SKANSKA	Washington State Department of Transportation I-405, Brickyard to SR 527 Improvement Project Contract No. 009727	Doc Type: TRAN REV#: 0 SPEC SECTION: DATE: 05/05/2025 CRE #: BY-CRE-02517

To:	From:
Washington State Dept. of Transportation 18911 N Creek Pkwy S Suite 150 Bothell, WA 98011	Skanska USA Civil West 1995 Agua Mansa Road Riverside, CA 92509

Submittal: BY-CRE-02517_009727_TRAN_18.05_Load Rating Report - Existing Vault NW-12

SKA REFERENCE DOCUMENTS

Subcontractor/Supplier: Skanska

SKA Title and Description: Load Rating Report - Existing Vault NW-12

Due Date: N/A

ADDITIONAL REMARKS

Approved by _____

Patrick Prendergast, Vice President - Operations

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

5/1/25

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: #7 bars at 5” o.c. transverse and #5 bars at 10” o.c. longitudinal
    - Wall – Interior: #5 bars at 5” o.c. vertical with #5 bars at 10” o.c. horizontal
    - Wall – Exterior: #7 bars at 5” o.c. vertical with #5 bars at 10” o.c. horizontal

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

- Concrete strength, f’c = 5000 psi. Typical for precast concrete.
- Reinforcing steel strength, fy = 60,000 psi
- Fill density above culvert: 120 pcf
- Interior and exterior water pressure approximately equal and at a depth of 3 ft
- Reinforcement:
    - Corner bars are assumed equivalent to vertical exterior wall bars (#7 at 5” o.c.) as is standard practice. These bars are often combined into one single U-shaped bar.
    - Bottom slab reinforcement is taken to be equal to the top slab reinforcement. Standard practice is equivalent or better.
    - Top and bottom slab exterior reinforcement is taken to be #5 bars at 10” o.c. in both directions, matching the top slab longitudinal rebar and the horizontal wall rebar.

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 4-5. 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. Vehicle descriptions and corresponding ratings can be found on Pages 10-12, with a summary found on Pages 3 and 8. Minimum controlling HL-93 inventory and operating ratings are approximately 1.21 and 1.57 respectively. The minimum Truck rating is 1.0 and is from the Notional Rating Load (NRL) loading. Consistent with the lower rating, it is noted that minor overstressing occurs at the exterior culvert walls under the NRL loading (see Page 14).

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In our opinion, since all load ratings are equal to or greater than 1.0, the minor overstresses can be disregarded, and the culvert is deemed sufficient to support the traffic loads during construction without the need for shoring. Indeed, given its close proximity to traffic and the reinforcing steel provided, it seems likely that the culvert was originally designed to support traffic loading. The calculations provided confirm the culvert design remains sufficient for any traffic loadings which may have been added since its construction in 1996.

BRIDGE RATING SUMMARY

Bridge Name:	Drainage Vault
Bridge Number:	V001
SID Number:	XG180500
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:	5/1/2025

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)	1.48	2.0	Stress @ exterior wall, bottom
AASHTO 2 (Type 3S2)	1.49	2.0	Stress @ exterior wall, bottom
AASHTO 3 (Type 3-3)	1.85	2.0	Stress @ exterior wall, bottom
Legal Lane	2.15	2.0	Stress @ exterior wall, bottom
NRL	1.00	2.0	Stress @ exterior wall, bottom
LGL-105	1.21	2.0	Stress @ exterior wall, bottom
OL-1	1.63	1.20	Stress @ exterior wall, bottom
OL-2	1.50	1.20	Stress @ exterior wall, bottom
EV2	1.78	1.30	Stress @ exterior wall, bottom
EV3	1.30	1.30	Stress @ exterior wall, bottom

SNBI Rating	RF	γ	Controlling Point
Inventory (HL-93)	1.21	1.75	Stress @ exterior wall, bottom
Operating (HL-93)	1.57	1.35	Stress @ exterior wall, bottom

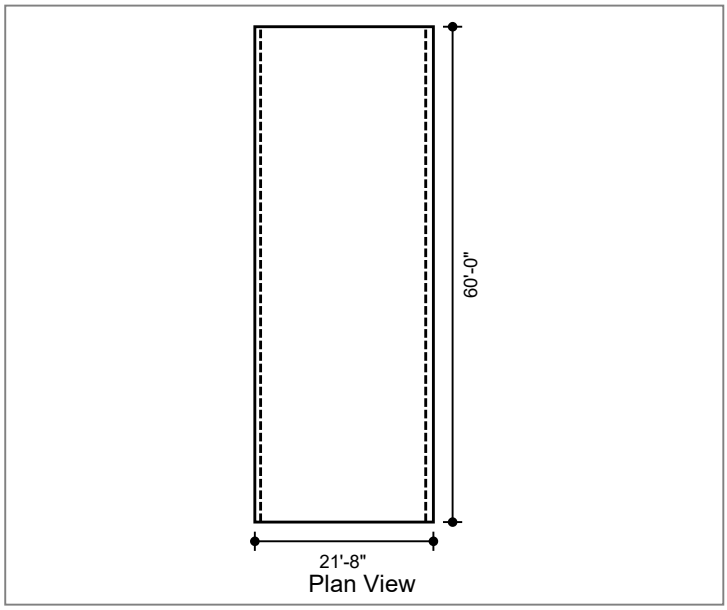
Remarks:

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

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

Physical Dimensions

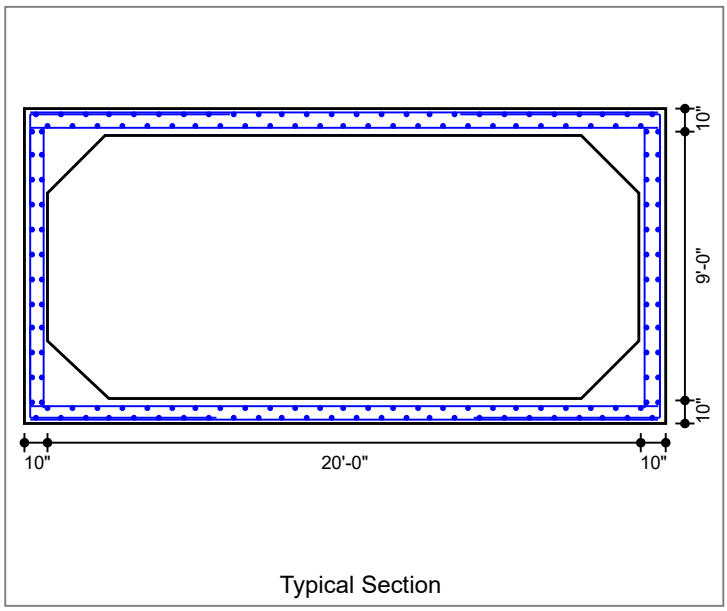
Clear Span:	20'-0"
Clear Height:	9'-0"
Top Slab:	10"
Bottom Slab:	10"
Ext. Wall:	10"
Fill Depth Range	
Maximum:	6.00 ft
Minimum:	4.00 ft
Increment:	0.50 ft
Length:	60'-0"
Skew Angle:	0.00 deg
Bottom Slab Support:	Full Slab
Top Haunch, Width:	2'-0"
Top Haunch, Height:	2'-0"
Bottom Haunch, Width:	2'-0"
Bottom Haunch, Height:	2'-0"



Plan View

Material Properties

Concrete	
Strength, f'c:	5.000 ksi
Density:	0.150 kcf
Elasticity, Ec:	4592 ksi
Type:	Normal wt
Steel	
Yield, fy:	60 ksi
Allow Stress:	36 ksi
Elasticity, Es:	29000 ksi
Soil	
Density:	0.120 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: 1.00
Operating Rating: 1.00

Loads

Live Load

Vehicle Names:	HL-93	NRL	Type 3
	Type 3S2	Type 3-3	Overload 1
	Overload 2	EV 2	EV 3
	NRL - Legal Lane	WA-105	
Traffic Direction:	Parallel		
Eq. Height of Soil:	Calculated		

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

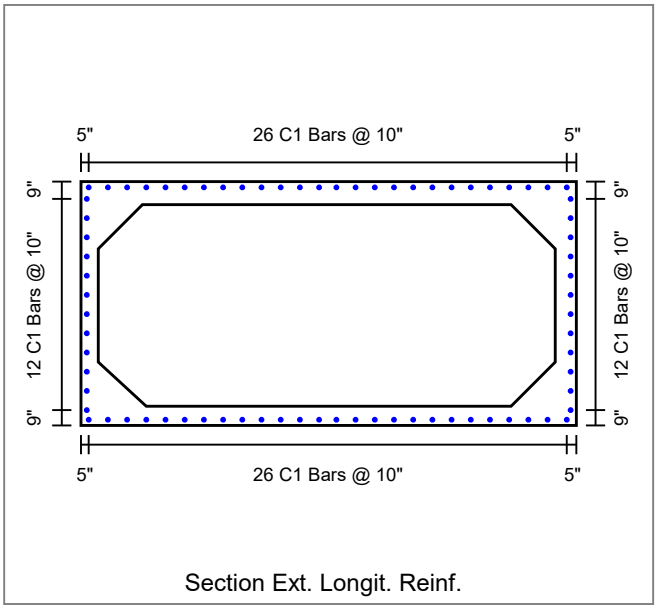
Interior Water Pressure:	yes, head pressure = 3 ft
Exterior Water Pressure:	yes, head pressure = 3 ft

Water head inside and outside the culvert are assumed to be approximately equal

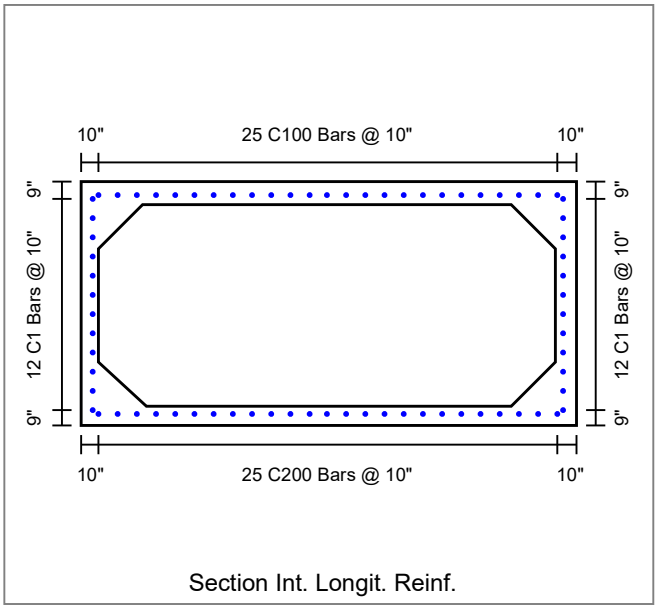
Concrete Summary
Volume of Concrete: 2.189 cy/ft Total Volume of Concrete: 131.358 cy

Reinforcing Steel Bar Schedule (lb)

Location	Mark	Qty	Size	Spacing	Type	Length	Hor.Leg	Ver.Leg	Tot.Weight
Top Slab(Int)	A100 (AS2)	144	7	5"	S	21'-3"	--	--	6255.0
Bot Slab(Int)	A200 (AS3)	144	7	5"	S	21'-3"	--	--	6255.0
Top Slab(Ext)	A300 (AS7)	72	5	10"	S	21'-3"	--	--	1596.0
Bot Slab(Ext)	A400 (AS8)	72	5	10"	S	21'-3"	--	--	1596.0
Corner(Top)	A1 (AS1)	288	7	5"	L	9'-10"	6'-9"	3'-1"	5789.0
Corner(Bot)	A2 (AS1)	288	7	5"	L	9'-5"	6'-4"	3'-1"	5543.0
Wall(Int)	B1 (AS4)	288	5	5"	S	9'-6"	--	--	2854.0
Wall(Ext)	B2 (AS1)	288	7	5"	S	9'-0"	--	--	5298.0
Longit. Top (Int)	C100 (AS5)	25	5	10"	S	59'-11"	--	--	1562.0
Longit. Bot (Int)	C200	25	5	10"	S	59'-11"	--	--	1562.0
Longit. Top (Ext)	C1 (AS6)	26	5	10"	S	59'-11"	--	--	1624.7
Longit. Bot (Ext)	C1 (AS6)	26	5	10"	S	59'-11"	--	--	1624.7
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
									44559

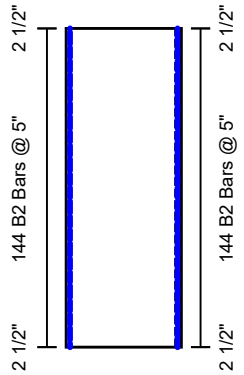


Section Ext. Longit. Reinf.

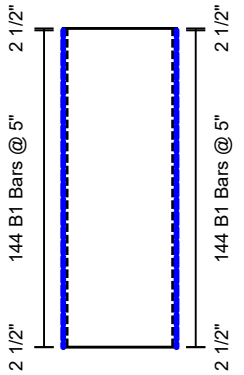


Section Int. Longit. Reinf.

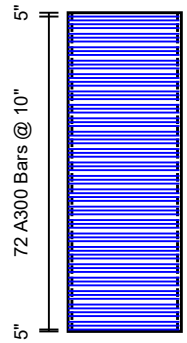
Notes:
-Field verified values are highlighted.
-A1, A2, and B2 are often combined into one U-bar, or same sizes used. A1 and A2 are assumed to match B2.
-Bottom slab interior rebar typically matches or exceeds top slab interior rebar (assumed to match top slab rebar)
-Other bars are conservatively assumed to be #5 @ 10" o.c.



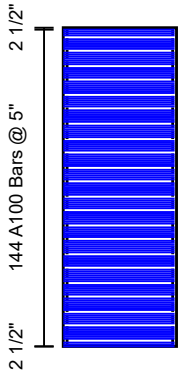
Ext. Wall Reinf.



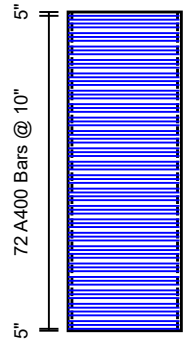
Int. Wall Reinf.



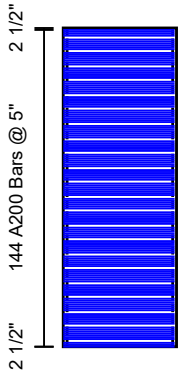
Top Slab Ext. Reinf.



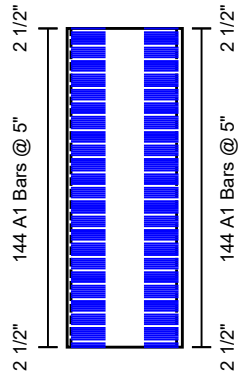
Top Slab Int. Reinf.



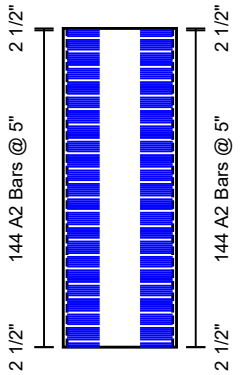
Bottom Slab Ext. Reinf.



Bottom Slab Int. Reinf.



Top Slab Corner Reinf.



Bottom Slab Corner Reinf.

RATINGS SUMMARY
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	Flexure			Shear		
Truck	RF(INV)	RF(OP)	Controlling Point	RF(INV)	RF(OP)	Controlling Point
(AA) HL-93	1.21	1.57	Ext Wall, BOT	1.32	1.71	Bottom Slab, LT
(AB) NRL	1.00	1.00	Ext Wall, BOT	1.14	1.14	Bottom Slab, LT
(AC) Type 3	1.48	1.48	Ext Wall, BOT	1.76	1.76	Top Slab, LT
(AD) Type 3S2	1.49	1.49	Ext Wall, BOT	1.77	1.77	Bottom Slab, LT
(AE) Type 3-3	1.85	1.85	Ext Wall, BOT	2.15	2.15	Top Slab, LT
(AF) Overload	1.63	1.63	Ext Wall, BOT	1.89	1.89	Bottom Slab, LT
(AG) Overload	1.50	1.50	Ext Wall, BOT	1.74	1.74	Bottom Slab, LT
(AH) EV 2	1.78	1.78	Ext Wall, BOT	2.05	2.05	Bottom Slab, LT
(AI) EV 3	1.30	1.30	Ext Wall, BOT	1.49	1.49	Top Slab, LT
(AJ) NRL - Le	2.15	2.15	Ext Wall, BOT	2.59	2.59	Top Slab, LT
(AK) WA-105	1.21	1.21	Ext Wall, BOT	1.43	1.43	Bottom Slab, LT

REINFORCEMENT SUMMARY
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M dimension = 5' 4" (method of equivalent capacity)
= 7' 4" (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	7	STR	5.00	1.440	21- 3	6255		
Bot Slab (int)	A200 (AS3)	144	7	STR	5.00	1.440	21- 3	6255		
Top Slab (ext)	A300 (AS7)	72	5	STR	10.00	0.372	21- 3	1596		
Bot Slab (ext)	A400 (AS8)	72	5	STR	10.00	0.372	21- 3	1596		
Corner (Top)	A1 (AS1)	288	7	L-BAR	5.00	1.440	9-10	5789	6- 9	3- 1
Corner (Bottom)	A2 (AS1)	288	7	L-BAR	5.00	1.440	9- 5	5543	6- 4	3- 1
Ext Wall (int)	B1 (AS4)	288	5	STR	5.00	0.744	9- 6	2854		
Ext Wall (ext)	B2 (AS1)	288	7	STR	5.00	1.440	9- 0	5298		
Top Slab (int- 1)	C100 (AS5)	25	5	STR	10.00	0.372	59-11	1562		
Bot Slab (int- 1)	C200	25	5	STR	10.00	0.372	59-11	1562		
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		
							Total	44559		

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)	1.440
Transverse Top Slab - Inside Face (AS2)	1.440
Transverse Bottom Slab - Inside Face (AS3)	1.440
Transverse Side Wall - Inside Face (AS4)	0.744
Distribution Top Slab - Inside Face (AS5)	0.372
Distribution Top Slab - OutSide Face (AS6)	0.372
Transverse Top Slab - Outside Face (AS7)	0.372
Transverse Bottom Slab - Outside Face (AS8)	0.372

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: 1 Name: BoxCulvert
Clear Span : 20.0000 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: 24.0000 in Height: 24.0000 in
Bottom, Length: 24.0000 in Height: 24.0000 in
Member Thicknesses: Top Slab: 10.0000 in Bot Slab: 10.0000 in
Ext Wall: 10.0000 in
Wall Joint: None

Material Properties

Concrete: Strength,f'c : 5.000 ksi Density : 0.150 kcf Elasticity,Ec: 4592 ksi
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 : 0.120 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 I
Override MPF: no
Override DLA: no

Vehicle: (AB) 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: (AC) 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: (AD) 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: (AE) 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: (AF) Overload 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) Overload 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) 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: (AI) 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: (AJ) 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: (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: 1
Traffic Direction : Lanes Parallel 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. : yes, both interior and exterior
: Interior Pressure Head : 3.00 ft
: Exterior Pressure Head : 3.00 ft
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)	7	5.0000
Bottom Slab Inside	A200 (AS3)	7	5.0000
Top Slab Outside	A300 (AS7)	5	10.0000
Bottom Slab Outside	A400 (AS8)	5	10.0000
Top Corner	A1 (AS1)	7	5.0000
Bottom Corner	A2 (AS1)	7	5.0000
Ext. Wall Inside	B1 (AS4)	5	5.0000
Ext. Wall Outside	B2 (AS1)	7	5.0000
Longitudinal	C1 (AS6)	5	10.0000
Top Distribution	C100 (AS5)	5	10.0000
Bottom Distribution	C200	5	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: No
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 durability factors: no
Load Combinations : LRFD min/min: no

ANALYSIS RESULTS
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Top Slab Thickness = 10.00 in
Bottom Slab Thickness = 10.00 in
Exterior Wall Thickness = 10.00 in

Modular Ratio (N) = 6.32 Max. Steel Ratio = 0.025
Design Span = 20.83 ft Design Height = 9.83 ft

Volume of Concrete: 2.189 cy/ft Weight of Steel: 743 lb/ft

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

M dimension = 5' 4" (method of equivalent capacity)
= 7' 4" (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	7	STR	5.00	1.440	21- 3	6255		
Bot Slab (int)	A200 (AS3)	144	7	STR	5.00	1.440	21- 3	6255		
Top Slab (ext)	A300 (AS7)	72	5	STR	10.00	0.372	21- 3	1596		
Bot Slab (ext)	A400 (AS8)	72	5	STR	10.00	0.372	21- 3	1596		
Corner (Top)	A1 (AS1)	288	7	L-BAR	5.00	1.440	9-10	5789	6- 9	3- 1
Corner (Bottom)	A2 (AS1)	288	7	L-BAR	5.00	1.440	9- 5	5543	6- 4	3- 1
Ext Wall (int)	B1 (AS4)	288	5	STR	5.00	0.744	9- 6	2854		
Ext Wall (ext)	B2 (AS1)	288	7	STR	5.00	1.440	9- 0	5298		
Top Slab (int- 1)	C100 (AS5)	25	5	STR	10.00	0.372	59-11	1562		
Bot Slab (int- 1)	C200	25	5	STR	10.00	0.372	59-11	1562		
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		
							Total	44559		

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)	1.440
Transverse Top Slab - Inside Face (AS2)	1.440
Transverse Bottom Slab - Inside Face (AS3)	1.440
Transverse Side Wall - Inside Face (AS4)	0.744
Distribution Top Slab - Inside Face (AS5)	0.372
Distribution Top Slab - OutSide Face (AS6)	0.372
Transverse Top Slab - Outside Face (AS7)	0.372
Transverse Bottom Slab - Outside Face (AS8)	0.372

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

Summary of Ratings Table:

Truck	ILF	OLF	Flexure Fill	Flexure Member	Flexure Location	Flexure IR	Flexure OR	Shear Fill	Shear Member	Shear Location	Shear IR	Shear OR
(AA)HL-93	1.75	1.35	6.00	1	BOT	1.21	1.57	6.00	4	LT	1.32	1.71
(AB)NRL	2.00	2.00	6.00	1	BOT	1.00	1.00	6.00	4	LT	1.14	1.14
(AC)Type 3	2.00	2.00	6.00	1	BOT	1.48	1.48	6.00	2	LT	1.76	1.76
(AD)Type 3	2.00	2.00	6.00	1	BOT	1.49	1.49	6.00	4	LT	1.77	1.77
(AE)Type 3	2.00	2.00	6.00	1	BOT	1.85	1.85	6.00	2	LT	2.15	2.15
(AF)Overlo	1.20	1.20	6.00	1	BOT	1.63	1.63	6.00	4	LT	1.89	1.89
(AG)Overlo	1.20	1.20	6.00	1	BOT	1.50	1.50	6.00	4	LT	1.74	1.74
(AH)EV 2	1.30	1.30	6.00	1	BOT	1.78	1.78	6.00	4	LT	2.05	2.05
(AI)EV 3	1.30	1.30	6.00	1	BOT	1.30	1.30	6.00	2	LT	1.49	1.49
(AJ)NRL -	2.00	2.00	6.00	1	BOT	2.15	2.15	6.00	2	LT	2.59	2.59
(AK)WA-105	2.00	2.00	6.00	1	BOT	1.21	1.21	6.00	4	LT	1.43	1.43

Critical Sections Summary: Flexure

Member 1: (Exterior Wall), 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	Load Ratings Truck	Fill Depth (ft)
BOT	24.00	-53.76	17.00	48.35	7.56	52.80*	1.00	1.44	14.31	1.00	1.00	14AB	6.00

MID	59.00	0.00	6.05	26.97	7.69	29.02	1.00	0.74	14.31	NC	NC	AA	4.00
MID-	59.00	-52.37	17.00	48.35	7.56	52.80	1.00	1.44	14.31	1.18	1.18	AB	6.00
TOP	24.00	-49.91	17.20	48.35	7.56	52.85	1.00	1.44	14.31	1.34	1.74	AA	6.00

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	24.00	-25.56	6.72	48.35	7.56	50.17	1.00	1.44	14.31	3.87	5.01	AA	6.00
MID	125.00	37.47	-0.90	48.35	7.56	48.10	1.00	1.44	14.31	2.02	2.61	AA	6.00
MID-	125.00	0.54	6.43	13.89	7.69	16.30	1.00	0.37	14.31	NC	NC	AA	6.00
RT	24.00	-25.56	6.72	48.35	7.56	50.17	1.00	1.44	14.31	3.87	5.01	AA	6.00

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	24.00	-27.38	10.43	48.35	7.56	51.14	1.00	1.44	14.31	4.91	6.36	AA	6.00
MID	125.00	38.18	0.59	48.35	7.56	48.51	1.00	1.44	14.31	1.93	1.93	AB	6.00
MID-	125.00	0.82	9.87	13.89	7.69	17.56	1.00	0.37	14.31	NC	NC	AA	6.00
RT	24.00	-27.38	10.43	48.35	7.56	51.14	1.00	1.44	14.31	4.91	6.36	AA	6.00

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	8.11	54.0	17.20	7.20	10.99	2.000	12.21 b	0.00	0.00	0.00	4.86	6.30	AA	6.00
MID	59.00	1.20	11.1	8.30	7.25	15.39	2.781	17.10 a	0.00	0.00	0.00	44.95	44.95	AG	6.00
MID-	59.00	0.54	46.0	15.87	7.20	10.99	2.000	12.21 b	0.00	0.00	0.00	13.63	17.67	AA	4.00
TOP	12.20	-5.67	49.6	17.20	7.20	10.99	2.000	12.21 b	0.00	0.00	0.00	4.75	6.16	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	15.47	39.4	6.72	7.56	17.31	n/a	19.24 c	0.00	0.00	0.00	1.38	1.78	AA	6.00
MID	125.00	2.31	35.3	-1.48	7.56	17.31	n/a	19.24 c	0.00	0.00	0.00	7.51	9.73	AA	4.00
MID-	125.00	2.30	9.2	5.73	7.69	17.60	n/a	19.56 c	0.00	0.00	0.00	7.64	9.90	AA	4.00
RT	12.20	15.47	39.4	6.72	7.56	17.31	n/a	19.24 c	0.00	0.00	0.00	1.38	1.78	AA	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	16.11	43.0	10.20	7.56	17.31	n/a	19.24 c	0.00	0.00	0.00	1.14	1.14	AB	6.00
MID	125.00	0.18	33.9	-0.29	7.56	17.31	n/a	19.24 c	0.00	0.00	0.00	95.17	99.99	AA	4.00
MID-	125.00	0.18	0.0	9.17	7.69	23.39	5.077	25.99 a	0.00	0.00	0.00	NC	NC	AA	4.00
RT	12.20	16.07	43.1	10.43	7.56	17.31	n/a	19.24 c	0.00	0.00	0.00	1.32	1.71	AA	6.00

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

Analysis Results: Fill Depth = 4.00 ft

Load Parameters:

Fe = 1.00 Surcharge Depth : 2.53 ft

Applied Horizontal Loads: (k/ft)

Load Description	Bottom of Wall	Top of Wall
Live Load Surcharge	0.152	0.152
Internal Water Pressure	-0.749(5.0in)	-0.187(-5.0in)
External Water Pressure	0.801(0.0in)	0.187(0.0in)
Horizontal Earth Load	0.855	0.265

Applied Uniform Bottom Slab Loads: (k/ft)

Load Description	
Dead Load	0.284
Vertical Earth	0.480
Wearing Surface	0.000

Unfactored Moments due to All Loads: (k-ft) / Unfactored Shears due to All Loads: (k)

M-PT	Mdc	Mev	Mdw	Meh	Mls	Mwa	Mgw	Vdc	Vev	Vdw	Veh	Vls	Vwa	Vgw
Member 1: (Exterior Wall)														
Bottom														
1- 0	-9.58	-15.12	0.00	-1.47	-0.39	1.23	-1.30	0.61	0.00	0.00	3.24	0.75	-2.50	2.94
1- 1	-8.97	-15.12	0.00	1.31	0.27	-1.11	1.21	0.61	0.00	0.00	2.43	0.60	-2.08	2.18
1- 2	-8.37	-15.12	0.00	3.33	0.78	-2.83	3.01	0.61	0.00	0.00	1.68	0.45	-1.41	1.48
1- 3	-7.77	-15.12	0.00	4.63	1.15	-3.91	4.15	0.61	0.00	0.00	0.98	0.30	-0.80	0.85
1- 4	-7.17	-15.12	0.00	5.29	1.37	-4.43	4.70	0.61	0.00	0.00	0.34	0.15	-0.25	0.27
1- 5	-6.57	-15.12	0.00	5.34	1.44	-4.43	4.71	0.61	0.00	0.00	-0.24	0.00	0.24	-0.25
1- 6	-5.97	-15.12	0.00	4.85	1.37	-3.99	4.25	0.61	0.00	0.00	-0.76	-0.15	0.67	-0.70
1- 7	-5.36	-15.12	0.00	3.88	1.15	-3.15	3.36	0.61	0.00	0.00	-1.22	-0.30	1.04	-1.10
1- 8	-4.76	-15.12	0.00	2.47	0.78	-1.97	2.12	0.61	0.00	0.00	-1.63	-0.45	1.35	-1.43
1- 9	-4.16	-15.12	0.00	0.70	0.27	-0.52	0.57	0.61	0.00	0.00	-1.97	-0.60	1.60	-1.71
1-10	-3.56	-15.12	0.00	-1.39	-0.39	1.14	-1.21	0.61	0.00	0.00	-2.26	-0.75	1.71	-1.92
Top														
Member 2: (Top Slab)														
Left														
2- 0	-3.56	-15.12	0.00	-1.42	-0.39	1.17	-1.25	1.73	5.00	0.00	0.00	0.00	0.00	0.00
2- 1	-0.71	-5.74	0.00	-1.42	-0.39	1.17	-1.25	1.05	4.00	0.00	0.00	0.00	0.00	0.00
2- 2	1.19	1.55	0.00	-1.42	-0.39	1.17	-1.25	0.78	3.00	0.00	0.00	0.00	0.00	0.00
2- 3	2.55	6.76	0.00	-1.42	-0.39	1.17	-1.25	0.52	2.00	0.00	0.00	0.00	0.00	0.00
2- 4	3.36	9.88	0.00	-1.42	-0.39	1.17	-1.25	0.26	1.00	0.00	0.00	0.00	0.00	0.00
2- 5	3.63	10.92	0.00	-1.42	-0.39	1.17	-1.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 6	3.36	9.88	0.00	-1.42	-0.39	1.17	-1.25	-0.26	-1.00	0.00	0.00	0.00	0.00	0.00
2- 7	2.55	6.76	0.00	-1.42	-0.39	1.17	-1.25	-0.52	-2.00	0.00	0.00	0.00	0.00	0.00
2- 8	1.19	1.55	0.00	-1.42	-0.39	1.17	-1.25	-0.78	-3.00	0.00	0.00	0.00	0.00	0.00
2- 9	-0.71	-5.74	0.00	-1.42	-0.39	1.17	-1.25	-1.05	-4.00	0.00	0.00	0.00	0.00	0.00
2-10	-3.56	-15.12	0.00	-1.42	-0.39	1.17	-1.25	-1.73	-5.00	0.00	0.00	0.00	0.00	0.00
Right														
Member 4: (Bottom Slab)														
Left														
4- 0	-9.58	-15.12	0.00	-1.47	-0.39	1.23	-1.30	2.96	5.00	0.00	0.00	0.00	0.00	0.00
4- 1	-4.03	-5.74	0.00	-1.47	-0.39	1.23	-1.30	2.37	4.00	0.00	0.00	0.00	0.00	0.00
4- 2	0.28	1.55	0.00	-1.47	-0.39	1.23	-1.30	1.77	3.00	0.00	0.00	0.00	0.00	0.00
4- 3	3.36	6.76	0.00	-1.47	-0.39	1.23	-1.30	1.18	2.00	0.00	0.00	0.00	0.00	0.00
4- 4	5.20	9.88	0.00	-1.47	-0.39	1.23	-1.30	0.59	1.00	0.00	0.00	0.00	0.00	0.00
4- 5	5.82	10.92	0.00	-1.47	-0.39	1.23	-1.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 6	5.20	9.88	0.00	-1.47	-0.39	1.23	-1.30	-0.59	-1.00	0.00	0.00	0.00	0.00	0.00
4- 7	3.36	6.76	0.00	-1.47	-0.39	1.23	-1.30	-1.18	-2.00	0.00	0.00	0.00	0.00	0.00
4- 8	0.28	1.55	0.00	-1.47	-0.39	1.23	-1.30	-1.77	-3.00	0.00	0.00	0.00	0.00	0.00
4- 9	-4.03	-5.74	0.00	-1.47	-0.39	1.23	-1.30	-2.37	-4.00	0.00	0.00	0.00	0.00	0.00
4-10	-9.58	-15.12	0.00	-1.47	-0.39	1.23	-1.30	-2.96	-5.00	0.00	0.00	0.00	0.00	0.00
Right														

Unfactored Thrusts due to All Loads: (k) (Fill Depth = 4.00 ft)

Member	Pdc	Pev	Pdw	Peh	Pls	Pwa
1	1.73	5.00	0.00	0.00	0.00	0.00
2	-0.61	0.00	0.00	2.26	0.75	-1.71
4	0.61	0.00	0.00	3.24	0.75	-2.50

Analysis Truck, HL-93

Vehicle	Axle No.	Weight (k/ft)	Length (ft)	Dist. From Previous (ft)
Truck	1	0.153	5.43	
	2	0.611	5.43	14.00
	3	0.611	5.43	14.00

Tandem 1 0.550 9.43

***Distributed loads may have been intensified due to axle overlap between lanes

Live Load Parameters:

Traffic Direction is Parallel to Main Reinforcement
Distribution Width : 13.47 ft
Impact Factor : 1.17
Truck MPF : 1.20 Tandem MPF : 1.20
Lane Load Distribution Width : 15.80 ft
Lane Load: 0.000 k/ft

Truck Positions That Cause Maximum Results:

Maximum +Moment in Top Slab

Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)
Truck	1	0.153	5.43	24.42
	2	0.611	5.43	10.42
	3	0.611	5.43	-3.58

Maximum +Moment : 7.21 k-ft
Corresponding Moment at End : -7.83 k-ft
Coincident Bottom Slab Load : 0.16 k/ft

Maximum -Moment in Top Slab

Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)
Truck	1	0.153	5.43	39.87
	2	0.611	5.43	25.87
	3	0.611	5.43	11.87

Maximum -Moment : -8.01 k-ft
Corresponding Moment at Mid : 6.75 k-ft
Coincident Bottom Slab Load : 0.16 k/ft

Maximum +Shear in Top Slab

Truck	1	0.153	5.43	30.72
	2	0.611	5.43	16.72
	3	0.611	5.43	2.72

Maximum +Shear : 3.53 k
Corresponding Shear at Mid : 0.21 k
Coincident Bottom Slab Load : 0.32 k/ft

Maximum -Shear in Top Slab

Truck	1	0.153	5.43	32.12
	2	0.611	5.43	18.12
	3	0.611	5.43	4.12

Maximum -Shear : -3.53 k
Corresponding Shear at Mid : -0.20 k
Coincident Bottom Slab Load : 0.32 k/ft

Maximum +Moment in Top Slab

Tandem	1	0.550	9.43	10.42

Maximum +Moment : 9.33 k-ft
Corresponding Moment at End : -11.59 k-ft
Coincident Bottom Slab Load : 0.25 k/ft

Maximum -Moment in Top Slab

Tandem	1	0.550	9.43	9.38

Maximum -Moment : -11.77 k-ft
Corresponding Moment at Mid : 9.17 k-ft
Coincident Bottom Slab Load : 0.25 k/ft

Maximum +Shear in Top Slab

Tandem	1	0.550	9.43	4.72

Maximum +Shear : 4.12 k
Corresponding Shear at Mid : -1.07 k
Coincident Bottom Slab Load : 0.25 k/ft

Maximum -Shear in Top Slab

Tandem	1	0.550	9.43	16.12

Maximum -Shear : -4.12 k
Corresponding Shear at Mid : 1.07 k
Coincident Bottom Slab Load : 0.25 k/ft

Unfactored Moments and Shears due to Truck Loads: (k-ft, k)

	Truck				Tandem				Lane			
M-PT	Mll+	Mll-	Vll+	Vll-	Mll+	Mll-	Vll+	Vll-	Mll+	Mll-	Vll+	Vll-
Member 1: (Exterior Wall)												
Bottom												
1- 0	0.00	-10.55	0.30	-0.32	0.00	-8.98	0.23	-0.43	0.00	0.00	0.00	0.00
1- 1	0.00	-10.25	0.30	-0.32	0.00	-8.93	0.23	-0.43	0.00	0.00	0.00	0.00
1- 2	0.00	-9.96	0.30	-0.32	0.00	-9.03	0.23	-0.43	0.00	0.00	0.00	0.00
1- 3	0.00	-9.66	0.30	-0.32	0.00	-9.25	0.23	-0.43	0.00	0.00	0.00	0.00
1- 4	0.00	-9.36	0.30	-0.32	0.00	-9.54	0.23	-0.43	0.00	0.00	0.00	0.00
1- 5	0.00	-9.07	0.30	-0.32	0.00	-9.87	0.23	-0.43	0.00	0.00	0.00	0.00
1- 6	0.00	-8.77	0.30	-0.32	0.00	-10.23	0.23	-0.43	0.00	0.00	0.00	0.00
1- 7	0.00	-8.47	0.30	-0.32	0.00	-10.60	0.23	-0.43	0.00	0.00	0.00	0.00
1- 8	0.00	-8.18	0.30	-0.32	0.00	-10.99	0.23	-0.43	0.00	0.00	0.00	0.00
1- 9	0.00	-7.96	0.30	-0.32	0.00	-11.37	0.23	-0.43	0.00	0.00	0.00	0.00
1-10	0.02	-8.01	0.30	-0.32	0.02	-11.77	0.23	-0.43	0.00	0.00	0.00	0.00
Top												
Member 2: (Top Slab)												
Left												
2- 0	0.02	-8.01	3.53	0.00	0.02	-11.77	4.12	0.00	0.00	0.00	0.00	0.00
2- 1	1.45	-4.43	2.92	-0.05	1.31	-6.31	3.59	-0.05	0.00	0.00	0.00	0.00
2- 2	3.75	-1.75	2.38	-0.21	3.98	-2.23	3.02	-0.19	0.00	0.00	0.00	0.00
2- 3	5.73	-0.04	1.93	-0.49	6.87	0.00	2.44	-0.44	0.00	0.00	0.00	0.00
2- 4	6.95	0.00	1.54	-0.81	8.69	0.00	1.87	-0.82	0.00	0.00	0.00	0.00
2- 5	7.21	0.00	1.17	-1.17	9.33	0.00	1.32	-1.32	0.00	0.00	0.00	0.00
2- 6	6.94	0.00	0.81	-1.54	8.69	0.00	0.82	-1.87	0.00	0.00	0.00	0.00
2- 7	5.73	-0.05	0.49	-1.93	6.88	0.00	0.44	-2.44	0.00	0.00	0.00	0.00
2- 8	3.76	-1.75	0.21	-2.38	3.98	-2.23	0.19	-3.02	0.00	0.00	0.00	0.00
2- 9	1.45	-4.43	0.05	-2.92	1.31	-6.31	0.05	-3.59	0.00	0.00	0.00	0.00

2-10	0.02	-8.01	0.00	-3.53	0.02	-11.77	0.00	-4.12	0.00	0.00	0.00	0.00
Right												

Member 4: (Bottom Slab)

