures, LRFD Table 3.6.1.2.6a-1
$H_{int.trck} := \dfrac{s_{a.trck} - l_t - 0.06 \cdot D_i}{LLDF} = 10.41\ ft$	wheel/axle load interaction distribution depth transverse to culvert span for HL-93, LRFD Eqn. 3.6.1.2.6b-1 (modified for auto unit conversion in Mathcad)
$H_{int.tand} := \dfrac{s_{a.tand} - l_t - 0.06 \cdot D_i}{LLDF} = 1.71\ ft$	wheel/axle load interaction distribution depth transverse to culvert span for tandem, LRFD Eqn. 3.6.1.2.6b-1 (modified for auto unit conversion in Mathcad)
$m_1 := 1$	multiple presence factor for 2 loaded lanes, LRFD Table 3.6.1.1.2-1

Plan View of Culvert



4.1 Live Load Distribution Transverse to Girder Span (Traffic Perpendicular to Culvert Span) -

Two HL-93 Trucks Live Load Distribution Transverse to Span



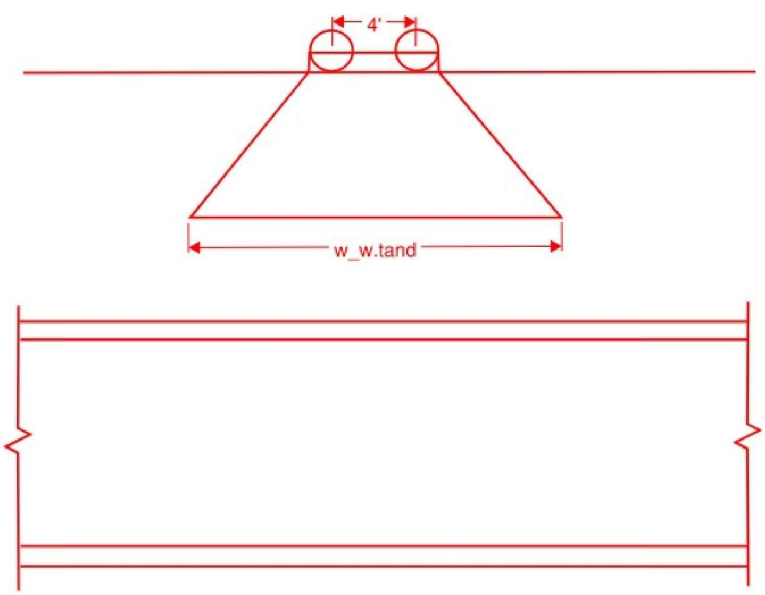
$$w_{w.trck} := \text{if } H_s < H_{int.trck} \;\; \| \; l_t + LLDF \cdot H_s + 0.06 \cdot D_i \;\; \text{else} \;\; \| \; l_t + s_{a.trck} + LLDF \cdot H_s + 0.06 \cdot D_i \quad = 8.93 \; ft$$

live load patch at depth H, LRFD Eqn. 3.6.1.2.6b-2&3

$l_t + LLDF \cdot H_s + 0.06 \cdot D_i = 8.93 \; ft$ not overlapping

$l_t + s_{a.trck} + LLDF \cdot H_s + 0.06 \cdot D_i = 22.93 \; ft$ overlapping

Two HL-93 Tandems Live Load Distribution Transverse to Span



$$w_{w.tand} := \text{if } H_s < H_{int.tand} \;\; \| \; l_t + LLDF \cdot H_s + 0.06 \cdot D_i \;\; \text{else} \;\; \| \; l_t + s_{a.tand} + LLDF \cdot H_s + 0.06 \cdot D_i \quad = 12.93 \; ft$$

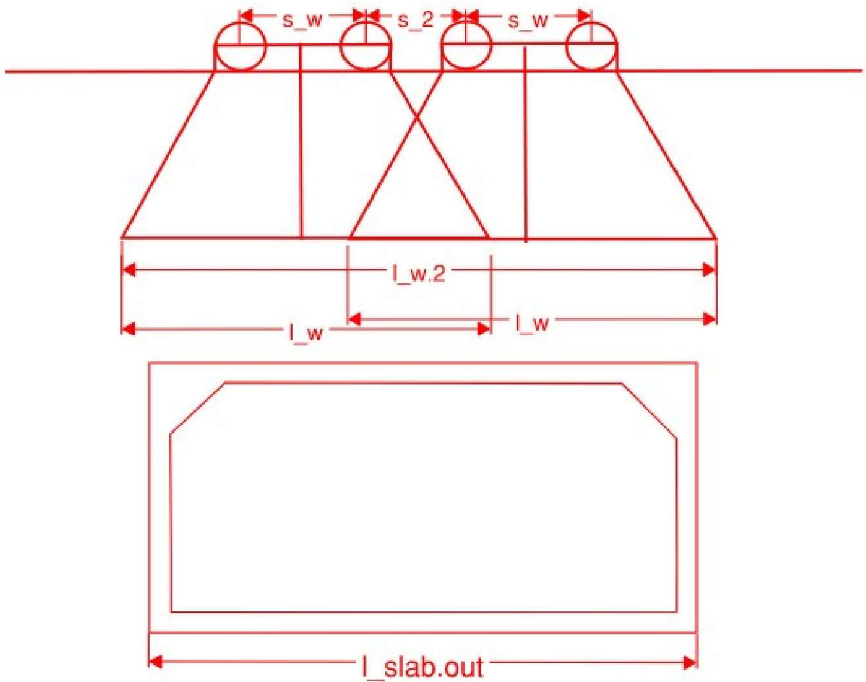
live load patch at depth H, LRFD Eqn. 3.6.1.2.6b-2&3

$l_t + LLDF \cdot H_s + 0.06 \cdot D_i = 8.93 \; ft$ not overlapping

$l_t + s_{a.tand} + LLDF \cdot H_s + 0.06 \cdot D_i = 12.93 \; ft$ overlapping

4.2 Live Load Distribution Parallel to Girder Span (Traffic Perpendicular to Culvert Span) -

Note: HL-93 truck shown, HL-93 tandem similar



$P_{a.1} := 8\ kip$ $\quad P_{a.2} := 32\ kip$ orientation of design truck axles

$H_{int.p} := \frac{s_w - w_t}{LLDF} = 3.77\ ft$ wheel/axle load interaction depth for traffic parallel to culvert span for design truck, LRFD Eqn. 3.6.1.2.6b-4 (modified for auto unit conversion in Mathcad)

$l_w := \text{if } H_s < H_{int.p} \;\; \| w_t + LLDF \cdot H_s \;\; \text{else} \;\; \| w_t + s_w + LLDF \cdot H_s = 14.57\ ft$

live load patch at depth H for design truck, LRFD Eqn. 3.6.1.2.6b-5&6 (modified for auto unit conversion)

$w_t + LLDF \cdot H_s = 8.57\ ft$ Eqn 5, not overlapping

$w_t + s_w + LLDF \cdot H_s = 14.57\ ft$ Eqn 6, overlapping

$l_{w.2} := l_w + s_w + s_2 = 24.57\ ft$

$D_E := H_s = 6\ ft$ minimum depth of earth fill, recalled

$IM := \max\left(0, 33 \cdot \left(1.0 - 0.125 \cdot \frac{D_E}{ft}\right)\right) = 8.25$ dynamic load allowance for culvert, LRFD Eqn. 3.6.2.2-1

$A_{LL.2.trcks} := w_{w.trck} \cdot l_{w.2} = 219.46\ ft^2$

$P_{L.2.trcks} := \frac{\left(P_{a.2} + P_{a.2}\right) \cdot \left(1 + \frac{IM}{100}\right) \cdot m_1}{A_{LL.2.trcks}} = 0.32\ ksf$ unfactored live load vertical crown pressure for large axle of design truck, LRFD Eqn. 3.6.1.2.6b-7

$udl_{2.trcks} := P_{L.2.trcks} \cdot w_{slab} = 0.32\ \frac{kip}{ft}$

unfactored distributed load per unit length for two HL-93 trucks

$P_{a.tand} := 25\ kip$

HL-93 tandem axle load

$H_{int.tand.p} := \frac{s_w - w_t}{LLDF} = 3.77\ ft$

wheel/axle load interaction depth for traffic parallel to culvert span for design tandem, LRFD Eqn. 3.6.1.2.6b-4 (modified for auto unit conversion in Mathcad)

$$l_{w.tand} := \begin{array}{l} \text{if } H_s < H_{int.tand.p} \\ \quad \| w_t + LLDF \cdot H_s \\ \text{else} \\ \quad \| w_t + s_w + LLDF \cdot H_s \end{array} = 14.57\ ft$$

live load patch at depth H for design tandem, LRFD Eqn. 3.6.1.2.6b-5&6 (modified for auto unit conversion)

$w_t + LLDF \cdot H_s = 8.57\ ft$ Eqn 5, not overlapping

$w_t + s_w + LLDF \cdot H_s = 14.57\ ft$ Eqn 6, overlapping

Two HL-93 tandems on span

$A_{LL.2.tand} := w_{w.tand} \cdot l_{w.2} = 317.73\ ft^2$

live load rectangular area for design tandem, LRFD Eqn. 3.6.1.2.6a-1

$$P_{L.2.tand} := \frac{(4 \cdot P_{a.tand}) \cdot \left(1 + \frac{IM}{100}\right) \cdot m_1}{A_{LL.2.tand}} = 0.34\ ksf$$

unfactored live load vertical crown pressure for tandem, LRFD Eqn. 3.6.1.2.6b-7

$udl_{2.tand} := P_{L.2.tand} \cdot w_{slab} = 0.34\ \frac{kip}{ft}$

unfactored distributed load per unit length for two HL-93 tandems

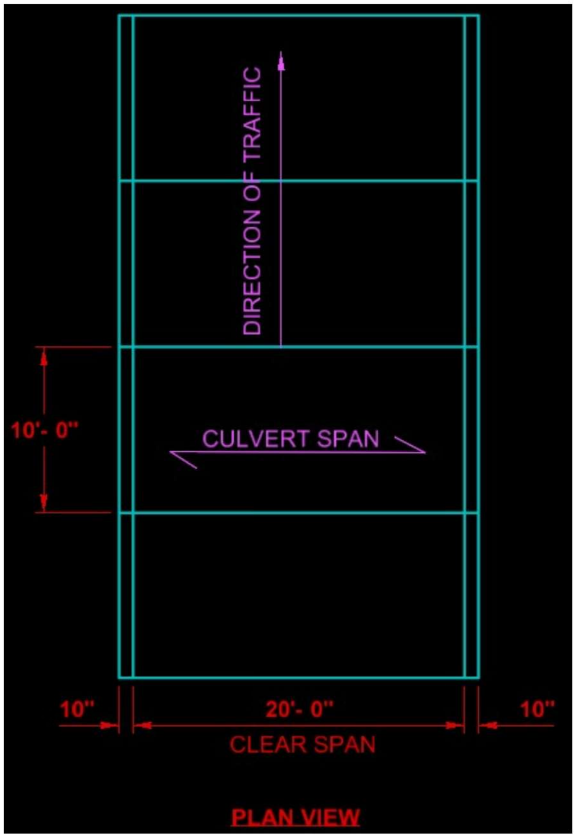
NW-12 CULVERT INDEPENDENT CHECK

3.2.1.2 MINIMUM FILL (4')

4.0 Live Load Distribution Through Earth Fill

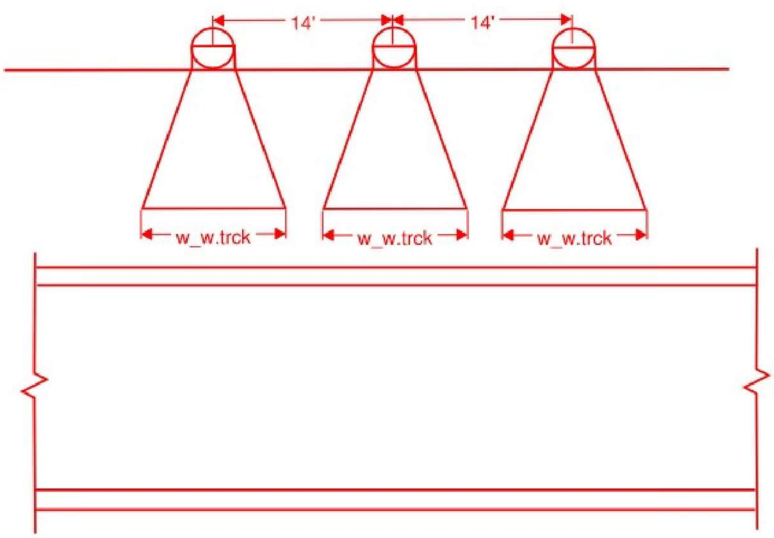
$l_t := 10\ in$	tire patch length, LRFD 3.6.1.2.5
$s_w := 6\ ft$	wheel spacing, LRFD Fig. 3.6.1.2.2-1 & 3.6.1.2.3
$s_{a.trck} := 14\ ft$	axle spacing on HL-93 truck
$s_{a.tand} := 4\ ft$	axle spacing of tandem
$s_2 := 4\ ft$	spacing of the two vehicles on span (MBE 6A.2.3.2)
$w_t := 20\ in$	tire patch width, LRFD 3.6.1.2.5
$D_i := 20\ ft$	inside diameter/clear span of culvert
$H_s := d_{total.fill} = 4\ ft$	design depth for live load interaction depth
$LLDF := 1.15$	live load distribution factor for buried structures, LRFD Table 3.6.1.2.6a-1
$H_{int.trck} := \dfrac{s_{a.trck} - l_t - 0.06 \cdot D_i}{LLDF} = 10.41\ ft$	wheel/axle load interaction distribution depth transverse to culvert span for HL-93, LRFD Eqn. 3.6.1.2.6b-1 (modified for auto unit conversion in Mathcad)
$H_{int.tand} := \dfrac{s_{a.tand} - l_t - 0.06 \cdot D_i}{LLDF} = 1.71\ ft$	wheel/axle load interaction distribution depth transverse to culvert span for tandem, LRFD Eqn. 3.6.1.2.6b-1 (modified for auto unit conversion in Mathcad)
$m_1 := 1$	multiple presence factor for 2 loaded lanes, LRFD Table 3.6.1.1.2-1

Plan View of Culvert



3.1 Live Load Distribution Transverse to Girder Span (Traffic Perpendicular to Culvert Span) -

Two HL-93 Trucks Live Load Distribution Transverse to Span



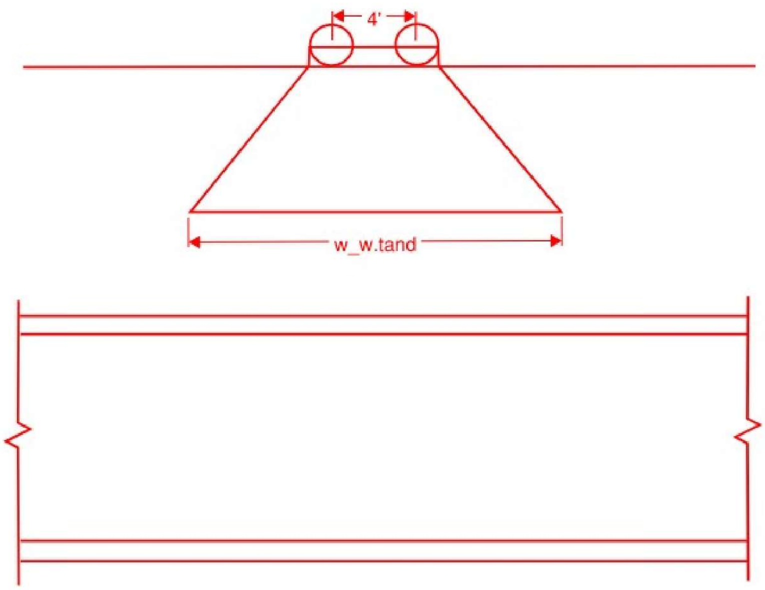
$$w_{w.trck} := \text{if } H_s < H_{int.trck} \;\; \| \; l_t + LLDF \cdot H_s + 0.06 \cdot D_i \;\; \text{else} \;\; \| \; l_t + s_{a.trck} + LLDF \cdot H_s + 0.06 \cdot D_i = 6.63 \; ft$$

live load patch at depth H, LRFD Eqn. 3.6.1.2.6b-2&3

$l_t + LLDF \cdot H_s + 0.06 \cdot D_i = 6.63 \; ft$ not overlapping

$l_t + s_{a.trck} + LLDF \cdot H_s + 0.06 \cdot D_i = 20.63 \; ft$ overlapping

Two HL-93 Tandems Live Load Distribution Transverse to Span



$$w_{w.tand} := \text{if } H_s < H_{int.tand} \;\; \| \; l_t + LLDF \cdot H_s + 0.06 \cdot D_i \;\; \text{else} \;\; \| \; l_t + s_{a.tand} + LLDF \cdot H_s + 0.06 \cdot D_i = 10.63 \; ft$$

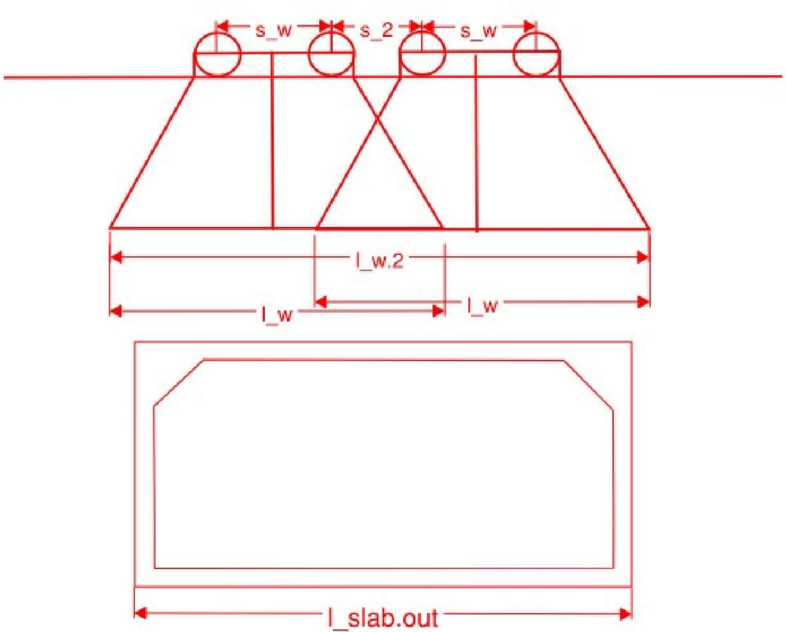
live load patch at depth H, LRFD Eqn. 3.6.1.2.6b-2&3

$l_t + LLDF \cdot H_s + 0.06 \cdot D_i = 6.63 \; ft$ not overlapping

$l_t + s_{a.tand} + LLDF \cdot H_s + 0.06 \cdot D_i = 10.63 \; ft$ overlapping

3.2 Live Load Distribution Parallel to Girder Span (Traffic Perpendicular to Culvert Span) -

Note: HL-93 truck shown, HL-93 tandem similar



$P_{a.1} := 8\ kip$ $\quad P_{a.2} := 32\ kip$ — orientation of design truck axles

$H_{int.p} := \dfrac{s_w - w_t}{LLDF} = 3.77\ ft$ — wheel/axle load interaction depth for traffic parallel to culvert span for design truck, LRFD Eqn. 3.6.1.2.6b-4 (modified for auto unit conversion in Mathcad)

$$l_{w.trck} := \text{if } H_s < H_{int.p} \;\; \| \; w_t + LLDF \cdot H_s \;\; \text{else} \;\; \| \; w_t + s_w + LLDF \cdot H_s = 12.27\ ft$$

live load patch at depth H for design truck, LRFD Eqn. 3.6.1.2.6b-5&6 (modified for auto unit conversion)

$w_t + LLDF \cdot H_s = 6.27\ ft$ — Eqn 5, not overlapping

$w_t + s_w + LLDF \cdot H_s = 12.27\ ft$ — Eqn 6, overlapping

$l_{w.2} := l_{w.trck} + s_w + s_2 = 22.27\ ft$

$A_{LL.2.trcks} := w_{w.trck} \cdot l_{w.2} = 147.7\ ft^2$

$D_E := H_s = 4\ ft$ — minimum depth of earth fill, recalled

$$IM := \max\left(0, 33 \cdot \left(1 - .125 \cdot \frac{D_E}{ft}\right)\right) = 16.5$$

$$P_{L.2.trcks} := \frac{\left(P_{a.2} + P_{a.2}\right) \cdot \left(1 + \frac{IM}{100}\right) \cdot m_1}{A_{LL.2.trcks}} = 0.5\ ksf$$

unfactored live load vertical crown pressure for large axle of design truck, LRFD Eqn. 3.6.1.2.6b-7

$udl_{2.trcks} := P_{L.2.trcks} \cdot w_{slab} = 0.5\ \dfrac{kip}{ft}$ — unfactored distributed load per unit length for two HL-93 trucks

Two HL-93 tandems on span

$P_{a.tand} := 25\ kip$ — HL-93 tandem axle load

$H_{int.tand.p} := \dfrac{s_w - w_t}{LLDF} = 3.77\ ft$ — wheel/axle load interaction depth for traffic parallel to culvert span for design tandem, LRFD Eqn. 3.6.1.2.6b-4 (modified for auto unit conversion in Mathcad)

$$l_{w.tand} := \text{if } H_s < H_{int.tand.p} \;\; \| \; w_t + LLDF \cdot H_s \;\; \text{else} \;\; \| \; w_t + s_w + LLDF \cdot H_s = 12.27\ ft$$

live load patch at depth H for design tandem, LRFD Eqn. 3.6.1.2.6b-5&6 (modified for auto unit conversion)

$w_t + LLDF \cdot H_s = 6.27\ ft$ — Eqn 5, not overlapping

$w_t + s_w + LLDF \cdot H_s = 12.27\ ft$ — Eqn 6, overlapping

$l_{w.2.tand} := l_{w.tand} + s_w + s_2 = 22.27\ ft$

$A_{LL.2.tand} := w_{w.tand} \cdot l_{w.2.tand} = 236.77\ ft^2$ — live load rectangular area for design tandem, LRFD Eqn. 3.6.1.2.6a-1

$$P_{L.2.tand} := \frac{\left(4 \cdot P_{a.tand}\right) \cdot \left(1 + \frac{IM}{100}\right) \cdot m_1}{A_{LL.2.tand}} = 0.49\ ksf$$

unfactored live load vertical crown pressure for tandem, LRFD Eqn. 3.6.1.2.6b-7

$udl_{2.tand} := P_{L.2.tand} \cdot w_{slab} = 0.49\ \dfrac{kip}{ft}$ — unfactored distributed load per unit length for two HL-93 tandems

NW-12 CULVERT INDEPENDENT CHECK

3.2.2 LEGAL, PERMIT, AND EMERGENCY VEHICLES

NW-12 CULVERT INDEPENDENT CHECK

3.2.2.1 MAXIMUM FILL (6')

2.0 Geometry

$D_E = H_s =$	6.0	ft	max depth of fill
$D_i =$	20.00	ft	clear span along skew
$w_{slab} =$	1.00	ft	analyzed width of culvert

3.0 Live Loads

LLDF =	1.15		live load distribution factor for buried structures, LRFD Table 3.6.1.2.6a-1
$m_1 =$	1.2		multiple presence factor for one lane, BDM 13.1.1.E & 13.2.17
$m_2 =$	1		multiple presence factor for two lanes, BDM 13.1.1.E & 13.2.18
$l_t =$	10	in	tire patch length, LRFD 3.6.1.2.5
$s_w =$	6	ft	wheel spacing, LRFD Fig. 3.6.1.2.2-1 & 3.6.1.2.3
$w_t =$	20	in	tire patch width, LRFD 3.6.1.2.5
$s_2 =$	4	ft	minimum spacing between two vehicles (in two lanes), MBE 6A.2.3.2

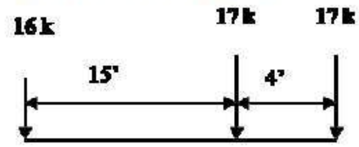
3.1 Design Live Load Distribution Summary -

IM = 8.25 % — dynamic load allowance for buried structure, LRFD Eqn. 3.6.2.2-1

3.2 Live Load Distribution Load Rating Trucks - Legal, Overload, and EV -

3.2.1 LEGAL Type 3 -

Figure 13.1-3 **Type 3 (LRFR & LFR Methods)**



$\gamma_{t3} =$	2.00		load factor for legal loads, BDM 13.2.17
$N_{a.t3} =$	3		number of axles
$s_{a1} =$	15	ft	first axle spacing of type 3
$P_{a.t3.1} =$	16	kip	first axle load
$s_{a2} =$	4	ft	second axle spacing of type 3
$P_{a.t3.2} =$	17	kip	second axle load
$P_{a.t3.3} =$	17	kip	third axle load

Distribution ***Transverse*** *to Structure Span*

$l_{t.t3} =$ 13.86 in — tire patch length

Axle SPA #	Interaction Depth $H_{int.t.t3}$ (ft)	Length Patch $w_{w.t3}$ (ft)	Condition
1	11.00	9.25	*Not Overlapping*
2	1.43	13.25	*Overlapping*

Distribution ***Parallel*** *to Structure Span*

Axle #	Adjusted Tire Width $w_{t.t3}$ (in)	Interaction Depth $H_{int.p.t3}$ (ft)	Length Patch $l_{w.t3}$ (ft)	Condition
1	10.00	4.49	13.73	*Overlapping*
2	10.63	4.45	13.79	*Overlapping*
3	10.63	4.45	13.79	*Overlapping*

2 Type 3 trucks:

btwn trcks	10.63	2.71	11.79	*Overlapping*

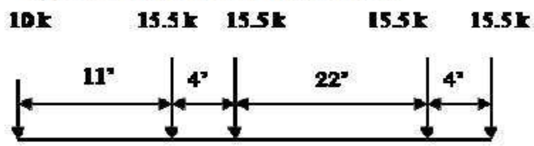
3.4.2 Type 3 Live Load Summary -

Axle #	LL Area $A_{LL.t3}$ (ft^2)	Crown Pressure $p_{L.t3}$ (ksf)	Distributed Load udl_{t3} (klf)
1	127.1	0.14	0.136
2 & 3	182.7	0.20	0.201
btwn trcks	314.58	0.234	0.234

BDM 13.2.17

3.2.2 LEGAL Type 3S2 -

Figure 13.1-4 **Type 3S2 (LRFR & LFR Methods)**



γ_{legal} =	2.00		load factor for legal loads
$N_{a.t3}$ =	5		number of axles
$P_{a.t3.1}$ =	10	kip	first axle load
s_{a1} =	11	ft	axle spacing of type 3S2
$P_{a.t3.2}$ =	15.5	kip	second axle load
s_{a2} =	4	ft	axle spacing of type 3S2
$P_{a.t3.3}$ =	15.5	kip	third axle load
s_{a3} =	22	ft	third axle spacing
$P_{a.t3.4}$ =	15.5	kip	fourth axle load
s_{a4} =	4	ft	fourth axle spacing
$P_{a.t3.5}$ =	15.5	kip	fifth axle load

*Distribution **Transverse** to Structure Span*

$l_{t.t3S2}$ = 13.86 in — tire patch length

Axle SPA #	Interaction Depth $H_{int.t.t3S2}$ (ft)	Length Patch $w_{w.t3S2}$ (ft)	Condition
1	7.52	9.25	*Not Overlapping*
2	1.43	13.25	*Overlapping*
3	17.08	9.25	*Not Overlapping*
4	1.43	13.25	*Overlapping*

*Distribution **Parallel** to Structure Span*

Axle SPA #	Adjusted Tire Width $w_{t.t3S2}$ (in)	Interaction Depth $H_{int.p.t3S2}$ (ft)	Length Patch $l_{w.t3S2}$ (ft)	Condition
1	6.25	4.76	13.42	*Overlapping*
2	9.69	4.52	13.71	*Overlapping*
3	9.69	4.52	13.71	*Overlapping*
4	9.69	4.52	13.71	*Overlapping*
5	9.69	4.52	13.71	*Overlapping*
btwn trcks	9.69	2.78	11.71	*Overlapping*

2 Type 3S2 trucks:

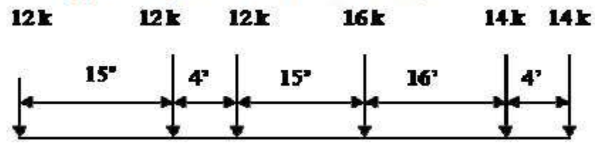
3.4.4 Type 3S2 Live Load Summary -

Axle #	LL Area $A_{LL.t3S2}$ (ft^2)	Crown Pressure $p_{L.t3S2}$ (ksf)	Distributed Load udl_{t3S2} (klf)
1	124.2	0.087	0.087
2 & 3	181.7	0.185	0.185
4 & 5	181.7	0.185	0.185
btwn trcks	310.4	0.216	0.216

2 Type 3S2 trucks:

3.2.3 LEGAL Type 3-3 -

Figure 13.1-5 **Type 3-3 (LRFR & LFR Methods)**



γ_{legal} =	2.00		load factor for legal loads
$N_{a.t33}$ =	6		number of axles
$P_{a.t33.1}$ =	12	kip	first axle load
s_{a1} =	15	ft	axle spacing of type 3S2
$P_{a.t33.2}$ =	12	kip	second axle load
s_{a2} =	4	ft	axle spacing of type 3S2
$P_{a.t33.3}$ =	12	kip	third axle load
s_{a3} =	15	ft	third axle spacing
$P_{a.t33.4}$ =	16	kip	fourth axle load
s_{a4} =	16	ft	fourth axle spacing
$P_{a.t33.5}$ =	14	kip	fifth axle load
s_{a5} =	4	ft	fifth axle spacing
$P_{a.t33.6}$ =	14	kip	sixth axle load

Distribution ***Transverse*** *to Structure Span*

$l_{t.t33}$ = 13.86 in — tire patch length

Axle SPA #	Interaction Depth $H_{int.t.t33}$ (ft)	Length Patch $w_{w.t33}$ (ft)	Condition
1	11.00	9.25	*Not Overlapping*
2	1.43	13.25	*Overlapping*
3	11.00	9.25	*Not Overlapping*
4	11.87	9.25	*Not Overlapping*
5	1.43	13.25	*Overlapping*

Distribution ***Parallel*** *to Structure Span*

Axle #	Adjusted Tire Width $w_{t.t33}$ (in)	Interaction Depth $H_{int.p.t33}$ (ft)	Length Patch $l_{w.t33}$ (ft)	Condition
1	7.50	4.67	13.53	*Overlapping*
2	7.50	4.67	13.53	*Overlapping*
3	7.50	4.67	13.53	*Overlapping*
4	10.0	4.49	13.73	*Overlapping*
5	8.75	4.58	13.63	*Overlapping*
6	8.75	4.58	13.63	*Overlapping*

2 Type 3-3 trucks:

btwn trcks	8.75	2.84	11.63	*Overlapping*

3.4.6 Type 3-3 Live Load Summary -

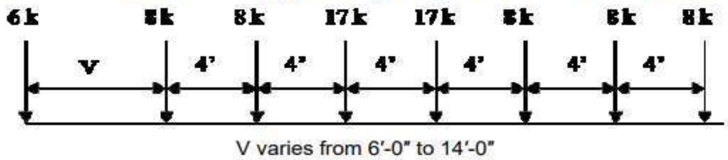
Axle #	LL Area $A_{LL.t33}$ (ft^2)	Crown Pressure $p_{L.t33}$ (ksf)	Distributed Load udl_{t33} (klf)
1	125.2	0.104	0.104
2 & 3	179.3	0.145	0.145
4	127.1	0.136	0.136
5 & 6	180.7	0.168	0.168

2 Type 3-3 trucks:

btwn trcks	311.8	0.194	0.194

3.2.4 LEGAL Notional Rating Load (NRL) -

Figure 13.1-6 Notional Rating Load (NRL) (LRFR & LFR Methods)



γ_{legal} =	2.00		load factor for legal loads
$N_{a.nrl}$ =	8		number of axles
$P_{a.nrl.1}$ =	6	kip	first axle load
s_{a1} =	6	ft	first axle spacing of type 3S2
$P_{a.nrl.2}$ =	8	kip	second axle load
s_{a2} =	4	ft	second axle spacing of type 3S2
$P_{a.nrl.3}$ =	8	kip	third axle load
s_{a3} =	4	ft	third axle spacing
$P_{a.nrl.4}$ =	17	kip	fourth axle load
s_{a4} =	4	ft	fourth axle spacing
$P_{a.nrl.5}$ =	17	kip	fifth axle load
s_{a5} =	4	ft	fifth axle spacing
$P_{a.nrl.6}$ =	8	kip	sixth axle load
s_{a6} =	4	ft	sixth axle spacing
$P_{a.nrl.7}$ =	8	kip	seventh axle load
s_{a7} =	4	ft	seventh axle spacing
$P_{a.nrl.8}$ =	8	kip	eighth axle load

Distribution ***Transverse*** *to Structure Span*

$l_{t.nrl}$ = 13.86 in — tire patch length

Axle SPA #	Interaction Depth $H_{int.t.nrl}$ (ft)	Length Patch $w_{w.nrl}$ (ft)	Condition
1	3.17	15.25	*Overlapping*
2	1.43	13.25	*Overlapping*
3	1.43	13.25	*Overlapping*
4	1.43	13.25	*Overlapping*
5	1.43	13.25	*Overlapping*
6	1.43	13.25	*Overlapping*
7	1.43	13.25	*Overlapping*

Distribution ***Parallel*** *to Structure Span*

Axle #	Adjusted Tire Width $w_{t.nrl}$ (in)	Interaction Depth $H_{int.p.nrl}$ (ft)	Length Patch $l_{w.nrl}$ (ft)	Condition
1	3.75	4.95	13.21	*Overlapping*
2	5.00	4.86	13.32	*Overlapping*
3	5.00	4.86	13.32	*Overlapping*
4	10.63	4.45	13.79	*Overlapping*
5	10.63	4.45	13.79	*Overlapping*
6	5.00	4.86	13.32	*Overlapping*
7	5.00	4.86	13.32	*Overlapping*
8	5.00	4.86	13.32	*Overlapping*

2 NRL trucks:

btwn trcks	3.75	3.21	11.21	*Overlapping*

3.4.8 Legal NRL Live Load Summary -

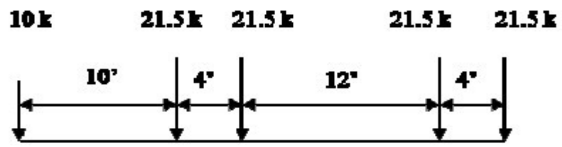
Axle #	LL Area $A_{LL.nrl}$ (ft^2)	Crown Pressure $p_{L.nrl}$ (ksf)	Distributed Load udl_{nrl} (klf)
1 thru 8	518.7	0.167	0.167

2 NRL trucks:

btwn trcks	911.2	0.190	0.190

3.2.5 Overload 1 (OL1) -

Figure 13.1-8 **Overload 1* (LRFR & LFR Methods)**



γ_{permit} =	1.20	load factor for permit loads, BDM Table 13.1-1
$N_{a.OL1}$ =	5	number of axles
$P_{a.OL1.1}$ =	10 kip	first axle load
s_{a1} =	10 ft	first axle spacing of type 3S2
$P_{a.OL1.2}$ =	21.5 kip	second axle load
s_{a2} =	4 ft	second axle spacing of type 3S2
$P_{a.OL1.3}$ =	21.5 kip	third axle load
s_{a3} =	12 ft	third axle spacing
$P_{a.OL1.4}$ =	21.5 kip	fourth axle load
s_{a4} =	4 ft	fourth axle spacing
$P_{a.OL1.5}$ =	21.5 kip	fifth axle load

Distribution ***Transverse*** *to Structure Span*

$l_{t.OL1}$ = 8.31 in — tire patch length

Axle SPA #	Interaction Depth $H_{int.t.OL1}$ (ft)	Length Patch $w_{w.OL1}$ (ft)	Condition
1	7.05	8.79	*Not Overlapping*
2	1.83	12.79	*Overlapping*
3	8.79	8.79	*Not Overlapping*
4	1.83	12.79	*Overlapping*

Distribution ***Parallel*** *to Structure Span*

Axle #	Adjusted Tire Width $w_{t.OL1}$ (in)	Interaction Depth $H_{int.p.OL1}$ (ft)	Length Patch $l_{w.OL1}$ (ft)	Condition
1	6.25	4.76	13.42	*Overlapping*
2	13.44	4.24	14.02	*Overlapping*
3	13.44	4.24	14.02	*Overlapping*
4	13.44	4.24	14.02	*Overlapping*
5	13.44	4.24	14.02	*Overlapping*

1 OL1 truck & 1 Type 3 truck:

btwn trucks	13.44	2.50	12.02	*Overlapping*

3.4.10 Overload 1 (OL1) Live Load Summary -

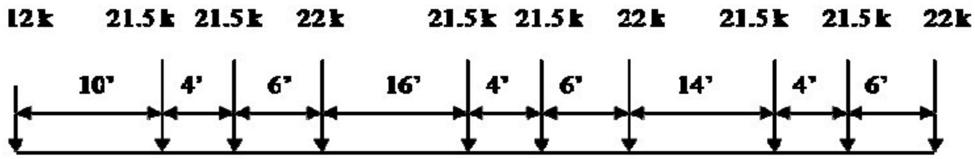
Axle #	LL Area $A_{LL.OL1}$ (ft^2)	Crown Pressure $p_{L.OL1}$ (ksf)	Distributed Load udl_{OL1} (klf)
1	118.0	0.092	0.092
2 & 3	179.4	0.260	0.260
4 & 5	179.4	0.130	0.130

1 OL1 truck & 1 Type 3 truck:

btwn trucks	305.8	0.273	0.273

3.2.6 Overload 2 (OL2) -

Figure 13.1-9 Overload 2* (LRFR & LFR Methods)



	γ_{permit} =	1.20	load factor for permit loads, BDM Table 13.1-1
	$N_{a.OL2}$ =	10	number of axles
1	$P_{a.OL2.1}$ =	12 kip	first axle load
	s_{a1} =	10 ft	first axle spacing
2	$P_{a.OL2.2}$ =	21.5 kip	second axle load
	s_{a2} =	4 ft	second axle spacing
3	$P_{a.OL2.3}$ =	21.5 kip	third axle load
	s_{a3} =	6 ft	third axle spacing
4	$P_{a.OL2.4}$ =	22 kip	fourth axle load
	s_{a4} =	16 ft	fourth axle spacing
5	$P_{a.OL2.5}$ =	21.5 kip	fifth axle load
	s_{a5} =	4 ft	fifth axle spacing
6	$P_{a.OL2.6}$ =	21.5 kip	sixth axle load
	s_{a6} =	6 ft	sixth axle spacing
7	$P_{a.OL2.7}$ =	22 kip	seventh axle load
	s_{a7} =	14 ft	seventh axle spacing
8	$P_{a.OL2.8}$ =	21.5 kip	eighth axle load
	s_{a8} =	4 ft	eighth axle spacing
9	$P_{a.OL2.9}$ =	21.5 kip	ninth axle load
	s_{a9} =	6 ft	ninth axle spacing
10	$P_{a.OL2.10}$ =	22 kip	tenth axle load

*Distribution **Transverse** to Structure Span*

$l_{t.OL2}$ = 8.31 in tire patch length

Axle SPA #	Interaction Depth $H_{int.t.OL2}$ (ft)	Length Patch $w_{w.OL2}$ (ft)	Condition
1	7.05	8.79	*Not Overlapping*
2	1.83	12.79	*Overlapping*
3	3.57	14.79	*Overlapping*
4	12.27	8.79	*Not Overlapping*
5	1.83	12.79	*Overlapping*
6	3.57	14.79	*Overlapping*
7	10.53	8.79	*Not Overlapping*
8	1.83	12.79	*Overlapping*
9	3.57	14.79	*Overlapping*

*Distribution **Parallel** to Structure Span*

Axle #	Adjusted Tire Width $w_{t.OL2}$ (in)	Interaction Depth $H_{int.p.OL2}$ (ft)	Length Patch $l_{w.OL2}$ (ft)	Condition
1	7.50	4.67	13.53	*Overlapping*
2	13.44	4.24	14.02	*Overlapping*
3	13.44	4.24	14.02	*Overlapping*
4	13.75	4.22	14.05	*Overlapping*
5	13.44	4.24	14.02	*Overlapping*
6	13.44	4.24	14.02	*Overlapping*
7	13.75	4.22	14.05	*Overlapping*
8	13.44	4.24	14.02	*Overlapping*
9	13.44	4.24	14.02	*Overlapping*
10	13.75	4.22	14.05	*Overlapping*

1 OL2 truck & 1 Type 3 truck:

btwn trucks	13.44	2.50	12.02	*Overlapping*

3.4.12 Overload 2 (OL2) Live Load Summary -

Axle #	LL Area $A_{LL.OL2}$ (ft^2)	Crown Pressure $p_{L.OL2}$ (ksf)	Distributed Load udl_{OL2} (klf)
1	118.9	0.109	0.109
2&3&4	263.5	0.267	0.267
5&6&7	263.5	0.267	0.267
8&9&10	263.5	0.267	0.267

1 OL2 truck & 1 Type 3 truck:

btwn trucks	316.8	0.338	0.338

3.2.7 Emergency Vehicle (EV2) -

Figure 13.1-10 Type EV2 (LRFR & LFR Methods)

$\gamma_{LL.EV}$ = 1.30 load factor for EV (BDM Table 13.1-1 for ADT > 1000)

$N_{a.EV2}$ = 2 number of axles

$P_{a.tEV2.1}$ = 24 kip first axle load

s_{a1} = 15 ft first axle spacing

$P_{a.tEV2.2}$ = 33.5 kip second axle load

*Distribution **Transverse** to Structure Span*

$l_{t.EV2}$ = 9.01 in tire patch length

Axle SPA #	Interaction Depth $H_{int.t.EV2}$ (ft)	Length Patch $w_{w.EV2}$ (ft)	Condition
1	11.35	8.85	*Not Overlapping*

*Distribution **Parallel** to Structure Span*

Axle #	Adjusted Tire Width $w_{t.EV2}$ (in)	Interaction Depth $H_{int.p.EV2}$ (ft)	Length Patch $l_{w.EV2}$ (ft)	Condition
1	15.00	4.13	14.15	*Overlapping*
2	20.94	3.70	14.64	*Overlapping*

1 EV2 truck & 1 Type 3 truck:

btwn trucks	20.94	1.96	12.64	*Overlapping*

3.4.14 Emergency Vehicle (EV2) Live Load Summary -

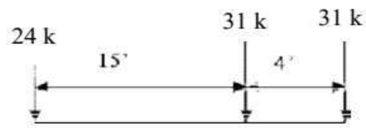
Axle #	LL Area $A_{LL.EV2}$ (ft^2)	Crown Pressure $p_{L.EV2}$ (ksf)	Distributed Load udl_{EV2} (klf)
1	125.2	0.207	0.207
2	129.6	0.280	0.280

1 EV2 truck & 1 Type 3 truck:

btwn trucks	214.3	0.341	0.341

3.2.8 Emergency Vehicle (EV3) -

Figure 13.1-11 Type EV3 (LRFR & LFR Methods)



$\gamma_{LL.EV}$ = 1.30 load factor for EV

$N_{a.EV3}$ = 3 number of axles
$P_{a.tEV3.1}$ = 24 kip first axle load
s_{a1} = 15 ft first axle spacing
$P_{a.tEV3.2}$ = 31 kip second axle load
s_{a2} = 4 ft second axle spacing
$P_{a.tEV3.3}$ = 31 kip third axle load

Distribution ***Transverse*** *to Structure Span*

$l_{t.EV3}$ = 9.01 in tire patch length

Axle SPA #	Interaction Depth $H_{int.t.EV3}$ (ft)	Length Patch $w_{w.EV3}$ (ft)	Condition
1	11.35	8.85	*Not Overlapping*
2	1.78	12.85	*Overlapping*

Distribution ***Parallel*** *to Structure Span*

Axle #	Adjusted Tire Width $w_{t.EV3}$ (in)	Interaction Depth $H_{int.p.EV3}$ (ft)	Length Patch $l_{w.EV3}$ (ft)	Condition
1	15.00	4.13	14.15	*Overlapping*
2	19.38	3.81	14.51	*Overlapping*
3	19.38	3.81	14.51	*Overlapping*
1 EV3 truck & 1 Type 3 truck:				
btwn trucks	19.38	2.07	12.51	*Overlapping*

3.4.16 Emergency Vehicle (EV3) Live Load Summary -

Axle #	LL Area $A_{LL.EV3}$ (ft^2)	Crown Pressure $p_{L.EV3}$ (ksf)	Distributed Load udl_{EV3} (klf)
1	125.2	0.207	0.207
2&3	186.5	0.360	0.360
1 EV3 truck & 1 Type 3 truck:			
btwn trucks	310.34	0.33	0.33

NW-12 CULVERT INDEPENDENT CHECK

3.2.2.2 MINIMUM FILL (4')

2.0 Geometry

$D_E = H_s$ =	4.0 ft	min depth of fill
D_i =	20.00 ft	clear span along skew
w_{slab} =	1.00 ft	analyzed width of culvert

3.0 Live Loads

LLDF =	1.15	live load distribution factor for buried structures, LRFD Table 3.6.1.2.6a-1
m_1 =	1.2	multiple presence factor for one lane, BDM 13.1.1.E & 13.2.17
m_2 =	1	multiple presence factor for two lanes, BDM 13.1.1.E & 13.2.18
l_t =	10 in	tire patch length, LRFD 3.6.1.2.5
s_w =	6 ft	wheel spacing, LRFD Fig. 3.6.1.2.2-1 & 3.6.1.2.3
w_t =	20 in	tire patch width, LRFD 3.6.1.2.5
s_2 =	4 ft	minimum spacing between two vehicles (in two lanes), MBE 6A.2.3.2

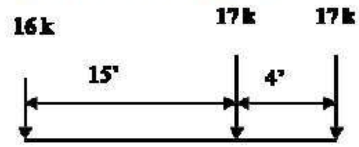
3.1 Design Live Load Distribution Summary -

IM = 16.50 % — dynamic load allowance for buried structure, LRFD Eqn. 3.6.2.2-1

3.2 Live Load Distribution Load Rating Trucks - Legal, Overload, and EV -

3.2.1 LEGAL Type 3 -

Figure 13.1-3 **Type 3 (LRFR & LFR Methods)**



γ_{t3} =	2.00	load factor for legal loads, BDM 13.2.17
$N_{a.t3}$ =	3	number of axles
s_{a1} =	15 ft	first axle spacing of type 3
$P_{a.t3.1}$ =	16 kip	first axle load
s_{a2} =	4 ft	second axle spacing of type 3
$P_{a.t3.2}$ =	17 kip	second axle load
$P_{a.t3.3}$ =	17 kip	third axle load

Distribution ***Transverse*** *to Structure Span*

$l_{t.t3}$ = 14.91 in — tire patch length

Axle SPA #	Interaction Depth $H_{int.t.t3}$ (ft)	Length Patch $w_{w.t3}$ (ft)	Condition
1	10.92	7.04	*Not Overlapping*
2	1.35	11.04	*Overlapping*

Distribution ***Parallel*** *to Structure Span*

Axle #	Adjusted Tire Width $w_{t.t3}$ (in)	Interaction Depth $H_{int.p.t3}$ (ft)	Length Patch $l_{w.t3}$ (ft)	Condition
1	10.00	4.49	5.43	*Not Overlapping*
2	10.63	4.45	5.49	*Not Overlapping*
3	10.63	4.45	5.49	*Not Overlapping*

2 Type 3 trucks:

btwn trcks	10.63	2.71	9.49	*Overlapping*

3.4.2 Type 3 Live Load Summary -

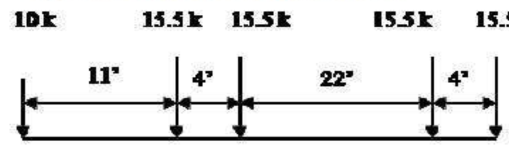
Axle #	LL Area $A_{LL.t3}$ (ft^2)	Crown Pressure $p_{L.t3}$ (ksf)	Distributed Load udl_{t3} (klf)
1	38.3	0.24	0.244
2 & 3	60.6	0.33	0.327
btwn trcks	104.74	0.378	0.378

BDM 13.2.17

2 Type 3 trucks: (btwn trcks row)

3.2.2 LEGAL Type 3S2 -

Figure 13.1-4 Type 3S2 (LRFR & LFR Methods)



γ_{legal} = 2.00 — load factor for legal loads

$N_{a.t3}$ =	5		number of axles
$P_{a.t3.1}$ =	10	kip	first axle load
s_{a1} =	11	ft	first axle spacing of type 3S2
$P_{a.t3.2}$ =	15.5	kip	second axle load
s_{a2} =	4	ft	second axle spacing of type 3S2
$P_{a.t3.3}$ =	15.5	kip	third axle load
s_{a3} =	22	ft	third axle spacing
$P_{a.t3.4}$ =	15.5	kip	fourth axle load
s_{a4} =	4	ft	fourth axle spacing
$P_{a.t3.5}$ =	15.5	kip	fifth axle load

Distribution ***Transverse*** *to Structure Span*

$l_{t.t3S2}$ = 14.91 in — tire patch length

Axle SPA #	Interaction Depth $H_{int.t.t3S2}$ (ft)	Length Patch $w_{w.t3S2}$ (ft)	Condition
1	7.44	7.04	*Not Overlapping*
2	1.35	11.04	*Overlapping*
3	17.01	7.04	*Not Overlapping*
4	1.35	11.04	*Overlapping*

Distribution ***Parallel*** *to Structure Span*

Axle SPA #	Adjusted Tire Width $w_{t.t3S2}$ (in)	Interaction Depth $H_{int.p.t3S2}$ (ft)	Length Patch $l_{w.t3S2}$ (ft)	Condition
1	6.25	4.76	5.12	*Not Overlapping*
2	9.69	4.52	5.41	*Not Overlapping*
3	9.69	4.52	5.41	*Not Overlapping*
4	9.69	4.52	5.41	*Not Overlapping*
5	9.69	4.52	5.41	*Not Overlapping*
btwn trcks	9.69	2.78	9.41	*Overlapping*

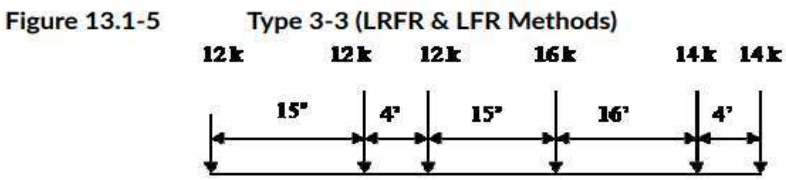
2 Type 3S2 trucks: (btwn trcks row)