Left												
4- 0	0.00	-10.55	3.34	0.00	0.00	-8.98	2.70	0.00	0.00	0.00	0.00	0.00
4- 1	0.00	-4.28	2.68	0.00	0.00	-3.89	2.18	0.00	0.00	0.00	0.00	0.00
4- 2	1.18	-0.14	2.01	0.00	1.62	-0.13	1.66	0.00	0.00	0.00	0.00	0.00
4- 3	4.25	0.00	1.35	0.00	4.15	0.00	1.14	0.00	0.00	0.00	0.00	0.00
4- 4	6.29	0.00	0.68	0.00	5.63	0.00	0.62	0.00	0.00	0.00	0.00	0.00
4- 5	6.95	0.00	0.09	-0.09	6.11	0.00	0.10	-0.10	0.00	0.00	0.00	0.00
4- 6	6.29	0.00	0.00	-0.68	5.63	0.00	0.00	-0.62	0.00	0.00	0.00	0.00
4- 7	4.25	0.00	0.00	-1.35	4.15	0.00	0.00	-1.14	0.00	0.00	0.00	0.00
4- 8	1.18	-0.14	0.00	-2.01	1.62	-0.13	0.00	-1.66	0.00	0.00	0.00	0.00
4- 9	0.00	-4.28	0.00	-2.68	0.00	-3.89	0.00	-2.18	0.00	0.00	0.00	0.00
4-10	0.00	-10.54	0.00	-3.34	0.00	-8.98	0.00	-2.70	0.00	0.00	0.00	0.00
Right												

Note: Unfactored live load results computed at 4.00 ft and 0 ft fill depths, per LRFD 3.6.1.2.6

Serviceability Check: Crack Control

Bar Mark	Location	Moment (k-ft)	Thrust (k)	Fss (ksi)	Spacing (in)	Allow (in)
A1	Top Corner Bar	-31.6	10.85	35.37	5.00	8.68
A2	Bot Corner Bar	-34.6	10.85	39.09*	5.00	7.39
A100	Top Slab (int)	24.3	-1.50	31.04	5.00	10.57
A200	Bot Slab (int)	24.2	-0.69	30.52	5.00	10.83
B2	Ext Wall (ext)	-33.6	10.85	37.87	5.00	7.78

Strength Limit State at Critical Sections: Flexure

Member 1: (Exterior Wall), 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
BOT	24.00	-48.10	15.87	48.35	7.56	52.52	1.00	1.44	14.31	1.42	1.84
MID	59.00	0.00	6.05	26.97	7.69	29.02	1.00	0.74	14.31	NC	NC
MID-	59.00	-46.18	15.87	48.35	7.56	52.52	1.00	1.44	14.31	1.59	2.06
TOP	24.00	-45.15	15.87	48.35	7.56	52.52	1.00	1.44	14.31	1.49	1.93

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
LT	24.00	-24.26	6.26	48.35	7.56	50.04	1.00	1.44	14.31	3.23	4.19
MID	125.00	35.28	-1.48	48.35	7.56	47.94	1.00	1.44	14.31	1.85	2.40
MID-	125.00	0.48	5.73	13.89	7.69	16.04	1.00	0.37	14.31	NC	NC
RT	24.00	-24.26	6.26	48.35	7.56	50.04	1.00	1.44	14.31	3.23	4.19

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
LT	24.00	-25.19	9.92	48.35	7.56	51.00	1.00	1.44	14.31	4.14	5.37
MID	125.00	33.87	-0.29	48.35	7.56	48.27	1.00	1.44	14.31	2.29	2.96
MID-	125.00	0.76	9.17	13.89	7.69	17.31	1.00	0.37	14.31	NC	NC
RT	24.00	-25.18	9.92	48.35	7.56	51.00	1.00	1.44	14.31	4.15	5.38

Notes: Mu - Resisting moment under pure flexure, Ma - Allowable moment under applied axial load

Strength Limit State at Critical Sections: 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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
BOT	12.20	7.74	49.0	15.87	7.20	10.99	2.000	45.00	12.21 b	0.00	0.00	0.00	4.45	5.77
MID	59.00	1.38	5.1	6.05	7.25	19.93	3.603	31.45	22.15 a	0.00	0.00	0.00	35.56	46.10
MID-	59.00	0.54	46.0	15.87	7.20	10.99	2.000	45.00	12.21 b	0.00	0.00	0.00	13.63	17.67
TOP	12.20	-5.36	44.8	15.87	7.20	10.99	2.000	45.00	12.21 b	0.00	0.00	0.00	4.25	5.51

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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
LT	12.20	14.37	36.2	6.26	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.44	1.86
MID	125.00	2.31	35.3	-1.48	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	7.51	9.73
MID-	125.00	2.30	9.2	5.73	7.69	17.60	n/a	n/a	19.56 c	0.00	0.00	0.00	7.64	9.90
RT	12.20	14.37	36.2	6.26	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.44	1.86

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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
LT	12.20	14.48	39.4	9.92	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.54	1.99
MID	125.00	0.18	33.9	-0.29	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	95.17	99.99
MID-	125.00	0.18	0.0	9.17	7.69	23.39	5.077	27.85	25.99 a	0.00	0.00	0.00	NC	NC
RT	12.20	14.48	39.4	9.92	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.54	1.99

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

Load Combination Results at Tenth Points: (k-ft, k)(Fill Depth = 4.00 ft)

M-PT	+Moment	-Moment	+Axial	-Axial	+Shear	-Shear
Member 1: (Exterior Wall)						
Bottom						
1- 0	-26.208	-54.072	6.054	15.866	9.917	-0.288
1- 1	-18.236	-49.045	6.054	15.866	7.803	-0.421
1- 2	-12.266	-48.128	6.054	15.866	5.827	-0.259
1- 3	-8.180	-47.061	6.054	15.866	3.989	-0.117
1- 4	-5.825	-46.181	6.054	15.866	2.291	0.003
1- 5	-5.071	-45.975	6.054	15.866	1.376	-0.544
1- 6	-5.784	-45.724	6.054	15.866	1.454	-1.965
1- 7	-7.825	-45.446	6.054	15.866	1.511	-3.248
1- 8	-11.069	-45.132	6.054	15.866	1.546	-4.392
1- 9	-15.361	-44.798	6.054	15.866	1.561	-5.397
1-10	-20.582	-48.478	6.054	15.866	1.481	-6.264
Top						
Member 2: (Top Slab)						
Left						
2- 0	-20.662	-48.558	5.734	6.264	15.866	6.054
2- 1	-5.602	-23.251	-1.481	6.264	12.792	4.545
2- 2	10.685	-4.248	-1.481	6.264	10.167	3.403
2- 3	24.202	4.521	-1.481	5.734	7.523	2.269
2- 4	32.472	8.066	-1.481	5.734	4.890	0.188
2- 5	35.277	9.248	-1.481	5.734	2.306	-2.305
2- 6	32.472	8.066	-1.481	5.734	-0.188	-4.890
2- 7	24.220	4.521	-1.481	5.734	-2.269	-7.523
2- 8	10.685	-4.250	-1.481	6.264	-3.403	-10.167
2- 9	-5.602	-23.251	-1.481	6.264	-4.545	-12.792
2-10	-20.662	-48.558	5.734	6.264	-6.054	-15.866
Right						
Member 4: (Bottom Slab)						
Left						
4- 0	-26.208	-54.072	9.173	9.917	16.041	7.161
4- 1	-12.277	-23.989	-0.288	9.917	12.839	5.728
4- 2	5.420	-2.339	-0.288	9.173	9.638	4.296
4- 3	20.642	5.120	-0.288	9.173	6.436	2.864
4- 4	30.584	9.595	-0.288	9.173	3.234	1.432
4- 5	33.869	11.087	-0.288	9.173	0.182	-0.181
4- 6	30.589	9.595	-0.288	9.173	-1.432	-3.232
4- 7	20.651	5.120	-0.288	9.173	-2.864	-6.434
4- 8	5.421	-2.339	-0.288	9.173	-4.296	-9.636
4- 9	-12.277	-23.978	-0.288	9.917	-5.728	-12.838
4-10	-26.208	-54.058	9.173	9.917	-7.161	-16.040
Right						

---------- Analysis Truck, NRL ----------

Vehicle	Axle No.	Weight (k/ft)	Length (ft)	Dist. From Previous (ft)
Truck	1	0.153	5.43	
	2	0.176	9.43	6.00
	3	0.374	9.43	8.00
	4	0.176	9.43	8.00
	5	0.115	5.43	8.00

***Distributed loads may have been intensified due to axle overlap between lanes

Live Load Parameters:

Traffic Direction is Parallel to Main Reinforcement
Distribution Width : 13.47 ft
Impact Factor : 1.17
Truck MPF : 1.20 Tandem MPF : 0.00
Lane Load Distribution Width : 15.80 ft
Lane Load: 0.000 k/ft

Truck Positions That Cause Maximum Results:

Maximum +Moment in Top Slab

Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)
Truck	1	0.153	5.43	24.42
	2	0.176	9.43	18.42
	3	0.374	9.43	10.42

Maximum -Moment in Top Slab

Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)
Truck	1	0.153	5.43	25.46
	2	0.176	9.43	19.46
	3	0.374	9.43	11.46

	4	0.176	9.43	2.42		4	0.176	9.43	3.46
	5	0.115	5.43	-5.58		5	0.115	5.43	-4.54

Maximum +Moment : 7.97 k-ft
Corresponding Moment at End : -10.73 k-ft
Coincident Bottom Slab Load : 0.29 k/ft

Maximum -Moment : -10.81 k-ft
Corresponding Moment at Mid : 7.93 k-ft
Coincident Bottom Slab Load : 0.29 k/ft

Maximum +Shear in Top Slab

Truck	1	0.153	5.43	18.72
	2	0.176	9.43	12.72
	3	0.374	9.43	4.72
	4	0.176	9.43	-3.28
	5	0.115	5.43	-11.28

Maximum +Shear : 3.74 k
Corresponding Shear at Mid : -0.46 k
Coincident Bottom Slab Load : 0.30 k/ft

Maximum -Shear in Top Slab

Truck	1	0.153	5.43	30.12
	2	0.176	9.43	24.12
	3	0.374	9.43	16.12
	4	0.176	9.43	8.12
	5	0.115	5.43	0.12

Maximum -Shear : -3.69 k
Corresponding Shear at Mid : 0.52 k
Coincident Bottom Slab Load : 0.28 k/ft

Unfactored Moments and Shears due to Truck Loads: (k-ft, k)

	Truck				Tandem				Lane			
M-PT	Mll+	Mll-	Vll+	Vll-	Mll+	Mll-	Vll+	Vll-	Mll+	Mll-	Vll+	Vll-
Member 1: (Exterior Wall)												
Bottom												
1- 0	0.00	-9.76	0.10	-0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 1	0.00	-9.78	0.10	-0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 2	0.00	-9.86	0.10	-0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 3	0.00	-9.95	0.10	-0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 4	0.00	-10.06	0.10	-0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 5	0.00	-10.17	0.10	-0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 6	0.00	-10.27	0.10	-0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 7	0.00	-10.38	0.10	-0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 8	0.00	-10.50	0.10	-0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 9	0.00	-10.64	0.10	-0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-10	0.01	-10.80	0.10	-0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Top												
Member 2: (Top Slab)												
Left												
2- 0	0.01	-10.80	3.74	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 1	0.45	-4.89	3.12	-0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 2	2.02	-0.90	2.48	-0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 3	5.33	0.00	1.85	-0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 4	7.34	0.00	1.22	-0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 5	7.97	0.00	0.62	-0.58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 6	7.30	0.00	0.26	-1.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 7	5.32	0.00	0.14	-1.85	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 8	2.24	-0.80	0.06	-2.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 9	0.42	-4.89	0.02	-3.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-10	0.01	-10.81	0.00	-3.69	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Right												
Member 4: (Bottom Slab)												
Left												
4- 0	0.00	-9.76	3.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 1	0.00	-3.89	2.53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 2	1.28	-0.05	1.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 3	4.35	0.00	1.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 4	6.25	0.00	0.66	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 5	6.95	0.00	0.04	-0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 6	6.36	0.00	0.00	-0.63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 7	4.45	0.00	0.00	-1.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 8	1.26	-0.04	0.00	-1.88	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 9	0.00	-3.71	0.00	-2.51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4-10	0.00	-9.47	0.00	-3.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Right												

Note: Unfactored live load results computed at 4.00 ft and 0 ft fill depths, per LRFD 3.6.1.2.6

Serviceability Check: Crack Control

Bar Mark	Location	Moment (k-ft)	Thrust (k)	Fss (ksi)	Spacing (in)	Allow (in)
A1	Top Corner Bar	-31.1	10.47	34.91	5.00	8.85
A2	Bot Corner Bar	-34.5	10.47	39.12*	5.00	7.38
A100	Top Slab (int)	23.0	-1.30	29.26	5.00	11.51
A200	Bot Slab (int)	24.2	-0.45	30.43	5.00	10.88
B2	Ext Wall (ext)	-34.1	10.47	38.65	5.00	7.53

Strength Limit State at Critical Sections: Flexure

Member 1: (Exterior Wall), 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
BOT	24.00	-47.94	15.21	48.35	7.56	52.35	1.00	1.44	14.31	1.24	1.24
MID	59.00	0.00	6.05	26.97	7.69	29.02	1.00	0.74	14.31	NC	NC
MID-	59.00	-47.08	15.21	48.35	7.56	52.35	1.00	1.44	14.31	1.34	1.34
TOP	24.00	-44.31	15.21	48.35	7.56	52.35	1.00	1.44	14.31	1.35	1.35

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
LT	24.00	-21.81	5.84	48.35	7.56	49.93	1.00	1.44	14.31	3.54	3.54
MID	125.00	32.90	-1.13	48.35	7.56	48.04	1.00	1.44	14.31	1.90	1.90
MID-	125.00	0.48	5.73	13.89	7.69	16.04	1.00	0.37	14.31	NC	NC
RT	24.00	-21.80	5.84	48.35	7.56	49.93	1.00	1.44	14.31	3.54	3.54

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
LT	24.00	-24.47	9.56	48.35	7.56	50.91	1.00	1.44	14.31	3.95	3.95
MID	125.00	33.87	0.14	48.35	7.56	48.39	1.00	1.44	14.31	2.01	2.01
MID-	125.00	0.76	9.17	13.89	7.69	17.31	1.00	0.37	14.31	NC	NC
RT	24.00	-24.15	9.56	48.35	7.56	50.91	1.00	1.44	14.31	4.12	4.12

Notes: Mu - Resisting moment under pure flexure, Ma - Allowable moment under applied axial load

Strength Limit State at Critical Sections: 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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
BOT	12.20	7.38	48.2	15.21	7.20	10.99	2.000	45.00	12.21 b	0.00	0.00	0.00	5.03	5.03
MID	59.00	1.02	5.1	6.05	7.25	20.12	3.637	31.33	22.36 a	0.00	0.00	0.00	94.23	94.23
MID-	59.00	0.12	46.5	15.21	7.20	10.99	2.000	45.00	12.21 b	0.00	0.00	0.00	27.93	27.93
TOP	12.20	-4.94	43.5	15.21	7.20	11.01	2.003	39.18	12.23 a	0.00	0.00	0.00	4.90	4.90

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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
LT	12.20	13.63	34.1	5.84	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.41	1.41
MID	125.00	1.09	32.9	-1.13	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	13.96	13.96
MID-	125.00	1.02	9.2	5.73	7.69	17.60	n/a	n/a	19.56 c	0.00	0.00	0.00	15.12	15.12
RT	12.20	13.56	34.1	5.84	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.43	1.43

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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
LT	12.20	14.19	38.3	9.56	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.42	1.42
MID	125.00	0.07	33.9	0.14	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	NC	NC
MID-	125.00	0.08	0.0	9.17	7.69	23.39	5.080	27.84	25.99 a	0.00	0.00	0.00	NC	NC
RT	12.20	14.15	37.9	9.56	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.43	1.43

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

Load Combination Results at Tenth Points: (k-ft, k)(Fill Depth = 4.00 ft)

M-PT	+Moment	-Moment	+Axial	-Axial	+Shear	-Shear
Member 1: (Exterior Wall)						
Bottom						
1- 0	-26.208	-52.688	6.054	15.210	9.564	0.138
1- 1	-18.236	-48.212	6.054	15.210	7.449	0.005
1- 2	-12.266	-47.950	6.054	15.210	5.473	0.167
1- 3	-8.180	-47.572	6.054	15.210	3.636	0.309
1- 4	-5.825	-47.081	6.054	15.210	1.937	0.429
1- 5	-5.071	-46.487	6.054	15.210	1.023	-0.117
1- 6	-5.784	-45.806	6.054	15.210	1.101	-1.539
1- 7	-7.825	-45.058	6.054	15.210	1.158	-2.822
1- 8	-11.069	-44.275	6.054	15.210	1.193	-3.966
1- 9	-15.361	-43.515	6.054	15.210	1.207	-4.971
1-10	-20.582	-46.779	6.054	15.210	1.128	-5.838
Top						
Member 2: (Top Slab)						
Left						
2- 0	-20.662	-46.859	5.734	5.838	15.210	6.054
2- 1	-7.359	-20.763	-1.128	5.838	11.974	4.545
2- 2	7.245	-1.922	-1.128	5.838	9.221	3.403
2- 3	21.508	4.521	-1.128	5.734	6.489	2.269
2- 4	30.112	8.066	-1.128	5.734	3.766	1.134
2- 5	32.900	9.248	-1.128	5.734	1.085	-1.018
2- 6	30.038	8.066	-1.128	5.734	-1.134	-3.749
2- 7	21.490	4.521	-1.128	5.734	-2.269	-6.489
2- 8	7.631	-1.751	-1.128	5.838	-3.403	-9.219
2- 9	-7.410	-20.758	-1.128	5.838	-4.545	-11.936
2-10	-20.662	-46.864	5.734	5.838	-6.054	-15.116
Right						
Member 4: (Bottom Slab)						
Left						
4- 0	-26.208	-52.688	9.173	9.564	15.720	7.161
4- 1	-12.277	-23.296	0.138	9.564	12.585	5.728
4- 2	4.826	-2.339	0.138	9.173	9.451	4.296
4- 3	20.821	5.120	0.138	9.173	6.319	2.864
4- 4	30.513	9.595	0.138	9.173	3.191	1.432
4- 5	33.875	11.087	0.138	9.173	0.068	-0.081
4- 6	30.706	9.595	0.138	9.173	-1.432	-3.145
4- 7	21.006	5.120	0.138	9.173	-2.864	-6.276
4- 8	4.799	-2.339	0.138	9.173	-4.296	-9.411
4- 9	-12.277	-22.980	0.138	9.564	-5.728	-12.546
4-10	-26.208	-52.175	9.173	9.564	-7.161	-15.680
Right						

---------- Analysis Truck, Type 3 ----------

Vehicle	Axle No.	Weight (k/ft)	Length (ft)	Dist. From Previous (ft)
Truck	1	0.374	9.43	
	2	0.306	5.43	17.00

***Distributed loads may have been intensified due to axle overlap between lanes

Live Load Parameters:

Traffic Direction is Parallel to Main Reinforcement
Distribution Width : 13.47 ft
Impact Factor : 1.17
Truck MPF : 1.20 Tandem MPF : 0.00
Lane Load Distribution Width : 15.80 ft
Lane Load: 0.000 k/ft

Truck Positions That Cause Maximum Results:

Maximum +Moment in Top Slab

Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)
Truck	1	0.374	9.43	10.42
	2	0.306	5.43	-6.58

Maximum +Moment : 6.34 k-ft
Corresponding Moment at End : -7.88 k-ft
Coincident Bottom Slab Load : 0.17 k/ft

Maximum -Moment in Top Slab

Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)
Truck	1	0.374	9.43	9.38
	2	0.306	5.43	-7.62

Maximum -Moment : -8.01 k-ft
Corresponding Moment at Mid : 6.24 k-ft
Coincident Bottom Slab Load : 0.17 k/ft

Maximum +Shear in Top Slab					Maximum -Shear in Top Slab				
Truck	1	0.306	5.43	21.72	Truck	1	0.374	9.43	16.12
	2	0.374	9.43	4.72		2	0.306	5.43	-0.88
Maximum +Shear :		2.82 k			Maximum -Shear :		-2.82 k		
Corresponding Shear at Mid :		-0.71 k			Corresponding Shear at Mid :		0.71 k		
Coincident Bottom Slab Load :		0.20 k/ft			Coincident Bottom Slab Load :		0.20 k/ft		

Unfactored Moments and Shears due to Truck Loads: (k-ft, k)

	Truck				Tandem				Lane			
M-PT	Mll+	Mll-	Vll+	Vll-	Mll+	Mll-	Vll+	Vll-	Mll+	Mll-	Vll+	Vll-
Member 1: (Exterior Wall)												
Bottom												
1- 0	0.00	-7.00	0.26	-0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 1	0.00	-6.88	0.26	-0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 2	0.00	-6.75	0.26	-0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 3	0.00	-6.63	0.26	-0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 4	0.00	-6.52	0.26	-0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 5	0.00	-6.71	0.26	-0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 6	0.00	-6.96	0.26	-0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 7	0.00	-7.21	0.26	-0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 8	0.00	-7.47	0.26	-0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 9	0.00	-7.73	0.26	-0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-10	0.01	-8.01	0.26	-0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Top												
Member 2: (Top Slab)												
Left												
2- 0	0.01	-8.01	2.82	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 1	0.89	-4.29	2.44	-0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 2	2.72	-1.51	2.06	-0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 3	4.69	-0.02	1.66	-0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 4	5.91	0.00	1.27	-0.56	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 5	6.34	0.00	0.90	-0.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 6	5.91	0.00	0.56	-1.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 7	4.70	-0.02	0.30	-1.66	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 8	2.72	-1.51	0.13	-2.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 9	0.89	-4.29	0.03	-2.44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-10	0.01	-8.01	0.00	-2.82	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Right												
Member 4: (Bottom Slab)												
Left												
4- 0	0.00	-7.00	2.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 1	0.00	-3.02	1.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 2	1.10	-0.09	1.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 3	2.91	0.00	0.88	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 4	4.05	0.00	0.47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 5	4.34	0.00	0.07	-0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 6	4.05	0.00	0.00	-0.47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 7	2.91	0.00	0.00	-0.88	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 8	1.10	-0.09	0.00	-1.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 9	0.00	-3.02	0.00	-1.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4-10	0.00	-6.99	0.00	-2.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Right												

Note: Unfactored live load results computed at 4.00 ft and 0 ft fill depths, per LRFD 3.6.1.2.6

Serviceability Check: Crack Control

Bar Mark	Location	Moment (k-ft)	Thrust (k)	Fss (ksi)	Spacing (in)	Allow (in)
A1	Top Corner Bar	-28.1	9.55	31.48	5.00	10.35
A2	Bot Corner Bar	-31.4	9.55	35.59	5.00	8.59
A100	Top Slab (int)	21.4	-1.46	27.29	5.00	12.69
A200	Bot Slab (int)	21.6	-0.55	27.20	5.00	12.75
B2	Ext Wall (ext)	-30.6	9.55	34.58	5.00	8.98

Strength Limit State at Critical Sections: Flexure

Member 1: (Exterior Wall), 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
BOT	24.00	-42.50	13.60	48.35	7.56	51.95	1.00	1.44	14.31	1.79	1.79
MID	59.00	0.00	6.05	26.97	7.69	29.02	1.00	0.74	14.31	NC	NC
MID-	59.00	-40.89	13.60	48.35	7.56	51.95	1.00	1.44	14.31	2.00	2.00
TOP	24.00	-39.00	13.60	48.35	7.56	51.95	1.00	1.44	14.31	1.88	1.88

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
LT	24.00	-20.61	6.03	48.35	7.56	49.98	1.00	1.44	14.31	4.04	4.04
MID	125.00	30.05	-1.41	48.35	7.56	47.96	1.00	1.44	14.31	2.38	2.38
MID-	125.00	0.48	5.73	13.89	7.69	16.04	1.00	0.37	14.31	NC	NC
RT	24.00	-20.61	6.03	48.35	7.56	49.98	1.00	1.44	14.31	4.04	4.04

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
LT	24.00	-22.83	9.85	48.35	7.56	50.99	1.00	1.44	14.31	4.99	4.99
MID	125.00	29.30	-0.05	48.35	7.56	48.34	1.00	1.44	14.31	3.21	3.21
MID-	125.00	0.76	9.17	13.89	7.69	17.31	1.00	0.37	14.31	NC	NC
RT	24.00	-22.82	9.85	48.35	7.56	50.99	1.00	1.44	14.31	5.00	5.00

Notes: Mu - Resisting moment under pure flexure, Ma - Allowable moment under applied axial load

Strength Limit State at Critical Sections: Vertical Shear

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

Loc	Dist. (in)	Design Shear (k)	Moment (k-ft)	Corr. A. F. (k)	Dv (in)	phi*Vn (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
BOT	12.20	7.67	43.1	13.60	7.20	10.99	2.000	45.00	12.21 b	0.00	0.00	0.00	4.07	4.07
MID	59.00	1.31	5.1	6.05	7.25	19.97	3.610	31.43	22.19 a	0.00	0.00	0.00	35.84	35.84
MID-	59.00	0.31	40.4	13.60	7.20	11.52	2.097	38.53	12.80 a	0.00	0.00	0.00	18.46	18.46
TOP	12.20	-5.13	38.4	13.60	7.20	11.55	2.102	38.50	12.83 a	0.00	0.00	0.00	4.61	4.61

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

Loc	Dist. (in)	Design Shear (k)	Moment (k-ft)	Corr. A. F. (k)	Dv (in)	phi*Vn (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
LT	12.20	12.22	31.1	6.03	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.84	1.84
MID	125.00	1.57	30.1	-1.41	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	9.66	9.66
MID-	125.00	1.57	9.2	5.73	7.69	17.60	n/a	n/a	19.56 c	0.00	0.00	0.00	9.83	9.83
RT	12.20	12.22	31.1	6.03	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.84	1.84

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

Loc	Dist. (in)	Design Shear (k)	Moment (k-ft)	Corr. A. F. (k)	Dv (in)	phi*Vn (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
LT	12.20	12.54	35.1	9.85	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	2.12	2.12
MID	125.00	0.12	29.3	-0.05	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	NC	NC
MID-	125.00	0.12	0.0	9.17	7.69	23.39	5.079	27.84	25.99 a	0.00	0.00	0.00	NC	NC
RT	12.20	12.54	35.1	9.85	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	2.12	2.12

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

Load Combination Results at Tenth Points: (k-ft, k)(Fill Depth = 4.00 ft)

M-PT	+Moment	-Moment	+Axial	-Axial	+Shear	-Shear
Member 1: (Exterior Wall)						
Bottom						
1- 0	-26.208	-47.851	6.054	13.595	9.848	-0.050
1- 1	-18.236	-43.130	6.054	13.595	7.734	-0.183
1- 2	-12.266	-42.521	6.054	13.595	5.758	-0.021
1- 3	-8.180	-41.761	6.054	13.595	3.920	0.121
1- 4	-5.825	-40.886	6.054	13.595	2.222	0.241
1- 5	-5.071	-40.446	6.054	13.595	1.307	-0.305
1- 6	-5.784	-39.996	6.054	13.595	1.385	-1.727
1- 7	-7.825	-39.508	6.054	13.595	1.442	-3.010
1- 8	-11.069	-38.979	6.054	13.595	1.477	-4.154
1- 9	-15.361	-38.430	6.054	13.595	1.492	-5.159
1-10	-20.582	-41.885	6.054	13.595	1.412	-6.026
Top						
Member 2: (Top Slab)						
Left						
2- 0	-20.662	-41.965	5.734	6.026	13.595	6.054
2- 1	-6.588	-19.716	-1.412	6.026	10.783	4.545
2- 2	8.480	-3.001	-1.412	6.026	8.474	3.403
2- 3	20.390	4.521	-1.412	5.734	6.156	2.269
2- 4	27.604	8.066	-1.412	5.734	3.845	0.648
2- 5	30.053	9.248	-1.412	5.734	1.568	-1.567
2- 6	27.604	8.066	-1.412	5.734	-0.648	-3.845
2- 7	20.405	4.521	-1.412	5.734	-2.269	-6.156
2- 8	8.475	-3.002	-1.412	6.026	-3.403	-8.474
2- 9	-6.588	-19.716	-1.412	6.026	-4.545	-10.782
2-10	-20.662	-41.965	5.734	6.026	-6.054	-13.594
Right						
Member 4: (Bottom Slab)						
Left						
4- 0	-26.208	-47.851	9.173	9.848	13.889	7.161
4- 1	-12.277	-21.785	-0.050	9.848	11.134	5.728
4- 2	4.515	-2.339	-0.050	9.173	8.379	4.296
4- 3	18.299	5.120	-0.050	9.173	5.625	2.864
4- 4	26.670	9.595	-0.050	9.173	2.870	1.432
4- 5	29.302	11.087	-0.050	9.173	0.124	-0.123
4- 6	26.671	9.595	-0.050	9.173	-1.432	-2.869
4- 7	18.302	5.120	-0.050	9.173	-2.864	-5.624
4- 8	4.516	-2.339	-0.050	9.173	-4.296	-8.378
4- 9	-12.277	-21.775	-0.050	9.848	-5.728	-11.133
4-10	-26.208	-47.839	9.173	9.848	-7.161	-13.888
Right						

---------- Analysis Truck, Type 3S2 ----------

Vehicle	Axle No.	Weight (k/ft)	Length (ft)	Dist. From Previous (ft)
Truck	1	0.341	9.43	
	2	0.341	9.43	26.00
	3	0.191	5.43	13.00

***Distributed loads may have been intensified due to axle overlap between lanes

Live Load Parameters:

Traffic Direction is Parallel to Main Reinforcement
Distribution Width : 13.47 ft
Impact Factor : 1.17
Truck MPF : 1.20 Tandem MPF : 0.00
Lane Load Distribution Width : 15.80 ft
Lane Load: 0.000 k/ft

Truck Positions That Cause Maximum Results:

Maximum +Moment in Top Slab

Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)
Truck	1	0.191	5.43	22.93
	2	0.341	9.43	9.93
	3	0.341	9.43	-16.07

Maximum +Moment : 5.79 k-ft
Corresponding Moment at End : -7.25 k-ft

Maximum -Moment in Top Slab

Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)
Truck	1	0.341	9.43	37.95
	2	0.341	9.43	11.95
	3	0.191	5.43	-1.05

Maximum -Moment : -7.31 k-ft
Corresponding Moment at Mid : 5.66 k-ft

Coincident Bottom Slab Load : 0.16 k/ft

Maximum +Shear in Top Slab

Truck			
1	0.191	5.43	17.72
2	0.341	9.43	4.72
3	0.341	9.43	-21.28

Maximum +Shear : 2.69 k
Corresponding Shear at Mid : -0.53 k
Coincident Bottom Slab Load : 0.20 k/ft

Coincident Bottom Slab Load : 0.17 k/ft

Maximum -Shear in Top Slab

Truck			
1	0.341	9.43	42.12
2	0.341	9.43	16.12
3	0.191	5.43	3.12

Maximum -Shear : -2.69 k
Corresponding Shear at Mid : 0.53 k
Coincident Bottom Slab Load : 0.20 k/ft

Unfactored Moments and Shears due to Truck Loads: (k-ft, k)

	Truck				Tandem				Lane			
M-PT	Mll+	Mll-	Vll+	Vll-	Mll+	Mll-	Vll+	Vll-	Mll+	Mll-	Vll+	Vll-
Member 1: (Exterior Wall)												
Bottom												
1- 0	0.00	-6.97	0.21	-0.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 1	0.00	-6.90	0.21	-0.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 2	0.00	-6.83	0.21	-0.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 3	0.00	-6.76	0.21	-0.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 4	0.00	-6.70	0.21	-0.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 5	0.00	-6.70	0.21	-0.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 6	0.00	-6.74	0.21	-0.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 7	0.00	-6.84	0.21	-0.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 8	0.00	-6.97	0.21	-0.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 9	0.00	-7.13	0.21	-0.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-10	0.01	-7.31	0.21	-0.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Top												
Member 2: (Top Slab)												
Left												
2- 0	0.01	-7.31	2.69	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 1	0.82	-3.91	2.28	-0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 2	2.47	-1.38	1.89	-0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 3	4.30	-0.01	1.51	-0.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 4	5.48	0.00	1.16	-0.51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 5	5.79	0.00	0.82	-0.82	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 6	5.48	0.00	0.51	-1.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 7	4.30	-0.01	0.28	-1.51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 8	2.47	-1.38	0.12	-1.88	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 9	0.82	-3.91	0.03	-2.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-10	0.01	-7.31	0.00	-2.69	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Right												
Member 4: (Bottom Slab)												
Left												
4- 0	0.00	-6.97	2.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 1	0.00	-2.89	1.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 2	1.00	-0.08	1.32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 3	2.98	0.00	0.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 4	4.22	0.00	0.47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 5	4.58	0.00	0.06	-0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 6	4.22	0.00	0.00	-0.47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 7	2.98	0.00	0.00	-0.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 8	1.00	-0.08	0.00	-1.32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 9	0.00	-2.89	0.00	-1.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4-10	0.00	-6.97	0.00	-2.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Right												

Note: Unfactored live load results computed at 4.00 ft and 0 ft fill depths, per LRFD 3.6.1.2.6

Serviceability Check: Crack Control

Bar Mark	Location	Moment (k-ft)	Thrust (k)	Fss (ksi)	Spacing (in)	Allow (in)
A1	Top Corner Bar	-27.6	9.41	30.91	5.00	10.63
A2	Bot Corner Bar	-31.5	9.41	35.73	5.00	8.54
A100	Top Slab (int)	20.8	-1.41	26.57	5.00	13.16
A200	Bot Slab (int)	21.8	-0.53	27.49	5.00	12.56
B2	Ext Wall (ext)	-30.8	9.41	34.86	5.00	8.88

Strength Limit State at Critical Sections: Flexure

Member 1: (Exterior Wall), 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
BOT	24.00	-42.63	13.36	48.35	7.56	51.89	1.00	1.44	14.31	1.76	1.76
MID	59.00	0.00	6.05	26.97	7.69	29.02	1.00	0.74	14.31	NC	NC
MID-	59.00	-41.20	13.36	48.35	7.56	51.89	1.00	1.44	14.31	2.00	2.00
TOP	24.00	-38.13	13.36	48.35	7.56	51.89	1.00	1.44	14.31	2.01	2.01

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
LT	24.00	-19.92	5.98	48.35	7.56	49.97	1.00	1.44	14.31	4.40	4.40
MID	125.00	29.08	-1.32	48.35	7.56	47.99	1.00	1.44	14.31	2.61	2.61
MID-	125.00	0.48	5.73	13.89	7.69	16.04	1.00	0.37	14.31	NC	NC
RT	24.00	-19.92	5.98	48.35	7.56	49.97	1.00	1.44	14.31	4.40	4.40

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
LT	24.00	-22.59	9.76	48.35	7.56	50.96	1.00	1.44	14.31	5.19	5.19
MID	125.00	29.71	0.00	48.35	7.56	48.35	1.00	1.44	14.31	3.05	3.05
MID-	125.00	0.76	9.17	13.89	7.69	17.31	1.00	0.37	14.31	NC	NC
RT	24.00	-22.59	9.76	48.35	7.56	50.96	1.00	1.44	14.31	5.19	5.19

Notes: Mu - Resisting moment under pure flexure, Ma - Allowable moment under applied axial load

Strength Limit State at Critical Sections: 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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
BOT	12.20	7.57	43.2	13.36	7.20	10.99	2.000	45.00	12.21 b	0.00	0.00	0.00	4.34	4.34
MID	59.00	1.21	5.1	6.05	7.25	20.02	3.619	31.39	22.25 a	0.00	0.00	0.00	44.96	44.96
MID-	59.00	0.26	40.4	13.36	7.20	11.52	2.096	38.53	12.80 a	0.00	0.00	0.00	20.24	20.24
TOP	12.20	-5.08	37.4	13.36	7.20	11.70	2.130	38.32	13.00 a	0.00	0.00	0.00	4.84	4.84

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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
LT	12.20	11.96	30.2	5.98	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.95	1.95
MID	125.00	1.43	29.1	-1.32	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	10.60	10.60
MID-	125.00	1.43	9.2	5.73	7.69	17.60	n/a	n/a	19.56 c	0.00	0.00	0.00	10.78	10.78
RT	12.20	11.96	30.2	5.98	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.95	1.95

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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
LT	12.20	12.64	35.0	9.76	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	2.07	2.07
MID	125.00	0.11	29.7	0.00	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	NC	NC
MID-	125.00	0.11	0.0	9.17	7.69	23.39	5.079	27.84	25.99 a	0.00	0.00	0.00	NC	NC
RT	12.20	12.64	35.0	9.76	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	2.07	2.07

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

Load Combination Results at Tenth Points: (k-ft, k)(Fill Depth = 4.00 ft)

M-PT	+Moment	-Moment	+Axial	-Axial	+Shear	-Shear
Member 1: (Exterior Wall)						
Bottom						
1- 0	-26.208	-47.799	6.054	13.360	9.756	-0.005
1- 1	-18.236	-43.169	6.054	13.360	7.641	-0.139
1- 2	-12.266	-42.650	6.054	13.360	5.665	0.024
1- 3	-8.180	-41.980	6.054	13.360	3.828	0.165
1- 4	-5.825	-41.199	6.054	13.360	2.129	0.286
1- 5	-5.071	-40.412	6.054	13.360	1.215	-0.261
1- 6	-5.784	-39.627	6.054	13.360	1.292	-1.682
1- 7	-7.825	-38.858	6.054	13.360	1.349	-2.965
1- 8	-11.069	-38.099	6.054	13.360	1.385	-4.109
1- 9	-15.361	-37.373	6.054	13.360	1.399	-5.114
1-10	-20.582	-40.666	6.054	13.360	1.320	-5.981
Top						
Member 2: (Top Slab)						
Left						
2- 0	-20.662	-40.746	5.734	5.981	13.360	6.054
2- 1	-6.713	-19.054	-1.320	5.981	10.499	4.545
2- 2	8.036	-2.767	-1.320	5.981	8.175	3.403
2- 3	19.699	4.521	-1.320	5.734	5.900	2.269
2- 4	26.846	8.066	-1.320	5.734	3.650	0.734
2- 5	29.083	9.248	-1.320	5.734	1.430	-1.429
2- 6	26.841	8.066	-1.320	5.734	-0.734	-3.650
2- 7	19.710	4.521	-1.320	5.734	-2.269	-5.900
2- 8	8.036	-2.768	-1.320	5.981	-3.403	-8.175
2- 9	-6.713	-19.054	-1.320	5.981	-4.545	-10.499
2-10	-20.662	-40.746	5.734	5.981	-6.054	-13.360
Right						
Member 4: (Bottom Slab)						
Left						
4- 0	-26.208	-47.799	9.173	9.756	13.996	7.161
4- 1	-12.277	-21.542	-0.005	9.756	11.213	5.728
4- 2	4.345	-2.339	-0.005	9.173	8.429	4.296
4- 3	18.435	5.120	-0.005	9.173	5.645	2.864
4- 4	26.974	9.595	-0.005	9.173	2.861	1.432
4- 5	29.714	11.087	-0.005	9.173	0.113	-0.112
4- 6	26.974	9.595	-0.005	9.173	-1.432	-2.861
4- 7	18.435	5.120	-0.005	9.173	-2.864	-5.645
4- 8	4.346	-2.339	-0.005	9.173	-4.296	-8.429
4- 9	-12.277	-21.542	-0.005	9.756	-5.728	-11.213
4-10	-26.208	-47.799	9.173	9.756	-7.161	-13.996
Right						

---------- Analysis Truck, Type 3-3 ----------

Vehicle	Axle No.	Weight (k/ft)	Length (ft)	Dist. From Previous (ft)
Truck	1	0.308	9.43	
	2	0.306	5.43	18.00
	3	0.264	9.43	17.00
	4	0.229	5.43	17.00

***Distributed loads may have been intensified due to axle overlap between lanes

Live Load Parameters:

Traffic Direction is Parallel to Main Reinforcement
Distribution Width : 13.47 ft
Impact Factor : 1.17
Truck MPF : 1.20 Tandem MPF : 0.00
Lane Load Distribution Width : 15.80 ft
Lane Load: 0.000 k/ft

Truck Positions That Cause Maximum Results:

Maximum +Moment in Top Slab

Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)
Truck	1	0.308	9.43	10.42
	2	0.306	5.43	-7.58
	3	0.264	9.43	-24.58
	4	0.229	5.43	-41.58

Maximum -Moment in Top Slab

Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)
Truck	1	0.308	9.43	9.38
	2	0.306	5.43	-8.63
	3	0.264	9.43	-25.63
	4	0.229	5.43	-42.63

Maximum +Moment : 5.22 k-ft
Corresponding Moment at End : -6.49 k-ft
Coincident Bottom Slab Load : 0.14 k/ft

Maximum -Moment : -6.59 k-ft
Corresponding Moment at Mid : 5.14 k-ft
Coincident Bottom Slab Load : 0.14 k/ft

Maximum +Shear in Top Slab

Truck	1	0.229	5.43	56.72
	2	0.264	9.43	39.72
	3	0.306	5.43	22.72
	4	0.308	9.43	4.72

Maximum +Shear : 2.31 k
Corresponding Shear at Mid : -0.60 k
Coincident Bottom Slab Load : 0.15 k/ft

Maximum -Shear in Top Slab

Truck	1	0.308	9.43	16.12
	2	0.306	5.43	-1.88
	3	0.264	9.43	-18.88
	4	0.229	5.43	-35.88

Maximum -Shear : -2.31 k
Corresponding Shear at Mid : 0.60 k
Coincident Bottom Slab Load : 0.15 k/ft

Unfactored Moments and Shears due to Truck Loads: (k-ft, k)

	Truck				Tandem				Lane			
M-PT	Mll+	Mll-	Vll+	Vll-	Mll+	Mll-	Vll+	Vll-	Mll+	Mll-	Vll+	Vll-
Member 1: (Exterior Wall)												
Bottom												
1- 0	0.00	-5.46	0.25	-0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 1	0.00	-5.37	0.25	-0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 2	0.00	-5.30	0.25	-0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 3	0.00	-5.23	0.25	-0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 4	0.00	-5.34	0.25	-0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 5	0.00	-5.53	0.25	-0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 6	0.00	-5.73	0.25	-0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 7	0.00	-5.94	0.25	-0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 8	0.00	-6.15	0.25	-0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 9	0.00	-6.37	0.25	-0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-10	0.01	-6.59	0.25	-0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Top												
Member 2: (Top Slab)												
Left												
2- 0	0.01	-6.59	2.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 1	0.73	-3.53	2.01	-0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 2	2.27	-1.25	1.69	-0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 3	3.85	-0.02	1.37	-0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 4	4.87	0.00	1.04	-0.46	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 5	5.22	0.00	0.74	-0.74	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 6	4.87	0.00	0.46	-1.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 7	3.85	-0.02	0.25	-1.37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 8	2.27	-1.25	0.11	-1.69	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 9	0.73	-3.53	0.03	-2.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-10	0.01	-6.59	0.00	-2.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Right												
Member 4: (Bottom Slab)												
Left												
4- 0	0.00	-5.46	1.64	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 1	0.00	-2.38	1.32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 2	0.91	-0.07	1.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 3	2.32	0.00	0.69	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 4	3.16	0.00	0.37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 5	3.42	0.00	0.06	-0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 6	3.16	0.00	0.00	-0.37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 7	2.32	0.00	0.00	-0.69	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 8	0.91	-0.07	0.00	-1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 9	0.00	-2.38	0.00	-1.32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4-10	0.00	-5.45	0.00	-1.64	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Right												

Note: Unfactored live load results computed at 4.00 ft and 0 ft fill depths, per LRFD 3.6.1.2.6

Serviceability Check: Crack Control

Bar Mark	Location	Moment (k-ft)	Thrust (k)	Fss (ksi)	Spacing (in)	Allow (in)
A1	Top Corner Bar	-26.8	9.04	30.03	5.00	11.09
A2	Bot Corner Bar	-29.9	9.04	33.97	5.00	9.24
A100	Top Slab (int)	20.2	-1.44	25.88	5.00	13.64
A200	Bot Slab (int)	20.7	-0.50	26.03	5.00	13.54
B2	Ext Wall (ext)	-29.4	9.04	33.31	5.00	9.51

Strength Limit State at Critical Sections: Flexure

Member 1: (Exterior Wall), 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
BOT	24.00	-39.96	12.70	48.35	7.56	51.72	1.00	1.44	14.31	2.26	2.26
MID	59.00	0.00	6.05	26.97	7.69	29.02	1.00	0.74	14.31	NC	NC
MID-	59.00	-38.83	12.70	48.35	7.56	51.72	1.00	1.44	14.31	2.41	2.41
TOP	24.00	-36.70	12.70	48.35	7.56	51.72	1.00	1.44	14.31	2.26	2.26

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
LT	24.00	-19.24	5.94	48.35	7.56	49.96	1.00	1.44	14.31	4.82	4.82
MID	125.00	28.09	-1.39	48.35	7.56	47.97	1.00	1.44	14.31	2.89	2.89
MID-	125.00	0.48	5.73	13.89	7.69	16.04	1.00	0.37	14.31	NC	NC
RT	24.00	-19.24	5.94	48.35	7.56	49.96	1.00	1.44	14.31	4.82	4.82

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
LT	24.00	-21.64	9.82	48.35	7.56	50.98	1.00	1.44	14.31	6.16	6.16
MID	125.00	27.70	0.04	48.35	7.56	48.36	1.00	1.44	14.31	4.07	4.07
MID-	125.00	0.76	9.17	13.89	7.69	17.31	1.00	0.37	14.31	NC	NC
RT	24.00	-21.64	9.82	48.35	7.56	50.98	1.00	1.44	14.31	6.17	6.17

Notes: Mu - Resisting moment under pure flexure, Ma - Allowable moment under applied axial load

Strength Limit State at Critical Sections: 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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
BOT	12.20	7.64	40.5	12.70	7.20	11.14	2.028	39.00	12.38 a	0.00	0.00	0.00	4.24	4.24
MID	59.00	1.28	5.1	6.05	7.25	19.99	3.612	31.42	22.21 a	0.00	0.00	0.00	38.13	38.13
MID-	59.00	0.22	38.4	12.70	7.20	11.81	2.150	38.21	13.12 a	0.00	0.00	0.00	23.03	23.03
TOP	12.20	-5.04	36.1	12.70	7.20	11.88	2.163	38.12	13.21 a	0.00	0.00	0.00	8.25	8.25

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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
LT	12.20	11.40	29.2	5.94	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	2.24	2.24
MID	125.00	1.29	28.1	-1.39	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	11.73	11.73
MID-	125.00	1.29	9.2	5.73	7.69	17.60	n/a	n/a	19.56 c	0.00	0.00	0.00	11.93	11.93
RT	12.20	11.40	29.2	5.94	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	2.24	2.24

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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
LT	12.20	11.80	33.2	9.82	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	2.74	2.74
MID	125.00	0.10	27.7	0.04	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	NC	NC
MID-	125.00	0.10	0.0	9.17	7.69	23.39	5.080	27.84	25.99 a	0.00	0.00	0.00	NC	NC
RT	12.20	11.80	33.2	9.82	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	2.74	2.74

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

Load Combination Results at Tenth Points: (k-ft, k)(Fill Depth = 4.00 ft)

M-PT	+Moment	-Moment	+Axial	-Axial	+Shear	-Shear
Member 1: (Exterior Wall)						
Bottom						
1- 0	-26.208	-45.157	6.054	12.702	9.821	0.040
1- 1	-18.236	-40.503	6.054	12.702	7.706	-0.094
1- 2	-12.266	-39.976	6.054	12.702	5.730	0.069
1- 3	-8.180	-39.298	6.054	12.702	3.893	0.210
1- 4	-5.825	-38.832	6.054	12.702	2.194	0.330
1- 5	-5.071	-38.372	6.054	12.702	1.280	-0.216
1- 6	-5.784	-37.849	6.054	12.702	1.358	-1.638
1- 7	-7.825	-37.281	6.054	12.702	1.414	-2.920
1- 8	-11.069	-36.672	6.054	12.702	1.450	-4.064
1- 9	-15.361	-36.042	6.054	12.702	1.464	-5.070
1-10	-20.582	-39.413	6.054	12.702	1.385	-5.937
Top						
Member 2: (Top Slab)						
Left						
2- 0	-20.662	-39.493	5.734	5.937	12.702	6.054
2- 1	-6.862	-18.391	-1.385	5.937	10.029	4.545
2- 2	7.686	-2.534	-1.385	5.937	7.839	3.403
2- 3	18.912	4.521	-1.385	5.734	5.644	2.269
2- 4	25.778	8.066	-1.385	5.734	3.454	0.821
2- 5	28.094	9.248	-1.385	5.734	1.291	-1.291
2- 6	25.778	8.066	-1.385	5.734	-0.821	-3.454
2- 7	18.922	4.521	-1.385	5.734	-2.269	-5.644
2- 8	7.683	-2.535	-1.385	5.937	-3.403	-7.839
2- 9	-6.862	-18.391	-1.385	5.937	-4.545	-10.029
2-10	-20.662	-39.493	5.734	5.937	-6.054	-12.702
Right						
Member 4: (Bottom Slab)						
Left						
4- 0	-26.208	-45.157	9.173	9.821	13.061	7.161
4- 1	-12.277	-20.661	0.040	9.821	10.468	5.728
4- 2	4.176	-2.339	0.040	9.173	7.876	4.296
4- 3	17.277	5.120	0.040	9.173	5.284	2.864
4- 4	25.118	9.595	0.040	9.173	2.691	1.432
4- 5	27.697	11.087	0.040	9.173	0.102	-0.102
4- 6	25.119	9.595	0.040	9.173	-1.432	-2.691
4- 7	17.277	5.120	0.040	9.173	-2.864	-5.284
4- 8	4.176	-2.339	0.040	9.173	-4.296	-7.876
4- 9	-12.277	-20.655	0.040	9.821	-5.728	-10.468
4-10	-26.208	-45.150	9.173	9.821	-7.161	-13.061
Right						

---------- Analysis Truck, Overload 1 ----------

Vehicle	Axle No.	Weight (k/ft)	Length (ft)	Dist. From Previous (ft)
Truck	1	0.473	9.43	
	2	0.473	9.43	16.00
	3	0.191	5.43	12.00

***Distributed loads may have been intensified due to axle overlap between lanes

Live Load Parameters:

Traffic Direction is Parallel to Main Reinforcement
Distribution Width : 13.47 ft
Impact Factor : 1.17
Truck MPF : 1.20 Tandem MPF : 0.00
Lane Load Distribution Width : 15.80 ft
Lane Load: 0.000 k/ft

Truck Positions That Cause Maximum Results:

Maximum +Moment in Top Slab

Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)
Truck	1	0.191	5.43	21.93
	2	0.473	9.43	9.93
	3	0.473	9.43	-6.07

Maximum +Moment : 8.08 k-ft
Corresponding Moment at End : -10.09 k-ft

Maximum -Moment in Top Slab

Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)
Truck	1	0.473	9.43	28.01
	2	0.473	9.43	12.01
	3	0.191	5.43	0.01

Maximum -Moment : -10.23 k-ft
Corresponding Moment at Mid : 7.88 k-ft

Coincident Bottom Slab Load : 0.23 k/ft

Maximum +Shear in Top Slab

Truck	1	0.473	9.43	20.72
	2	0.473	9.43	4.72
	3	0.191	5.43	-7.28

Maximum +Shear : 3.76 k
Corresponding Shear at Mid : -0.70 k
Coincident Bottom Slab Load : 0.32 k/ft

Coincident Bottom Slab Load : 0.24 k/ft

Maximum -Shear in Top Slab

Truck	1	0.473	9.43	16.12
	2	0.473	9.43	0.12
	3	0.191	5.43	-11.88

Maximum -Shear : -3.76 k
Corresponding Shear at Mid : 0.70 k
Coincident Bottom Slab Load : 0.32 k/ft

Unfactored Moments and Shears due to Truck Loads: (k-ft, k)

	Truck				Tandem				Lane			
M-PT	Mll+	Mll-	Vll+	Vll-	Mll+	Mll-	Vll+	Vll-	Mll+	Mll-	Vll+	Vll-
Member 1: (Exterior Wall)												
Bottom												
1- 0	0.00	-10.94	0.29	-0.37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 1	0.00	-10.70	0.29	-0.37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 2	0.00	-10.47	0.29	-0.37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 3	0.00	-10.23	0.29	-0.37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 4	0.00	-9.99	0.29	-0.37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 5	0.00	-9.75	0.29	-0.37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 6	0.00	-9.59	0.29	-0.37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 7	0.00	-9.54	0.29	-0.37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 8	0.00	-9.75	0.29	-0.37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 9	0.00	-9.98	0.29	-0.37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-10	0.02	-10.23	0.29	-0.37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Top												
Member 2: (Top Slab)												
Left												
2- 0	0.02	-10.23	3.76	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 1	1.12	-5.43	3.17	-0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 2	3.43	-1.92	2.63	-0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 3	6.03	-0.01	2.10	-0.38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 4	7.61	0.00	1.60	-0.71	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 5	8.08	0.00	1.13	-1.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 6	7.61	0.00	0.71	-1.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 7	6.03	-0.01	0.38	-2.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 8	3.43	-1.92	0.16	-2.63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 9	1.12	-5.43	0.04	-3.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-10	0.02	-10.23	0.00	-3.76	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Right												
Member 4: (Bottom Slab)												
Left												
4- 0	0.00	-10.94	3.42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 1	0.00	-4.51	2.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 2	1.39	-0.11	2.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 3	4.50	0.00	1.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 4	6.52	0.00	0.72	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 5	7.12	0.00	0.09	-0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 6	6.52	0.00	0.00	-0.72	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 7	4.50	0.00	0.00	-1.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 8	1.39	-0.11	0.00	-2.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 9	0.00	-4.51	0.00	-2.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4-10	0.00	-10.94	0.00	-3.42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Right												

Note: Unfactored live load results computed at 4.00 ft and 0 ft fill depths, per LRFD 3.6.1.2.6

Serviceability Check: Crack Control

Bar Mark	Location	Moment (k-ft)	Thrust (k)	Fss (ksi)	Spacing (in)	Allow (in)
A1	Top Corner Bar	-30.4	10.49	33.97	5.00	9.24
A2	Bot Corner Bar	-35.1	10.49	39.86*	5.00	7.15
A100	Top Slab (int)	23.1	-1.48	29.47	5.00	11.39
A200	Bot Slab (int)	24.4	-0.63	30.71	5.00	10.73
B2	Ext Wall (ext)	-34.1	10.49	38.56	5.00	7.55

Strength Limit State at Critical Sections: Flexure

Member 1: (Exterior Wall), 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
BOT	24.00	-44.80	13.74	48.35	7.56	51.98	1.00	1.44	14.31	1.93	1.93
MID	59.00	0.00	6.05	26.97	7.69	29.02	1.00	0.74	14.31	NC	NC
MID-	59.00	-42.97	13.74	48.35	7.56	51.98	1.00	1.44	14.31	2.25	2.25
TOP	24.00	-39.09	13.74	48.35	7.56	51.98	1.00	1.44	14.31	2.40	2.40

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
LT	24.00	-20.27	5.71	48.35	7.56	49.90	1.00	1.44	14.31	5.41	5.41
MID	125.00	29.86	-1.34	48.35	7.56	47.98	1.00	1.44	14.31	3.12	3.12
MID-	125.00	0.45	5.44	13.89	7.69	15.93	1.00	0.37	14.31	NC	NC
RT	24.00	-20.27	5.71	48.35	7.56	49.90	1.00	1.44	14.31	5.41	5.41

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
LT	24.00	-23.54	9.48	48.35	7.56	50.89	1.00	1.44	14.31	5.75	5.75
MID	125.00	31.32	-0.04	48.35	7.56	48.34	1.00	1.44	14.31	3.26	3.26
MID-	125.00	0.74	8.87	13.89	7.69	17.20	1.00	0.37	14.31	NC	NC
RT	24.00	-23.54	9.48	48.35	7.56	50.89	1.00	1.44	14.31	5.75	5.75

Notes: Mu - Resisting moment under pure flexure, Ma - Allowable moment under applied axial load

Strength Limit State at Critical Sections: 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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
BOT	12.20	7.36	45.5	13.74	7.20	10.99	2.000	45.00	12.21 b	0.00	0.00	0.00	6.60	6.60
MID	59.00	1.24	5.6	6.05	7.25	19.39	3.504	31.81	21.54 a	0.00	0.00	0.00	52.85	52.85
MID-	59.00	0.29	41.9	13.74	7.20	11.32	2.060	38.76	12.57 a	0.00	0.00	0.00	23.87	23.87
TOP	12.20	-4.88	38.4	13.74	7.20	11.58	2.107	38.46	12.86 a	0.00	0.00	0.00	7.10	7.10

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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
LT	12.20	12.30	30.8	5.71	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	2.33	2.33
MID	125.00	1.53	29.9	-1.34	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	12.73	12.73
MID-	125.00	1.53	9.4	5.44	7.69	17.60	n/a	n/a	19.56 c	0.00	0.00	0.00	12.95	12.95
RT	12.20	12.30	30.8	5.71	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	2.33	2.33

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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
LT	12.20	13.37	36.7	9.48	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	2.19	2.19
MID	125.00	0.12	31.3	-0.04	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	NC	NC
MID-	125.00	0.12	0.0	8.87	7.69	23.39	5.077	27.85	25.99 a	0.00	0.00	0.00	NC	NC
RT	12.20	13.37	36.7	9.48	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	2.19	2.19

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

Filename: Bothell Culvert Analysis 043025.etcx

Load Combination Results at Tenth Points: (k-ft, k)(Fill Depth = 4.00 ft)

M-PT	+Moment	-Moment	+Axial	-Axial	+Shear	-Shear
Member 1: (Exterior Wall)						
Bottom						
1- 0	-26.051	-50.219	6.054	13.741	9.478	-0.037
1- 1	-18.343	-45.547	6.054	13.741	7.423	-0.171
1- 2	-12.580	-44.830	6.054	13.741	5.507	-0.008
1- 3	-8.641	-43.961	6.054	13.741	3.729	0.133
1- 4	-6.373	-42.966	6.054	13.741	2.090	0.253
1- 5	-5.649	-41.862	6.054	13.741	1.236	-0.293
1- 6	-6.332	-40.770	6.054	13.741	1.314	-1.655
1- 7	-8.286	-39.773	6.054	13.741	1.370	-2.878
1- 8	-11.382	-39.063	6.054	13.741	1.406	-3.962
1- 9	-15.468	-38.372	6.054	13.741	1.420	-4.908
1-10	-20.425	-41.525	6.054	13.741	1.341	-5.715
Top						
Member 2: (Top Slab)						
Left						
2- 0	-20.505	-41.605	5.435	5.715	13.741	6.054
2- 1	-6.625	-19.376	-1.341	5.715	10.796	4.545
2- 2	8.338	-2.780	-1.341	5.715	8.423	3.403
2- 3	20.313	4.678	-1.341	5.435	6.087	2.269
2- 4	27.529	8.223	-1.341	5.435	3.791	0.672
2- 5	29.858	9.405	-1.341	5.435	1.530	-1.529
2- 6	27.526	8.223	-1.341	5.435	-0.672	-3.791
2- 7	20.325	4.678	-1.341	5.435	-2.269	-6.087
2- 8	8.338	-2.781	-1.341	5.715	-3.403	-8.423
2- 9	-6.625	-19.376	-1.341	5.715	-4.545	-10.796
2-10	-20.505	-41.605	5.435	5.715	-6.054	-13.741
Right						
Member 4: (Bottom Slab)						
Left						
4- 0	-26.051	-50.219	8.874	9.478	14.815	7.161
4- 1	-12.277	-22.429	-0.037	9.478	11.864	5.728
4- 2	4.468	-2.182	-0.037	8.874	8.914	4.296
4- 3	19.289	5.277	-0.037	8.874	5.963	2.864
4- 4	28.380	9.752	-0.037	8.874	3.013	1.432
4- 5	31.323	11.244	-0.037	8.874	0.121	-0.120
4- 6	28.380	9.752	-0.037	8.874	-1.432	-3.013
4- 7	19.289	5.277	-0.037	8.874	-2.864	-5.963
4- 8	4.469	-2.182	-0.037	8.874	-4.296	-8.914
4- 9	-12.277	-22.429	-0.037	9.478	-5.728	-11.864
4-10	-26.051	-50.219	8.874	9.478	-7.161	-14.815
Right						

---------- Analysis Truck, Overload 2 ----------

Vehicle	Axle No.	Weight (k/ft)	Length (ft)	Dist. From Previous (ft)
Truck	1	0.229	5.43	
	2	0.473	9.43	12.00
	3	0.420	5.43	8.00
	4	0.473	9.43	18.00
	5	0.420	5.43	8.00
	6	0.473	9.43	16.00
	7	0.420	5.43	8.00

***Distributed loads may have been intensified due to axle overlap between lanes

Live Load Parameters:

Traffic Direction is Parallel to Main Reinforcement
Distribution Width : 13.47 ft
Impact Factor : 1.17
Truck MPF : 1.20 Tandem MPF : 0.00
Lane Load Distribution Width : 15.80 ft
Lane Load: 0.000 k/ft

Truck Positions That Cause Maximum Results:

Maximum +Moment in Top Slab					Maximum -Moment in Top Slab				
Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)	Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)
Truck	1	0.420	5.43	16.67	Truck	1	0.420	5.43	15.22

	2	0.473	9.43	8.67	2	0.473	9.43	7.22
	3	0.420	5.43	-7.33	3	0.420	5.43	-8.78
	4	0.473	9.43	-15.33	4	0.473	9.43	-16.78
	5	0.420	5.43	-33.33	5	0.420	5.43	-34.78
	6	0.473	9.43	-41.33	6	0.473	9.43	-42.78
	7	0.229	5.43	-53.33	7	0.229	5.43	-54.78

Maximum +Moment : 9.28 k-ft
Corresponding Moment at End : -12.61 k-ft
Coincident Bottom Slab Load : 0.32 k/ft

Maximum -Moment : -13.01 k-ft
Corresponding Moment at Mid : 9.13 k-ft
Coincident Bottom Slab Load : 0.32 k/ft

Maximum +Shear in Top Slab

Truck	1	0.420	5.43	12.72
	2	0.473	9.43	4.72
	3	0.420	5.43	-11.28
	4	0.473	9.43	-19.28
	5	0.420	5.43	-37.28
	6	0.473	9.43	-45.28
	7	0.229	5.43	-57.28

Maximum +Shear : 4.40 k
Corresponding Shear at Mid : -0.24 k
Coincident Bottom Slab Load : 0.32 k/ft

Maximum -Shear in Top Slab

Truck	1	0.229	5.43	28.12
	2	0.473	9.43	16.12
	3	0.420	5.43	8.12
	4	0.473	9.43	-9.88
	5	0.420	5.43	-17.88
	6	0.473	9.43	-33.88
	7	0.420	5.43	-41.88

Maximum -Shear : -4.40 k
Corresponding Shear at Mid : 0.24 k
Coincident Bottom Slab Load : 0.32 k/ft

Unfactored Moments and Shears due to Truck Loads: (k-ft, k)

	Truck				Tandem				Lane			
M-PT	Mll+	Mll-	Vll+	Vll-	Mll+	Mll-	Vll+	Vll-	Mll+	Mll-	Vll+	Vll-
Member 1: (Exterior Wall)												
Bottom												
1- 0	0.00	-10.69	0.36	-0.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 1	0.00	-10.86	0.36	-0.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 2	0.00	-11.02	0.36	-0.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 3	0.00	-11.18	0.36	-0.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 4	0.00	-11.34	0.36	-0.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 5	0.00	-11.58	0.36	-0.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 6	0.00	-11.85	0.36	-0.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 7	0.00	-12.14	0.36	-0.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 8	0.00	-12.42	0.36	-0.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 9	0.00	-12.71	0.36	-0.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-10	0.01	-13.01	0.36	-0.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Top												
Member 2: (Top Slab)												
Left												
2- 0	0.01	-13.01	4.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 1	1.00	-6.32	3.69	-0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 2	3.48	-1.86	2.98	-0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 3	6.27	-0.02	2.28	-0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 4	8.53	0.00	1.66	-0.68	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 5	9.28	0.00	1.13	-1.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 6	8.53	0.00	0.68	-1.66	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 7	6.27	-0.02	0.34	-2.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 8	3.48	-1.87	0.15	-2.98	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 9	1.00	-6.32	0.04	-3.69	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-10	0.01	-13.01	0.00	-4.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Right												
Member 4: (Bottom Slab)												
Left												
4- 0	0.00	-10.69	3.51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 1	0.00	-4.17	2.81	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 2	1.54	-0.10	2.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 3	5.01	0.00	1.42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 4	7.10	0.00	0.73	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 5	7.75	0.00	0.09	-0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 6	7.10	0.00	0.00	-0.73	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 7	5.01	0.00	0.00	-1.42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 8	1.54	-0.10	0.00	-2.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 9	0.00	-4.17	0.00	-2.81	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4-10	0.00	-10.69	0.00	-3.51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Right												

Note: Unfactored live load results computed at 4.00 ft and 0 ft fill depths, per LRFD 3.6.1.2.6

Serviceability Check: Crack Control

Bar Mark	Location	Moment (k-ft)	Thrust (k)	Fss (ksi)	Spacing (in)	Allow (in)
A1	Top Corner Bar	-33.1	11.12	37.07*	5.00	8.06
A2	Bot Corner Bar	-35.7	11.12	40.33*	5.00	7.01
A100	Top Slab (int)	24.3	-1.56	31.00	5.00	10.59
A200	Bot Slab (int)	25.0	-0.57	31.47	5.00	10.35
B2	Ext Wall (ext)	-35.4	11.12	40.01	5.00	7.11

Strength Limit State at Critical Sections: Flexure

Member 1: (Exterior Wall), 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
BOT	24.00	-45.57	14.59	48.35	7.56	52.20	1.00	1.44	14.31	1.84	1.84
MID	59.00	0.00	6.05	26.97	7.69	29.02	1.00	0.74	14.31	NC	NC
MID-	59.00	-44.79	14.59	48.35	7.56	52.20	1.00	1.44	14.31	1.96	1.96
TOP	24.00	-42.70	14.59	48.35	7.56	52.20	1.00	1.44	14.31	1.90	1.90

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
LT	24.00	-21.57	5.63	48.35	7.56	49.88	1.00	1.44	14.31	4.66	4.66
MID	125.00	31.48	-1.44	48.35	7.56	47.95	1.00	1.44	14.31	2.71	2.71
MID-	125.00	0.45	5.44	13.89	7.69	15.93	1.00	0.37	14.31	NC	NC
RT	24.00	-21.57	5.63	48.35	7.56	49.88	1.00	1.44	14.31	4.65	4.65

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
LT	24.00	-23.09	9.58	48.35	7.56	50.91	1.00	1.44	14.31	6.15	6.15
MID	125.00	32.17	0.04	48.35	7.56	48.36	1.00	1.44	14.31	3.00	3.00
MID-	125.00	0.74	8.87	13.89	7.69	17.20	1.00	0.37	14.31	NC	NC
RT	24.00	-23.09	9.58	48.35	7.56	50.91	1.00	1.44	14.31	6.15	6.15

Notes: Mu - Resisting moment under pure flexure, Ma - Allowable moment under applied axial load

Strength Limit State at Critical Sections: 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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
BOT	12.20	7.46	45.7	14.59	7.20	10.99	2.000	45.00	12.21 b	0.00	0.00	0.00	6.10	6.10
MID	59.00	1.33	5.6	6.05	7.25	19.34	3.495	31.85	21.48 a	0.00	0.00	0.00	42.15	42.15
MID-	59.00	0.21	44.3	14.59	7.20	11.09	2.018	39.07	12.32 a	0.00	0.00	0.00	27.91	27.91
TOP	12.20	-4.79	42.1	14.59	7.20	11.14	2.028	38.99	12.38 a	0.00	0.00	0.00	12.72	12.72

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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
LT	12.20	13.08	33.3	5.63	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	2.00	2.00
MID	125.00	1.53	31.5	-1.44	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	12.71	12.71
MID-	125.00	1.53	9.4	5.44	7.69	17.60	n/a	n/a	19.56 c	0.00	0.00	0.00	12.93	12.93
RT	12.20	13.08	33.3	5.63	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	2.00	2.00

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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
LT	12.20	13.48	36.3	9.58	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	2.14	2.14
MID	125.00	0.12	32.2	0.04	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	NC	NC
MID-	125.00	0.12	0.0	8.87	7.69	23.39	5.077	27.85	25.99 a	0.00	0.00	0.00	NC	NC
RT	12.20	13.48	36.3	9.58	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	2.14	2.14

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

Load Combination Results at Tenth Points: (k-ft, k)(Fill Depth = 4.00 ft)

M-PT	+Moment	-Moment	+Axial	-Axial	+Shear	-Shear
Member 1: (Exterior Wall)						
Bottom						
1- 0	-26.051	-49.888	6.054	14.593	9.576	0.044
1- 1	-18.343	-45.756	6.054	14.593	7.521	-0.090
1- 2	-12.580	-45.577	6.054	14.593	5.604	0.072
1- 3	-8.641	-45.247	6.054	14.593	3.827	0.214
1- 4	-6.373	-44.790	6.054	14.593	2.188	0.334
1- 5	-5.649	-44.321	6.054	14.593	1.333	-0.212
1- 6	-6.332	-43.825	6.054	14.593	1.411	-1.574
1- 7	-8.286	-43.272	6.054	14.593	1.468	-2.797
1- 8	-11.382	-42.677	6.054	14.593	1.503	-3.881
1- 9	-15.468	-42.063	6.054	14.593	1.518	-4.827
1-10	-20.425	-45.278	6.054	14.593	1.438	-5.634
Top						
Member 2: (Top Slab)						
Left						
2- 0	-20.505	-45.358	5.435	5.634	14.593	6.054
2- 1	-6.795	-20.578	-1.438	5.634	11.496	4.545
2- 2	8.411	-2.709	-1.438	5.634	8.896	3.403
2- 3	20.648	4.678	-1.438	5.435	6.325	2.269
2- 4	28.771	8.223	-1.438	5.435	3.861	0.714
2- 5	31.484	9.405	-1.438	5.435	1.532	-1.531
2- 6	28.775	8.223	-1.438	5.435	-0.713	-3.861
2- 7	20.648	4.678	-1.438	5.435	-2.269	-6.325
2- 8	8.408	-2.714	-1.438	5.634	-3.403	-8.895
2- 9	-6.795	-20.579	-1.438	5.634	-4.545	-11.496
2-10	-20.505	-45.358	5.435	5.634	-6.054	-14.593
Right						
Member 4: (Bottom Slab)						
Left						
4- 0	-26.051	-49.888	8.874	9.576	14.928	7.161
4- 1	-12.277	-21.968	0.044	9.576	11.952	5.728
4- 2	4.667	-2.182	0.044	8.874	8.976	4.296
4- 3	19.974	5.277	0.044	8.874	6.000	2.864
4- 4	29.172	9.752	0.044	8.874	3.024	1.432
4- 5	32.171	11.244	0.044	8.874	0.121	-0.120
4- 6	29.172	9.752	0.044	8.874	-1.432	-3.024
4- 7	19.974	5.277	0.044	8.874	-2.864	-6.000
4- 8	4.675	-2.182	0.044	8.874	-4.296	-8.976
4- 9	-12.277	-21.968	0.044	9.576	-5.728	-11.952
4-10	-26.051	-49.888	8.874	9.576	-7.161	-14.928
Right						

---------- Analysis Truck, EV 2 ----------

Vehicle	Axle No.	Weight (k/ft)	Length (ft)	Dist. From Previous (ft)
Truck	1	0.640	5.43	
	2	0.459	5.43	15.00

***Distributed loads may have been intensified due to axle overlap between lanes

Live Load Parameters:

Traffic Direction is Parallel to Main Reinforcement
Distribution Width : 13.47 ft
Impact Factor : 1.17
Truck MPF : 1.20 Tandem MPF : 0.00
Lane Load Distribution Width : 15.80 ft
Lane Load: 0.000 k/ft

Truck Positions That Cause Maximum Results:

Maximum +Moment in Top Slab

Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)
Truck	1	0.459	5.43	25.42
	2	0.640	5.43	10.42

Maximum +Moment : 7.55 k-ft
Corresponding Moment at End : -8.20 k-ft
Coincident Bottom Slab Load : 0.17 k/ft

Maximum -Moment in Top Slab

Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)
Truck	1	0.459	5.43	23.97
	2	0.640	5.43	8.97

Maximum -Moment : -8.38 k-ft
Corresponding Moment at Mid : 7.06 k-ft
Coincident Bottom Slab Load : 0.17 k/ft

Maximum +Shear in Top Slab

Truck	1	0.459	5.43	17.72
	2	0.640	5.43	2.72

Maximum +Shear : 3.41 k
Corresponding Shear at Mid : -0.07 k
Coincident Bottom Slab Load : 0.29 k/ft

Maximum -Shear in Top Slab

Truck	1	0.640	5.43	18.12
	2	0.459	5.43	3.12

Maximum -Shear : -3.41 k
Corresponding Shear at Mid : 0.07 k
Coincident Bottom Slab Load : 0.29 k/ft

Unfactored Moments and Shears due to Truck Loads: (k-ft, k)

	Truck				Tandem				Lane			
M-PT	Mll+	Mll-	Vll+	Vll-	Mll+	Mll-	Vll+	Vll-	Mll+	Mll-	Vll+	Vll-
Member 1: (Exterior Wall)												
Bottom												
1- 0	0.00	-9.69	0.39	-0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 1	0.00	-9.32	0.39	-0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 2	0.00	-8.95	0.39	-0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 3	0.00	-8.58	0.39	-0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 4	0.00	-8.21	0.39	-0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 5	0.00	-7.90	0.39	-0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 6	0.00	-7.72	0.39	-0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 7	0.00	-7.68	0.39	-0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 8	0.00	-7.79	0.39	-0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 9	0.00	-8.07	0.39	-0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-10	0.02	-8.38	0.39	-0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Top												
Member 2: (Top Slab)												
Left												
2- 0	0.02	-8.38	3.41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 1	1.52	-4.63	2.89	-0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 2	3.92	-1.84	2.43	-0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 3	5.96	-0.04	2.02	-0.51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 4	7.13	0.00	1.62	-0.85	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 5	7.55	0.00	1.22	-1.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 6	7.13	0.00	0.85	-1.62	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 7	5.96	-0.05	0.51	-2.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 8	3.94	-1.84	0.22	-2.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 9	1.52	-4.63	0.06	-2.89	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-10	0.02	-8.38	0.00	-3.41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Right												
Member 4: (Bottom Slab)												
Left												
4- 0	0.00	-9.69	3.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 1	0.00	-4.04	2.41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 2	1.23	-0.15	1.82	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 3	3.75	0.00	1.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 4	5.56	0.00	0.62	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 5	6.13	0.00	0.09	-0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 6	5.56	0.00	0.00	-0.62	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 7	3.75	0.00	0.00	-1.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 8	1.23	-0.15	0.00	-1.82	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 9	0.00	-4.04	0.00	-2.41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4-10	0.00	-9.69	0.00	-3.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Right												

Note: Unfactored live load results computed at 4.00 ft and 0 ft fill depths, per LRFD 3.6.1.2.6

Serviceability Check: Crack Control

Bar Mark	Location	Moment (k-ft)	Thrust (k)	Fss (ksi)	Spacing (in)	Allow (in)
A1	Top Corner Bar	-28.4	10.14	31.66	5.00	10.26
A2	Bot Corner Bar	-33.6	10.14	38.09*	5.00	7.71
A100	Top Slab (int)	22.6	-1.59	28.85	5.00	11.74
A200	Bot Slab (int)	23.4	-0.60	29.45	5.00	11.40
B2	Ext Wall (ext)	-32.3	10.14	36.46	5.00	8.27

Strength Limit State at Critical Sections: Flexure

Member 1: (Exterior Wall), 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
BOT	24.00	-42.75	13.26	48.35	7.56	51.86	1.00	1.44	14.31	2.07	2.07
MID	59.00	0.00	6.05	26.97	7.69	29.02	1.00	0.74	14.31	NC	NC
MID-	59.00	-40.56	13.26	48.35	7.56	51.86	1.00	1.44	14.31	2.51	2.51
TOP	24.00	-36.46	13.26	48.35	7.56	51.86	1.00	1.44	14.31	2.76	2.76

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
LT	24.00	-19.13	5.67	48.35	7.56	49.89	1.00	1.44	14.31	5.80	5.80
MID	125.00	29.15	-1.48	48.35	7.56	47.94	1.00	1.44	14.31	3.07	3.07
MID-	125.00	0.45	5.44	13.89	7.69	15.93	1.00	0.37	14.31	NC	NC
RT	24.00	-19.13	5.67	48.35	7.56	49.89	1.00	1.44	14.31	5.80	5.80

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
LT	24.00	-22.86	9.62	48.35	7.56	50.93	1.00	1.44	14.31	5.89	5.89
MID	125.00	29.98	0.00	48.35	7.56	48.35	1.00	1.44	14.31	3.50	3.50
MID-	125.00	0.74	8.87	13.89	7.69	17.20	1.00	0.37	14.31	NC	NC
RT	24.00	-22.86	9.62	48.35	7.56	50.93	1.00	1.44	14.31	5.89	5.89

Notes: Mu - Resisting moment under pure flexure, Ma - Allowable moment under applied axial load

Strength Limit State at Critical Sections: 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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
BOT	12.20	7.50	43.6	13.26	7.20	10.99	2.000	45.00	12.21 b	0.00	0.00	0.00	5.44	5.44
MID	59.00	1.38	5.6	6.05	7.25	19.31	3.491	31.86	21.46 a	0.00	0.00	0.00	35.60	35.60
MID-	59.00	0.25	39.4	13.26	7.20	11.68	2.126	38.35	12.98 a	0.00	0.00	0.00	24.90	24.90
TOP	12.20	-4.83	35.8	13.26	7.20	11.96	2.177	38.04	13.29 a	0.00	0.00	0.00	12.80	12.80

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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
LT	12.20	11.88	29.0	5.67	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	2.36	2.36
MID	125.00	1.65	29.1	-1.48	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	10.89	10.89
MID-	125.00	1.65	9.4	5.44	7.69	17.60	n/a	n/a	19.56 c	0.00	0.00	0.00	11.07	11.07
RT	12.20	11.88	29.0	5.67	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	2.36	2.36

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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
LT	12.20	12.87	35.5	9.62	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	2.30	2.30
MID	125.00	0.12	30.0	0.00	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	NC	NC
MID-	125.00	0.12	0.0	8.87	7.69	23.39	5.077	27.85	25.99 a	0.00	0.00	0.00	NC	NC
RT	12.20	12.87	35.5	9.62	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	2.30	2.30

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

Load Combination Results at Tenth Points: (k-ft, k)(Fill Depth = 4.00 ft)