3.4.4 Type 3S2 Live Load Summary -

Axle #	LL Area $A_{LL.t3S2}$ (ft^2)	Crown Pressure $p_{L.t3S2}$ (ksf)	Distributed Load udl_{t3S2} (klf)
1	36.1	0.162	0.162
2 & 3	59.7	0.302	0.302
4 & 5	59.7	0.302	0.302
btwn trcks	103.9	0.348	0.348

2 Type 3S2 trucks: (btwn trcks row)

3.2.3 LEGAL Type 3-3 -



γ_{legal} =	2.00	load factor for legal loads
$N_{a.t33}$ =	6	number of axles
$P_{a.t33.1}$ =	12 kip	first axle load
s_{a1} =	15 ft	first axle spacing of type 3S2
$P_{a.t33.2}$ =	12 kip	second axle load
s_{a2} =	4 ft	second axle spacing of type 3S2
$P_{a.t33.3}$ =	12 kip	third axle load
s_{a3} =	15 ft	third axle spacing
$P_{a.t33.4}$ =	16 kip	fourth axle load
s_{a4} =	16 ft	fourth axle spacing
$P_{a.t33.5}$ =	14 kip	fifth axle load
s_{a5} =	4 ft	fifth axle spacing
$P_{a.t33.6}$ =	14 kip	sixth axle load

*Distribution **Transverse** to Structure Span*

$l_{t.t33}$ = 14.91 in — tire patch length

Axle SPA #	Interaction Depth $H_{int.t.t33}$ (ft)	Length Patch $w_{w.t33}$ (ft)	Condition
1	10.92	7.04	*Not Overlapping*
2	1.35	11.04	*Overlapping*
3	10.92	7.04	*Not Overlapping*
4	11.79	7.04	*Not Overlapping*
5	1.35	11.04	*Overlapping*

*Distribution **Parallel** to Structure Span*

Axle #	Adjusted Tire Width $w_{t.t33}$ (in)	Interaction Depth $H_{int.p.t33}$ (ft)	Length Patch $l_{w.t33}$ (ft)	Condition
1	7.50	4.67	5.23	*Not Overlapping*
2	7.50	4.67	5.23	*Not Overlapping*
3	7.50	4.67	5.23	*Not Overlapping*
4	10.0	4.49	5.43	*Not Overlapping*
5	8.75	4.58	5.33	*Not Overlapping*
6	8.75	4.58	5.33	*Not Overlapping*

2 Type 3-3 trucks:

btwn trcks	8.75	2.84	9.33	*Overlapping*

3.4.6 Type 3-3 Live Load Summary -

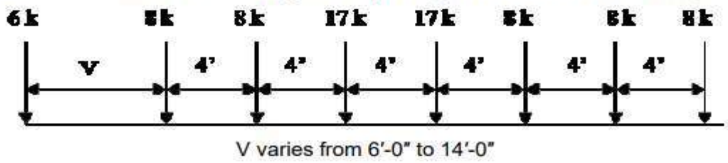
Axle #	LL Area $A_{LL.t33}$ (ft^2)	Crown Pressure $p_{L.t33}$ (ksf)	Distributed Load udl_{t33} (klf)
1	36.8	0.190	0.190
2 & 3	57.7	0.242	0.242
4	38.3	0.244	0.244
5 & 6	58.8	0.277	0.277

2 Type 3-3 trucks:

btwn trcks	103.0	0.317	0.317

3.2.4 LEGAL Notional Rating Load (NRL) -

Figure 13.1-6 Notional Rating Load (NRL) (LRFR & LFR Methods)



γ_{legal} =	2.00	load factor for legal loads
$N_{a.nrl}$ =	8	number of axles
$P_{a.nrl.1}$ =	6 kip	first axle load
s_{a1} =	6 ft	first axle spacing of type 3S2
$P_{a.nrl.2}$ =	8 kip	second axle load
s_{a2} =	4 ft	second axle spacing of type 3S2
$P_{a.nrl.3}$ =	8 kip	third axle load
s_{a3} =	4 ft	third axle spacing
$P_{a.nrl.4}$ =	17 kip	fourth axle load
s_{a4} =	4 ft	fourth axle spacing
$P_{a.nrl.5}$ =	17 kip	fifth axle load
s_{a5} =	4 ft	fifth axle spacing
$P_{a.nrl.6}$ =	8 kip	sixth axle load
s_{a6} =	4 ft	sixth axle spacing
$P_{a.nrl.7}$ =	8 kip	seventh axle load
s_{a7} =	4 ft	seventh axle spacing
$P_{a.nrl.8}$ =	8 kip	eighth axle load

Distribution ***Transverse*** *to Structure Span*

$l_{t.nrl}$ = 14.91 in — tire patch length

Axle SPA #	Interaction Depth $H_{int.t.nrl}$ (ft)	Length Patch $w_{w.nrl}$ (ft)	Condition
1	3.09	13.04	*Overlapping*
2	1.35	11.04	*Overlapping*
3	1.35	11.04	*Overlapping*
4	1.35	11.04	*Overlapping*
5	1.35	11.04	*Overlapping*
6	1.35	11.04	*Overlapping*
7	1.35	11.04	*Overlapping*

Distribution ***Parallel*** *to Structure Span*

Axle #	Adjusted Tire Width $w_{t.nrl}$ (in)	Interaction Depth $H_{int.p.nrl}$ (ft)	Length Patch $l_{w.nrl}$ (ft)	Condition
1	3.75	4.95	4.91	*Not Overlapping*
2	5.00	4.86	5.02	*Not Overlapping*
3	5.00	4.86	5.02	*Not Overlapping*
4	10.63	4.45	5.49	*Not Overlapping*
5	10.63	4.45	5.49	*Not Overlapping*
6	5.00	4.86	5.02	*Not Overlapping*
7	5.00	4.86	5.02	*Not Overlapping*
8	5.00	4.86	5.02	*Not Overlapping*

2 NRL trucks:

btwn trcks	3.75	3.21	8.91	*Overlapping*

3.4.8 Legal NRL Live Load Summary -

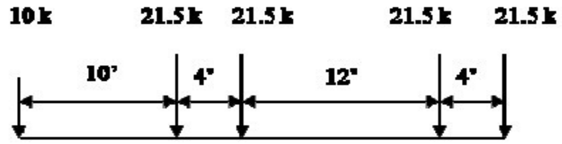
Axle #	LL Area $A_{LL.nrl}$ (ft^2)	Crown Pressure $p_{L.nrl}$ (ksf)	Distributed Load udl_{nrl} (klf)
1 thru 8	182.0	0.256	0.256

2 NRL trucks:

btwn trcks	330.1	0.282	0.282

3.2.5 Overload 1 (OL1) -

Figure 13.1-8 **Overload 1* (LRFR & LFR Methods)**



γ_{permit} = 1.20 — load factor for permit loads, BDM Table 13.1-1

$N_{a.OL1}$ =	5		number of axles
$P_{a.OL1.1}$ =	10	kip	first axle load
s_{a1} =	10	ft	first axle spacing of type 3S2
$P_{a.OL1.2}$ =	21.5	kip	second axle load
s_{a2} =	4	ft	second axle spacing of type 3S2
$P_{a.OL1.3}$ =	21.5	kip	third axle load
s_{a3} =	12	ft	third axle spacing
$P_{a.OL1.4}$ =	21.5	kip	fourth axle load
s_{a4} =	4	ft	fourth axle spacing
$P_{a.OL1.5}$ =	21.5	kip	fifth axle load

Distribution ***Transverse*** *to Structure Span*

$l_{t.OL1}$ = 8.95 in — tire patch length

Axle SPA #	Interaction Depth $H_{int.t.OL1}$ (ft)	Length Patch $w_{w.OL1}$ (ft)	Condition
1	7.00	6.55	*Not Overlapping*
2	1.79	10.55	*Overlapping*
3	8.74	6.55	*Not Overlapping*
4	1.79	10.55	*Overlapping*

Distribution ***Parallel*** *to Structure Span*

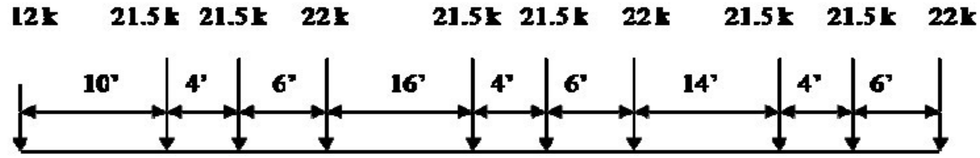
Axle #	Adjusted Tire Width $w_{t.OL1}$ (in)	Interaction Depth $H_{int.p.OL1}$ (ft)	Length Patch $l_{w.OL1}$ (ft)	Condition
1	6.25	4.76	5.12	*Not Overlapping*
2	13.44	4.24	5.72	*Not Overlapping*
3	13.44	4.24	5.72	*Not Overlapping*
4	13.44	4.24	5.72	*Not Overlapping*
5	13.44	4.24	5.72	*Not Overlapping*
1 OL1 truck & 1 Type 3 truck:				
btwn trucks	13.44	2.50	9.72	*Overlapping*

3.4.10 Overload 1 (OL1) Live Load Summary -

Axle #	LL Area $A_{LL.OL1}$ (ft^2)	Crown Pressure $p_{L.OL1}$ (ksf)	Distributed Load udl_{OL1} (klf)
1	33.5	0.174	0.174
2 & 3	60.3	0.415	0.415
4 & 5	60.3	0.208	0.208
1 OL1 truck & 1 Type 3 truck:			
btwn trucks	102.5	0.438	0.438

3.2.6 Overload 2 (OL2) -

Figure 13.1-9 Overload 2* (LRFR & LFR Methods)



γ_{permit} = 1.20 — load factor for permit loads, BDM Table 13.1-1

$N_{a.OL2}$ = 10 — number of axles

1 $P_{a.OL2.1}$ = 12 kip — first axle load
s_{a1} = 10 ft — first axle spacing
2 $P_{a.OL2.2}$ = 21.5 kip — second axle load
s_{a2} = 4 ft — second axle spacing
3 $P_{a.OL2.3}$ = 21.5 kip — third axle load
s_{a3} = 6 ft — third axle spacing
4 $P_{a.OL2.4}$ = 22 kip — fourth axle load
s_{a4} = 16 ft — fourth axle spacing
5 $P_{a.OL2.5}$ = 21.5 kip — fifth axle load
s_{a5} = 4 ft — fifth axle spacing
6 $P_{a.OL2.6}$ = 21.5 kip — sixth axle load
s_{a6} = 6 ft — sixth axle spacing
7 $P_{a.OL2.7}$ = 22 kip — seventh axle load
s_{a7} = 14 ft — seventh axle spacing
8 $P_{a.OL2.8}$ = 21.5 kip — eighth axle load
s_{a8} = 4 ft — eighth axle spacing
9 $P_{a.OL2.9}$ = 21.5 kip — ninth axle load
s_{a9} = 6 ft — ninth axle spacing
10 $P_{a.OL2.10}$ = 22 kip — tenth axle load

*Distribution **Transverse** to Structure Span*

$l_{t.OL2}$ = 8.95 in — tire patch length

Axle SPA #	Interaction Depth $H_{int.t.OL2}$ (ft)	Length Patch $w_{w.OL2}$ (ft)	Condition
1	7.00	6.55	*Not Overlapping*
2	1.79	10.55	*Overlapping*
3	3.53	12.55	*Overlapping*
4	12.22	6.55	*Not Overlapping*
5	1.79	10.55	*Overlapping*
6	3.53	12.55	*Overlapping*
7	10.48	6.55	*Not Overlapping*
8	1.79	10.55	*Overlapping*
9	3.53	12.55	*Overlapping*

*Distribution **Parallel** to Structure Span*

Axle #	Adjusted Tire Width $w_{t.OL2}$ (in)	Interaction Depth $H_{int.p.OL2}$ (ft)	Length Patch $l_{w.OL2}$ (ft)	Condition
1	7.50	4.67	5.23	*Not Overlapping*
2	13.44	4.24	5.72	*Not Overlapping*
3	13.44	4.24	5.72	*Not Overlapping*
4	13.75	4.22	5.75	*Not Overlapping*
5	13.44	4.24	5.72	*Not Overlapping*
6	13.44	4.24	5.72	*Not Overlapping*
7	13.75	4.22	5.75	*Not Overlapping*
8	13.44	4.24	5.72	*Not Overlapping*
9	13.44	4.24	5.72	*Not Overlapping*
10	13.75	4.22	5.75	*Not Overlapping*

1 OL2 truck & 1 Type 3 truck:

btwn trucks	13.44	2.50	9.72	*Overlapping*

3.4.12 Overload 2 (OL2) Live Load Summary -

Axle #	LL Area $A_{LL.OL2}$ (ft^2)	Crown Pressure $p_{L.OL2}$ (ksf)	Distributed Load udl_{OL2} (klf)
1	34.2	0.204	0.204
2&3&4	94.6	0.400	0.400
5&6&7	94.6	0.400	0.400
8&9&10	94.6	0.400	0.400

1 OL2 truck & 1 Type 3 truck:

btwn trucks	134.1	0.430	0.430

3.2.7 Emergency Vehicle (EV2) -

Figure 13.1-10 Type EV2 (LRFR & LFR Methods)

$\gamma_{LL.EV}$ = 1.30 load factor for EV (BDM Table 13.1-1 for ADT > 1000)

$N_{a.EV2}$ = 2 number of axles

$P_{a.tEV2.1}$ = 24 kip first axle load

s_{a1} = 15 ft first axle spacing

$P_{a.tEV2.2}$ = 33.5 kip second axle load

*Distribution **Transverse** to Structure Span*

$l_{t.EV2}$ = 9.69 in tire patch length

Axle SPA #	Interaction Depth $H_{int.t.EV2}$ (ft)	Length Patch $w_{w.EV2}$ (ft)	Condition
1	11.30	6.61	*Not Overlapping*

*Distribution **Parallel** to Structure Span*

Axle #	Adjusted Tire Width $w_{t.EV2}$ (in)	Interaction Depth $H_{int.p.EV2}$ (ft)	Length Patch $l_{w.EV2}$ (ft)	Condition
1	15.00	4.13	5.85	*Not Overlapping*
2	20.94	3.70	12.34	*Overlapping*

1 EV2 truck & 1 Type 3 truck:

btwn trucks	20.94	1.96	10.34	*Overlapping*

3.4.14 Emergency Vehicle (EV2) Live Load Summary -

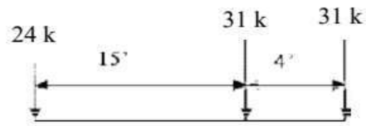
Axle #	LL Area $A_{LL.EV2}$ (ft^2)	Crown Pressure $p_{L.EV2}$ (ksf)	Distributed Load udl_{EV2} (klf)
1	38.7	0.362	0.362
2	81.6	0.478	0.478

1 EV2 truck & 1 Type 3 truck:

btwn trucks	121.2	0.485	0.485

3.2.8 Emergency Vehicle (EV3) -

Figure 13.1-11 Type EV3 (LRFR & LFR Methods)



$\gamma_{LL.EV}$ =	1.30	load factor for EV
$N_{a.EV3}$ =	3	number of axles
$P_{a.tEV3.1}$ =	24 kip	first axle load
s_{a1} =	15 ft	first axle spacing
$P_{a.tEV3.2}$ =	31 kip	second axle load
s_{a2} =	4 ft	second axle spacing
$P_{a.tEV3.3}$ =	31 kip	third axle load

Distribution ***Transverse*** *to Structure Span*

$l_{t.EV3}$ = 9.69 in — tire patch length

Axle SPA #	Interaction Depth $H_{int.t.EV3}$ (ft)	Length Patch $w_{w.EV3}$ (ft)	Condition
1	11.30	6.61	*Not Overlapping*
2	1.73	10.61	*Overlapping*

Distribution ***Parallel*** *to Structure Span*

Axle #	Adjusted Tire Width $w_{t.EV3}$ (in)	Interaction Depth $H_{int.p.EV3}$ (ft)	Length Patch $l_{w.EV3}$ (ft)	Condition
1	15.00	4.13	5.85	*Not Overlapping*
2	19.38	3.81	12.21	*Overlapping*
3	19.38	3.81	12.21	*Overlapping*
1 EV3 truck & 1 Type 3 truck:				
btwn trucks	19.38	2.07	10.21	*Overlapping*

3.4.16 Emergency Vehicle (EV3) Live Load Summary -

Axle #	LL Area $A_{LL.EV3}$ (ft^2)	Crown Pressure $p_{L.EV3}$ (ksf)	Distributed Load udl_{EV3} (klf)
1	38.7	0.362	0.362
2&3	129.6	0.557	0.557
1 EV3 truck & 1 Type 3 truck:			
btwn trucks	193.22	0.48	0.48

NW-12 CULVERT INDEPENDENT CHECK

4. CAPACITY

NW-12 CULVERT INDEPENDENT CHECK

4.1 SHEAR CAPACITY

For 10" depth Slab

Nominal Shear Resistance (AASHTO 5.12.7.3)

Concrete strength	f'c=	6.5	ksi	
Shear resistance factor	ϕ_v =	0.9		Three-sided structure, AASHTO Table 12.5.5.1
Beta	β =	2.0		
Concrete density modification factor	λ =	1.0		
Angle of transv. rebar to long. axis	α =	90	deg	
Effective shear width	b_v =	12	in	
Depth of steel to extreme compression fiber	d_e =	7.63	in	
Effective shear depth	$d_{v1} = 0.9d_e$ =	6.86	in	
	$d_{v2} = 0.72h$ =	7.20	in	
Effective shear depth	$d_v = \max(d_{v1},d_{v2})$ =	7.20	in	

For single-cell box culverts only, V_c for slabs monolithic with walls need not be taken to be less than $0.0948\lambda\sqrt{f'_c}bd_e$, and V_c for slabs simply supported need not be taken to be less than $0.0791\lambda\sqrt{f'_c}bd$. The quantity $V_u d_e/M_u$ shall not be taken to be greater than 1.0 where M_u is the factored moment occurring simultaneously with V_u at the section considered. The provisions of Articles 5.7 and 5.12.8.6 shall apply to slabs of box culverts under less than 2.0 ft of fill and to sidewalls.

AASHTO 5.12.7.3

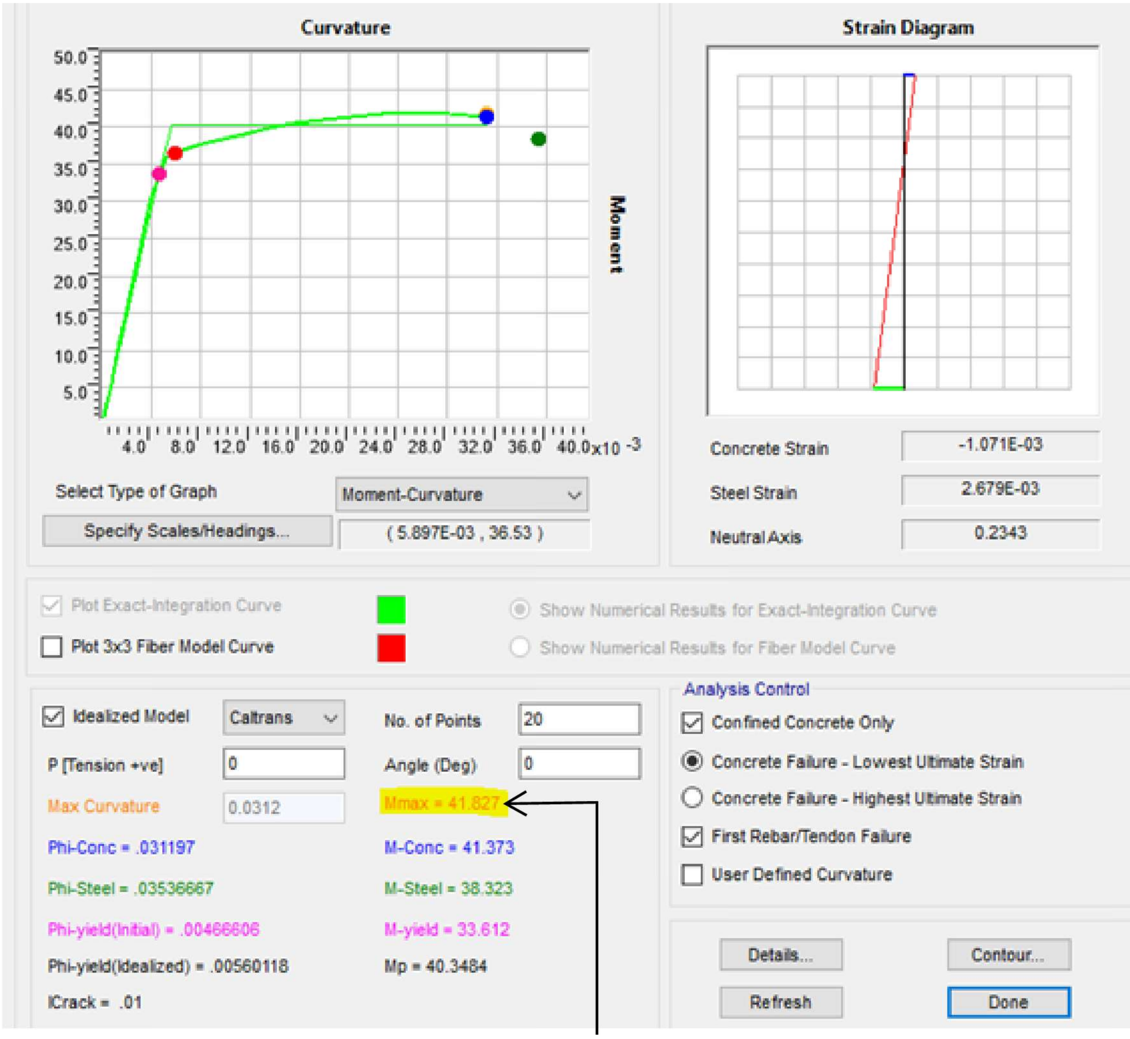
Nominal shear capacity 1	V_{n1} =	20.88	kips	Vc from AASHTO LRFD section 5.12.7.3
Nominal shear capacity 2	V_{n2} =	29.39	kips	0.126*λ*sqrt(f'c)*bv*de. AASHTO LRFD eqn 5.12.7.3-2
	ϕV_n=	18.79	kips	

NW-12 CULVERT INDEPENDENT CHECK

4.2 MOMENT CAPACITY

Moment Capacity

From CSi Section Designer - Slab



Mn = 41.8 k-ft

Reinforced Concrete Cast-in-Place Box Structures	
• Flexure • Shear	0.90 0.85
Reinforced Concrete Precast Box Structures	
• Flexure • Shear	1.00 0.90
Reinforced Concrete Precast Three-Sided Structures	
• Flexure • Shear	0.95 0.90

FMn = 1.0*41.8 k-ft = 41.8 k-ft

NW-12 CULVERT INDEPENDENT CHECK

5. LOAD RATING FACTORS

Comparison of LL Distribution Loads (k/ft) with Maximum and Minimum Fills

HL-93

	Truck	Tandem
Max Fill Dist Load	0.32	0.34
Min Fill Dist Load	0.50	0.49
HL-93 Load Used in RF	0.50	

Note: Minimum fill controls for HL-93

Legal, Permit & Emergency Vehicles

	Type 3	Type 3S2	Type 3-3	NRL	O1	O2	EV2	EV3
Max Fill Max Dist Load	0.234	0.216	0.194	0.190	0.273	0.338	0.341	0.360
Min Fill Max Dist Load	0.378	0.348	0.317	0.282	0.438	0.430	0.485	0.557
Load Used in RF	0.378	0.348	0.317	0.282	0.438	0.430	0.485	0.557

Note: Minimum fill controls for all vehicles above

NW-12 CULVERT INDEPENDENT CHECK

5.1 PINNED CONDITION

I405 BRICKYARD PROJECT - NW12 EXISTING VAULT

HL-93 truck Dist Load = 0.5 k/ft

	Dist Load (k/ft)	Factor
Type 3 =	0.378	0.756
Type 3S2 =	0.348	0.696
Type 3-3 =	0.317	0.634
NRL =	0.282	0.564
OL-1 =	0.438	0.876
OL-2 =	0.430	0.86
EV2 =	0.485	0.97
EV3 =	0.557	1.114

Load Rating factor calculations for pinned end condition:

Moment RF at midspan of top slab

Moment Capacity =	41.80	k-ft	From section designer of CSIBridge (phi factor included)
Moment due to DC=	2.89	k-ft	From CSIBridge
Moment due to DW=	1.52	k-ft	From CSIBridge
Moment due to HL-93 (w impact)=	10.83	k-ft	From CSIBridge
Moment due to Type 3 (w impact) =	8.19	k-ft	
Moment due to Type 3S2 (w impact) =	7.54	k-ft	
Moment due to Type 3-3 (w impact) =	6.87	k-ft	
Moment due to NRL (w impact) =	6.11	k-ft	
Moment due to OL-1 (w impact) =	9.49	k-ft	
Moment due to OL-2 (w impact) =	9.31	k-ft	
Moment due to EV2 (w impact) =	10.51	k-ft	
Moment due to EV3 (w impact) =	12.06	k-ft	
Moment due to EV=	9.53	k-ft	From CSIBridge
Moment due to EH (max)=	-2.78	k-ft	
Moment due to EH (min)=	-1.39	k-ft	
Γ_{DC}=	1.25		
Γ_{DW}=	1.50		
$\Gamma_{LL(Inv\ HL93)}$=	1.75		
$\Gamma_{LL(Oper\ HL93)}$=	1.35		
$\Gamma_{LL(Legal)}$=	2.00		
$\Gamma_{LL(Permit)}$=	1.20		
$\Gamma_{LL(EV)}$=	1.30		
Γ_{EV}=	1.30		
$\Gamma_{EH(min)}$=	1.00		MBE 6A.10.5-1

Chapter 13 — ***Bridge Load Rating***

13.1.1 LRFR Method per the MBE

13.1.1.A Rating Equation

$$RF = \frac{(C - \gamma_{DC}\,DC - \gamma_{DW}\,DW \pm \gamma_P\,P)}{\gamma_{LL}\,LL\,(1+IM)} \qquad (13.1.1A\text{-}1)$$

Where:

- RF = Rating factor
- C = $\phi c\ \phi s\ \phi n\ R_n$, where $\phi c\ \phi s \geq 0.85$ for strength limit state
- C = f_R for service limit state
- R_n = Nominal Capacity of member
- f_R = Allowable Stress per LRFD
- DC = Dead load due to structural components and attachments
- DW = Dead load due to wearing surface and utilities
- P = Permanent loads other than dead loads
- LL = Live load effect
- IM = Dynamic load allowance (Impact)
- $^*\gamma_{DC}$ = Dead load factor for structural components and attachments
- γ_{DW} = Dead load factor for wearing surface (ACP/HMA) and utilities
- γ_P = Load factor for permanent load
- γ_{LL} = Live load factor
- ϕ_c = Condition factor
- ϕ_s = System factor
- ϕ_n = Resistance factor based on construction material

** for concrete overlays use γ_{DC}*

Moment RF (INV) =	**1.31**	BDM 13.1.1.A
Moment RF (OPER) =	**1.70**	
Moment RF (Type 3) =	**1.52**	
Moment RF (Type 3S2) =	**1.65**	
Moment RF (Type 3-3) =	**1.81**	
Moment RF (NRL) =	**2.04**	
Moment RF (OL-1) =	**2.19**	
Moment RF (OL-2) =	**2.23**	
Moment RF (EV2) =	**1.82**	
Moment RF (EV3) =	**1.59**	

Moment RF at support of top slab

Moment Capacity =	41.80	k-ft	From section designer of CSIBridge
Moment due to DC =	1.24	k-ft	From CSIBridge
Moment due to DW =	0.72	k-ft	From CSIBridge
Moment due to HL-93 truck (w impact)=	5.17	k-ft	From CSIBridge
Moment due to Type 3 (w impact) =	3.91	k-ft	
Moment due to Type 3S2 (w impact) =	3.60	k-ft	
Moment due to Type 3-3 (w impact) =	3.28	k-ft	
Moment due to NRL (w impact) =	2.92	k-ft	
Moment due to OL-1 (w impact) =	4.53	k-ft	
Moment due to OL-2 (w impact) =	4.45	k-ft	
Moment due to EV2 (w impact) =	5.01	k-ft	
Moment due to EV3 (w impact) =	5.76	k-ft	
Moment due to EV =	4.55	k-ft	From CSIBridge
Moment due to EH (max) =	2.78	k-ft	From CSIBridge
Moment due to EH (min) =	1.39	k-ft	From CSIBridge
Γ_{DC}=	1.25		
Γ_{DW}=	1.5		
$\Gamma_{LL(Inv\ HL93)}$=	1.75		
$\Gamma_{LL(Oper\ HL93)}$=	1.35		
$\Gamma_{LL(Legal)}$=	2.00		
$\Gamma_{LL(Permit)}$=	1.20		
$\Gamma_{LL(EV)}$=	1.3		
Γ_{EV}=	1.3		
$\Gamma_{EH(max)}$=	1.35		

Moment RF (INV) =	**3.26**	BDM 13.1.1.A
Moment RF (OPER) =	**4.23**	BDM 13.1.1.A
Moment RF (Type 3) =	**3.77**	
Moment RF (Type 3S2) =	**4.10**	
Moment RF (Type 3-3) =	**4.50**	
Moment RF (NRL) =	**5.06**	
Moment RF (OL-1) =	**5.43**	

Moment RF (OL-2) =	**5.53**		
Moment RF (EV2) =	**4.53**		
Moment RF (EV3) =	**3.94**		

Shear RF at support of top slab

Shear Capacity =	18.79	kips	
Shear due to DC=	1.03	kips	From CSIBridge
Shear due to DW=	0.56	kips	From CSIBridge
Shear due to HL-93 truck (w impact)=	4.00	kips	From CSIBridge
Shear due to two HL-93 tandems (w impact)=	3.92	kips	From CSIBridge
Shear due to Type 3 (w impact) =	3.02	kips	
Shear due to Type 3S2 (w impact) =	2.78	kips	
Shear due to Type 3-3 (w impact) =	2.54	kips	
Shear due to NRL (w impact) =	2.26	kips	
Shear due to OL-1 (w impact) =	3.50	kips	
Shear due to OL-2 (w impact) =	3.44	kips	
Shear due to EV2 (w impact) =	3.88	kips	
Shear due to EV3 (w impact) =	4.46	kips	
Shear due to EV=	3.52	kips	From CSIBridge
Shear due to EH (max)=	0	kips	From CSIBridge
Shear due to EH (min)=	0	kips	From CSIBridge

Γ_{DC}=	1.25
Γ_{DW}=	1.5
$\Gamma_{LL(Inv\ HL93)}$=	1.75
$\Gamma_{LL(Oper\ HL93)}$=	1.35
$\Gamma_{LL(Legal)}$=	2.00
$\Gamma_{LL(Permit)}$=	1.20
$\Gamma_{LL(EV)}$=	1.3
Γ_{EV}=	1.3
$\Gamma_{EH(max)}$=	1.35

Shear RF (INV) =	**1.73**	BDM 13.1.1.A
Shear RF (OPER) =	**2.24**	BDM 13.1.1.A
Shear due to Type 3 =	**2.00**	
Shear due to Type 3S2 =	**2.17**	
Shear due to Type 3-3 =	**2.38**	
Shear due to NRL =	**2.68**	
Shear due to OL-1 =	**2.88**	
Shear due to OL-2 =	**2.93**	
Shear due to EV2 =	**2.40**	
Shear due to EV3 =	**2.09**	

NW-12 CULVERT INDEPENDENT CHECK

5.2 FIXED CONDITION

I405 BRICKYARD PROJECT - NW12 EXISTING VAULT

HL-93 truck Dist Load = 0.5 k/ft

	Dist Load (k/ft)	Factor
Type 3 =	0.378	0.756
Type 3S2 =	0.348	0.696
Type 3-3 =	0.317	0.634
NRL =	0.282	0.564
OL-1 =	0.438	0.876
OL-2 =	0.430	0.86
EV2 =	0.485	0.97
EV3 =	0.557	1.114

Load Rating factor calculations for pinned end condition:

Moment RF at midspan of top slab

Moment Capacity =	41.80	k-ft	From section designer of CSIBridge (phi factor included)
Moment due to DC=	2.53	k-ft	From CSIBridge
Moment due to DW=	1.34	k-ft	From CSIBridge
Moment due to HL-93 LL (w impact)=	9.54	k-ft	From CSIBridge
Moment due to Type 3 (w impact) =	7.21	k-ft	
Moment due to Type 3S2 (w impact) =	6.64	k-ft	
Moment due to Type 3-3 (w impact) =	6.05	k-ft	
Moment due to NRL (w impact) =	5.38	k-ft	
Moment due to OL-1 (w impact) =	8.36	k-ft	
Moment due to OL-2 (w impact) =	8.20	k-ft	
Moment due to EV2 (w impact) =	9.25	k-ft	
Moment due to EV3 (w impact) =	10.63	k-ft	
Moment due to EV=	8.39	k-ft	From CSIBridge
Moment due to EH (max) =	-1.39	k-ft	
Moment due to EH (min) =	-0.70	k-ft	

Γ_{DC}=	1.25
Γ_{DW}=	1.50
$\Gamma_{LL(Inv\ HL93)}$=	1.75
$\Gamma_{LL(Oper\ HL93)}$=	1.35
$\Gamma_{LL(Legal)}$=	2.00
$\Gamma_{LL(Permit)}$=	1.20
$\Gamma_{LL(EV)}$=	1.30
Γ_{EV}=	1.30
$\Gamma_{EH(min)}$=	1.00

Chapter 13 — Bridge Load Rating

13.1.1 LRFR Method per the MBE

13.1.1.A Rating Equation

$$RF = \frac{(C - \gamma_{DC} DC - \gamma_{DW} DW \pm \gamma_p P)}{\gamma_{LL} LL (1+IM)} \quad (13.1.1A\text{-}1)$$

Where:

- RF = Rating factor
- C = $\phi c\ \phi s\ \phi n\ R_n$, where $\phi c\ \phi s \geq 0.85$ for strength limit state
- C = f_R for service limit state
- R_n = Nominal Capacity of member
- f_R = Allowable Stress per LRFD
- DC = Dead load due to structural components and attachments
- DW = Dead load due to wearing surface and utilities
- P = Permanent loads other than dead loads
- LL = Live load effect
- IM = Dynamic load allowance (Impact)
- $^*\gamma_{DC}$ = Dead load factor for structural components and attachments
- γ_{DW} = Dead load factor for wearing surface (ACP/HMA) and utilities
- γ_P = Load factor for permanent load
- γ_{LL} = Live load factor
- ϕ_c = Condition factor
- ϕ_s = System factor
- ϕ_n = Resistance factor based on construction material

** for concrete overlays use γ_{DC}*

Moment RF (INV) =	**1.58**	BDM 13.1.1.A
Moment RF (OPER) =	**2.05**	
Moment RF (Type 3) =	**1.83**	
Moment RF (Type 3S2) =	**1.99**	
Moment RF (Type 3-3) =	**2.18**	
Moment RF (NRL) =	**2.46**	
Moment RF (OL-1) =	**2.63**	
Moment RF (OL-2) =	**2.68**	
Moment RF (EV2) =	**2.20**	
Moment RF (EV3) =	**1.91**	

Moment RF at support of top slab

Moment Capacity =	41.80	k-ft	From section designer of CSIBridge
Moment due to DC=	1.60	k-ft	From CSIBridge
Moment due to DW=	0.90	k-ft	From CSIBridge
Moment due to HL-93 LL (w impact)=	6.46	k-ft	From CSIBridge
Moment due to Type 3 (w impact) =	4.88	k-ft	
Moment due to Type 3S2 (w impact) =	4.50	k-ft	
Moment due to Type 3-3 (w impact) =	4.10	k-ft	
Moment due to NRL (w impact) =	3.64	k-ft	
Moment due to OL-1 (w impact) =	5.66	k-ft	
Moment due to OL-2 (w impact) =	5.56	k-ft	
Moment due to EV2 (w impact) =	6.27	k-ft	
Moment due to EV3 (w impact) =	7.20	k-ft	
Moment due to EV=	5.69	k-ft	From CSIBridge
Moment due to EH (max)=	1.40	k-ft	From CSIBridge
Moment due to EH (min)=	0.70	k-ft	From CSIBridge

Γ_{DC}=	1.25
Γ_{DW}=	1.5
$\Gamma_{LL(Inv\ HL93)}$=	1.75
$\Gamma_{LL(Oper\ HL93)}$=	1.35
$\Gamma_{LL(Legal)}$=	2.00
$\Gamma_{LL(Permit)}$=	1.20
$\Gamma_{LL(EV)}$=	1.3
Γ_{EV}=	1.3
$\Gamma_{EH(max)}$=	1.35

Moment RF (INV) =	**2.58**		BDM 13.1.1.A
Moment RF (OPER) =	**3.34**		BDM 13.1.1.A
Moment RF (Type 3) =	**2.99**		
Moment RF (Type 3S2) =	**3.24**		
Moment RF (Type 3-3) =	**3.56**		
Moment RF (NRL) =	**4.00**		
Moment RF (OL-1) =	**4.29**		
Moment RF (OL-2) =	**4.37**		
Moment RF (EV2) =	**3.58**		
Moment RF (EV3) =	**3.12**		

Shear RF at support of top slab

Shear Capacity =	18.79	kips	
Shear due to DC=	1.03	kips	From CSIBridge
Shear due to DW=	0.56	kips	From CSIBridge
Shear due to HL-93 LL (w impact)=	4.00	kips	From CSIBridge
Shear due to Type 3 (w impact) =	3.02	kips	
Shear due to Type 3S2 (w impact) =	2.78	kips	
Shear due to Type 3-3 (w impact) =	2.54	kips	
Shear due to NRL (w impact) =	2.26	kips	
Shear due to OL-1 (w impact) =	3.504	kips	
Shear due to OL-2 (w impact) =	3.44	kips	
Shear due to EV2 (w impact) =	3.88	kips	
Shear due to EV3 (w impact) =	4.46	kips	
Shear due to EV=	3.52	kips	From CSIBridge
Moment due to EH (max)=	0	kips	From CSIBridge
Moment due to EH (min)=	0	kips	From CSIBridge

Γ_{DC}=	1.25
Γ_{DW}=	1.5
$\Gamma_{LL(Inv\ HL93)}$=	1.75
$\Gamma_{LL(Oper\ HL93)}$=	1.35
$\Gamma_{LL(Legal)}$=	2.00
$\Gamma_{LL(Permit)}$=	1.20
$\Gamma_{LL(EV)}$=	1.3
Γ_{EV}=	1.3
$\Gamma_{EH(max)}$=	1.35

Shear RF (INV) =	**1.73**		BDM 13.1.1.A
Shear RF (OPER) =	**2.24**		BDM 13.1.1.A
Shear RF (Type 3) =	**2.00**		
Shear RF (Type 3S2) =	**2.17**		
Shear RF (Type 3-3) =	**2.38**		
Shear RF (NRL) =	**2.68**		
Shear RF (OL-1) =	**2.88**		
Shear RF (OL-2) =	**2.93**		
Shear RF (EV2) =	**2.40**		
Shear RF (EV3) =	**2.09**		

NW-12 CULVERT INDEPENDENT CHECK

6. STRUCTURAL EVALUATION

NW-12 CULVERT INDEPENDENT CHECK

6.1 PINNED CONDITION

Structural evaluation calculations:

D/C ratio for Moment at midspan of top slab

				CSiBridge Outputs for HL-93 fixed (min fill) (k-ft)
Moment Capacity =	41.80	k-ft	From section designer of CSIBridge	
Moment due to DC=	2.89	k-ft	From CSIBridge	2.89
Moment due to DW=	1.52	k-ft	From CSIBridge	1.52
Moment due to HL-93 truck (w impact)=	10.83	k-ft	From CSIBridge	10.83
Moment due to HL-93 tandem (w impact)=	10.61	k-ft	From CSIBridge	10.61
Moment due to EV=	9.53	k-ft	From CSIBridge	9.53

*no EH for moment at midspan is conservative

Γ_{DC}=	1.25
Γ_{DW}=	1.5
$\Gamma_{LL(HL93)}$=	1.75
Γ_{EV}=	1.3

D/C Ratio for Moment = **0.89**

D/C ratio for Moment at support of top slab <- @ Fillet

				CSiBridge Outputs for HL-93 fixed (min fill) (k-ft)
Moment Capacity =	41.80	k-ft	From section designer of CSIBridge	
Moment due to DC=	1.24	k-ft	From CSIBridge	1.24
Moment due to DW=	0.72	k-ft	From CSIBridge	0.72
Moment due to HL-93 truck (w impact)=	5.17	k-ft	From CSIBridge	5.17
Moment due to HL-93 tandem (w impact)=	5.07	k-ft	From CSIBridge	5.07
Moment due to EV=	4.55	k-ft	From CSIBridge	4.55
Moment due to EH (max)=	2.78	k-ft	From CSIBridge	2.78
Moment due to EH (min)=	1.39	k-ft	From CSIBridge	1.39

Γ_{DC}=	1.25
Γ_{DW}=	1.5
$\Gamma_{LL(Inv\ HL93)}$=	1.75
Γ_{EV}=	1.3
$\Gamma_{EH(max)}$=	1.35

D/C Ratio for Moment = **0.51** using maximum EH

D/C ratio for Shear at support of top slab

				CSiBridge Outputs for HL-93 fixed (min fill) (k-ft)
Shear Capacity =	18.79	kips		
Shear due to DC=	1.03	kips	From CSIBridge	1.03
Shear due to DW=	0.56	kips	From CSIBridge	0.56
Shear due to HL-93 truck (w impact)=	4	kips	From CSIBridge	4
Shear due to HL-93 tandem (w impact)=	3.92	kips	From CSIBridge	3.92
Shear due to EV=	3.52	kips	From CSIBridge	3.52
Moment due to EH (max)=	0	kips	From CSIBridge	0
Moment due to EH (min)=	0	kips	From CSIBridge	0

Γ_{DC}=	1.25
Γ_{DW}=	1.5
$\Gamma_{LL(Inv\ HL93)}$=	1.75
Γ_{EV}=	1.3
$\Gamma_{EH(max)}$=	1.35

D/C Ratio for Shear = **0.73**

NW-12 CULVERT INDEPENDENT CHECK

6.2 FIXED CONDITION

Structural evaluation calculations:

D/C ratio for Moment at midspan of top slab

Moment Capacity =	41.8	k-ft	From section designer of CSIBridge	CSiBridge Outputs for HL-93 pinned (min fill) (k-ft)
Moment due to DC=	2.53	k-ft	From CSIBridge	2.53
Moment due to DW=	1.34	k-ft	From CSIBridge	1.34
Moment due to HL-93 truck (w impact)=	9.54	k-ft	From CSIBridge	9.54
Moment due to HL-93 tandem (w impact)=	9.35		From CSIBridge	9.35
Moment due to EV=	8.39		From CSIBridge	8.39
				*no EH for moment at midspan is conservative
Γ_{DC}=	1.25			
Γ_{DW}=	1.5			
$\Gamma_{LL(HL93)}$=	1.75			
Γ_{EV}=	1.3			
D/C Ratio for Moment =	**0.78**			

D/C ratio for Moment at support of top slab <- @ Fillet

Moment Capacity =	41.8	k-ft	From section designer of CSIBridge	CSiBridge Outputs for HL-93 pinned (min fill) (k-ft)
Moment due to DC=	1.6	k-ft	From CSIBridge	1.60
Moment due to DW=	0.9	k-ft	From CSIBridge	0.90
Moment due to HL-93 truck (w impact)=	6.46	k-ft	From CSIBridge	6.46
Moment due to HL-93 tandem (w impact)=	6.33	k-ft	From CSIBridge	6.33
Moment due to EV=	5.69	k-ft	From CSIBridge	5.69
Moment due to EH (max)=	1.4	k-ft	From CSIBridge	1.40
Moment due to EH (min)=	0.7	k-ft	From CSIBridge	0.70
Γ_{DC}=	1.25			
Γ_{DW}=	1.5			
$\Gamma_{LL(Inv\ HL93)}$=	1.75			
Γ_{EV}=	1.3			
$\Gamma_{EH(max)}$=	1.35			
D/C Ratio for Moment =	**0.57**	using maximum EH		

D/C ratio for Shear at support of top slab

Shear Capacity =	18.79	kips		CSiBridge Outputs for HL-93 pinned (min fill) (k-ft)
Shear due to DC=	1.03	kips	From CSIBridge	1.03
Shear due to DW=	0.56	kips	From CSIBridge	0.56
Shear due to HL-93 truck (w impact)=	4	kips	From CSIBridge	4
Shear due to HL-93 tandem (w impact)=	3.92	kips	From CSIBridge	3.92
Shear due to EV=	3.52	kips	From CSIBridge	3.52
Moment due to EH (max)=	0	kips	From CSIBridge	0
Moment due to EH (min)=	0	kips	From CSIBridge	0
Γ_{DC}=	1.25			
Γ_{DW}=	1.5			
$\Gamma_{LL(Inv\ HL93)}$=	1.75			
Γ_{EV}=	1.3			
$\Gamma_{EH(max)}$=	1.35			
D/C Ratio for Shear =	**0.73**			

NW-12 CULVERT INDEPENDENT CHECK

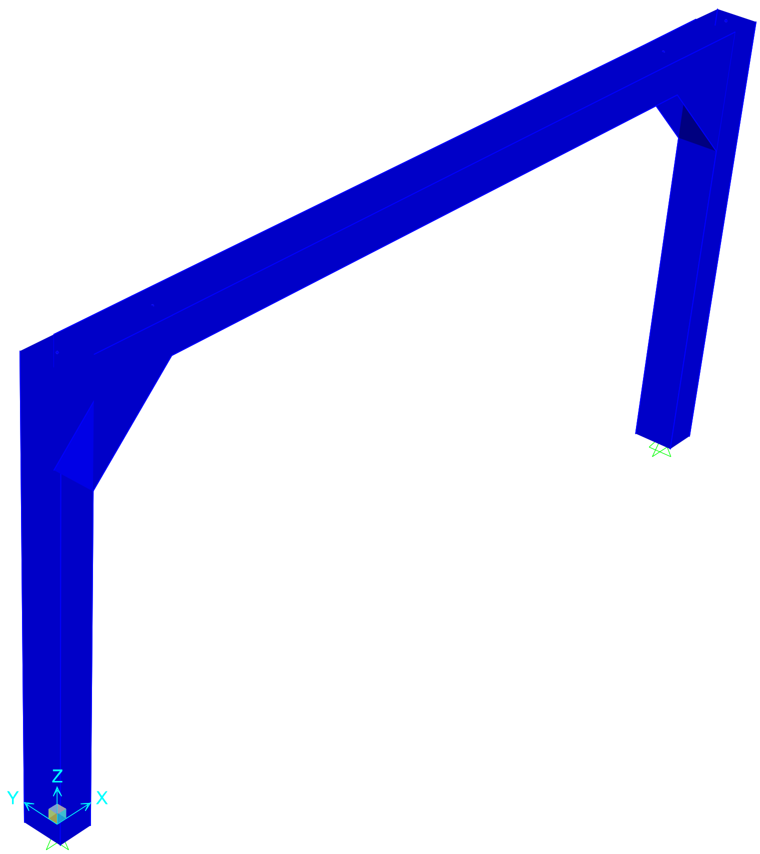
7. APPENDICES

NW-12 CULVERT INDEPENDENT CHECK

7.1 APPENDIX A: CSiBridge Model Results

NW-12 CULVERT INDEPENDENT CHECK

7.1.1 PINNED CONDITION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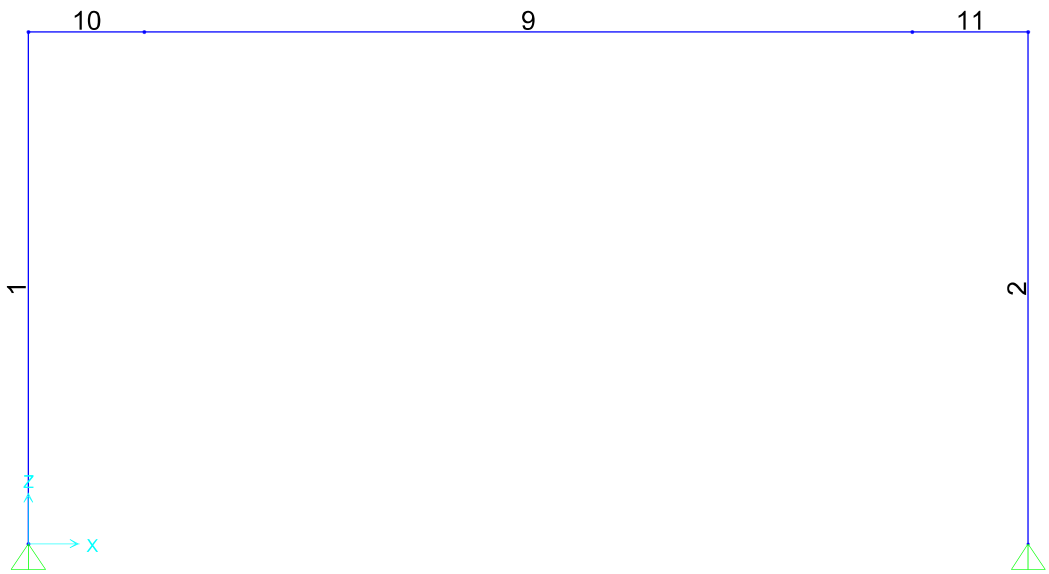
Y
X


10
9
11
1
2
Z
X

AECOM

CSIBRIDGE FRAME DEMAND OUTPUT, PINNED CONDITION MINIMUM FILL

TOP SLAB

Member	Station	Output Case	V2	M3
#	ft		*kip*	*kip-ft*
9	0	DEAD	-1.033	-1.24
9	8	DEAD	-1.04E-12	2.89
9	16	DEAD	1.033	-1.24
9	0	MAX EH	-2.19E-12	-2.78
9	8	MAX EH	-2.19E-12	-2.78
9	16	MAX EH	-2.19E-12	-2.78
9	0	MIN EH	-1.09E-12	-1.39
9	8	MIN EH	-1.09E-12	-1.39
9	16	MIN EH	-1.09E-12	-1.39
9	0	EV	-3.52	-4.55
9	8	EV	3.34E-12	9.53
9	16	EV	3.52	-4.55
9	0	DW	-0.56	-0.72
9	8	DW	5.31E-13	1.52
9	16	DW	0.56	-0.72
9	0	LL-HL93 TRUCK	-4.00	-5.17
9	8	LL-HL93 TRUCK	3.79E-12	10.83
9	16	LL-HL93 TRUCK	4.00	-5.17
9	0	LL-HL-93 TANDEM	-3.92	-5.07
9	8	LL-HL-93 TANDEM	3.72E-12	10.61
9	16	LL-HL-93 TANDEM	3.92	-5.07

Note: Member #9 length is 16 ft.

List of Tables

Table: Case - Static 1 - Load Assignments

Table: Case - Static 1 - Load Assignments

Case	LoadType	LoadName	LoadSF
DEAD	Load pattern	DEAD	1.
Max EH	Load pattern	Max EH	1.
DW	Load pattern	DW	1.
LL-HL93 TRUCK	Load pattern	LL-HL93 TRUCK	1.
LL-HL-93 TANDEM	Load pattern	LL-HL-93 TANDEM	1.
EV	Load pattern	EV	1.
Unit Load	Load pattern	Unit Load	1.
Min EH	Load pattern	Min EH	1.

Table: Connectivity - Frame, Part 1 of 2

Table: Connectivity - Frame, Part 1 of 2

Frame	JointI	JointJ	IsCurved	Length	CentroidX	CentroidY	CentroidZ
				ft	ft	ft	ft
1	6	1	No	10.6667	0.	0.	5.3333
2	7	2	No	10.6667	20.8333	0.	5.3333
9	4	5	No	16.	10.4167	0.	10.6667
10	6	4	No	2.4167	1.2083	0.	10.6667
11	7	5	No	2.4167	19.625	0.	10.6667

Table: Connectivity - Frame, Part 2 of 2

Table: Connectivity - Frame, Part 2 of 2

Frame	GUID
1	2dcd99b0-f597-481c-8c61-4d667a03a521
2	5dbeac1d-9394-4ba2-8a80-cac18a20be51
9	e2681b62-6842-4915-8f43-fe7b4ccf0105
10	12494f3b-e090-4333-8b44-e9230d9badce
11	b150946a-fcb4-47bb-bd37-f84189564700

Table: Element Forces - Frames, Part 1 of 2

Table: Element Forces - Frames, Part 1 of 2

Frame	Station	OutputCase	CaseType	P	V2	V3	T	M2
	ft			Kip	Kip	Kip	Kip-ft	Kip-ft
1	1.4167	DEAD	LinStatic	-2.035	0.445	0.	0.	0.
1	6.0417	DEAD	LinStatic	-2.632	0.445	0.	0.	0.
1	10.6667	DEAD	LinStatic	-3.23	0.445	0.	0.	0.
1	1.4167	Max EH	LinStatic	-1.068E-11	3.007	0.	0.	0.
1	6.0417	Max EH	LinStatic	-1.068E-11	0.177	0.	0.	0.
1	10.6667	Max EH	LinStatic	-1.068E-11	-3.988	0.	0.	0.
1	1.4167	DW	LinStatic	-0.746	0.225	0.	0.	0.

Table: Element Forces - Frames, Part 1 of 2

Frame	Station	OutputCase	CaseType	P	V2	V3	T	M2
	ft			Kip	Kip	Kip	Kip-ft	Kip-ft
1	6.0417	DW	LinStatic	-0.746	0.225	0.	0.	0.
1	10.6667	DW	LinStatic	-0.746	0.225	0.	0.	0.
1	1.4167	LL-HL93 TRUCK	LinStatic	-5.326	1.606	0.	0.	0.
1	6.0417	LL-HL93 TRUCK	LinStatic	-5.326	1.606	0.	0.	0.
1	10.6667	LL-HL93 TRUCK	LinStatic	-5.326	1.606	0.	0.	0.
1	1.4167	LL-HL-93 TANDEM	LinStatic	-5.22	1.574	0.	0.	0.
1	6.0417	LL-HL-93 TANDEM	LinStatic	-5.22	1.574	0.	0.	0.
1	10.6667	LL-HL-93 TANDEM	LinStatic	-5.22	1.574	0.	0.	0.
1	1.4167	EV	LinStatic	-4.687	1.413	0.	0.	0.
1	6.0417	EV	LinStatic	-4.687	1.413	0.	0.	0.
1	10.6667	EV	LinStatic	-4.687	1.413	0.	0.	0.
1	1.4167	Min EH	LinStatic	-5.340E-12	1.503	0.	0.	0.
1	6.0417	Min EH	LinStatic	-5.340E-12	0.089	0.	0.	0.
1	10.6667	Min EH	LinStatic	-5.340E-12	-1.995	0.	0.	0.
2	1.4167	DEAD	LinStatic	-2.035	-0.445	0.	0.	0.
2	6.0417	DEAD	LinStatic	-2.632	-0.445	0.	0.	0.
2	10.6667	DEAD	LinStatic	-3.23	-0.445	0.	0.	0.
2	1.4167	Max EH	LinStatic	1.280E-12	-3.007	0.	0.	0.
2	6.0417	Max EH	LinStatic	1.280E-12	-0.177	0.	0.	0.
2	10.6667	Max EH	LinStatic	1.280E-12	3.988	0.	0.	0.
2	1.4167	DW	LinStatic	-0.746	-0.225	0.	0.	0.
2	6.0417	DW	LinStatic	-0.746	-0.225	0.	0.	0.
2	10.6667	DW	LinStatic	-0.746	-0.225	0.	0.	0.
2	1.4167	LL-HL93 TRUCK	LinStatic	-5.326	-1.606	0.	0.	0.
2	6.0417	LL-HL93 TRUCK	LinStatic	-5.326	-1.606	0.	0.	0.
2	10.6667	LL-HL93 TRUCK	LinStatic	-5.326	-1.606	0.	0.	0.
2	1.4167	LL-HL-93 TANDEM	LinStatic	-5.22	-1.574	0.	0.	0.
2	6.0417	LL-HL-93 TANDEM	LinStatic	-5.22	-1.574	0.	0.	0.
2	10.6667	LL-HL-93 TANDEM	LinStatic	-5.22	-1.574	0.	0.	0.
2	1.4167	EV	LinStatic	-4.687	-1.413	0.	0.	0.
2	6.0417	EV	LinStatic	-4.687	-1.413	0.	0.	0.
2	10.6667	EV	LinStatic	-4.687	-1.413	0.	0.	0.
2	1.4167	Min EH	LinStatic	6.394E-13	-1.503	0.	0.	0.
2	6.0417	Min EH	LinStatic	6.394E-13	-0.089	0.	0.	0.
2	10.6667	Min EH	LinStatic	6.394E-13	1.995	0.	0.	0.
9	0.	DEAD	LinStatic	-0.445	-1.033	0.	0.	0.
9	2.	DEAD	LinStatic	-0.445	-0.775	0.	0.	0.
9	4.	DEAD	LinStatic	-0.445	-0.517	0.	0.	0.
9	6.	DEAD	LinStatic	-0.445	-0.258	0.	0.	0.
9	8.	DEAD	LinStatic	-0.445	1.040E-12	0.	0.	0.
9	10.	DEAD	LinStatic	-0.445	0.258	0.	0.	0.
9	12.	DEAD	LinStatic	-0.445	0.517	0.	0.	0.
9	14.	DEAD	LinStatic	-0.445	0.775	0.	0.	0.
9	16.	DEAD	LinStatic	-0.445	1.033	0.	0.	0.

Table: Element Forces - Frames, Part 1 of 2

Frame	Station	OutputCase	CaseType	P	V2	V3	T	M2
	ft			Kip	Kip	Kip	Kip-ft	Kip-ft
9	0.	Max EH	LinStatic	-3.607	-2.184E-12	0.	0.	0.
9	2.	Max EH	LinStatic	-3.607	-2.184E-12	0.	0.	0.
9	4.	Max EH	LinStatic	-3.607	-2.184E-12	0.	0.	0.
9	6.	Max EH	LinStatic	-3.607	-2.184E-12	0.	0.	0.
9	8.	Max EH	LinStatic	-3.607	-2.184E-12	0.	0.	0.
9	10.	Max EH	LinStatic	-3.607	-2.184E-12	0.	0.	0.
9	12.	Max EH	LinStatic	-3.607	-2.184E-12	0.	0.	0.
9	14.	Max EH	LinStatic	-3.607	-2.184E-12	0.	0.	0.
9	16.	Max EH	LinStatic	-3.607	-2.184E-12	0.	0.	0.
9	0.	DW	LinStatic	-0.225	-0.56	0.	0.	0.
9	2.	DW	LinStatic	-0.225	-0.42	0.	0.	0.
9	4.	DW	LinStatic	-0.225	-0.28	0.	0.	0.
9	6.	DW	LinStatic	-0.225	-0.14	0.	0.	0.
9	8.	DW	LinStatic	-0.225	5.310E-13	0.	0.	0.
9	10.	DW	LinStatic	-0.225	0.14	0.	0.	0.
9	12.	DW	LinStatic	-0.225	0.28	0.	0.	0.
9	14.	DW	LinStatic	-0.225	0.42	0.	0.	0.
9	16.	DW	LinStatic	-0.225	0.56	0.	0.	0.
9	0.	LL-HL93 TRUCK	LinStatic	-1.606	-4.	0.	0.	0.
9	2.	LL-HL93 TRUCK	LinStatic	-1.606	-3.	0.	0.	0.
9	4.	LL-HL93 TRUCK	LinStatic	-1.606	-2.	0.	0.	0.
9	6.	LL-HL93 TRUCK	LinStatic	-1.606	-1.	0.	0.	0.
9	8.	LL-HL93 TRUCK	LinStatic	-1.606	3.792E-12	0.	0.	0.
9	10.	LL-HL93 TRUCK	LinStatic	-1.606	1.	0.	0.	0.
9	12.	LL-HL93 TRUCK	LinStatic	-1.606	2.	0.	0.	0.
9	14.	LL-HL93 TRUCK	LinStatic	-1.606	3.	0.	0.	0.
9	16.	LL-HL93 TRUCK	LinStatic	-1.606	4.	0.	0.	0.
9	0.	LL-HL-93 TANDEM	LinStatic	-1.574	-3.92	0.	0.	0.
9	2.	LL-HL-93 TANDEM	LinStatic	-1.574	-2.94	0.	0.	0.
9	4.	LL-HL-93 TANDEM	LinStatic	-1.574	-1.96	0.	0.	0.
9	6.	LL-HL-93 TANDEM	LinStatic	-1.574	-0.98	0.	0.	0.
9	8.	LL-HL-93 TANDEM	LinStatic	-1.574	3.717E-12	0.	0.	0.
9	10.	LL-HL-93 TANDEM	LinStatic	-1.574	0.98	0.	0.	0.
9	12.	LL-HL-93 TANDEM	LinStatic	-1.574	1.96	0.	0.	0.
9	14.	LL-HL-93 TANDEM	LinStatic	-1.574	2.94	0.	0.	0.
9	16.	LL-HL-93 TANDEM	LinStatic	-1.574	3.92	0.	0.	0.
9	0.	EV	LinStatic	-1.413	-3.52	0.	0.	0.
9	2.	EV	LinStatic	-1.413	-2.64	0.	0.	0.
9	4.	EV	LinStatic	-1.413	-1.76	0.	0.	0.
9	6.	EV	LinStatic	-1.413	-0.88	0.	0.	0.

Table: Element Forces - Frames, Part 1 of 2

Frame	Station	OutputCase	CaseType	P	V2	V3	T	M2
	ft			Kip	Kip	Kip	Kip-ft	Kip-ft
9	8.	EV	LinStatic	-1.413	3.338E-12	0.	0.	0.
9	10.	EV	LinStatic	-1.413	0.88	0.	0.	0.
9	12.	EV	LinStatic	-1.413	1.76	0.	0.	0.
9	14.	EV	LinStatic	-1.413	2.64	0.	0.	0.
9	16.	EV	LinStatic	-1.413	3.52	0.	0.	0.
9	0.	Min EH	LinStatic	-1.802	-1.092E-12	0.	0.	0.
9	2.	Min EH	LinStatic	-1.802	-1.092E-12	0.	0.	0.
9	4.	Min EH	LinStatic	-1.802	-1.092E-12	0.	0.	0.
9	6.	Min EH	LinStatic	-1.802	-1.092E-12	0.	0.	0.
9	8.	Min EH	LinStatic	-1.802	-1.092E-12	0.	0.	0.
9	10.	Min EH	LinStatic	-1.802	-1.092E-12	0.	0.	0.
9	12.	Min EH	LinStatic	-1.802	-1.092E-12	0.	0.	0.
9	14.	Min EH	LinStatic	-1.802	-1.092E-12	0.	0.	0.
9	16.	Min EH	LinStatic	-1.802	-1.092E-12	0.	0.	0.
10	0.4167	DEAD	LinStatic	-1.144	-1.294	0.	0.	0.
10	2.4167	DEAD	LinStatic	-0.86	-0.725	0.	0.	0.
10	0.4167	Max EH	LinStatic	-3.226	1.613	0.	0.	0.
10	2.4167	Max EH	LinStatic	-3.226	1.613	0.	0.	0.
10	0.4167	DW	LinStatic	-0.522	-0.54	0.	0.	0.
10	2.4167	DW	LinStatic	-0.452	-0.4	0.	0.	0.
10	0.4167	LL-HL93 TRUCK	LinStatic	-3.725	-3.859	0.	0.	0.
10	2.4167	LL-HL93 TRUCK	LinStatic	-3.225	-2.859	0.	0.	0.
10	0.4167	LL-HL-93 TANDEM	LinStatic	-3.651	-3.782	0.	0.	0.
10	2.4167	LL-HL-93 TANDEM	LinStatic	-3.161	-2.802	0.	0.	0.
10	0.4167	EV	LinStatic	-3.278	-3.396	0.	0.	0.
10	2.4167	EV	LinStatic	-2.838	-2.516	0.	0.	0.
10	0.4167	Min EH	LinStatic	-1.612	0.806	0.	0.	0.
10	2.4167	Min EH	LinStatic	-1.612	0.806	0.	0.	0.
11	0.4167	DEAD	LinStatic	-1.144	-1.294	0.	0.	0.
11	2.4167	DEAD	LinStatic	-0.86	-0.725	0.	0.	0.
11	0.4167	Max EH	LinStatic	-3.226	1.613	0.	0.	0.
11	2.4167	Max EH	LinStatic	-3.226	1.613	0.	0.	0.
11	0.4167	DW	LinStatic	-0.522	-0.54	0.	0.	0.
11	2.4167	DW	LinStatic	-0.452	-0.4	0.	0.	0.
11	0.4167	LL-HL93 TRUCK	LinStatic	-3.725	-3.859	0.	0.	0.
11	2.4167	LL-HL93 TRUCK	LinStatic	-3.225	-2.859	0.	0.	0.
11	0.4167	LL-HL-93 TANDEM	LinStatic	-3.651	-3.782	0.	0.	0.
11	2.4167	LL-HL-93 TANDEM	LinStatic	-3.161	-2.802	0.	0.	0.
11	0.4167	EV	LinStatic	-3.278	-3.396	0.	0.	0.
11	2.4167	EV	LinStatic	-2.838	-2.516	0.	0.	0.
11	0.4167	Min EH	LinStatic	-1.612	0.806	0.	0.	0.
11	2.4167	Min EH	LinStatic	-1.612	0.806	0.	0.	0.

Table: Element Forces - Frames, Part 2 of 2

Frame	Station ft	OutputCase	M3 Kip-ft	FrameElem	ElemStation ft
1	1.4167	DEAD	4.1165	1-1	1.4167
1	6.0417	DEAD	2.0582	1-1	6.0417
1	10.6667	DEAD	-3.627E-15	1-1	10.6667
1	1.4167	Max EH	-0.4196	1-1	1.4167
1	6.0417	Max EH	-8.2979	1-1	6.0417
1	10.6667	Max EH	4.052E-15	1-1	10.6667
1	1.4167	DW	2.08	1-1	1.4167
1	6.0417	DW	1.04	1-1	6.0417
1	10.6667	DW	-1.140E-15	1-1	10.6667
1	1.4167	LL-HL93 TRUCK	14.8569	1-1	1.4167
1	6.0417	LL-HL93 TRUCK	7.4285	1-1	6.0417
1	10.6667	LL-HL93 TRUCK	-2.692E-15	1-1	10.6667
1	1.4167	LL-HL-93 TANDEM	14.5598	1-1	1.4167
1	6.0417	LL-HL-93 TANDEM	7.2799	1-1	6.0417
1	10.6667	LL-HL-93 TANDEM	-4.885E-15	1-1	10.6667
1	1.4167	EV	13.0741	1-1	1.4167
1	6.0417	EV	6.537	1-1	6.0417
1	10.6667	EV	-7.078E-15	1-1	10.6667
1	1.4167	Min EH	-0.2093	1-1	1.4167
1	6.0417	Min EH	-4.1494	1-1	6.0417
1	10.6667	Min EH	2.012E-15	1-1	10.6667
2	1.4167	DEAD	-4.1165	2-1	1.4167
2	6.0417	DEAD	-2.0582	2-1	6.0417
2	10.6667	DEAD	1.318E-15	2-1	10.6667
2	1.4167	Max EH	0.4196	2-1	1.4167
2	6.0417	Max EH	8.2979	2-1	6.0417
2	10.6667	Max EH	-1.684E-15	2-1	10.6667
2	1.4167	DW	-2.08	2-1	1.4167
2	6.0417	DW	-1.04	2-1	6.0417
2	10.6667	DW	6.060E-16	2-1	10.6667
2	1.4167	LL-HL93 TRUCK	-14.8569	2-1	1.4167
2	6.0417	LL-HL93 TRUCK	-7.4285	2-1	6.0417
2	10.6667	LL-HL93 TRUCK	4.367E-15	2-1	10.6667
2	1.4167	LL-HL-93 TANDEM	-14.5598	2-1	1.4167
2	6.0417	LL-HL-93 TANDEM	-7.2799	2-1	6.0417
2	10.6667	LL-HL-93 TANDEM	6.671E-15	2-1	10.6667
2	1.4167	EV	-13.0741	2-1	1.4167
2	6.0417	EV	-6.537	2-1	6.0417
2	10.6667	EV	1.915E-15	2-1	10.6667
2	1.4167	Min EH	0.2093	2-1	1.4167
2	6.0417	Min EH	4.1494	2-1	6.0417
2	10.6667	Min EH	-2.604E-15	2-1	10.6667
9	0.	DEAD	-1.2415	9	0.

Table: Element Forces - Frames, Part 2 of 2

Frame	Station	OutputCase	M3	FrameElem	ElemStation
	ft		Kip-ft		ft
9	2.	DEAD	0.5668	9	2.
9	4.	DEAD	1.8585	9	4.
9	6.	DEAD	2.6335	9	6.
9	8.	DEAD	2.8918	9	8.
9	10.	DEAD	2.6335	9	10.
9	12.	DEAD	1.8585	9	12.
9	14.	DEAD	0.5668	9	14.
9	16.	DEAD	-1.2415	9	16.
9	0.	Max EH	-2.7771	9	0.
9	2.	Max EH	-2.7771	9	2.
9	4.	Max EH	-2.7771	9	4.
9	6.	Max EH	-2.7771	9	6.
9	8.	Max EH	-2.7771	9	8.
9	10.	Max EH	-2.7771	9	10.
9	12.	Max EH	-2.7771	9	12.
9	14.	Max EH	-2.7771	9	14.
9	16.	Max EH	-2.7771	9	16.
9	0.	DW	-0.7237	9	0.
9	2.	DW	0.2563	9	2.
9	4.	DW	0.9563	9	4.
9	6.	DW	1.3763	9	6.
9	8.	DW	1.5163	9	8.
9	10.	DW	1.3763	9	10.
9	12.	DW	0.9563	9	12.
9	14.	DW	0.2563	9	14.
9	16.	DW	-0.7237	9	16.
9	0.	LL-HL93 TRUCK	-5.1691	9	0.
9	2.	LL-HL93 TRUCK	1.8309	9	2.
9	4.	LL-HL93 TRUCK	6.8309	9	4.
9	6.	LL-HL93 TRUCK	9.8309	9	6.
9	8.	LL-HL93 TRUCK	10.8309	9	8.
9	10.	LL-HL93 TRUCK	9.8309	9	10.
9	12.	LL-HL93 TRUCK	6.8309	9	12.
9	14.	LL-HL93 TRUCK	1.8309	9	14.
9	16.	LL-HL93 TRUCK	-5.1691	9	16.
9	0.	LL-HL-93 TANDEM	-5.0657	9	0.
9	2.	LL-HL-93 TANDEM	1.7943	9	2.
9	4.	LL-HL-93 TANDEM	6.6943	9	4.
9	6.	LL-HL-93 TANDEM	9.6343	9	6.
9	8.	LL-HL-93 TANDEM	10.6143	9	8.
9	10.	LL-HL-93 TANDEM	9.6343	9	10.

Table: Element Forces - Frames, Part 2 of 2

Frame	Station	OutputCase	M3	FrameElem	ElemStation
	ft		Kip-ft		ft
9	12.	LL-HL-93 TANDEM	6.6943	9	12.
9	14.	LL-HL-93 TANDEM	1.7943	9	14.
9	16.	LL-HL-93 TANDEM	-5.0657	9	16.
9	0.	EV	-4.5488	9	0.
9	2.	EV	1.6112	9	2.
9	4.	EV	6.0112	9	4.
9	6.	EV	8.6512	9	6.
9	8.	EV	9.5312	9	8.
9	10.	EV	8.6512	9	10.
9	12.	EV	6.0112	9	12.
9	14.	EV	1.6112	9	14.
9	16.	EV	-4.5488	9	16.
9	0.	Min EH	-1.3885	9	0.
9	2.	Min EH	-1.3885	9	2.
9	4.	Min EH	-1.3885	9	4.
9	6.	Min EH	-1.3885	9	6.
9	8.	Min EH	-1.3885	9	8.
9	10.	Min EH	-1.3885	9	10.
9	12.	Min EH	-1.3885	9	12.
9	14.	Min EH	-1.3885	9	14.
9	16.	Min EH	-1.3885	9	16.
10	0.4167	DEAD	-3.3831	10-2	0.
10	2.4167	DEAD	-1.2415	10-2	2.
10	0.4167	Max EH	0.8295	10-2	0.
10	2.4167	Max EH	-2.7771	10-2	2.
10	0.4167	DW	-1.7753	10-2	0.
10	2.4167	DW	-0.7237	10-2	2.
10	0.4167	LL-HL93 TRUCK	-12.681	10-2	0.
10	2.4167	LL-HL93 TRUCK	-5.1691	10-2	2.
10	0.4167	LL-HL-93 TANDEM	-12.4274	10-2	0.
10	2.4167	LL-HL-93 TANDEM	-5.0657	10-2	2.
10	0.4167	EV	-11.1593	10-2	0.
10	2.4167	EV	-4.5488	10-2	2.
10	0.4167	Min EH	0.4138	10-2	0.
10	2.4167	Min EH	-1.3885	10-2	2.
11	0.4167	DEAD	-3.3831	11-2	0.
11	2.4167	DEAD	-1.2415	11-2	2.
11	0.4167	Max EH	0.8295	11-2	0.
11	2.4167	Max EH	-2.7771	11-2	2.
11	0.4167	DW	-1.7753	11-2	0.
11	2.4167	DW	-0.7237	11-2	2.
11	0.4167	LL-HL93 TRUCK	-12.681	11-2	0.
11	2.4167	LL-HL93 TRUCK	-5.1691	11-2	2.
11	0.4167	LL-HL-93 TANDEM	-12.4274	11-2	0.
11	2.4167	LL-HL-93 TANDEM	-5.0657	11-2	2.

Table: Element Forces - Frames, Part 2 of 2

Frame	Station	OutputCase	M3	FrameElem	ElemStation
	ft		Kip-ft		ft
11	0.4167	EV	-11.1593	11-2	0.
11	2.4167	EV	-4.5488	11-2	2.
11	0.4167	Min EH	0.4138	11-2	0.
11	2.4167	Min EH	-1.3885	11-2	2.

Table: Frame Auto Mesh Assignments

Table: Frame Auto Mesh Assignments

Frame	AutoMesh	AtJoints	AtFrames	NumSegments	MaxLength	MaxDegrees
					ft	Degrees
1	Yes	Yes	No	0	0.	0.
2	Yes	Yes	No	0	0.	0.
9	No	No	No	0	0.	0.
10	No	No	No	0	0.	0.
11	No	No	No	0	0.	0.

Table: Frame Design Procedures

Table: Frame Design Procedures

Frame	DesignProc
1	No Design
2	No Design
9	No Design
10	No Design
11	No Design

Table: Frame Insertion Point Assignments

Table: Frame Insertion Point Assignments

Frame	CardinalPt	Mirror2	Mirror3	Transform
1	10 (centroid)	No	No	Yes
2	10 (centroid)	No	No	Yes
9	8 (top center)	No	No	Yes
10	8 (top center)	No	No	Yes
11	8 (top center)	No	No	Yes

Table: Frame Load Transfer Options

Table: Frame Load Transfer Options

Frame	Transfer
1	Yes
2	Yes
9	Yes
10	Yes
11	Yes

Table: Frame Loads - Distributed, Part 1 of 3

Table: Frame Loads - Distributed, Part 1 of 3

Frame	LoadPat	CoordSys	Type	Dir	DistType	RelDistA
9	DW	GLOBAL	Force	Gravity	RelDist	0.
9	EV	GLOBAL	Force	Gravity	RelDist	0.
9	LL-HL93 TRUCK	GLOBAL	Force	Gravity	RelDist	0.
9	LL-HL-93 TANDEM	GLOBAL	Force	Gravity	RelDist	0.
10	DW	GLOBAL	Force	Gravity	RelDist	0.
10	EV	GLOBAL	Force	Gravity	RelDist	0.
10	LL-HL93 TRUCK	GLOBAL	Force	Gravity	RelDist	0.
10	LL-HL-93 TANDEM	GLOBAL	Force	Gravity	RelDist	0.
11	DW	GLOBAL	Force	Gravity	RelDist	0.
11	EV	GLOBAL	Force	Gravity	RelDist	0.
11	LL-HL93 TRUCK	GLOBAL	Force	Gravity	RelDist	0.
11	LL-HL-93 TANDEM	GLOBAL	Force	Gravity	RelDist	0.
1	Max EH	GLOBAL	Force	X	RelDist	0.
1	Min EH	GLOBAL	Force	X	RelDist	0.
2	Max EH	GLOBAL	Force	X	RelDist	0.
2	Min EH	GLOBAL	Force	X	RelDist	0.

Table: Frame Loads - Distributed, Part 2 of 3

Table: Frame Loads - Distributed, Part 2 of 3

Frame	LoadPat	RelDistB	AbsDistA	AbsDistB	FOverLA	FOverLB
			ft	ft	Kip/ft	Kip/ft
9	DW	1.	0.	16.	0.07	0.07
9	EV	1.	0.	16.	0.44	0.44
9	LL-HL93 TRUCK	1.	0.	16.	0.5	0.5
9	LL-HL-93 TANDEM	1.	0.	16.	0.49	0.49
10	DW	1.	0.	2.4167	0.07	0.07
10	EV	1.	0.	2.4167	0.44	0.44
10	LL-HL93 TRUCK	1.	0.	2.4167	0.5	0.5
10	LL-HL-93 TANDEM	1.	0.	2.4167	0.49	0.49
11	DW	1.	0.	2.4167	0.07	0.07
11	EV	1.	0.	2.4167	0.44	0.44
11	LL-HL93 TRUCK	1.	0.	2.4167	0.5	0.5
11	LL-HL-93 TANDEM	1.	0.	2.4167	0.49	0.49
1	Max EH	1.	0.	10.6667	0.379	1.045
1	Min EH	1.	0.	10.6667	0.189	0.523
2	Max EH	1.	0.	10.6667	-0.379	-1.045
2	Min EH	1.	0.	10.6667	-0.189	-0.523

Table: Frame Loads - Distributed, Part 3 of 3

Table: Frame Loads - Distributed, Part 3 of 3

Frame	LoadPat	GUID
9	DW	290d0e68-0315-4685-ae7d-0ddee0acf898
9	EV	8d373bd3-06dd-467c-9dd1-0e378aa4f33e
9	LL-HL93 TRUCK	44812ded-8e79-490f-b751-87c8ac79ad50

Table: Frame Loads - Distributed, Part 3 of 3

Frame	LoadPat	GUID
9	LL-HL-93 TANDEM	9472fdf5-0f99-49a4-9249-9d32053eabb7
10	DW	da8ac313-5017-4b0a-8163-71c5d00afc5f
10	EV	18dd6280-6b5f-4abe-938b-5ed7f03aba6b
10	LL-HL93 TRUCK	688806c4-c2eb-469b-bfca-145933c42aa3
10	LL-HL-93 TANDEM	c8e9c74b-d516-43b3-8876-a646299c015e
11	DW	9153f1bd-9d7f-4b01-aeb8-98f6810bf9ac
11	EV	b16daf7e-9a5b-4198-8755-5853d30d82e6
11	LL-HL93 TRUCK	12d058c4-fbe9-4afb-92cc-853d62320e98
11	LL-HL-93 TANDEM	f73d532d-3cf1-4dbb-97bb-8e9a011d0ee9
1	Max EH	08bbde81-91b3-444d-870c-800d343e8fba
1	Min EH	bbabf3e1-2c62-4e55-8cb2-b533e2dbd744
2	Max EH	00089407-fd44-467c-bb66-80dda0f6d7ce
2	Min EH	6c9121ec-9a2f-45ec-b1be-25e9fd425601

Table: Frame Offset Along Length Assignments

Table: Frame Offset Along Length Assignments

Frame	Type	LengthI ft	LengthJ ft	RigidFactor
1	Automatic	1.41667	0.	1.
2	Automatic	1.41667	0.	1.
9	User	0.	0.	0.
10	Automatic	0.41667	0.	1.
11	Automatic	0.41667	0.	1.

Table: Frame Output Station Assignments

Table: Frame Output Station Assignments

Frame	StationType	MinNumSta	MaxStaSpcg ft	AddAtElmInt	AddAtPtLoad
1	MinNumSta	3		Yes	Yes
2	MinNumSta	3		Yes	Yes
9	MaxStaSpcg		2.	Yes	Yes
10	MaxStaSpcg		2.	Yes	Yes
11	MaxStaSpcg		2.	Yes	Yes

Table: Frame Section Assignments, Part 1 of 2

Table: Frame Section Assignments, Part 1 of 2

Frame	SectionType	AutoSelect	AnalSect	DesignSect	MatProp
1	Section Designer	N.A.	Wall	N.A.	Default
2	Section Designer	N.A.	Wall	N.A.	Default
9	Section Designer	N.A.	Slab	N.A.	Default
10	Nonprismatic	N.A.	Fillet	N.A.	Default
11	Nonprismatic	N.A.	Fillet	N.A.	Default

Table: Frame Section Assignments, Part 2 of 2

Table: Frame Section Assignments, Part 2 of 2

Frame	NPSectType	NPSectLen	NPSectRD
		ft	
1			
2			
9			
10	Default		
11	Default		

Table: Frame Section Properties 01 - General, Part 1 of 7

Table: Frame Section Properties 01 - General, Part 1 of 7

SectionName	Material	Shape	t3	t2	Area	TorsConst
			ft	ft	ft2	ft4
10x12	6500Psi	Rectangular	0.83333	1.	0.8333	0.095698
12x12	6500Psi	Rectangular	1.	1.	1.	0.140833
Fillet		Nonprismatic				
Fillet Small	6500Psi	SD Section			0.8333	0.096333
Fillet Wide	6500Psi	SD Section			2.8333	0.735663
Slab	6500Psi	SD Section			0.8333	0.096333
Wall	6500Psi	SD Section			0.8333	0.096333

Table: Frame Section Properties 01 - General, Part 2 of 7

Table: Frame Section Properties 01 - General, Part 2 of 7

SectionName	I33	I22	I23	AS2	AS3	S33Top	S33Bot
	ft4	ft4	ft4	ft2	ft2	ft3	ft3
10x12	0.048225	0.069444	0.	0.6944	0.6944	0.115741	0.115741
12x12	0.083333	0.083333	0.	0.8333	0.8333	0.166667	0.166667
Fillet							
Fillet Small	0.048225	0.069444	0.	0.6944	0.6944	0.115741	0.115741
Fillet Wide	1.895448	0.236111	0.	2.3611	2.3611	1.337963	1.337963
Slab	0.048225	0.069444	0.	0.6944	0.6944	0.115741	0.115741
Wall	0.048225	0.069444	0.	0.6944	0.6944	0.115741	0.115741

Table: Frame Section Properties 01 - General, Part 3 of 7

Table: Frame Section Properties 01 - General, Part 3 of 7

SectionName	S22Left	S22Right	Z33	Z22	R33	R22	CGOffset3
	ft3	ft3	ft3	ft3	ft	ft	ft
10x12	0.138889	0.138889	0.173611	0.208333	0.24056	0.28868	0.

Table: Frame Section Properties 01 - General, Part 3 of 7

SectionName	S22Left	S22Right	Z33	Z22	R33	R22	CGOffset3
	ft3	ft3	ft3	ft3	ft	ft	ft
12x12	0.166667	0.166667	0.25	0.25	0.28868	0.28868	0.
Fillet							
Fillet Small	0.138889	0.138889	0.173611	0.208333	0.24056	0.28868	0.
Fillet Wide	0.472222	0.472222	2.006944	0.708333	0.81791	0.28868	0.
Slab	0.138889	0.138889	0.173611	0.208333	0.24056	0.28868	0.
Wall	0.138889	0.138889	0.173611	0.208333	0.24056	0.28868	0.

Table: Frame Section Properties 01 - General, Part 4 of 7

Table: Frame Section Properties 01 - General, Part 4 of 7

SectionName	CGOffset2	EccV2	EccV3	Cw	ConcCol	ConcBeam	Color
	ft	ft	ft	ft6			
10x12	0.	0.	0.	0.	Yes	No	Red
12x12	0.	0.	0.	0.	Yes	No	Green
Fillet							Gray8Dark
Fillet Small	0.	0.	0.	0.	No	No	Yellow
Fillet Wide	0.	0.	0.	0.	No	No	Cyan
Slab	0.	0.	0.	0.	No	No	Red
Wall	0.	0.	0.	0.	No	No	Blue

Table: Frame Section Properties 01 - General, Part 5 of 7

Table: Frame Section Properties 01 - General, Part 5 of 7

SectionName	TotalWt	TotalMass	FromFile	AMod	A2Mod	A3Mod	JMod
	Kip	Kip-s2/ft					
10x12	0.	0.	No	1.	1.	1.	1.
12x12	0.	0.	No	1.	1.	1.	1.
Fillet	1.649	5.127E-02					
Fillet Small	0.	0.	No	1.	1.	1.	1.
Fillet Wide	0.	0.	No	1.	1.	1.	1.
Slab	2.067	6.423E-02	No	1.	1.	1.	1.
Wall	2.756	8.565E-02	No	1.	1.	1.	1.

Table: Frame Section Properties 01 - General, Part 6 of 7

Table: Frame Section Properties 01 - General, Part 6 of 7

SectionName	I2Mod	I3Mod	MMod	WMod	GUID
10x12	1.	1.	1.	1.	2c896abc-a828-409d-8cfc-d44c671fe50d
12x12	1.	1.	1.	1.	ef9d842a-47d5-4c62-89a2-5f27d528722d
Fillet					378ebe5f-bb91-42d3-a9e2-d3c5b2ec1587
Fillet Small	1.	1.	1.	1.	3f3e5357-e3bb-4589-8a1f-c305c9403827
Fillet Wide	1.	1.	1.	1.	248cbf9e-4cee-4e47-8814-7a3977296d50
Slab	1.	1.	1.	1.	4e363f34-6443-4a27-ab3c-7caa32a4e42d
Wall	1.	1.	1.	1.	c373bd2c-492a-4dda-8bb9-365d72062656

Table: Frame Section Properties 01 - General, Part 7 of 7

Table: Frame Section Properties 01 - General, Part 7 of 7

SectionName	Notes
10x12	Added 8/9/2025 12:27:57 AM
12x12	Added 8/9/2025 12:27:27 AM
Fillet	Added 9/22/2025 5:07:29 PM
Fillet Small	Added 9/22/2025 5:05:43 PM
Fillet Wide	Added 9/22/2025 5:02:47 PM
Slab	Added 9/22/2025 1:30:48 PM
Wall	Added 9/23/2025 3:27:07 PM

Table: Joint Coordinates, Part 1 of 2

Table: Joint Coordinates, Part 1 of 2

Joint	CoordSys	CoordType	XorR	Y	Z	SpecialJt	GlobalX
			ft	ft	ft		ft
1	GLOBAL	Cartesian	0.	0.	0.	Yes	0.
2	GLOBAL	Cartesian	20.8333	0.	0.	Yes	20.8333
4	GLOBAL	Cartesian	2.4167	0.	10.6667	Yes	2.4167
5	GLOBAL	Cartesian	18.4167	0.	10.6667	Yes	18.4167
6	GLOBAL	Cartesian	0.	0.	10.6667	No	0.
7	GLOBAL	Cartesian	20.8333	0.	10.6667	No	20.8333

Table: Joint Coordinates, Part 2 of 2

Table: Joint Coordinates, Part 2 of 2

Joint	GlobalY	GlobalZ	GUID
	ft	ft	
1	0.	0.	20bffeb1-7139-4923-a402-6a6de5242086
2	0.	0.	fa9afa9c-c9bd-4366-87b4-b63f54ee58d2
4	0.	10.6667	9350834e-3fa5-41ff-8d87-07e85dd8e266
5	0.	10.6667	e8f6242e-497b-4864-a3f2-949fa3945686
6	0.	10.6667	320bf24a-dcee-4da5-94ef-a5162780f833
7	0.	10.6667	494fe73b-1b11-4a41-bd7e-146c79897beb

Table: Joint Restraint Assignments

Table: Joint Restraint Assignments

Joint	U1	U2	U3	R1	R2	R3
1	Yes	Yes	Yes	No	No	No
2	Yes	Yes	Yes	No	No	No

Table: Link Property Definitions 01 - General, Part 1 of 3

Table: Link Property Definitions 01 - General, Part 1 of 3

Link	LinkType	Mass	Weight	RotInert1	RotInert2	RotInert3	DefLength
		Kip-s2/ft	Kip	Kip-ft-s2	Kip-ft-s2	Kip-ft-s2	ft
LINK1	Linear	0.	0.	0.	0.	0.	0.08333
Rigid LK	Linear	0.	0.	0.	0.	0.	0.08333

Table: Link Property Definitions 01 - General, Part 2 of 3

Table: Link Property Definitions 01 - General, Part 2 of 3

Link	DefArea	PDM2I	PDM2J	PDM3I	PDM3J	StiffDFact	Color
	ft2						
LINK1	0.0069	0.	0.	0.	0.	1.	Yellow
Rigid LK	0.0069	0.	0.	0.	0.	1.	Yellow

Table: Link Property Definitions 01 - General, Part 3 of 3

Table: Link Property Definitions 01 - General, Part 3 of 3

Link	GUID	Notes
LINK1	42272bd8-588c-48d7-97bb-3f7e02585879	Added 8/9/2025 12:29:51 AM
Rigid LK	bc900310-34f4-457a-8335-c550f80c0593	Added 8/9/2025 9:57:39 PM

Table: Link Property Definitions 02 - Linear

Table: Link Property Definitions 02 - Linear

Link	DOF	Fixed	TransKE	TransCE
			Kip/ft	Kip-s/ft
LINK1	U1	No	12.	0.
Rigid LK	U1	Yes		
Rigid LK	U2	Yes		
Rigid LK	U3	Yes		
Rigid LK	R1	Yes		
Rigid LK	R2	Yes		
Rigid LK	R3	Yes		

Table: Load Case Definitions, Part 1 of 3

Table: Load Case Definitions, Part 1 of 3

Case	Type	InitialCond	ModalCase	BaseCase	MassSource	DesTypeOpt	DesignType
DEAD	LinStatic	Zero				Prog Det	Dead
MODAL	LinModal	Zero				Prog Det	Other
Max EH	LinStatic	Zero				Prog Det	Dead
DW	LinStatic	Zero				Prog Det	Dead
LL-HL93 TRUCK	LinStatic	Zero				Prog Det	Dead
LL-HL-93 TANDEM	LinStatic	Zero				Prog Det	Dead
EV	LinStatic	Zero				Prog Det	Dead
Unit Load	LinStatic	Zero				Prog Det	Dead
Min EH	LinStatic	Zero				Prog Det	Dead

Table: Load Case Definitions, Part 2 of 3

Table: Load Case Definitions, Part 2 of 3

Case	DesActOpt	DesignAct	AutoType	RunCase	CaseStatus	GUID
DEAD	Prog Det	Non-Composite	None	Yes	Finished	ae956d17-40d1-4e7f-9714-7df5bf75d86d
MODAL	Prog Det	Other	None	No	Not Run	1e732a0a-83b8-487a-b703-105358a3125e
Max EH	Prog Det	Non-Composite	None	Yes	Finished	0dd49601-5d61-4332-afaf-8e3b874a2dcf
DW	Prog Det	Non-Composite	None	Yes	Finished	ebdcce01-de40-4e6e-af16-6779a29af740
LL-HL93 TRUCK	Prog Det	Non-Composite	None	Yes	Finished	0296b74a-9ceb-4db0-8c40-f5087b83a777
LL-HL-93 TANDEM	Prog Det	Non-Composite	None	Yes	Finished	cf2bca0c-68d4-4d84-924b-4cc4227a8a31
EV	Prog Det	Non-Composite	None	Yes	Finished	265a0aee-bca1-459a-8953-f8356c127cdc
Unit Load	Prog Det	Non-Composite	None	No	Not Run	c96576d3-11da-4bd1-a4d7-2868178810a7
Min EH	Prog Det	Non-Composite	None	Yes	Finished	8f62e889-b807-40fb-b77f-861ee44ef536

Table: Load Case Definitions, Part 3 of 3

Table: Load Case Definitions, Part 3 of 3

Case	Notes
DEAD	
MODAL	
Max EH	
DW	
LL-HL93 TRUCK	
LL-HL-93 TANDEM	
EV	
Unit Load	
Min EH	

Table: Load Pattern Definitions

Table: Load Pattern Definitions

LoadPat	DesignType	SelfWtMult	AutoLoad	GUID	Notes
DEAD	Dead	1.		4cf4e507-b462-45d8-ae2a-4aef1aacac93	
Max EH	Dead	0.		fc216621-b047-415c-b62e-47680c7d9fd6	Added 8/9/2025 12:33:18 AM
DW	Dead	0.		7cff2c05-8d31-48ac-b626-bd8aa40caf7f	Added 8/9/2025 12:40:49 AM
LL-HL93 TRUCK	Dead	0.		713c5ac7-6f16-4661-a3c7-4a827dde024b	Added 8/9/2025 12:53:37 AM
LL-HL-93 TANDEM	Dead	0.		89695f19-31bb-4e05-a274-4fd63b436725	Added 9/26/2025 11:14:37 AM

Table: Load Pattern Definitions

LoadPat	DesignType	SelfWtMult	AutoLoad	GUID	Notes
EV	Dead	0.		be03650e-772e-4986-afdd-6210a53b3691	Added 9/30/2025 1:20:58 PM
Min EH	Dead	0.		573978f6-4a3b-48e5-979a-64e985e38f70	Added 10/6/2025 11:10:16 AM

Table: Material Properties 01 - General, Part 1 of 2

Table: Material Properties 01 - General, Part 1 of 2

Material	Type	Grade	SymType	TempDepend	Color	GUID
6500Psi	Concrete	f'c 6500 psi	Isotropic	No	Blue	2ed16f06-7449-46f6-8a33-2b900cea8a73
A416Gr270	Tendon	Grade 270	Uniaxial	No	Gray8Dark	e2f1ea47-3677-4ba9-8721-508907ff7bca
A615Gr60	Rebar	Grade 60	Uniaxial	No	Yellow	a215b18a-238c-471a-a755-12e8eb47f5ba
A709Gr50	Steel	Grade 50	Isotropic	No	Gray8Dark	21c10362-2094-486d-bec4-360137ad0349

Table: Material Properties 01 - General, Part 2 of 2

Table: Material Properties 01 - General, Part 2 of 2

Material	Notes
6500Psi	Customary f'c 4000 psi 8/9/2025 12:24:54 AM
A416Gr270	ASTM A416 Grade 270 8/9/2025 12:27:04 AM
A615Gr60	ASTM A615 Grade 60 8/9/2025 12:27:04 AM
A709Gr50	ASTM A709 Grade 50 8/9/2025 12:24:54 AM

Table: Material Properties 02 - Basic Mechanical Properties

Table: Material Properties 02 - Basic Mechanical Properties

Material	UnitWeight	UnitMass	E1	G12	U12	A1
	Kip/ft3	Kip-s2/ft4	Kip/ft2	Kip/ft2		1/F
6500Psi	1.5500E-01	4.8175E-03	721087.2	300453.	0.2	5.5000E-06
A416Gr270	4.9000E-01	1.5230E-02	4104000.			6.5000E-06
A615Gr60	4.9000E-01	1.5230E-02	4176000.			6.5000E-06
A709Gr50	4.9000E-01	1.5230E-02	4176000.	1606153.85	0.3	6.5000E-06

Table: Material Properties 03a - Steel Data, Part 1 of 2

Table: Material Properties 03a - Steel Data, Part 1 of 2

Material	Fy	Fu	EffFy	EffFu	SSCurveOpt	SSHysType	SHard	SMax
	Kip/ft2	Kip/ft2	Kip/ft2	Kip/ft2				
A709Gr50	7200.	9360.	7920.	10296.	Simple	Kinematic	0.015	0.11

Table: Material Properties 03a - Steel Data, Part 2 of 2

Table: Material Properties 03a - Steel Data, Part 2 of 2

Material	SRup	FinalSlope	CoupModType
A709Gr50	0.17	-0.1	Von Mises

Table: Material Properties 03b - Concrete Data, Part 1 of 2

Table: Material Properties 03b - Concrete Data, Part 1 of 2

Material	Fc	eFc	LtWtConc	SSCurveOpt	SSHysType	SFc	SCap	FinalSlope
	Kip/ft2	Kip/ft2						
6500Psi	936.	936.	No	Mander	Takeda	0.002219	0.005	-0.1

Table: Material Properties 03b - Concrete Data, Part 2 of 2

Table: Material Properties 03b - Concrete Data, Part 2 of 2

Material	FAngle	DAngle	CoupModType
	Degrees	Degrees	
6500Psi	0.	0.	Modified Darwin-Pecknold

Table: Material Properties 03e - Rebar Data, Part 1 of 2

Table: Material Properties 03e - Rebar Data, Part 1 of 2

Material	Fy	Fu	EffFy	EffFu	SSCurveOpt	SSHysType	SHard	SCap
	Kip/ft2	Kip/ft2	Kip/ft2	Kip/ft2				
A615Gr60	8640.	12960.	8640.	12960.	Simple	Kinematic	0.015	0.06

Table: Material Properties 03e - Rebar Data, Part 2 of 2

Table: Material Properties 03e - Rebar Data, Part 2 of 2

Material	FinalSlope	UseCTDef	CoupModType
A615Gr60	-0.1	No	Von Mises

Table: Objects And Elements - Frames

Table: Objects And Elements - Frames

FrameElem	FrameObject	ElemJtI	ElemJtJ
9	9	4	5
10-1	10	6	~1
10-2	10	~1	4
11-1	11	7	~2
11-2	11	~2	5
1-1	1	6	1
2-1	2	7	2

Table: Rebar Sizes

Table: Rebar Sizes

RebarID	Area	Diameter
	ft2	ft
#2	0.000347	0.02083
#3	0.000764	0.03125
#4	0.001389	0.04167
#5	0.002153	0.05208
#6	0.003056	0.0625
#7	0.004167	0.07292
#8	0.005486	0.08333
#9	0.006944	0.094
#10	0.008819	0.10583
#11	0.010833	0.1175
#14	0.015625	0.14108
#18	0.027778	0.18808
10M	0.001076	0.03707
15M	0.002153	0.05249
20M	0.003229	0.06398
25M	0.005382	0.08268
30M	0.007535	0.0981
35M	0.010764	0.11713
45M	0.016146	0.14337
55M	0.02691	0.18504
6d	0.000305	0.01969
8d	0.000541	0.02625
10d	0.000845	0.03281
12d	0.001216	0.03937
14d	0.001658	0.04593
16d	0.002164	0.05249
20d	0.00338	0.06562
25d	0.005285	0.08202
26d	0.005716	0.0853
28d	0.006631	0.09186
N12	0.001216	0.03937
N16	0.002164	0.05249
N20	0.00338	0.06562
N24	0.004865	0.07874
N28	0.006631	0.09186
N32	0.008654	0.10499
N36	0.010979	0.11811

Table: Section Designer Properties 01 - General, Part 1 of 6

Table: Section Designer Properties 01 - General, Part 1 of 6

SectionName	DesignType	DsgnOrChck	BaseMat	IncludeVStr	AxisAngle	MeshSzAbs
					Degrees	ft
Fillet Small	No Check/Design	Check	6500Psi	No	90.	0.
Fillet Wide	No Check/Design	Check	6500Psi	No	90.	0.
Slab	No Check/Design	Check	6500Psi	No	90.	0.
Wall	No Check/Design	Check	6500Psi	No	90.	0.