M-PT	+Moment	-Moment	+Axial	-Axial	+Shear	-Shear
Member 1: (Exterior Wall)						
Bottom						
1- 0	-26.051	-48.532	6.054	13.264	9.620	0.004
1- 1	-18.343	-43.679	6.054	13.264	7.565	-0.129
1- 2	-12.580	-42.780	6.054	13.264	5.649	0.033
1- 3	-8.641	-41.731	6.054	13.264	3.871	0.175
1- 4	-6.373	-40.555	6.054	13.264	2.233	0.295
1- 5	-5.649	-39.357	6.054	13.264	1.378	-0.251
1- 6	-6.332	-38.245	6.054	13.264	1.456	-1.613
1- 7	-8.286	-37.261	6.054	13.264	1.513	-2.836
1- 8	-11.382	-36.425	6.054	13.264	1.548	-3.920
1- 9	-15.468	-35.799	6.054	13.264	1.562	-4.866
1-10	-20.425	-39.034	6.054	13.264	1.483	-5.673
Top						
Member 2: (Top Slab)						
Left						
2- 0	-20.505	-39.114	5.435	5.673	13.264	6.054
2- 1	-6.091	-18.301	-1.483	5.673	10.420	4.545
2- 2	9.006	-2.673	-1.483	5.673	8.157	3.403
2- 3	20.224	4.678	-1.483	5.435	5.973	2.269
2- 4	26.880	8.223	-1.483	5.435	3.809	0.479
2- 5	29.146	9.405	-1.483	5.435	1.651	-1.651
2- 6	26.880	8.223	-1.483	5.435	-0.479	-3.809
2- 7	20.219	4.678	-1.483	5.435	-2.269	-5.973
2- 8	9.028	-2.673	-1.483	5.673	-3.403	-8.156
2- 9	-6.091	-18.301	-1.483	5.673	-4.545	-10.420
2-10	-20.505	-39.114	5.435	5.673	-6.054	-13.264
Right						
Member 4: (Bottom Slab)						
Left						
4- 0	-26.051	-48.532	8.874	9.620	14.260	7.161
4- 1	-12.277	-21.787	0.004	9.620	11.415	5.728
4- 2	4.253	-2.182	0.004	8.874	8.570	4.296
4- 3	18.271	5.277	0.004	8.874	5.725	2.864
4- 4	27.088	9.752	0.004	8.874	2.880	1.432
4- 5	29.978	11.244	0.004	8.874	0.122	-0.121
4- 6	27.088	9.752	0.004	8.874	-1.432	-2.880
4- 7	18.271	5.277	0.004	8.874	-2.864	-5.725
4- 8	4.253	-2.182	0.004	8.874	-4.296	-8.570
4- 9	-12.277	-21.787	0.004	9.620	-5.728	-11.415
4-10	-26.051	-48.532	8.874	9.620	-7.161	-14.260
Right						

---------- Analysis Truck, EV 3 ----------

Vehicle	Axle No.	Weight (k/ft)	Length (ft)	Dist. From Previous (ft)
Truck	1	0.682	9.43	
	2	0.459	5.43	17.00

***Distributed loads may have been intensified due to axle overlap between lanes

Live Load Parameters:

Traffic Direction is Parallel to Main Reinforcement
Distribution Width : 13.47 ft
Impact Factor : 1.17
Truck MPF : 1.20 Tandem MPF : 0.00
Lane Load Distribution Width : 15.80 ft
Lane Load: 0.000 k/ft

Truck Positions That Cause Maximum Results:

Maximum +Moment in Top Slab

Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)
Truck	1	0.459	5.43	27.42
	2	0.682	9.43	10.42

Maximum +Moment : 11.57 k-ft
Corresponding Moment at End : -14.37 k-ft
Coincident Bottom Slab Load : 0.31 k/ft

Maximum -Moment in Top Slab

Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)
Truck	1	0.459	5.43	26.38
	2	0.682	9.43	9.38

Maximum -Moment : -14.60 k-ft
Corresponding Moment at Mid : 11.37 k-ft
Coincident Bottom Slab Load : 0.31 k/ft

Maximum +Shear in Top Slab

Truck	1	0.459	5.43	21.72
	2	0.682	9.43	4.72

Maximum +Shear : 5.14 k
Corresponding Shear at Mid : -1.30 k
Coincident Bottom Slab Load : 0.35 k/ft

Maximum -Shear in Top Slab

Truck	1	0.682	9.43	16.12
	2	0.459	5.43	-0.88

Maximum -Shear : -5.14 k
Corresponding Shear at Mid : 1.30 k
Coincident Bottom Slab Load : 0.35 k/ft

Unfactored Moments and Shears due to Truck Loads: (k-ft, k)

	Truck				Tandem				Lane			
M-PT	Mll+	Mll-	Vll+	Vll-	Mll+	Mll-	Vll+	Vll-	Mll+	Mll-	Vll+	Vll-
Member 1: (Exterior Wall)												
Bottom												
1- 0	0.00	-12.47	0.44	-0.53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 1	0.00	-12.28	0.44	-0.53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 2	0.00	-12.08	0.44	-0.53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 3	0.00	-11.89	0.44	-0.53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 4	0.00	-11.83	0.44	-0.53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 5	0.00	-12.24	0.44	-0.53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 6	0.00	-12.68	0.44	-0.53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 7	0.00	-13.15	0.44	-0.53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 8	0.00	-13.62	0.44	-0.53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 9	0.00	-14.10	0.44	-0.53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-10	0.02	-14.60	0.44	-0.53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Top												
Member 2: (Top Slab)												
Left												
2- 0	0.02	-14.60	5.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 1	1.62	-7.83	4.45	-0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 2	4.96	-2.76	3.75	-0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 3	8.55	-0.03	3.03	-0.55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 4	10.78	0.00	2.31	-1.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 5	11.57	0.00	1.63	-1.63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 6	10.78	0.00	1.02	-2.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 7	8.56	-0.03	0.55	-3.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 8	4.96	-2.76	0.24	-3.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 9	1.62	-7.83	0.06	-4.45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-10	0.02	-14.60	0.00	-5.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Right												
Member 4: (Bottom Slab)												
Left												
4- 0	0.00	-12.47	3.76	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 1	0.00	-5.39	3.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 2	2.00	-0.16	2.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 3	5.21	0.00	1.58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 4	7.24	0.00	0.85	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 5	7.74	0.00	0.13	-0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 6	7.24	0.00	0.00	-0.85	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 7	5.22	0.00	0.00	-1.58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 8	2.01	-0.16	0.00	-2.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 9	0.00	-5.39	0.00	-3.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4-10	0.00	-12.46	0.00	-3.76	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Right												

Note: Unfactored live load results computed at 4.00 ft and 0 ft fill depths, per LRFD 3.6.1.2.6

Serviceability Check: Crack Control

Bar Mark	Location	Moment (k-ft)	Thrust (k)	Fss (ksi)	Spacing (in)	Allow (in)
A1	Top Corner Bar	-34.3	11.86	38.27*	5.00	7.65
A2	Bot Corner Bar	-36.7	11.86	41.36*	5.00	6.71
A100	Top Slab (int)	26.6	-1.64	33.89	5.00	9.27
A200	Bot Slab (int)	25.0	-0.79	31.55	5.00	10.32
B2	Ext Wall (ext)	-35.9	11.86	40.34	5.00	7.01

Strength Limit State at Critical Sections: Flexure

Member 1: (Exterior Wall), 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
BOT	24.00	-46.99	15.59	48.35	7.56	52.45	1.00	1.44	14.31	1.57	1.57
MID	59.00	0.00	6.05	26.97	7.69	29.02	1.00	0.74	14.31	NC	NC
MID-	59.00	-45.46	15.59	48.35	7.56	52.45	1.00	1.44	14.31	1.72	1.72
TOP	24.00	-44.31	15.59	48.35	7.56	52.45	1.00	1.44	14.31	1.61	1.61

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
LT	24.00	-23.61	5.93	48.35	7.56	49.96	1.00	1.44	14.31	3.54	3.54
MID	125.00	34.57	-1.55	48.35	7.56	47.92	1.00	1.44	14.31	2.00	2.00
MID-	125.00	0.45	5.44	13.89	7.69	15.93	1.00	0.37	14.31	NC	NC
RT	24.00	-23.61	5.93	48.35	7.56	49.96	1.00	1.44	14.31	3.54	3.54

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
LT	24.00	-24.76	9.68	48.35	7.56	50.94	1.00	1.44	14.31	4.52	4.52
MID	125.00	32.16	-0.26	48.35	7.56	48.28	1.00	1.44	14.31	2.76	2.76
MID-	125.00	0.74	8.87	13.89	7.69	17.20	1.00	0.37	14.31	NC	NC
RT	24.00	-24.75	9.68	48.35	7.56	50.94	1.00	1.44	14.31	4.53	4.53

Notes: Mu - Resisting moment under pure flexure, Ma - Allowable moment under applied axial load

Strength Limit State at Critical Sections: 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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
BOT	12.20	7.56	47.6	15.59	7.20	10.99	2.000	45.00	12.21 b	0.00	0.00	0.00	5.19	5.19
MID	59.00	1.44	5.6	6.05	7.25	19.28	3.485	31.88	21.42 a	0.00	0.00	0.00	31.71	31.71
MID-	59.00	0.51	45.2	15.59	7.20	11.01	2.004	39.17	12.24 a	0.00	0.00	0.00	14.83	14.83
TOP	12.20	-5.09	43.9	15.59	7.20	10.99	2.000	45.00	12.21 b	0.00	0.00	0.00	5.20	5.20

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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
LT	12.20	14.09	35.4	5.93	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.55	1.55
MID	125.00	2.21	34.6	-1.55	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	8.15	8.15
MID-	125.00	2.20	9.4	5.44	7.69	17.60	n/a	n/a	19.56 c	0.00	0.00	0.00	8.29	8.29
RT	12.20	14.09	35.4	5.93	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.55	1.55

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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
LT	12.20	13.80	38.3	9.68	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.83	1.83
MID	125.00	0.17	32.2	-0.26	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	NC	NC
MID-	125.00	0.17	0.0	8.87	7.69	23.39	5.075	27.85	25.99 a	0.00	0.00	0.00	NC	NC
RT	12.20	13.80	38.3	9.68	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.83	1.83

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

Load Combination Results at Tenth Points: (k-ft, k)(Fill Depth = 4.00 ft)

M-PT	+Moment	-Moment	+Axial	-Axial	+Shear	-Shear
Member 1: (Exterior Wall)						
Bottom						
1- 0	-26.051	-52.283	6.054	15.594	9.684	-0.255
1- 1	-18.343	-47.670	6.054	15.594	7.629	-0.389
1- 2	-12.580	-47.012	6.054	15.594	5.713	-0.226
1- 3	-8.641	-46.203	6.054	15.594	3.935	-0.085
1- 4	-6.373	-45.455	6.054	15.594	2.297	0.035
1- 5	-5.649	-45.225	6.054	15.594	1.442	-0.511
1- 6	-6.332	-44.947	6.054	15.594	1.520	-1.873
1- 7	-8.286	-44.640	6.054	15.594	1.577	-3.096
1- 8	-11.382	-44.297	6.054	15.594	1.612	-4.180
1- 9	-15.468	-43.934	6.054	15.594	1.626	-5.126
1-10	-20.425	-47.426	6.054	15.594	1.547	-5.933
Top						
Member 2: (Top Slab)						
Left						
2- 0	-20.505	-47.506	5.435	5.933	15.594	6.054
2- 1	-5.955	-22.614	-1.547	5.933	12.520	4.545
2- 2	10.409	-3.922	-1.547	5.933	9.937	3.403
2- 3	23.715	4.678	-1.547	5.435	7.338	2.269
2- 4	31.811	8.223	-1.547	5.435	4.748	0.250
2- 5	34.568	9.405	-1.547	5.435	2.206	-2.205
2- 6	31.811	8.223	-1.547	5.435	-0.250	-4.748
2- 7	23.733	4.678	-1.547	5.435	-2.269	-7.338
2- 8	10.402	-3.924	-1.547	5.933	-3.403	-9.937
2- 9	-5.955	-22.614	-1.547	5.933	-4.545	-12.519
2-10	-20.505	-47.506	5.435	5.933	-6.054	-15.593
Right						
Member 4: (Bottom Slab)						
Left						
4- 0	-26.051	-52.283	8.874	9.684	15.271	7.161
4- 1	-12.277	-23.616	-0.255	9.684	12.249	5.728
4- 2	5.298	-2.182	-0.255	8.874	9.228	4.296
4- 3	20.250	5.277	-0.255	8.874	6.206	2.864
4- 4	29.353	9.752	-0.255	8.874	3.185	1.432
4- 5	32.163	11.244	-0.255	8.874	0.174	-0.173
4- 6	29.354	9.752	-0.255	8.874	-1.432	-3.184
4- 7	20.253	5.277	-0.255	8.874	-2.864	-6.205
4- 8	5.298	-2.182	-0.255	8.874	-4.296	-9.227
4- 9	-12.277	-23.606	-0.255	9.684	-5.728	-12.248
4-10	-26.051	-52.270	8.874	9.684	-7.161	-15.270
Right						

---------- Analysis Truck, NRL - Legal Lane ----------

Vehicle	Axle No.	Weight (k/ft)	Length (ft)	Dist. From Previous (ft)
Truck	1	0.231	9.43	
	2	0.229	5.43	18.00
	3	0.198	9.43	17.00
	4	0.172	5.43	17.00

***Distributed loads may have been intensified due to axle overlap between lanes

Live Load Parameters:

Traffic Direction is Parallel to Main Reinforcement
Distribution Width : 13.47 ft
Impact Factor : 1.17
Truck MPF : 1.20 Tandem MPF : 0.00
Lane Load Distribution Width : 15.80 ft
Lane Load: 0.015 k/ft

Truck Positions That Cause Maximum Results:

Maximum +Moment in Top Slab

Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)
Truck	1	0.231	9.43	10.42
	2	0.229	5.43	-7.58
	3	0.198	9.43	-24.58
	4	0.172	5.43	-41.58

Maximum -Moment in Top Slab

Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)
Truck	1	0.231	9.43	9.38
	2	0.229	5.43	-8.63
	3	0.198	9.43	-25.63
	4	0.172	5.43	-42.63

Maximum +Moment : 3.92 k-ft
Corresponding Moment at End : -4.87 k-ft
Coincident Bottom Slab Load : 0.10 k/ft

Maximum -Moment : -4.94 k-ft
Corresponding Moment at Mid : 3.85 k-ft
Coincident Bottom Slab Load : 0.10 k/ft

Maximum +Shear in Top Slab

Truck	1	0.172	5.43	56.72
	2	0.198	9.43	39.72
	3	0.229	5.43	22.72
	4	0.231	9.43	4.72

Maximum +Shear : 1.73 k
Corresponding Shear at Mid : -0.45 k
Coincident Bottom Slab Load : 0.11 k/ft

Maximum -Shear in Top Slab

Truck	1	0.231	9.43	16.12
	2	0.229	5.43	-1.88
	3	0.198	9.43	-18.88
	4	0.172	5.43	-35.88

Maximum -Shear : -1.73 k
Corresponding Shear at Mid : 0.45 k
Coincident Bottom Slab Load : 0.11 k/ft

Unfactored Moments and Shears due to Truck Loads: (k-ft, k)

	Truck				Tandem				Lane			
M-PT	Mll+	Mll-	Vll+	Vll-	Mll+	Mll-	Vll+	Vll-	Mll+	Mll-	Vll+	Vll-
Member 1: (Exterior Wall)												
Bottom												
1- 0	0.00	-4.09	0.19	-0.18	0.00	0.00	0.00	0.00	0.00	-0.48	0.01	-0.01
1- 1	0.00	-4.03	0.19	-0.18	0.00	0.00	0.00	0.00	0.00	-0.48	0.01	-0.01
1- 2	0.00	-3.97	0.19	-0.18	0.00	0.00	0.00	0.00	0.00	-0.48	0.01	-0.01
1- 3	0.00	-3.92	0.19	-0.18	0.00	0.00	0.00	0.00	0.00	-0.48	0.01	-0.01
1- 4	0.00	-4.01	0.19	-0.18	0.00	0.00	0.00	0.00	0.00	-0.48	0.01	-0.01
1- 5	0.00	-4.15	0.19	-0.18	0.00	0.00	0.00	0.00	0.00	-0.48	0.01	-0.01
1- 6	0.00	-4.30	0.19	-0.18	0.00	0.00	0.00	0.00	0.00	-0.48	0.01	-0.01
1- 7	0.00	-4.45	0.19	-0.18	0.00	0.00	0.00	0.00	0.00	-0.48	0.01	-0.01
1- 8	0.00	-4.61	0.19	-0.18	0.00	0.00	0.00	0.00	0.00	-0.48	0.01	-0.01
1- 9	0.00	-4.78	0.19	-0.18	0.00	0.00	0.00	0.00	0.00	-0.48	0.01	-0.01
1-10	0.01	-4.94	0.19	-0.18	0.00	0.00	0.00	0.00	0.00	-0.48	0.01	-0.01
Top												
Member 2: (Top Slab)												
Left												
2- 0	0.01	-4.94	1.73	0.00	0.00	0.00	0.00	0.00	0.00	-0.48	0.16	0.00
2- 1	0.55	-2.65	1.51	-0.02	0.00	0.00	0.00	0.00	0.04	-0.22	0.13	0.00
2- 2	1.70	-0.94	1.27	-0.08	0.00	0.00	0.00	0.00	0.11	-0.06	0.10	-0.01
2- 3	2.89	-0.01	1.03	-0.19	0.00	0.00	0.00	0.00	0.22	0.00	0.08	-0.01
2- 4	3.65	0.00	0.78	-0.34	0.00	0.00	0.00	0.00	0.31	0.00	0.05	-0.02
2- 5	3.92	0.00	0.55	-0.55	0.00	0.00	0.00	0.00	0.35	0.00	0.04	-0.04
2- 6	3.65	0.00	0.34	-0.78	0.00	0.00	0.00	0.00	0.31	0.00	0.02	-0.05
2- 7	2.89	-0.01	0.19	-1.03	0.00	0.00	0.00	0.00	0.22	0.00	0.01	-0.08
2- 8	1.70	-0.94	0.08	-1.27	0.00	0.00	0.00	0.00	0.11	-0.06	0.01	-0.10
2- 9	0.55	-2.65	0.02	-1.51	0.00	0.00	0.00	0.00	0.04	-0.22	0.00	-0.13
2-10	0.01	-4.94	0.00	-1.73	0.00	0.00	0.00	0.00	0.00	-0.48	0.00	-0.16
Right												
Member 4: (Bottom Slab)												
Left												
4- 0	0.00	-4.09	1.23	0.00	0.00	0.00	0.00	0.00	0.00	-0.48	0.16	0.00
4- 1	0.00	-1.79	0.99	0.00	0.00	0.00	0.00	0.00	0.00	-0.18	0.13	0.00
4- 2	0.68	-0.05	0.75	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.09	0.00
4- 3	1.74	0.00	0.52	0.00	0.00	0.00	0.00	0.00	0.21	0.00	0.06	0.00
4- 4	2.37	0.00	0.28	0.00	0.00	0.00	0.00	0.00	0.31	0.00	0.03	0.00
4- 5	2.57	0.00	0.04	-0.04	0.00	0.00	0.00	0.00	0.35	0.00	0.00	0.00
4- 6	2.37	0.00	0.00	-0.28	0.00	0.00	0.00	0.00	0.31	0.00	0.00	-0.03
4- 7	1.74	0.00	0.00	-0.52	0.00	0.00	0.00	0.00	0.21	0.00	0.00	-0.06
4- 8	0.68	-0.05	0.00	-0.75	0.00	0.00	0.00	0.00	0.05	0.00	0.00	-0.09
4- 9	0.00	-1.78	0.00	-0.99	0.00	0.00	0.00	0.00	0.00	-0.18	0.00	-0.13
4-10	0.00	-4.09	0.00	-1.23	0.00	0.00	0.00	0.00	0.00	-0.48	0.00	-0.16
Right												

Note: Unfactored live load results computed at 4.00 ft and 0 ft fill depths, per LRFD 3.6.1.2.6

Serviceability Check: Crack Control

Bar Mark	Location	Moment (k-ft)	Thrust (k)	Fss (ksi)	Spacing (in)	Allow (in)
A1	Top Corner Bar	-25.7	8.62	28.87	5.00	11.73
A2	Bot Corner Bar	-29.1	8.62	33.07	5.00	9.62
A100	Top Slab (int)	19.3	-1.39	24.66	5.00	14.56
A200	Bot Slab (int)	20.1	-0.46	25.38	5.00	14.01
B2	Ext Wall (ext)	-28.6	8.62	32.40	5.00	9.92

Strength Limit State at Critical Sections: Flexure

Member 1: (Exterior Wall), 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
BOT	24.00	-38.48	11.97	48.35	7.56	51.53	1.00	1.44	14.31	2.66	2.66
MID	59.00	0.00	6.05	26.97	7.69	29.02	1.00	0.74	14.31	NC	NC
MID-	59.00	-37.33	11.97	48.35	7.56	51.53	1.00	1.44	14.31	2.86	2.86
TOP	24.00	-34.84	11.97	48.35	7.56	51.53	1.00	1.44	14.31	2.71	2.71

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
LT	24.00	-18.04	5.85	48.35	7.56	49.94	1.00	1.44	14.31	5.80	5.80
MID	125.00	26.41	-1.30	48.35	7.56	47.99	1.00	1.44	14.31	3.54	3.54
MID-	125.00	0.48	5.73	13.89	7.69	16.04	1.00	0.37	14.31	NC	NC
RT	24.00	-18.04	5.85	48.35	7.56	49.94	1.00	1.44	14.31	5.80	5.80

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
LT	24.00	-20.88	9.73	48.35	7.56	50.96	1.00	1.44	14.31	7.24	7.24
MID	125.00	26.80	0.12	48.35	7.56	48.38	1.00	1.44	14.31	4.79	4.79
MID-	125.00	0.76	9.17	13.89	7.69	17.31	1.00	0.37	14.31	NC	NC
RT	24.00	-20.88	9.73	48.35	7.56	50.96	1.00	1.44	14.31	7.25	7.25

Notes: Mu - Resisting moment under pure flexure, Ma - Allowable moment under applied axial load

Strength Limit State at Critical Sections: 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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
BOT	12.20	7.55	39.0	11.97	7.20	11.28	2.053	38.81	12.53 a	0.00	0.00	0.00	4.59	4.59
MID	59.00	1.19	5.1	6.05	7.25	20.03	3.621	31.39	22.26 a	0.00	0.00	0.00	47.76	47.76
MID-	59.00	0.13	36.8	11.97	7.20	12.03	2.190	37.96	13.37 a	0.00	0.00	0.00	29.28	29.28
TOP	12.20	-4.95	34.1	11.97	7.20	12.16	2.213	37.82	13.51 a	0.00	0.00	0.00	8.49	8.49

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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
LT	12.20	10.70	27.6	5.85	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	2.75	2.75
MID	125.00	1.03	26.4	-1.30	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	14.67	14.67
MID-	125.00	1.03	9.2	5.73	7.69	17.60	n/a	n/a	19.56 c	0.00	0.00	0.00	14.92	14.92
RT	12.20	10.70	27.6	5.85	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	2.75	2.75

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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
LT	12.20	11.40	32.1	9.73	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	3.23	3.23
MID	125.00	0.08	26.8	0.12	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	NC	NC
MID-	125.00	0.08	0.0	9.17	7.69	23.39	5.080	27.84	25.99 a	0.00	0.00	0.00	NC	NC
RT	12.20	11.40	32.1	9.73	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	3.23	3.23

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

Load Combination Results at Tenth Points: (k-ft, k)(Fill Depth = 4.00 ft)

M-PT	+Moment	-Moment	+Axial	-Axial	+Shear	-Shear
Member 1: (Exterior Wall)						
Bottom						
1- 0	-26.208	-43.607	6.054	11.968	9.734	0.122
1- 1	-18.236	-38.990	6.054	11.968	7.620	-0.012
1- 2	-12.266	-38.495	6.054	11.968	5.644	0.151
1- 3	-8.180	-37.850	6.054	11.968	3.806	0.292
1- 4	-5.825	-37.331	6.054	11.968	2.108	0.413
1- 5	-5.071	-36.791	6.054	11.968	1.193	-0.134
1- 6	-5.784	-36.181	6.054	11.968	1.271	-1.555
1- 7	-7.825	-35.521	6.054	11.968	1.328	-2.838
1- 8	-11.069	-34.819	6.054	11.968	1.363	-3.982
1- 9	-15.361	-34.094	6.054	11.968	1.378	-4.988
1-10	-20.582	-37.367	6.054	11.968	1.298	-5.854
Top						
Member 2: (Top Slab)						
Left						
2- 0	-20.662	-37.447	5.734	5.854	11.968	6.054
2- 1	-7.117	-17.228	-1.298	5.854	9.374	4.545
2- 2	6.887	-2.098	-1.298	5.854	7.274	3.403
2- 3	17.606	4.521	-1.298	5.734	5.178	2.269
2- 4	24.195	8.066	-1.298	5.734	3.092	0.982
2- 5	26.413	9.248	-1.298	5.734	1.033	-1.032
2- 6	24.196	8.066	-1.298	5.734	-0.982	-3.092
2- 7	17.614	4.521	-1.298	5.734	-2.269	-5.178
2- 8	6.886	-2.099	-1.298	5.854	-3.403	-7.274
2- 9	-7.116	-17.228	-1.298	5.854	-4.545	-9.374
2-10	-20.662	-37.446	5.734	5.854	-6.054	-11.968
Right						
Member 4: (Bottom Slab)						
Left						
4- 0	-26.208	-43.607	9.173	9.734	12.621	7.161
4- 1	-12.277	-19.937	0.122	9.734	10.112	5.728
4- 2	3.871	-2.339	0.122	9.173	7.603	4.296
4- 3	16.634	5.120	0.122	9.173	5.093	2.864
4- 4	24.282	9.595	0.122	9.173	2.584	1.432
4- 5	26.805	11.087	0.122	9.173	0.082	-0.081
4- 6	24.282	9.595	0.122	9.173	-1.432	-2.584
4- 7	16.635	5.120	0.122	9.173	-2.864	-5.093
4- 8	3.872	-2.339	0.122	9.173	-4.296	-7.602
4- 9	-12.277	-19.932	0.122	9.734	-5.728	-10.112
4-10	-26.208	-43.601	9.173	9.734	-7.161	-12.621
Right						

---------- Analysis Truck, WA-105 ----------

Vehicle	Axle No.	Weight (k/ft)	Length (ft)	Dist. From Previous (ft)
Truck	1	0.308	9.43	
	2	0.325	5.43	12.00
	3	0.374	9.43	34.00
	4	0.154	9.43	8.00
	5	0.239	5.43	13.00

***Distributed loads may have been intensified due to axle overlap between lanes

Live Load Parameters:

Traffic Direction is Parallel to Main Reinforcement
Distribution Width : 13.47 ft
Impact Factor : 1.17
Truck MPF : 1.20 Tandem MPF : 0.00
Lane Load Distribution Width : 15.80 ft
Lane Load: 0.000 k/ft

Truck Positions That Cause Maximum Results:

Maximum +Moment in Top Slab

Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)
Truck	1	0.308	9.43	58.01
	2	0.325	5.43	46.01
	3	0.374	9.43	12.01

Maximum -Moment in Top Slab

Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)
Truck	1	0.308	9.43	59.21
	2	0.325	5.43	47.21
	3	0.374	9.43	13.21

	4	0.154	9.43	4.01		4	0.154	9.43	5.21
	5	0.239	5.43	-8.99		5	0.239	5.43	-7.79
Maximum +Moment : 7.23 k-ft					Maximum -Moment : -9.67 k-ft				
Corresponding Moment at End : -9.40 k-ft					Corresponding Moment at Mid : 7.12 k-ft				
Coincident Bottom Slab Load : 0.23 k/ft					Coincident Bottom Slab Load : 0.24 k/ft				
Maximum +Shear in Top Slab					Maximum -Shear in Top Slab				
Truck	1	0.239	5.43	25.72	Truck	1	0.308	9.43	62.12
	2	0.154	9.43	12.72		2	0.325	5.43	50.12
	3	0.374	9.43	4.72		3	0.374	9.43	16.12
	4	0.325	5.43	-29.28		4	0.154	9.43	8.12
	5	0.308	9.43	-41.28		5	0.239	5.43	-4.88
Maximum +Shear : 3.35 k					Maximum -Shear : -3.35 k				
Corresponding Shear at Mid : -0.55 k					Corresponding Shear at Mid : 0.55 k				
Coincident Bottom Slab Load : 0.24 k/ft					Coincident Bottom Slab Load : 0.24 k/ft				

Unfactored Moments and Shears due to Truck Loads: (k-ft, k)

	Truck				Tandem				Lane			
M-PT	Mll+	Mll-	Vll+	Vll-	Mll+	Mll-	Vll+	Vll-	Mll+	Mll-	Vll+	Vll-
Member 1: (Exterior Wall)												
Bottom												
1- 0	0.00	-8.01	0.20	-0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 1	0.00	-8.07	0.20	-0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 2	0.00	-8.14	0.20	-0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 3	0.00	-8.28	0.20	-0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 4	0.00	-8.46	0.20	-0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 5	0.00	-8.65	0.20	-0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 6	0.00	-8.84	0.20	-0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 7	0.00	-9.05	0.20	-0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 8	0.00	-9.25	0.20	-0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 9	0.00	-9.46	0.20	-0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-10	0.01	-9.67	0.20	-0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Top												
Member 2: (Top Slab)												
Left												
2- 0	0.01	-9.67	3.35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 1	0.89	-4.86	2.83	-0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 2	2.78	-1.57	2.31	-0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 3	5.04	-0.02	1.80	-0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 4	6.71	0.00	1.33	-0.56	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 5	7.23	0.00	0.91	-0.91	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 6	6.71	0.00	0.56	-1.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 7	5.04	-0.02	0.30	-1.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 8	2.79	-1.57	0.13	-2.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 9	0.89	-4.86	0.03	-2.83	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-10	0.01	-9.67	0.00	-3.35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Right												
Member 4: (Bottom Slab)												
Left												
4- 0	0.00	-8.01	2.54	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 1	0.00	-3.23	2.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 2	1.21	-0.09	1.55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 3	3.71	0.00	1.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 4	5.20	0.00	0.55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 5	5.67	0.00	0.07	-0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 6	5.20	0.00	0.00	-0.55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 7	3.71	0.00	0.00	-1.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 8	1.21	-0.09	0.00	-1.55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 9	0.00	-3.23	0.00	-2.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4-10	0.00	-8.01	0.00	-2.54	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Right												

Note: Unfactored live load results computed at 4.00 ft and 0 ft fill depths, per LRFD 3.6.1.2.6

Serviceability Check: Crack Control

Bar Mark	Location	Moment (k-ft)	Thrust (k)	Fss (ksi)	Spacing (in)	Allow (in)
A1	Top Corner Bar	-29.9	10.08	33.51	5.00	9.43
A2	Bot Corner Bar	-32.8	10.08	37.13*	5.00	8.03
A100	Top Slab (int)	22.2	-1.39	28.37	5.00	12.02
A200	Bot Slab (int)	22.9	-0.51	28.85	5.00	11.74
B2	Ext Wall (ext)	-32.5	10.08	36.80	5.00	8.15

Strength Limit State at Critical Sections: Flexure

Member 1: (Exterior Wall), 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
BOT	24.00	-44.94	14.52	48.35	7.56	52.18	1.00	1.44	14.31	1.50	1.50
MID	59.00	0.00	6.05	26.97	7.69	29.02	1.00	0.74	14.31	NC	NC
MID-	59.00	-44.28	14.52	48.35	7.56	52.18	1.00	1.44	14.31	1.57	1.57
TOP	24.00	-42.12	14.52	48.35	7.56	52.18	1.00	1.44	14.31	1.53	1.53

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
LT	24.00	-21.68	5.95	48.35	7.56	49.96	1.00	1.44	14.31	3.58	3.58
MID	125.00	31.60	-1.30	48.35	7.56	47.99	1.00	1.44	14.31	2.09	2.09
MID-	125.00	0.48	5.73	13.89	7.69	16.04	1.00	0.37	14.31	NC	NC
RT	24.00	-21.68	5.95	48.35	7.56	49.96	1.00	1.44	14.31	3.58	3.58

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
LT	24.00	-23.24	9.73	48.35	7.56	50.96	1.00	1.44	14.31	4.68	4.68
MID	125.00	31.63	0.03	48.35	7.56	48.36	1.00	1.44	14.31	2.46	2.46
MID-	125.00	0.76	9.17	13.89	7.69	17.31	1.00	0.37	14.31	NC	NC
RT	24.00	-23.24	9.73	48.35	7.56	50.96	1.00	1.44	14.31	4.68	4.68

Notes: Mu - Resisting moment under pure flexure, Ma - Allowable moment under applied axial load

Strength Limit State at Critical Sections: 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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
BOT	12.20	7.55	45.2	14.52	7.20	10.99	2.000	45.00	12.21 b	0.00	0.00	0.00	4.41	4.41
MID	59.00	1.19	5.1	6.05	7.25	20.03	3.621	31.39	22.26 a	0.00	0.00	0.00	47.93	47.93
MID-	59.00	0.23	43.8	14.52	7.20	11.14	2.027	39.00	12.37 a	0.00	0.00	0.00	20.96	20.96
TOP	12.20	-5.05	41.5	14.52	7.20	11.20	2.038	38.92	12.44 a	0.00	0.00	0.00	4.64	4.64

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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
LT	12.20	13.03	33.1	5.95	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.57	1.57
MID	125.00	1.60	31.6	-1.30	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	9.47	9.47
MID-	125.00	1.60	9.2	5.73	7.69	17.60	n/a	n/a	19.56 c	0.00	0.00	0.00	9.64	9.64
RT	12.20	13.03	33.1	5.95	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.57	1.57

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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
LT	12.20	13.22	36.2	9.73	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.76	1.76
MID	125.00	0.13	31.6	0.03	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	NC	NC
MID-	125.00	0.13	0.0	9.17	7.69	23.39	5.079	27.84	25.99 a	0.00	0.00	0.00	NC	NC
RT	12.20	13.22	36.2	9.73	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.76	1.76

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

Load Combination Results at Tenth Points: (k-ft, k)(Fill Depth = 4.00 ft)

M-PT	+Moment	-Moment	+Axial	-Axial	+Shear	-Shear
Member 1: (Exterior Wall)						
Bottom						
1- 0	-26.208	-49.620	6.054	14.518	9.733	0.027
1- 1	-18.236	-45.213	6.054	14.518	7.619	-0.107
1- 2	-12.266	-44.951	6.054	14.518	5.643	0.056
1- 3	-8.180	-44.651	6.054	14.518	3.805	0.197
1- 4	-5.825	-44.280	6.054	14.518	2.106	0.317
1- 5	-5.071	-43.826	6.054	14.518	1.192	-0.229
1- 6	-5.784	-43.303	6.054	14.518	1.270	-1.651
1- 7	-7.825	-42.723	6.054	14.518	1.327	-2.933
1- 8	-11.069	-42.100	6.054	14.518	1.362	-4.077
1- 9	-15.361	-41.457	6.054	14.518	1.377	-5.083
1-10	-20.582	-44.804	6.054	14.518	1.297	-5.950
Top						
Member 2: (Top Slab)						
Left						
2- 0	-20.662	-44.884	5.734	5.950	14.518	6.054
2- 1	-6.588	-20.718	-1.297	5.950	11.470	4.545
2- 2	8.583	-3.097	-1.297	5.950	8.912	3.403
2- 3	21.000	4.521	-1.297	5.734	6.400	2.269
2- 4	28.996	8.066	-1.297	5.734	3.955	0.647
2- 5	31.599	9.248	-1.297	5.734	1.599	-1.598
2- 6	28.993	8.066	-1.297	5.734	-0.647	-3.955
2- 7	21.000	4.521	-1.297	5.734	-2.269	-6.400
2- 8	8.589	-3.097	-1.297	5.950	-3.403	-8.912
2- 9	-6.588	-20.718	-1.297	5.950	-4.545	-11.469
2-10	-20.662	-44.884	5.734	5.950	-6.054	-14.518
Right						
Member 4: (Bottom Slab)						
Left						
4- 0	-26.208	-49.620	9.173	9.733	14.645	7.161
4- 1	-12.277	-22.141	0.027	9.733	11.734	5.728
4- 2	4.703	-2.339	0.027	9.173	8.823	4.296
4- 3	19.708	5.120	0.027	9.173	5.912	2.864
4- 4	28.683	9.595	0.027	9.173	3.001	1.432
4- 5	31.632	11.087	0.027	9.173	0.130	-0.129
4- 6	28.684	9.595	0.027	9.173	-1.432	-3.001
4- 7	19.712	5.120	0.027	9.173	-2.864	-5.912
4- 8	4.703	-2.339	0.027	9.173	-4.296	-8.823
4- 9	-12.277	-22.141	0.027	9.733	-5.728	-11.734
4-10	-26.208	-49.620	9.173	9.733	-7.161	-14.645
Right						

Analysis Results: Fill Depth = 4.50 ft

Load Parameters:

Fe = 1.00 Surcharge Depth : 2.48 ft

Applied Horizontal Loads: (k/ft)

Load Description	Bottom of Wall	Top of Wall
Live Load Surcharge	0.149	0.149
Internal Water Pressure	-0.749(5.0in)	-0.187(-5.0in)
External Water Pressure	0.801(0.0in)	0.187(0.0in)
Horizontal Earth Load	0.885	0.295

Applied Uniform Bottom Slab Loads: (k/ft)

Load Description	
Dead Load	0.284
Vertical Earth	0.540
Wearing Surface	0.000

Unfactored Moments due to All Loads: (k-ft) / Unfactored Shears due to All Loads: (k)

M-PT	Mdc	Mev	Mdw	Meh	Mls	Mwa	Mgw	Vdc	Vev	Vdw	Veh	Vls	Vwa	Vgw
Member 1: (Exterior Wall)														
Bottom														
1- 0	-9.58	-17.01	0.00	-1.55	-0.38	1.23	-1.30	0.61	0.00	0.00	3.39	0.73	-2.50	2.94
1- 1	-8.97	-17.01	0.00	1.36	0.26	-1.11	1.21	0.61	0.00	0.00	2.55	0.59	-2.08	2.18
1- 2	-8.37	-17.01	0.00	3.49	0.77	-2.83	3.01	0.61	0.00	0.00	1.77	0.44	-1.41	1.48
1- 3	-7.77	-17.01	0.00	4.86	1.13	-3.91	4.15	0.61	0.00	0.00	1.04	0.29	-0.80	0.85
1- 4	-7.17	-17.01	0.00	5.56	1.34	-4.43	4.70	0.61	0.00	0.00	0.37	0.15	-0.25	0.27
1- 5	-6.57	-17.01	0.00	5.62	1.42	-4.43	4.71	0.61	0.00	0.00	-0.24	0.00	0.24	-0.25
1- 6	-5.97	-17.01	0.00	5.12	1.34	-3.99	4.25	0.61	0.00	0.00	-0.79	-0.15	0.67	-0.70
1- 7	-5.36	-17.01	0.00	4.10	1.13	-3.15	3.36	0.61	0.00	0.00	-1.28	-0.29	1.04	-1.10
1- 8	-4.76	-17.01	0.00	2.63	0.77	-1.97	2.12	0.61	0.00	0.00	-1.72	-0.44	1.35	-1.43
1- 9	-4.16	-17.01	0.00	0.75	0.26	-0.52	0.57	0.61	0.00	0.00	-2.09	-0.59	1.60	-1.71
1-10	-3.56	-17.01	0.00	-1.46	-0.38	1.14	-1.21	0.61	0.00	0.00	-2.41	-0.73	1.71	-1.92
Top														
Member 2: (Top Slab)														
Left														
2- 0	-3.56	-17.01	0.00	-1.50	-0.38	1.17	-1.25	1.73	5.63	0.00	0.00	0.00	0.00	0.00
2- 1	-0.71	-6.46	0.00	-1.50	-0.38	1.17	-1.25	1.05	4.50	0.00	0.00	0.00	0.00	0.00
2- 2	1.19	1.74	0.00	-1.50	-0.38	1.17	-1.25	0.78	3.38	0.00	0.00	0.00	0.00	0.00
2- 3	2.55	7.60	0.00	-1.50	-0.38	1.17	-1.25	0.52	2.25	0.00	0.00	0.00	0.00	0.00
2- 4	3.36	11.12	0.00	-1.50	-0.38	1.17	-1.25	0.26	1.13	0.00	0.00	0.00	0.00	0.00
2- 5	3.63	12.29	0.00	-1.50	-0.38	1.17	-1.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 6	3.36	11.12	0.00	-1.50	-0.38	1.17	-1.25	-0.26	-1.13	0.00	0.00	0.00	0.00	0.00
2- 7	2.55	7.60	0.00	-1.50	-0.38	1.17	-1.25	-0.52	-2.25	0.00	0.00	0.00	0.00	0.00
2- 8	1.19	1.74	0.00	-1.50	-0.38	1.17	-1.25	-0.78	-3.38	0.00	0.00	0.00	0.00	0.00
2- 9	-0.71	-6.46	0.00	-1.50	-0.38	1.17	-1.25	-1.05	-4.50	0.00	0.00	0.00	0.00	0.00
2-10	-3.56	-17.01	0.00	-1.50	-0.38	1.17	-1.25	-1.73	-5.63	0.00	0.00	0.00	0.00	0.00
Right														
Member 4: (Bottom Slab)														
Left														
4- 0	-9.58	-17.01	0.00	-1.55	-0.38	1.23	-1.30	2.96	5.63	0.00	0.00	0.00	0.00	0.00
4- 1	-4.03	-6.46	0.00	-1.55	-0.38	1.23	-1.30	2.37	4.50	0.00	0.00	0.00	0.00	0.00
4- 2	0.28	1.74	0.00	-1.55	-0.38	1.23	-1.30	1.77	3.38	0.00	0.00	0.00	0.00	0.00
4- 3	3.36	7.60	0.00	-1.55	-0.38	1.23	-1.30	1.18	2.25	0.00	0.00	0.00	0.00	0.00
4- 4	5.20	11.12	0.00	-1.55	-0.38	1.23	-1.30	0.59	1.13	0.00	0.00	0.00	0.00	0.00
4- 5	5.82	12.29	0.00	-1.55	-0.38	1.23	-1.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 6	5.20	11.12	0.00	-1.55	-0.38	1.23	-1.30	-0.59	-1.13	0.00	0.00	0.00	0.00	0.00
4- 7	3.36	7.60	0.00	-1.55	-0.38	1.23	-1.30	-1.18	-2.25	0.00	0.00	0.00	0.00	0.00
4- 8	0.28	1.74	0.00	-1.55	-0.38	1.23	-1.30	-1.77	-3.38	0.00	0.00	0.00	0.00	0.00
4- 9	-4.03	-6.46	0.00	-1.55	-0.38	1.23	-1.30	-2.37	-4.50	0.00	0.00	0.00	0.00	0.00
4-10	-9.58	-17.01	0.00	-1.55	-0.38	1.23	-1.30	-2.96	-5.63	0.00	0.00	0.00	0.00	0.00
Right														