Table: Section Designer Properties 01 - General, Part 2 of 6

Table: Section Designer Properties 01 - General, Part 2 of 6

SectionName	MeshSzRel	SizeShell	SizeSolid	RefinedMesh	BSectType	nTotalShp	nIWideFlng
		ft	ft				
Fillet Small	0.05					1	0
Fillet Wide	0.05					1	0
Slab	0.05					7	0
Wall	0.05					1	0

Table: Section Designer Properties 01 - General, Part 3 of 6

Table: Section Designer Properties 01 - General, Part 3 of 6

SectionName	nChannel	nTee	nAngle	nDblAngle	nBoxTube	nPipe	nPlate
Fillet Small	0	0	0	0	0	0	0
Fillet Wide	0	0	0	0	0	0	0
Slab	0	0	0	0	0	0	0
Wall	0	0	0	0	0	0	0

Table: Section Designer Properties 01 - General, Part 4 of 6

Table: Section Designer Properties 01 - General, Part 4 of 6

SectionName	nSolidRect	nSolidCirc	nSolidSeg	nSolidSect	nPolygon	nReinfSing	nReinfLine
Fillet Small	1	0	0	0	0	0	0
Fillet Wide	1	0	0	0	0	0	0
Slab	1	0	0	0	0	6	0
Wall	1	0	0	0	0	0	0

Table: Section Designer Properties 01 - General, Part 5 of 6

Table: Section Designer Properties 01 - General, Part 5 of 6

SectionName	nReinfRect	nReinfCirc	nRefLine	nRefCirc	nCaltransSq	nCaltransCr	nCaltransHx
Fillet Small	0	0	0	0	0	0	0
Fillet Wide	0	0	0	0	0	0	0
Slab	0	0	0	0	0	0	0
Wall	0	0	0	0	0	0	0

Table: Section Designer Properties 01 - General, Part 6 of 6

Table: Section Designer Properties 01 - General, Part 6 of 6

SectionName	nCaltransOc	nBSectShell	nBSectSolid	nBSectCut	nBSectCentr
Fillet Small	0	0	0	0	0
Fillet Wide	0	0	0	0	0
Slab	0	0	0	0	0
Wall	0	0	0	0	0

Table: Section Designer Properties 12 - Shape Solid Rectangle, Part 1 of 4

Table: Section Designer Properties 12 - Shape Solid Rectangle, Part 1 of 4

SectionName	ShapeName	ShapeMat	ZOrder	FillColor	XCenter	YCenter	Height
					ft	ft	ft
Fillet Small	Rectangle1	6500Psi	1	Blue	0.	0.	0.83333
Fillet Wide	Rectangle1	6500Psi	1	Blue	0.	0.	2.83333
Slab	Rectangle1	6500Psi	1	Yellow	0.	0.	0.83333
Wall	Rectangle1	6500Psi	1	Yellow	0.	0.	0.83333

Table: Section Designer Properties 12 - Shape Solid Rectangle, Part 2 of 4

Table: Section Designer Properties 12 - Shape Solid Rectangle, Part 2 of 4

SectionName	ShapeName	Width	Rotation	Reinforcing	CoreDim	BCoreMajor	BCoreMinor
		ft	Degrees			ft	ft
Fillet Small	Rectangle1	1.	0.	No	Program Determined	0.8	0.66667
Fillet Wide	Rectangle1	1.	0.	No	Program Determined	0.8	2.26667
Slab	Rectangle1	1.	0.	No	Program Determined	0.8	0.66667
Wall	Rectangle1	1.	0.	No	Program Determined	0.8	0.66667

Table: Section Designer Properties 12 - Shape Solid Rectangle, Part 3 of 4

Table: Section Designer Properties 12 - Shape Solid Rectangle, Part 3 of 4

SectionName	ShapeName	DCoreMajor Positive	DCoreMajor Negative	DCoreMinor Positive	DCoreMinor Negative	RebarMat	BarMatType
		ft	ft	ft	ft		
Fillet Small	Rectangle1	0.75	0.75	0.9	0.9		
Fillet Wide	Rectangle1	2.55	2.55	0.9	0.9		
Slab	Rectangle1	0.75	0.75	0.9	0.9		
Wall	Rectangle1	0.75	0.75	0.9	0.9		

Table: Section Designer Properties 12 - Shape Solid Rectangle, Part 4 of 4

Table: Section Designer Properties 12 - Shape Solid Rectangle, Part 4 of 4

SectionName	ShapeName	ConcCover	ManderPlace
Fillet Small	Rectangle1		
Fillet Wide	Rectangle1		
Slab	Rectangle1		
Wall	Rectangle1		

Table: Section Designer Properties 17 - Shape Reinforcing Single, Part 1 of 2

Table: Section Designer Properties 17 - Shape Reinforcing Single, Part 1 of 2

SectionName	ShapeName	ShapeMat	MatType	XCenter	YCenter	BarSize	TendonForce
				ft	ft		Kip
Slab	SingleBar1	A615Gr60	Rebar	0.	0.21917	User	
Slab	SingleBar2	A615Gr60	Rebar	0.41667	0.21917	User	
Slab	SingleBar3	A615Gr60	Rebar	-0.41667	0.21917	User	
Slab	SingleBar4	A615Gr60	Rebar	-0.41667	-0.21917	User	
Slab	SingleBar5	A615Gr60	Rebar	0.	-0.21917	User	
Slab	SingleBar6	A615Gr60	Rebar	0.41667	-0.21917	User	

Table: Section Designer Properties 17 - Shape Reinforcing Single, Part 2 of 2

Table: Section Designer Properties 17 - Shape Reinforcing Single, Part 2 of 2

SectionName	ShapeName	BarArea
		ft2
Slab	SingleBar1	0.002431
Slab	SingleBar2	0.002431
Slab	SingleBar3	0.002431
Slab	SingleBar4	0.002431
Slab	SingleBar5	0.002431
Slab	SingleBar6	0.002431

Table: Section Designer Properties 30 - Fiber General, Part 1 of 2

Table: Section Designer Properties 30 - Fiber General, Part 1 of 2

SectionName	NumFibersD2	NumFibersD3	CoordSys	GridAngle	LumpRebar	FiberPMM
Fillet Small	3	3	Cartesian	0	No	No
Fillet Wide	3	3	Cartesian	0	No	No
Slab	3	3	Cartesian	0	No	No
Wall	3	3	Cartesian	0	No	No

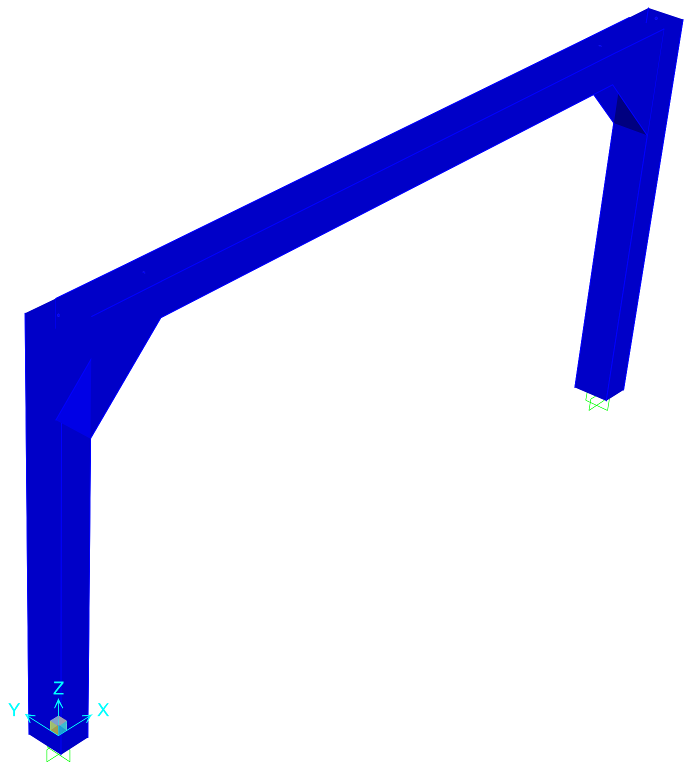
Table: Section Designer Properties 30 - Fiber General, Part 2 of 2

Table: Section Designer Properties 30 - Fiber General, Part 2 of 2

SectionName	FiberMC
Fillet Small	No
Fillet Wide	No
Slab	No
Wall	No

NW-12 CULVERT INDEPENDENT CHECK

7.1.2 FIXED CONDITION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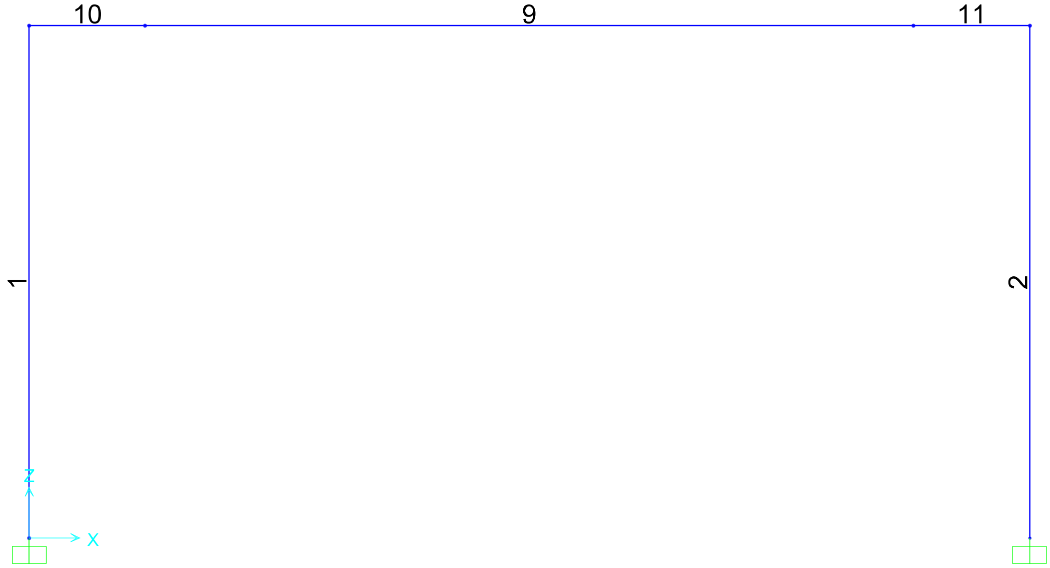

10
9
11
1
2
Z
X

AECOM

CSIBRIDGE FRAME DEMAND OUTPUT, FIXED CONDITION MINIMUM FILL

TOP SLAB

Member	Station	Output Case	V2	M3
#	ft		*kip*	*kip-ft*
9	0	DEAD	-1.033	-1.60
9	8	DEAD	-8.48E-13	2.53
9	16	DEAD	1.033	-1.60
9	0	MAX EH	1.14E-12	-1.40
9	8	MAX EH	1.14E-12	-1.40
9	16	MAX EH	1.14E-12	-1.40
9	0	MIN EH	5.71E-13	-0.70
9	8	MIN EH	5.71E-13	-0.70
9	16	MIN EH	5.71E-13	-0.70
9	0	EV	-3.52	-5.69
9	8	EV	-2.71E-12	8.39
9	16	EV	3.52	-5.69
9	0	DW	-0.56	-0.90
9	8	DW	-4.31E-13	1.34
9	16	DW	0.56	0.90
9	0	LL-HL93 TRUCK	-4.00	-6.46
9	8	LL-HL93 TRUCK	3.08E-12	9.54
9	16	LL-HL93 TRUCK	4.00	-6.46
9	0	LL-HL-93 TANDEM	-3.92	-6.33
9	8	LL-HL-93 TANDEM	-3.01E-12	9.35
9	16	LL-HL-93 TANDEM	3.92	-6.33

Note: Member #9 length is 16 ft.

List of Tables

Table: Case - Static 1 - Load Assignments

Table: Case - Static 1 - Load Assignments

Case	LoadType	LoadName	LoadSF
DEAD	Load pattern	DEAD	1.
Max EH	Load pattern	Max EH	1.
DW	Load pattern	DW	1.
LL-HL93 TRUCK	Load pattern	LL-HL93 TRUCK	1.
LL-HL-93 TANDEM	Load pattern	LL-HL-93 TANDEM	1.
EV	Load pattern	EV	1.
Unit Load	Load pattern	Unit Load	1.
Min EH	Load pattern	Min EH	1.

Table: Connectivity - Frame, Part 1 of 2

Table: Connectivity - Frame, Part 1 of 2

Frame	JointI	JointJ	IsCurved	Length	CentroidX	CentroidY	CentroidZ
				ft	ft	ft	ft
1	6	1	No	10.6667	0.	0.	5.3333
2	7	2	No	10.6667	20.8333	0.	5.3333
9	4	5	No	16.	10.4167	0.	10.6667
10	6	4	No	2.4167	1.2083	0.	10.6667
11	7	5	No	2.4167	19.625	0.	10.6667

Table: Connectivity - Frame, Part 2 of 2

Table: Connectivity - Frame, Part 2 of 2

Frame	GUID
1	2dcd99b0-f597-481c-8c61-4d667a03a521
2	5dbeac1d-9394-4ba2-8a80-cac18a20be51
9	e2681b62-6842-4915-8f43-fe7b4ccf0105
10	12494f3b-e090-4333-8b44-e9230d9badce
11	b150946a-fcb4-47bb-bd37-f84189564700

Table: Element Forces - Frames, Part 1 of 2

Table: Element Forces - Frames, Part 1 of 2

Frame	Station	OutputCase	CaseType	P	V2	V3	T	M2
	ft			Kip	Kip	Kip	Kip-ft	Kip-ft
1	1.4167	DEAD	LinStatic	-2.035	0.71	0.	0.	0.
1	6.0417	DEAD	LinStatic	-2.632	0.71	0.	0.	0.
1	10.6667	DEAD	LinStatic	-3.23	0.71	0.	0.	0.
1	1.4167	Max EH	LinStatic	-1.514E-12	1.987	0.	0.	0.
1	6.0417	Max EH	LinStatic	-1.514E-12	-0.843	0.	0.	0.
1	10.6667	Max EH	LinStatic	-1.514E-12	-5.008	0.	0.	0.
1	1.4167	DW	LinStatic	-0.746	0.359	0.	0.	0.

Table: Element Forces - Frames, Part 1 of 2

Frame	Station	OutputCase	CaseType	P	V2	V3	T	M2
	ft			Kip	Kip	Kip	Kip-ft	Kip-ft
1	6.0417	DW	LinStatic	-0.746	0.359	0.	0.	0.
1	10.6667	DW	LinStatic	-0.746	0.359	0.	0.	0.
1	1.4167	LL-HL93 TRUCK	LinStatic	-5.326	2.564	0.	0.	0.
1	6.0417	LL-HL93 TRUCK	LinStatic	-5.326	2.564	0.	0.	0.
1	10.6667	LL-HL93 TRUCK	LinStatic	-5.326	2.564	0.	0.	0.
1	1.4167	LL-HL-93 TANDEM	LinStatic	-5.22	2.513	0.	0.	0.
1	6.0417	LL-HL-93 TANDEM	LinStatic	-5.22	2.513	0.	0.	0.
1	10.6667	LL-HL-93 TANDEM	LinStatic	-5.22	2.513	0.	0.	0.
1	1.4167	EV	LinStatic	-4.687	2.256	0.	0.	0.
1	6.0417	EV	LinStatic	-4.687	2.256	0.	0.	0.
1	10.6667	EV	LinStatic	-4.687	2.256	0.	0.	0.
1	1.4167	Min EH	LinStatic	-7.569E-13	0.993	0.	0.	0.
1	6.0417	Min EH	LinStatic	-7.569E-13	-0.421	0.	0.	0.
1	10.6667	Min EH	LinStatic	-7.569E-13	-2.505	0.	0.	0.
2	1.4167	DEAD	LinStatic	-2.035	-0.71	0.	0.	0.
2	6.0417	DEAD	LinStatic	-2.632	-0.71	0.	0.	0.
2	10.6667	DEAD	LinStatic	-3.23	-0.71	0.	0.	0.
2	1.4167	Max EH	LinStatic	-5.876E-12	-1.987	0.	0.	0.
2	6.0417	Max EH	LinStatic	-5.876E-12	0.843	0.	0.	0.
2	10.6667	Max EH	LinStatic	-5.876E-12	5.008	0.	0.	0.
2	1.4167	DW	LinStatic	-0.746	-0.359	0.	0.	0.
2	6.0417	DW	LinStatic	-0.746	-0.359	0.	0.	0.
2	10.6667	DW	LinStatic	-0.746	-0.359	0.	0.	0.
2	1.4167	LL-HL93 TRUCK	LinStatic	-5.326	-2.564	0.	0.	0.
2	6.0417	LL-HL93 TRUCK	LinStatic	-5.326	-2.564	0.	0.	0.
2	10.6667	LL-HL93 TRUCK	LinStatic	-5.326	-2.564	0.	0.	0.
2	1.4167	LL-HL-93 TANDEM	LinStatic	-5.22	-2.513	0.	0.	0.
2	6.0417	LL-HL-93 TANDEM	LinStatic	-5.22	-2.513	0.	0.	0.
2	10.6667	LL-HL-93 TANDEM	LinStatic	-5.22	-2.513	0.	0.	0.
2	1.4167	EV	LinStatic	-4.687	-2.256	0.	0.	0.
2	6.0417	EV	LinStatic	-4.687	-2.256	0.	0.	0.
2	10.6667	EV	LinStatic	-4.687	-2.256	0.	0.	0.
2	1.4167	Min EH	LinStatic	-2.942E-12	-0.993	0.	0.	0.
2	6.0417	Min EH	LinStatic	-2.942E-12	0.421	0.	0.	0.
2	10.6667	Min EH	LinStatic	-2.942E-12	2.505	0.	0.	0.
9	0.	DEAD	LinStatic	-0.71	-1.033	0.	0.	0.
9	2.	DEAD	LinStatic	-0.71	-0.775	0.	0.	0.
9	4.	DEAD	LinStatic	-0.71	-0.517	0.	0.	0.
9	6.	DEAD	LinStatic	-0.71	-0.258	0.	0.	0.
9	8.	DEAD	LinStatic	-0.71	-8.480E-13	0.	0.	0.
9	10.	DEAD	LinStatic	-0.71	0.258	0.	0.	0.
9	12.	DEAD	LinStatic	-0.71	0.517	0.	0.	0.
9	14.	DEAD	LinStatic	-0.71	0.775	0.	0.	0.
9	16.	DEAD	LinStatic	-0.71	1.033	0.	0.	0.

Table: Element Forces - Frames, Part 1 of 2

Frame	Station	OutputCase	CaseType	P	V2	V3	T	M2
	ft			Kip	Kip	Kip	Kip-ft	Kip-ft
9	0.	Max EH	LinStatic	-2.586	1.141E-12	0.	0.	0.
9	2.	Max EH	LinStatic	-2.586	1.141E-12	0.	0.	0.
9	4.	Max EH	LinStatic	-2.586	1.141E-12	0.	0.	0.
9	6.	Max EH	LinStatic	-2.586	1.141E-12	0.	0.	0.
9	8.	Max EH	LinStatic	-2.586	1.141E-12	0.	0.	0.
9	10.	Max EH	LinStatic	-2.586	1.141E-12	0.	0.	0.
9	12.	Max EH	LinStatic	-2.586	1.141E-12	0.	0.	0.
9	14.	Max EH	LinStatic	-2.586	1.141E-12	0.	0.	0.
9	16.	Max EH	LinStatic	-2.586	1.141E-12	0.	0.	0.
9	0.	DW	LinStatic	-0.359	-0.56	0.	0.	0.
9	2.	DW	LinStatic	-0.359	-0.42	0.	0.	0.
9	4.	DW	LinStatic	-0.359	-0.28	0.	0.	0.
9	6.	DW	LinStatic	-0.359	-0.14	0.	0.	0.
9	8.	DW	LinStatic	-0.359	-4.308E-13	0.	0.	0.
9	10.	DW	LinStatic	-0.359	0.14	0.	0.	0.
9	12.	DW	LinStatic	-0.359	0.28	0.	0.	0.
9	14.	DW	LinStatic	-0.359	0.42	0.	0.	0.
9	16.	DW	LinStatic	-0.359	0.56	0.	0.	0.
9	0.	LL-HL93 TRUCK	LinStatic	-2.564	-4.	0.	0.	0.
9	2.	LL-HL93 TRUCK	LinStatic	-2.564	-3.	0.	0.	0.
9	4.	LL-HL93 TRUCK	LinStatic	-2.564	-2.	0.	0.	0.
9	6.	LL-HL93 TRUCK	LinStatic	-2.564	-1.	0.	0.	0.
9	8.	LL-HL93 TRUCK	LinStatic	-2.564	-3.077E-12	0.	0.	0.
9	10.	LL-HL93 TRUCK	LinStatic	-2.564	1.	0.	0.	0.
9	12.	LL-HL93 TRUCK	LinStatic	-2.564	2.	0.	0.	0.
9	14.	LL-HL93 TRUCK	LinStatic	-2.564	3.	0.	0.	0.
9	16.	LL-HL93 TRUCK	LinStatic	-2.564	4.	0.	0.	0.
9	0.	LL-HL-93 TANDEM	LinStatic	-2.513	-3.92	0.	0.	0.
9	2.	LL-HL-93 TANDEM	LinStatic	-2.513	-2.94	0.	0.	0.
9	4.	LL-HL-93 TANDEM	LinStatic	-2.513	-1.96	0.	0.	0.
9	6.	LL-HL-93 TANDEM	LinStatic	-2.513	-0.98	0.	0.	0.
9	8.	LL-HL-93 TANDEM	LinStatic	-2.513	-3.015E-12	0.	0.	0.
9	10.	LL-HL-93 TANDEM	LinStatic	-2.513	0.98	0.	0.	0.
9	12.	LL-HL-93 TANDEM	LinStatic	-2.513	1.96	0.	0.	0.
9	14.	LL-HL-93 TANDEM	LinStatic	-2.513	2.94	0.	0.	0.
9	16.	LL-HL-93 TANDEM	LinStatic	-2.513	3.92	0.	0.	0.
9	0.	EV	LinStatic	-2.256	-3.52	0.	0.	0.
9	2.	EV	LinStatic	-2.256	-2.64	0.	0.	0.
9	4.	EV	LinStatic	-2.256	-1.76	0.	0.	0.
9	6.	EV	LinStatic	-2.256	-0.88	0.	0.	0.

Table: Element Forces - Frames, Part 1 of 2

Frame	Station	OutputCase	CaseType	P	V2	V3	T	M2
	ft			Kip	Kip	Kip	Kip-ft	Kip-ft
9	8.	EV	LinStatic	-2.256	-2.709E-12	0.	0.	0.
9	10.	EV	LinStatic	-2.256	0.88	0.	0.	0.
9	12.	EV	LinStatic	-2.256	1.76	0.	0.	0.
9	14.	EV	LinStatic	-2.256	2.64	0.	0.	0.
9	16.	EV	LinStatic	-2.256	3.52	0.	0.	0.
9	0.	Min EH	LinStatic	-1.292	5.706E-13	0.	0.	0.
9	2.	Min EH	LinStatic	-1.292	5.706E-13	0.	0.	0.
9	4.	Min EH	LinStatic	-1.292	5.706E-13	0.	0.	0.
9	6.	Min EH	LinStatic	-1.292	5.706E-13	0.	0.	0.
9	8.	Min EH	LinStatic	-1.292	5.706E-13	0.	0.	0.
9	10.	Min EH	LinStatic	-1.292	5.706E-13	0.	0.	0.
9	12.	Min EH	LinStatic	-1.292	5.706E-13	0.	0.	0.
9	14.	Min EH	LinStatic	-1.292	5.706E-13	0.	0.	0.
9	16.	Min EH	LinStatic	-1.292	5.706E-13	0.	0.	0.
10	0.4167	DEAD	LinStatic	-1.382	-1.175	0.	0.	0.
10	2.4167	DEAD	LinStatic	-1.097	-0.607	0.	0.	0.
10	0.4167	Max EH	LinStatic	-2.313	1.157	0.	0.	0.
10	2.4167	Max EH	LinStatic	-2.313	1.157	0.	0.	0.
10	0.4167	DW	LinStatic	-0.641	-0.48	0.	0.	0.
10	2.4167	DW	LinStatic	-0.571	-0.34	0.	0.	0.
10	0.4167	LL-HL93 TRUCK	LinStatic	-4.582	-3.431	0.	0.	0.
10	2.4167	LL-HL93 TRUCK	LinStatic	-4.082	-2.431	0.	0.	0.
10	0.4167	LL-HL-93 TANDEM	LinStatic	-4.49	-3.362	0.	0.	0.
10	2.4167	LL-HL-93 TANDEM	LinStatic	-4.	-2.382	0.	0.	0.
10	0.4167	EV	LinStatic	-4.032	-3.019	0.	0.	0.
10	2.4167	EV	LinStatic	-3.592	-2.139	0.	0.	0.
10	0.4167	Min EH	LinStatic	-1.156	0.578	0.	0.	0.
10	2.4167	Min EH	LinStatic	-1.156	0.578	0.	0.	0.
11	0.4167	DEAD	LinStatic	-1.382	-1.175	0.	0.	0.
11	2.4167	DEAD	LinStatic	-1.097	-0.607	0.	0.	0.
11	0.4167	Max EH	LinStatic	-2.313	1.157	0.	0.	0.
11	2.4167	Max EH	LinStatic	-2.313	1.157	0.	0.	0.
11	0.4167	DW	LinStatic	-0.641	-0.48	0.	0.	0.
11	2.4167	DW	LinStatic	-0.571	-0.34	0.	0.	0.
11	0.4167	LL-HL93 TRUCK	LinStatic	-4.582	-3.431	0.	0.	0.
11	2.4167	LL-HL93 TRUCK	LinStatic	-4.082	-2.431	0.	0.	0.
11	0.4167	LL-HL-93 TANDEM	LinStatic	-4.49	-3.362	0.	0.	0.
11	2.4167	LL-HL-93 TANDEM	LinStatic	-4.	-2.382	0.	0.	0.
11	0.4167	EV	LinStatic	-4.032	-3.019	0.	0.	0.
11	2.4167	EV	LinStatic	-3.592	-2.139	0.	0.	0.
11	0.4167	Min EH	LinStatic	-1.156	0.578	0.	0.	0.
11	2.4167	Min EH	LinStatic	-1.156	0.578	0.	0.	0.

Table: Element Forces - Frames, Part 2 of 2

Frame	Station	OutputCase	M3	FrameElem	ElemStation
	ft		Kip-ft		ft
1	1.4167	DEAD	4.2095	1-1	1.4167
1	6.0417	DEAD	0.9243	1-1	6.0417
1	10.6667	DEAD	-2.361	1-1	10.6667
1	1.4167	Max EH	-0.7773	1-1	1.4167
1	6.0417	Max EH	-3.9377	1-1	6.0417
1	10.6667	Max EH	9.0781	1-1	10.6667
1	1.4167	DW	2.127	1-1	1.4167
1	6.0417	DW	0.4669	1-1	6.0417
1	10.6667	DW	-1.1932	1-1	10.6667
1	1.4167	LL-HL93 TRUCK	15.1928	1-1	1.4167
1	6.0417	LL-HL93 TRUCK	3.3349	1-1	6.0417
1	10.6667	LL-HL93 TRUCK	-8.5229	1-1	10.6667
1	1.4167	LL-HL-93 TANDEM	14.8889	1-1	1.4167
1	6.0417	LL-HL-93 TANDEM	3.2682	1-1	6.0417
1	10.6667	LL-HL-93 TANDEM	-8.3525	1-1	10.6667
1	1.4167	EV	13.3696	1-1	1.4167
1	6.0417	EV	2.9347	1-1	6.0417
1	10.6667	EV	-7.5002	1-1	10.6667
1	1.4167	Min EH	-0.3882	1-1	1.4167
1	6.0417	Min EH	-1.969	1-1	6.0417
1	10.6667	Min EH	4.5398	1-1	10.6667
2	1.4167	DEAD	-4.2095	2-1	1.4167
2	6.0417	DEAD	-0.9243	2-1	6.0417
2	10.6667	DEAD	2.361	2-1	10.6667
2	1.4167	Max EH	0.7773	2-1	1.4167
2	6.0417	Max EH	3.9377	2-1	6.0417
2	10.6667	Max EH	-9.0781	2-1	10.6667
2	1.4167	DW	-2.127	2-1	1.4167
2	6.0417	DW	-0.4669	2-1	6.0417
2	10.6667	DW	1.1932	2-1	10.6667
2	1.4167	LL-HL93 TRUCK	-15.1928	2-1	1.4167
2	6.0417	LL-HL93 TRUCK	-3.3349	2-1	6.0417
2	10.6667	LL-HL93 TRUCK	8.5229	2-1	10.6667
2	1.4167	LL-HL-93 TANDEM	-14.8889	2-1	1.4167
2	6.0417	LL-HL-93 TANDEM	-3.2682	2-1	6.0417
2	10.6667	LL-HL-93 TANDEM	8.3525	2-1	10.6667
2	1.4167	EV	-13.3696	2-1	1.4167
2	6.0417	EV	-2.9347	2-1	6.0417
2	10.6667	EV	7.5002	2-1	10.6667
2	1.4167	Min EH	0.3882	2-1	1.4167
2	6.0417	Min EH	1.969	2-1	6.0417
2	10.6667	Min EH	-4.5398	2-1	10.6667
9	0.	DEAD	-1.5999	9	0.

Table: Element Forces - Frames, Part 2 of 2

Frame	Station	OutputCase	M3	FrameElem	ElemStation
	ft		Kip-ft		ft
9	2.	DEAD	0.2085	9	2.
9	4.	DEAD	1.5001	9	4.
9	6.	DEAD	2.2751	9	6.
9	8.	DEAD	2.5335	9	8.
9	10.	DEAD	2.2751	9	10.
9	12.	DEAD	1.5001	9	12.
9	14.	DEAD	0.2085	9	14.
9	16.	DEAD	-1.5999	9	16.
9	0.	Max EH	-1.3992	9	0.
9	2.	Max EH	-1.3992	9	2.
9	4.	Max EH	-1.3992	9	4.
9	6.	Max EH	-1.3992	9	6.
9	8.	Max EH	-1.3992	9	8.
9	10.	Max EH	-1.3992	9	10.
9	12.	Max EH	-1.3992	9	12.
9	14.	Max EH	-1.3992	9	14.
9	16.	Max EH	-1.3992	9	16.
9	0.	DW	-0.9048	9	0.
9	2.	DW	0.0752	9	2.
9	4.	DW	0.7752	9	4.
9	6.	DW	1.1952	9	6.
9	8.	DW	1.3352	9	8.
9	10.	DW	1.1952	9	10.
9	12.	DW	0.7752	9	12.
9	14.	DW	0.0752	9	14.
9	16.	DW	-0.9048	9	16.
9	0.	LL-HL93 TRUCK	-6.4627	9	0.
9	2.	LL-HL93 TRUCK	0.5373	9	2.
9	4.	LL-HL93 TRUCK	5.5373	9	4.
9	6.	LL-HL93 TRUCK	8.5373	9	6.
9	8.	LL-HL93 TRUCK	9.5373	9	8.
9	10.	LL-HL93 TRUCK	8.5373	9	10.
9	12.	LL-HL93 TRUCK	5.5373	9	12.
9	14.	LL-HL93 TRUCK	0.5373	9	14.
9	16.	LL-HL93 TRUCK	-6.4627	9	16.
9	0.	LL-HL-93 TANDEM	-6.3334	9	0.
9	2.	LL-HL-93 TANDEM	0.5266	9	2.
9	4.	LL-HL-93 TANDEM	5.4266	9	4.
9	6.	LL-HL-93 TANDEM	8.3666	9	6.
9	8.	LL-HL-93 TANDEM	9.3466	9	8.
9	10.	LL-HL-93 TANDEM	8.3666	9	10.

Table: Element Forces - Frames, Part 2 of 2

Frame	Station	OutputCase	M3	FrameElem	ElemStation
	ft		Kip-ft		ft
9	12.	LL-HL-93 TANDEM	5.4266	9	12.
9	14.	LL-HL-93 TANDEM	0.5266	9	14.
9	16.	LL-HL-93 TANDEM	-6.3334	9	16.
9	0.	EV	-5.6872	9	0.
9	2.	EV	0.4728	9	2.
9	4.	EV	4.8728	9	4.
9	6.	EV	7.5128	9	6.
9	8.	EV	8.3928	9	8.
9	10.	EV	7.5128	9	10.
9	12.	EV	4.8728	9	12.
9	14.	EV	0.4728	9	14.
9	16.	EV	-5.6872	9	16.
9	0.	Min EH	-0.6995	9	0.
9	2.	Min EH	-0.6995	9	2.
9	4.	Min EH	-0.6995	9	4.
9	6.	Min EH	-0.6995	9	6.
9	8.	Min EH	-0.6995	9	8.
9	10.	Min EH	-0.6995	9	10.
9	12.	Min EH	-0.6995	9	12.
9	14.	Min EH	-0.6995	9	14.
9	16.	Min EH	-0.6995	9	16.
10	0.4167	DEAD	-3.4761	10-2	0.
10	2.4167	DEAD	-1.5999	10-2	2.
10	0.4167	Max EH	1.1872	10-2	0.
10	2.4167	Max EH	-1.3992	10-2	2.
10	0.4167	DW	-1.8224	10-2	0.
10	2.4167	DW	-0.9048	10-2	2.
10	0.4167	LL-HL93 TRUCK	-13.0169	10-2	0.
10	2.4167	LL-HL93 TRUCK	-6.4627	10-2	2.
10	0.4167	LL-HL-93 TANDEM	-12.7565	10-2	0.
10	2.4167	LL-HL-93 TANDEM	-6.3334	10-2	2.
10	0.4167	EV	-11.4548	10-2	0.
10	2.4167	EV	-5.6872	10-2	2.
10	0.4167	Min EH	0.5927	10-2	0.
10	2.4167	Min EH	-0.6995	10-2	2.
11	0.4167	DEAD	-3.4761	11-2	0.
11	2.4167	DEAD	-1.5999	11-2	2.
11	0.4167	Max EH	1.1872	11-2	0.
11	2.4167	Max EH	-1.3992	11-2	2.
11	0.4167	DW	-1.8224	11-2	0.
11	2.4167	DW	-0.9048	11-2	2.
11	0.4167	LL-HL93 TRUCK	-13.0169	11-2	0.
11	2.4167	LL-HL93 TRUCK	-6.4627	11-2	2.
11	0.4167	LL-HL-93 TANDEM	-12.7565	11-2	0.
11	2.4167	LL-HL-93 TANDEM	-6.3334	11-2	2.

Table: Element Forces - Frames, Part 2 of 2

Frame	Station	OutputCase	M3	FrameElem	ElemStation
	ft		Kip-ft		ft
11	0.4167	EV	-11.4548	11-2	0.
11	2.4167	EV	-5.6872	11-2	2.
11	0.4167	Min EH	0.5927	11-2	0.
11	2.4167	Min EH	-0.6995	11-2	2.

Table: Frame Auto Mesh Assignments

Table: Frame Auto Mesh Assignments

Frame	AutoMesh	AtJoints	AtFrames	NumSegments	MaxLength	MaxDegrees
					ft	Degrees
1	Yes	Yes	No	0	0.	0.
2	Yes	Yes	No	0	0.	0.
9	No	No	No	0	0.	0.
10	No	No	No	0	0.	0.
11	No	No	No	0	0.	0.

Table: Frame Design Procedures

Table: Frame Design Procedures

Frame	DesignProc
1	No Design
2	No Design
9	No Design
10	No Design
11	No Design

Table: Frame Insertion Point Assignments

Table: Frame Insertion Point Assignments

Frame	CardinalPt	Mirror2	Mirror3	Transform
1	10 (centroid)	No	No	Yes
2	10 (centroid)	No	No	Yes
9	8 (top center)	No	No	Yes
10	8 (top center)	No	No	Yes
11	8 (top center)	No	No	Yes

Table: Frame Load Transfer Options

Table: Frame Load Transfer Options

Frame	Transfer
1	Yes
2	Yes
9	Yes
10	Yes
11	Yes

Table: Frame Loads - Distributed, Part 1 of 3

Table: Frame Loads - Distributed, Part 1 of 3

Frame	LoadPat	CoordSys	Type	Dir	DistType	RelDistA
9	DW	GLOBAL	Force	Gravity	RelDist	0.
9	EV	GLOBAL	Force	Gravity	RelDist	0.
9	LL-HL93 TRUCK	GLOBAL	Force	Gravity	RelDist	0.
9	LL-HL-93 TANDEM	GLOBAL	Force	Gravity	RelDist	0.
10	DW	GLOBAL	Force	Gravity	RelDist	0.
10	EV	GLOBAL	Force	Gravity	RelDist	0.
10	LL-HL93 TRUCK	GLOBAL	Force	Gravity	RelDist	0.
10	LL-HL-93 TANDEM	GLOBAL	Force	Gravity	RelDist	0.
11	DW	GLOBAL	Force	Gravity	RelDist	0.
11	EV	GLOBAL	Force	Gravity	RelDist	0.
11	LL-HL93 TRUCK	GLOBAL	Force	Gravity	RelDist	0.
11	LL-HL-93 TANDEM	GLOBAL	Force	Gravity	RelDist	0.
1	Max EH	GLOBAL	Force	X	RelDist	0.
1	Min EH	GLOBAL	Force	X	RelDist	0.
2	Max EH	GLOBAL	Force	X	RelDist	0.
2	Min EH	GLOBAL	Force	X	RelDist	0.

Table: Frame Loads - Distributed, Part 2 of 3

Table: Frame Loads - Distributed, Part 2 of 3

Frame	LoadPat	RelDistB	AbsDistA	AbsDistB	FOverLA	FOverLB
			ft	ft	Kip/ft	Kip/ft
9	DW	1.	0.	16.	0.07	0.07
9	EV	1.	0.	16.	0.44	0.44
9	LL-HL93 TRUCK	1.	0.	16.	0.5	0.5
9	LL-HL-93 TANDEM	1.	0.	16.	0.49	0.49
10	DW	1.	0.	2.4167	0.07	0.07
10	EV	1.	0.	2.4167	0.44	0.44
10	LL-HL93 TRUCK	1.	0.	2.4167	0.5	0.5
10	LL-HL-93 TANDEM	1.	0.	2.4167	0.49	0.49
11	DW	1.	0.	2.4167	0.07	0.07
11	EV	1.	0.	2.4167	0.44	0.44
11	LL-HL93 TRUCK	1.	0.	2.4167	0.5	0.5
11	LL-HL-93 TANDEM	1.	0.	2.4167	0.49	0.49
1	Max EH	1.	0.	10.6667	0.379	1.045
1	Min EH	1.	0.	10.6667	0.189	0.523
2	Max EH	1.	0.	10.6667	-0.379	-1.045
2	Min EH	1.	0.	10.6667	-0.189	-0.523

Table: Frame Loads - Distributed, Part 3 of 3

Table: Frame Loads - Distributed, Part 3 of 3

Frame	LoadPat	GUID
9	DW	290d0e68-0315-4685-ae7d-0ddee0acf898
9	EV	8d373bd3-06dd-467c-9dd1-0e378aa4f33e
9	LL-HL93 TRUCK	44812ded-8e79-490f-b751-87c8ac79ad50

Table: Frame Loads - Distributed, Part 3 of 3

Frame	LoadPat	GUID
9	LL-HL-93 TANDEM	9472fdf5-0f99-49a4-9249-9d32053eabb7
10	DW	da8ac313-5017-4b0a-8163-71c5d00afc5f
10	EV	18dd6280-6b5f-4abe-938b-5ed7f03aba6b
10	LL-HL93 TRUCK	688806c4-c2eb-469b-bfca-145933c42aa3
10	LL-HL-93 TANDEM	c8e9c74b-d516-43b3-8876-a646299c015e
11	DW	9153f1bd-9d7f-4b01-aeb8-98f6810bf9ac
11	EV	b16daf7e-9a5b-4198-8755-5853d30d82e6
11	LL-HL93 TRUCK	12d058c4-fbe9-4afb-92cc-853d62320e98
11	LL-HL-93 TANDEM	f73d532d-3cf1-4dbb-97bb-8e9a011d0ee9
1	Max EH	08bbde81-91b3-444d-870c-800d343e8fba
1	Min EH	bbabf3e1-2c62-4e55-8cb2-b533e2dbd744
2	Max EH	00089407-fd44-467c-bb66-80dda0f6d7ce
2	Min EH	6c9121ec-9a2f-45ec-b1be-25e9fd425601

Table: Frame Offset Along Length Assignments

Table: Frame Offset Along Length Assignments

Frame	Type	LengthI	LengthJ	RigidFactor
		ft	ft	
1	Automatic	1.41667	0.	1.
2	Automatic	1.41667	0.	1.
9	User	0.	0.	0.
10	Automatic	0.41667	0.	1.
11	Automatic	0.41667	0.	1.

Table: Frame Output Station Assignments

Table: Frame Output Station Assignments

Frame	StationType	MinNumSta	MaxStaSpcg	AddAtElmInt	AddAtPtLoad
			ft		
1	MinNumSta	3		Yes	Yes
2	MinNumSta	3		Yes	Yes
9	MaxStaSpcg		2.	Yes	Yes
10	MaxStaSpcg		2.	Yes	Yes
11	MaxStaSpcg		2.	Yes	Yes

Table: Frame Section Assignments, Part 1 of 2

Table: Frame Section Assignments, Part 1 of 2

Frame	SectionType	AutoSelect	AnalSect	DesignSect	MatProp
1	Section Designer	N.A.	Wall	N.A.	Default
2	Section Designer	N.A.	Wall	N.A.	Default
9	Section Designer	N.A.	Slab	N.A.	Default
10	Nonprismatic	N.A.	Fillet	N.A.	Default
11	Nonprismatic	N.A.	Fillet	N.A.	Default

Table: Frame Section Assignments, Part 2 of 2

Table: Frame Section Assignments, Part 2 of 2

Frame	NPSectType	NPSectLen	NPSectRD
		ft	
1			
2			
9			
10	Default		
11	Default		

Table: Frame Section Properties 01 - General, Part 1 of 7

Table: Frame Section Properties 01 - General, Part 1 of 7

SectionName	Material	Shape	t3	t2	Area	TorsConst
			ft	ft	ft2	ft4
10x12	6500Psi	Rectangular	0.83333	1.	0.8333	0.095698
12x12	6500Psi	Rectangular	1.	1.	1.	0.140833
Fillet		Nonprismatic				
Fillet Small	6500Psi	SD Section			0.8333	0.096333
Fillet Wide	6500Psi	SD Section			2.8333	0.735663
Slab	6500Psi	SD Section			0.8333	0.096333
Wall	6500Psi	SD Section			0.8333	0.096333

Table: Frame Section Properties 01 - General, Part 2 of 7

Table: Frame Section Properties 01 - General, Part 2 of 7

SectionName	I33	I22	I23	AS2	AS3	S33Top	S33Bot
	ft4	ft4	ft4	ft2	ft2	ft3	ft3
10x12	0.048225	0.069444	0.	0.6944	0.6944	0.115741	0.115741
12x12	0.083333	0.083333	0.	0.8333	0.8333	0.166667	0.166667
Fillet							
Fillet Small	0.048225	0.069444	0.	0.6944	0.6944	0.115741	0.115741
Fillet Wide	1.895448	0.236111	0.	2.3611	2.3611	1.337963	1.337963
Slab	0.048225	0.069444	0.	0.6944	0.6944	0.115741	0.115741
Wall	0.048225	0.069444	0.	0.6944	0.6944	0.115741	0.115741

Table: Frame Section Properties 01 - General, Part 3 of 7

Table: Frame Section Properties 01 - General, Part 3 of 7

SectionName	S22Left	S22Right	Z33	Z22	R33	R22	CGOffset3
	ft3	ft3	ft3	ft3	ft	ft	ft
10x12	0.138889	0.138889	0.173611	0.208333	0.24056	0.28868	0.

Table: Frame Section Properties 01 - General, Part 3 of 7

SectionName	S22Left	S22Right	Z33	Z22	R33	R22	CGOffset3
	ft3	ft3	ft3	ft3	ft	ft	ft
12x12	0.166667	0.166667	0.25	0.25	0.28868	0.28868	0.
Fillet							
Fillet Small	0.138889	0.138889	0.173611	0.208333	0.24056	0.28868	0.
Fillet Wide	0.472222	0.472222	2.006944	0.708333	0.81791	0.28868	0.
Slab	0.138889	0.138889	0.173611	0.208333	0.24056	0.28868	0.
Wall	0.138889	0.138889	0.173611	0.208333	0.24056	0.28868	0.

Table: Frame Section Properties 01 - General, Part 4 of 7

Table: Frame Section Properties 01 - General, Part 4 of 7

SectionName	CGOffset2	EccV2	EccV3	Cw	ConcCol	ConcBeam	Color
	ft	ft	ft	ft6			
10x12	0.	0.	0.	0.	Yes	No	Red
12x12	0.	0.	0.	0.	Yes	No	Green
Fillet							Gray8Dark
Fillet Small	0.	0.	0.	0.	No	No	Yellow
Fillet Wide	0.	0.	0.	0.	No	No	Cyan
Slab	0.	0.	0.	0.	No	No	Red
Wall	0.	0.	0.	0.	No	No	Blue

Table: Frame Section Properties 01 - General, Part 5 of 7

Table: Frame Section Properties 01 - General, Part 5 of 7

SectionName	TotalWt	TotalMass	FromFile	AMod	A2Mod	A3Mod	JMod
	Kip	Kip-s2/ft					
10x12	0.	0.	No	1.	1.	1.	1.
12x12	0.	0.	No	1.	1.	1.	1.
Fillet	1.649	5.127E-02					
Fillet Small	0.	0.	No	1.	1.	1.	1.
Fillet Wide	0.	0.	No	1.	1.	1.	1.
Slab	2.067	6.423E-02	No	1.	1.	1.	1.
Wall	2.756	8.565E-02	No	1.	1.	1.	1.