Unfactored Thrusts due to All Loads: (k) (Fill Depth = 4.50 ft)

Member	Pdc	Pev	Pdw	Peh	Pls	Pwa
1	1.73	5.63	0.00	0.00	0.00	0.00
2	-0.61	0.00	0.00	2.41	0.73	-1.71
4	0.61	0.00	0.00	3.39	0.73	-2.50

Analysis Truck, HL-93

Vehicle	Axle No.	Weight (k/ft)	Length (ft)	Dist. From Previous (ft)
Truck	1	0.130	6.01	
	2	0.521	6.01	14.00
	3	0.521	6.01	14.00

Tandem 1 0.489 10.01

***Distributed loads may have been intensified due to axle overlap between lanes

Live Load Parameters:

Traffic Direction is Parallel to Main Reinforcement
Distribution Width : 14.04 ft
Impact Factor : 1.14
Truck MPF : 1.20 Tandem MPF : 1.20
Lane Load Distribution Width : 16.38 ft
Lane Load: 0.000 k/ft

Truck Positions That Cause Maximum Results:

Maximum +Moment in Top Slab

Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)
Truck	1	0.130	6.01	24.42
	2	0.521	6.01	10.42
	3	0.521	6.01	-3.58

Maximum +Moment : 6.61 k-ft
Corresponding Moment at End : -7.34 k-ft
Coincident Bottom Slab Load : 0.15 k/ft

Maximum -Moment in Top Slab

Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)
Truck	1	0.130	6.01	39.58
	2	0.521	6.01	25.58
	3	0.521	6.01	11.58

Maximum -Moment : -7.49 k-ft
Corresponding Moment at Mid : 6.37 k-ft
Coincident Bottom Slab Load : 0.15 k/ft

Maximum +Shear in Top Slab

Truck	1	0.130	6.01	31.00
	2	0.521	6.01	17.00
	3	0.521	6.01	3.00

Maximum +Shear : 3.24 k
Corresponding Shear at Mid : 0.11 k
Coincident Bottom Slab Load : 0.30 k/ft

Maximum -Shear in Top Slab

Truck	1	0.130	6.01	31.83
	2	0.521	6.01	17.83
	3	0.521	6.01	3.83

Maximum -Shear : -3.24 k
Corresponding Shear at Mid : -0.11 k
Coincident Bottom Slab Load : 0.30 k/ft

Maximum +Moment in Top Slab

Tandem	1	0.489	10.01	10.42

Maximum +Moment : 8.55 k-ft
Corresponding Moment at End : -10.80 k-ft
Coincident Bottom Slab Load : 0.23 k/ft

Maximum -Moment in Top Slab

Tandem	1	0.489	10.01	9.38

Maximum -Moment : -10.96 k-ft
Corresponding Moment at Mid : 8.42 k-ft
Coincident Bottom Slab Load : 0.23 k/ft

Maximum +Shear in Top Slab

Tandem	1	0.489	10.01	5.00

Maximum +Shear : 3.81 k
Corresponding Shear at Mid : -1.08 k
Coincident Bottom Slab Load : 0.23 k/ft

Maximum -Shear in Top Slab

Tandem	1	0.489	10.01	15.83

Maximum -Shear : -3.81 k
Corresponding Shear at Mid : 1.08 k
Coincident Bottom Slab Load : 0.23 k/ft

Unfactored Moments and Shears due to Truck Loads: (k-ft, k)

	Truck				Tandem				Lane			
M-PT	Mll+	Mll-	Vll+	Vll-	Mll+	Mll-	Vll+	Vll-	Mll+	Mll-	Vll+	Vll-
Member 1: (Exterior Wall)												
Bottom												
1- 0	0.00	-9.87	0.29	-0.30	0.00	-8.38	0.20	-0.39	0.00	0.00	0.00	0.00
1- 1	0.00	-9.59	0.29	-0.30	0.00	-8.36	0.20	-0.39	0.00	0.00	0.00	0.00
1- 2	0.00	-9.30	0.29	-0.30	0.00	-8.45	0.20	-0.39	0.00	0.00	0.00	0.00
1- 3	0.00	-9.02	0.29	-0.30	0.00	-8.65	0.20	-0.39	0.00	0.00	0.00	0.00
1- 4	0.00	-8.74	0.29	-0.30	0.00	-8.92	0.20	-0.39	0.00	0.00	0.00	0.00
1- 5	0.00	-8.46	0.29	-0.30	0.00	-9.23	0.20	-0.39	0.00	0.00	0.00	0.00
1- 6	0.00	-8.17	0.29	-0.30	0.00	-9.55	0.20	-0.39	0.00	0.00	0.00	0.00
1- 7	0.00	-7.89	0.29	-0.30	0.00	-9.89	0.20	-0.39	0.00	0.00	0.00	0.00
1- 8	0.00	-7.64	0.29	-0.30	0.00	-10.24	0.20	-0.39	0.00	0.00	0.00	0.00
1- 9	0.00	-7.50	0.29	-0.30	0.00	-10.60	0.20	-0.39	0.00	0.00	0.00	0.00
1-10	0.02	-7.49	0.29	-0.30	0.02	-10.96	0.20	-0.39	0.00	0.00	0.00	0.00
Top												
Member 2: (Top Slab)												
Left												
2- 0	0.02	-7.49	3.24	0.00	0.02	-10.96	3.81	0.00	0.00	0.00	0.00	0.00
2- 1	1.24	-4.13	2.68	-0.04	1.16	-5.84	3.31	-0.04	0.00	0.00	0.00	0.00
2- 2	3.36	-1.62	2.19	-0.18	3.53	-2.00	2.77	-0.17	0.00	0.00	0.00	0.00
2- 3	5.20	-0.01	1.77	-0.42	6.25	0.00	2.23	-0.40	0.00	0.00	0.00	0.00
2- 4	6.39	0.00	1.41	-0.72	7.96	0.00	1.69	-0.73	0.00	0.00	0.00	0.00
2- 5	6.61	0.00	1.05	-1.05	8.55	0.00	1.18	-1.18	0.00	0.00	0.00	0.00
2- 6	6.38	0.00	0.72	-1.41	7.96	0.00	0.73	-1.69	0.00	0.00	0.00	0.00
2- 7	5.20	-0.01	0.42	-1.77	6.26	0.00	0.40	-2.23	0.00	0.00	0.00	0.00
2- 8	3.38	-1.62	0.18	-2.19	3.53	-2.00	0.17	-2.77	0.00	0.00	0.00	0.00
2- 9	1.24	-4.13	0.05	-2.68	1.16	-5.84	0.04	-3.30	0.00	0.00	0.00	0.00

2-10	0.02	-7.49	0.00	-3.24	0.02	-10.96	0.00	-3.81	0.00	0.00	0.00	0.00
Right												

Member 4: (Bottom Slab)

Left												
4- 0	0.00	-9.87	3.14	0.00	0.00	-8.38	2.54	0.00	0.00	0.00	0.00	0.00
4- 1	0.00	-3.98	2.51	0.00	0.00	-3.60	2.05	0.00	0.00	0.00	0.00	0.00
4- 2	1.09	-0.12	1.89	0.00	1.49	-0.12	1.56	0.00	0.00	0.00	0.00	0.00
4- 3	3.97	0.00	1.26	0.00	3.88	0.00	1.07	0.00	0.00	0.00	0.00	0.00
4- 4	5.90	0.00	0.64	0.00	5.29	0.00	0.58	0.00	0.00	0.00	0.00	0.00
4- 5	6.54	0.00	0.08	-0.08	5.74	0.00	0.09	-0.09	0.00	0.00	0.00	0.00
4- 6	5.91	0.00	0.00	-0.64	5.29	0.00	0.00	-0.58	0.00	0.00	0.00	0.00
4- 7	3.97	0.00	0.00	-1.26	3.88	0.00	0.00	-1.07	0.00	0.00	0.00	0.00
4- 8	1.09	-0.12	0.00	-1.89	1.49	-0.12	0.00	-1.56	0.00	0.00	0.00	0.00
4- 9	0.00	-3.98	0.00	-2.51	0.00	-3.60	0.00	-2.05	0.00	0.00	0.00	0.00
4-10	0.00	-9.86	0.00	-3.14	0.00	-8.38	0.00	-2.54	0.00	0.00	0.00	0.00
Right												

Note: Unfactored live load results computed at 4.50 ft and 0 ft fill depths, per LRFD 3.6.1.2.6

Serviceability Check: Crack Control

Bar Mark	Location	Moment (k-ft)	Thrust (k)	Fss (ksi)	Spacing (in)	Allow (in)
A1	Top Corner Bar	-32.7	11.16	36.59*	5.00	8.23
A2	Bot Corner Bar	-35.8	11.16	40.42*	5.00	6.98
A100	Top Slab (int)	24.9	-1.41	31.69	5.00	10.25
A200	Bot Slab (int)	25.1	-0.58	31.62	5.00	10.28
B2	Ext Wall (ext)	-34.7	11.16	39.16	5.00	7.37

Strength Limit State at Critical Sections: Flexure

Member 1: (Exterior Wall), 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
BOT	24.00	-49.30	16.14	48.35	7.56	52.58	1.00	1.44	14.31	1.38	1.79
MID	59.00	0.00	6.62	26.97	7.69	29.21	1.00	0.74	14.31	NC	NC
MID-	59.00	-47.36	16.14	48.35	7.56	52.58	1.00	1.44	14.31	1.56	2.03
TOP	24.00	-46.20	16.14	48.35	7.56	52.58	1.00	1.44	14.31	1.47	1.90

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
LT	24.00	-24.50	6.37	48.35	7.56	50.07	1.00	1.44	14.31	3.38	4.39
MID	125.00	35.64	-1.36	48.35	7.56	47.98	1.00	1.44	14.31	1.90	2.47
MID-	125.00	0.49	5.91	13.89	7.69	16.11	1.00	0.37	14.31	NC	NC
RT	24.00	-24.50	6.37	48.35	7.56	50.07	1.00	1.44	14.31	3.38	4.39

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
LT	24.00	-25.72	10.07	48.35	7.56	51.04	1.00	1.44	14.31	4.31	5.58
MID	125.00	34.87	-0.12	48.35	7.56	48.32	1.00	1.44	14.31	2.28	2.96
MID-	125.00	0.78	9.35	13.89	7.69	17.37	1.00	0.37	14.31	NC	NC
RT	24.00	-25.71	10.07	48.35	7.56	51.04	1.00	1.44	14.31	4.31	5.59

Notes: Mu - Resisting moment under pure flexure, Ma - Allowable moment under applied axial load

Strength Limit State at Critical Sections: 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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
BOT	12.20	7.85	50.3	16.14	7.20	10.99	2.000	45.00	12.21 b	0.00	0.00	0.00	4.48	5.81
MID	59.00	1.35	6.4	6.62	7.25	18.66	3.373	32.29	20.73 a	0.00	0.00	0.00	34.78	45.08
MID-	59.00	0.48	47.1	16.14	7.20	10.99	2.000	45.00	12.21 b	0.00	0.00	0.00	14.96	19.40
TOP	12.20	-5.43	45.9	16.14	7.20	10.99	2.000	45.00	12.21 b	0.00	0.00	0.00	4.38	5.67

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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
LT	12.20	14.58	36.9	6.37	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.44	1.87
MID	125.00	2.06	35.6	-1.36	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	8.40	10.89
MID-	125.00	2.06	10.4	5.91	7.69	17.60	n/a	n/a	19.56 c	0.00	0.00	0.00	8.54	11.07
RT	12.20	14.58	36.9	6.37	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.44	1.87

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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
LT	12.20	14.89	40.3	10.07	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.49	1.93
MID	125.00	0.16	34.9	-0.12	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	NC	NC
MID-	125.00	0.16	0.0	9.35	7.69	23.39	5.079	27.84	25.99 a	0.00	0.00	0.00	NC	NC
RT	12.20	14.89	40.3	10.07	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.49	1.93

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

Filename: Bothell Culvert Analysis 043025.etcx

Load Combination Results at Tenth Points: (k-ft, k)(Fill Depth = 4.50 ft)

M-PT	+Moment	-Moment	+Axial	-Axial	+Shear	-Shear
Member 1: (Exterior Wall)						
Bottom						
1- 0	-28.000	-55.428	6.617	16.135	10.066	-0.122
1- 1	-19.874	-50.297	6.617	16.135	7.917	-0.276
1- 2	-13.786	-49.336	6.617	16.135	5.906	-0.133
1- 3	-9.615	-48.244	6.617	16.135	4.034	-0.011
1- 4	-7.208	-47.358	6.617	16.135	2.301	0.089
1- 5	-6.437	-47.107	6.617	16.135	1.352	-0.477
1- 6	-7.167	-46.818	6.617	16.135	1.410	-1.933
1- 7	-9.260	-46.491	6.617	16.135	1.446	-3.251
1- 8	-12.588	-46.182	6.617	16.135	1.462	-4.430
1- 9	-17.000	-45.873	6.617	16.135	1.456	-5.470
1-10	-22.374	-49.608	6.617	16.135	1.357	-6.371
Top						
Member 2: (Top Slab)						
Left						
2- 0	-22.454	-49.688	5.907	6.371	16.135	6.617
2- 1	-6.964	-23.450	-1.357	6.371	12.946	4.995
2- 2	10.092	-3.689	-1.357	6.371	10.214	3.741
2- 3	24.162	5.190	-1.357	5.907	7.470	2.494
2- 4	32.740	9.087	-1.357	5.907	4.741	0.512
2- 5	35.641	10.385	-1.357	5.907	2.061	-2.061
2- 6	32.740	9.087	-1.357	5.907	-0.512	-4.741
2- 7	24.182	5.190	-1.357	5.907	-2.494	-7.470
2- 8	10.092	-3.693	-1.357	6.371	-3.741	-10.214
2- 9	-6.964	-23.450	-1.357	6.371	-4.995	-12.946
2-10	-22.454	-49.688	5.907	6.371	-6.617	-16.135
Right						
Member 4: (Bottom Slab)						
Left						
4- 0	-28.000	-55.428	9.346	10.066	16.503	7.723
4- 1	-13.263	-24.482	-0.122	10.066	13.206	6.178
4- 2	5.394	-2.256	-0.122	9.346	9.909	4.634
4- 3	21.200	5.789	-0.122	9.346	6.612	3.089
4- 4	31.468	10.616	-0.122	9.346	3.315	1.545
4- 5	34.872	12.225	-0.122	9.346	0.162	-0.162
4- 6	31.473	10.616	-0.122	9.346	-1.545	-3.313
4- 7	21.207	5.789	-0.122	9.346	-3.089	-6.610
4- 8	5.397	-2.256	-0.122	9.346	-4.634	-9.907
4- 9	-13.263	-24.472	-0.122	10.066	-6.178	-13.204
4-10	-28.000	-55.415	9.346	10.066	-7.723	-16.501
Right						

---------- Analysis Truck, NRL ----------

Vehicle	Axle No.	Weight (k/ft)	Length (ft)	Dist. From Previous (ft)
Truck	1	0.130	6.01	
	2	0.156	10.01	6.00
	3	0.332	10.01	8.00
	4	0.156	10.01	8.00
	5	0.098	6.01	8.00

***Distributed loads may have been intensified due to axle overlap between lanes

Live Load Parameters:

Traffic Direction is Parallel to Main Reinforcement
Distribution Width : 14.04 ft
Impact Factor : 1.14
Truck MPF : 1.20 Tandem MPF : 0.00
Lane Load Distribution Width : 16.38 ft
Lane Load: 0.000 k/ft

Truck Positions That Cause Maximum Results:

Maximum +Moment in Top Slab

Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)
Truck	1	0.130	6.01	24.42
	2	0.156	10.01	18.42
	3	0.332	10.01	10.42

Maximum -Moment in Top Slab

Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)
Truck	1	0.130	6.01	25.46
	2	0.156	10.01	19.46
	3	0.332	10.01	11.46

	4	0.156	10.01	2.42		4	0.156	10.01	3.46
	5	0.098	6.01	-5.58		5	0.098	6.01	-4.54

Maximum +Moment : 7.39 k-ft
Corresponding Moment at End : -10.07 k-ft
Coincident Bottom Slab Load : 0.27 k/ft

Maximum -Moment : -10.14 k-ft
Corresponding Moment at Mid : 7.36 k-ft
Coincident Bottom Slab Load : 0.27 k/ft

Maximum +Shear in Top Slab

Truck	1	0.130	6.01	19.00
	2	0.156	10.01	13.00
	3	0.332	10.01	5.00
	4	0.156	10.01	-3.00
	5	0.098	6.01	-11.00

Maximum +Shear : 3.52 k
Corresponding Shear at Mid : -0.50 k
Coincident Bottom Slab Load : 0.28 k/ft

Maximum -Shear in Top Slab

Truck	1	0.130	6.01	29.83
	2	0.156	10.01	23.83
	3	0.332	10.01	15.83
	4	0.156	10.01	7.83
	5	0.098	6.01	-0.17

Maximum -Shear : -3.47 k
Corresponding Shear at Mid : 0.54 k
Coincident Bottom Slab Load : 0.26 k/ft

Unfactored Moments and Shears due to Truck Loads: (k-ft, k)

	Truck				Tandem				Lane			
M-PT	Mll+	Mll-	Vll+	Vll-	Mll+	Mll-	Vll+	Vll-	Mll+	Mll-	Vll+	Vll-
Member 1: (Exterior Wall)												
Bottom												
1- 0	0.00	-9.19	0.09	-0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 1	0.00	-9.22	0.09	-0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 2	0.00	-9.29	0.09	-0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 3	0.00	-9.38	0.09	-0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 4	0.00	-9.47	0.09	-0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 5	0.00	-9.56	0.09	-0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 6	0.00	-9.65	0.09	-0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 7	0.00	-9.74	0.09	-0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 8	0.00	-9.85	0.09	-0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 9	0.00	-9.98	0.09	-0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-10	0.01	-10.13	0.09	-0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Top												
Member 2: (Top Slab)												
Left												
2- 0	0.01	-10.13	3.52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 1	0.42	-4.61	2.93	-0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 2	1.91	-0.83	2.33	-0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 3	4.93	0.00	1.74	-0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 4	6.81	0.00	1.15	-0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 5	7.39	0.00	0.59	-0.55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 6	6.77	0.00	0.23	-1.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 7	4.92	0.00	0.13	-1.74	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 8	2.10	-0.74	0.05	-2.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 9	0.37	-4.59	0.01	-2.91	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-10	0.00	-10.14	0.00	-3.47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Right												
Member 4: (Bottom Slab)												
Left												
4- 0	0.00	-9.19	2.98	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 1	0.00	-3.65	2.39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 2	1.19	-0.05	1.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 3	4.07	0.00	1.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 4	5.87	0.00	0.62	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 5	6.55	0.00	0.04	-0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 6	5.99	0.00	0.00	-0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 7	4.20	0.00	0.00	-1.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 8	1.18	-0.04	0.00	-1.76	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 9	0.00	-3.49	0.00	-2.35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4-10	0.00	-8.86	0.00	-2.94	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Right												

Note: Unfactored live load results computed at 4.50 ft and 0 ft fill depths, per LRFD 3.6.1.2.6

Serviceability Check: Crack Control

Bar Mark	Location	Moment (k-ft)	Thrust (k)	Fss (ksi)	Spacing (in)	Allow (in)
A1	Top Corner Bar	-32.3	10.87	36.21*	5.00	8.36
A2	Bot Corner Bar	-35.8	10.87	40.53*	5.00	6.95
A100	Top Slab (int)	23.7	-1.22	30.16	5.00	11.02
A200	Bot Slab (int)	25.1	-0.37	31.55	5.00	10.32
B2	Ext Wall (ext)	-35.3	10.87	39.96	5.00	7.12

Strength Limit State at Critical Sections: Flexure

Member 1: (Exterior Wall), 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
BOT	24.00	-49.31	15.63	48.35	7.56	52.46	1.00	1.44	14.31	1.20	1.20
MID	59.00	0.00	6.62	26.97	7.69	29.21	1.00	0.74	14.31	NC	NC
MID-	59.00	-48.33	15.63	48.35	7.56	52.46	1.00	1.44	14.31	1.32	1.32
TOP	24.00	-45.52	15.63	48.35	7.56	52.46	1.00	1.44	14.31	1.33	1.33

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
LT	24.00	-22.37	6.00	48.35	7.56	49.97	1.00	1.44	14.31	3.64	3.64
MID	125.00	33.61	-1.02	48.35	7.56	48.07	1.00	1.44	14.31	1.93	1.93
MID-	125.00	0.49	5.91	13.89	7.69	16.11	1.00	0.37	14.31	NC	NC
RT	24.00	-22.35	6.00	48.35	7.56	49.97	1.00	1.44	14.31	3.65	3.65

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
LT	24.00	-25.11	9.73	48.35	7.56	50.95	1.00	1.44	14.31	4.06	4.06
MID	125.00	34.88	0.25	48.35	7.56	48.42	1.00	1.44	14.31	2.00	2.00
MID-	125.00	0.78	9.35	13.89	7.69	17.37	1.00	0.37	14.31	NC	NC
RT	24.00	-24.83	9.73	48.35	7.56	50.95	1.00	1.44	14.31	4.23	4.23

Notes: Mu - Resisting moment under pure flexure, Ma - Allowable moment under applied axial load

Strength Limit State at Critical Sections: 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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
BOT	12.20	7.51	49.6	15.63	7.20	10.99	2.000	45.00	12.21 b	0.00	0.00	0.00	5.05	5.05
MID	59.00	1.01	6.4	6.62	7.25	18.84	3.405	32.18	20.93 a	0.00	0.00	0.00	93.70	93.70
MID-	59.00	0.11	47.7	15.63	7.20	10.99	2.000	45.00	12.21 b	0.00	0.00	0.00	29.03	29.03
TOP	12.20	-5.06	44.8	15.63	7.20	10.99	2.000	45.00	12.21 b	0.00	0.00	0.00	4.91	4.91

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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
LT	12.20	14.00	35.1	6.00	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.39	1.39
MID	125.00	1.03	33.6	-1.02	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	14.73	14.73
MID-	125.00	0.96	10.4	5.91	7.69	17.60	n/a	n/a	19.56 c	0.00	0.00	0.00	16.07	16.07
RT	12.20	13.94	35.1	6.00	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.40	1.40

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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
LT	12.20	14.64	39.4	9.73	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.37	1.37
MID	125.00	0.06	34.9	0.25	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	NC	NC
MID-	125.00	0.07	0.0	9.35	7.69	23.39	5.082	27.84	25.99 a	0.00	0.00	0.00	NC	NC
RT	12.20	14.57	39.0	9.73	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.39	1.39

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

Load Combination Results at Tenth Points: (k-ft, k)(Fill Depth = 4.50 ft)

M-PT	+Moment	-Moment	+Axial	-Axial	+Shear	-Shear
Member 1: (Exterior Wall)						
Bottom						
1- 0	-28.000	-54.233	6.617	15.631	9.726	0.250
1- 1	-19.874	-49.651	6.617	15.631	7.577	0.097
1- 2	-13.786	-49.317	6.617	15.631	5.566	0.239
1- 3	-9.615	-48.873	6.617	15.631	3.694	0.361
1- 4	-7.208	-48.323	6.617	15.631	1.961	0.461
1- 5	-6.437	-47.684	6.617	15.631	1.012	-0.105
1- 6	-7.167	-46.978	6.617	15.631	1.070	-1.561
1- 7	-9.260	-46.230	6.617	15.631	1.107	-2.879
1- 8	-12.588	-45.492	6.617	15.631	1.122	-4.057
1- 9	-17.000	-44.787	6.617	15.631	1.117	-5.098
1-10	-22.374	-48.153	6.617	15.631	1.017	-5.999
Top						
Member 2: (Top Slab)						
Left						
2- 0	-22.454	-48.233	5.907	5.999	15.631	6.617
2- 1	-8.386	-21.293	-1.017	5.999	12.292	4.995
2- 2	7.261	-1.644	-1.017	5.999	9.442	3.741
2- 3	21.849	5.190	-1.017	5.907	6.620	2.494
2- 4	30.736	9.087	-1.017	5.907	3.807	1.247
2- 5	33.611	10.385	-1.017	5.907	1.028	-0.959
2- 6	30.657	9.087	-1.017	5.907	-1.247	-3.783
2- 7	21.837	5.190	-1.017	5.907	-2.494	-6.619
2- 8	7.589	-1.485	-1.017	5.999	-3.741	-9.440
2- 9	-8.478	-21.267	-1.017	5.999	-4.995	-12.259
2-10	-22.454	-48.245	5.907	5.999	-6.617	-15.550
Right						
Member 4: (Bottom Slab)						
Left						
4- 0	-28.000	-54.233	9.346	9.726	16.223	7.723
4- 1	-13.263	-23.901	0.250	9.726	12.988	6.178
4- 2	4.877	-2.256	0.250	9.346	9.753	4.634
4- 3	21.377	5.789	0.250	9.346	6.518	3.089
4- 4	31.417	10.616	0.250	9.346	3.287	1.545
4- 5	34.885	12.225	0.250	9.346	0.062	-0.075
4- 6	31.612	10.616	0.250	9.346	-1.545	-3.242
4- 7	21.599	5.789	0.250	9.346	-3.089	-6.462
4- 8	4.852	-2.256	0.250	9.346	-4.634	-9.691
4- 9	-13.263	-23.631	0.250	9.726	-6.178	-12.921
4-10	-28.000	-53.657	9.346	9.726	-7.723	-16.151
Right						

---------- Analysis Truck, Type 3 ----------

Vehicle	Axle No.	Weight (k/ft)	Length (ft)	Dist. From Previous (ft)
Truck	1	0.332	10.01	
	2	0.260	6.01	17.00

***Distributed loads may have been intensified due to axle overlap between lanes

Live Load Parameters:

Traffic Direction is Parallel to Main Reinforcement
Distribution Width : 14.04 ft
Impact Factor : 1.14
Truck MPF : 1.20 Tandem MPF : 0.00
Lane Load Distribution Width : 16.38 ft
Lane Load: 0.000 k/ft

Truck Positions That Cause Maximum Results:

Maximum +Moment in Top Slab

Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)
Truck	1	0.332	10.01	10.42
	2	0.260	6.01	-6.58

Maximum +Moment : 5.82 k-ft
Corresponding Moment at End : -7.34 k-ft
Coincident Bottom Slab Load : 0.16 k/ft

Maximum -Moment in Top Slab

Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)
Truck	1	0.332	10.01	9.38
	2	0.260	6.01	-7.62

Maximum -Moment : -7.45 k-ft
Corresponding Moment at Mid : 5.73 k-ft
Coincident Bottom Slab Load : 0.16 k/ft

Maximum +Shear in Top Slab

Truck	1	0.260	6.01	22.00
	2	0.332	10.01	5.00

Maximum +Shear : 2.61 k
Corresponding Shear at Mid : -0.72 k
Coincident Bottom Slab Load : 0.18 k/ft

Maximum -Shear in Top Slab

Truck	1	0.332	10.01	15.83
	2	0.260	6.01	-1.17

Maximum -Shear : -2.61 k
Corresponding Shear at Mid : 0.72 k
Coincident Bottom Slab Load : 0.18 k/ft

Unfactored Moments and Shears due to Truck Loads: (k-ft, k)

	Truck				Tandem				Lane			
M-PT	Mll+	Mll-	Vll+	Vll-	Mll+	Mll-	Vll+	Vll-	Mll+	Mll-	Vll+	Vll-
Member 1: (Exterior Wall)												
Bottom												
1- 0	0.00	-6.46	0.22	-0.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 1	0.00	-6.37	0.22	-0.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 2	0.00	-6.29	0.22	-0.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 3	0.00	-6.20	0.22	-0.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 4	0.00	-6.12	0.22	-0.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 5	0.00	-6.27	0.22	-0.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 6	0.00	-6.50	0.22	-0.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 7	0.00	-6.72	0.22	-0.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 8	0.00	-6.97	0.22	-0.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 9	0.00	-7.21	0.22	-0.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-10	0.01	-7.45	0.22	-0.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Top												
Member 2: (Top Slab)												
Left												
2- 0	0.01	-7.45	2.61	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 1	0.79	-3.97	2.25	-0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 2	2.40	-1.37	1.88	-0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 3	4.28	0.00	1.51	-0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 4	5.41	0.00	1.15	-0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 5	5.82	0.00	0.80	-0.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 6	5.41	0.00	0.50	-1.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 7	4.29	-0.01	0.27	-1.51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 8	2.40	-1.37	0.12	-1.88	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 9	0.79	-3.97	0.03	-2.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-10	0.01	-7.45	0.00	-2.61	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Right												
Member 4: (Bottom Slab)												
Left												
4- 0	0.00	-6.46	1.96	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 1	0.00	-2.77	1.58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 2	1.01	-0.08	1.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 3	2.73	0.00	0.82	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 4	3.79	0.00	0.44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 5	4.06	0.00	0.06	-0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 6	3.79	0.00	0.00	-0.44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 7	2.73	0.00	0.00	-0.82	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 8	1.01	-0.08	0.00	-1.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 9	0.00	-2.77	0.00	-1.58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4-10	0.00	-6.45	0.00	-1.96	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Right												

Note: Unfactored live load results computed at 4.50 ft and 0 ft fill depths, per LRFD 3.6.1.2.6

Serviceability Check: Crack Control

Bar Mark	Location	Moment (k-ft)	Thrust (k)	Fss (ksi)	Spacing (in)	Allow (in)
A1	Top Corner Bar	-29.4	9.96	32.95	5.00	9.67
A2	Bot Corner Bar	-32.7	9.96	37.12*	5.00	8.04
A100	Top Slab (int)	22.2	-1.34	28.24	5.00	12.10
A200	Bot Slab (int)	22.6	-0.45	28.48	5.00	11.96
B2	Ext Wall (ext)	-32.0	9.96	36.12	5.00	8.39

Strength Limit State at Critical Sections: Flexure

Member 1: (Exterior Wall), 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
BOT	24.00	-44.04	14.03	48.35	7.56	52.06	1.00	1.44	14.31	1.74	1.74
MID	59.00	0.00	6.62	26.97	7.69	29.21	1.00	0.74	14.31	NC	NC
MID-	59.00	-42.47	14.03	48.35	7.56	52.06	1.00	1.44	14.31	1.97	1.97
TOP	24.00	-40.47	14.03	48.35	7.56	52.06	1.00	1.44	14.31	1.85	1.85

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
LT	24.00	-21.11	6.15	48.35	7.56	50.02	1.00	1.44	14.31	4.23	4.23
MID	125.00	30.85	-1.24	48.35	7.56	48.01	1.00	1.44	14.31	2.45	2.45
MID-	125.00	0.49	5.91	13.89	7.69	16.11	1.00	0.37	14.31	NC	NC
RT	24.00	-21.11	6.15	48.35	7.56	50.02	1.00	1.44	14.31	4.23	4.23

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
LT	24.00	-23.45	9.95	48.35	7.56	51.01	1.00	1.44	14.31	5.25	5.25
MID	125.00	30.54	0.09	48.35	7.56	48.38	1.00	1.44	14.31	3.22	3.22
MID-	125.00	0.78	9.35	13.89	7.69	17.37	1.00	0.37	14.31	NC	NC
RT	24.00	-23.44	9.95	48.35	7.56	51.01	1.00	1.44	14.31	5.25	5.25

Notes: Mu - Resisting moment under pure flexure, Ma - Allowable moment under applied axial load

Strength Limit State at Critical Sections: 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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
BOT	12.20	7.73	44.7	14.03	7.20	10.99	2.000	45.00	12.21 b	0.00	0.00	0.00	4.24	4.24
MID	59.00	1.24	6.4	6.62	7.25	18.72	3.384	32.25	20.80 a	0.00	0.00	0.00	39.42	39.42
MID-	59.00	0.26	41.9	14.03	7.20	11.32	2.060	38.76	12.58 a	0.00	0.00	0.00	19.88	19.88
TOP	12.20	-5.22	40.0	14.03	7.20	11.33	2.063	38.74	12.59 a	0.00	0.00	0.00	4.60	4.60

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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
LT	12.20	12.60	32.1	6.15	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.84	1.84
MID	125.00	1.40	30.9	-1.24	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	10.81	10.81
MID-	125.00	1.40	10.4	5.91	7.69	17.60	n/a	n/a	19.56 c	0.00	0.00	0.00	10.99	10.99
RT	12.20	12.60	32.1	6.15	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.84	1.84

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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
LT	12.20	13.04	36.2	9.95	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	2.08	2.08
MID	125.00	0.11	30.5	0.09	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	NC	NC
MID-	125.00	0.11	0.0	9.35	7.69	23.39	5.081	27.84	25.99 a	0.00	0.00	0.00	NC	NC
RT	12.20	13.04	36.2	9.95	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	2.08	2.08

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

Load Combination Results at Tenth Points: (k-ft, k)(Fill Depth = 4.50 ft)

M-PT	+Moment	-Moment	+Axial	-Axial	+Shear	-Shear
Member 1: (Exterior Wall)						
Bottom						
1- 0	-28.000	-49.459	6.617	14.034	9.952	0.095
1- 1	-19.874	-44.674	6.617	14.034	7.803	-0.059
1- 2	-13.786	-44.059	6.617	14.034	5.792	0.084
1- 3	-9.615	-43.313	6.617	14.034	3.920	0.206
1- 4	-7.208	-42.466	6.617	14.034	2.187	0.306
1- 5	-6.437	-41.940	6.617	14.034	1.238	-0.260
1- 6	-7.167	-41.468	6.617	14.034	1.296	-1.717
1- 7	-9.260	-40.955	6.617	14.034	1.332	-3.034
1- 8	-12.588	-40.447	6.617	14.034	1.348	-4.213
1- 9	-17.000	-39.936	6.617	14.034	1.342	-5.253
1-10	-22.374	-43.469	6.617	14.034	1.243	-6.154
Top						
Member 2: (Top Slab)						
Left						
2- 0	-22.454	-43.549	5.907	6.154	14.034	6.617
2- 1	-7.747	-20.180	-1.243	6.154	11.096	4.995
2- 2	8.114	-2.580	-1.243	6.154	8.662	3.741
2- 3	20.719	5.190	-1.243	5.907	6.224	2.494
2- 4	28.283	9.087	-1.243	5.907	3.796	0.920
2- 5	30.852	10.385	-1.243	5.907	1.402	-1.402
2- 6	28.283	9.087	-1.243	5.907	-0.920	-3.796
2- 7	20.732	5.190	-1.243	5.907	-2.494	-6.224
2- 8	8.114	-2.582	-1.243	6.154	-3.741	-8.662
2- 9	-7.747	-20.180	-1.243	6.154	-4.995	-11.095
2-10	-22.454	-43.549	5.907	6.154	-6.617	-14.033
Right						
Member 4: (Bottom Slab)						
Left						
4- 0	-28.000	-49.459	9.346	9.952	14.439	7.723
4- 1	-13.263	-22.364	0.095	9.952	11.572	6.178
4- 2	4.561	-2.256	0.095	9.346	8.705	4.634
4- 3	19.026	5.789	0.095	9.346	5.838	3.089
4- 4	27.770	10.616	0.095	9.346	2.971	1.545
4- 5	30.541	12.225	0.095	9.346	0.110	-0.110
4- 6	27.771	10.616	0.095	9.346	-1.545	-2.970
4- 7	19.028	5.789	0.095	9.346	-3.089	-5.837
4- 8	4.563	-2.256	0.095	9.346	-4.634	-8.704
4- 9	-13.263	-22.356	0.095	9.952	-6.178	-11.571
4-10	-28.000	-49.449	9.346	9.952	-7.723	-14.438
Right						

---------- Analysis Truck, Type 3S2 ----------

Vehicle	Axle No.	Weight (k/ft)	Length (ft)	Dist. From Previous (ft)
Truck	1	0.303	10.01	
	2	0.303	10.01	26.00
	3	0.163	6.01	13.00

***Distributed loads may have been intensified due to axle overlap between lanes

Live Load Parameters:

Traffic Direction is Parallel to Main Reinforcement
Distribution Width : 14.04 ft
Impact Factor : 1.14
Truck MPF : 1.20 Tandem MPF : 0.00
Lane Load Distribution Width : 16.38 ft
Lane Load: 0.000 k/ft

Truck Positions That Cause Maximum Results:

Maximum +Moment in Top Slab

Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)
Truck	1	0.163	6.01	23.21
	2	0.303	10.01	10.21
	3	0.303	10.01	-15.79

Maximum +Moment : 5.32 k-ft
Corresponding Moment at End : -6.72 k-ft

Maximum -Moment in Top Slab

Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)
Truck	1	0.303	10.01	38.08
	2	0.303	10.01	12.08
	3	0.163	6.01	-0.92

Maximum -Moment : -6.82 k-ft
Corresponding Moment at Mid : 5.19 k-ft

Coincident Bottom Slab Load : 0.15 k/ft

Maximum +Shear in Top Slab

Truck			
1	0.163	6.01	18.00
2	0.303	10.01	5.00
3	0.303	10.01	-21.00

Maximum +Shear : 2.47 k
Corresponding Shear at Mid : -0.56 k
Coincident Bottom Slab Load : 0.19 k/ft

Coincident Bottom Slab Load : 0.16 k/ft

Maximum -Shear in Top Slab

Truck			
1	0.303	10.01	41.83
2	0.303	10.01	15.83
3	0.163	6.01	2.83

Maximum -Shear : -2.47 k
Corresponding Shear at Mid : 0.56 k
Coincident Bottom Slab Load : 0.19 k/ft

Unfactored Moments and Shears due to Truck Loads: (k-ft, k)