Table: Frame Section Properties 01 - General, Part 6 of 7

Table: Frame Section Properties 01 - General, Part 6 of 7

SectionName	I2Mod	I3Mod	MMod	WMod	GUID
10x12	1.	1.	1.	1.	2c896abc-a828-409d-8cfc-d44c671fe50d
12x12	1.	1.	1.	1.	ef9d842a-47d5-4c62-89a2-5f27d528722d
Fillet					378ebe5f-bb91-42d3-a9e2-d3c5b2ec1587
Fillet Small	1.	1.	1.	1.	3f3e5357-e3bb-4589-8a1f-c305c9403827
Fillet Wide	1.	1.	1.	1.	248cbf9e-4cee-4e47-8814-7a3977296d50
Slab	1.	1.	1.	1.	4e363f34-6443-4a27-ab3c-7caa32a4e42d
Wall	1.	1.	1.	1.	c373bd2c-492a-4dda-8bb9-365d72062656

Table: Frame Section Properties 01 - General, Part 7 of 7

SectionName	Notes
10x12	Added 8/9/2025 12:27:57 AM
12x12	Added 8/9/2025 12:27:27 AM
Fillet	Added 9/22/2025 5:07:29 PM
Fillet Small	Added 9/22/2025 5:05:43 PM
Fillet Wide	Added 9/22/2025 5:02:47 PM
Slab	Added 9/22/2025 1:30:48 PM
Wall	Added 9/23/2025 3:27:07 PM

Table: Joint Coordinates, Part 1 of 2

Joint	CoordSys	CoordType	XorR ft	Y ft	Z ft	SpecialJt	GlobalX ft
1	GLOBAL	Cartesian	0.	0.	0.	Yes	0.
2	GLOBAL	Cartesian	20.8333	0.	0.	Yes	20.8333
4	GLOBAL	Cartesian	2.4167	0.	10.6667	Yes	2.4167
5	GLOBAL	Cartesian	18.4167	0.	10.6667	Yes	18.4167
6	GLOBAL	Cartesian	0.	0.	10.6667	No	0.
7	GLOBAL	Cartesian	20.8333	0.	10.6667	No	20.8333

Table: Joint Coordinates, Part 2 of 2

Joint	GlobalY ft	GlobalZ ft	GUID
1	0.	0.	20bffeb1-7139-4923-a402-6a6de5242086
2	0.	0.	fa9afa9c-c9bd-4366-87b4-b63f54ee58d2
4	0.	10.6667	9350834e-3fa5-41ff-8d87-07e85dd8e266
5	0.	10.6667	e8f6242e-497b-4864-a3f2-949fa3945686
6	0.	10.6667	320bf24a-dcee-4da5-94ef-a5162780f833
7	0.	10.6667	494fe73b-1b11-4a41-bd7e-146c79897beb

Table: Joint Restraint Assignments

Joint	U1	U2	U3	R1	R2	R3
1	Yes	Yes	Yes	Yes	Yes	Yes
2	Yes	Yes	Yes	Yes	Yes	Yes

Table: Link Property Definitions 01 - General, Part 1 of 3

Table: Link Property Definitions 01 - General, Part 1 of 3

Link	LinkType	Mass	Weight	RotInert1	RotInert2	RotInert3	DefLength
		Kip-s2/ft	Kip	Kip-ft-s2	Kip-ft-s2	Kip-ft-s2	ft
LINK1	Linear	0.	0.	0.	0.	0.	0.08333
Rigid LK	Linear	0.	0.	0.	0.	0.	0.08333

Table: Link Property Definitions 01 - General, Part 2 of 3

Table: Link Property Definitions 01 - General, Part 2 of 3

Link	DefArea	PDM2I	PDM2J	PDM3I	PDM3J	StiffDFact	Color
	ft2						
LINK1	0.0069	0.	0.	0.	0.	1.	Yellow
Rigid LK	0.0069	0.	0.	0.	0.	1.	Yellow

Table: Link Property Definitions 01 - General, Part 3 of 3

Table: Link Property Definitions 01 - General, Part 3 of 3

Link	GUID	Notes
LINK1	42272bd8-588c-48d7-97bb-3f7e02585879	Added 8/9/2025 12:29:51 AM
Rigid LK	bc900310-34f4-457a-8335-c550f80c0593	Added 8/9/2025 9:57:39 PM

Table: Link Property Definitions 02 - Linear

Table: Link Property Definitions 02 - Linear

Link	DOF	Fixed	TransKE	TransCE
			Kip/ft	Kip-s/ft
LINK1	U1	No	12.	0.
Rigid LK	U1	Yes		
Rigid LK	U2	Yes		
Rigid LK	U3	Yes		
Rigid LK	R1	Yes		
Rigid LK	R2	Yes		
Rigid LK	R3	Yes		

Table: Load Case Definitions, Part 1 of 3

Table: Load Case Definitions, Part 1 of 3

Case	Type	InitialCond	ModalCase	BaseCase	MassSource	DesTypeOpt	DesignType
DEAD	LinStatic	Zero				Prog Det	Dead
MODAL	LinModal	Zero				Prog Det	Other
Max EH	LinStatic	Zero				Prog Det	Dead
DW	LinStatic	Zero				Prog Det	Dead
LL-HL93 TRUCK	LinStatic	Zero				Prog Det	Dead
LL-HL-93 TANDEM	LinStatic	Zero				Prog Det	Dead
EV	LinStatic	Zero				Prog Det	Dead
Unit Load	LinStatic	Zero				Prog Det	Dead
Min EH	LinStatic	Zero				Prog Det	Dead

Table: Load Case Definitions, Part 2 of 3

Table: Load Case Definitions, Part 2 of 3

Case	DesActOpt	DesignAct	AutoType	RunCase	CaseStatus	GUID
DEAD	Prog Det	Non-Composite	None	Yes	Finished	ae956d17-40d1-4e7f-9714-7df5bf75d86d
MODAL	Prog Det	Other	None	No	Not Run	1e732a0a-83b8-487a-b703-105358a3125e
Max EH	Prog Det	Non-Composite	None	Yes	Finished	0dd49601-5d61-4332-afaf-8e3b874a2dcf
DW	Prog Det	Non-Composite	None	Yes	Finished	ebdcce01-de40-4e6e-af16-6779a29af740
LL-HL93 TRUCK	Prog Det	Non-Composite	None	Yes	Finished	0296b74a-9ceb-4db0-8c40-f5087b83a777
LL-HL-93 TANDEM	Prog Det	Non-Composite	None	Yes	Finished	cf2bca0c-68d4-4d84-924b-4cc4227a8a31
EV	Prog Det	Non-Composite	None	Yes	Finished	265a0aee-bca1-459a-8953-f8356c127cdc
Unit Load	Prog Det	Non-Composite	None	No	Not Run	c96576d3-11da-4bd1-a4d7-2868178810a7
Min EH	Prog Det	Non-Composite	None	Yes	Finished	8f62e889-b807-40fb-b77f-861ee44ef536

Table: Load Case Definitions, Part 3 of 3

Table: Load Case Definitions, Part 3 of 3

Case	Notes
DEAD	
MODAL	
Max EH	
DW	
LL-HL93 TRUCK	
LL-HL-93 TANDEM	
EV	
Unit Load	
Min EH	

Table: Load Pattern Definitions

Table: Load Pattern Definitions

LoadPat	DesignType	SelfWtMult	AutoLoad	GUID	Notes
DEAD	Dead	1.		4cf4e507-b462-45d8-ae2a-4aef1aacac93	
Max EH	Dead	0.		fc216621-b047-415c-b62e-47680c7d9fd6	Added 8/9/2025 12:33:18 AM
DW	Dead	0.		7cff2c05-8d31-48ac-b626-bd8aa40caf7f	Added 8/9/2025 12:40:49 AM
LL-HL93 TRUCK	Dead	0.		713c5ac7-6f16-4661-a3c7-4a827dde024b	Added 8/9/2025 12:53:37 AM
LL-HL-93 TANDEM	Dead	0.		89695f19-31bb-4e05-a274-4fd63b436725	Added 9/26/2025 11:14:37 AM

Table: Load Pattern Definitions

LoadPat	DesignType	SelfWtMult	AutoLoad	GUID	Notes
EV	Dead	0.		be03650e-772e-4986-afdd-6210a53b3691	Added 9/30/2025 1:20:58 PM
Min EH	Dead	0.		573978f6-4a3b-48e5-979a-64e985e38f70	Added 10/6/2025 11:10:16 AM

Table: Material Properties 01 - General, Part 1 of 2

Table: Material Properties 01 - General, Part 1 of 2

Material	Type	Grade	SymType	TempDepend	Color	GUID
6500Psi	Concrete	f'c 6500 psi	Isotropic	No	Blue	2ed16f06-7449-46f6-8a33-2b900cea8a73
A416Gr270	Tendon	Grade 270	Uniaxial	No	Gray8Dark	e2f1ea47-3677-4ba9-8721-508907ff7bca
A615Gr60	Rebar	Grade 60	Uniaxial	No	Yellow	a215b18a-238c-471a-a755-12e8eb47f5ba
A709Gr50	Steel	Grade 50	Isotropic	No	Gray8Dark	21c10362-2094-486d-bec4-360137ad0349

Table: Material Properties 01 - General, Part 2 of 2

Table: Material Properties 01 - General, Part 2 of 2

Material	Notes
6500Psi	Customary f'c 4000 psi 8/9/2025 12:24:54 AM
A416Gr270	ASTM A416 Grade 270 8/9/2025 12:27:04 AM
A615Gr60	ASTM A615 Grade 60 8/9/2025 12:27:04 AM
A709Gr50	ASTM A709 Grade 50 8/9/2025 12:24:54 AM

Table: Material Properties 02 - Basic Mechanical Properties

Table: Material Properties 02 - Basic Mechanical Properties

Material	UnitWeight	UnitMass	E1	G12	U12	A1
	Kip/ft3	Kip-s2/ft4	Kip/ft2	Kip/ft2		1/F
6500Psi	1.5500E-01	4.8175E-03	721087.2	300453.	0.2	5.5000E-06
A416Gr270	4.9000E-01	1.5230E-02	4104000.			6.5000E-06
A615Gr60	4.9000E-01	1.5230E-02	4176000.			6.5000E-06
A709Gr50	4.9000E-01	1.5230E-02	4176000.	1606153.85	0.3	6.5000E-06

Table: Material Properties 03a - Steel Data, Part 1 of 2

Table: Material Properties 03a - Steel Data, Part 1 of 2

Material	Fy	Fu	EffFy	EffFu	SSCurveOpt	SSHysType	SHard	SMax
	Kip/ft2	Kip/ft2	Kip/ft2	Kip/ft2				
A709Gr50	7200.	9360.	7920.	10296.	Simple	Kinematic	0.015	0.11

Table: Material Properties 03a - Steel Data, Part 2 of 2

Table: Material Properties 03a - Steel Data, Part 2 of 2

Material	SRup	FinalSlope	CoupModType
A709Gr50	0.17	-0.1	Von Mises

Table: Material Properties 03b - Concrete Data, Part 1 of 2

Table: Material Properties 03b - Concrete Data, Part 1 of 2

Material	Fc	eFc	LtWtConc	SSCurveOpt	SSHysType	SFc	SCap	FinalSlope
	Kip/ft2	Kip/ft2						
6500Psi	936.	936.	No	Mander	Takeda	0.002219	0.005	-0.1

Table: Material Properties 03b - Concrete Data, Part 2 of 2

Table: Material Properties 03b - Concrete Data, Part 2 of 2

Material	FAngle	DAngle	CoupModType
	Degrees	Degrees	
6500Psi	0.	0.	Modified Darwin-Pecknold

Table: Material Properties 03e - Rebar Data, Part 1 of 2

Table: Material Properties 03e - Rebar Data, Part 1 of 2

Material	Fy	Fu	EffFy	EffFu	SSCurveOpt	SSHysType	SHard	SCap
	Kip/ft2	Kip/ft2	Kip/ft2	Kip/ft2				
A615Gr60	8640.	12960.	8640.	12960.	Simple	Kinematic	0.015	0.06

Table: Material Properties 03e - Rebar Data, Part 2 of 2

Table: Material Properties 03e - Rebar Data, Part 2 of 2

Material	FinalSlope	UseCTDef	CoupModType
A615Gr60	-0.1	No	Von Mises

Table: Objects And Elements - Frames

Table: Objects And Elements - Frames

FrameElem	FrameObject	ElemJtI	ElemJtJ
9	9	4	5
10-1	10	6	~1
10-2	10	~1	4
11-1	11	7	~2
11-2	11	~2	5
1-1	1	6	1
2-1	2	7	2

Table: Rebar Sizes

Table: Rebar Sizes

RebarID	Area	Diameter
	ft2	ft
#2	0.000347	0.02083
#3	0.000764	0.03125
#4	0.001389	0.04167
#5	0.002153	0.05208
#6	0.003056	0.0625
#7	0.004167	0.07292
#8	0.005486	0.08333
#9	0.006944	0.094
#10	0.008819	0.10583
#11	0.010833	0.1175
#14	0.015625	0.14108
#18	0.027778	0.18808
10M	0.001076	0.03707
15M	0.002153	0.05249
20M	0.003229	0.06398
25M	0.005382	0.08268
30M	0.007535	0.0981
35M	0.010764	0.11713
45M	0.016146	0.14337
55M	0.02691	0.18504
6d	0.000305	0.01969
8d	0.000541	0.02625
10d	0.000845	0.03281
12d	0.001216	0.03937
14d	0.001658	0.04593
16d	0.002164	0.05249
20d	0.00338	0.06562
25d	0.005285	0.08202
26d	0.005716	0.0853
28d	0.006631	0.09186
N12	0.001216	0.03937
N16	0.002164	0.05249
N20	0.00338	0.06562
N24	0.004865	0.07874
N28	0.006631	0.09186
N32	0.008654	0.10499
N36	0.010979	0.11811

Table: Section Designer Properties 01 - General, Part 1 of 6

Table: Section Designer Properties 01 - General, Part 1 of 6

SectionName	DesignType	DsgnOrChck	BaseMat	IncludeVStr	AxisAngle	MeshSzAbs
					Degrees	ft
Fillet Small	No Check/Design	Check	6500Psi	No	90.	0.
Fillet Wide	No Check/Design	Check	6500Psi	No	90.	0.
Slab	No Check/Design	Check	6500Psi	No	90.	0.
Wall	No Check/Design	Check	6500Psi	No	90.	0.

Table: Section Designer Properties 01 - General, Part 2 of 6

Table: Section Designer Properties 01 - General, Part 2 of 6

SectionName	MeshSzRel	SizeShell	SizeSolid	RefinedMesh	BSectType	nTotalShp	nIWideFlng
		ft	ft				
Fillet Small	0.05					1	0
Fillet Wide	0.05					1	0
Slab	0.05					7	0
Wall	0.05					1	0

Table: Section Designer Properties 01 - General, Part 3 of 6

Table: Section Designer Properties 01 - General, Part 3 of 6

SectionName	nChannel	nTee	nAngle	nDblAngle	nBoxTube	nPipe	nPlate
Fillet Small	0	0	0	0	0	0	0
Fillet Wide	0	0	0	0	0	0	0
Slab	0	0	0	0	0	0	0
Wall	0	0	0	0	0	0	0

Table: Section Designer Properties 01 - General, Part 4 of 6

Table: Section Designer Properties 01 - General, Part 4 of 6

SectionName	nSolidRect	nSolidCirc	nSolidSeg	nSolidSect	nPolygon	nReinfSing	nReinfLine
Fillet Small	1	0	0	0	0	0	0
Fillet Wide	1	0	0	0	0	0	0
Slab	1	0	0	0	0	6	0
Wall	1	0	0	0	0	0	0

Table: Section Designer Properties 01 - General, Part 5 of 6

Table: Section Designer Properties 01 - General, Part 5 of 6

SectionName	nReinfRect	nReinfCirc	nRefLine	nRefCirc	nCaltransSq	nCaltransCr	nCaltransHx
Fillet Small	0	0	0	0	0	0	0
Fillet Wide	0	0	0	0	0	0	0
Slab	0	0	0	0	0	0	0
Wall	0	0	0	0	0	0	0

Table: Section Designer Properties 01 - General, Part 6 of 6

Table: Section Designer Properties 01 - General, Part 6 of 6

SectionName	nCaltransOc	nBSectShell	nBSectSolid	nBSectCut	nBSectCentr
Fillet Small	0	0	0	0	0
Fillet Wide	0	0	0	0	0
Slab	0	0	0	0	0
Wall	0	0	0	0	0

Table: Section Designer Properties 12 - Shape Solid Rectangle, Part 1 of 4

Table: Section Designer Properties 12 - Shape Solid Rectangle, Part 1 of 4

SectionName	ShapeName	ShapeMat	ZOrder	FillColor	XCenter	YCenter	Height
					ft	ft	ft
Fillet Small	Rectangle1	6500Psi	1	Blue	0.	0.	0.83333
Fillet Wide	Rectangle1	6500Psi	1	Blue	0.	0.	2.83333
Slab	Rectangle1	6500Psi	1	Yellow	0.	0.	0.83333
Wall	Rectangle1	6500Psi	1	Yellow	0.	0.	0.83333

Table: Section Designer Properties 12 - Shape Solid Rectangle, Part 2 of 4

Table: Section Designer Properties 12 - Shape Solid Rectangle, Part 2 of 4

SectionName	ShapeName	Width	Rotation	Reinforcing	CoreDim	BCoreMajor	BCoreMinor
		ft	Degrees			ft	ft
Fillet Small	Rectangle1	1.	0.	No	Program Determined	0.8	0.66667
Fillet Wide	Rectangle1	1.	0.	No	Program Determined	0.8	2.26667
Slab	Rectangle1	1.	0.	No	Program Determined	0.8	0.66667
Wall	Rectangle1	1.	0.	No	Program Determined	0.8	0.66667

Table: Section Designer Properties 12 - Shape Solid Rectangle, Part 3 of 4

Table: Section Designer Properties 12 - Shape Solid Rectangle, Part 3 of 4

SectionName	ShapeName	DCoreMajor Positive	DCoreMajor Negative	DCoreMinor Positive	DCoreMinor Negative	RebarMat	BarMatType
		ft	ft	ft	ft		
Fillet Small	Rectangle1	0.75	0.75	0.9	0.9		
Fillet Wide	Rectangle1	2.55	2.55	0.9	0.9		
Slab	Rectangle1	0.75	0.75	0.9	0.9		
Wall	Rectangle1	0.75	0.75	0.9	0.9		

Table: Section Designer Properties 12 - Shape Solid Rectangle, Part 4 of 4

Table: Section Designer Properties 12 - Shape Solid Rectangle, Part 4 of 4

SectionName	ShapeName	ConcCover	ManderPlace
Fillet Small	Rectangle1		
Fillet Wide	Rectangle1		
Slab	Rectangle1		
Wall	Rectangle1		

Table: Section Designer Properties 17 - Shape Reinforcing Single, Part 1 of 2

Table: Section Designer Properties 17 - Shape Reinforcing Single, Part 1 of 2

SectionName	ShapeName	ShapeMat	MatType	XCenter	YCenter	BarSize	TendonForce
				ft	ft		Kip
Slab	SingleBar1	A615Gr60	Rebar	0.	0.21917	User	
Slab	SingleBar2	A615Gr60	Rebar	0.41667	0.21917	User	
Slab	SingleBar3	A615Gr60	Rebar	-0.41667	0.21917	User	
Slab	SingleBar4	A615Gr60	Rebar	-0.41667	-0.21917	User	
Slab	SingleBar5	A615Gr60	Rebar	0.	-0.21917	User	
Slab	SingleBar6	A615Gr60	Rebar	0.41667	-0.21917	User	

Table: Section Designer Properties 17 - Shape Reinforcing Single, Part 2 of 2

Table: Section Designer Properties 17 - Shape Reinforcing Single, Part 2 of 2

SectionName	ShapeName	BarArea
		ft2
Slab	SingleBar1	0.002431
Slab	SingleBar2	0.002431
Slab	SingleBar3	0.002431
Slab	SingleBar4	0.002431
Slab	SingleBar5	0.002431
Slab	SingleBar6	0.002431

Table: Section Designer Properties 30 - Fiber General, Part 1 of 2

Table: Section Designer Properties 30 - Fiber General, Part 1 of 2

SectionName	NumFibersD2	NumFibersD3	CoordSys	GridAngle	LumpRebar	FiberPMM
Fillet Small	3	3	Cartesian	0	No	No
Fillet Wide	3	3	Cartesian	0	No	No
Slab	3	3	Cartesian	0	No	No
Wall	3	3	Cartesian	0	No	No

Table: Section Designer Properties 30 - Fiber General, Part 2 of 2

Table: Section Designer Properties 30 - Fiber General, Part 2 of 2

SectionName	FiberMC
Fillet Small	No
Fillet Wide	No
Slab	No
Wall	No

NW-12 CULVERT INDEPENDENT CHECK

7.2 APPENDIX B: Traffic Shift onto Existing Culvert Calc 7-23-25 ZL File

4M ENGINEERING
CIVIL – STRUCTURAL
6675 Purple Poppy Ln., Park City, UT 84098 801-380-0562

7/23/25

Washington State Department of Transportation

RE: Existing Box Culvert Evaluation

As part of the I-405, SR522 Vicinity to SR527 Express Toll Lanes Improvement Project, traffic from the I-405 will be shifted onto an existing concrete box culvert located in the median. The existing culvert was built in 1996. Since the available plans for the culvert do not match field conditions, the following information was determined based on field investigation:

- Configuration and materials: Single-cell precast concrete box culvert
- Geometry: Interior dimensions are 20' wide x 9' high, with 2' chamfer at top and bottom. Wall and slab thicknesses are 10".
- Depth of fill above culvert: Varies from 4'-6'
- Reinforcement:
    - Top Slab - Interior: #6 bars at 5" o.c. transverse and #5 bars at 12" o.c. longitudinal
    - Top Slab – Exterior: #6 bars at 5" o.c. transverse and #5 bars at 12" o.c. longitudinal
    - Wall – Interior: #5 bars at 5" o.c. vertical with #5 bars at 10" o.c. horizontal
    - Wall – Exterior: #6 bars at 5" o.c. vertical with #5 bars at 10" o.c. horizontal
- Concrete strength, f'c = 6500 psi min.
- Reinforcing steel strength, fy = 60,000 psi

In order to analyze the culvert, the below assumptions were made:

- Fill density above culvert: 127 pcf. This is a weighted average which includes 6" of asphalt at 140 pcf with compacted or saturated soils below at 125 pcf.
- Reinforcement:
    - Corner bars are assumed at least equivalent to vertical interior wall bars (#5 at 5" o.c.)
    - Bottom slab reinforcement is taken to be equal to the top slab reinforcement. Standard practice is equivalent or better.

The culvert parameters outlined above were analyzed in the Erikkson Culvert software, the program indicated for box culvert design and analysis per the WSDOT Bridge Design Manual (BDM). The software inputs can be viewed on Pages 5-6. Input values that were confirmed by field investigations are highlighted for reference.

To evaluate the ability of the culvert to support traffic loading, load ratings were determined for HL-93 loads and the additional rating trucks outlined in Chapter 13 of the BDM. It was determined that the culvert could support the various truck loadings with ratings greater than 1.0 for all loadings, modeling the culvert as a double box culvert with pinned connections to the lid. A double box culvert was modeled to represent the addition of post shores which will be placed at the center of the culvert, rather than a center stem. The shoring is designed to carry the Truck Live Load and Pavement Dead Load only. The corresponding load ratings can be found on Pages 9, 15&16. Minimum controlling HL-93 inventory, and operating ratings are 1.81 and 2.35 respectively, demonstrating that the culvert can safely support the worst-case traffic loadings which could occur during construction.

Post shore calculations and Load Rating can be found on sheets 17-22.

Field investigations did not determine if additional reinforcement was installed near the access riser openings, additional post shores will be placed to prop up the top slab adjacent to the risers.

Additionally, the concrete riser and steel plate cover strength was evaluated under HL-93 LL and soil DL and found to be acceptable (see Pages 24-26).

7-23-25

7-7-25

BRIDGE RATING SUMMARY:
EXISTING CULVERT (WITH SHORING)

Bridge Name:	I-405 OVER DETENTION VAULT
Bridge Number:	405/102.5DV
SID Number:	
Span Types:	N/A
Bridge Length:	285 ft
Design Load:	HL-93
Engineering Firm/Agency:	4M Engineering
Rated By:	Jessica Merrell
Checked By:	Forrest Megargel
Date:	7/7/2025

Inspection Report Date:	3/13/2025	Deck Condition	N/A
Rating Method:	LRFR	Superstructure Condition	N/A
Overlay Thickness:	N/A	Substructure Condition	N/A

Truck	**RF**	**γ**	**Controlling Point**
AASHTO 1 (Type 3)	2.75	2.0	Shear @ top slab
AASHTO 2 (Type 3S2)	3.07	2.0	Shear @ top slab
AASHTO 3 (Type 3-3)	3.48	2.0	Shear @ top slab
Legal Lane	4.57	2.0	Shear @ top slab
NRL	2.75	2.0	Shear @ top slab
LGL-105	2.75	2.0	Shear @ top slab
OL-1	4.76	1.20	Shear @ top slab
OL-2	4.76	1.20	Shear @ top slab
EV2	3.20	1.30	Shear @ top slab
EV3	2.82	1.30	Shear @ top slab

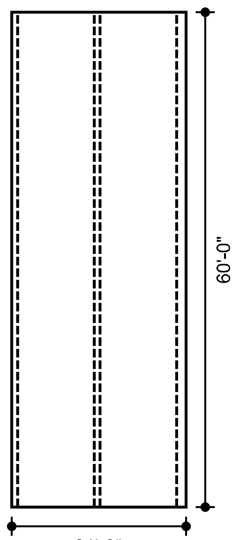
SNBI Rating	**RF**	**γ**	**Controlling Point**
Inventory (HL-93)	1.81	1.75	Shear @ bottom slab
Operating (HL-93)	2.35	1.35	Shear @ bottom slab

Remarks:

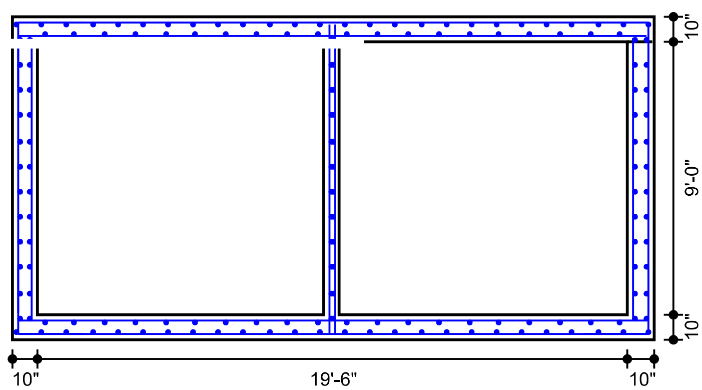
Per inspection report, concrete culvert is 20'x9' in good condition.

Existing Culvert Analysis (Shored)

Spec.: LRFD 9th ed.
Type of Culvert: Precast



Plan View



Typical Section

Physical Dimensions

Clear Span:	9'-6"
Clear Height:	9'-0"
Top Slab:	10"
Bottom Slab:	10"
Ext. Wall:	10"
Int. Wall:	6"
Fill Depth Range	
Maximum:	6.00 ft
Minimum:	4.00 ft
Increment:	0.50 ft
Length:	60'-0"
Skew Angle:	0.00 deg
Bottom Slab Support:	Full Slab
Top Haunch, Width:	0"
Top Haunch, Height:	0"
Bottom Haunch, Width:	0"
Bottom Haunch, Height:	0"

Material Properties

Concrete	
Strength, f'c:	6.500 ksi
Density:	0.155 kcf
Elasticity, Ec:	5347 ksi
Type:	Normal wt
Steel	
Yield, fy:	60 ksi
Allow Stress:	36 ksi
Elasticity, Es:	29000 ksi
Soil	
Density:	0.127 kcf
Exposure Factor	
User-Defined:	1.00
Reinforcement Covers	
Ext. Cover Top Slab:	2"
Ext. Cover Bottom Slab	2"
Ext. Cover Walls	2"
Int. Cover Walls	2"
Int. Cover Top Slab	2"
Int. Cover Bottom Slab	2"

Controlling Ratings

Inventory Rating: 1.81
Operating Rating: 2.35

Loads

Live Load

Vehicle Names:	HL-93	EV 2	EV 3
	NRL - Legal Lane	NRL	Oveload 1
	Oveload 2	Type 3-3	Type 3
	Type 3S2	WA-105	
Traffic Direction:	Perpendicular		
Eq. Height of Soil:	Calculated		
Max No. of Lanes:	2		

Dead Load

Future Wearing Surface:	0.000 klf
Additional Dead Load:	0.000 klf
Concentrated Loads:	none

Lateral Soil Loads

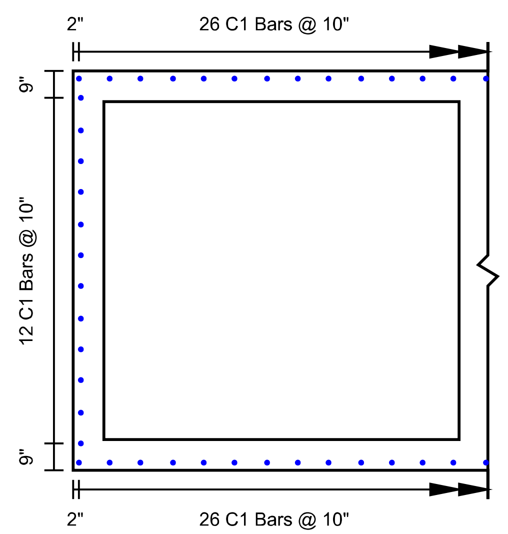
Eq. Fluid Press. Max:	60.00 pcf
Eq. Fluid Press. Min:	30.00 pcf

Interior Water Pressure:	no
Exterior Water Pressure:	no

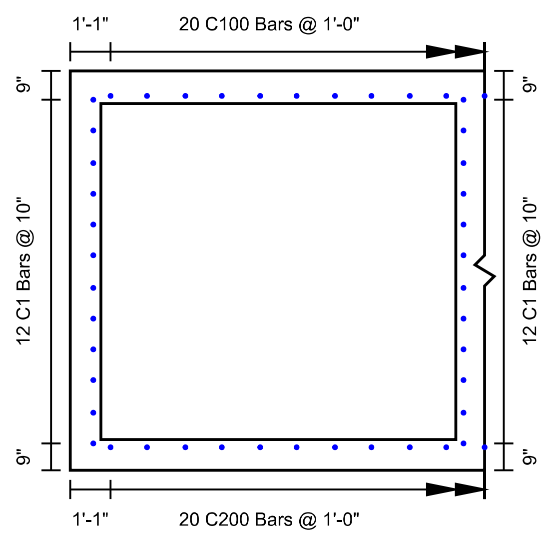
Concrete Summary
Volume of Concrete: 2.029 cy/ft Total Volume of Concrete: 121.728 cy

Reinforcing Steel Bar Schedule (lb)

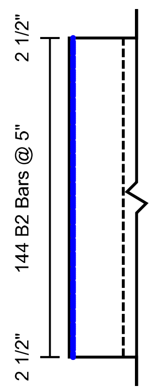
Location	Mark	Qty	Size	Spacing	Type	Length	Hor.Leg	Ver.Leg	Tot.Weight
Top Slab(Int)	A100 (AS2)	144	6	5"	S	20'-9"	--	--	4488.0
Bot Slab(Int)	A200 (AS3)	144	6	5"	S	20'-9"	--	--	4488.0
Top Slab(Ext)	A300 (AS7)	144	6	5"	S	20'-9"	--	--	4488.0
Bot Slab(Ext)	A400 (AS8)	144	6	5"	S	20'-9"	--	--	4488.0
Corner(Top)	A1 (AS1)	288	5	5"	L	4'-4"	2'-2"	2'-2"	1302.0
Corner(Bot)	A2 (AS1)	288	5	5"	L	4'-4"	2'-2"	2'-2"	1302.0
Wall(Int)	B1 (AS4)	288	5	5"	S	9'-4"	--	--	2854.0
Wall(Ext)	B2 (AS1)	288	6	5"	S	8'-10"	--	--	3893.0
Int Wall	B3	120	3	1'-0"	S	10'-3"	--	--	462.0
Longit. Top (Int)	C100 (AS5)	20	5	1'-0"	S	59'-11"	--	--	1250.0
Longit. Bot (Int)	C200	20	5	1'-0"	S	59'-11"	--	--	1250.0
Longit. Top (Ext)	C1 (AS6)	26	5	10"	S	59'-11"	--	--	1624.8
Longit. Bot (Ext)	C1 (AS6)	26	5	10"	S	59'-11"	--	--	1624.8
Longit. Wall (Ext)	C1 (AS6)	24	5	10"	S	59'-11"	--	--	1499.8
Longit. Wall (Int)	C1 (AS6)	24	5	10"	S	59'-11"	--	--	1499.8
Longit. Int	C1 (AS6)	24	5	10"	S	59'-11"	--	--	1374.8
									37889



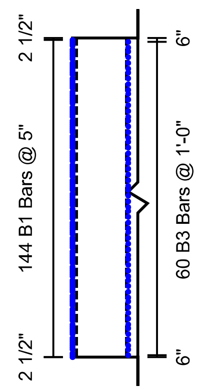
Section Ext. Longit. Reinf.



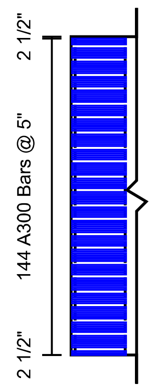
Section Int. Longit. Reinf.



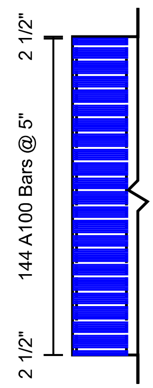
Ext. Wall Reinf.



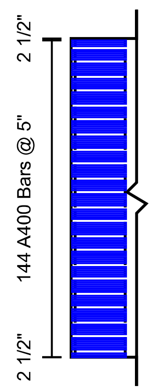
Int. Wall Reinf.



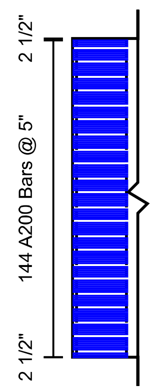
Top Slab Ext. Reinf.



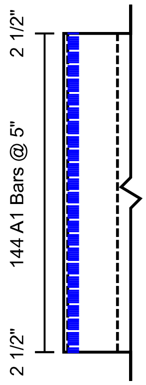
Top Slab Int. Reinf.



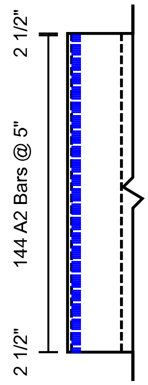
Bottom Slab Ext. Reinf.



Bottom Slab Int. Reinf.



Top Slab Corner Reinf.



Bottom Slab Corner Reinf.

Filename: Bothell DBC pinned.etcx

RATINGS SUMMARY
================

	Flexure			Shear		
Truck	RF(INV)	RF(OP)	Controlling Point	RF(INV)	RF(OP)	Controlling Point
(AA) HL-93	2.59	3.36	Top Slab, RT	1.81	2.35	Top Slab, RT
(AB) EV 2	3.91	3.91	Top Slab, MID	3.20	3.20	Top Slab, RT
(AC) EV 3	3.52	3.52	Top Slab, MID	2.82	2.82	Top Slab, RT
(AD) NRL - Le	5.38	5.38	Top Slab, RT	4.57	4.57	Top Slab, RT
(AE) NRL	3.56	3.56	Top Slab, RT	2.75	2.75	Top Slab, RT
(AF) Oveload	5.51	5.51	Top Slab, MID	4.76	4.76	Top Slab, RT
(AG) Oveload	5.51	5.51	Top Slab, MID	4.76	4.76	Top Slab, RT
(AH) Type 3-3	4.32	4.32	Top Slab, RT	3.48	3.48	Top Slab, RT
(AI) Type 3	3.56	3.56	Top Slab, RT	2.75	2.75	Top Slab, RT
(AJ) Type 3S2	3.91	3.91	Top Slab, RT	3.07	3.07	Top Slab, RT
(AK) WA-105	3.56	3.56	Top Slab, RT	2.75	2.75	Top Slab, RT

REINFORCEMENT SUMMARY
=====================

M dimension = 1' 6" (method of equivalent capacity)
= 4' 9" (method of contraflexure - ASTM)

Reinforcing Steel Schedule

Location	Bar Mark		Qty	Size	Type	Spacing (in)	As,prv (in2/ft)	Length (ft-in)	Wgt (lbs)	H Leg (ft-in)	V Leg (ft-in)
Top Slab (int)	A100	(AS2)	144	6	STR	5.00	1.056	20- 9	4488		
Bot Slab (int)	A200	(AS3)	144	6	STR	5.00	1.056	20- 9	4488		
Top Slab (ext)	A300	(AS7)	144	6	STR	5.00	1.056	20- 9	4488		
Bot Slab (ext)	A400	(AS8)	144	6	STR	5.00	1.056	20- 9	4488		
Corner (Top)	A1	(AS1)	288	5	L-BAR	5.00	0.744	4- 4	1302	2- 2	2- 2
Corner (Bottom)	A2	(AS1)	288	5	L-BAR	5.00	0.744	4- 4	1302	2- 2	2- 2
Ext Wall (int)	B1	(AS4)	288	5	STR	5.00	0.744	9- 4	2854		
Ext Wall (ext)	B2	(AS1)	288	6	STR	5.00	1.056	8-10	3893		
Int Wall	B3		120	3	STR	12.00	0.110	10- 3	462		
Top Slab (int- 1)	C100	(AS5)	20	5	STR	12.00	0.310	59-11	1250		
Bot Slab (int- 1)	C200		20	5	STR	12.00	0.310	59-11	1250		
Temperature (1)	C1	(AS6)	26	5	STR	10.00	0.372	59-11	1625		
Temperature (1)	C1	(AS6)	26	5	STR	10.00	0.372	59-11	1625		
Temperature (1)	C1	(AS6)	24	5	STR	10.00	0.372	59-11	1500		
Temperature (1)	C1	(AS6)	24	5	STR	10.00	0.372	59-11	1500		
Temperature (1)	C1	(AS6)	24	5	STR	10.00	0.372	59-11	1375		
								Total	37889		

Note: A denotes flexural steel, B denotes vertical steel, C denotes longitudinal steel

AS Bar Marks

Location	As prv in2/ft
Transverse Side Wall - Outside Face (AS1)	1.056
Transverse Top Slab - Inside Face (AS2)	1.056
Transverse Bottom Slab - Inside Face (AS3)	1.056
Transverse Side Wall - Inside Face (AS4)	0.744
Distribution Top Slab - Inside Face (AS5)	0.310
Distribution Top Slab - OutSide Face (AS6)	0.372
Transverse Top Slab - Outside Face (AS7)	1.056
Transverse Bottom Slab - Outside Face (AS8)	1.056

Notes: 1.) Final areas of steel provided must be checked in analysis mode

```
Project: Bothell to Swamp Creek
Task   : Box Culvert Evaluation
Client : Skanska
Job No.:


CULVERT PROPERTIES
==================
Type of Culvert: Precast              Specification : LRFD 9th Edition
Operating Mode : Analysis

Physical Dimensions
-------------------
No. of Boxes: 2             Name: BoxCulvert
Clear Span  :  9.5000 ft
Clear Height:  9.0000 ft     Skew Angle  :  0.00 deg
Length      : 60.0000 ft     Bottom Slab Support: Full Slab
Fill Depth Range:            Maximum :  6.00 ft       Minimum  :  4.00 ft     Increment :  0.50 ft
Haunches: Top, Length:  0.0000 in     Height:  0.0000 in
       Bottom, Length:  0.0000 in     Height:  0.0000 in
Member Thicknesses:          Top Slab: 10.0000 in      Bot Slab: 10.0000 in
                             Ext Wall: 10.0000 in      Int Wall:  6.0000 in
Wall Joint: Top
Releases  : Moment

Material Properties
-------------------
Concrete, Bot: Strength:  6.500 ksi   Density:  0.155 kcf   Elasticity:   5347 ksi
Concrete, Top: Strength:  5.000 ksi   Density:  0.155 kcf   Elasticity:   4903 ksi
Concrete, All:     Type:  Normal Weight           Density Modification Factor :   1.00
         Fr Factor    :   0.24       Gamma1      :   1.60       Gamma3       :   1.00 (user defined)
Steel:   Yield,fy     :  60.00 ksi   fss Limit   :  0.60fy      Elasticity,Es:  29000 ksi
         Yield,fyv    :  60.00 ksi   Diameter    :  1.000 in    Type         : Rebar
Soil:    Density      :  0.127 kcf   Slope Factor:  1.150
         Poisson's    :  0.5
         Fe Factor    :  1.000 (User Defined)
Serviceability, Gamma-e:  1.00

Loads
-----
Live Load:  Vehicle: (AA) HL-93 - Design Vehicle
                     Axle No.    Weight(k)   Dist. From Previous(ft)
                        1           8.00             0.00
                        2          32.00            14.00
                        3          32.00            14.00
                     Gage Width: 6.00 ft, Tread Width: 20.00 in, Tread Length: 10.00 in
                     Include Tandem: yes
                     Tandem: Axle 1: 25.00 k, Axle 2: 25.00 k, Axle Spacing: 4.00 ft
                     Lane Load: 0.00 klf, P-Moment: 0.00 k, P-Shear: 0.00 k
                     Combine: Truck + Lane Or Tandem + Lane
                     Inventory Rating Load Factor: 1.75  Operating Rating Load Factor: 1.35
                     Design Load Combinations: Strength II
                     Override MPF: no
                     Override DLA: no
            Vehicle: (AB) EV 2 - Permit Vehicle
                     Axle No.    Weight(k)   Dist. From Previous(ft)
                        1          24.00             0.00
                        2          33.50            15.00
                     Gage Width: 6.00 ft, Tread Width: 20.00 in, Tread Length: 10.00 in
                     Include Tandem: no
                     Lane Load: 0.00 klf, P-Moment: 0.00 k, P-Shear: 0.00 k
                     Combine: Truck Or Tandem Or Lane
                     Rating Load Factor: 1.3
                     Design Load Combinations: Strength II
                     Override MPF: no
                     Override DLA: no
            Vehicle: (AC) EV 3 - Permit Vehicle
                     Axle No.    Weight(k)   Dist. From Previous(ft)
                        1          24.00             0.00
                        2          31.00            15.00
                        3          31.00             4.00
                     Gage Width: 6.00 ft, Tread Width: 20.00 in, Tread Length: 10.00 in
                     Include Tandem: no
                     Lane Load: 0.00 klf, P-Moment: 0.00 k, P-Shear: 0.00 k
                     Combine: Truck Or Tandem Or Lane
                     Rating Load Factor: 1.3
                     Design Load Combinations: Strength II
                     Override MPF: no
                     Override DLA: no
            Vehicle: (AD) NRL - Legal Lane - Legal Vehicle
                     Axle No.    Weight(k)   Dist. From Previous(ft)
```

1	10.50	0.00
2	10.50	4.00
3	12.00	16.00
4	9.00	15.00
5	9.00	4.00
6	9.00	15.00

Gage Width: 6.00 ft, Tread Width: 20.00 in, Tread Length: 10.00 in
Include Tandem: no
Lane Load: 0.20 klf, P-Moment: 0.00 k, P-Shear: 0.00 k
Combine: Truck + Lane Or Tandem + Lane
Rating Load Factor: 2
Design Load Combinations: Strength I
Override MPF: no
Override DLA: no

Vehicle: (AE) NRL - Legal Vehicle

Axle No.	Weight(k)	Dist. From Previous(ft)
1	8.00	0.00
2	8.00	4.00
3	8.00	4.00
4	17.00	4.00
5	17.00	4.00
6	8.00	4.00
7	8.00	4.00
8	6.00	6.00

Gage Width: 6.00 ft, Tread Width: 20.00 in, Tread Length: 10.00 in
Include Tandem: no
Lane Load: 0.00 klf, P-Moment: 0.00 k, P-Shear: 0.00 k
Combine: Truck + Lane Or Tandem + Lane
Rating Load Factor: 2
Design Load Combinations: Strength I
Override MPF: no
Override DLA: no

Vehicle: (AF) Oveload 1 - Permit Vehicle

Axle No.	Weight(k)	Dist. From Previous(ft)
1	21.50	0.00
2	21.50	4.00
3	21.50	12.00
4	21.50	4.00
5	10.00	10.00

Gage Width: 6.00 ft, Tread Width: 20.00 in, Tread Length: 10.00 in
Include Tandem: no
Lane Load: 0.00 klf, P-Moment: 0.00 k, P-Shear: 0.00 k
Combine: Truck + Lane Or Tandem + Lane
Rating Load Factor: 1.2
Design Load Combinations: Strength II
Override MPF: no
Override DLA: no

Vehicle: (AG) Oveload 2 - Permit Vehicle

Axle No.	Weight(k)	Dist. From Previous(ft)
1	22.00	0.00
2	21.50	6.00
3	21.50	4.00
4	22.00	14.00
5	21.50	6.00
6	21.50	4.00
7	22.00	16.00
8	21.50	6.00
9	21.50	4.00
10	12.00	10.00

Gage Width: 6.00 ft, Tread Width: 20.00 in, Tread Length: 10.00 in
Include Tandem: no
Lane Load: 0.00 klf, P-Moment: 0.00 k, P-Shear: 0.00 k
Combine: Truck + Lane Or Tandem + Lane
Rating Load Factor: 1.2
Design Load Combinations: Strength II
Override MPF: no
Override DLA: no

Vehicle: (AH) Type 3-3 - Legal Vehicle

Axle No.	Weight(k)	Dist. From Previous(ft)
1	14.00	0.00
2	14.00	4.00
3	16.00	16.00
4	12.00	15.00
5	12.00	4.00
6	12.00	15.00

Gage Width: 6.00 ft, Tread Width: 20.00 in, Tread Length: 10.00 in
Include Tandem: no
Lane Load: 0.00 klf, P-Moment: 0.00 k, P-Shear: 0.00 k
Combine: Truck + Lane Or Tandem + Lane
Rating Load Factor: 2
Design Load Combinations: Strength I
Override MPF: no

```
                  Override DLA: no
         Vehicle: (AI) Type 3 - Legal Vehicle
                  Axle No.    Weight(k)   Dist. From Previous(ft)
                     1          17.00             0.00
                     2          17.00             4.00
                     3          16.00            15.00
                  Gage Width: 6.00 ft, Tread Width: 20.00 in, Tread Length: 10.00 in
                  Include Tandem: no
                  Lane Load: 0.00 klf, P-Moment: 0.00 k, P-Shear: 0.00 k
                  Combine: Truck + Lane Or Tandem + Lane
                  Rating Load Factor: 2
                  Design Load Combinations: Strength I
                  Override MPF: no
                  Override DLA: no
         Vehicle: (AJ) Type 3S2 - Legal Vehicle
                  Axle No.    Weight(k)   Dist. From Previous(ft)
                     1          15.50             0.00
                     2          15.50             4.00
                     3          15.50            22.00
                     4          15.50             4.00
                     5          10.00            11.00
                  Gage Width: 6.00 ft, Tread Width: 20.00 in, Tread Length: 10.00 in
                  Include Tandem: no
                  Lane Load: 0.00 klf, P-Moment: 0.00 k, P-Shear: 0.00 k
                  Combine: Truck + Lane Or Tandem + Lane
                  Rating Load Factor: 2
                  Design Load Combinations: Strength I
                  Override MPF: no
                  Override DLA: no
         Vehicle: (AK) WA-105 - Legal Vehicle
                  Axle No.    Weight(k)   Dist. From Previous(ft)
                     1          14.00             0.00
                     2          14.00             4.00
                     3          17.00            10.00
                     4          17.00            32.00
                     5          17.00             4.00
                     6           7.00             4.00
                     7           7.00             4.00
                     8          12.50            11.00
                  Gage Width: 6.00 ft, Tread Width: 20.00 in, Tread Length: 10.00 in
                  Include Tandem: no
                  Lane Load: 0.00 klf, P-Moment: 0.00 k, P-Shear: 0.00 k
                  Combine: Truck + Lane Or Tandem + Lane
                  Rating Load Factor: 2
                  Design Load Combinations: Strength I
                  Override MPF: no
                  Override DLA: no
         Include Lane Load      : yes         Max. No. of Lanes: 2
         Traffic Direction      : Lanes Perpendicular to Main Reinforcement
         Neglect Live Load if: Fill > 8 ft and Fill > Clear Span
         Apply Surcharge at Fill Depths > 2 ft  : yes
         Compute Surcharge Depth: yes
Dead Load:  Future Wearing Surface :  0.00 klf   Add. Dead Load   :  0.00 klf
         Concentrated Loads     : none
Lateral Soil Loads: Max. Equiv. Fluid Press.: 60.00 pcf   Min. Equiv. Fluid Press.  : 30.00 pcf
Include Additional Uniform Horiz. Load: no
Include Additional Uniform Vert. Load: no
Buoyancy Check    : no
Fluid Pressures   : Apply Water Press.  : no
Foundation Model  : Uniform Loads
Seismic Analysis  : Do not include

Load and Resistance Factors
---------------------------
     Max      Min
DC: 1.250    0.900
DW: 1.500    0.650
EV: 1.300    0.900
EH: 1.350    0.900
WA: 1.000
EQ: 1.000
LL I     : 1.750   LL II     : 1.350   LL Legal     : 1.750   LL Extreme : 0.500
Ductility: 1.000   Importance: 1.000   Redundancy, non-earth: 1.000   Redundancy, earth: 1.000
Condition: 1.000   System    : 1.000
Phi Shear: 0.900   Phi Moment: 1.000   PM Compression: 0.750   PM Tension    : 0.900
Load Factor Multipliers, Design Mode: 1.00 Analysis Mode: 1.00

Reinforcement
-------------
Reinforcement Covers  :  Exterior      Interior
           Top Slab:  2.0000 in     2.0000 in
           Walls   :  2.0000 in     2.0000 in
```

Bot Slab: 2.0000 in 2.0000 in

Assigned reinforcement:

Location	Mark		Size	Spacing (in)
Top Slab Inside	A100	(AS2)	6	5.0000
Bottom Slab Inside	A200	(AS3)	6	5.0000
Top Slab Outside	A300	(AS7)	6	5.0000
Bottom Slab Outside	A400	(AS8)	6	5.0000
Top Corner	A1	(AS1)	5	5.0000
Bottom Corner	A2	(AS1)	5	5.0000
Ext. Wall Inside	B1	(AS4)	5	5.0000
Ext. Wall Outside	B2	(AS1)	6	5.0000
Interior Wall	B3		3	12.0000
Longitudinal	C1	(AS6)	5	10.0000
Top Distribution	C100	(AS5)	5	12.0000
Bottom Distribution	C200		5	12.0000

Analysis Options

```
LL Analysis       : Automatically Set Traffic Direction to Account for Skew Effects: no
                    Limit LL Distribution Width to Culvert Length for: None
                    Combine Longitudinal Axle Distribution Overlaps: Yes, Max of 2 Axles
                    Combine Transverse Axle Distribution Overlaps: Yes, Max of 2 Axles
                    Axle Placement Increment for Moving Load Analysis: 20
                    Include Impact on Bottom Slab: yes
                    Always Distribute Wheel Load: yes
                    Deflection Criteria     : 1/800
                    Approach Slab will be Used: no
Reinforcement     : Always Include Distribution Steel: no
                    Distribution Slab Provided: no
                    User Defined Longitudinal Steel: yes
                    Max. As used in Vc Calcs: 2.00 in2/ft
                    Distribute Minimum Reinforcement per Face: yes
                    Use individual Member Thicknesses for Min Steel: no
                    Epoxy coat steel: no
                    Use M-dimension for bar length calcs.: no
Slenderness       : Checked       K Factor: 2.00
Analysis Modeling : Use Haunches in the Structural Analysis Model: yes
Critical Sections : Flexure critical section location: 1.5 member depth
                    Shear critical section location: dv beyond support
                    Use Max. Moment with Max. Shear at the Critical Section for Shear: no
                    Include depth of haunch for critical sections: no
Flexure           : Ignore Axial Thrust: no
                    Use Eq. 12.10.4.2.4a-1: yes   Nu Multiplier: 1.00
Shear             : Always Check Iterative Beta Method
Environmental     : Apply duribility factors: no
Load Combinations : LRFD min/min: no
```

ANALYSIS RESULTS

Top Slab Thickness = 10.00 in
Bottom Slab Thickness = 10.00 in
Exterior Wall Thickness = 10.00 in
Interior Wall Thickness = 6.00 in

Modular Ratio (N) = 5.42 Max. Steel Ratio = 0.030
Design Span = 10.17 ft Design Height = 9.83 ft

Volume of Concrete: 2.029 cy/ft Weight of Steel: 631 lb/ft

Note: Design and analysis results do not include force effects from stipping and handling stages

M dimension = 1' 6" (method of equivalent capacity)
= 4' 9" (method of contraflexure - ASTM)

Reinforcing Steel Schedule

Location	Bar Mark	Qty	Size	Type	Spacing (in)	As,prv (in2/ft)	Length (ft-in)	Wgt (lbs)	H Leg (ft-in)	V Leg (ft-in)
Top Slab (int)	A100 (AS2)	144	6	STR	5.00	1.056	20- 9	4488		
Bot Slab (int)	A200 (AS3)	144	6	STR	5.00	1.056	20- 9	4488		
Top Slab (ext)	A300 (AS7)	144	6	STR	5.00	1.056	20- 9	4488		
Bot Slab (ext)	A400 (AS8)	144	6	STR	5.00	1.056	20- 9	4488		
Corner (Top)	A1 (AS1)	288	5	L-BAR	5.00	0.744	4- 4	1302	2- 2	2- 2
Corner (Bottom)	A2 (AS1)	288	5	L-BAR	5.00	0.744	4- 4	1302	2- 2	2- 2
Ext Wall (int)	B1 (AS4)	288	5	STR	5.00	0.744	9- 4	2854		
Ext Wall (ext)	B2 (AS1)	288	6	STR	5.00	1.056	8-10	3893		
Int Wall	B3	120	3	STR	12.00	0.110	10- 3	462		
Top Slab (int- 1)	C100 (AS5)	20	5	STR	12.00	0.310	59-11	1250		
Bot Slab (int- 1)	C200	20	5	STR	12.00	0.310	59-11	1250		
Temperature (1)	C1 (AS6)	26	5	STR	10.00	0.372	59-11	1625		
Temperature (1)	C1 (AS6)	26	5	STR	10.00	0.372	59-11	1625		
Temperature (1)	C1 (AS6)	24	5	STR	10.00	0.372	59-11	1500		
Temperature (1)	C1 (AS6)	24	5	STR	10.00	0.372	59-11	1500		
Temperature (1)	C1 (AS6)	24	5	STR	10.00	0.372	59-11	1375		
							Total	37889		

Note: A denotes flexural steel, B denotes vertical steel, C denotes longitudinal steel

AS Bar Marks

Location	As prv in2/ft
Transverse Side Wall - Outside Face (AS1)	1.056
Transverse Top Slab - Inside Face (AS2)	1.056
Transverse Bottom Slab - Inside Face (AS3)	1.056
Transverse Side Wall - Inside Face (AS4)	0.744
Distribution Top Slab - Inside Face (AS5)	0.310
Distribution Top Slab - OutSide Face (AS6)	0.372
Transverse Top Slab - Outside Face (AS7)	1.056
Transverse Bottom Slab - Outside Face (AS8)	1.056

Notes: 1.) Final areas of steel provided must be checked in analysis mode

Summary of Ratings Table:

			Flexure					Shear				
Truck	ILF	OLF	Fill	Member	Location	IR	OR	Fill	Member	Location	IR	OR
(AA)HL-93	1.75	1.35	4.00	2	RT	2.59	3.36	4.00	2	RT	1.81	2.35
(AB)EV 2	1.30	1.30	4.00	2	MID	3.91	3.91	4.00	2	RT	3.20	3.20
(AC)EV 3	1.30	1.30	4.00	2	MID	3.52	3.52	4.00	2	RT	2.82	2.82
(AD)NRL -	2.00	2.00	4.00	2	RT	5.38	5.38	4.00	2	RT	4.57	4.57
(AE)NRL	2.00	2.00	4.00	2	RT	3.56	3.56	4.00	2	RT	2.75	2.75
(AF)Oveloa	1.20	1.20	4.00	2	MID	5.51	5.51	4.00	2	RT	4.76	4.76
(AG)Oveloa	1.20	1.20	4.00	2	MID	5.51	5.51	4.00	2	RT	4.76	4.76
(AH)Type 3	2.00	2.00	4.00	2	RT	4.32	4.32	4.00	2	RT	3.48	3.48
(AI)Type 3	2.00	2.00	4.00	2	RT	3.56	3.56	4.00	2	RT	2.75	2.75
(AJ)Type 3	2.00	2.00	4.00	2	RT	3.91	3.91	4.00	2	RT	3.07	3.07
(AK)WA-105	2.00	2.00	4.00	2	RT	3.56	3.56	4.00	2	RT	2.75	2.75

Critical Sections Summary: Flexure

Member 1: (Exterior Wall), Thickness = 10.00 in
Design Corr. Load Ratings Fill

Loc	Dist. (in)	Moment (k-ft)	A. F. (k)	Mu (k-ft)	ds (in)	Ma (k-ft)	phi	As (in2)	Mcr (k-ft)	IR	OR	Truck	Depth (ft)
BOT	5.00	-12.59	8.38	27.35	7.69	30.32	1.00	0.74	16.32	6.11	7.92	AA	6.00
MID	59.00	8.24	3.08	27.35	7.69	28.45	1.00	0.74	16.32	10.49	13.60	AA	6.00
MID-	59.00	-1.58	8.76	37.74	7.63	40.64	1.00	1.06	16.32	18.62	24.13	AA	4.00
TOP	5.00	0.0#	2.20	27.35	7.69	28.14	1.00	0.74	16.32	NC	NC	AA	4.00

Member 2: (Top Slab), Thickness = 10.00 in

Loc	Dist. (in)	Design Moment (k-ft)	Corr. A. F. (k)	Mu (k-ft)	ds (in)	Ma (k-ft)	phi	As (in2)	Mcr (k-ft)	Load Ratings IR	OR	Truck	Fill Depth (ft)
LT	5.00	0.0#	0.87	27.35	7.69	27.66	1.00	0.74	16.32	NC	NC	AA	4.00
MID	48.80	17.24	0.50	37.74	7.63	37.90	1.00	1.06	16.32	2.85	3.69	AA	4.00
MID-	48.80	0.0#	0.87	37.74	7.63	38.03	1.00	1.06	16.32	NC	NC	AA	4.00
RT	3.00	-20.71	1.09	38.07	7.69	38.43	1.00	1.06	16.32	3.27	4.24	AA	6.00

Member 3: (Interior Wall), Thickness = 6.00 in

Loc	Dist. (in)	Design Moment (k-ft)	Corr. A. F. (k)	Mu (k-ft)	ds (in)	Ma (k-ft)	phi	As (in2)	Mcr (k-ft)	Load Ratings IR	OR	Truck	Fill Depth (ft)
BOT	5.00	0.00	7.26	2.07	3.81	3.79	1.00	0.11	5.87	NC	NC	AA	4.00
MID	59.00	0.00	12.49	2.07	3.81	4.99	1.00	0.11	5.87	NC	NC	AA	5.00
TOP	5.00	0.00	7.26	2.07	3.81	3.79	1.00	0.11	5.87	NC	NC	AA	4.00

Member 4: (Bottom Slab), Thickness = 10.00 in

Loc	Dist. (in)	Design Moment (k-ft)	Corr. A. F. (k)	Mu (k-ft)	ds (in)	Ma (k-ft)	phi	As (in2)	Mcr (k-ft)	Load Ratings IR	OR	Truck	Fill Depth (ft)
LT	5.00	-11.95	7.96	27.35	7.69	30.17	1.00	0.74	16.32	7.09	9.19	AA	6.00
MID	48.80	10.46	2.85	37.74	7.63	38.69	1.00	1.06	16.32	5.97	7.74	AA	4.00
MID-	48.80	0.0#	6.68	37.74	7.63	39.96	1.00	1.06	16.32	NC	NC	AA	4.00
RT	3.00	-18.30	3.22	38.07	7.69	39.15	1.00	1.06	16.32	3.18	4.12	AA	4.00

\# - A 0.0 design moment indicates no negative moments at this location. Check the 'Load Combination Results' table to determine if a positive moment exists.

Critical Sections Summary: Vertical Shear

Member 1: (Exterior Wall), Thickness = 10.00 in

Loc	Dist. (in)	Design Shear (k)	Corr. Moment (k-ft)	Corr. A. F. (k)	Dv (in)	phi*Vn	Beta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR	Truck	Fill Depth (ft)
BOT	12.20	6.41	8.4	8.38	7.35	18.15	2.838	20.17 a	0.00	0.00	0.00	9.56	12.39	AA	6.00
MID	59.00	1.26	8.2	3.08	7.35	18.76	2.932	20.84 a	0.00	0.00	0.00	43.02	55.76	AA	6.00
MID-	59.00	0.68	0.8	6.20	7.20	31.63	5.049	35.14 a	0.00	0.00	0.00	NC	NC	AD	6.00
TOP	12.20	-3.06	0.7	3.08	7.35	25.36	3.966	28.18 a	0.00	0.00	0.00	29.37	38.07	AA	6.00

Member 2: (Top Slab), Thickness = 10.00 in

Loc	Dist. (in)	Design Shear (k)	Corr. Moment (k-ft)	Corr. A. F. (k)	Dv (in)	phi*Vn	Beta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR	Truck	Fill Depth (ft)
LT	12.20	6.71	7.8	0.87	7.69	17.78	2.658	19.76 a	0.00	0.00	0.00	3.52	4.57	AA	4.00
MID	61.00	1.00	15.1	0.84	7.63	17.46	2.631	19.40 a	0.00	0.00	0.00	82.10	99.99	AA	6.00
MID-	61.00	2.76	4.8	1.03	7.63	23.67	3.568	26.30 a	0.00	0.00	0.00	15.65	20.29	AA	5.50
RT	10.20	11.09	14.5	0.87	7.69	16.45	n/a	18.28 c	0.00	0.00	0.00	1.81	2.35	AA	4.00

Member 3: (Interior Wall), Thickness = 6.00 in

Loc	Dist. (in)	Design Shear (k)	Corr. Moment (k-ft)	Corr. A. F. (k)	Dv (in)	phi*Vn	Beta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR	Truck	Fill Depth (ft)
BOT	9.32	0.00	0.0	10.15	4.32	19.76	5.256	21.95 a	0.00	0.00	0.00	NC	NC	AA	6.00
MID	59.00	0.00	0.0	14.58	4.32	19.93	5.303	22.15 a	0.00	0.00	0.00	NC	NC	AA	6.00
TOP	9.32	0.00	0.0	19.40	4.32	20.12	5.353	22.36 a	0.00	0.00	0.00	NC	NC	AF	6.00

Member 4: (Bottom Slab), Thickness = 10.00 in

Loc	Dist. (in)	Design Shear (k)	Corr. Moment (k-ft)	Corr. A. F. (k)	Dv (in)	phi*Vn	Beta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR	Truck	Fill Depth (ft)
LT	12.20	7.90	6.7	7.96	7.69	19.72	2.948	21.91 a	0.00	0.00	0.00	5.90	7.64	AA	6.00
MID	61.00	0.53	10.4	2.85	7.63	20.28	3.056	22.53 a	0.00	0.00	0.00	73.87	95.76	AA	4.00
MID-	61.00	1.05	0.0	6.68	7.63	26.45	5.030	29.39 a	0.00	0.00	0.00	97.02	99.99	AA	4.00
RT	10.20	9.56	12.2	3.22	7.69	17.59	2.630	19.54 a	0.00	0.00	0.00	2.65	3.43	AA	4.00

Vc Calculation By: a - Iterative Beta, b - Constant Beta, c - Box Culvert, d - Standard/Arema

Culvert Shoring Calculations

Post Shore Loading

Results Grid

Fill Depth, ft: 6 | Truck: HL-93 | Member: Interior wall | Load Type: Unfactored Dead Load (DL)

Location (ft)	Moment (kip-ft/ft)	Shear (k/ft)	Axial Force (k/ft)
0.42	0.00	0.00	-1.63
1.40	0.00	0.00	-1.63
2.38	0.00	0.00	-1.63
3.37	0.00	0.00	-1.63
4.35	0.00	0.00	-1.63
5.33	0.00	0.00	-1.63
6.32	0.00	0.00	-1.63
7.30	0.00	0.00	-1.63
8.28	0.00	0.00	-1.63
9.27	0.00	0.00	-1.63
10.25	0.00	0.00	-1.63

Close

Results Grid

Fill Depth, ft: 4 | Truck: HL-93 | Member: Interior wall | Load Type: Unfactored Live Load (LL)

Location (ft)	+Moment (kip-ft/ft)	-Moment (kip-ft/ft)	+Shear (k/ft)	-Shear (k/ft)	+Axial Force (k/ft)	-Axial Force (k/ft)
0.42	0.00	0.00	0.00	0.00	0.00	-7.21
1.40	0.00	0.00	0.00	0.00	0.00	-7.21
2.38	0.00	0.00	0.00	0.00	0.00	-7.21
3.37	0.00	0.00	0.00	0.00	0.00	-7.21
4.35	0.00	0.00	0.00	0.00	0.00	-7.21
5.33	0.00	0.00	0.00	0.00	0.00	-7.21
6.32	0.00	0.00	0.00	0.00	0.00	-7.21
7.30	0.00	0.00	0.00	0.00	0.00	-7.21
8.28	0.00	0.00	0.00	0.00	0.00	-7.21
9.27	0.00	0.00	0.00	0.00	0.00	-7.21
10.25	0.00	0.00	0.00	0.00	0.00	-7.21

Close

Total vertical load = 1.63 + 7.21 = 8.84 kips/ft

Post allowable load = 8.5 kips ea.

Spacing = 8.5/8.8 * 12 = 11.6" o.c. – Use 12"

Check Punching Shear at Slab

f'c	6500	psi		
d	7.69	in		
Load Factor, LF	1.0		Max LF for LL	
Load, P	8.8	kips	Load per shore	
c1	5	in	Dimensions of Jack Bas	
c2	5	in		
b_0 = 2(c1+d)+2(c2+d)	50.75	in	Critical Shear perimete	
ϕ	0.75			
Vu = P*LF	8.8	kips		
ϕVc ϕ(4*f'c^0.5*b_0*d)	94.4	kips	OK	ACI Eq 11-3

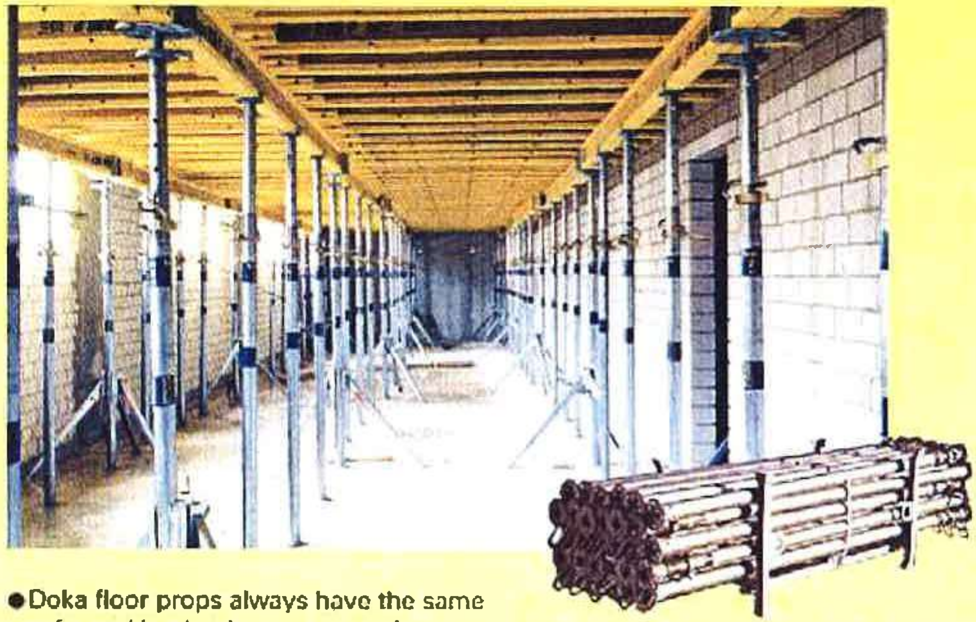
Check Shear at Slab

ϕ	0.75		
b	12	in	
d	7.69	in	
f'c	6500	psi	
ϕVc = ϕ(2*f'c^0.5*b*d)	11156	lbs per ft	
Vu = wl/2	7215	lbs	OK

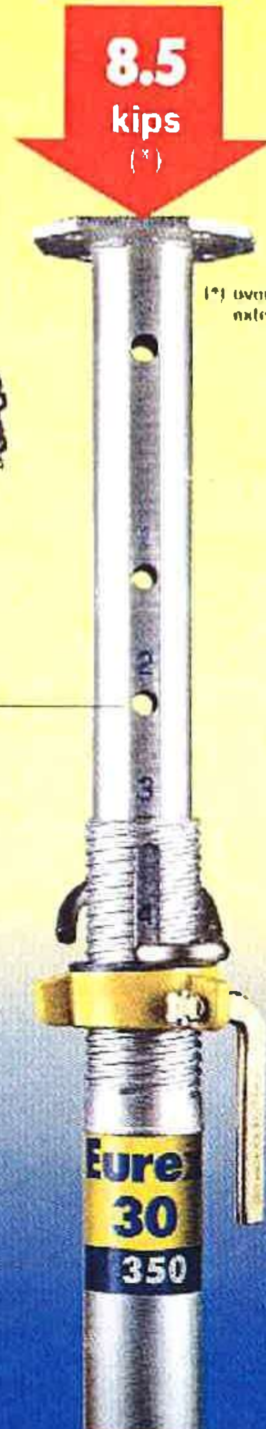
Check Longitudinal Slab Bending Between Shoring Posts

f'c	6500	psi	
fy	60000	psi	
b	12	in	
No. Bar	5		
db	0.625	in	
As per bar	0.31	in^2/bar	
Spacing	10	in	
As per width "b"	0.37	in^2/ft	
Slab Thickness, t	10	in	
d = t - 2" cover - 0.5*db	7.69	in	
a = As*fy / (0.85*f'c*b)	0.34	in	
ϕ	0.9		
ϕMn = ϕAs*fy*(d-a/2)	12587	lb-ft /ft	
w (Strength I, factored)	10850	plf	
Span, l	1.33	ft	
M = wl^2/8	2399.1	lb-ft	OK

The best possible "support" on your site – Doka floor props



Eurex 30



(*) over entire extension range

- Doka floor props always have the same safe working load at any extension eliminating field calculation
- Doka floor props are light weight
- Doka floor props are galvanized – no rust
- Doka floor props come with accessories for both H20 and Alu beams

The numbered holes are a convenient feature that makes for quicker and easier height adjustments.

Eurex 30 floor props						
Type	Article Number	closed	extended	weight	Safe working load	safetey factor
Eurex 30 250	586092000	5' - 0"	8' - 2"	33 lbs	8.5 kips (37.8 kN) (**)	3 : 1
Eurex 30 300	586093000	5' - 8"	9' - 10"	37 lbs		3 : 1
Eurex 30 350	586094000	6' - 6"	11' - 5"	45 lbs		3 : 1
Eurex 30 400	586095000	7' - 6"	13' - 1"	55 lbs		3 : 1

(**) according to DOKA TEST REPORT on compressions test for Doka-post-shores EUREX 30 8.5 kips, Nr. 861/01, Date: 27.09.2001 and US Standards

doka
The Formwork Experts

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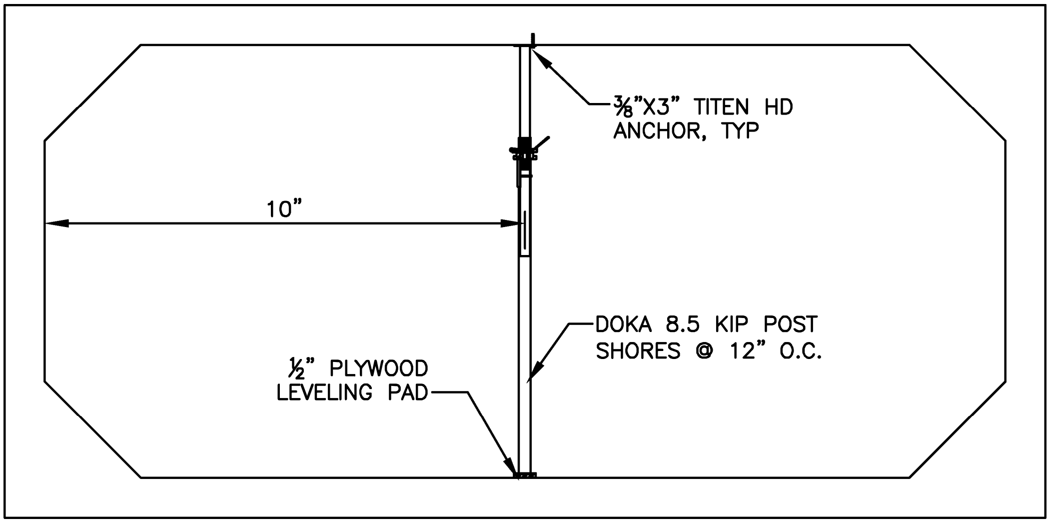
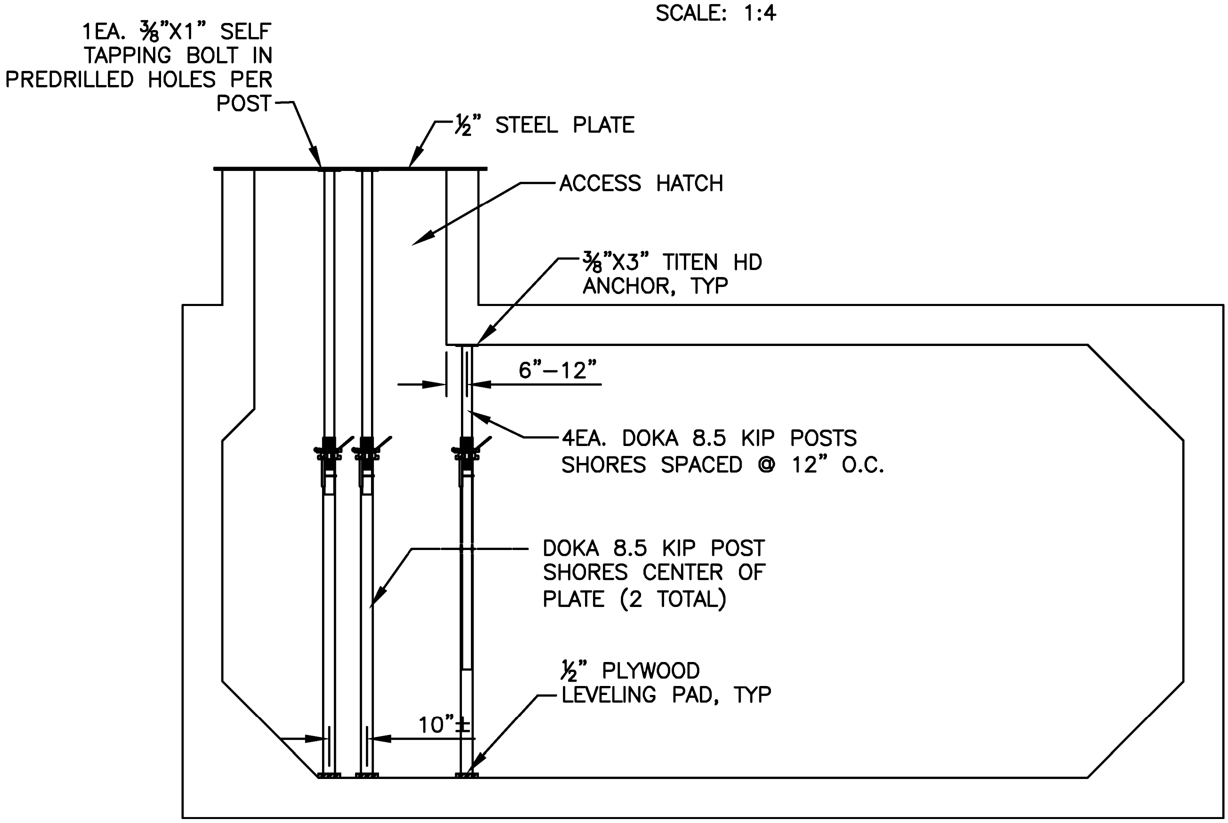


BOX CULVERT TEMP SHORING
SCALE: 1:4



HATCH LID & ACCESS OPENING
TEMP SHORING
SCALE: 1:4

FORREST G. MEGARGEL
STATE OF WASHINGTON
20100237
REGISTERED
PROFESSIONAL ENGINEER

7-7-25

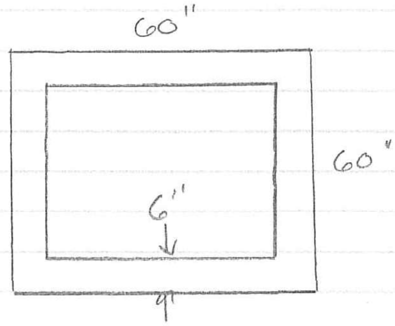
Rating Factor for Temporary Shoring

$$RF = \frac{(C - \gamma_{DC}\,DC - \gamma_{DW}\,DW \pm \gamma_p\,P)}{\gamma_{LL}\,LL\,(1+IM)}$$ eqn 13.1.1A-1

Pipe Shore ult capacity	=	25.5	kips	Rn	(8.5 allowable w/ FS = 3)
Unfactored DL	=	1.63	k/ft	Dw	
Unfactored LL	=	7.21	k/ft	LL	
ɣDW	=	1.75	table 13.1.1.D (HL-93 inventory rating)		
ɣLL	=	1.45		table 13.1-1	
∅s, c, n	=	1		tables 13.1.1B, C, 13.1.2.C	
IM	=	0		no impact on structure	
C	=	25.5			
Dc	=	0		no structural load	
P	=	0		no addt'l permanent loads	
RF, IR	=	2.2			

Access Riser Calculations

Concrete Riser



Area = 108 in²

Assume min steel = 12 no. 3's

Riser Load = HL-93 wheel load + Soil DL

$= 1.75(16,000) + 1.25(2' \cdot 127)(5^2) = 35,938 \text{ lbs}$

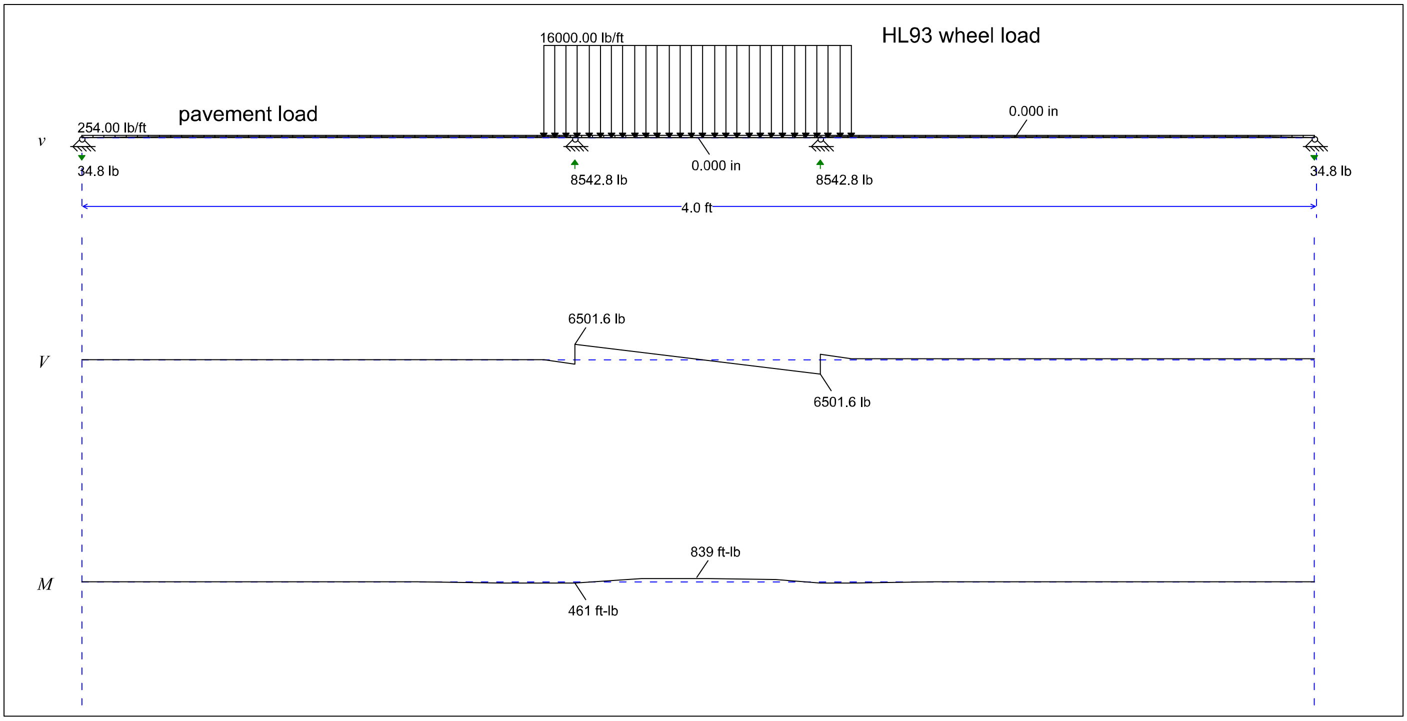
Compressive stress = $\frac{35938 \text{ lbs}}{108 \text{ in}^2} = 333 \text{ psi}$

4M ENGINEERING CIVIL - STRUCTURAL

Project Name: Box Culvert
Date: 5-28-25

Check Concrete Risers as Concrete Columns

Dead Load	6.35	kips		
Live Load	16.0	kips		
Design Load (Vertical)	36	kips		1.25 DL + 1.75LL
Lateral Load	0	kips		
Divided over 4 supports (Lateral)	0	kips		
f'c	3.5	ksi		
fy	60	ksi		
ρ trial	0.03			
Ag_trial	17.0	sq in		
	4.1	in		
Check w/ #3 bars				
Bar Number	3			
Number of Bars	12			
db	0.375	in		
As per bar	0.11	sq in		
Ast (total)	1.32	sq in		
Length	60	in		
Width	60	in		
Int width	48	in		
Ag	108	sq in		
ρ = Ast/Ag	0.012			Per ACI 10.9, Must be between 0.01 to 0.08
ϕ	0.7			
ϕ*Pn = 0.8*ϕ*[0.85*f'c*(Ag-Ast)+fy*Ast)]	222	kips	OK	ACI-318 Eq. 10-2
Rating Factor RF	7.6			AASHTO eqn 13.1.1A-1
Check Slenderness Effects				
Effective length factor, k	2			
Unsupported length, lu	4.5	ft		
Radius of gyration, r	76.8	in		Per ACI 10.10.1.2, equal to 0.3x dimension
Check k*lu/r < 22	1.41		OK	ACI-318 Eq. 10-6
Check Concrete for Shear				
ϕ	0.75			
b	60	in		
d	57.81	in		
f'c	3500	psi		
ϕVc = ϕ[2*(1+Nu/2000Ag)*f'c^0.5*b*d]	309	kips	OK	ACI-318 Eq. 11-4



Beam Parameters: Length = 4.0 ft, E = 29000.0 ksi, I = 140.0 in^4, A = 6.0 in^2

Rating Factor for Temporary Shoring

$$RF = \frac{(C - \gamma_{DC}\,DC - \gamma_{DW}\,DW \pm \gamma_p\,P)}{\gamma_{LL}\,LL\,(1+IM)}$$ eqn 13.1.1A-1

Pipe Shore ult capacity	=	25.5	kips	Rn	(8.5 allowable w/ FS = 3)
Unfactored DL	=	0.34	kip	Dw	
Unfactored LL	=	8.2	kip	LL	
γDW	=	1.75	table 13.1.1.D (HL-93 inventory rating)		
γLL	=	1.45		table 13.1-1	
Øs, Øc, Øn	=	1		tables 13.1.1B, C, 13.1.2.C	
IM	=	0.33			
C	=	25.5			
Dc	=	0		no structural load	
P	=	0		no addt'l permanent loads	
RF, IR	=	1.6			

APPENDIX

Inspection

CD Guid: 119f214d-5bdd-451a-87b6-c08671b799fb

Agency: Washington State   Program Mgr: Sonia L. Lowry   CD Status: Work   Release Date:

Structure No. V001   **SID** XG180500   **Structure Name** Drainge vault

Carrying   **Route On**   **Mile Post**

Intersecting   **Route Under**   **Mile Post**

2/9/2028   3/18/2028

Inspector's Signature JJL   Cert # G1805   Cert Exp Date   Co-Inspector's Signature

Current Inspections Performed

Report Type	Subtype	Rsk Mthd	Begin Date	Comp Date	Interval	Due Date	Hours	Inspector	Cert No	Co-Insp
Initial		1	3/13/2025	3/13/2025			1.0	JJL	G1805	
Routine Bridge		1	3/13/2025	3/13/2025			1.0	JJL	G1805	

Component Condition Ratings

G	Overall Condition Classification	(BC12)
N	FHWA Deck Overall	(BC01)
N	WSDOT Deck Overall	(WC01)
N	Bridge Railings	(BC05)
N	Bridge Railing Transitions	(BC06)
N	Bridge Joints	(BC08)
N	Superstructure Overall	(BC02)
N	NSTM Inspection	(BC14)
N	Bridge Bearings	(BC07)
N	Substructure Overall	(BC03)
N	UW Inspection	(BC15)
8	Culvert Overall	(BC04)
N	Scour Condition	(BC11)
N	Channel Condition	(BC09)
N	Channel Protection	(BC10)
	Chan/Prot (NBI Disc)	(1677)
	Pier/Abut/Prot (NBI Disc)	(1679)

Appraisal

	Scour Critical (NBI Disc)	(1680)
N	Scour Vulnerability	(BAP03)
X	Scour Plan of Action	(BAP04)
	Waterway (NBI Disc)	(1662)
N	Overtopping Likelihood	(BAP02)
	Appr Roadway Align	(BAP01)
	Fatigue Details	(BIR02)
	Seismic Vulnerability	(BAP05)

Optional Condition Ratings

6	Drain Condition	(LP01)
9	Retaining Wall Condition	(LP02)

Miscellaneous Fields

1996	Year Built	(BW01)
	Asphalt Depth	(WIE30)
0.00	Design Curb Height	(WIE31)
0.00	Bridge Rail Height	(WIE32)
1	Number of Utilities	(WIE33)
Y	Subject to NBIS	(WIE34)
03/17/2025	Inspn QA Date	(BIE09)

Inspection Flags

	Soundings	(WIE20)
	Clearance	(WIE21)
	Revise Rating	(WIE22)
P	PhotosFlag	(WIE23)
Y	Roadside Hardware Flag	(WIE25)
Y	QA Flag	(WIE24)

BMS Elements

Element	Element Description	Total	Units	CS 1	CS 2	CS 3	CS 4
	Culvert Elements						
241	Concrete Culvert	285	LF	285	0	0	0

Notes

Culvert Notes

241 This is a drainage detention vault running along the median area of I-405 near Exist 26, north of 228th St. SE., Bothell, WA . The actual length of culvert is approximately 285 feet, and the vault interior width and height are approximately 20 x 9 feet . The inspection was performed by entering the vault through one of the hatches at night around 11:30 pm on March 12, with one lane I-405 closure. The ground above the vault was not inspected due to the night condition. At the hatch opening, the ground is about 4 feet above the vault. The vault bottom has standing water due to rain on the inspection day. The vault is an active drainage structure with three cells, an inlet chamber, a settling chamber, and an outlet chamber connecting to outfall. the structure condition is good, with typical longitudinal hairline cracks at each expansion joint. The expansion joint spaces at 10 feet, all expansion joints and hatches leak significantly.

CD Guid: 119f214d-5bdd-451a-87b6-c08671b799fb

Agency: Washington State | Program Mgr: Sonia L. Lowry | CD Status: Work | Release Date:

Structure No. V001 **SID** XG180500 **Structure Name** Drainge vault

Carrying **Route On** **Mile Post**

Intersecting **Route Under** **Mile Post**

Repairs

Repair No	Pr	R	Repair Descriptions	BMS	Noted	Maint	Verified
			(No repairs for this structure)				

All Inspections and Resources Required

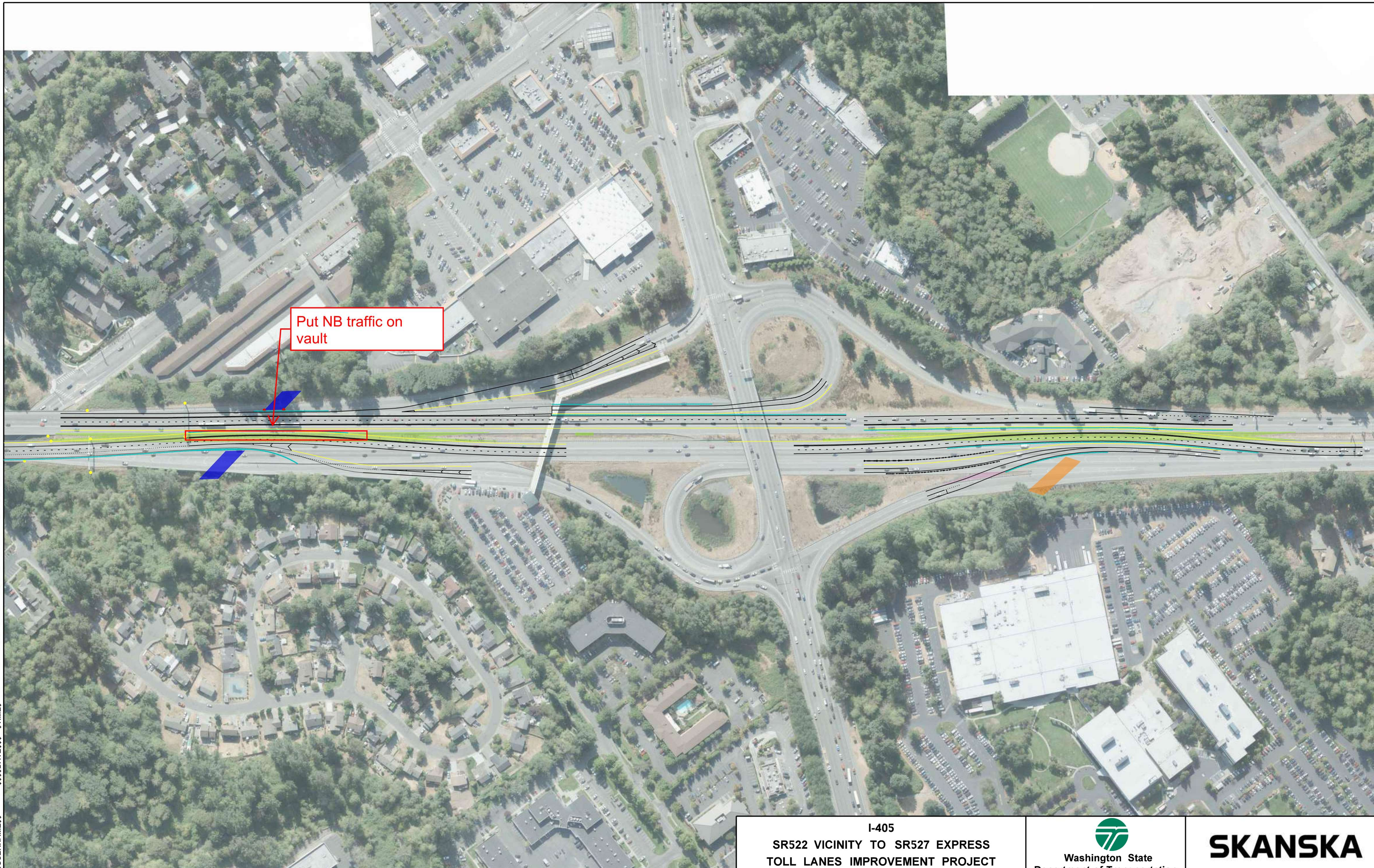
Report Type	Subtype	Rsk Mthd	Begin Date	Comp Date	Interval	Due Date	Hours	Inspector	Cert No	Co-Insp
Initial		N	3/13/2025	3/13/2025			1.0	JJL	G1805	

Inspection Note	Late Inspection Explanation	Late PM Resp Date	Late PM Approval	Insp QC Date	Inspn Data Update Date
Mid night underground inspection, rainy					

Report Type	Subtype	Rsk Mthd	Begin Date	Comp Date	Interval	Due Date	Hours	Inspector	Cert No	Co-Insp
Routine Bridge		N	3/13/2025	3/13/2025			1.0	JJL	G1805	

Inspection Note	Late Inspection Explanation	Late PM Resp Date	Late PM Approval	Insp QC Date	Inspn Data Update Date
Mid night underground inspection, rainy					

Plans

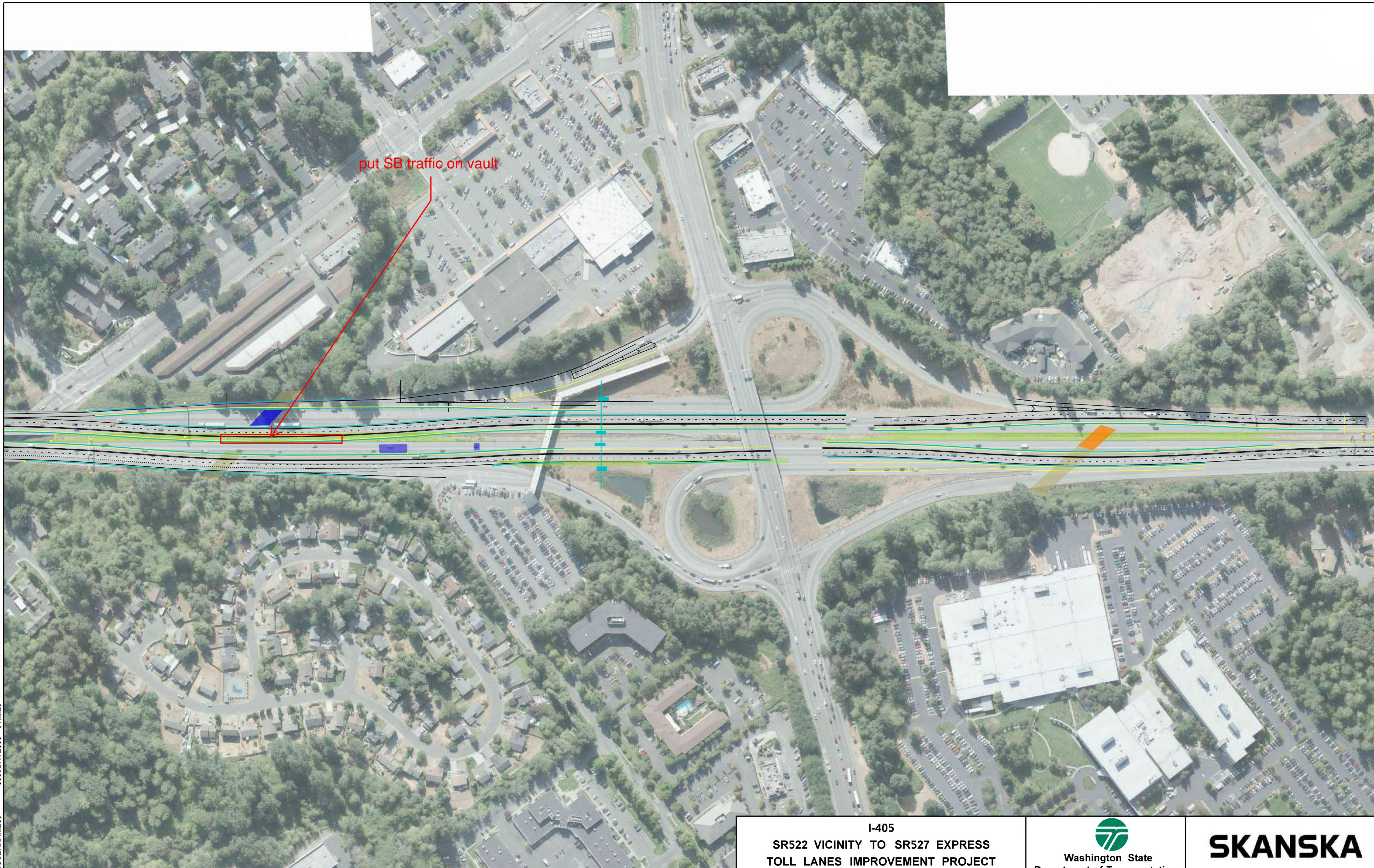


I-405
SR522 VICINITY TO SR527 EXPRESS
TOLL LANES IMPROVEMENT PROJECT

Washington State
Department of Transportation

SKANSKA

$$$$$$$DESIGNFILENAME$$$$$$ $$$DATE$$$ $TIME$
$$USERNAME$$



I-405

SR522 VICINITY TO SR527 EXPRESS TOLL LANES IMPROVEMENT PROJECT

Washington State Department of Transportation

SKANSKA

$$$$$$$$DESIGNFILENAME$$$$$$ $$$$DATE$$$$ $TIME$

$$USERNAME$$

$l_{w.2} := l_{w.trck} + s_w + s_2 = 22.27\ ft$ + 2 = 24.27

$A_{LL.2.trcks} := w_{w.trck} \cdot l_{w.2} = 147.7\ ft^2$ =6.63 * 24.47 = 160.9

$D_E := H_s = 4\ ft$ minimum depth of earth fill, recalled

$IM := \max\left(0, 33 \cdot \left(1 - .125 \cdot \frac{D_E}{ft}\right)\right) = 16.5$

$P_{L.2.trcks} := \frac{(P_{a.2} + P_{a.2}) \cdot \left(1 + \frac{IM}{100}\right) \cdot m_1}{A_{LL.2.trcks}} = 0.5\ ksf$ unfactored live load vertical crown pressure for large axle of design truck, LRFD Eqn. 3.6.1.2.6b-7

0.5 * 147.7/160.9 = 0.46

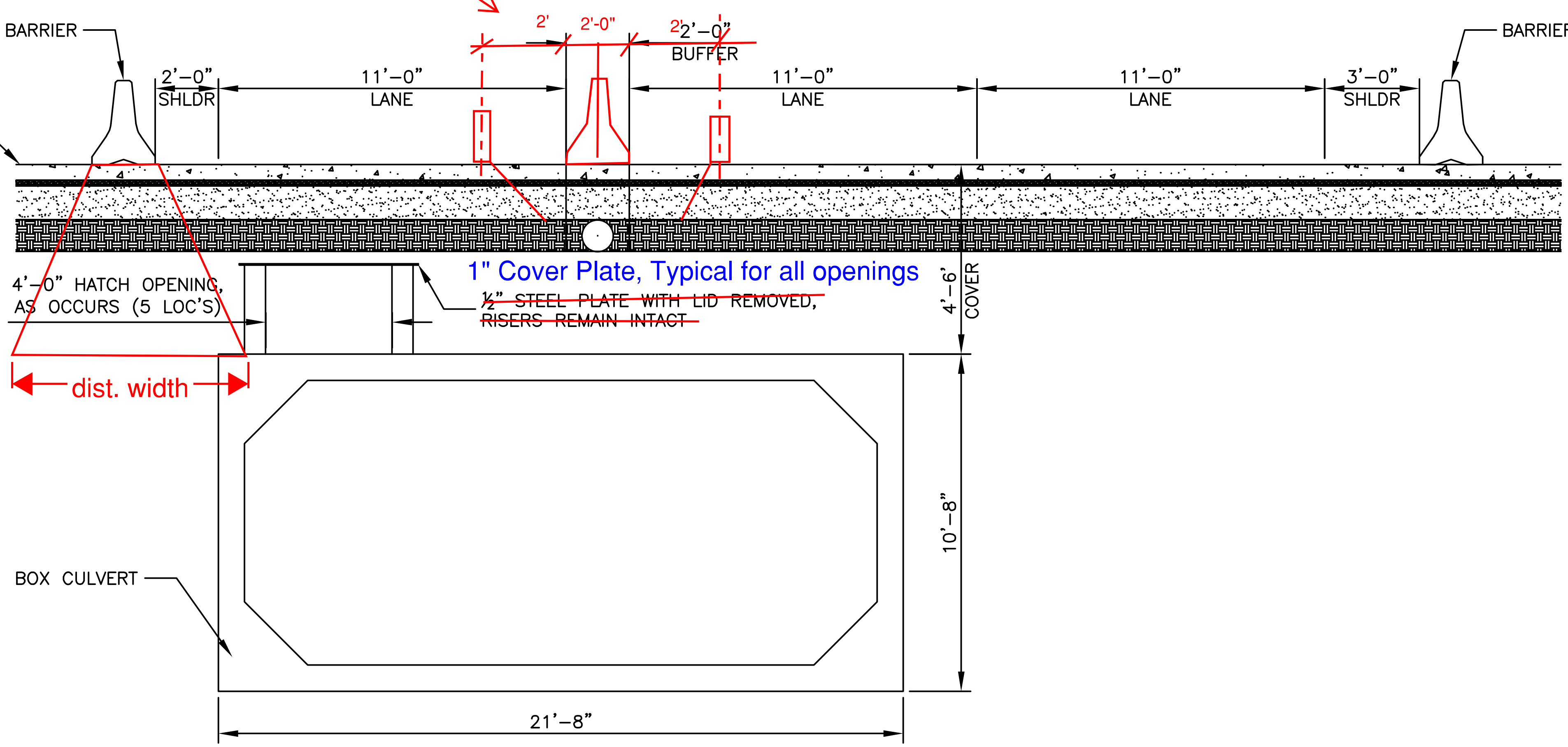
$udl_{2.trcks} := P_{L.2.trcks} \cdot w_{slab} = 0.5\ \frac{kip}{ft}$ unfactored distributed load per unit length for two HL-93 trucks

Pressure taffic barrier = 0.067*1.25 = 0.083 ksf

Live load effect decrease due to longer distribution length = (0.5-0.46)*1.75 = 0.07 ksf

Decrease LL pressure and increase DC pressure are almost canceled out. Therefore, the barrier load can be ignored.

For dead load, use 1:1 slope for barrier - Barrier load per BDM is approximately .67klf. The distributed width is 4ft*2+barrier width =10.ft Unit pressure = .67klf/10.0ft = 0.07k/ft^2 However, this is minor and the pressure is almost outside of culvert. Therefore, the barrier load can be ignored.



TYP SECTION THROUGH VAULT NW–12

SCALE: 1:5

REVISIONS | # | DATE | DESCRIPTION | 0 | 5–16–25 | ISSUED FOR CONSTRUCTION

6/3/25

PLANS PREPARED BY 4M ENGINEERING CIVIL – STRUCTURAL 6675 PURPLE POPPY LN., PARK CITY, UT 84098 801–380–0562 WWW.4MENGINEERS.COM

DESIGNED BY: JESSICA MERRELL

PLANS PREPARED FOR: SKANSKA USA CIVIL 18911 NORTH CREEK PKWY, STE 300

PROJECT INFORMATION PROJECT TITLE: I–405 BRICKYARD TO SR527 OWNER: WASH DOT

DIST – COUNTY SNOHOMISH ROUTE 405 POST MILE –

CONTRACT NO.: 9727

SHEET NAME: TYP SECTION @ VAULT NW–12

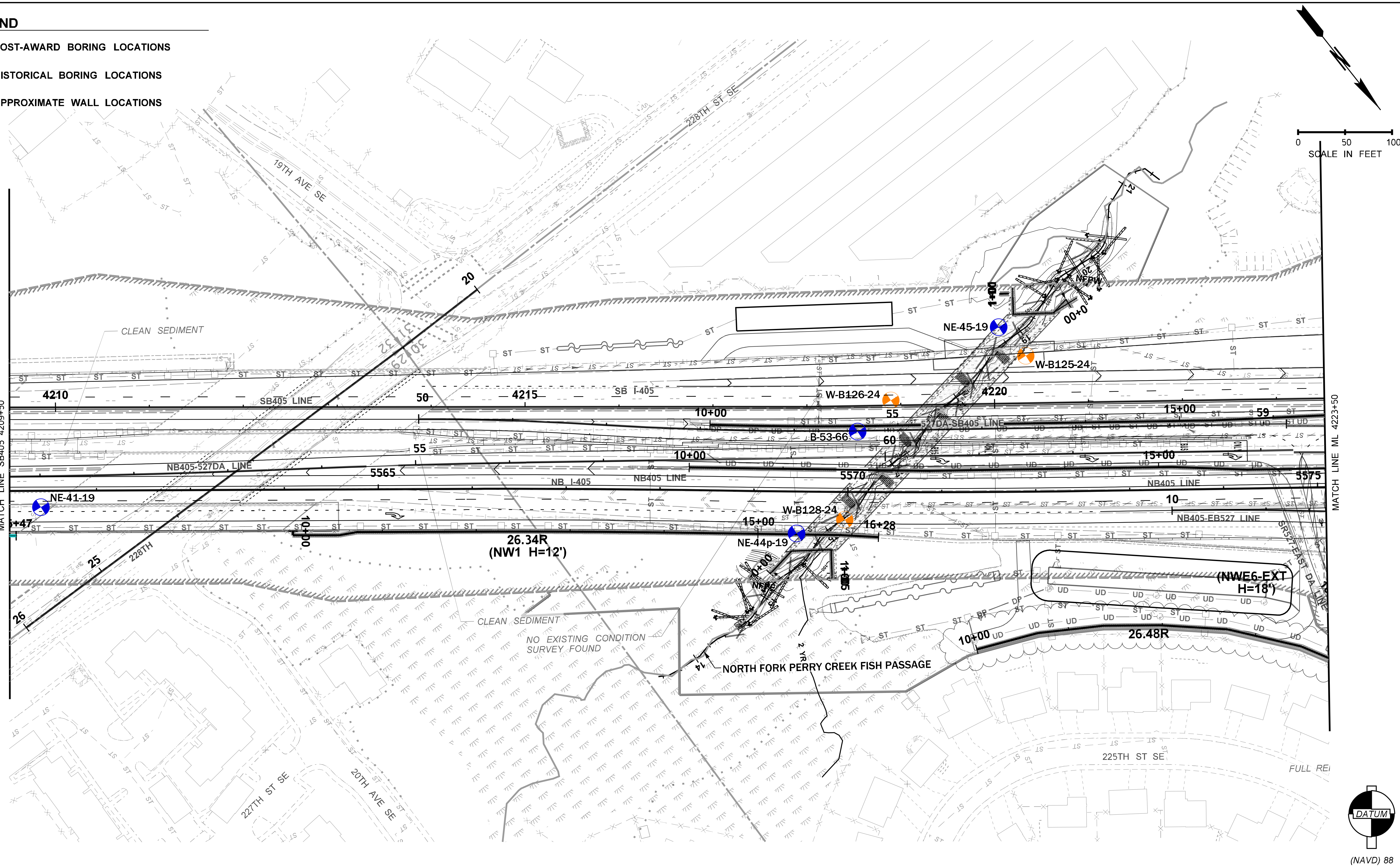
STR NAME: VAULT NW–12 STR NO.: VAULT NW–12

SHEET 1 OF 1

FILE: Bothell culvert section.dwg

LEGEND

- POST-AWARD BORING LOCATIONS
- HISTORICAL BORING LOCATIONS
- APPROXIMATE WALL LOCATIONS



FILE NAME	c:\pwworking\uswa\dms10950\C9727_BP_EJK-P8_04.dgn
TIME	7:10:07 PM
DATE	10/4/2024
PLOTTED BY	ejkennedy
DESIGNED BY	
ENTERED BY	
CHECKED BY	
PROJ. ENGR.	J SLAVICEK
REGIONAL ADM.	L HODGSON

REVISION	DATE	BY

REGION NO.	STATE	FED.AID PROJ.NO.
10	WASH	

JOB NUMBER 22AB17

CONTRACT NO. 9727 — LOCATION NO. XL5446

FINAL NOT FOR CONSTRUCTION

SEE SHEET CT1 DATE

P.E. STAMP BOX

AECOM

Terracon Consulting Engineers and Scientists

Washington State Department of Transportation

SKANSKA

I-405 BRICKYARD TO SR527 IMPROVEMENT PROJECT

PLAN VIEW: Package 8

PLAN REF NO

SHEET 3 OF 7 SHEETS

Drilled	Start 4/11/2024	End 4/11/2024	Total Depth (ft) 50.25	Logged By JSP / Checked By GDT	Driller Holocene Drilling	Drilling Method Hollow-stem Auger

Surface Elevation (ft) 116.89 / Vertical Datum NAVD88	Hammer Data: Autohammer 140 (lbs) / 30 (in) Drop	Drilling Equipment: Diedrich D70 Track Rig #137
Easting (X) 1630287.35 / Northing (Y) 620145.73	System Datum / Project Datum	See "Remarks" section for groundwater observed

Notes: Autohammer Average Transfer Efficiency = 85%

Elevation (feet)	Depth (feet)	Recovered (in)	Blows/foot	Sample Name / Testing	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
	0				AC	Approximately 8 inches of asphalt concrete			
					RX	Approximately 16 inches of base course			
115		13	41	1	SP-SM	Brown poorly graded sand with silt (dense, moist)			
	5	17	19	2 AL, HA	CL	Gray lean clay with sand (very stiff, moist)	15	70	AL (LL=40; PI=19)
110		13	28	3		Grades to with oxidation staining			
	10	4	5	4A 4B	SM	Brown silty sand (loose, moist)			
105					ML	Gray silt (medium stiff, moist)			
	15	16	7	5A 5B	SP-SM	Gray poorly graded sand with silt and gravel (loose, wet)			Driller noted groundwater seepage at approximately 16 feet at time of drilling
100									
	20	18	22	6 SA		Becomes medium dense	16	11	
95									
	25								

Note: See Figure A-1 for explanation of symbols.