	Truck				Tandem				Lane			
M-PT	Mll+	Mll-	Vll+	Vll-	Mll+	Mll-	Vll+	Vll-	Mll+	Mll-	Vll+	Vll-
Member 1: (Exterior Wall)												
Bottom												
1- 0	0.00	-6.50	0.20	-0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 1	0.00	-6.42	0.20	-0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 2	0.00	-6.35	0.20	-0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 3	0.00	-6.28	0.20	-0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 4	0.00	-6.23	0.20	-0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 5	0.00	-6.24	0.20	-0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 6	0.00	-6.29	0.20	-0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 7	0.00	-6.39	0.20	-0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 8	0.00	-6.51	0.20	-0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 9	0.00	-6.66	0.20	-0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-10	0.01	-6.82	0.20	-0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Top												
Member 2: (Top Slab)												
Left												
2- 0	0.01	-6.82	2.47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 1	0.74	-3.62	2.09	-0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 2	2.19	-1.24	1.73	-0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 3	3.90	0.00	1.38	-0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 4	5.02	0.00	1.05	-0.45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 5	5.32	0.00	0.73	-0.73	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 6	5.02	0.00	0.45	-1.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 7	3.91	0.00	0.24	-1.38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 8	2.19	-1.24	0.11	-1.73	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 9	0.74	-3.62	0.03	-2.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-10	0.01	-6.82	0.00	-2.47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Right												
Member 4: (Bottom Slab)												
Left												
4- 0	0.00	-6.50	2.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 1	0.00	-2.68	1.63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 2	0.92	-0.07	1.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 3	2.77	0.00	0.83	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 4	3.94	0.00	0.44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 5	4.27	0.00	0.06	-0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 6	3.94	0.00	0.00	-0.44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 7	2.77	0.00	0.00	-0.83	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 8	0.92	-0.07	0.00	-1.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 9	0.00	-2.68	0.00	-1.63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4-10	0.00	-6.50	0.00	-2.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Right												

Note: Unfactored live load results computed at 4.50 ft and 0 ft fill depths, per LRFD 3.6.1.2.6

Serviceability Check: Crack Control

Bar Mark	Location	Moment (k-ft)	Thrust (k)	Fss (ksi)	Spacing (in)	Allow (in)
A1	Top Corner Bar	-29.0	9.83	32.44	5.00	9.90
A2	Bot Corner Bar	-32.8	9.83	37.24*	5.00	7.99
A100	Top Slab (int)	21.7	-1.32	27.62	5.00	12.48
A200	Bot Slab (int)	22.8	-0.43	28.73	5.00	11.81
B2	Ext Wall (ext)	-32.1	9.83	36.30	5.00	8.33

Strength Limit State at Critical Sections: Flexure

Member 1: (Exterior Wall), 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
BOT	24.00	-44.14	13.80	48.35	7.56	52.00	1.00	1.44	14.31	1.72	1.72
MID	59.00	0.00	6.62	26.97	7.69	29.21	1.00	0.74	14.31	NC	NC
MID-	59.00	-42.65	13.80	48.35	7.56	52.00	1.00	1.44	14.31	1.98	1.98
TOP	24.00	-39.68	13.80	48.35	7.56	52.00	1.00	1.44	14.31	1.98	1.98

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
LT	24.00	-20.48	6.11	48.35	7.56	50.00	1.00	1.44	14.31	4.60	4.60
MID	125.00	29.99	-1.20	48.35	7.56	48.02	1.00	1.44	14.31	2.68	2.68
MID-	125.00	0.49	5.91	13.89	7.69	16.11	1.00	0.37	14.31	NC	NC
RT	24.00	-20.48	6.11	48.35	7.56	50.00	1.00	1.44	14.31	4.60	4.60

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
LT	24.00	-23.31	9.91	48.35	7.56	51.00	1.00	1.44	14.31	5.38	5.38
MID	125.00	30.90	0.14	48.35	7.56	48.39	1.00	1.44	14.31	3.07	3.07
MID-	125.00	0.78	9.35	13.89	7.69	17.37	1.00	0.37	14.31	NC	NC
RT	24.00	-23.31	9.91	48.35	7.56	51.00	1.00	1.44	14.31	5.38	5.38

Notes: Mu - Resisting moment under pure flexure, Ma - Allowable moment under applied axial load

Strength Limit State at Critical Sections: 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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
BOT	12.20	7.69	44.7	13.80	7.20	10.99	2.000	45.00	12.21 b	0.00	0.00	0.00	4.36	4.36
MID	59.00	1.20	6.4	6.62	7.25	18.74	3.387	32.24	20.82 a	0.00	0.00	0.00	43.91	43.91
MID-	59.00	0.22	41.9	13.80	7.20	11.32	2.060	38.76	12.58 a	0.00	0.00	0.00	21.81	21.81
TOP	12.20	-5.18	39.0	13.80	7.20	11.47	2.087	38.59	12.74 a	0.00	0.00	0.00	4.81	4.81

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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
LT	12.20	12.35	31.3	6.11	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.96	1.96
MID	125.00	1.28	30.0	-1.20	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	11.86	11.86
MID-	125.00	1.28	10.4	5.91	7.69	17.60	n/a	n/a	19.56 c	0.00	0.00	0.00	12.05	12.05
RT	12.20	12.35	31.3	6.11	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.96	1.96

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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
LT	12.20	13.14	36.2	9.91	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	2.01	2.01
MID	125.00	0.10	30.9	0.14	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	NC	NC
MID-	125.00	0.10	0.0	9.35	7.69	23.39	5.081	27.84	25.99 a	0.00	0.00	0.00	NC	NC
RT	12.20	13.14	36.2	9.91	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	2.01	2.01

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

Load Combination Results at Tenth Points: (k-ft, k)(Fill Depth = 4.50 ft)

M-PT	+Moment	-Moment	+Axial	-Axial	+Shear	-Shear
Member 1: (Exterior Wall)						
Bottom						
1- 0	-28.000	-49.524	6.617	13.802	9.913	0.136
1- 1	-19.874	-44.760	6.617	13.802	7.763	-0.018
1- 2	-13.786	-44.165	6.617	13.802	5.752	0.125
1- 3	-9.615	-43.440	6.617	13.802	3.880	0.246
1- 4	-7.208	-42.647	6.617	13.802	2.147	0.347
1- 5	-6.437	-41.874	6.617	13.802	1.198	-0.220
1- 6	-7.167	-41.113	6.617	13.802	1.256	-1.676
1- 7	-9.260	-40.372	6.617	13.802	1.293	-2.993
1- 8	-12.588	-39.653	6.617	13.802	1.308	-4.172
1- 9	-17.000	-38.968	6.617	13.802	1.303	-5.212
1-10	-22.374	-42.353	6.617	13.802	1.204	-6.114
Top						
Member 2: (Top Slab)						
Left						
2- 0	-22.454	-42.433	5.907	6.114	13.802	6.617
2- 1	-7.826	-19.566	-1.204	6.114	10.828	4.995
2- 2	7.744	-2.359	-1.204	6.114	8.387	3.741
2- 3	20.057	5.190	-1.204	5.907	5.990	2.494
2- 4	27.598	9.087	-1.204	5.907	3.619	0.997
2- 5	29.989	10.385	-1.204	5.907	1.278	-1.278
2- 6	27.598	9.087	-1.204	5.907	-0.997	-3.619
2- 7	20.069	5.190	-1.204	5.907	-2.494	-5.990
2- 8	7.744	-2.362	-1.204	6.114	-3.741	-8.387
2- 9	-7.827	-19.566	-1.204	6.114	-4.995	-10.828
2-10	-22.454	-42.434	5.907	6.114	-6.617	-13.802
Right						
Member 4: (Bottom Slab)						
Left						
4- 0	-28.000	-49.524	9.346	9.913	14.558	7.723
4- 1	-13.263	-22.213	0.136	9.913	11.660	6.178
4- 2	4.405	-2.256	0.136	9.346	8.762	4.634
4- 3	19.107	5.789	0.136	9.346	5.864	3.089
4- 4	28.024	10.616	0.136	9.346	2.965	1.545
4- 5	30.904	12.225	0.136	9.346	0.101	-0.101
4- 6	28.024	10.616	0.136	9.346	-1.545	-2.965
4- 7	19.107	5.789	0.136	9.346	-3.089	-5.864
4- 8	4.406	-2.256	0.136	9.346	-4.634	-8.762
4- 9	-13.263	-22.213	0.136	9.913	-6.178	-11.660
4-10	-28.000	-49.524	9.346	9.913	-7.723	-14.558
Right						

---------- Analysis Truck, Type 3-3 ----------

Vehicle	Axle No.	Weight (k/ft)	Length (ft)	Dist. From Previous (ft)
Truck	1	0.274	10.01	
	2	0.260	6.01	18.00
	3	0.235	10.01	17.00
	4	0.195	6.01	17.00

***Distributed loads may have been intensified due to axle overlap between lanes

Live Load Parameters:

Traffic Direction is Parallel to Main Reinforcement
Distribution Width : 14.04 ft
Impact Factor : 1.14
Truck MPF : 1.20 Tandem MPF : 0.00
Lane Load Distribution Width : 16.38 ft
Lane Load: 0.000 k/ft

Truck Positions That Cause Maximum Results:

Maximum +Moment in Top Slab

Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)
Truck	1	0.274	10.01	10.42
	2	0.260	6.01	-7.58
	3	0.235	10.01	-24.58
	4	0.195	6.01	-41.58

Maximum -Moment in Top Slab

Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)
Truck	1	0.274	10.01	9.38
	2	0.260	6.01	-8.63
	3	0.235	10.01	-25.63
	4	0.195	6.01	-42.63

Maximum +Moment : 4.79 k-ft
Corresponding Moment at End : -6.05 k-ft
Coincident Bottom Slab Load : 0.13 k/ft

Maximum -Moment : -6.14 k-ft
Corresponding Moment at Mid : 4.72 k-ft
Coincident Bottom Slab Load : 0.13 k/ft

Maximum +Shear in Top Slab

Truck	1	0.195	6.01	57.00
	2	0.235	10.01	40.00
	3	0.260	6.01	23.00
	4	0.274	10.01	5.00

Maximum +Shear : 2.14 k
Corresponding Shear at Mid : -0.60 k
Coincident Bottom Slab Load : 0.14 k/ft

Maximum -Shear in Top Slab

Truck	1	0.274	10.01	15.83
	2	0.260	6.01	-2.17
	3	0.235	10.01	-19.17
	4	0.195	6.01	-36.17

Maximum -Shear : -2.14 k
Corresponding Shear at Mid : 0.60 k
Coincident Bottom Slab Load : 0.14 k/ft

Unfactored Moments and Shears due to Truck Loads: (k-ft, k)

	Truck				Tandem				Lane			
M-PT	Mll+	Mll-	Vll+	Vll-	Mll+	Mll-	Vll+	Vll-	Mll+	Mll-	Vll+	Vll-
Member 1: (Exterior Wall)												
Bottom												
1- 0	0.00	-5.06	0.21	-0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 1	0.00	-5.00	0.21	-0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 2	0.00	-4.96	0.21	-0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 3	0.00	-4.91	0.21	-0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 4	0.00	-4.99	0.21	-0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 5	0.00	-5.17	0.21	-0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 6	0.00	-5.35	0.21	-0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 7	0.00	-5.54	0.21	-0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 8	0.00	-5.74	0.21	-0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 9	0.00	-5.94	0.21	-0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-10	0.01	-6.14	0.21	-0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Top												
Member 2: (Top Slab)												
Left												
2- 0	0.01	-6.14	2.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 1	0.65	-3.27	1.85	-0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 2	2.01	-1.12	1.55	-0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 3	3.50	0.00	1.25	-0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 4	4.46	0.00	0.94	-0.41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 5	4.79	0.00	0.66	-0.66	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 6	4.46	0.00	0.41	-0.94	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 7	3.51	-0.01	0.22	-1.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 8	2.00	-1.12	0.09	-1.55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 9	0.65	-3.27	0.02	-1.85	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-10	0.01	-6.14	0.00	-2.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Right												
Member 4: (Bottom Slab)												
Left												
4- 0	0.00	-5.06	1.53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 1	0.00	-2.19	1.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 2	0.83	-0.06	0.94	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 3	2.17	0.00	0.64	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 4	2.98	0.00	0.35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 5	3.22	0.00	0.05	-0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 6	2.98	0.00	0.00	-0.35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 7	2.17	0.00	0.00	-0.64	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 8	0.83	-0.06	0.00	-0.94	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 9	0.00	-2.19	0.00	-1.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4-10	0.00	-5.06	0.00	-1.53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Right												

Note: Unfactored live load results computed at 4.50 ft and 0 ft fill depths, per LRFD 3.6.1.2.6

Serviceability Check: Crack Control

Bar Mark	Location	Moment (k-ft)	Thrust (k)	Fss (ksi)	Spacing (in)	Allow (in)
A1	Top Corner Bar	-28.2	9.49	31.60	5.00	10.29
A2	Bot Corner Bar	-31.4	9.49	35.63	5.00	8.58
A100	Top Slab (int)	21.1	-1.33	26.95	5.00	12.91
A200	Bot Slab (int)	21.8	-0.41	27.40	5.00	12.62
B2	Ext Wall (ext)	-30.8	9.49	34.89	5.00	8.86

Strength Limit State at Critical Sections: Flexure

Member 1: (Exterior Wall), 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
BOT	24.00	-41.71	13.21	48.35	7.56	51.85	1.00	1.44	14.31	2.19	2.19
MID	59.00	0.00	6.62	26.97	7.69	29.21	1.00	0.74	14.31	NC	NC
MID-	59.00	-40.49	13.21	48.35	7.56	51.85	1.00	1.44	14.31	2.37	2.37
TOP	24.00	-38.32	13.21	48.35	7.56	51.85	1.00	1.44	14.31	2.23	2.23

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
LT	24.00	-19.84	6.07	48.35	7.56	49.99	1.00	1.44	14.31	5.04	5.04
MID	125.00	29.06	-1.22	48.35	7.56	48.01	1.00	1.44	14.31	2.98	2.98
MID-	125.00	0.49	5.91	13.89	7.69	16.11	1.00	0.37	14.31	NC	NC
RT	24.00	-19.84	6.07	48.35	7.56	49.99	1.00	1.44	14.31	5.04	5.04

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
LT	24.00	-22.38	9.93	48.35	7.56	51.01	1.00	1.44	14.31	6.43	6.43
MID	125.00	29.06	0.18	48.35	7.56	48.40	1.00	1.44	14.31	4.07	4.07
MID-	125.00	0.78	9.35	13.89	7.69	17.37	1.00	0.37	14.31	NC	NC
RT	24.00	-22.37	9.93	48.35	7.56	51.01	1.00	1.44	14.31	6.44	6.44

Notes: Mu - Resisting moment under pure flexure, Ma - Allowable moment under applied axial load

Strength Limit State at Critical Sections: 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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
BOT	12.20	7.71	42.3	13.21	7.20	10.99	2.000	45.00	12.21 b	0.00	0.00	0.00	4.30	4.30
MID	59.00	1.22	6.4	6.62	7.25	18.73	3.386	32.25	20.81 a	0.00	0.00	0.00	41.76	41.76
MID-	59.00	0.18	40.0	13.21	7.20	11.58	2.107	38.46	12.87 a	0.00	0.00	0.00	24.74	24.74
TOP	12.20	-5.14	37.7	13.21	7.20	11.64	2.119	38.39	12.94 a	0.00	0.00	0.00	5.06	5.06

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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
LT	12.20	11.84	30.4	6.07	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	2.25	2.25
MID	125.00	1.15	29.1	-1.22	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	13.13	13.13
MID-	125.00	1.15	10.4	5.91	7.69	17.60	n/a	n/a	19.56 c	0.00	0.00	0.00	13.34	13.34
RT	12.20	11.84	30.4	6.07	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	2.25	2.25

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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
LT	12.20	12.36	34.5	9.93	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	2.67	2.67
MID	125.00	0.09	29.1	0.18	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	NC	NC
MID-	125.00	0.09	0.0	9.35	7.69	23.39	5.081	27.84	25.99 a	0.00	0.00	0.00	NC	NC
RT	12.20	12.36	34.5	9.93	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	2.67	2.67

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

Load Combination Results at Tenth Points: (k-ft, k)(Fill Depth = 4.50 ft)

M-PT	+Moment	-Moment	+Axial	-Axial	+Shear	-Shear
Member 1: (Exterior Wall)						
Bottom						
1- 0	-28.000	-47.005	6.617	13.210	9.930	0.176
1- 1	-19.874	-42.277	6.617	13.210	7.781	0.023
1- 2	-13.786	-41.726	6.617	13.210	5.770	0.165
1- 3	-9.615	-41.043	6.617	13.210	3.898	0.287
1- 4	-7.208	-40.491	6.617	13.210	2.165	0.387
1- 5	-6.437	-40.002	6.617	13.210	1.216	-0.179
1- 6	-7.167	-39.461	6.617	13.210	1.274	-1.635
1- 7	-9.260	-38.879	6.617	13.210	1.311	-2.953
1- 8	-12.588	-38.296	6.617	13.210	1.326	-4.131
1- 9	-17.000	-37.710	6.617	13.210	1.321	-5.171
1-10	-22.374	-41.167	6.617	13.210	1.221	-6.073
Top						
Member 2: (Top Slab)						
Left						
2- 0	-22.454	-41.247	5.907	6.073	13.210	6.617
2- 1	-7.991	-18.953	-1.221	6.073	10.402	4.995
2- 2	7.422	-2.150	-1.221	6.073	8.080	3.741
2- 3	19.350	5.190	-1.221	5.907	5.757	2.494
2- 4	26.612	9.087	-1.221	5.907	3.442	1.073
2- 5	29.056	10.385	-1.221	5.907	1.154	-1.154
2- 6	26.612	9.087	-1.221	5.907	-1.073	-3.442
2- 7	19.361	5.190	-1.221	5.907	-2.494	-5.757
2- 8	7.418	-2.152	-1.221	6.073	-3.741	-8.080
2- 9	-7.991	-18.953	-1.221	6.073	-4.995	-10.401
2-10	-22.454	-41.247	5.907	6.073	-6.617	-13.209
Right						
Member 4: (Bottom Slab)						
Left						
4- 0	-28.000	-47.005	9.346	9.930	13.683	7.723
4- 1	-13.263	-21.355	0.176	9.930	10.965	6.178
4- 2	4.248	-2.256	0.176	9.346	8.246	4.634
4- 3	18.060	5.789	0.176	9.346	5.527	3.089
4- 4	26.343	10.616	0.176	9.346	2.808	1.545
4- 5	29.059	12.225	0.176	9.346	0.091	-0.091
4- 6	26.343	10.616	0.176	9.346	-1.545	-2.808
4- 7	18.060	5.789	0.176	9.346	-3.089	-5.527
4- 8	4.250	-2.256	0.176	9.346	-4.634	-8.246
4- 9	-13.263	-21.349	0.176	9.930	-6.178	-10.964
4-10	-28.000	-47.002	9.346	9.930	-7.723	-13.683
Right						

---------- Analysis Truck, Overload 1 ----------

Vehicle	Axle No.	Weight (k/ft)	Length (ft)	Dist. From Previous (ft)
Truck	1	0.420	10.01	
	2	0.420	10.01	16.00
	3	0.163	6.01	12.00

***Distributed loads may have been intensified due to axle overlap between lanes

Live Load Parameters:

Traffic Direction is Parallel to Main Reinforcement
Distribution Width : 14.04 ft
Impact Factor : 1.14
Truck MPF : 1.20 Tandem MPF : 0.00
Lane Load Distribution Width : 16.38 ft
Lane Load: 0.000 k/ft

Truck Positions That Cause Maximum Results:

Maximum +Moment in Top Slab

Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)
Truck	1	0.163	6.01	22.21
	2	0.420	10.01	10.21
	3	0.420	10.01	-5.79

Maximum +Moment : 7.42 k-ft
Corresponding Moment at End : -9.35 k-ft

Maximum -Moment in Top Slab

Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)
Truck	1	0.420	10.01	28.00
	2	0.420	10.01	12.00
	3	0.163	6.01	0.00

Maximum -Moment : -9.54 k-ft
Corresponding Moment at Mid : 7.26 k-ft

Coincident Bottom Slab Load : 0.21 k/ft

Maximum +Shear in Top Slab

Truck				
	1	0.420	10.01	21.00
	2	0.420	10.01	5.00
	3	0.163	6.01	-7.00

Maximum +Shear : 3.47 k
Corresponding Shear at Mid : -0.73 k
Coincident Bottom Slab Load : 0.30 k/ft

Coincident Bottom Slab Load : 0.23 k/ft

Maximum -Shear in Top Slab

Truck				
	1	0.420	10.01	15.83
	2	0.420	10.01	-0.17
	3	0.163	6.01	-12.17

Maximum -Shear : -3.47 k
Corresponding Shear at Mid : 0.73 k
Coincident Bottom Slab Load : 0.30 k/ft

Unfactored Moments and Shears due to Truck Loads: (k-ft, k)

	Truck				Tandem				Lane			
M-PT	Mll+	Mll-	Vll+	Vll-	Mll+	Mll-	Vll+	Vll-	Mll+	Mll-	Vll+	Vll-
Member 1: (Exterior Wall)												
Bottom												
1- 0	0.00	-10.07	0.24	-0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 1	0.00	-9.88	0.24	-0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 2	0.00	-9.69	0.24	-0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 3	0.00	-9.51	0.24	-0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 4	0.00	-9.32	0.24	-0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 5	0.00	-9.13	0.24	-0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 6	0.00	-8.99	0.24	-0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 7	0.00	-8.96	0.24	-0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 8	0.00	-9.10	0.24	-0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 9	0.00	-9.31	0.24	-0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-10	0.01	-9.54	0.24	-0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Top												
Member 2: (Top Slab)												
Left												
2- 0	0.01	-9.54	3.47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 1	1.00	-5.02	2.92	-0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 2	3.04	-1.72	2.41	-0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 3	5.47	0.00	1.91	-0.34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 4	6.99	0.00	1.45	-0.63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 5	7.42	0.00	1.01	-1.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 6	6.98	0.00	0.63	-1.45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 7	5.48	0.00	0.34	-1.91	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 8	3.04	-1.72	0.15	-2.41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 9	1.00	-5.02	0.04	-2.92	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-10	0.01	-9.54	0.00	-3.47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Right												
Member 4: (Bottom Slab)												
Left												
4- 0	0.00	-10.07	3.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 1	0.00	-4.13	2.54	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 2	1.28	-0.10	1.91	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 3	4.19	0.00	1.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 4	6.05	0.00	0.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 5	6.61	0.00	0.08	-0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 6	6.05	0.00	0.00	-0.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 7	4.19	0.00	0.00	-1.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 8	1.28	-0.10	0.00	-1.91	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 9	0.00	-4.13	0.00	-2.54	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4-10	0.00	-10.07	0.00	-3.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Right												

Note: Unfactored live load results computed at 4.50 ft and 0 ft fill depths, per LRFD 3.6.1.2.6

Serviceability Check: Crack Control

Bar Mark	Location	Moment (k-ft)	Thrust (k)	Fss (ksi)	Spacing (in)	Allow (in)
A1	Top Corner Bar	-31.6	10.83	35.29	5.00	8.71
A2	Bot Corner Bar	-36.1	10.83	41.04*	5.00	6.80
A100	Top Slab (int)	23.8	-1.36	30.26	5.00	10.97
A200	Bot Slab (int)	25.2	-0.52	31.69	5.00	10.25
B2	Ext Wall (ext)	-35.2	10.83	39.79	5.00	7.17

Strength Limit State at Critical Sections: Flexure

Member 1: (Exterior Wall), 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
BOT	24.00	-46.12	14.16	48.35	7.56	52.09	1.00	1.44	14.31	1.89	1.89
MID	59.00	0.00	6.62	26.97	7.69	29.21	1.00	0.74	14.31	NC	NC
MID-	59.00	-44.34	14.16	48.35	7.56	52.09	1.00	1.44	14.31	2.21	2.21
TOP	24.00	-40.57	14.16	48.35	7.56	52.09	1.00	1.44	14.31	2.37	2.37

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
LT	24.00	-20.79	5.85	48.35	7.56	49.93	1.00	1.44	14.31	5.66	5.66
MID	125.00	30.70	-1.17	48.35	7.56	48.03	1.00	1.44	14.31	3.20	3.20
MID-	125.00	0.47	5.61	13.89	7.69	16.00	1.00	0.37	14.31	NC	NC
RT	24.00	-20.79	5.85	48.35	7.56	49.93	1.00	1.44	14.31	5.66	5.66

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
LT	24.00	-24.09	9.59	48.35	7.56	50.92	1.00	1.44	14.31	6.06	6.06
MID	125.00	32.36	0.11	48.35	7.56	48.38	1.00	1.44	14.31	3.30	3.30
MID-	125.00	0.75	9.05	13.89	7.69	17.27	1.00	0.37	14.31	NC	NC
RT	24.00	-24.09	9.59	48.35	7.56	50.92	1.00	1.44	14.31	6.06	6.06

Notes: Mu - Resisting moment under pure flexure, Ma - Allowable moment under applied axial load

Strength Limit State at Critical Sections: 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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
BOT	12.20	7.43	46.8	14.16	7.20	10.99	2.000	45.00	12.21 b	0.00	0.00	0.00	6.94	6.94
MID	59.00	1.17	7.0	6.62	7.25	18.14	3.280	32.63	20.16 a	0.00	0.00	0.00	59.67	59.67
MID-	59.00	0.25	43.3	14.16	7.20	11.18	2.035	38.94	12.42 a	0.00	0.00	0.00	25.86	25.86
TOP	12.20	-4.97	39.9	14.16	7.20	11.35	2.066	38.71	12.62 a	0.00	0.00	0.00	7.09	7.09

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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
LT	12.20	12.67	31.8	5.85	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	2.34	2.34
MID	125.00	1.37	30.7	-1.17	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	14.25	14.25
MID-	125.00	1.37	10.5	5.61	7.69	17.60	n/a	n/a	19.56 c	0.00	0.00	0.00	14.48	14.48
RT	12.20	12.67	31.8	5.85	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	2.34	2.34

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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
LT	12.20	13.79	37.6	9.59	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	2.15	2.15
MID	125.00	0.11	32.4	0.11	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	NC	NC
MID-	125.00	0.11	0.0	9.05	7.69	23.39	5.079	27.84	25.99 a	0.00	0.00	0.00	NC	NC
RT	12.20	13.79	37.6	9.59	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	2.15	2.15

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

Eriksson Culvert v6.3.4

Filename: Bothell Culvert Analysis 043025.etcx

Load Combination Results at Tenth Points: (k-ft, k)(Fill Depth = 4.50 ft)

M-PT	+Moment	-Moment	+Axial	-Axial	+Shear	-Shear
Member 1: (Exterior Wall)						
Bottom						
1- 0	-27.846	-51.592	6.617	14.160	9.589	0.106
1- 1	-19.980	-46.859	6.617	14.160	7.499	-0.047
1- 2	-14.093	-46.141	6.617	14.160	5.546	0.095
1- 3	-10.066	-45.293	6.617	14.160	3.733	0.217
1- 4	-7.745	-44.336	6.617	14.160	2.058	0.317
1- 5	-7.003	-43.291	6.617	14.160	1.168	-0.249
1- 6	-7.704	-42.241	6.617	14.160	1.226	-1.647
1- 7	-9.711	-41.286	6.617	14.160	1.263	-2.906
1- 8	-12.895	-40.541	6.617	14.160	1.278	-4.026
1- 9	-17.105	-39.893	6.617	14.160	1.273	-5.007
1-10	-22.220	-43.151	6.617	14.160	1.173	-5.850
Top						
Member 2: (Top Slab)						
Left						
2- 0	-22.300	-43.231	5.614	5.850	14.160	6.617
2- 1	-7.781	-19.856	-1.173	5.850	11.100	4.995
2- 2	8.012	-2.357	-1.173	5.850	8.613	3.741
2- 3	20.614	5.344	-1.173	5.614	6.160	2.494
2- 4	28.245	9.240	-1.173	5.614	3.747	0.941
2- 5	30.697	10.539	-1.173	5.614	1.367	-1.367
2- 6	28.237	9.240	-1.173	5.614	-0.941	-3.747
2- 7	20.627	5.344	-1.173	5.614	-2.494	-6.160
2- 8	8.012	-2.360	-1.173	5.850	-3.741	-8.613
2- 9	-7.781	-19.856	-1.173	5.850	-4.995	-11.099
2-10	-22.300	-43.231	5.614	5.850	-6.617	-14.160
Right						
Member 4: (Bottom Slab)						
Left						
4- 0	-27.846	-51.592	9.053	9.589	15.274	7.723
4- 1	-13.263	-22.941	0.106	9.589	12.231	6.178
4- 2	4.518	-2.102	0.106	9.053	9.188	4.634
4- 3	19.916	5.943	0.106	9.053	6.144	3.089
4- 4	29.308	10.770	0.106	9.053	3.101	1.545
4- 5	32.359	12.379	0.106	9.053	0.108	-0.108
4- 6	29.308	10.770	0.106	9.053	-1.545	-3.101
4- 7	19.916	5.943	0.106	9.053	-3.089	-6.144
4- 8	4.520	-2.102	0.106	9.053	-4.634	-9.188
4- 9	-13.263	-22.941	0.106	9.589	-6.178	-12.231
4-10	-27.846	-51.592	9.053	9.589	-7.723	-15.274
Right						

---------- Analysis Truck, Overload 2 ----------

Vehicle	Axle No.	Weight (k/ft)	Length (ft)	Dist. From Previous (ft)
Truck	1	0.195	6.01	
	2	0.420	10.01	12.00
	3	0.358	6.01	8.00
	4	0.420	10.01	18.00
	5	0.358	6.01	8.00
	6	0.420	10.01	16.00
	7	0.358	6.01	8.00

***Distributed loads may have been intensified due to axle overlap between lanes

Live Load Parameters:

Traffic Direction is Parallel to Main Reinforcement
Distribution Width : 14.04 ft
Impact Factor : 1.14
Truck MPF : 1.20 Tandem MPF : 0.00
Lane Load Distribution Width : 16.38 ft
Lane Load: 0.000 k/ft

Truck Positions That Cause Maximum Results:

Maximum +Moment in Top Slab

Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)
Truck	1	0.358	6.01	16.33

Maximum -Moment in Top Slab

Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)
Truck	1	0.358	6.01	15.00

	2	0.420	10.01	8.33		2	0.420	10.01	7.09
	3	0.358	6.01	-7.67		3	0.358	6.01	-8.91
	4	0.420	10.01	-15.67		4	0.420	10.01	-16.91
	5	0.358	6.01	-33.67		5	0.358	6.01	-34.91
	6	0.420	10.01	-41.67		6	0.420	10.01	-42.91
	7	0.195	6.01	-53.67		7	0.195	6.01	-54.91

Maximum +Moment : 8.62 k-ft
Corresponding Moment at End : -11.89 k-ft
Coincident Bottom Slab Load : 0.31 k/ft

Maximum -Moment : -12.11 k-ft
Corresponding Moment at Mid : 8.54 k-ft
Coincident Bottom Slab Load : 0.31 k/ft

Maximum +Shear in Top Slab

Truck	1	0.358	6.01	13.00
	2	0.420	10.01	5.00
	3	0.358	6.01	-11.00
	4	0.420	10.01	-19.00
	5	0.358	6.01	-37.00
	6	0.420	10.01	-45.00
	7	0.195	6.01	-57.00

Maximum +Shear : 4.05 k
Corresponding Shear at Mid : -0.31 k
Coincident Bottom Slab Load : 0.31 k/ft

Maximum -Shear in Top Slab

Truck	1	0.195	6.01	27.83
	2	0.420	10.01	15.83
	3	0.358	6.01	7.83
	4	0.420	10.01	-10.17
	5	0.358	6.01	-18.17
	6	0.420	10.01	-34.17
	7	0.358	6.01	-42.17

Maximum -Shear : -4.05 k
Corresponding Shear at Mid : 0.31 k
Coincident Bottom Slab Load : 0.31 k/ft

Unfactored Moments and Shears due to Truck Loads: (k-ft, k)

	Truck				Tandem				Lane			
M-PT	Mll+	Mll-	Vll+	Vll-	Mll+	Mll-	Vll+	Vll-	Mll+	Mll-	Vll+	Vll-
Member 1: (Exterior Wall)												
Bottom												
1- 0	0.00	-9.99	0.31	-0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 1	0.00	-10.15	0.31	-0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 2	0.00	-10.32	0.31	-0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 3	0.00	-10.48	0.31	-0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 4	0.00	-10.64	0.31	-0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 5	0.00	-10.83	0.31	-0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 6	0.00	-11.07	0.31	-0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 7	0.00	-11.33	0.31	-0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 8	0.00	-11.59	0.31	-0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 9	0.00	-11.85	0.31	-0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-10	0.01	-12.11	0.31	-0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Top												
Member 2: (Top Slab)												
Left												
2- 0	0.01	-12.11	4.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 1	0.85	-5.83	3.38	-0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 2	3.08	-1.69	2.71	-0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 3	5.76	0.00	2.06	-0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 4	7.91	0.00	1.50	-0.58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 5	8.62	0.00	1.01	-1.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 6	7.91	0.00	0.58	-1.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 7	5.76	-0.01	0.29	-2.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 8	3.07	-1.70	0.12	-2.71	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 9	0.85	-5.83	0.03	-3.38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-10	0.01	-12.11	0.00	-4.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Right												
Member 4: (Bottom Slab)												
Left												
4- 0	0.00	-9.99	3.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 1	0.00	-3.88	2.64	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 2	1.42	-0.08	1.99	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 3	4.70	0.00	1.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 4	6.68	0.00	0.68	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 5	7.29	0.00	0.08	-0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 6	6.68	0.00	0.00	-0.68	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 7	4.70	0.00	0.00	-1.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 8	1.42	-0.08	0.00	-1.99	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 9	0.00	-3.88	0.00	-2.64	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4-10	0.00	-9.99	0.00	-3.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Right												

Note: Unfactored live load results computed at 4.50 ft and 0 ft fill depths, per LRFD 3.6.1.2.6

Serviceability Check: Crack Control

Bar Mark	Location	Moment (k-ft)	Thrust (k)	Fss (ksi)	Spacing (in)	Allow (in)
A1	Top Corner Bar	-34.0	11.40	38.18*	5.00	7.68
A2	Bot Corner Bar	-36.8	11.40	41.61*	5.00	6.64
A100	Top Slab (int)	25.0	-1.43	31.78	5.00	10.21
A200	Bot Slab (int)	25.9	-0.46	32.52	5.00	9.86
B2	Ext Wall (ext)	-36.5	11.40	41.22	5.00	6.75

Strength Limit State at Critical Sections: Flexure

Member 1: (Exterior Wall), 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
BOT	24.00	-46.97	14.94	48.35	7.56	52.28	1.00	1.44	14.31	1.79	1.79
MID	59.00	0.00	6.62	26.97	7.69	29.21	1.00	0.74	14.31	NC	NC
MID-	59.00	-46.13	14.94	48.35	7.56	52.28	1.00	1.44	14.31	1.92	1.92
TOP	24.00	-43.92	14.94	48.35	7.56	52.28	1.00	1.44	14.31	1.87	1.87

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
LT	24.00	-21.98	5.77	48.35	7.56	49.91	1.00	1.44	14.31	4.88	4.88
MID	125.00	32.31	-1.27	48.35	7.56	48.00	1.00	1.44	14.31	2.76	2.76
MID-	125.00	0.47	5.61	13.89	7.69	16.00	1.00	0.37	14.31	NC	NC
RT	24.00	-21.98	5.77	48.35	7.56	49.91	1.00	1.44	14.31	4.88	4.88

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
LT	24.00	-23.75	9.68	48.35	7.56	50.94	1.00	1.44	14.31	6.39	6.39
MID	125.00	33.28	0.19	48.35	7.56	48.40	1.00	1.44	14.31	2.99	2.99
MID-	125.00	0.75	9.05	13.89	7.69	17.27	1.00	0.37	14.31	NC	NC
RT	24.00	-23.75	9.68	48.35	7.56	50.94	1.00	1.44	14.31	6.39	6.39

Notes: Mu - Resisting moment under pure flexure, Ma - Allowable moment under applied axial load

Strength Limit State at Critical Sections: 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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
BOT	12.20	7.53	47.2	14.94	7.20	10.99	2.000	45.00	12.21 b	0.00	0.00	0.00	6.39	6.39
MID	59.00	1.26	7.0	6.62	7.25	18.10	3.271	32.66	20.11 a	0.00	0.00	0.00	46.00	46.00
MID-	59.00	0.17	45.6	14.94	7.20	10.99	2.000	45.00	12.21 b	0.00	0.00	0.00	30.90	30.90
TOP	12.20	-4.89	43.3	14.94	7.20	11.02	2.006	39.16	12.24 a	0.00	0.00	0.00	12.57	12.57

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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
LT	12.20	13.37	34.1	5.77	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	2.01	2.01
MID	125.00	1.37	32.3	-1.27	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	14.25	14.25
MID-	125.00	1.37	10.5	5.61	7.69	17.60	n/a	n/a	19.56 c	0.00	0.00	0.00	14.48	14.48
RT	12.20	13.37	34.1	5.77	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	2.01	2.01

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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
LT	12.20	13.94	37.4	9.68	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	2.07	2.07
MID	125.00	0.11	33.3	0.19	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	NC	NC
MID-	125.00	0.11	0.0	9.05	7.69	23.39	5.079	27.84	25.99 a	0.00	0.00	0.00	NC	NC
RT	12.20	13.94	37.4	9.68	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	2.07	2.07

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

Load Combination Results at Tenth Points: (k-ft, k)(Fill Depth = 4.50 ft)

M-PT	+Moment	-Moment	+Axial	-Axial	+Shear	-Shear
Member 1: (Exterior Wall)						
Bottom						
1- 0	-27.846	-51.484	6.617	14.935	9.684	0.187
1- 1	-19.980	-47.224	6.617	14.935	7.593	0.033
1- 2	-14.093	-46.980	6.617	14.935	5.641	0.176
1- 3	-10.066	-46.604	6.617	14.935	3.827	0.297
1- 4	-7.745	-46.121	6.617	14.935	2.153	0.398
1- 5	-7.003	-45.574	6.617	14.935	1.262	-0.169
1- 6	-7.704	-45.049	6.617	14.935	1.320	-1.566
1- 7	-9.711	-44.481	6.617	14.935	1.357	-2.825
1- 8	-12.895	-43.898	6.617	14.935	1.373	-3.945
1- 9	-17.105	-43.313	6.617	14.935	1.367	-4.927
1-10	-22.220	-46.616	6.617	14.935	1.268	-5.770
Top						
Member 2: (Top Slab)						
Left						
2- 0	-22.300	-46.696	5.614	5.770	14.935	6.617
2- 1	-7.980	-20.950	-1.268	5.770	11.729	4.995
2- 2	8.064	-2.320	-1.268	5.770	9.026	3.741
2- 3	20.995	5.344	-1.268	5.614	6.364	2.494
2- 4	29.492	9.240	-1.268	5.614	3.807	1.001
2- 5	32.308	10.539	-1.268	5.614	1.367	-1.367
2- 6	29.492	9.240	-1.268	5.614	-1.001	-3.807
2- 7	20.995	5.344	-1.268	5.614	-2.494	-6.364
2- 8	8.060	-2.326	-1.268	5.770	-3.741	-9.025
2- 9	-7.980	-20.951	-1.268	5.770	-4.995	-11.729
2-10	-22.300	-46.692	5.614	5.770	-6.617	-14.935
Right						
Member 4: (Bottom Slab)						
Left						
4- 0	-27.846	-51.484	9.053	9.684	15.448	7.723
4- 1	-13.263	-22.598	0.187	9.684	12.366	6.178
4- 2	4.701	-2.102	0.187	9.053	9.285	4.634
4- 3	20.601	5.943	0.187	9.053	6.203	3.089
4- 4	30.150	10.770	0.187	9.053	3.121	1.545
4- 5	33.278	12.379	0.187	9.053	0.108	-0.108
4- 6	30.150	10.770	0.187	9.053	-1.545	-3.121
4- 7	20.602	5.943	0.187	9.053	-3.089	-6.203
4- 8	4.706	-2.102	0.187	9.053	-4.634	-9.284
4- 9	-13.263	-22.598	0.187	9.684	-6.178	-12.366
4-10	-27.846	-51.484	9.053	9.684	-7.723	-15.448
Right						