Date:9/23/24 Path:C:\USERS\LHUSTON\ONEDRIVE - GEOENGINEERS, INC\WORK\018042301.GPJ DBLibrary/Library:GEOENGINEERS_DF_STD_US_JUNE_2017.GLB/GEI_GEOTECH_STD_%F_NO GW_NO DATA SOURCE

Log of Boring W-B126-24

GEOENGINEERS

Project: I-405, Brickyard to SR 527 Improvement Project
Project Location: King and Snohomish Counties, Washington
Project Number: 0180-423-01

Figure A-
Sheet 1 of 2

Elevation (feet)	Depth (feet)	Interval	Recovered (in)	Blows/foot	Collected Sample	Sample Name / Testing	Graphic Log	Group Classification	MATERIAL DESCRIPTION	Moisture Content (%)	Fines Content (%)	REMARKS
	25		17	39		7			Becomes dense			Corrosion test pH=8.5, Resistivity=6,700 ohm-cm
90								SM	Gray silty sand (very dense, moist)			
	30		13	85		8 / SA				13	43	Corrosion test pH=8.3, Chloride=trace (<30 ppm), Resistivity=6,500 ohm-cm, Sulfate=trace (<2 ppm)
85								CH	Gray fat clay (very hard, moist)			
	35		6	50/4"		9						
80								GP-GM	Gray poorly graded gravel with silt (very dense, wet)			
	40		7	50/4"		10						
75								CL	Gray lean clay (very hard, moist)			
	45		10	50/5"		11						
70												
	50		0	50/3"		12						No recovery

Boring terminated at 50.25 feet below ground surface

Date:9/23/24 Path:C:\USERS\LHUSTON\ONEDRIVE - GEOENGINEERS, INC\WORK\018042301.GPJ DBLibrary/Library:GEOENGINEERS_DF_STD_US_JUNE_2017.GLB/GEI_GEOTECH_STD_%F_NO GW_NO DATA SOURCE

Log of Boring W-B126-24 (continued)

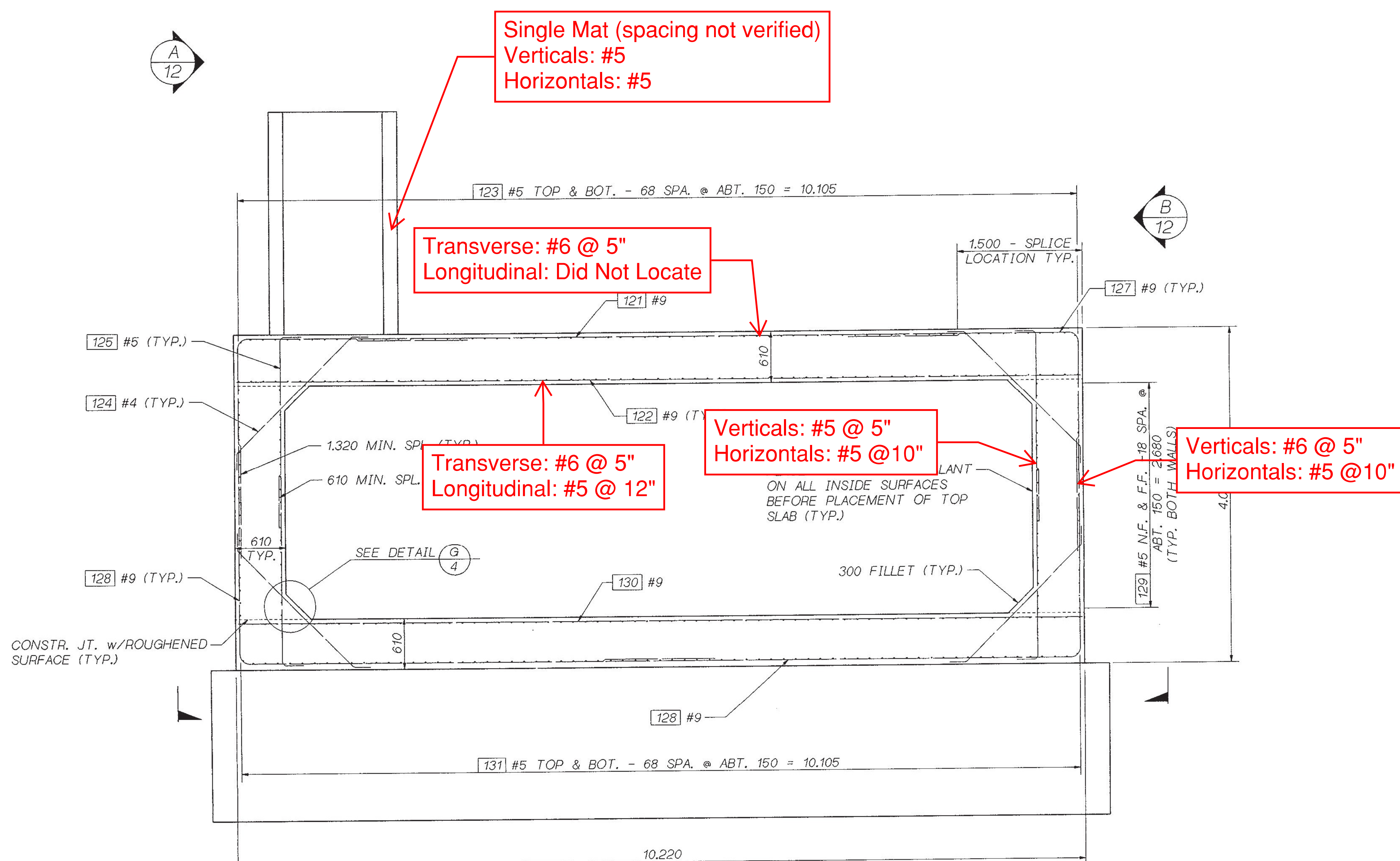
GEOENGINEERS

AECOM

Project: I-405, Brickyard to SR 527 Improvement Project
Project Location: King and Snohomish Counties, Washington
Project Number: 0180-423-01

Figure A-
Sheet 2 of 2

Field Investigations



TYPICAL TRANSVERSE SECTION

FOR "AS CONSTRUCTED PLANS" ONLY

SR 405 JOB NO. 7082 SHEET 9

Bridge Design Engr. C. C. RUTH
Supervisor R. T. SHAEFER
Designed By M.TALUKDAR 8/96
Checked By F. KESHAVARZI 10/96
Detailed By V.B. SCHICCHI 8/96
Bridge Projects Engr.
Prelim. Plan By
Architect/Specialist

VAULTSROOT:[FGB]VAULT9_1.FGB;1

DATE | REVISION | BY | APP'D

REGION NO. 10 | STATE WASH. | FED. AID PROJ. NO. | SHEET NO. | TOTAL SHEETS
JOB NUMBER 96W035
5054

BRIDGE AND STRUCTURES OFFICE
SUPERVISING BRIDGE ENGINEER
BRIDGE DESIGN ENGINEER

Washington State Department of Transportation

SR 405
BOTHELL TO SWAMP CREEK I/C
HOV LANES - STAGE 1
TANKS AND VAULTS

NW-12 VAULT SECTIONS

BRIDGE SHEET NO. 9
SHEET 199 OF 663 SHEETS

15-NOV-96

REPORT OF CORED CYLINDER TEST

O'Neill Service Group

17619 NE 67th Ct Suite 100, Redmond, WA 98052

Report Date: 7/2/25

Project Number: 3181

Report Number: 3181-20250701MC-1

Project: I-405 Brickyard to SR 527

Client: Skanska

Address:

Attn:

SAMPLING INFORMATION (ASTM C 42)

Date Sampled: 7/1/2025

Time Sampled: na

Technician: Miles C

Date Placed: 7/1/2025

Location of Sample: Drainage vault N-12

Supplier: na

Mix Number: na

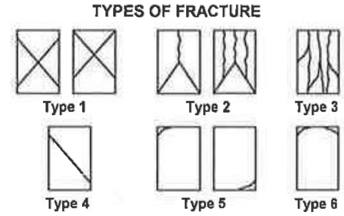
Design Strength:

LABORATORY TEST RESULTS (ASTM C 39)

Specimen	Test Date	Age	Load	Diameter	Area	Un-capped Height	Capped Height	Strength	Percent of Design	Type of Fracture
150918	7/2/2025	1	99395	3.74	10.99		3.75	7870		1

Remarks: Specimen 150918 is core #1.

TYPES OF FRACTURE



Copies to:

Reported by:

MIke Holtz

Laboratory Manager

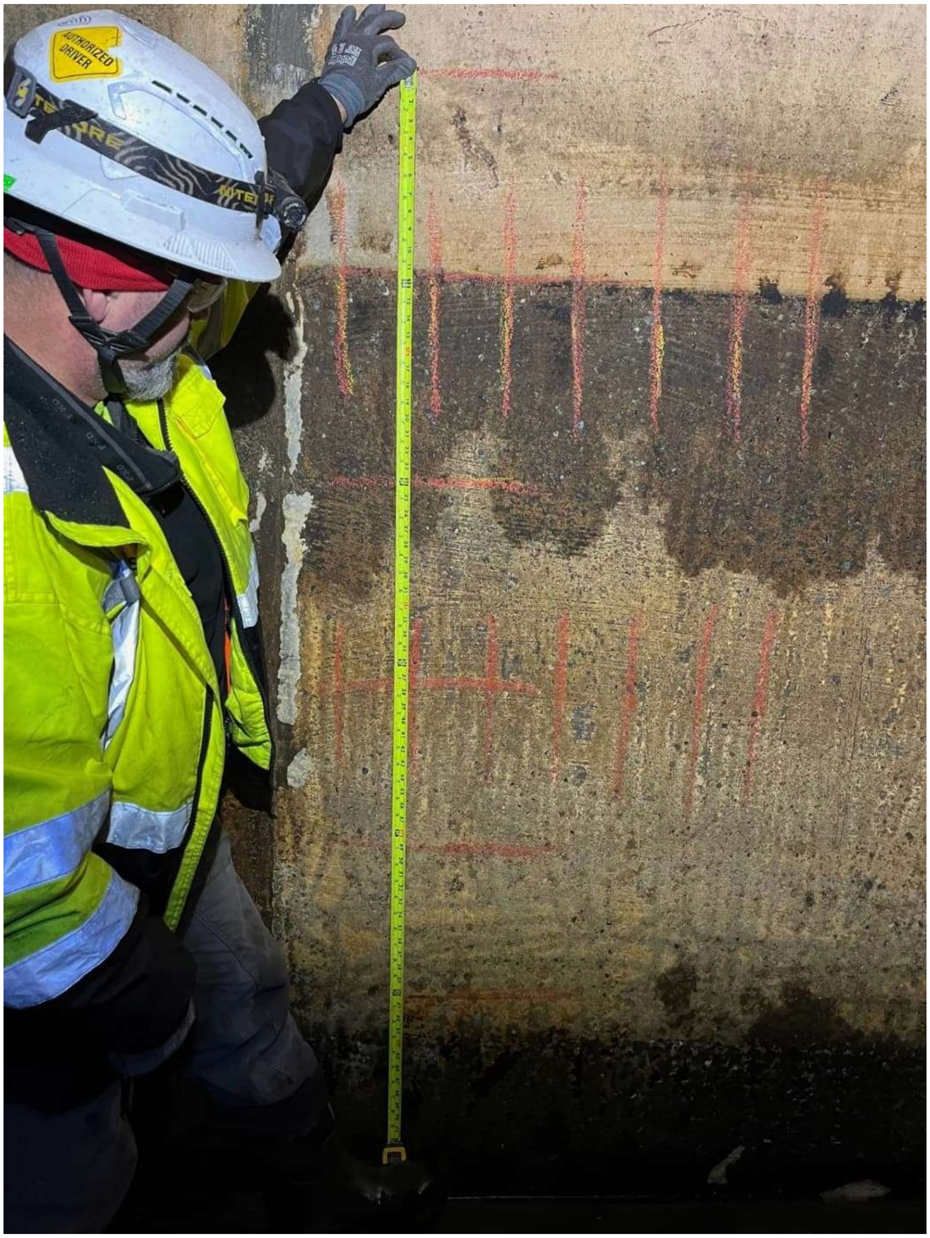
Ceiling Rebar

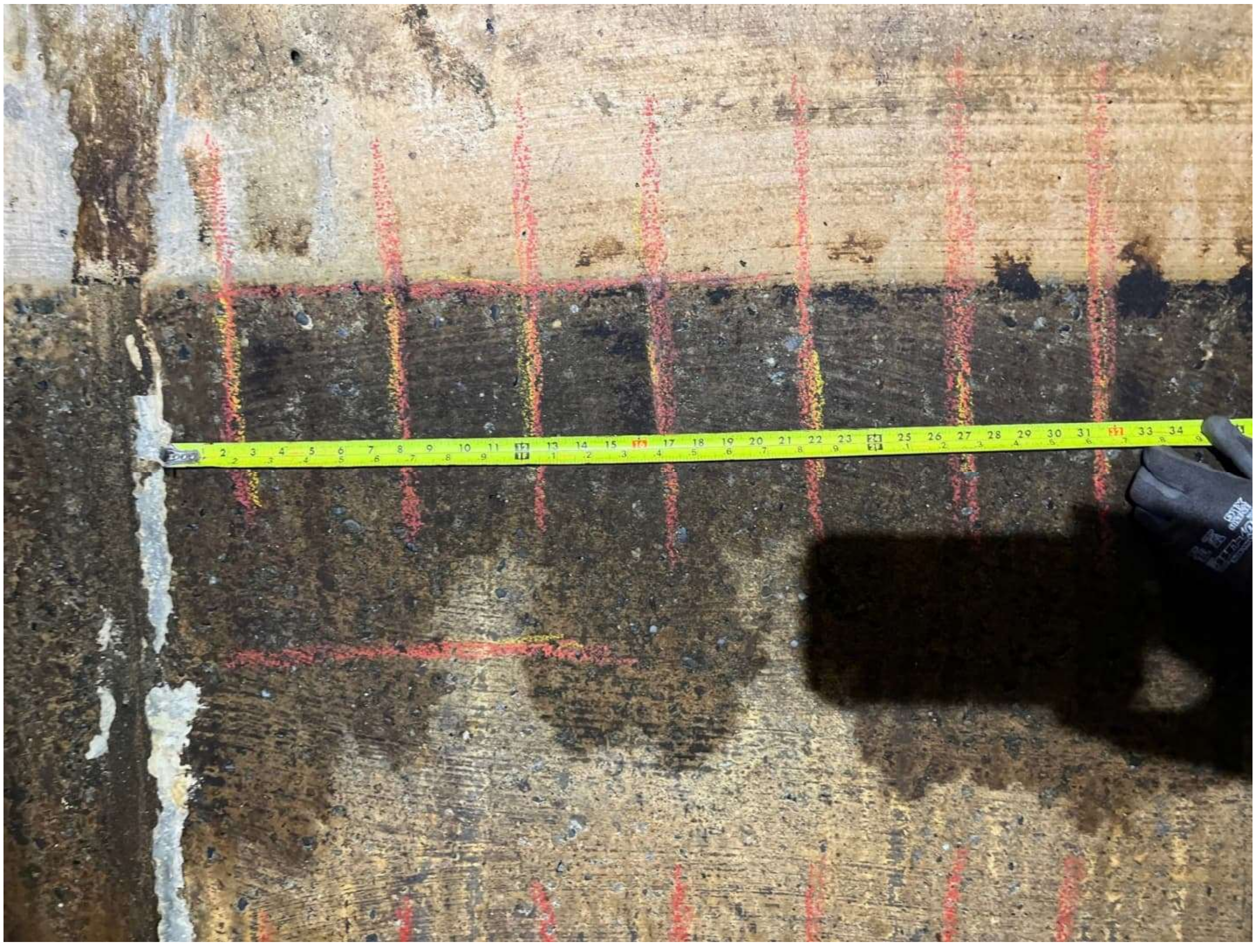

Network:Mar 13, 2025 at 1:14:08 AM PDT
Local:Mar 13, 2025 at 1:14:08 AM PDT
N 47° 47' 33.121", W 122° 12' 35.475"
I-405 S
Bothell WA 98021
United States

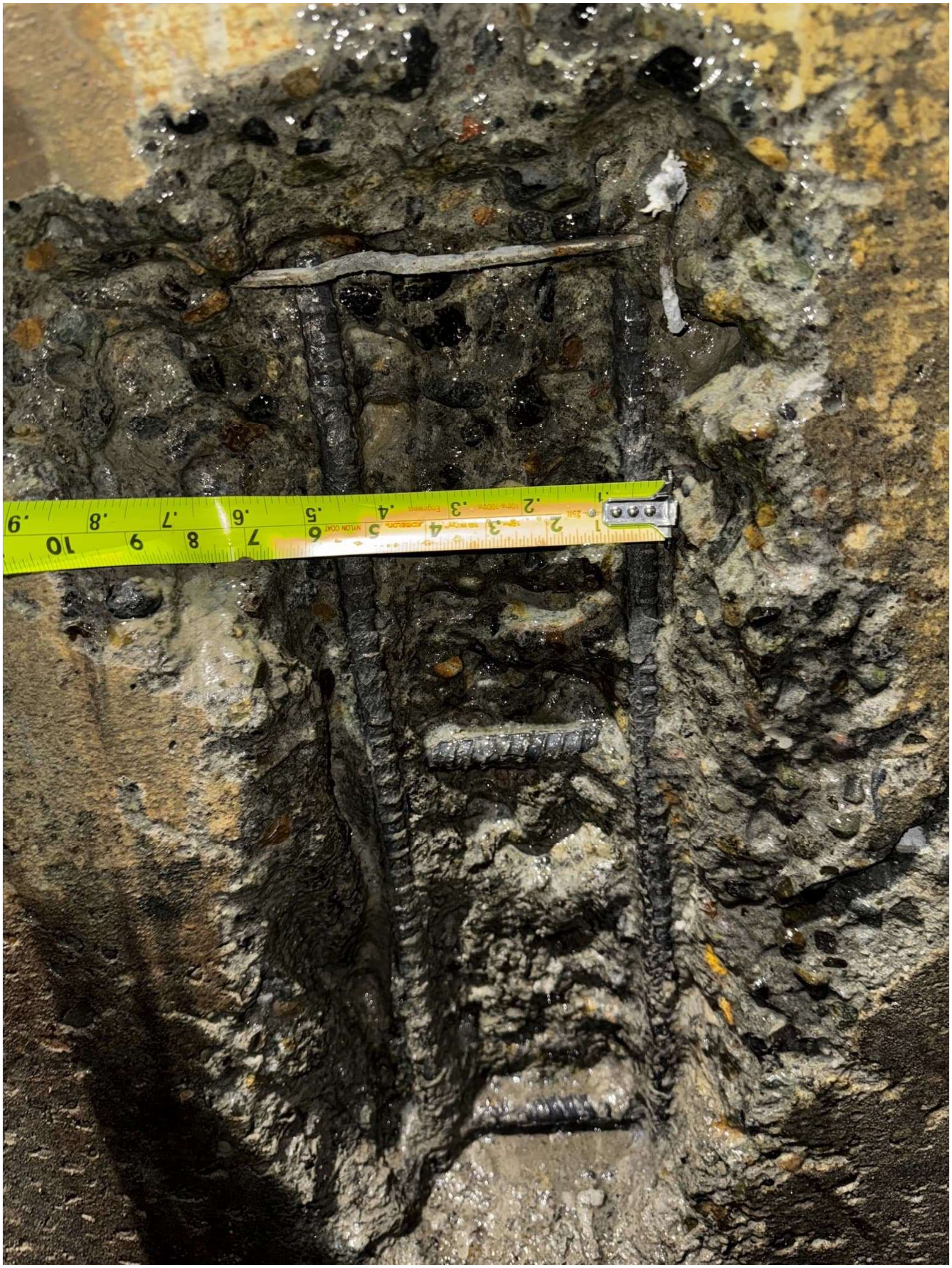

2 DEWALT 3
4
5
6
7
8
9
10
11
12


DEWALT

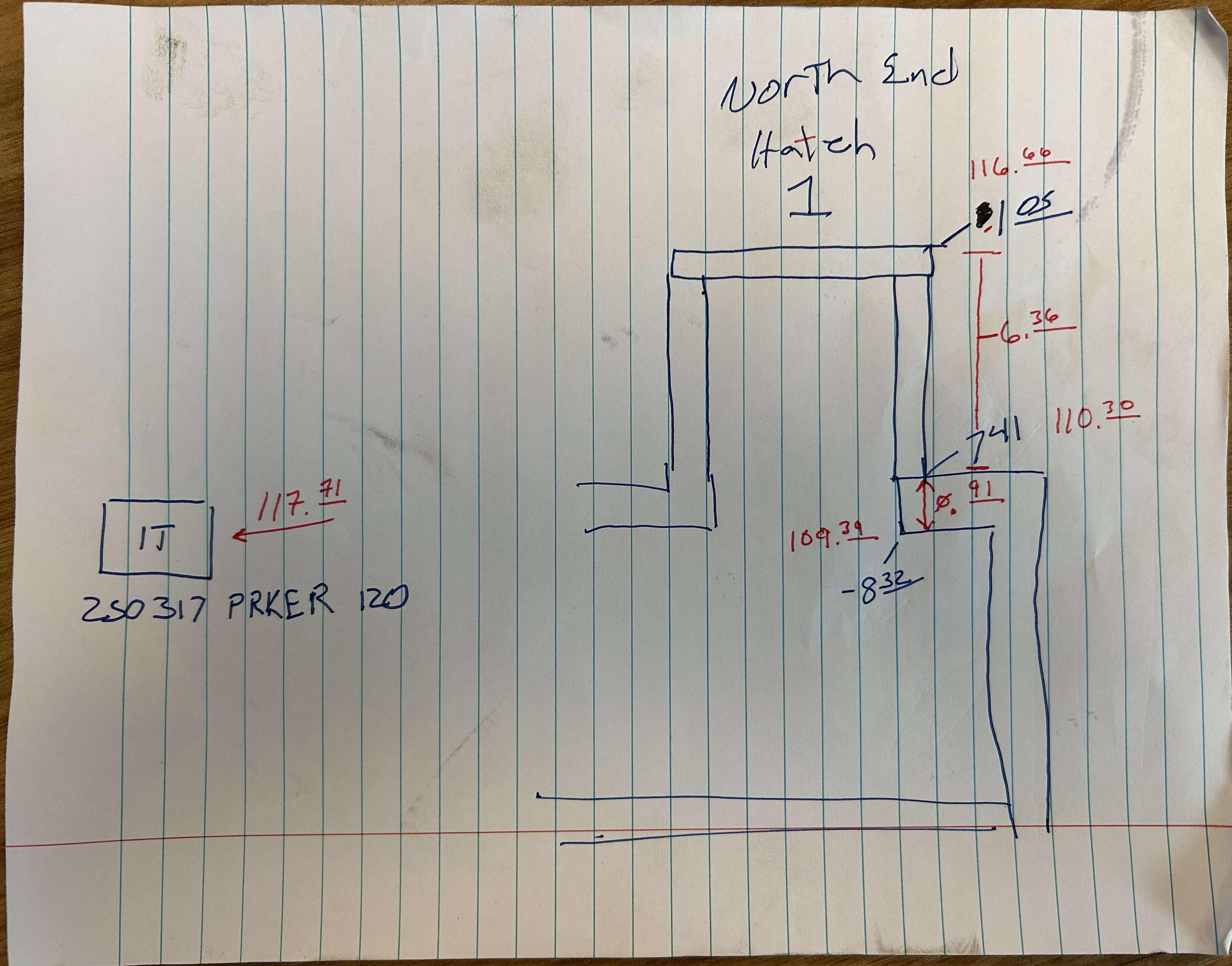
Wall Rebar





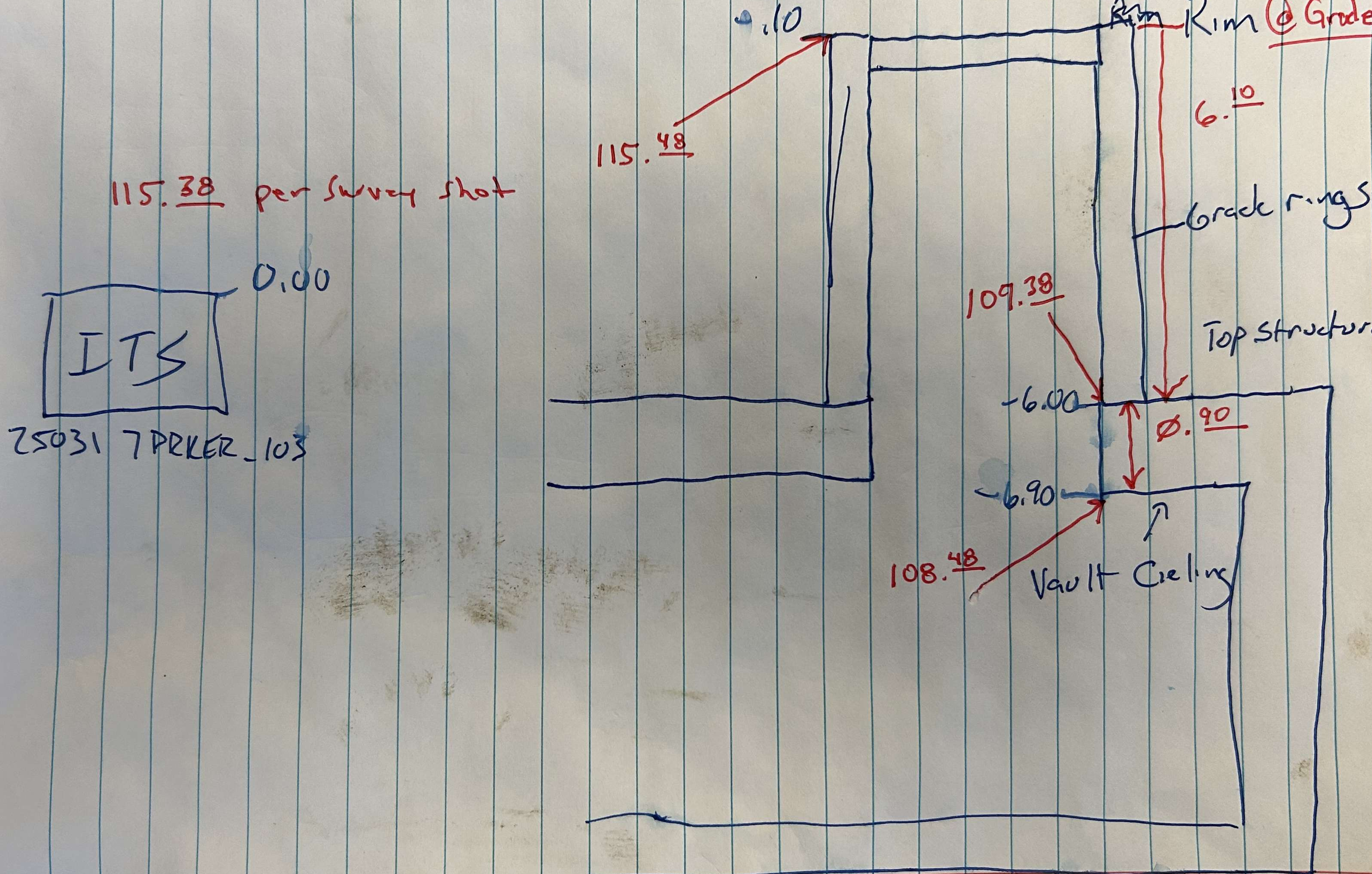


I-405 NB
ITS #103
1
2
3
4
5
6
7
I-405 SB



North End
Hatch
1
116.66
1.05
6.36
741
110.30
0.91
109.39
-8.32
117.71
1J
250317 PRKER 120

Hatch 6


.10
Rim @ Grade
6.10
115.48
115.38 per survey shot
Grade rings
0.00
ITS
109.38
Top structure
-6.00
0.90
25031 7PRKER_103
-6.90
108.48
Vault Ceiling

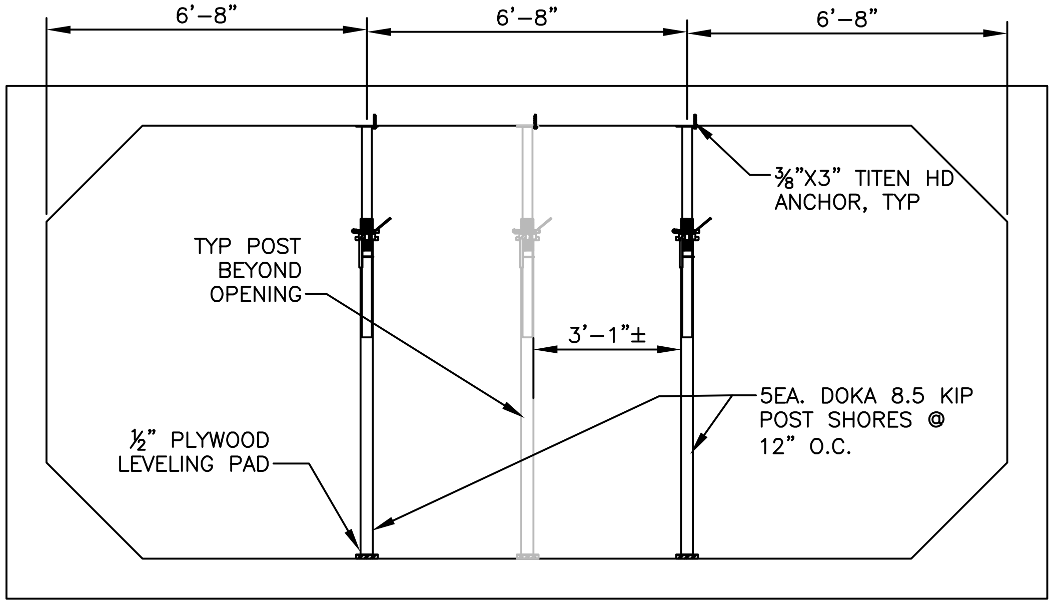

May 15, 2025 at 2:00:35 AM
I-405 S
Bothell WA 98021
United States

SUPPLEMENTARY CALCULATIONS

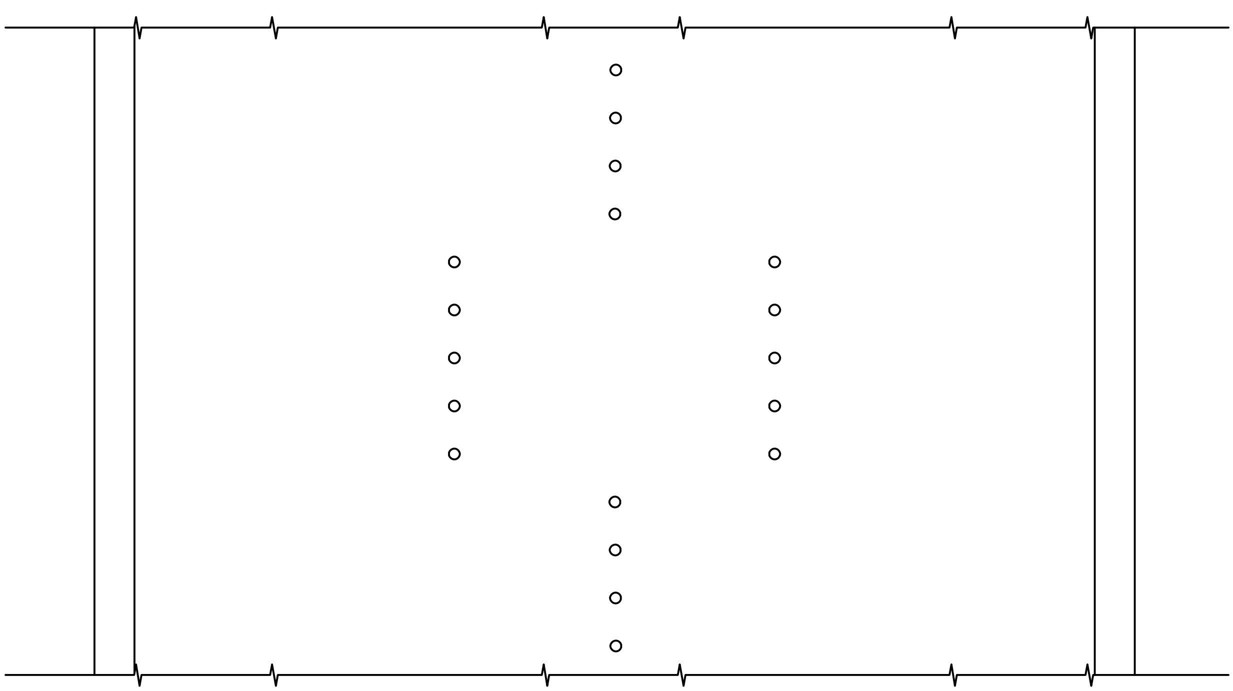
DATE:	7-17-2025
CLIENT:	SKANSKA USA CIVIL
PROJECT:	I -405 BRICKYARD
SUB-PROJECT:	BOX CULVERT TRAFFIC SHIFT
TYPE:	ACCESS POINT TEMP SHORING
REVISION:	0
PREPARED BY:	FORREST MEGARGEL

These supplementary calculations are for a revised shoring configuration to enable workers and emergency personnel to access each side of the box culvert. All external loads have remained unchanged. The bridge rating summary will not change from the original submittal which is based on a single center post configuration. That design is less conservative than this design. Load ratings are considerably higher with the 2 post configuration.

4M ENGINEERING
CIVIL – STRUCTURAL
6675 Purple Poppy Ln., Park City, UT 84098 801-380-0562



BOX CULVERT TEMP SHORING @
INTERIOR ACCESS POINTS
SCALE: 1:4



PLAN LAYOUT
INTERIOR ACCESS POINT
SCALE: 1:4

Results Grid

Fill Depth, ft: 4 | Truck: HL-93 | Member: Interior walls | Load Type: Unfactored Dead Load (DL)

Location (ft)	Moment (kip-ft/ft)	Shear (k/ft)	Axial Force (k/ft)
0.42	0.04	0.00	-0.97
1.40	0.03	0.00	-0.97
2.38	0.03	0.00	-0.97
3.37	0.03	0.00	-0.97
4.35	0.02	0.00	-0.97
5.33	0.02	0.00	-0.97
6.32	0.01	0.00	-0.97
7.30	0.01	0.00	-0.97
8.28	0.01	0.00	-0.97
9.27	0.00	0.00	-0.97
10.25	0.00	0.00	-0.97

Close

Results Grid

Fill Depth, ft: 4 | Truck: HL-93 | Member: Interior walls | Load Type: Unfactored Live Load (LL)

Location (ft)	+Moment (kip-ft/ft)	-Moment (kip-ft/ft)	+Shear (k/ft)	-Shear (k/ft)	+Axial Force (k/ft)	-Axial Force (k/ft)
0.42	0.06	0.00	0.00	-0.01	0.39	-5.25
1.40	0.05	0.00	0.00	-0.01	0.39	-5.25
2.38	0.05	0.00	0.00	-0.01	0.39	-5.25
3.37	0.04	0.00	0.00	-0.01	0.39	-5.25
4.35	0.04	0.00	0.00	-0.01	0.39	-5.25
5.33	0.03	0.00	0.00	-0.01	0.39	-5.25
6.32	0.02	0.00	0.00	-0.01	0.39	-5.25
7.30	0.02	0.00	0.00	-0.01	0.39	-5.25
8.28	0.01	0.00	0.00	-0.01	0.39	-5.25
9.27	0.01	0.00	0.00	-0.01	0.39	-5.25
10.25	0.00	0.00	0.00	-0.01	0.39	-5.25

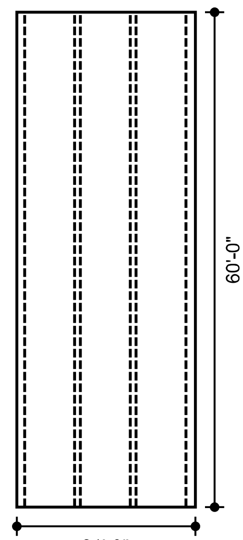
Close

Total vertical load = .97 + 5.25 = 6.22 kips/ft
Post allowable load = 8.5 kips ea.
Spacing = 12" O.C, OK

Spec.: LRFD 9th ed.
Type of Culvert: Precast

Physical Dimensions

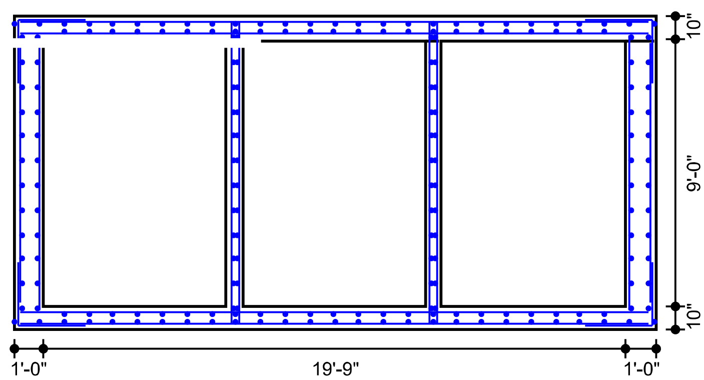
Clear Span:	6'-3"
Clear Height:	9'-0"
Top Slab:	10"
Bottom Slab:	10"
Ext. Wall:	1'-0"
Int. Wall:	6"
Fill Depth Range	
Maximum:	6.00 ft
Minimum:	4.00 ft
Increment:	0.50 ft
Length:	60'-0"
Skew Angle:	0.00 deg
Bottom Slab Support:	Full Slab
Top Haunch, Width:	0"
Top Haunch, Height:	0"
Bottom Haunch, Width:	0"
Bottom Haunch, Height:	0"



Plan View

Material Properties

Concrete	
Strength, f'c:	6.500 ksi
Density:	0.155 kcf
Elasticity, Ec:	5347 ksi
Type:	Normal wt
Steel	
Yield, fy:	60 ksi
Allow Stress:	36 ksi
Elasticity, Es:	29000 ksi
Soil	
Density:	0.127 kcf
Exposure Factor	
User-Defined:	1.00
Reinforcement Covers	
Ext. Cover Top Slab:	2"
Ext. Cover Bottom Slab	2"
Ext. Cover Walls	2"
Int. Cover Walls	2"
Int. Cover Top Slab	2"
Int. Cover Bottom Slab	2"



Typical Section

Controlling Ratings

Inventory Rating: 4.05
Operating Rating: 5.24

Loads

Live Load

Vehicle Names:	HL-93	EV 2	EV 3
	NRL - Legal Lane	NRL	Oveload 1
	Oveload 2	Type 3-3	Type 3
	Type 3S2	WA-105	
Traffic Direction:	Perpendicular		
Eq. Height of Soil:	Calculated		
Max No. of Lanes:	2		

Dead Load

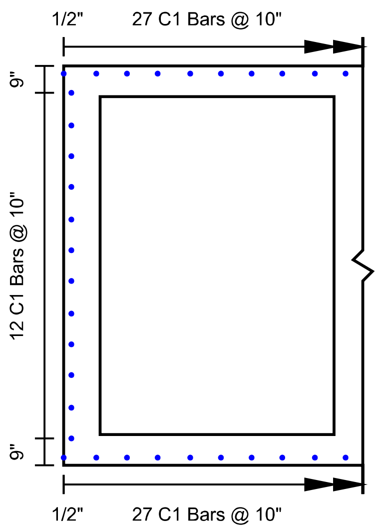
		Lateral Soil Loads	
Future Wearing Surface:	0.000 klf	Active, Ka:	0.33
Additional Dead Load:	0.000 klf		
Concentrated Loads:	none		

Interior Water Pressure:	no
Exterior Water Pressure:	no

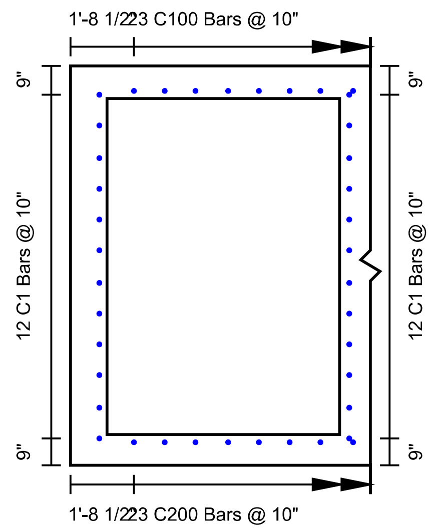
Concrete Summary
Volume of Concrete: 2.343 cy/ft Total Volume of Concrete: 140.556 cy

Reinforcing Steel Bar Schedule (lb)

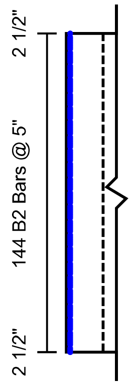
Location	Mark	Qty	Size	Spacing	Type	Length	Hor.Leg	Ver.Leg	Tot.Weight
Top Slab(Int)	A100 (AS2)	144	6	5"	S	21'-4"	--	--	4614.0
Bot Slab(Int)	A200 (AS3)	144	6	5"	S	21'-4"	--	--	4614.0
Top Slab(Ext)	A300 (AS7)	144	6	5"	S	21'-4"	--	--	4614.0
Bot Slab(Ext)	A400 (AS8)	144	6	5"	S	21'-4"	--	--	4614.0
Corner(Top)	A1 (AS1)	288	5	5"	L	4'-6"	2'-4"	2'-2"	1352.0
Corner(Bot)	A2 (AS1)	288	5	5"	L	4'-6"	2'-4"	2'-2"	1352.0
Wall(Int)	B1 (AS4)	288	5	5"	S	9'-4"	--	--	2854.0
Wall(Ext)	B2 (AS1)	288	6	5"	S	8'-10"	--	--	3893.0
Int Wall	B3	240	3	1'-0"	S	10'-3"	--	--	925.0
Longit. Top (Int)	C100 (AS5)	23	3	10"	S	59'-11"	--	--	518.0
Longit. Bot (Int)	C200	23	3	10"	S	59'-11"	--	--	518.0
Longit. Top (Ext)	C1 (AS6)	27	3	10"	S	59'-11"	--	--	608.2
Longit. Bot (Ext)	C1 (AS6)	27	3	10"	S	59'-11"	--	--	608.2
Longit. Wall (Ext)	C1 (AS6)	24	3	10"	S	59'-11"	--	--	540.7
Longit. Wall (Int)	C1 (AS6)	24	3	10"	S	59'-11"	--	--	540.7
Longit. Int	C1 (AS6)	48	3	10"	S	59'-11"	--	--	991.2
									33157



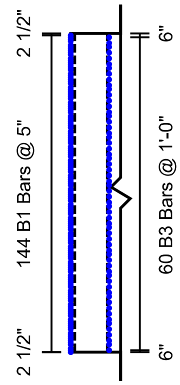
Section Ext. Longit. Reinf.



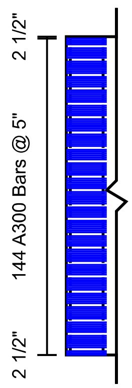
Section Int. Longit. Reinf.



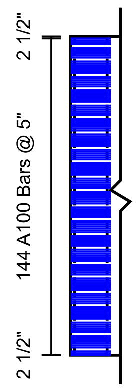
Ext. Wall Reinf.



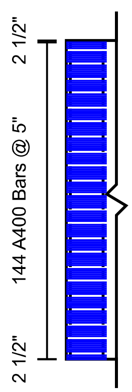
Int. Wall Reinf.



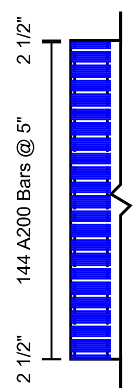
Top Slab Ext. Reinf.



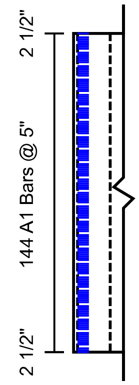
Top Slab Int. Reinf.



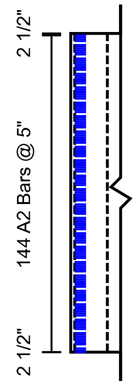
Bottom Slab Ext. Reinf.



Bottom Slab Int. Reinf.



Top Slab Corner Reinf.



Bottom Slab Corner Reinf.

RATINGS SUMMARY
================

Truck	Flexure RF(INV)	Flexure RF(OP)	Flexure Controlling Point	Shear RF(INV)	Shear RF(OP)	Shear Controlling Point
(AA) HL-93	5.88	7.62	Top Slab, MID	4.05	5.24	Top Slab, RT
(AB) EV 2	8.71	8.71	Top Slab, MID	7.25	7.25	Top Slab, RT
(AC) EV 3	7.94	7.94	Top Slab, MID	6.52	6.52	Top Slab, RT
(AD) NRL - Le	12.50	12.50	Top Slab, MID	9.86	9.86	Top Slab, RT
(AE) NRL	8.18	8.18	Top Slab, MID	6.11	6.11	Top Slab, RT
(AF) Oveload	12.41	12.41	Top Slab, MID	10.67	10.67	Top Slab, RT
(AG) Oveload	12.41	12.41	Top Slab, MID	10.67	10.67	Top Slab, RT
(AH) Type 3-3	9.94	9.94	Top Slab, MID	7.61	7.61	Top Slab, RT
(AI) Type 3	8.18	8.18	Top Slab, MID	6.11	6.11	Top Slab, RT
(AJ) Type 3S2	8.97	8.97	Top Slab, MID	6.79	6.79	Top Slab, RT
(AK) WA-105	8.18	8.18	Top Slab, MID	6.11	6.11	Top Slab, RT

REINFORCEMENT SUMMARY
=====================

M dimension = 1' 7" (method of equivalent capacity)
= 4' 6" (method of contraflexure - ASTM)

Reinforcing Steel Schedule

Location	Bar Mark		Qty	Size	Type	Spacing (in)	As,prv (in2/ft)	Length (ft-in)	Wgt (lbs)	H Leg (ft-in)	V Leg (ft-in)
Top Slab (int)	A100	(AS2)	144	6	STR	5.00	1.056	21- 4	4614		
Bot Slab (int)	A200	(AS3)	144	6	STR	5.00	1.056	21- 4	4614		
Top Slab (ext)	A300	(AS7)	144	6	STR	5.00	1.056	21- 4	4614		
Bot Slab (ext)	A400	(AS8)	144	6	STR	5.00	1.056	21- 4	4614		
Corner (Top)	A1	(AS1)	288	5	L-BAR	5.00	0.744	4- 6	1352	2- 4	2- 2
Corner (Bottom)	A2	(AS1)	288	5	L-BAR	5.00	0.744	4- 6	1352	2- 4	2- 2
Ext Wall (int)	B1	(AS4)	288	5	STR	5.00	0.744	9- 4	2854		
Ext Wall (ext)	B2	(AS1)	288	6	STR	5.00	1.056	8-10	3893		
Int Wall	B3		240	3	STR	12.00	0.110	10- 3	925		
Top Slab (int- 1)	C100	(AS5)	23	3	STR	10.00	0.132	59-11	518		
Bot Slab (int- 1)	C200		23	3	STR	10.00	0.132	59-11	518		
Temperature (1)	C1	(AS6)	27	3	STR	10.00	0.132	59-11	608		
Temperature (1)	C1	(AS6)	27	3	STR	10.00	0.132	59-11	608		
Temperature (1)	C1	(AS6)	24	3	STR	10.00	0.132	59-11	541		
Temperature (1)	C1	(AS6)	24	3	STR	10.00	0.132	59-11	541		
Temperature (1)	C1	(AS6)	48	3	STR	10.00	0.132	59-11	991		
								Total	33157		

Note: A denotes flexural steel, B denotes vertical steel, C denotes longitudinal steel

AS Bar Marks

Location	As prv in2/ft
Transverse Side Wall - Outside Face (AS1)	1.056
Transverse Top Slab - Inside Face (AS2)	1.056
Transverse Bottom Slab - Inside Face (AS3)	1.056
Transverse Side Wall - Inside Face (AS4)	0.744
Distribution Top Slab - Inside Face (AS5)	0.132
Distribution Top Slab - OutSide Face (AS6)	0.132
Transverse Top Slab - Outside Face (AS7)	1.056
Transverse Bottom Slab - Outside Face (AS8)	1.056

Notes: 1.) Final areas of steel provided must be checked in analysis mode

```
Project: Bothell to Swamp Creek
Task   : Box Culvert Evaluation
Client : Skanska
Job No.:


CULVERT PROPERTIES
==================
Type of Culvert: Precast              Specification : LRFD 9th Edition
Operating Mode : Analysis

Physical Dimensions
-------------------
No. of Boxes: 3             Name: BoxCulvert
Clear Span  :  6.2500 ft
Clear Height:  9.0000 ft     Skew Angle  :  0.00 deg
Length      : 60.0000 ft     Bottom Slab Support: Full Slab
Fill Depth Range:            Maximum :  6.00 ft        Minimum  :  4.00 ft     Increment :  0.50 ft
Haunches: Top, Length:  0.0000 in     Height:  0.0000 in
       Bottom, Length:  0.0000 in     Height:  0.0000 in
Member Thicknesses:          Top Slab: 10.0000 in      Bot Slab: 10.0000 in
                             Ext Wall: 12.0000 in      Int Wall:  6.0000 in
Wall Joint: Top
Releases  : Moment

Material Properties
-------------------
Concrete, Bot: Strength:  6.500 ksi   Density:  0.155 kcf   Elasticity:   5347 ksi
Concrete, Top: Strength:  5.000 ksi   Density:  0.155 kcf   Elasticity:   4903 ksi
Concrete, All:     Type:  Normal Weight            Density Modification Factor :   1.00
          Fr Factor    :   0.24       Gamma1      :   1.60       Gamma3       :   1.00 (user defined)
Steel:    Yield,fy     :  60.00 ksi   fss Limit   :  0.60fy      Elasticity,Es:  29000 ksi
          Yield,fyv    :  60.00 ksi   Diameter    :  1.000 in    Type         : Rebar
Soil:     Density      :  0.127 kcf   Slope Factor:  1.150
          Poisson's    :  0.5
          Fe Factor    :  1.000 (User Defined)
Serviceability, Gamma-e:  1.00

Loads
-----
Live Load:  Vehicle: (AA) HL-93 - Design Vehicle
                     Axle No.    Weight(k)   Dist. From Previous(ft)
                        1           8.00            0.00
                        2          32.00           14.00
                        3          32.00           14.00
                     Gage Width: 6.00 ft, Tread Width: 20.00 in, Tread Length: 10.00 in
                     Include Tandem: yes
                     Tandem: Axle 1: 25.00 k, Axle 2: 25.00 k, Axle Spacing: 4.00 ft
                     Lane Load: 0.00 klf, P-Moment: 0.00 k, P-Shear: 0.00 k
                     Combine: Truck + Lane Or Tandem + Lane
                     Inventory Rating Load Factor: 1.75  Operating Rating Load Factor: 1.35
                     Design Load Combinations: Strength II
                     Override MPF: no
                     Override DLA: no
            Vehicle: (AB) EV 2 - Permit Vehicle
                     Axle No.    Weight(k)   Dist. From Previous(ft)
                        1          24.00            0.00
                        2          33.50           15.00
                     Gage Width: 6.00 ft, Tread Width: 20.00 in, Tread Length: 10.00 in
                     Include Tandem: no
                     Lane Load: 0.00 klf, P-Moment: 0.00 k, P-Shear: 0.00 k
                     Combine: Truck Or Tandem Or Lane
                     Rating Load Factor: 1.3
                     Design Load Combinations: Strength II
                     Override MPF: no
                     Override DLA: no
            Vehicle: (AC) EV 3 - Permit Vehicle
                     Axle No.    Weight(k)   Dist. From Previous(ft)
                        1          24.00            0.00
                        2          31.00           15.00
                        3          31.00            4.00
                     Gage Width: 6.00 ft, Tread Width: 20.00 in, Tread Length: 10.00 in
                     Include Tandem: no
                     Lane Load: 0.00 klf, P-Moment: 0.00 k, P-Shear: 0.00 k
                     Combine: Truck Or Tandem Or Lane
                     Rating Load Factor: 1.3
                     Design Load Combinations: Strength II
                     Override MPF: no
                     Override DLA: no
            Vehicle: (AD) NRL - Legal Lane - Legal Vehicle
                     Axle No.    Weight(k)   Dist. From Previous(ft)
```

1	10.50	0.00
2	10.50	4.00
3	12.00	16.00
4	9.00	15.00
5	9.00	4.00
6	9.00	15.00

Gage Width: 6.00 ft, Tread Width: 20.00 in, Tread Length: 10.00 in
Include Tandem: no
Lane Load: 0.20 klf, P-Moment: 0.00 k, P-Shear: 0.00 k
Combine: Truck + Lane Or Tandem + Lane
Rating Load Factor: 2
Design Load Combinations: Strength I
Override MPF: no
Override DLA: no

Vehicle: (AE) NRL - Legal Vehicle

Axle No.	Weight(k)	Dist. From Previous(ft)
1	8.00	0.00
2	8.00	4.00
3	8.00	4.00
4	17.00	4.00
5	17.00	4.00
6	8.00	4.00
7	8.00	4.00
8	6.00	6.00

Gage Width: 6.00 ft, Tread Width: 20.00 in, Tread Length: 10.00 in
Include Tandem: no
Lane Load: 0.00 klf, P-Moment: 0.00 k, P-Shear: 0.00 k
Combine: Truck + Lane Or Tandem + Lane
Rating Load Factor: 2
Design Load Combinations: Strength I
Override MPF: no
Override DLA: no

Vehicle: (AF) Oveload 1 - Permit Vehicle

Axle No.	Weight(k)	Dist. From Previous(ft)
1	21.50	0.00
2	21.50	4.00
3	21.50	12.00
4	21.50	4.00
5	10.00	10.00

Gage Width: 6.00 ft, Tread Width: 20.00 in, Tread Length: 10.00 in
Include Tandem: no
Lane Load: 0.00 klf, P-Moment: 0.00 k, P-Shear: 0.00 k
Combine: Truck + Lane Or Tandem + Lane
Rating Load Factor: 1.2
Design Load Combinations: Strength II
Override MPF: no
Override DLA: no

Vehicle: (AG) Oveload 2 - Permit Vehicle

Axle No.	Weight(k)	Dist. From Previous(ft)
1	22.00	0.00
2	21.50	6.00
3	21.50	4.00
4	22.00	14.00
5	21.50	6.00
6	21.50	4.00
7	22.00	16.00
8	21.50	6.00
9	21.50	4.00
10	12.00	10.00

Gage Width: 6.00 ft, Tread Width: 20.00 in, Tread Length: 10.00 in
Include Tandem: no
Lane Load: 0.00 klf, P-Moment: 0.00 k, P-Shear: 0.00 k
Combine: Truck + Lane Or Tandem + Lane
Rating Load Factor: 1.2
Design Load Combinations: Strength II
Override MPF: no
Override DLA: no

Vehicle: (AH) Type 3-3 - Legal Vehicle

Axle No.	Weight(k)	Dist. From Previous(ft)
1	14.00	0.00
2	14.00	4.00
3	16.00	16.00
4	12.00	15.00
5	12.00	4.00
6	12.00	15.00

Gage Width: 6.00 ft, Tread Width: 20.00 in, Tread Length: 10.00 in
Include Tandem: no
Lane Load: 0.00 klf, P-Moment: 0.00 k, P-Shear: 0.00 k
Combine: Truck + Lane Or Tandem + Lane
Rating Load Factor: 2
Design Load Combinations: Strength I
Override MPF: no

```
                  Override DLA: no
         Vehicle: (AI) Type 3 - Legal Vehicle
                  Axle No.    Weight(k)   Dist. From Previous(ft)
                     1          17.00             0.00
                     2          17.00             4.00
                     3          16.00            15.00
                  Gage Width: 6.00 ft, Tread Width: 20.00 in, Tread Length: 10.00 in
                  Include Tandem: no
                  Lane Load: 0.00 klf, P-Moment: 0.00 k, P-Shear: 0.00 k
                  Combine: Truck + Lane Or Tandem + Lane
                  Rating Load Factor: 2
                  Design Load Combinations: Strength I
                  Override MPF: no
                  Override DLA: no
         Vehicle: (AJ) Type 3S2 - Legal Vehicle
                  Axle No.    Weight(k)   Dist. From Previous(ft)
                     1          15.50             0.00
                     2          15.50             4.00
                     3          15.50            22.00
                     4          15.50             4.00
                     5          10.00            11.00
                  Gage Width: 6.00 ft, Tread Width: 20.00 in, Tread Length: 10.00 in
                  Include Tandem: no
                  Lane Load: 0.00 klf, P-Moment: 0.00 k, P-Shear: 0.00 k
                  Combine: Truck + Lane Or Tandem + Lane
                  Rating Load Factor: 2
                  Design Load Combinations: Strength I
                  Override MPF: no
                  Override DLA: no
         Vehicle: (AK) WA-105 - Legal Vehicle
                  Axle No.    Weight(k)   Dist. From Previous(ft)
                     1          14.00             0.00
                     2          14.00             4.00
                     3          17.00            10.00
                     4          17.00            32.00
                     5          17.00             4.00
                     6           7.00             4.00
                     7           7.00             4.00
                     8          12.50            11.00
                  Gage Width: 6.00 ft, Tread Width: 20.00 in, Tread Length: 10.00 in
                  Include Tandem: no
                  Lane Load: 0.00 klf, P-Moment: 0.00 k, P-Shear: 0.00 k
                  Combine: Truck + Lane Or Tandem + Lane
                  Rating Load Factor: 2
                  Design Load Combinations: Strength I
                  Override MPF: no
                  Override DLA: no
         Include Lane Load      : yes         Max. No. of Lanes: 2
         Traffic Direction      : Lanes Perpendicular to Main Reinforcement
         Neglect Live Load if: Fill > 8 ft and Fill > Clear Span
         Apply Surcharge at Fill Depths > 2 ft  : yes
         Compute Surcharge Depth: yes
Dead Load:  Future Wearing Surface :  0.00 klf   Add. Dead Load   :  0.00 klf
         Concentrated Loads     : none
Lateral Soil Loads: Active, Ka:  0.33
Include Additional Uniform Horiz. Load: no
Include Additional Uniform Vert. Load: no
Buoyancy Check    : no
Fluid Pressures   : Apply Water Press.  : no
Foundation Model  : Uniform Loads
Seismic Analysis  : Do not include

Load and Resistance Factors
---------------------------
     Max      Min
DC: 1.250    0.900
DW: 1.500    0.650
EV: 1.300    0.900
EH: 1.500    0.900
WA: 1.000
EQ: 1.000
LL I     : 1.750   LL II     : 1.350   LL Legal     : 1.750   LL Extreme : 0.500
Ductility: 1.000   Importance: 1.000   Redundancy, non-earth: 1.000   Redundancy, earth: 1.000
Condition: 1.000   System    : 1.000
Phi Shear: 0.900   Phi Moment: 1.000   PM Compression: 0.750   PM Tension    : 0.900
Load Factor Multipliers, Design Mode: 1.00 Analysis Mode: 1.00

Reinforcement
-------------
Reinforcement Covers  :  Exterior      Interior
          Top Slab:  2.0000 in     2.0000 in
          Walls   :  2.0000 in     2.0000 in
```

Bot Slab: 2.0000 in 2.0000 in

Assigned reinforcement:

Location	Mark		Size	Spacing (in)
Top Slab Inside	A100	(AS2)	6	5.0000
Bottom Slab Inside	A200	(AS3)	6	5.0000
Top Slab Outside	A300	(AS7)	6	5.0000
Bottom Slab Outside	A400	(AS8)	6	5.0000
Top Corner	A1	(AS1)	5	5.0000
Bottom Corner	A2	(AS1)	5	5.0000
Ext. Wall Inside	B1	(AS4)	5	5.0000
Ext. Wall Outside	B2	(AS1)	6	5.0000
Interior Wall	B3		3	12.0000
Longitudinal	C1	(AS6)	3	10.0000
Top Distribution	C100	(AS5)	3	10.0000
Bottom Distribution	C200		3	10.0000

Analysis Options

```
LL Analysis       : Automatically Set Traffic Direction to Account for Skew Effects: no
                    Limit LL Distribution Width to Culvert Length for: None
                    Combine Longitudinal Axle Distribution Overlaps: Yes, Max of 2 Axles
                    Combine Transverse Axle Distribution Overlaps: Yes, Max of 2 Axles
                    Axle Placement Increment for Moving Load Analysis: 20
                    Include Impact on Bottom Slab: yes
                    Always Distribute Wheel Load: yes
                    Deflection Criteria     : 1/800
                    Approach Slab will be Used: no
Reinforcement     : Always Include Distribution Steel: no
                    Distribution Slab Provided: no
                    User Defined Longitudinal Steel: no, Follow Specification
                    Max. As used in Vc Calcs: 2.00 in2/ft
                    Distribute Minimum Reinforcement per Face: yes
                    Use individual Member Thicknesses for Min Steel: no
                    Epoxy coat steel: no
                    Use M-dimension for bar length calcs.: no
Slenderness       : Checked       K Factor: 2.00
Analysis Modeling : Use Haunches in the Structural Analysis Model: yes
Critical Sections : Flexure critical section location: 1.5 member depth
                    Shear critical section location: dv beyond support
                    Use Max. Moment with Max. Shear at the Critical Section for Shear: no
                    Include depth of haunch for critical sections: no
Flexure           : Ignore Axial Thrust: no
                    Use Eq. 12.10.4.2.4a-1: yes   Nu Multiplier: 1.00
Shear             : Always Check Iterative Beta Method
Environmental     : Apply duribility factors: no
Load Combinations : LRFD min/min: no
```

ANALYSIS RESULTS

Top Slab Thickness = 10.00 in
Bottom Slab Thickness = 10.00 in
Exterior Wall Thickness = 12.00 in
Interior Wall Thickness = 6.00 in

Modular Ratio (N) = 5.42 Max. Steel Ratio = 0.030
Design Span = 7.00 ft Design Height = 9.83 ft

Volume of Concrete: 2.343 cy/ft Weight of Steel: 553 lb/ft

Note: Design and analysis results do not include force effects from stipping and handling stages

M dimension = 1' 7" (method of equivalent capacity)
= 4' 6" (method of contraflexure - ASTM)

Reinforcing Steel Schedule

Location	Bar Mark		Qty	Size	Type	Spacing (in)	As,prv (in2/ft)	Length (ft-in)	Wgt (lbs)	H Leg (ft-in)	V Leg (ft-in)
Top Slab (int)	A100	(AS2)	144	6	STR	5.00	1.056	21- 4	4614		
Bot Slab (int)	A200	(AS3)	144	6	STR	5.00	1.056	21- 4	4614		
Top Slab (ext)	A300	(AS7)	144	6	STR	5.00	1.056	21- 4	4614		
Bot Slab (ext)	A400	(AS8)	144	6	STR	5.00	1.056	21- 4	4614		
Corner (Top)	A1	(AS1)	288	5	L-BAR	5.00	0.744	4- 6	1352	2- 4	2- 2
Corner (Bottom)	A2	(AS1)	288	5	L-BAR	5.00	0.744	4- 6	1352	2- 4	2- 2
Ext Wall (int)	B1	(AS4)	288	5	STR	5.00	0.744	9- 4	2854		
Ext Wall (ext)	B2	(AS1)	288	6	STR	5.00	1.056	8-10	3893		
Int Wall	B3		240	3	STR	12.00	0.110	10- 3	925		
Top Slab (int- 1)	C100	(AS5)	23	3	STR	10.00	0.132	59-11	518		
Bot Slab (int- 1)	C200		23	3	STR	10.00	0.132	59-11	518		
Temperature (1)	C1	(AS6)	27	3	STR	10.00	0.132	59-11	608		
Temperature (1)	C1	(AS6)	27	3	STR	10.00	0.132	59-11	608		
Temperature (1)	C1	(AS6)	24	3	STR	10.00	0.132	59-11	541		
Temperature (1)	C1	(AS6)	24	3	STR	10.00	0.132	59-11	541		
Temperature (1)	C1	(AS6)	48	3	STR	10.00	0.132	59-11	991		
								Total	33157		

Note: A denotes flexural steel, B denotes vertical steel, C denotes longitudinal steel

AS Bar Marks

Location	As prv in2/ft
Transverse Side Wall - Outside Face (AS1)	1.056
Transverse Top Slab - Inside Face (AS2)	1.056
Transverse Bottom Slab - Inside Face (AS3)	1.056
Transverse Side Wall - Inside Face (AS4)	0.744
Distribution Top Slab - Inside Face (AS5)	0.132
Distribution Top Slab - OutSide Face (AS6)	0.132
Transverse Top Slab - Outside Face (AS7)	1.056
Transverse Bottom Slab - Outside Face (AS8)	1.056

Notes: 1.) Final areas of steel provided must be checked in analysis mode

Summary of Ratings Table:

			Flexure					Shear				
Truck	ILF	OLF	Fill	Member	Location	IR	OR	Fill	Member	Location	IR	OR
(AA)HL-93	1.75	1.35	4.00	2	MID	5.88	7.62	4.00	2	RT	4.05	5.24
(AB)EV 2	1.30	1.30	4.00	2	MID	8.71	8.71	4.00	2	RT	7.25	7.25
(AC)EV 3	1.30	1.30	4.00	2	MID	7.94	7.94	4.00	2	RT	6.52	6.52
(AD)NRL -	2.00	2.00	4.00	2	MID	12.50	12.50	4.00	2	RT	9.86	9.86
(AE)NRL	2.00	2.00	4.00	2	MID	8.18	8.18	4.00	2	RT	6.11	6.11
(AF)Oveloa	1.20	1.20	4.00	2	MID	12.41	12.41	4.00	2	RT	10.67	10.67
(AG)Oveloa	1.20	1.20	4.00	2	MID	12.41	12.41	4.00	2	RT	10.67	10.67
(AH)Type 3	2.00	2.00	4.00	2	MID	9.94	9.94	4.00	2	RT	7.61	7.61
(AI)Type 3	2.00	2.00	4.00	2	MID	8.18	8.18	4.00	2	RT	6.11	6.11
(AJ)Type 3	2.00	2.00	4.00	2	MID	8.97	8.97	4.00	2	RT	6.79	6.79
(AK)WA-105	2.00	2.00	4.00	2	MID	8.18	8.18	4.00	2	RT	6.11	6.11

Critical Sections Summary: Flexure

Member 1: (Exterior Wall), Thickness = 12.00 in
Design Corr. Load Ratings Fill

Loc	Dist. (in)	Moment (k-ft)	A. F. (k)	Mu (k-ft)	ds (in)	Ma (k-ft)	phi	As (in2)	Mcr (k-ft)	IR	OR	Truck	Depth (ft)
BOT	5.00	-7.50	6.24	34.79	9.69	37.53	1.00	0.74	23.50	16.21	21.01	AA	6.00
MID	59.00	7.00	2.28	34.79	9.69	35.79	1.00	0.74	23.50	19.29	25.01	AA	6.00
MID-	59.00	1.35	4.58	48.30	9.63	50.21	1.00	1.06	23.50	NC	NC	AF	6.00
TOP	5.00	0.0#	1.63	34.79	9.69	35.51	1.00	0.74	23.50	NC	NC	AA	4.00

Member 2: (Top Slab), Thickness = 10.00 in

Loc	Dist. (in)	Design Moment (k-ft)	Corr. A. F. (k)	Mu (k-ft)	ds (in)	Ma (k-ft)	phi	As (in2)	Mcr (k-ft)	Load Ratings IR	Load Ratings OR	Truck	Fill Depth (ft)
LT	6.00	0.0#	0.97	27.35	7.69	27.70	1.00	0.74	16.32	NC	NC	AA	4.00
MID	33.60	9.22	0.75	37.74	7.63	37.99	1.00	1.06	16.32	5.88	7.62	AA	4.00
MID-	33.60	0.0#	2.66	37.74	7.63	38.63	1.00	1.06	16.32	NC	NC	AA	4.00
RT	3.00	-7.92	0.97	38.07	7.69	38.39	1.00	1.06	16.32	7.21	9.35	AA	4.00

Member 3: (Interior Wall), Thickness = 6.00 in

Loc	Dist. (in)	Design Moment (k-ft)	Corr. A. F. (k)	Mu (k-ft)	ds (in)	Ma (k-ft)	phi	As (in2)	Mcr (k-ft)	Load Ratings IR	Load Ratings OR	Truck	Fill Depth (ft)
BOT	5.00	-0.10	4.32	2.07	3.81	3.10	1.00	0.11	5.87	71.36	92.51	AA	4.00
MID	47.20	0.08	5.51	2.07	3.81	3.38	1.00	0.11	5.87	53.66	69.56	AA	4.00
TOP	5.00	0.00	9.99	2.07	3.81	4.42	1.00	0.11	5.87	NC	NC	AD	4.00

Member 4: (Bottom Slab), Thickness = 10.00 in

Loc	Dist. (in)	Design Moment (k-ft)	Corr. A. F. (k)	Mu (k-ft)	ds (in)	Ma (k-ft)	phi	As (in2)	Mcr (k-ft)	Load Ratings IR	Load Ratings OR	Truck	Fill Depth (ft)
LT	6.00	-6.30	5.84	27.35	7.69	29.43	1.00	0.74	16.32	17.68	22.92	AA	6.00
MID	42.00	5.19	2.49	37.74	7.63	38.57	1.00	1.06	16.32	12.64	16.39	AA	4.00
MID-	42.00	0.0#	4.94	37.74	7.63	39.39	1.00	1.06	16.32	NC	NC	AA	4.00
RT	3.00	-6.96	2.71	38.07	7.69	38.98	1.00	1.06	16.32	10.11	13.11	AA	4.00

Member 5: (Top Slab - Interior Cell), Thickness = 10.00 in

Loc	Dist. (in)	Design Moment (k-ft)	Corr. A. F. (k)	Mu (k-ft)	ds (in)	Ma (k-ft)	phi	As (in2)	Mcr (k-ft)	Load Ratings IR	Load Ratings OR	Truck	Fill Depth (ft)
LT	3.00	-8.44	0.98	37.74	7.63	38.07	1.00	1.06	16.32	6.64	8.61	AA	4.00
MID	42.00	3.82	0.77	37.74	7.63	37.99	1.00	1.06	16.32	12.65	16.40	AA	4.00
RT	3.00	-8.44	0.98	37.74	7.63	38.07	1.00	1.06	16.32	6.64	8.61	AA	4.00

Member 7: (Bottom Slab - Interior Cell), Thickness = 10.00 in

Loc	Dist. (in)	Design Moment (k-ft)	Corr. A. F. (k)	Mu (k-ft)	ds (in)	Ma (k-ft)	phi	As (in2)	Mcr (k-ft)	Load Ratings IR	Load Ratings OR	Truck	Fill Depth (ft)
LT	3.00	-7.01	2.70	37.74	7.63	38.64	1.00	1.06	16.32	9.93	12.87	AA	4.00
MID	42.00	3.94	5.70	37.74	7.63	39.64	1.00	1.06	16.32	33.09	42.89	AA	6.00
RT	3.00	-7.01	2.70	37.74	7.63	38.64	1.00	1.06	16.32	9.93	12.87	AA	4.00

- A 0.0 design moment indicates no negative moments at this location. Check the 'Load Combination Results' table to determine if a positive moment exists.

Critical Sections Summary: Vertical Shear

Member 1: (Exterior Wall), Thickness = 12.00 in

Loc	Dist. (in)	Design Shear (k)	Corr. Moment (k-ft)	Corr. A. F. (k)	Dv (in)	phi*Vn	Beta	Vc (k)		Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	Load Ratings OR	Truck	Fill Depth (ft)
BOT	13.64	4.53	4.1	6.24	9.35	28.79	3.538	31.99	a	0.00	0.00	0.00	28.26	36.64	AA	6.00
MID	59.00	0.73	7.0	2.28	9.35	26.17	3.216	29.08	a	0.00	0.00	0.00	NC	NC	AA	6.00
MID-	59.00	0.42	2.0	4.58	9.15	37.98	4.772	42.20	a	0.00	0.00	0.00	NC	NC	AF	6.00
TOP	13.64	-2.39	1.0	2.28	9.35	32.52	3.997	36.13	a	0.00	0.00	0.00	56.14	72.77	AA	6.00

Member 2: (Top Slab), Thickness = 10.00 in

Loc	Dist. (in)	Design Shear (k)	Corr. Moment (k-ft)	Corr. A. F. (k)	Dv (in)	phi*Vn	Beta	Vc (k)		Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	Load Ratings OR	Truck	Fill Depth (ft)
LT	13.20	4.22	5.6	0.97	7.69	20.12	3.009	22.36	a	0.00	0.00	0.00	6.71	8.69	AA	4.00
MID	42.00	0.51	8.5	1.08	7.63	21.46	3.234	23.84	a	0.00	0.00	0.00	82.13	99.99	AA	6.00
MID-	42.00	2.08	2.2	2.66	7.63	26.45	4.207	29.39	a	0.00	0.00	0.00	16.89	21.89	AA	4.00
RT	10.20	7.46	3.7	0.97	7.69	21.89	3.273	24.33	a	0.00	0.00	0.00	4.05	5.24	AA	4.00

Member 3: (Interior Wall), Thickness = 6.00 in

Loc	Dist. (in)	Design Shear (k)	Corr. Moment (k-ft)	Corr. A. F. (k)	Dv (in)	phi*Vn	Beta	Vc (k)		Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	Load Ratings OR	Truck	Fill Depth (ft)
BOT	9.32	0.01	0.1	6.04	4.32	19.57	5.207	21.75	a	0.00	0.00	0.00	NC	NC	AA	6.00
MID	59.00	0.01	0.1	8.28	4.32	19.67	5.233	21.86	a	0.00	0.00	0.00	NC	NC	AA	6.00
TOP	9.32	0.01	0.0	15.37	4.32	19.96	5.310	22.18	a	0.00	0.00	0.00	99.99	99.99	AA	4.00

Member 4: (Bottom Slab), Thickness = 10.00 in

Loc	Dist. (in)	Design Shear (k)	Corr. Moment (k-ft)	Corr. A. F. (k)	Dv (in)	phi*Vn	Beta	Vc (k)		Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR	Truck	Fill Depth (ft)
LT	13.20	5.23	3.6	5.84	7.69	23.54	3.520	26.16	a	0.00	0.00	0.00	13.02	16.87	AA	6.00
MID	42.00	0.60	4.9	2.98	7.63	25.35	3.822	28.17	a	0.00	0.00	0.00	NC	NC	AA	6.00
MID-	42.00	0.29	0.0	4.94	7.63	26.45	5.038	29.39	a	0.00	0.00	0.00	NC	NC	AA	4.00
RT	10.20	5.85	3.0	2.71	7.69	23.88	3.570	26.53	a	0.00	0.00	0.00	7.06	9.15	AA	4.00

Member 5: (Top Slab - Interior Cell), Thickness = 10.00 in

Loc	Dist. (in)	Design Shear (k)	Corr. Moment (k-ft)	Corr. A. F. (k)	Dv (in)	phi*Vn	Beta	Vc (k)		Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR	Truck	Fill Depth (ft)
LT	10.20	5.96	5.3	0.98	7.63	21.88	3.298	24.31	a	0.00	0.00	0.00	5.13	6.65	AA	4.00
MID	42.00	0.72	3.8	0.77	7.63	25.86	3.897	28.73	a	0.00	0.00	0.00	36.14	46.85	AA	4.00
RT	10.20	5.94	5.3	0.98	7.63	21.89	3.299	24.32	a	0.00	0.00	0.00	5.15	6.68	AA	4.00

Member 7: (Bottom Slab - Interior Cell), Thickness = 10.00 in

Loc	Dist. (in)	Design Shear (k)	Corr. Moment (k-ft)	Corr. A. F. (k)	Dv (in)	phi*Vn	Beta	Vc (k)		Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR	Truck	Fill Depth (ft)
LT	10.20	3.94	0.2	2.70	7.63	26.12	3.938	29.03	a	0.00	0.00	0.00	12.75	16.53	AA	4.00
MID	42.00	0.00	3.9	5.70	7.63	26.45	4.319	29.39	a	0.00	0.00	0.00	NC	NC	AA	6.00
RT	10.20	5.36	3.5	2.70	7.63	24.07	3.628	26.75	a	0.00	0.00	0.00	8.30	10.76	AA	4.00

Vc Calculation By: a - Iterative Beta, b - Constant Beta, c - Box Culvert, d - Standard/Arema

Confined Space Access
(Skanska Provided)

Construction Work Plan

Overall Risk Level: Moderate

Editing

NW 12 Access and Inspection Plan

Skanska BU	Skanska USA Civil
Project Number	90009590
Project Name	I-405/BRICKYARD TO SR527
Project State	WA
Cost Code	
CWP No.	C-90009590-0346-A
Valid Dates	06/30/2025 - 12/30/2030
Plan Creator	Barrios, Josh
Project Manager	Turner, Scott
Engineer	Barrios, Josh
Superintendent	
EHS Professional	Barrios, Josh
Foreman	

Work Area

Vault NW 12

Access to Area

Access to the work area and vault will be provided via a left lane closure on southbound I-405 or by center median.

PPE & Safety Equipment

ANSI class II high visibility Safety Vest, Confined space gear, Fall protection, Head Protection (Hard Hat or Type II Helmet where required), Safety Glasses, Safety Toe Work Boots, sniffers., Task Appropriate Cut Resistant Level 3 Gloves

Specific PPE

Full Body Harness with Retrieval Line

Revision Notes

None

Site Specific Hazards & Controls

1) Care for Life 5: Human-Machine Interface, Energized Systems, Line of Fire, Falls, Lifting Operations

3) If using a forklift or excavator to hoist as a secondary function, no lift plan is needed. However, capacity for front and side, load weight, rigging, and path of travel must be included in the plan details portion of the CWP.

Emergency Action Plans

Office
For medical attention, alert supervisor
Morgan, Johnny J 951-453-5110
Barrios, Josh 510-456-5511

Muster Point & Other Instructions: 18911 N Creek Pkwy S, Bothell, WA 98011

Muster points will be located at the foreman's truck or closest safe area.

Scope of Work

Step 1: This Construction Work Plan outlines the access procedures and safety protocols for the inspection of Vault NW12, located in the southbound median of I-405. Following the traffic switch scheduled for completion by the end of July, all inspections will require nighttime access due to mandatory lane closures, as entry will occur from the far-left lane of I-405 southbound.

Scheduling and Access Requests
All inspection requests must be submitted a minimum of two weeks in advance of the intended inspection date to allow time for CUR coordination. Requests must be made through Skanska Superintendent Danny Villalobos at danny.villalobos@skanska.com. Start times will vary depending on the approved lane closure schedule, and all access will be coordinated between Skanska and WSDOT inspectors.

All WSDOT inspectors participating in this work must be confined space trained prior to the scheduled inspection date. Inspections will occur at night due to required traffic control (MOT) closures of the left lane on I-405 southbound. Class 3 PPE is required.

Step 2: Day-of-Work Protocol

On the night of the scheduled work, inspectors will report to the Skanska/WSDOT main office at Brickyard for a Daily Hazard Analysis (DHA) meeting with the Skanska foreman. Inspectors will remain at the office until they receive confirmation from Skanska that the lane closure is in place and the vault is safe to enter. At that point, they will proceed to the vault site, either in their own or a company-issued vehicle.

Vehicles must have 360° amber construction lights when entering or exiting the lane closure.
Class 3 high-visibility PPE is required for all personnel at night.
Harnesses are required
If an inspector’s vehicle does not meet lighting requirements, a Skanska vehicle and driver will be made available.

Step 3: Confined Space Entry Procedures

Vault NW12 is classified as an Alternate Entry Confined Space, due to limited means of access and the absence of other known hazards. Prior to entry, a Skanska competent person will perform an alternate entry evaluation. Entry will not begin until the evaluation is complete and approved.

Skanska will provide:

All required confined space equipment and permits
Continuous atmospheric monitoring using a bump-tested Altair 4X gas meter
Onsite oversight by a Skanska competent person throughout the inspection

Step 4: CFL5 line of fire and Safety Considerations

Although protected by the MOT lane closure, this work is still located on an active highway. Inspectors are expected to remain behind the Truck-Mounted Attenuator (TMA) protection at all times and exercise caution when entering or exiting both the closure and the vault.

Step 5: Completion and Sign-Out
Once the inspection is complete, the Skanska foreman will meet the inspectors back at the Skanska/WSDOT main office to formally sign them out of the DHA.

Scope of Work Categories

confined space, Storm Water Pollution Prevention - SWPPP, Traffic Control & Circulation, Underground

Triggers

Task Environment

Confined Space

Equipment

Truck - Attenuator

Confined and Enclosed Spaces

Objective

The purpose of this program is to protect workers from the hazards associated with permit-required and non-permit required confined spaces on our jobsites. Projects will take the necessary steps to correctly evaluate confined spaces in order to safely enter and perform our work. All workers taking part in an entry will be trained in accordance with the requirements of this program.

Legal and Other Requirements

Federal, State, Local Regulations

a. OSHA 29 CFR 1926.21 Subpart C - General Safety and Health Provisions - Safety training and education
b. OSHA 29 CFR 1926 Subpart AA - Confined Spaces in Construction - Authority for 1926 Subpart AA
c. OSHA 29 CFR 1910.146 Subpart J - General Environmental Controls - Permit-required confined spaces
d. WAC 296-809 - Confined Spaces

Procedure

1. General Requirements
    1. Evaluate the work environment using the Confined Space Evaluation Checklist to determine if it is a confined space. A confined space meets the following conditions:
        a. Is large enough for an employee to enter fully and perform assigned work
        b. Is not designed for continuous occupancy by the employee
        c. Has a limited or restricted means of entry or exit
    2. The Confined Space Evaluation Checklist will also determine if the space is a permit-required confined space or a non-permit-required confined space. A permit-required confined space meets one or more of the following conditions:
        a. Contains or has the potential to contain a hazardous atmosphere
        b. Contains a material with the potential to engulf someone who enters the space
        c. Has an internal configuration that might cause an entrant to be trapped or asphyxiated by inwardly converging walls or by a floor that slopes downward and tapers to a smaller cross section
        d. Contains any other recognized serious safety or health hazards
    3. If work activity produces a hazardous atmosphere, the confined space will be classified as permit required. Examples:
        - Fumes from welding
        - Fumes from painting
        - Fumes from waterproofing
        - Oxygen deficiency caused from various different work activities
    4. If the space is deemed a permit-required confined space, the Confined Space Entry Permit must be completed before entry.
    5. Follow all procedures identified for safe entry according to this program.
    6. Any project specific requirements for this section are listed here.
        a. None
2. Non-permit required confined space.
    1. Pre-Entry
        1. Identify tasks to be performed in the space and their potential hazards.
        2. Secure the following equipment prior to entry:
            a. Testing and monitoring equipment.
            b. Adequate lighting equipment.
            c. Rescue and emergency equipment as needed.
            d. Any other equipment necessary for safe entry into and rescue from space.
        3. Isolate the space and implement measures to prevent unauthorized entry.
        4. Complete the air-monitoring log on the Confined Space Evaluation and maintain at the jobsite for inspection. Properly calibrate air-monitoring equipment and maintain records of calibration.
            a. Test the space for atmospheric hazards in this order: oxygen content, combustible gases, vapors, dusts, and toxic gases.

        b. If necessary, purge, flush or ventilate the space to eliminate or control atmospheric hazard for at least thirty (30) minutes prior to retesting air quality.
    5. Implement Lockout/tagout as necessary.
    6. If necessary, select rescue and retrieval methods and/or notify proper emergency services that may be required to respond.
  2. Entry
    1. Only confined space trained personnel shall enter non-permit required confined spaces.
    2. Follow all entry procedures including, but not limited to:
        a. Verification of acceptable entry conditions
            i. Perform one single monitoring event at the beginning of each shift and document on the confined space evaluation form to be approved
            ii. The confined space evaluation should be signed off by the competent person
        b. Implementation of forced air ventilation if necessary
        c. Proper use of equipment required
        d. Ensure an attendant is available if a rescue system is needed for precautionary measures
        e. Any other procedures deemed necessary for safe operations
    3. Evacuate the space if a prohibited condition is detected inside or outside the space, entrant exhibits signs of hazard exposure or evacuation orders are given.

3. Permit-required confined space
  1. Pre-Entry
    1. Identify tasks to be performed in the space and their potential hazards.
    2. Secure the following equipment prior to entry:
        a. Testing and monitoring equipment
        b. Ventilation equipment needed to maintain acceptable entry conditions
        c. Any necessary communications equipment
        d. Personal protective equipment when feasible engineering and work practice controls do not adequately protect employees
        e. Adequate lighting equipment
        f. Non-sparking hand tools
        g. Barriers and shields as required
        h. Rescue and emergency equipment needed
        i. Any other equipment necessary for safe entry into and rescue
        j. In an explosive environment, use explosion-proof mechanical equipment and lighting (Class one (1) Div one (1))
    3. Isolate the space and implement measures to prevent unauthorized entry.
    4. Complete the air-monitoring log on the Confined Space Entry Permit and maintain at the jobsite for inspection. Properly calibrate air monitoring equipment and maintain records of calibration.
        a. Test the space for atmospheric hazards in this order: oxygen content, combustible gases, vapors, dusts and toxic gases.
        b. Purge, flush or ventilate the space to eliminate or control atmospheric hazard for at least thirty (30) minutes prior to retesting air quality.
        c. No employee will be allowed to enter an oxygen-deficient or potentially toxic/explosive confined space until project management approves the Construction Work Plan.
    5. Implement Lockout/tagout as necessary.
    6. Identify appropriate controls if hot work is to be performed in the space.
    7. Select rescue and retrieval methods and/or notify proper emergency services that may be required to respond. In addition:
        a. Evaluate a prospective rescuer's ability to respond to a rescue summons in a timely manner.
        b. To facilitate non-entry rescue, use retrieval systems or methods whenever an authorized entrant enters a confined space. Retrieval equipment is not required when its use would increase the overall risk of entry or would not contribute to rescue such as with confined spaces with side openings. Side openings in a confined space are those within three and a half (3½) feet off the bottom. Retrieval systems must meet the following requirements:
            i. Each authorized entrant must use a chest or full body harness with the retrieval line attached at the center of the entrant's back near shoulder level, or above the entrant's head. Wristlets may be used in lieu of the chest or full body harness if the use of a full body harness is infeasible or creates a greater hazard. The wristlets must be the safest and most effective alternative in this case.

        ii. The other end of the retrieval line must be attached to a mechanical device or fixed point outside the permit space in such a manner that rescue can begin as soon as the rescuer becomes aware that rescue is necessary. A mechanical device must be available to retrieve personnel from vertical-type permit spaces more than five (5) feet deep.

    8. Select a communication method based on configuration of space and work task.
    9. Before entry is authorized, the entry supervisor must complete and sign the entry permit. The permit must be posted for attendants and entrants to review. The duration of the permit may not exceed the time required to complete the work, or eight hours.
    10. During pre-entry, the entry supervisor must:
        a. Evaluate the confined space to determine known and potential hazards.
        b. Identify acceptable entry conditions.
        c. Verify appropriate equipment (retrieval, personal protective equipment, air monitors, etc.) based on hazards in the confined space.
        d. Verify that rescue services are available and the means for summoning them are operable.
        e. Assign qualified and trained individuals as authorized entrants and attendants.
        f. Keep all Safety Data Sheets (SDS) for hazardous chemicals involved with entry available for emergency personnel if an employee is overexposed to a substance.
        g. Provide pedestrian, vehicle or other barriers as necessary to protect entrants from external hazards.
        h. Provide adequate lighting equipment.
        i. Provide equipment needed for safe access.
        j. Before signing the permit allowing entry to begin, verify the following:
            i. The permit has been completed.
            ii. All tests specified by the permit have been conducted.
            iii. All procedures and equipment specified by the permit are in place.
        k. For confined space work extending beyond eight (8) hours, determine when responsibility for a confined space entry operation is transferred, at intervals dictated by the hazards and operations performed within the space, to maintain safe confined space operations.
    11. During pre-entry the attendant must:
        a. Verify acceptable entry conditions.
        b. Monitor air continuously.
        c. Implement forced air ventilation if necessary.
        d. Communicate with entrants.
        e. Ensure rescue controls are in place.
        f. Comply with any other procedures deemed necessary for safe operations.
    12. Only authorized personnel shall enter confined spaces. Authorized entrants must review posted permit and verify the following before entry:
        a. Acceptable entry conditions
        b. Continuous air monitoring
        c. Implementation of forced air ventilation if necessary
        d. Proper use of equipment required
        e. Communication with attendant and other entrants
        f. Any other procedures deemed necessary for safe operations

2. Entry
    1. During entry, the entry supervisor must:
        a. Remove unauthorized persons who enter or who attempt to enter the confined space during entry operations.
        b. Terminate the entry and cancel the permit when a prohibited condition is detected, or a condition that is not allowed under the entry permit criteria arises inside or near the confined space.
        c. Verify that operations covered by the entry permit have been completed.
    2. During entry, the attendant must:
        a. Remain outside the confined space during entry operations until relieved by another approved attendant.
        b. Continuously maintain an accurate count of authorized entrants in the confined space and note time of entry and exit.
        c. Test or monitor the space continuously to determine if acceptable entry conditions are being maintained. Document readings every fifteen (15) minutes on the air monitoring log.
        d. Monitor activities inside and outside the space to determine if it is safe for entrants to remain in the space.

e. Ensure continuous communication between themselves and the entrants in order to monitor their status.
f. If unauthorized persons approach or enter a confined space while entry is in progress, take the following actions:
    i. Warn the unauthorized person(s) that they must stay away from the confined space.
    ii. Advise the unauthorized persons that they must exit immediately if they have entered the confined space.
    iii. Inform the authorized entrants and the entry supervisor if an unauthorized person(s) has entered the confined space.
g. Order evacuation if any of the following conditions occur:
    i. A prohibited condition is detected.
    ii. The behavioral effects of hazard exposure are detected in an authorized entrant.
    iii. A situation outside the space could endanger the authorized entrants.
    iv. He/she cannot effectively and safely perform all the required duties of an attendant.
    v. Summon rescue and other emergency services as soon as it is determined that authorized entrants may need assistance to escape from space hazards.
    vi. Perform non-entry rescues with retrieval equipment.

3. During entry, entrants must:
    a. Alert attendant when:
        i. Any warning sign or symptom of exposure to a hazard is recognized.
        ii. A prohibited condition is detected.
    b. Evacuate the permit space immediately when:
        i. An order to evacuate is given by the attendant or the entry supervisor.
        ii. Any warning sign or symptom of exposure to a hazard is recognized.
        iii. A prohibited condition is recognized.
        iv. An evacuation alarm is sounded.

3. Post-Entry
    1. The entry supervisor must cancel the permit and file it with the safety department for one year to facilitate a review of the confined space program. Document any problems during entry operations, in order to make continuous improvements to the confined space program.
    2. Remove all entrants and equipment from space.
    3. Replace the cover, hatch, door, etc., in space to prevent unauthorized entry.
4. Emergency
    1. In the event of an emergency, the following emergency procedure will be followed:
        1. The Attendant will notify all Entrants to evacuate and immediately notify the Supervisor and the project EAP Director. Specific information related to the emergency should be conveyed, including, the nature of the emergency, hazards associated with the space, and approximate number of affected employees.
        2. The EAP Director will ensure notification is made for internal and external emergency services to respond.
        3. The Entry Supervisor will immediately cancel the Entry Permit.
        4. The EAP Director, Entry Supervisor, and Attendant will provide emergency services with any observations or information about the emergency.
        5. Unauthorized personnel will evacuate the area and await further instruction from the EAP Director or designee.

EHS Forms and Documents

a. Confined Space Evaluation Checklist - Confined Space Evaluation Checklist
b. Confined Space Entry Permit - Confined Space Entry Permit

Applicable Training

Training Links

a. Confined Space Entry--Permit-Required [Competent Person] - Confined Space Entry--Permit-Required [Competent Person]

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Inspection Template

Skanska USA
, New York

Confined Space Evaluation

TYPE: EH&S Optional **TRADE:**

DESCRIPTION:
This checklist is optional - can be required if determined by the project team. It can be completed prior to work inside a confined space to evaluate the space to determine if it fits the definition of a permit-required confined space. If the space is determined to not require a permit (non-PRCS), the checklist on this form shall be completed prior to entry in this non-PRCS. Acceptable Air Monitoring Levels Oxygen: 19.5% - 23.5% Explosive (Gas/Vapor): < 10% LEL Carbon Monoxide: < 35 ppm Hydrogen Sulfide: < 10 ppm

ATTACHMENTS:

Confined Space Evaluation Checklist.pdf

General Information	
1.1	Confined Space Name and Location
1.2	Purpose for Entry
1.3	Date of Entry

Does the space meet the criteria for a confined space? If all three boxes are checked, this space is a CONFINED SPACE.	
2.1	Does it have limited means of access and egress?
2.2	Is it not designed for continuous occupancy?
2.3	Is the space large enough to enter to perform work?

Does the space meet the criteria for a PERMIT REQUIRED confined space? If any of the below items are not met, this space is a PERMIT REQUIRED confined space. A CONFINED SPACE ENTRY PERMIT must be used in order to conduct work in this space. If all of the below items are met, this space is a NON PERMIT REQUIRED confined space.	
3.1	The space does not contain or have the potential to contain a hazardous atmosphere
3.2	The space does not contain material that has the potential to engulf an entrant
3.3	The space does not have walls that converge inward or floors that slope downward and taper into a smaller area which could trap or asphyxiate an entrant
3.4	The space does not contain any other recognized safety or health hazard (unguarded machinery, exposed live wires, etc.)

A NON PERMIT REQUIRED confined space must have the following

4.1	Employees have confined space training and are trained in the use of a retrieval system, if needed
4.2	Air monitoring has been conducted to ensure there is no risk of a hazardous atmosphere. See description for acceptable levels.
4.3	Air monitoring is being conducted for the duration of the work in the space
4.4	Ventilation is installed and properly functioning, if needed. It has been inspected prior to use.
4.5	A retrieval system (tripod, davit arm, winch, harness, SRL, etc.) is installed and properly functioning, if needed. It has been inspected prior to use.
4.6	Proper access is installed for safe entry into the space. It has been inspected prior to use.

Entry Authorization	
5.1	Name
5.2	Title
5.3	Time
5.4	Date

Skanska USA
, New York

Confined Space Entry Permit

TYPE: EH&S **TRADE:**

DESCRIPTION:
This permit is required to be completed (following the review of the attached Confined Space Evaluation Checklist) if the space is determined to fit the definition of a permit-required confined space (PRCS). This permit is to be completed prior to entry into the PRCS and acts as a checklist to confirm the space is safe for employee entry - through confirmation of proper LOTO, purging, training, setup of emergency provisions, etc. This permit requires signature by the Entry Supervisor. Create a separate entry if more entrants are involved in permit required confined space activity than allowed for on this form.

ATTACHMENTS:

Confined Space Evaluation Checklist.pdf

Description - Required for All Entries	
1.1	Permit #
1.2	Supervisor
1.3	Type (Permit or Non-Permit)
1.4	Date
1.5	Time of Entry
1.6	Location of Confined Space
1.7	Type of Confined Space (Tank, Pipe, Manhole, Tunnel, Vault, or Other)
1.8	Work Description/Purpose of Enry
1.9	Hazards

Pre-Entry Preparation (Select N/A if not required)	
2.1	EHS Notified
2.2	Training
2.3	Lockout/Tagout (Electrical, Mechanical, Hydraulic, etc.)
2.4	Purged, Cleaned, Drained, and Ventilated
2.5	Adequate Access
2.6	Adequate Lighting (low voltage)
2.7	Harness/Lifelines
2.8	Ventilation Adequacy

2.9	Communications Equipment
2.10	Continuous Air Monitoring

Additional Permit Controls (Select N/A if not required)	
3.1	Authorized Entry Log at Access
3.2	Fire Extinguisher Available (Do not use O2 displacing fire extinguishers in confined space)
3.3	Attendant (if needed, add name in Comments)
3.4	Warning Signs Posted at Access
3.5	Respirators (if needed, add respirator type in Comments)
3.6	Protective Clothing Required (if needed, add type in Comments) 3
3.7	Rescue Equipment/Service Available (if needed, add equipment/service in Comments)
3.8	Hot Work Permit

Names	
4.1	Attendant(s) Name(s):
4.2	Entrant(s) Name(s):

Air Monitoring - Required for All entries	
5.1	Make
5.2	Model
5.3	ID #
5.4	Field Calibration Date
5.5	Calibrated By
5.6	Atmosphere Checked By

Substance Monitored - % Oxygen (O2) - Permissible Level: 19.5% to 23.5%	
6.1	1st Check Reading
6.2	1st Check Time
6.3	2nd Check Reading

6.4	2nd Check Time	
6.5	3rd Check Reading	
6.6	3rd Check Time	

Substance Monitored - % LEL - Permissible Level: Less than 10%		
7.1	1st Check Reading	
7.2	1st Check Time	
7.3	2nd Check Reading	
7.4	2nd Check Time	
7.5	3rd Check Reading	
7.6	3rd Check Time	

Substance Monitored - Carbon Monoxide (CO) - Permissible Level: Less than 35 ppm		
8.1	1st Check Reading	
8.2	1st Check Time	
8.3	2nd Check Reading	
8.4	2nd Check Time	
8.5	3rd Check Reading	
8.6	3rd Check Time	

Substance Monitored - Hydrogen Sulfide (H2S) - Permissible Level: Less than 10 ppm		
9.1	1st Check Reading	
9.2	1st Check Time	
9.3	2nd Check Reading	
9.4	2nd Check Time	
9.5	3rd Check Reading	
9.6	3rd Check Time	

Substance Monitored - Other

10.1	1st Check Reading
10.2	1st Check Time
10.3	2nd Check Reading
10.4	2nd Check Time
10.5	3rd Check Reading
10.6	3rd Check Time

Emergency Information	
11.1	IN CASE OF EMERGENCY CALL
11.2	SECONDARY CALL
11.3	Entry Supervisor Name (Permit to be emailed to this contact)
11.4	Entry Supervisor Phone Number

Supervisor Authorization (This section to be completed by Entry Supervisor)	
12.1	Authorization
12.2	Entry Supervisor
12.3	Date

Post Shore Inspection Template

(Skanska Provided)

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Inspection Checklist for NW-12 Vault Shoring

(Doka 8.5 Kip Screw Jack Post Shores Under Live Load Conditions)

Inspection Information	
1.1	Date:
1.2	Inspector:

General Site Conditions				
2.1	Vault access is clear and safe.	Y	N	N/A
2.2	Barricades and signage in place.	Y	N	N/A
2.3	Vault access is clear and safe.	Y	N	N/A
2.4	Emergency egress routes clearly marked and unobstructed.	Y	N	N/A
2.5	Confined Space Checklists have been completed.	Y	N	N/A

Shoring Equipment Inspection				
3.1	Doka 8.5 Kip post shores installed according to manufacturer specifications.	Y	N	N/A
3.2	Post shores are vertical and plumb without leaning or shifting.	Y	N	N/A
3.3	Post shores are installed at the location and spacing as per the approved load rating report.	Y	N	N/A
3.4	Shore base plates properly seated firmly on leveling pad.	Y	N	N/A
3.5	Shore heads properly adjusted to bear against structure without gaps.	Y	N	N/A
3.6	All locking pins, collars, and adjustment mechanisms secured and functional.	Y	N	N/A
3.7	No visible damage, deformation, corrosion, or cracks on posts and components.	Y	N	N/A
3.8	Locking devices or safety collars on screw jacks are fully engaged to prevent unintended adjustment or loosening.	Y	N	N/A
3.9	Were any adjustments made to screw jacks during this inspection? If Yes, also document at the end of this document.	Y	N	N/A

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Documentation and Compliance		
4.1	Shoring installation was inspected and approved by qualified engineers or designee prior to load application.	Y N N/A
4.2	This document, along with all other inspections, is electronically stored for compliance with project requirements.	Y N N/A

Additional Checks		
5.1	No debris or materials compromising shore stability or access inside the vault.	Y N N/A
5.2	No signs of concrete cracking, debris, or structural failure on vault interior surfaces.	Y N N/A

Notes