---------- Analysis Truck, EV 2 ----------

Vehicle	Axle No.	Weight (k/ft)	Length (ft)	Dist. From Previous (ft)
Truck	1	0.545	6.01	
	2	0.391	6.01	15.00

***Distributed loads may have been intensified due to axle overlap between lanes

Live Load Parameters:

Traffic Direction is Parallel to Main Reinforcement
Distribution Width : 14.04 ft
Impact Factor : 1.14
Truck MPF : 1.20 Tandem MPF : 0.00
Lane Load Distribution Width : 16.38 ft
Lane Load: 0.000 k/ft

Truck Positions That Cause Maximum Results:

Maximum +Moment in Top Slab

Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)
Truck	1	0.391	6.01	25.42
	2	0.545	6.01	10.42

Maximum +Moment : 6.92 k-ft
Corresponding Moment at End : -7.68 k-ft
Coincident Bottom Slab Load : 0.16 k/ft

Maximum -Moment in Top Slab

Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)
Truck	1	0.391	6.01	24.25
	2	0.545	6.01	9.25

Maximum -Moment : -7.84 k-ft
Corresponding Moment at Mid : 6.67 k-ft
Coincident Bottom Slab Load : 0.16 k/ft

Maximum +Shear in Top Slab

Truck	1	0.391	6.01	18.00
	2	0.545	6.01	3.00

Maximum +Shear : 3.14 k
Corresponding Shear at Mid : -0.13 k
Coincident Bottom Slab Load : 0.27 k/ft

Maximum -Shear in Top Slab

Truck	1	0.545	6.01	17.83
	2	0.391	6.01	2.83

Maximum -Shear : -3.14 k
Corresponding Shear at Mid : 0.13 k
Coincident Bottom Slab Load : 0.27 k/ft

Unfactored Moments and Shears due to Truck Loads: (k-ft, k)

	Truck				Tandem				Lane			
M-PT	Mll+	Mll-	Vll+	Vll-	Mll+	Mll-	Vll+	Vll-	Mll+	Mll-	Vll+	Vll-
Member 1: (Exterior Wall)												
Bottom												
1- 0	0.00	-8.98	0.35	-0.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 1	0.00	-8.64	0.35	-0.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 2	0.00	-8.29	0.35	-0.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 3	0.00	-7.94	0.35	-0.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 4	0.00	-7.60	0.35	-0.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 5	0.00	-7.36	0.35	-0.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 6	0.00	-7.24	0.35	-0.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 7	0.00	-7.23	0.35	-0.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 8	0.00	-7.33	0.35	-0.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 9	0.00	-7.56	0.35	-0.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-10	0.02	-7.84	0.35	-0.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Top												
Member 2: (Top Slab)												
Left												
2- 0	0.02	-7.84	3.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 1	1.29	-4.32	2.67	-0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 2	3.52	-1.69	2.24	-0.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 3	5.42	-0.01	1.85	-0.44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 4	6.55	0.00	1.47	-0.76	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 5	6.92	0.00	1.10	-1.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 6	6.55	0.00	0.76	-1.47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 7	5.42	-0.01	0.44	-1.85	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 8	3.54	-1.69	0.19	-2.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 9	1.29	-4.32	0.05	-2.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-10	0.02	-7.84	0.00	-3.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Right												
Member 4: (Bottom Slab)												
Left												
4- 0	0.00	-8.98	2.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 1	0.00	-3.73	2.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 2	1.14	-0.13	1.69	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 3	3.47	0.00	1.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 4	5.17	0.00	0.58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 5	5.70	0.00	0.08	-0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 6	5.17	0.00	0.00	-0.58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 7	3.47	0.00	0.00	-1.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 8	1.14	-0.13	0.00	-1.69	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 9	0.00	-3.73	0.00	-2.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4-10	0.00	-8.98	0.00	-2.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Right												

Note: Unfactored live load results computed at 4.50 ft and 0 ft fill depths, per LRFD 3.6.1.2.6

Serviceability Check: Crack Control

Bar Mark	Location	Moment (k-ft)	Thrust (k)	Fss (ksi)	Spacing (in)	Allow (in)
A1	Top Corner Bar	-29.8	10.50	33.21	5.00	9.56
A2	Bot Corner Bar	-34.7	10.50	39.40*	5.00	7.29
A100	Top Slab (int)	23.3	-1.47	29.68	5.00	11.28
A200	Bot Slab (int)	24.3	-0.50	30.54	5.00	10.82
B2	Ext Wall (ext)	-33.4	10.50	37.76	5.00	7.82

Strength Limit State at Critical Sections: Flexure

Member 1: (Exterior Wall), 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
BOT	24.00	-44.21	13.72	48.35	7.56	51.98	1.00	1.44	14.31	2.03	2.03
MID	59.00	0.00	6.62	26.97	7.69	29.21	1.00	0.74	14.31	NC	NC
MID-	59.00	-42.02	13.72	48.35	7.56	51.98	1.00	1.44	14.31	2.50	2.50
TOP	24.00	-38.18	13.72	48.35	7.56	51.98	1.00	1.44	14.31	2.70	2.70

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
LT	24.00	-19.79	5.82	48.35	7.56	49.93	1.00	1.44	14.31	6.02	6.02
MID	125.00	30.02	-1.33	48.35	7.56	47.98	1.00	1.44	14.31	3.16	3.16
MID-	125.00	0.47	5.61	13.89	7.69	16.00	1.00	0.37	14.31	NC	NC
RT	24.00	-19.79	5.82	48.35	7.56	49.93	1.00	1.44	14.31	6.02	6.02

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
LT	24.00	-23.51	9.74	48.35	7.56	50.96	1.00	1.44	14.31	6.15	6.15
MID	125.00	31.13	0.14	48.35	7.56	48.39	1.00	1.44	14.31	3.53	3.53
MID-	125.00	0.75	9.05	13.89	7.69	17.27	1.00	0.37	14.31	NC	NC
RT	24.00	-23.51	9.74	48.35	7.56	50.96	1.00	1.44	14.31	6.15	6.15

Notes: Mu - Resisting moment under pure flexure, Ma - Allowable moment under applied axial load

Strength Limit State at Critical Sections: 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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
BOT	12.20	7.59	45.1	13.72	7.20	10.99	2.000	45.00	12.21 b	0.00	0.00	0.00	5.61	5.61
MID	59.00	1.32	7.0	6.62	7.25	18.07	3.265	32.69	20.07 a	0.00	0.00	0.00	36.96	36.96
MID-	59.00	0.22	40.9	13.72	7.20	11.46	2.086	38.60	12.73 a	0.00	0.00	0.00	26.33	26.33
TOP	12.20	-4.94	37.5	13.72	7.20	11.71	2.130	38.32	13.01 a	0.00	0.00	0.00	12.51	12.51

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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
LT	12.20	12.28	30.2	5.82	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	2.37	2.37
MID	125.00	1.49	30.0	-1.33	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	12.07	12.07
MID-	125.00	1.49	10.5	5.61	7.69	17.60	n/a	n/a	19.56 c	0.00	0.00	0.00	12.27	12.27
RT	12.20	12.28	30.2	5.82	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	2.37	2.37

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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
LT	12.20	13.35	36.6	9.74	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	2.25	2.25
MID	125.00	0.11	31.1	0.14	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	NC	NC
MID-	125.00	0.11	0.0	9.05	7.69	23.39	5.078	27.84	25.99 a	0.00	0.00	0.00	NC	NC
RT	12.20	13.35	36.6	9.74	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	2.25	2.25

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

Load Combination Results at Tenth Points: (k-ft, k)(Fill Depth = 4.50 ft)

M-PT	+Moment	-Moment	+Axial	-Axial	+Shear	-Shear
Member 1: (Exterior Wall)						
Bottom						
1- 0	-27.846	-50.127	6.617	13.715	9.745	0.137
1- 1	-19.980	-45.178	6.617	13.715	7.654	-0.016
1- 2	-14.093	-44.245	6.617	13.715	5.702	0.126
1- 3	-10.066	-43.181	6.617	13.715	3.888	0.248
1- 4	-7.745	-42.012	6.617	13.715	2.214	0.348
1- 5	-7.003	-40.898	6.617	13.715	1.323	-0.218
1- 6	-7.704	-39.870	6.617	13.715	1.381	-1.616
1- 7	-9.711	-38.950	6.617	13.715	1.418	-2.874
1- 8	-12.895	-38.152	6.617	13.715	1.434	-3.995
1- 9	-17.105	-37.524	6.617	13.715	1.428	-4.976
1-10	-22.220	-40.856	6.617	13.715	1.329	-5.819
Top						
Member 2: (Top Slab)						
Left						
2- 0	-22.300	-40.936	5.614	5.819	13.715	6.617
2- 1	-7.380	-18.912	-1.329	5.819	10.764	4.995
2- 2	8.665	-2.322	-1.329	5.819	8.383	3.741
2- 3	20.542	5.344	-1.329	5.614	6.070	2.494
2- 4	27.657	9.240	-1.329	5.614	3.776	0.767
2- 5	30.022	10.539	-1.329	5.614	1.490	-1.490
2- 6	27.656	9.240	-1.329	5.614	-0.767	-3.776
2- 7	20.542	5.344	-1.329	5.614	-2.494	-6.070
2- 8	8.686	-2.322	-1.329	5.819	-3.741	-8.382
2- 9	-7.380	-18.912	-1.329	5.819	-4.995	-10.764
2-10	-22.300	-40.936	5.614	5.819	-6.617	-13.715
Right						
Member 4: (Bottom Slab)						
Left						
4- 0	-27.846	-50.127	9.053	9.745	14.786	7.723
4- 1	-13.263	-22.399	0.137	9.745	11.834	6.178
4- 2	4.331	-2.102	0.137	9.053	8.883	4.634
4- 3	18.945	5.943	0.137	9.053	5.931	3.089
4- 4	28.110	10.770	0.137	9.053	2.980	1.545
4- 5	31.126	12.379	0.137	9.053	0.112	-0.111
4- 6	28.110	10.770	0.137	9.053	-1.545	-2.980
4- 7	18.945	5.943	0.137	9.053	-3.089	-5.931
4- 8	4.331	-2.102	0.137	9.053	-4.634	-8.883
4- 9	-13.263	-22.399	0.137	9.745	-6.178	-11.834
4-10	-27.846	-50.127	9.053	9.745	-7.723	-14.786
Right						

---------- Analysis Truck, EV 3 ----------

Vehicle	Axle No.	Weight (k/ft)	Length (ft)	Dist. From Previous (ft)
Truck	1	0.606	10.01	
	2	0.391	6.01	17.00

***Distributed loads may have been intensified due to axle overlap between lanes

Live Load Parameters:

Traffic Direction is Parallel to Main Reinforcement
Distribution Width : 14.04 ft
Impact Factor : 1.14
Truck MPF : 1.20 Tandem MPF : 0.00
Lane Load Distribution Width : 16.38 ft
Lane Load: 0.000 k/ft

Truck Positions That Cause Maximum Results:

Maximum +Moment in Top Slab

Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)
Truck	1	0.391	6.01	27.42
	2	0.606	10.01	10.42

Maximum +Moment : 10.60 k-ft
Corresponding Moment at End : -13.39 k-ft
Coincident Bottom Slab Load : 0.29 k/ft

Maximum -Moment in Top Slab

Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)
Truck	1	0.391	6.01	26.38
	2	0.606	10.01	9.38

Maximum -Moment : -13.59 k-ft
Corresponding Moment at Mid : 10.44 k-ft
Coincident Bottom Slab Load : 0.29 k/ft

Maximum +Shear in Top Slab

Truck	1	0.391	6.01	22.00
	2	0.606	10.01	5.00

Maximum +Shear : 4.75 k
Corresponding Shear at Mid : -1.32 k
Coincident Bottom Slab Load : 0.33 k/ft

Maximum -Shear in Top Slab

Truck	1	0.606	10.01	15.83
	2	0.391	6.01	-1.17

Maximum -Shear : -4.75 k
Corresponding Shear at Mid : 1.32 k
Coincident Bottom Slab Load : 0.33 k/ft

Unfactored Moments and Shears due to Truck Loads: (k-ft, k)

	Truck				Tandem				Lane			
M-PT	Mll+	Mll-	Vll+	Vll-	Mll+	Mll-	Vll+	Vll-	Mll+	Mll-	Vll+	Vll-
Member 1: (Exterior Wall)												
Bottom												
1- 0	0.00	-11.53	0.38	-0.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 1	0.00	-11.40	0.38	-0.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 2	0.00	-11.27	0.38	-0.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 3	0.00	-11.14	0.38	-0.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 4	0.00	-11.07	0.38	-0.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 5	0.00	-11.44	0.38	-0.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 6	0.00	-11.85	0.38	-0.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 7	0.00	-12.26	0.38	-0.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 8	0.00	-12.70	0.38	-0.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 9	0.00	-13.15	0.38	-0.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-10	0.02	-13.59	0.38	-0.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Top												
Member 2: (Top Slab)												
Left												
2- 0	0.02	-13.59	4.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 1	1.44	-7.24	4.10	-0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 2	4.38	-2.49	3.44	-0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 3	7.80	-0.01	2.76	-0.49	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 4	9.87	0.00	2.09	-0.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 5	10.60	0.00	1.46	-1.46	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 6	9.87	0.00	0.90	-2.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 7	7.81	-0.01	0.49	-2.76	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 8	4.38	-2.49	0.21	-3.44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 9	1.44	-7.24	0.05	-4.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-10	0.02	-13.59	0.00	-4.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Right												
Member 4: (Bottom Slab)												
Left												
4- 0	0.00	-11.53	3.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 1	0.00	-4.95	2.82	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 2	1.84	-0.14	2.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 3	4.89	0.00	1.47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 4	6.79	0.00	0.79	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 5	7.27	0.00	0.12	-0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 6	6.79	0.00	0.00	-0.79	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 7	4.90	0.00	0.00	-1.46	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 8	1.85	-0.14	0.00	-2.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 9	0.00	-4.94	0.00	-2.82	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4-10	0.00	-11.52	0.00	-3.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Right												

Note: Unfactored live load results computed at 4.50 ft and 0 ft fill depths, per LRFD 3.6.1.2.6

Serviceability Check: Crack Control

Bar Mark	Location	Moment (k-ft)	Thrust (k)	Fss (ksi)	Spacing (in)	Allow (in)
A1	Top Corner Bar	-35.1	12.10	39.30*	5.00	7.32
A2	Bot Corner Bar	-37.7	12.10	42.52*	5.00	6.40
A100	Top Slab (int)	26.9	-1.50	34.29	5.00	9.10
A200	Bot Slab (int)	25.8	-0.67	32.57	5.00	9.84
B2	Ext Wall (ext)	-36.9	12.10	41.49	5.00	6.68

Strength Limit State at Critical Sections: Flexure

Member 1: (Exterior Wall), 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
BOT	24.00	-48.24	15.88	48.35	7.56	52.52	1.00	1.44	14.31	1.53	1.53
MID	59.00	0.00	6.62	26.97	7.69	29.21	1.00	0.74	14.31	NC	NC
MID-	59.00	-46.70	15.88	48.35	7.56	52.52	1.00	1.44	14.31	1.69	1.69
TOP	24.00	-45.42	15.88	48.35	7.56	52.52	1.00	1.44	14.31	1.59	1.59

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
LT	24.00	-23.89	6.05	48.35	7.56	49.99	1.00	1.44	14.31	3.71	3.71
MID	125.00	34.99	-1.36	48.35	7.56	47.98	1.00	1.44	14.31	2.07	2.07
MID-	125.00	0.47	5.61	13.89	7.69	16.00	1.00	0.37	14.31	NC	NC
RT	24.00	-23.89	6.05	48.35	7.56	49.99	1.00	1.44	14.31	3.71	3.71

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
LT	24.00	-25.22	9.78	48.35	7.56	50.97	1.00	1.44	14.31	4.76	4.76
MID	125.00	33.24	-0.09	48.35	7.56	48.33	1.00	1.44	14.31	2.77	2.77
MID-	125.00	0.75	9.05	13.89	7.69	17.27	1.00	0.37	14.31	NC	NC
RT	24.00	-25.21	9.78	48.35	7.56	50.97	1.00	1.44	14.31	4.76	4.76

Notes: Mu - Resisting moment under pure flexure, Ma - Allowable moment under applied axial load

Strength Limit State at Critical Sections: 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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
BOT	12.20	7.62	48.9	15.88	7.20	10.99	2.000	45.00	12.21 b	0.00	0.00	0.00	5.48	5.48
MID	59.00	1.35	7.0	6.62	7.25	18.05	3.262	32.70	20.06 a	0.00	0.00	0.00	34.67	34.67
MID-	59.00	0.45	46.4	15.88	7.20	10.99	2.000	45.00	12.21 b	0.00	0.00	0.00	16.25	16.25
TOP	12.20	-5.17	45.1	15.88	7.20	10.99	2.000	45.00	12.21 b	0.00	0.00	0.00	5.38	5.38

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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
LT	12.20	14.33	36.1	6.05	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.56	1.56
MID	125.00	1.97	35.0	-1.36	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	9.12	9.12
MID-	125.00	1.97	10.5	5.61	7.69	17.60	n/a	n/a	19.56 c	0.00	0.00	0.00	9.27	9.27
RT	12.20	14.33	36.1	6.05	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.56	1.56

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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
LT	12.20	14.21	39.2	9.78	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.79	1.79
MID	125.00	0.16	33.2	-0.09	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	NC	NC
MID-	125.00	0.16	0.0	9.05	7.69	23.39	5.077	27.85	25.99 a	0.00	0.00	0.00	NC	NC
RT	12.20	14.21	39.2	9.78	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.79	1.79

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

Load Combination Results at Tenth Points: (k-ft, k)(Fill Depth = 4.50 ft)

M-PT	+Moment	-Moment	+Axial	-Axial	+Shear	-Shear
Member 1: (Exterior Wall)						
Bottom						
1- 0	-27.846	-53.570	6.617	15.881	9.776	-0.093
1- 1	-19.980	-48.910	6.617	15.881	7.685	-0.246
1- 2	-14.093	-48.266	6.617	15.881	5.733	-0.103
1- 3	-10.066	-47.490	6.617	15.881	3.920	0.018
1- 4	-7.745	-46.697	6.617	15.881	2.245	0.118
1- 5	-7.003	-46.405	6.617	15.881	1.354	-0.448
1- 6	-7.704	-46.092	6.617	15.881	1.412	-1.845
1- 7	-9.711	-45.740	6.617	15.881	1.449	-3.104
1- 8	-12.895	-45.404	6.617	15.881	1.465	-4.224
1- 9	-17.105	-45.068	6.617	15.881	1.459	-5.206
1-10	-22.220	-48.621	6.617	15.881	1.360	-6.049
Top						
Member 2: (Top Slab)						
Left						
2- 0	-22.300	-48.701	5.614	6.049	15.881	6.617
2- 1	-7.186	-22.852	-1.360	6.049	12.695	4.995
2- 2	9.823	-3.397	-1.360	6.049	10.004	3.741
2- 3	23.751	5.344	-1.360	5.614	7.301	2.494
2- 4	32.135	9.240	-1.360	5.614	4.613	0.567
2- 5	34.991	10.539	-1.360	5.614	1.972	-1.972
2- 6	32.135	9.240	-1.360	5.614	-0.567	-4.613
2- 7	23.771	5.344	-1.360	5.614	-2.494	-7.301
2- 8	9.823	-3.400	-1.360	6.049	-3.741	-10.004
2- 9	-7.186	-22.852	-1.360	6.049	-4.995	-12.695
2-10	-22.300	-48.701	5.614	6.049	-6.617	-15.880
Right						
Member 4: (Bottom Slab)						
Left						
4- 0	-27.846	-53.570	9.053	9.776	15.732	7.723
4- 1	-13.263	-24.042	-0.093	9.776	12.615	6.178
4- 2	5.281	-2.102	-0.093	9.053	9.498	4.634
4- 3	20.865	5.943	-0.093	9.053	6.382	3.089
4- 4	30.299	10.770	-0.093	9.053	3.265	1.545
4- 5	33.239	12.379	-0.093	9.053	0.155	-0.155
4- 6	30.299	10.770	-0.093	9.053	-1.545	-3.264
4- 7	20.868	5.943	-0.093	9.053	-3.089	-6.381
4- 8	5.284	-2.102	-0.093	9.053	-4.634	-9.498
4- 9	-13.263	-24.033	-0.093	9.776	-6.178	-12.614
4-10	-27.846	-53.559	9.053	9.776	-7.723	-15.731
Right						

---------- Analysis Truck, NRL - Legal Lane ----------

Vehicle	Axle No.	Weight (k/ft)	Length (ft)	Dist. From Previous (ft)
Truck	1	0.205	10.01	
	2	0.195	6.01	18.00
	3	0.176	10.01	17.00
	4	0.146	6.01	17.00

***Distributed loads may have been intensified due to axle overlap between lanes

Live Load Parameters:

Traffic Direction is Parallel to Main Reinforcement
Distribution Width : 14.04 ft
Impact Factor : 1.14
Truck MPF : 1.20 Tandem MPF : 0.00
Lane Load Distribution Width : 16.38 ft
Lane Load: 0.015 k/ft

Truck Positions That Cause Maximum Results:

Maximum +Moment in Top Slab

Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)
Truck	1	0.205	10.01	10.42
	2	0.195	6.01	-7.58
	3	0.176	10.01	-24.58
	4	0.146	6.01	-41.58

Maximum -Moment in Top Slab

Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)
Truck	1	0.205	10.01	9.38
	2	0.195	6.01	-8.63
	3	0.176	10.01	-25.63
	4	0.146	6.01	-42.63

Maximum +Moment : 3.59 k-ft
Corresponding Moment at End : -4.54 k-ft
Coincident Bottom Slab Load : 0.10 k/ft

Maximum -Moment : -4.60 k-ft
Corresponding Moment at Mid : 3.54 k-ft
Coincident Bottom Slab Load : 0.10 k/ft

Maximum +Shear in Top Slab

Truck	1	0.146	6.01	57.00
	2	0.176	10.01	40.00
	3	0.195	6.01	23.00
	4	0.205	10.01	5.00

Maximum +Shear : 1.60 k
Corresponding Shear at Mid : -0.45 k
Coincident Bottom Slab Load : 0.11 k/ft

Maximum -Shear in Top Slab

Truck	1	0.205	10.01	15.83
	2	0.195	6.01	-2.17
	3	0.176	10.01	-19.17
	4	0.146	6.01	-36.17

Maximum -Shear : -1.60 k
Corresponding Shear at Mid : 0.45 k
Coincident Bottom Slab Load : 0.11 k/ft

Unfactored Moments and Shears due to Truck Loads: (k-ft, k)

	Truck				Tandem				Lane			
M-PT	Mll+	Mll-	Vll+	Vll-	Mll+	Mll-	Vll+	Vll-	Mll+	Mll-	Vll+	Vll-
Member 1: (Exterior Wall)												
Bottom												
1- 0	0.00	-3.79	0.16	-0.16	0.00	0.00	0.00	0.00	0.00	-0.46	0.01	-0.01
1- 1	0.00	-3.75	0.16	-0.16	0.00	0.00	0.00	0.00	0.00	-0.46	0.01	-0.01
1- 2	0.00	-3.72	0.16	-0.16	0.00	0.00	0.00	0.00	0.00	-0.46	0.01	-0.01
1- 3	0.00	-3.68	0.16	-0.16	0.00	0.00	0.00	0.00	0.00	-0.46	0.01	-0.01
1- 4	0.00	-3.75	0.16	-0.16	0.00	0.00	0.00	0.00	0.00	-0.46	0.01	-0.01
1- 5	0.00	-3.88	0.16	-0.16	0.00	0.00	0.00	0.00	0.00	-0.46	0.01	-0.01
1- 6	0.00	-4.01	0.16	-0.16	0.00	0.00	0.00	0.00	0.00	-0.46	0.01	-0.01
1- 7	0.00	-4.15	0.16	-0.16	0.00	0.00	0.00	0.00	0.00	-0.46	0.01	-0.01
1- 8	0.00	-4.30	0.16	-0.16	0.00	0.00	0.00	0.00	0.00	-0.46	0.01	-0.01
1- 9	0.00	-4.45	0.16	-0.16	0.00	0.00	0.00	0.00	0.00	-0.46	0.01	-0.01
1-10	0.01	-4.60	0.16	-0.16	0.00	0.00	0.00	0.00	0.00	-0.46	0.01	-0.01
Top												
Member 2: (Top Slab)												
Left												
2- 0	0.01	-4.60	1.60	0.00	0.00	0.00	0.00	0.00	0.00	-0.46	0.15	0.00
2- 1	0.49	-2.45	1.39	-0.02	0.00	0.00	0.00	0.00	0.04	-0.21	0.12	0.00
2- 2	1.50	-0.84	1.16	-0.07	0.00	0.00	0.00	0.00	0.11	-0.06	0.10	-0.01
2- 3	2.62	0.00	0.93	-0.17	0.00	0.00	0.00	0.00	0.21	0.00	0.07	-0.01
2- 4	3.34	0.00	0.71	-0.31	0.00	0.00	0.00	0.00	0.30	0.00	0.05	-0.02
2- 5	3.59	0.00	0.49	-0.49	0.00	0.00	0.00	0.00	0.33	0.00	0.04	-0.04
2- 6	3.34	0.00	0.31	-0.71	0.00	0.00	0.00	0.00	0.30	0.00	0.02	-0.05
2- 7	2.63	0.00	0.17	-0.93	0.00	0.00	0.00	0.00	0.21	0.00	0.01	-0.07
2- 8	1.50	-0.84	0.07	-1.16	0.00	0.00	0.00	0.00	0.11	-0.06	0.01	-0.10
2- 9	0.49	-2.45	0.02	-1.39	0.00	0.00	0.00	0.00	0.04	-0.21	0.00	-0.12
2-10	0.01	-4.60	0.00	-1.60	0.00	0.00	0.00	0.00	0.00	-0.46	0.00	-0.15
Right												
Member 4: (Bottom Slab)												
Left												
4- 0	0.00	-3.79	1.15	0.00	0.00	0.00	0.00	0.00	0.00	-0.46	0.15	0.00
4- 1	0.00	-1.65	0.92	0.00	0.00	0.00	0.00	0.00	0.00	-0.18	0.12	0.00
4- 2	0.62	-0.05	0.70	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.09	0.00
4- 3	1.63	0.00	0.48	0.00	0.00	0.00	0.00	0.00	0.21	0.00	0.06	0.00
4- 4	2.23	0.00	0.26	0.00	0.00	0.00	0.00	0.00	0.30	0.00	0.03	0.00
4- 5	2.41	0.00	0.04	-0.04	0.00	0.00	0.00	0.00	0.33	0.00	0.00	0.00
4- 6	2.23	0.00	0.00	-0.26	0.00	0.00	0.00	0.00	0.30	0.00	0.00	-0.03
4- 7	1.63	0.00	0.00	-0.48	0.00	0.00	0.00	0.00	0.21	0.00	0.00	-0.06
4- 8	0.63	-0.05	0.00	-0.70	0.00	0.00	0.00	0.00	0.05	0.00	0.00	-0.09
4- 9	0.00	-1.64	0.00	-0.92	0.00	0.00	0.00	0.00	0.00	-0.18	0.00	-0.12
4-10	0.00	-3.79	0.00	-1.15	0.00	0.00	0.00	0.00	0.00	-0.46	0.00	-0.15
Right												

Note: Unfactored live load results computed at 4.50 ft and 0 ft fill depths, per LRFD 3.6.1.2.6

Serviceability Check: Crack Control

Bar Mark	Location	Moment (k-ft)	Thrust (k)	Fss (ksi)	Spacing (in)	Allow (in)
A1	Top Corner Bar	-27.2	9.11	30.53	5.00	10.82
A2	Bot Corner Bar	-30.6	9.11	34.81	5.00	8.90
A100	Top Slab (int)	20.3	-1.29	25.86	5.00	13.66
A200	Bot Slab (int)	21.3	-0.37	26.79	5.00	13.01
B2	Ext Wall (ext)	-30.0	9.11	34.06	5.00	9.20

Strength Limit State at Critical Sections: Flexure

Member 1: (Exterior Wall), 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
BOT	24.00	-40.35	12.54	48.35	7.56	51.68	1.00	1.44	14.31	2.58	2.58
MID	59.00	0.00	6.62	26.97	7.69	29.21	1.00	0.74	14.31	NC	NC
MID-	59.00	-39.12	12.54	48.35	7.56	51.68	1.00	1.44	14.31	2.81	2.81
TOP	24.00	-36.62	12.54	48.35	7.56	51.68	1.00	1.44	14.31	2.67	2.67

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
LT	24.00	-18.75	6.00	48.35	7.56	49.97	1.00	1.44	14.31	6.04	6.04
MID	125.00	27.54	-1.15	48.35	7.56	48.03	1.00	1.44	14.31	3.63	3.63
MID-	125.00	0.49	5.91	13.89	7.69	16.11	1.00	0.37	14.31	NC	NC
RT	24.00	-18.75	6.00	48.35	7.56	49.97	1.00	1.44	14.31	6.04	6.04

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
LT	24.00	-21.70	9.86	48.35	7.56	50.99	1.00	1.44	14.31	7.52	7.52
MID	125.00	28.24	0.25	48.35	7.56	48.42	1.00	1.44	14.31	4.77	4.77
MID-	125.00	0.78	9.35	13.89	7.69	17.37	1.00	0.37	14.31	NC	NC
RT	24.00	-21.69	9.86	48.35	7.56	50.99	1.00	1.44	14.31	7.53	7.53

Notes: Mu - Resisting moment under pure flexure, Ma - Allowable moment under applied axial load

Strength Limit State at Critical Sections: 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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
BOT	12.20	7.64	40.9	12.54	7.20	11.10	2.019	39.06	12.33 a	0.00	0.00	0.00	4.61	4.61
MID	59.00	1.14	6.4	6.62	7.25	18.77	3.392	32.22	20.85 a	0.00	0.00	0.00	51.86	51.86
MID-	59.00	0.11	38.5	12.54	7.20	11.78	2.144	38.24	13.09 a	0.00	0.00	0.00	31.30	31.30
TOP	12.20	-5.06	35.9	12.54	7.20	11.89	2.165	38.11	13.22 a	0.00	0.00	0.00	5.51	5.51

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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
LT	12.20	11.21	28.9	6.00	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	2.74	2.74
MID	125.00	0.93	27.5	-1.15	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	16.33	16.33
MID-	125.00	0.93	10.4	5.91	7.69	17.60	n/a	n/a	19.56 c	0.00	0.00	0.00	16.60	16.60
RT	12.20	11.21	28.9	6.00	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	2.74	2.74

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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
LT	12.20	11.99	33.5	9.86	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	3.14	3.14
MID	125.00	0.07	28.2	0.25	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	NC	NC
MID-	125.00	0.07	0.0	9.35	7.69	23.39	5.082	27.84	25.99 a	0.00	0.00	0.00	NC	NC
RT	12.20	11.99	33.4	9.86	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	3.14	3.14

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

Filename: Bothell Culvert Analysis 043025.etcx

Load Combination Results at Tenth Points: (k-ft, k)(Fill Depth = 4.50 ft)

M-PT	+Moment	-Moment	+Axial	-Axial	+Shear	-Shear
Member 1: (Exterior Wall)						
Bottom						
1- 0	-28.000	-45.601	6.617	12.542	9.859	0.250
1- 1	-19.874	-40.896	6.617	12.542	7.710	0.097
1- 2	-13.786	-40.366	6.617	12.542	5.699	0.239
1- 3	-9.615	-39.705	6.617	12.542	3.827	0.361
1- 4	-7.208	-39.115	6.617	12.542	2.094	0.461
1- 5	-6.437	-38.550	6.617	12.542	1.144	-0.105
1- 6	-7.167	-37.929	6.617	12.542	1.202	-1.561
1- 7	-9.260	-37.266	6.617	12.542	1.239	-2.879
1- 8	-12.588	-36.595	6.617	12.542	1.255	-4.058
1- 9	-17.000	-35.921	6.617	12.542	1.249	-5.098
1-10	-22.374	-39.290	6.617	12.542	1.150	-5.999
Top						
Member 2: (Top Slab)						
Left						
2- 0	-22.454	-39.370	5.907	5.999	12.542	6.617
2- 1	-8.213	-17.892	-1.150	5.999	9.808	4.995
2- 2	6.732	-1.766	-1.150	5.999	7.570	3.741
2- 3	18.182	5.190	-1.150	5.907	5.339	2.494
2- 4	25.190	9.087	-1.150	5.907	3.120	1.214
2- 5	27.544	10.385	-1.150	5.907	0.928	-0.928
2- 6	25.190	9.087	-1.150	5.907	-1.214	-3.120
2- 7	18.191	5.190	-1.150	5.907	-2.494	-5.339
2- 8	6.731	-1.768	-1.150	5.999	-3.741	-7.570
2- 9	-8.212	-17.892	-1.150	5.999	-4.995	-9.807
2-10	-22.454	-39.369	5.907	5.999	-6.617	-12.542
Right						
Member 4: (Bottom Slab)						
Left						
4- 0	-28.000	-45.601	9.346	9.859	13.282	7.723
4- 1	-13.263	-20.703	0.250	9.859	10.639	6.178
4- 2	3.973	-2.256	0.250	9.346	7.996	4.634
4- 3	17.470	5.789	0.250	9.346	5.353	3.089
4- 4	25.569	10.616	0.250	9.346	2.710	1.545
4- 5	28.236	12.225	0.250	9.346	0.073	-0.073
4- 6	25.570	10.616	0.250	9.346	-1.545	-2.710
4- 7	17.471	5.789	0.250	9.346	-3.089	-5.353
4- 8	3.974	-2.256	0.250	9.346	-4.634	-7.996
4- 9	-13.263	-20.697	0.250	9.859	-6.178	-10.639
4-10	-28.000	-45.597	9.346	9.859	-7.723	-13.281
Right						

---------- Analysis Truck, WA-105 ----------

Vehicle	Axle No.	Weight (k/ft)	Length (ft)	Dist. From Previous (ft)
Truck	1	0.274	10.01	
	2	0.277	6.01	12.00
	3	0.332	10.01	34.00
	4	0.137	10.01	8.00
	5	0.203	6.01	13.00

***Distributed loads may have been intensified due to axle overlap between lanes

Live Load Parameters:

Traffic Direction is Parallel to Main Reinforcement
Distribution Width : 14.04 ft
Impact Factor : 1.14
Truck MPF : 1.20 Tandem MPF : 0.00
Lane Load Distribution Width : 16.38 ft
Lane Load: 0.000 k/ft

Truck Positions That Cause Maximum Results:

Maximum +Moment in Top Slab

Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)
Truck	1	0.274	10.01	58.30
	2	0.277	6.01	46.30
	3	0.332	10.01	12.30

Maximum -Moment in Top Slab

Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)
Truck	1	0.274	10.01	59.21
	2	0.277	6.01	47.21
	3	0.332	10.01	13.21

	4	0.137	10.01	4.30		4	0.137	10.01	5.21
	5	0.203	6.01	-8.70		5	0.203	6.01	-7.79
Maximum +Moment :				6.70 k-ft	Maximum -Moment :				-9.00 k-ft
Corresponding Moment at End :				-8.74 k-ft	Corresponding Moment at Mid :				6.65 k-ft
Coincident Bottom Slab Load :				0.22 k/ft	Coincident Bottom Slab Load :				0.23 k/ft
Maximum +Shear in Top Slab					Maximum -Shear in Top Slab				
Truck	1	0.203	6.01	26.00	Truck	1	0.274	10.01	61.83
	2	0.137	10.01	13.00		2	0.277	6.01	49.83
	3	0.332	10.01	5.00		3	0.332	10.01	15.83
	4	0.277	6.01	-29.00		4	0.137	10.01	7.83
	5	0.274	10.01	-41.00		5	0.203	6.01	-5.17
Maximum +Shear :				3.09 k	Maximum -Shear :				-3.09 k
Corresponding Shear at Mid :				-0.57 k	Corresponding Shear at Mid :				0.57 k
Coincident Bottom Slab Load :				0.23 k/ft	Coincident Bottom Slab Load :				0.23 k/ft

Unfactored Moments and Shears due to Truck Loads: (k-ft, k)

	Truck				Tandem				Lane			
M-PT	Mll+	Mll-	Vll+	Vll-	Mll+	Mll-	Vll+	Vll-	Mll+	Mll-	Vll+	Vll-
Member 1: (Exterior Wall)												
Bottom												
1- 0	0.00	-7.49	0.18	-0.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 1	0.00	-7.56	0.18	-0.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 2	0.00	-7.63	0.18	-0.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 3	0.00	-7.76	0.18	-0.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 4	0.00	-7.92	0.18	-0.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 5	0.00	-8.08	0.18	-0.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 6	0.00	-8.26	0.18	-0.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 7	0.00	-8.44	0.18	-0.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 8	0.00	-8.63	0.18	-0.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 9	0.00	-8.81	0.18	-0.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-10	0.01	-9.00	0.18	-0.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Top												
Member 2: (Top Slab)												
Left												
2- 0	0.01	-9.00	3.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 1	0.79	-4.52	2.60	-0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 2	2.49	-1.43	2.11	-0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 3	4.64	0.00	1.64	-0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 4	6.21	0.00	1.20	-0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 5	6.70	0.00	0.82	-0.82	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 6	6.21	0.00	0.50	-1.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 7	4.64	-0.01	0.27	-1.64	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 8	2.49	-1.43	0.12	-2.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 9	0.79	-4.52	0.03	-2.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-10	0.01	-9.00	0.00	-3.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Right												
Member 4: (Bottom Slab)												
Left												
4- 0	0.00	-7.49	2.39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 1	0.00	-3.00	1.92	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 2	1.12	-0.08	1.45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 3	3.48	0.00	0.98	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 4	4.88	0.00	0.51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 5	5.33	0.00	0.07	-0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 6	4.88	0.00	0.00	-0.51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 7	3.48	0.00	0.00	-0.98	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 8	1.12	-0.08	0.00	-1.45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 9	0.00	-3.00	0.00	-1.92	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4-10	0.00	-7.49	0.00	-2.39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Right												

Note: Unfactored live load results computed at 4.50 ft and 0 ft fill depths, per LRFD 3.6.1.2.6

Serviceability Check: Crack Control

Bar Mark	Location	Moment (k-ft)	Thrust (k)	Fss (ksi)	Spacing (in)	Allow (in)
A1	Top Corner Bar	-31.1	10.44	34.85	5.00	8.88
A2	Bot Corner Bar	-34.1	10.44	38.62*	5.00	7.53
A100	Top Slab (int)	23.0	-1.30	29.33	5.00	11.47
A200	Bot Slab (int)	23.9	-0.42	30.04	5.00	11.08
B2	Ext Wall (ext)	-33.7	10.44	38.18	5.00	7.68

Strength Limit State at Critical Sections: Flexure

Member 1: (Exterior Wall), 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
BOT	24.00	-46.40	14.87	48.35	7.56	52.27	1.00	1.44	14.31	1.45	1.45
MID	59.00	0.00	6.62	26.97	7.69	29.21	1.00	0.74	14.31	NC	NC
MID-	59.00	-45.61	14.87	48.35	7.56	52.27	1.00	1.44	14.31	1.54	1.54
TOP	24.00	-43.38	14.87	48.35	7.56	52.27	1.00	1.44	14.31	1.51	1.51

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
LT	24.00	-22.14	6.09	48.35	7.56	50.00	1.00	1.44	14.31	3.74	3.74
MID	125.00	32.40	-1.17	48.35	7.56	48.03	1.00	1.44	14.31	2.13	2.13
MID-	125.00	0.49	5.91	13.89	7.69	16.11	1.00	0.37	14.31	NC	NC
RT	24.00	-22.14	6.09	48.35	7.56	50.00	1.00	1.44	14.31	3.74	3.74

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
LT	24.00	-23.90	9.88	48.35	7.56	50.99	1.00	1.44	14.31	4.86	4.86
MID	125.00	32.76	0.16	48.35	7.56	48.39	1.00	1.44	14.31	2.46	2.46
MID-	125.00	0.78	9.35	13.89	7.69	17.37	1.00	0.37	14.31	NC	NC
RT	24.00	-23.90	9.88	48.35	7.56	50.99	1.00	1.44	14.31	4.86	4.86

Notes: Mu - Resisting moment under pure flexure, Ma - Allowable moment under applied axial load

Strength Limit State at Critical Sections: 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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
BOT	12.20	7.66	46.7	14.87	7.20	10.99	2.000	45.00	12.21 b	0.00	0.00	0.00	4.47	4.47
MID	59.00	1.16	6.4	6.62	7.25	18.76	3.390	32.23	20.84 a	0.00	0.00	0.00	48.49	48.49
MID-	59.00	0.20	45.1	14.87	7.20	11.01	2.004	39.17	12.24 a	0.00	0.00	0.00	22.32	22.32
TOP	12.20	-5.16	42.8	14.87	7.20	11.07	2.014	39.10	12.30 a	0.00	0.00	0.00	4.63	4.63

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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
LT	12.20	13.33	34.0	6.09	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.57	1.57
MID	125.00	1.43	32.4	-1.17	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	10.60	10.60
MID-	125.00	1.43	10.4	5.91	7.69	17.60	n/a	n/a	19.56 c	0.00	0.00	0.00	10.78	10.78
RT	12.20	13.33	34.0	6.09	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.57	1.57

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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
LT	12.20	13.72	37.4	9.88	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.71	1.71
MID	125.00	0.12	32.8	0.16	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	NC	NC
MID-	125.00	0.12	0.0	9.35	7.69	23.39	5.081	27.84	25.99 a	0.00	0.00	0.00	NC	NC
RT	12.20	13.72	37.4	9.88	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.71	1.71

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

Load Combination Results at Tenth Points: (k-ft, k)(Fill Depth = 4.50 ft)

M-PT	+Moment	-Moment	+Axial	-Axial	+Shear	-Shear
Member 1: (Exterior Wall)						
Bottom						
1- 0	-28.000	-51.266	6.617	14.871	9.880	0.157
1- 1	-19.874	-46.748	6.617	14.871	7.730	0.004
1- 2	-13.786	-46.413	6.617	14.871	5.719	0.146
1- 3	-9.615	-46.042	6.617	14.871	3.847	0.268
1- 4	-7.208	-45.607	6.617	14.871	2.114	0.368
1- 5	-6.437	-45.107	6.617	14.871	1.165	-0.198
1- 6	-7.167	-44.556	6.617	14.871	1.223	-1.654
1- 7	-9.260	-43.965	6.617	14.871	1.260	-2.972
1- 8	-12.588	-43.352	6.617	14.871	1.275	-4.150
1- 9	-17.000	-42.738	6.617	14.871	1.270	-5.191
1-10	-22.374	-46.169	6.617	14.871	1.171	-6.092
Top						
Member 2: (Top Slab)						
Left						
2- 0	-22.454	-46.249	5.907	6.092	14.871	6.617
2- 1	-7.747	-21.135	-1.171	6.092	11.712	4.995
2- 2	8.269	-2.688	-1.171	6.092	9.051	3.741
2- 3	21.338	5.190	-1.171	5.907	6.440	2.494
2- 4	29.672	9.087	-1.171	5.907	3.894	0.920
2- 5	32.398	10.385	-1.171	5.907	1.429	-1.429
2- 6	29.675	9.087	-1.171	5.907	-0.920	-3.894
2- 7	21.338	5.190	-1.171	5.907	-2.494	-6.440
2- 8	8.277	-2.688	-1.171	6.092	-3.741	-9.051
2- 9	-7.747	-21.135	-1.171	6.092	-4.995	-11.711
2-10	-22.454	-46.249	5.907	6.092	-6.617	-14.871
Right						
Member 4: (Bottom Slab)						
Left						
4- 0	-28.000	-51.266	9.346	9.880	15.193	7.723
4- 1	-13.263	-22.762	0.157	9.880	12.170	6.178
4- 2	4.756	-2.256	0.157	9.346	9.147	4.634
4- 3	20.343	5.789	0.157	9.346	6.124	3.089
4- 4	29.683	10.616	0.157	9.346	3.101	1.545
4- 5	32.755	12.225	0.157	9.346	0.117	-0.116
4- 6	29.683	10.616	0.157	9.346	-1.545	-3.101
4- 7	20.348	5.789	0.157	9.346	-3.089	-6.124
4- 8	4.756	-2.256	0.157	9.346	-4.634	-9.147
4- 9	-13.263	-22.762	0.157	9.880	-6.178	-12.170
4-10	-28.000	-51.266	9.346	9.880	-7.723	-15.193
Right						

Analysis Results: Fill Depth = 5.00 ft

Load Parameters:

Fe = 1.00 Surcharge Depth : 2.43 ft

Applied Horizontal Loads: (k/ft)

Load Description	Bottom of Wall	Top of Wall
Live Load Surcharge	0.146	0.146
Internal Water Pressure	-0.749(5.0in)	-0.187(-5.0in)
External Water Pressure	0.801(0.0in)	0.187(0.0in)
Horizontal Earth Load	0.915	0.325

Applied Uniform Bottom Slab Loads: (k/ft)

Load Description	
Dead Load	0.284
Vertical Earth	0.600
Wearing Surface	0.000

	Unfactored Moments due to All Loads: (k-ft)							Unfactored Shears due to All Loads: (k)						
M-PT	Mdc	Mev	Mdw	Meh	Mls	Mwa	Mgw	Vdc	Vev	Vdw	Veh	Vls	Vwa	Vgw
Member 1: (Exterior Wall)														
Bottom														
1- 0	-9.58	-18.90	0.00	-1.63	-0.38	1.23	-1.30	0.61	0.00	0.00	3.54	0.72	-2.50	2.94
1- 1	-8.97	-18.90	0.00	1.42	0.26	-1.11	1.21	0.61	0.00	0.00	2.67	0.57	-2.08	2.18
1- 2	-8.37	-18.90	0.00	3.64	0.75	-2.83	3.01	0.61	0.00	0.00	1.85	0.43	-1.41	1.48
1- 3	-7.77	-18.90	0.00	5.09	1.11	-3.91	4.15	0.61	0.00	0.00	1.10	0.29	-0.80	0.85
1- 4	-7.17	-18.90	0.00	5.83	1.32	-4.43	4.70	0.61	0.00	0.00	0.40	0.14	-0.25	0.27
1- 5	-6.57	-18.90	0.00	5.91	1.39	-4.43	4.71	0.61	0.00	0.00	-0.24	0.00	0.24	-0.25
1- 6	-5.97	-18.90	0.00	5.39	1.32	-3.99	4.25	0.61	0.00	0.00	-0.82	-0.14	0.67	-0.70
1- 7	-5.36	-18.90	0.00	4.33	1.11	-3.15	3.36	0.61	0.00	0.00	-1.34	-0.29	1.04	-1.10
1- 8	-4.76	-18.90	0.00	2.78	0.75	-1.97	2.12	0.61	0.00	0.00	-1.80	-0.43	1.35	-1.43
1- 9	-4.16	-18.90	0.00	0.81	0.26	-0.52	0.57	0.61	0.00	0.00	-2.21	-0.57	1.60	-1.71
1-10	-3.56	-18.90	0.00	-1.54	-0.38	1.14	-1.21	0.61	0.00	0.00	-2.56	-0.72	1.71	-1.92
Top														
Member 2: (Top Slab)														
Left														
2- 0	-3.56	-18.90	0.00	-1.57	-0.38	1.17	-1.25	1.73	6.25	0.00	0.00	0.00	0.00	0.00
2- 1	-0.71	-7.18	0.00	-1.57	-0.38	1.17	-1.25	1.05	5.00	0.00	0.00	0.00	0.00	0.00
2- 2	1.19	1.93	0.00	-1.57	-0.38	1.17	-1.25	0.78	3.75	0.00	0.00	0.00	0.00	0.00
2- 3	2.55	8.44	0.00	-1.57	-0.38	1.17	-1.25	0.52	2.50	0.00	0.00	0.00	0.00	0.00
2- 4	3.36	12.35	0.00	-1.57	-0.38	1.17	-1.25	0.26	1.25	0.00	0.00	0.00	0.00	0.00
2- 5	3.63	13.65	0.00	-1.57	-0.38	1.17	-1.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 6	3.36	12.35	0.00	-1.57	-0.38	1.17	-1.25	-0.26	-1.25	0.00	0.00	0.00	0.00	0.00
2- 7	2.55	8.44	0.00	-1.57	-0.38	1.17	-1.25	-0.52	-2.50	0.00	0.00	0.00	0.00	0.00
2- 8	1.19	1.93	0.00	-1.57	-0.38	1.17	-1.25	-0.78	-3.75	0.00	0.00	0.00	0.00	0.00
2- 9	-0.71	-7.18	0.00	-1.57	-0.38	1.17	-1.25	-1.05	-5.00	0.00	0.00	0.00	0.00	0.00
2-10	-3.56	-18.90	0.00	-1.57	-0.38	1.17	-1.25	-1.73	-6.25	0.00	0.00	0.00	0.00	0.00
Right														
Member 4: (Bottom Slab)														
Left														
4- 0	-9.58	-18.90	0.00	-1.63	-0.38	1.23	-1.30	2.96	6.25	0.00	0.00	0.00	0.00	0.00
4- 1	-4.03	-7.18	0.00	-1.63	-0.38	1.23	-1.30	2.37	5.00	0.00	0.00	0.00	0.00	0.00
4- 2	0.28	1.93	0.00	-1.63	-0.38	1.23	-1.30	1.77	3.75	0.00	0.00	0.00	0.00	0.00
4- 3	3.36	8.44	0.00	-1.63	-0.38	1.23	-1.30	1.18	2.50	0.00	0.00	0.00	0.00	0.00
4- 4	5.20	12.35	0.00	-1.63	-0.38	1.23	-1.30	0.59	1.25	0.00	0.00	0.00	0.00	0.00
4- 5	5.82	13.65	0.00	-1.63	-0.38	1.23	-1.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 6	5.20	12.35	0.00	-1.63	-0.38	1.23	-1.30	-0.59	-1.25	0.00	0.00	0.00	0.00	0.00
4- 7	3.36	8.44	0.00	-1.63	-0.38	1.23	-1.30	-1.18	-2.50	0.00	0.00	0.00	0.00	0.00
4- 8	0.28	1.93	0.00	-1.63	-0.38	1.23	-1.30	-1.77	-3.75	0.00	0.00	0.00	0.00	0.00
4- 9	-4.03	-7.18	0.00	-1.63	-0.38	1.23	-1.30	-2.37	-5.00	0.00	0.00	0.00	0.00	0.00
4-10	-9.58	-18.90	0.00	-1.63	-0.38	1.23	-1.30	-2.96	-6.25	0.00	0.00	0.00	0.00	0.00
Right														

Unfactored Thrusts due to All Loads: (k) (Fill Depth = 5.00 ft)

Member	Pdc	Pev	Pdw	Peh	Pls	Pwa
1	1.73	6.25	0.00	0.00	0.00	0.00
2	-0.61	0.00	0.00	2.56	0.72	-1.71
4	0.61	0.00	0.00	3.54	0.72	-2.50

Analysis Truck, HL-93

Vehicle	Axle No.	Weight (k/ft)	Length (ft)	Dist. From Previous (ft)
Truck	1	0.112	6.58	
	2	0.448	6.58	14.00
	3	0.448	6.58	14.00

Tandem 1 0.436 10.58

***Distributed loads may have been intensified due to axle overlap between lanes

Live Load Parameters:

Traffic Direction is Parallel to Main Reinforcement
Distribution Width : 14.62 ft
Impact Factor : 1.12
Truck MPF : 1.20 Tandem MPF : 1.20
Lane Load Distribution Width : 16.95 ft
Lane Load: 0.000 k/ft

Truck Positions That Cause Maximum Results:

Maximum +Moment in Top Slab

Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)
Truck	1	0.112	6.58	24.42
	2	0.448	6.58	10.42
	3	0.448	6.58	-3.58

Maximum +Moment : 6.07 k-ft
Corresponding Moment at End : -6.87 k-ft
Coincident Bottom Slab Load : 0.14 k/ft

Maximum -Moment in Top Slab

Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)
Truck	1	0.112	6.58	35.46
	2	0.448	6.58	21.46
	3	0.448	6.58	7.46

Maximum -Moment : -7.06 k-ft
Corresponding Moment at Mid : 5.14 k-ft
Coincident Bottom Slab Load : 0.20 k/ft

Maximum +Shear in Top Slab

Truck	1	0.112	6.58	31.29
	2	0.448	6.58	17.29
	3	0.448	6.58	3.29

Maximum +Shear : 2.99 k
Corresponding Shear at Mid : 0.03 k
Coincident Bottom Slab Load : 0.28 k/ft

Maximum -Shear in Top Slab

Truck	1	0.112	6.58	31.54
	2	0.448	6.58	17.54
	3	0.448	6.58	3.54

Maximum -Shear : -2.99 k
Corresponding Shear at Mid : -0.03 k
Coincident Bottom Slab Load : 0.28 k/ft

Maximum +Moment in Top Slab

Tandem	1	0.436	10.58	10.42

Maximum +Moment : 7.85 k-ft
Corresponding Moment at End : -10.07 k-ft
Coincident Bottom Slab Load : 0.22 k/ft

Maximum -Moment in Top Slab

Tandem	1	0.436	10.58	9.38

Maximum -Moment : -10.21 k-ft
Corresponding Moment at Mid : 7.74 k-ft
Coincident Bottom Slab Load : 0.22 k/ft

Maximum +Shear in Top Slab

Tandem	1	0.436	10.58	5.29

Maximum +Shear : 3.52 k
Corresponding Shear at Mid : -1.02 k
Coincident Bottom Slab Load : 0.22 k/ft

Maximum -Shear in Top Slab

Tandem	1	0.436	10.58	15.54

Maximum -Shear : -3.52 k
Corresponding Shear at Mid : 1.02 k
Coincident Bottom Slab Load : 0.22 k/ft

Unfactored Moments and Shears due to Truck Loads: (k-ft, k)

	Truck				Tandem				Lane			
M-PT	Mll+	Mll-	Vll+	Vll-	Mll+	Mll-	Vll+	Vll-	Mll+	Mll-	Vll+	Vll-
Member 1: (Exterior Wall)												
Bottom												
1- 0	0.00	-9.24	0.28	-0.27	0.00	-7.83	0.18	-0.35	0.00	0.00	0.00	0.00
1- 1	0.00	-8.97	0.28	-0.27	0.00	-7.84	0.18	-0.35	0.00	0.00	0.00	0.00
1- 2	0.00	-8.70	0.28	-0.27	0.00	-7.92	0.18	-0.35	0.00	0.00	0.00	0.00
1- 3	0.00	-8.42	0.28	-0.27	0.00	-8.11	0.18	-0.35	0.00	0.00	0.00	0.00
1- 4	0.00	-8.15	0.28	-0.27	0.00	-8.34	0.18	-0.35	0.00	0.00	0.00	0.00
1- 5	0.00	-7.88	0.28	-0.27	0.00	-8.63	0.18	-0.35	0.00	0.00	0.00	0.00
1- 6	0.00	-7.60	0.28	-0.27	0.00	-8.92	0.18	-0.35	0.00	0.00	0.00	0.00
1- 7	0.00	-7.35	0.28	-0.27	0.00	-9.22	0.18	-0.35	0.00	0.00	0.00	0.00
1- 8	0.00	-7.17	0.28	-0.27	0.00	-9.55	0.18	-0.35	0.00	0.00	0.00	0.00
1- 9	0.00	-7.07	0.28	-0.27	0.00	-9.88	0.18	-0.35	0.00	0.00	0.00	0.00
1-10	0.02	-7.06	0.28	-0.27	0.01	-10.21	0.18	-0.35	0.00	0.00	0.00	0.00
Top												
Member 2: (Top Slab)												
Left												
2- 0	0.02	-7.06	2.99	0.00	0.01	-10.21	3.52	0.00	0.00	0.00	0.00	0.00
2- 1	1.06	-3.85	2.47	-0.04	1.03	-5.40	3.05	-0.04	0.00	0.00	0.00	0.00
2- 2	3.02	-1.49	2.01	-0.16	3.15	-1.79	2.54	-0.15	0.00	0.00	0.00	0.00
2- 3	4.73	0.00	1.62	-0.36	5.69	0.00	2.03	-0.35	0.00	0.00	0.00	0.00
2- 4	5.88	0.00	1.28	-0.64	7.30	0.00	1.53	-0.65	0.00	0.00	0.00	0.00
2- 5	6.07	0.00	0.95	-0.95	7.85	0.00	1.05	-1.05	0.00	0.00	0.00	0.00
2- 6	5.87	0.00	0.64	-1.28	7.30	0.00	0.65	-1.53	0.00	0.00	0.00	0.00
2- 7	4.73	0.00	0.36	-1.62	5.70	0.00	0.35	-2.03	0.00	0.00	0.00	0.00
2- 8	3.03	-1.49	0.16	-2.01	3.15	-1.80	0.15	-2.54	0.00	0.00	0.00	0.00
2- 9	1.06	-3.85	0.04	-2.47	1.03	-5.40	0.04	-3.05	0.00	0.00	0.00	0.00

2-10	0.01	-7.06	0.00	-2.99	0.01	-10.21	0.00	-3.52	0.00	0.00	0.00	0.00
Right												

Member 4: (Bottom Slab)

Left												
4- 0	0.00	-9.24	2.95	0.00	0.00	-7.83	2.39	0.00	0.00	0.00	0.00	0.00
4- 1	0.00	-3.70	2.36	0.00	0.00	-3.33	1.93	0.00	0.00	0.00	0.00	0.00
4- 2	1.01	-0.11	1.77	0.00	1.37	-0.10	1.47	0.00	0.00	0.00	0.00	0.00
4- 3	3.71	0.00	1.18	0.00	3.63	0.00	1.01	0.00	0.00	0.00	0.00	0.00
4- 4	5.55	0.00	0.59	0.00	4.97	0.00	0.54	0.00	0.00	0.00	0.00	0.00
4- 5	6.16	0.00	0.07	-0.07	5.41	0.00	0.08	-0.08	0.00	0.00	0.00	0.00
4- 6	5.55	0.00	0.00	-0.59	4.97	0.00	0.00	-0.54	0.00	0.00	0.00	0.00
4- 7	3.71	0.00	0.00	-1.18	3.63	0.00	0.00	-1.01	0.00	0.00	0.00	0.00
4- 8	1.01	-0.11	0.00	-1.77	1.37	-0.10	0.00	-1.47	0.00	0.00	0.00	0.00
4- 9	0.00	-3.70	0.00	-2.36	0.00	-3.33	0.00	-1.93	0.00	0.00	0.00	0.00
4-10	0.00	-9.24	0.00	-2.95	0.00	-7.83	0.00	-2.39	0.00	0.00	0.00	0.00
Right												

Note: Unfactored live load results computed at 5.00 ft and 0 ft fill depths, per LRFD 3.6.1.2.6

Serviceability Check: Crack Control

Bar Mark	Location	Moment (k-ft)	Thrust (k)	Fss (ksi)	Spacing (in)	Allow (in)
A1	Top Corner Bar	-33.8	11.50	37.86*	5.00	7.78
A2	Bot Corner Bar	-37.0	11.50	41.79*	5.00	6.59
A100	Top Slab (int)	25.5	-1.33	32.44	5.00	9.90
A200	Bot Slab (int)	26.0	-0.47	32.76	5.00	9.75
B2	Ext Wall (ext)	-35.9	11.50	40.50	5.00	6.96

Strength Limit State at Critical Sections: Flexure

Member 1: (Exterior Wall), 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
BOT	24.00	-50.59	16.45	48.35	7.56	52.66	1.00	1.44	14.31	1.33	1.72
MID	59.00	0.00	7.18	26.97	7.69	29.40	1.00	0.74	14.31	NC	NC
MID-	59.00	-48.63	16.45	48.35	7.56	52.66	1.00	1.44	14.31	1.53	1.98
TOP	24.00	-47.35	16.45	48.35	7.56	52.66	1.00	1.44	14.31	1.44	1.87

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
LT	24.00	-24.80	6.48	48.35	7.56	50.10	1.00	1.44	14.31	3.54	4.59
MID	125.00	36.14	-1.24	48.35	7.56	48.01	1.00	1.44	14.31	1.95	2.53
MID-	125.00	0.51	6.08	13.89	7.69	16.17	1.00	0.37	14.31	NC	NC
RT	24.00	-24.80	6.48	48.35	7.56	50.10	1.00	1.44	14.31	3.54	4.59

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
LT	24.00	-26.30	10.22	48.35	7.56	51.08	1.00	1.44	14.31	4.47	5.79
MID	125.00	35.93	0.04	48.35	7.56	48.36	1.00	1.44	14.31	2.27	2.94
MID-	125.00	0.79	9.52	13.89	7.69	17.44	1.00	0.37	14.31	NC	NC
RT	24.00	-26.30	10.22	48.35	7.56	51.08	1.00	1.44	14.31	4.47	5.79

Notes: Mu - Resisting moment under pure flexure, Ma - Allowable moment under applied axial load

Strength Limit State at Critical Sections: 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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
BOT	12.20	7.97	51.6	16.45	7.20	10.99	2.000	45.00	12.21 b	0.00	0.00	0.00	4.49	5.82
MID	59.00	1.33	7.8	7.18	7.25	17.38	3.142	33.14	19.31 a	0.00	0.00	0.00	33.47	43.38
MID-	59.00	0.42	48.3	16.45	7.20	10.99	2.000	45.00	12.21 b	0.00	0.00	0.00	16.46	21.33
TOP	12.20	-5.51	47.0	16.45	7.20	10.99	2.000	45.00	12.21 b	0.00	0.00	0.00	4.50	5.83

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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
LT	12.20	14.84	37.6	6.48	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.43	1.85
MID	125.00	1.84	36.1	-1.24	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	9.40	12.19
MID-	125.00	1.84	11.5	6.08	7.69	17.60	n/a	n/a	19.56 c	0.00	0.00	0.00	9.56	12.39
RT	12.20	14.84	37.6	6.48	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.43	1.85

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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
LT	12.20	15.33	41.3	10.22	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.42	1.85
MID	125.00	0.15	35.9	0.04	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	NC	NC
MID-	125.00	0.15	0.0	9.52	7.69	23.39	5.081	27.84	25.99 a	0.00	0.00	0.00	NC	NC
RT	12.20	15.33	41.3	10.22	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.42	1.85

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

Filename: Bothell Culvert Analysis 043025.etcx

Load Combination Results at Tenth Points: (k-ft, k)(Fill Depth = 5.00 ft)

M-PT	+Moment	-Moment	+Axial	-Axial	+Shear	-Shear
Member 1: (Exterior Wall)						
Bottom						
1- 0	-29.792	-56.881	7.179	16.451	10.221	0.039
1- 1	-21.513	-51.640	7.179	16.451	8.037	-0.134
1- 2	-15.305	-50.627	7.179	16.451	5.992	-0.012
1- 3	-11.049	-49.502	7.179	16.451	4.085	0.090
1- 4	-8.591	-48.628	7.179	16.451	2.317	0.170
1- 5	-7.803	-48.325	7.179	16.451	1.333	-0.416
1- 6	-8.549	-47.988	7.179	16.451	1.371	-1.907
1- 7	-10.694	-47.638	7.179	16.451	1.388	-3.259
1- 8	-14.108	-47.330	7.179	16.451	1.384	-4.472
1- 9	-18.638	-47.038	7.179	16.451	1.358	-5.547
1-10	-24.166	-50.846	7.179	16.451	1.239	-6.483
Top						
Member 2: (Top Slab)						
Left						
2- 0	-24.246	-50.926	6.081	6.483	16.451	7.179
2- 1	-8.251	-23.711	-1.239	6.483	13.144	5.445
2- 2	9.629	-3.167	-1.239	6.483	10.301	4.078
2- 3	24.233	5.859	-1.239	6.081	7.452	2.719
2- 4	33.136	10.107	-1.239	6.081	4.623	0.812
2- 5	36.138	11.523	-1.239	6.081	1.841	-1.841
2- 6	33.136	10.107	-1.239	6.081	-0.812	-4.623
2- 7	24.251	5.859	-1.239	6.081	-2.719	-7.452
2- 8	9.629	-3.172	-1.239	6.483	-4.078	-10.301
2- 9	-8.251	-23.711	-1.239	6.483	-5.445	-13.144
2-10	-24.246	-50.926	6.081	6.483	-7.179	-16.451
Right						
Member 4: (Bottom Slab)						
Left						
4- 0	-29.792	-56.881	9.520	10.221	16.991	8.286
4- 1	-14.248	-25.021	0.039	10.221	13.594	6.628
4- 2	5.383	-2.173	0.039	9.520	10.197	4.971
4- 3	21.795	6.458	0.039	9.520	6.799	3.314
4- 4	32.402	11.636	0.039	9.520	3.402	1.657
4- 5	35.932	13.363	0.039	9.520	0.145	-0.145
4- 6	32.402	11.636	0.039	9.520	-1.657	-3.402
4- 7	21.795	6.458	0.039	9.520	-3.314	-6.799
4- 8	5.387	-2.173	0.039	9.520	-4.971	-10.197
4- 9	-14.248	-25.021	0.039	10.221	-6.628	-13.594
4-10	-29.792	-56.881	9.520	10.221	-8.286	-16.991
Right						

Analysis Truck, NRL

Vehicle	Axle No.	Weight (k/ft)	Length (ft)	Dist. From Previous (ft)
Truck	1	0.112	6.58	
	2	0.139	10.58	6.00
	3	0.296	10.58	8.00
	4	0.139	10.58	8.00
	5	0.084	6.58	8.00

***Distributed loads may have been intensified due to axle overlap between lanes

Live Load Parameters:

Traffic Direction is Parallel to Main Reinforcement
Distribution Width : 14.62 ft
Impact Factor : 1.12
Truck MPF : 1.20 Tandem MPF : 0.00
Lane Load Distribution Width : 16.95 ft
Lane Load: 0.000 k/ft

Truck Positions That Cause Maximum Results:

Maximum +Moment in Top Slab

Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)
Truck	1	0.112	6.58	23.71
	2	0.139	10.58	17.71
	3	0.296	10.58	9.71

Maximum -Moment in Top Slab

Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)
Truck	1	0.112	6.58	25.38
	2	0.139	10.58	19.38
	3	0.296	10.58	11.38

	4	0.139	10.58	1.71		4	0.139	10.58	3.38
	5	0.084	6.58	-6.29		5	0.084	6.58	-4.62

Maximum +Moment : 6.87 k-ft
Corresponding Moment at End : -9.51 k-ft
Coincident Bottom Slab Load : 0.26 k/ft

Maximum -Moment : -9.52 k-ft
Corresponding Moment at Mid : 6.86 k-ft
Coincident Bottom Slab Load : 0.25 k/ft

Maximum +Shear in Top Slab

Truck	1	0.112	6.58	19.29
	2	0.139	10.58	13.29
	3	0.296	10.58	5.29
	4	0.139	10.58	-2.71
	5	0.084	6.58	-10.71

Maximum +Shear : 3.31 k
Corresponding Shear at Mid : -0.48 k
Coincident Bottom Slab Load : 0.26 k/ft

Maximum -Shear in Top Slab

Truck	1	0.112	6.58	29.54
	2	0.139	10.58	23.54
	3	0.296	10.58	15.54
	4	0.139	10.58	7.54
	5	0.084	6.58	-0.46

Maximum -Shear : -3.27 k
Corresponding Shear at Mid : 0.52 k
Coincident Bottom Slab Load : 0.25 k/ft

Unfactored Moments and Shears due to Truck Loads: (k-ft, k)

	Truck				Tandem				Lane			
M-PT	Mll+	Mll-	Vll+	Vll-	Mll+	Mll-	Vll+	Vll-	Mll+	Mll-	Vll+	Vll-
Member 1: (Exterior Wall)												
Bottom												
1- 0	0.00	-8.66	0.09	-0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 1	0.00	-8.70	0.09	-0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 2	0.00	-8.77	0.09	-0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 3	0.00	-8.84	0.09	-0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 4	0.00	-8.91	0.09	-0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 5	0.00	-8.98	0.09	-0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 6	0.00	-9.05	0.09	-0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 7	0.00	-9.14	0.09	-0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 8	0.00	-9.25	0.09	-0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 9	0.00	-9.38	0.09	-0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-10	0.00	-9.51	0.09	-0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Top												
Member 2: (Top Slab)												
Left												
2- 0	0.00	-9.51	3.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 1	0.39	-4.34	2.75	-0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 2	1.81	-0.77	2.18	-0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 3	4.57	0.00	1.63	-0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 4	6.33	0.00	1.08	-0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 5	6.87	0.00	0.55	-0.51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 6	6.29	0.00	0.21	-1.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 7	4.56	0.00	0.11	-1.63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 8	1.98	-0.68	0.05	-2.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 9	0.33	-4.31	0.01	-2.73	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-10	0.00	-9.52	0.00	-3.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Right												
Member 4: (Bottom Slab)												
Left												
4- 0	0.00	-8.66	2.81	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 1	0.00	-3.43	2.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 2	1.11	-0.04	1.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 3	3.83	0.00	1.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 4	5.53	0.00	0.58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 5	6.17	0.00	0.03	-0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 6	5.64	0.00	0.00	-0.56	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 7	3.95	0.00	0.00	-1.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 8	1.10	-0.03	0.00	-1.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 9	0.00	-3.30	0.00	-2.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4-10	0.00	-8.36	0.00	-2.78	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Right												

Note: Unfactored live load results computed at 5.00 ft and 0 ft fill depths, per LRFD 3.6.1.2.6

Serviceability Check: Crack Control

Bar Mark	Location	Moment (k-ft)	Thrust (k)	Fss (ksi)	Spacing (in)	Allow (in)
A1	Top Corner Bar	-33.5	11.28	37.57*	5.00	7.88
A2	Bot Corner Bar	-37.0	11.28	41.98*	5.00	6.54
A100	Top Slab (int)	24.5	-1.13	31.14	5.00	10.52
A200	Bot Slab (int)	26.1	-0.28	32.70	5.00	9.78
B2	Ext Wall (ext)	-36.5	11.28	41.29	5.00	6.73

Strength Limit State at Critical Sections: Flexure

Member 1: (Exterior Wall), 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
BOT	24.00	-50.74	16.07	48.35	7.56	52.57	1.00	1.44	14.31	1.14	1.14
MID	59.00	0.00	7.18	26.97	7.69	29.40	1.00	0.74	14.31	NC	NC
MID-	59.00	-49.62	16.07	48.35	7.56	52.57	1.00	1.44	14.31	1.28	1.28
TOP	24.00	-46.82	16.07	48.35	7.56	52.57	1.00	1.44	14.31	1.29	1.29

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
LT	24.00	-22.96	6.16	48.35	7.56	50.02	1.00	1.44	14.31	3.75	3.75
MID	125.00	34.42	-0.90	48.35	7.56	48.10	1.00	1.44	14.31	1.96	1.96
MID-	125.00	0.51	6.08	13.89	7.69	16.17	1.00	0.37	14.31	NC	NC
RT	24.00	-22.92	6.16	48.35	7.56	50.02	1.00	1.44	14.31	3.77	3.77

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
LT	24.00	-25.80	9.89	48.35	7.56	50.99	1.00	1.44	14.31	4.17	4.17
MID	125.00	35.94	0.36	48.35	7.56	48.45	1.00	1.44	14.31	1.99	1.99
MID-	125.00	0.79	9.52	13.89	7.69	17.44	1.00	0.37	14.31	NC	NC
RT	24.00	-25.55	9.89	48.35	7.56	50.99	1.00	1.44	14.31	4.32	4.32

Notes: Mu - Resisting moment under pure flexure, Ma - Allowable moment under applied axial load

Strength Limit State at Critical Sections: 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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
BOT	12.20	7.63	51.2	16.07	7.20	10.99	2.000	45.00	12.21 b	0.00	0.00	0.00	5.08	5.08
MID	59.00	1.00	7.8	7.18	7.25	17.55	3.172	33.03	19.50 a	0.00	0.00	0.00	95.04	95.04
MID-	59.00	0.09	48.9	16.07	7.20	10.99	2.000	45.00	12.21 b	0.00	0.00	0.00	30.41	30.41
TOP	12.20	-5.19	46.2	16.07	7.20	10.99	2.000	45.00	12.21 b	0.00	0.00	0.00	4.93	4.93

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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
LT	12.20	14.39	36.1	6.16	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.36	1.36
MID	125.00	0.96	34.4	-0.90	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	15.73	15.73
MID-	125.00	0.89	11.5	6.08	7.69	17.60	n/a	n/a	19.56 c	0.00	0.00	0.00	17.31	17.31
RT	12.20	14.34	36.1	6.16	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.37	1.37

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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
LT	12.20	15.12	40.6	9.89	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.31	1.31
MID	125.00	0.06	35.9	0.36	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	NC	NC
MID-	125.00	0.07	0.0	9.52	7.69	23.39	5.083	27.83	25.99 a	0.00	0.00	0.00	NC	NC
RT	12.20	15.05	40.2	9.89	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.33	1.33

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

Load Combination Results at Tenth Points: (k-ft, k)(Fill Depth = 5.00 ft)

M-PT	+Moment	-Moment	+Axial	-Axial	+Shear	-Shear
Member 1: (Exterior Wall)						
Bottom						
1- 0	-29.792	-55.863	7.179	16.068	9.886	0.364
1- 1	-21.513	-51.169	7.179	16.068	7.702	0.190
1- 2	-15.305	-50.753	7.179	16.068	5.656	0.313
1- 3	-11.049	-50.229	7.179	16.068	3.749	0.414
1- 4	-8.591	-49.617	7.179	16.068	1.981	0.495
1- 5	-7.803	-48.937	7.179	16.068	0.998	-0.091
1- 6	-8.549	-48.210	7.179	16.068	1.036	-1.582
1- 7	-10.694	-47.490	7.179	16.068	1.053	-2.934
1- 8	-14.108	-46.797	7.179	16.068	1.048	-4.148
1- 9	-18.638	-46.147	7.179	16.068	1.023	-5.222
1-10	-24.166	-49.619	7.179	16.068	0.904	-6.158
Top						
Member 2: (Top Slab)						
Left						
2- 0	-24.246	-49.699	6.081	6.158	16.068	7.179
2- 1	-9.427	-21.847	-0.904	6.158	12.621	5.445
2- 2	7.279	-1.375	-0.904	6.158	9.674	4.078
2- 3	22.267	5.859	-0.904	6.081	6.754	2.719
2- 4	31.452	10.107	-0.904	6.081	3.844	1.359
2- 5	34.425	11.523	-0.904	6.081	0.963	-0.890
2- 6	31.370	10.107	-0.904	6.081	-1.359	-3.813
2- 7	22.257	5.859	-0.904	6.081	-2.719	-6.751
2- 8	7.574	-1.228	-0.904	6.158	-4.078	-9.672
2- 9	-9.534	-21.799	-0.904	6.158	-5.445	-12.593
2-10	-24.246	-49.711	6.081	6.158	-7.179	-15.999
Right						
Member 4: (Bottom Slab)						
Left						
4- 0	-29.792	-55.863	9.520	9.886	16.746	8.286
4- 1	-14.248	-24.542	0.364	9.886	13.406	6.628
4- 2	4.938	-2.173	0.364	9.520	10.066	4.971
4- 3	22.008	6.458	0.364	9.520	6.726	3.314
4- 4	32.367	11.636	0.364	9.520	3.387	1.657
4- 5	35.942	13.363	0.364	9.520	0.058	-0.070
4- 6	32.558	11.636	0.364	9.520	-1.657	-3.349
4- 7	22.215	6.458	0.364	9.520	-3.314	-6.671
4- 8	4.916	-2.173	0.364	9.520	-4.971	-10.007
4- 9	-14.248	-24.312	0.364	9.886	-6.628	-13.343
4-10	-29.792	-55.336	9.520	9.886	-8.286	-16.679
Right						

---------- Analysis Truck, Type 3 ----------

Vehicle	Axle No.	Weight (k/ft)	Length (ft)	Dist. From Previous (ft)
Truck	1	0.296	10.58	
	2	0.224	6.58	17.00

***Distributed loads may have been intensified due to axle overlap between lanes

Live Load Parameters:

Traffic Direction is Parallel to Main Reinforcement
Distribution Width : 14.62 ft
Impact Factor : 1.12
Truck MPF : 1.20 Tandem MPF : 0.00
Lane Load Distribution Width : 16.95 ft
Lane Load: 0.000 k/ft

Truck Positions That Cause Maximum Results:

Maximum +Moment in Top Slab

Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)
Truck	1	0.296	10.58	10.42
	2	0.224	6.58	-6.58

Maximum +Moment : 5.34 k-ft
Corresponding Moment at End : -6.85 k-ft
Coincident Bottom Slab Load : 0.15 k/ft

Maximum -Moment in Top Slab

Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)
Truck	1	0.296	10.58	9.38
	2	0.224	6.58	-7.62

Maximum -Moment : -6.95 k-ft
Corresponding Moment at Mid : 5.26 k-ft
Coincident Bottom Slab Load : 0.15 k/ft

Maximum +Shear in Top Slab				Maximum -Shear in Top Slab			
Truck 1	0.224	6.58	22.29	Truck 1	0.296	10.58	15.54
2	0.296	10.58	5.29	2	0.224	6.58	-1.46
Maximum +Shear :	2.41 k			Maximum -Shear :	-2.41 k		
Corresponding Shear at Mid :	-0.68 k			Corresponding Shear at Mid :	0.68 k		
Coincident Bottom Slab Load :	0.17 k/ft			Coincident Bottom Slab Load :	0.17 k/ft		

Unfactored Moments and Shears due to Truck Loads: (k-ft, k)

	Truck				Tandem				Lane			
M-PT	Mll+	Mll-	Vll+	Vll-	Mll+	Mll-	Vll+	Vll-	Mll+	Mll-	Vll+	Vll-
Member 1: (Exterior Wall)												
Bottom												
1- 0	0.00	-5.98	0.19	-0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 1	0.00	-5.92	0.19	-0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 2	0.00	-5.87	0.19	-0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 3	0.00	-5.81	0.19	-0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 4	0.00	-5.75	0.19	-0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 5	0.00	-5.87	0.19	-0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 6	0.00	-6.07	0.19	-0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 7	0.00	-6.27	0.19	-0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 8	0.00	-6.50	0.19	-0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 9	0.00	-6.72	0.19	-0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-10	0.01	-6.95	0.19	-0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Top												
Member 2: (Top Slab)												
Left												
2- 0	0.01	-6.95	2.41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 1	0.70	-3.67	2.07	-0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 2	2.14	-1.22	1.73	-0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 3	3.91	0.00	1.38	-0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 4	4.96	0.00	1.04	-0.44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 5	5.34	0.00	0.72	-0.72	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 6	4.96	0.00	0.44	-1.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 7	3.91	0.00	0.24	-1.38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 8	2.14	-1.22	0.10	-1.73	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 9	0.70	-3.67	0.03	-2.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-10	0.01	-6.95	0.00	-2.41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Right												
Member 4: (Bottom Slab)												
Left												
4- 0	0.00	-5.98	1.83	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 1	0.00	-2.54	1.47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 2	0.93	-0.07	1.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 3	2.56	0.00	0.76	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 4	3.56	0.00	0.41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 5	3.82	0.00	0.06	-0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 6	3.56	0.00	0.00	-0.41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 7	2.56	0.00	0.00	-0.76	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 8	0.93	-0.07	0.00	-1.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 9	0.00	-2.54	0.00	-1.47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4-10	0.00	-5.97	0.00	-1.83	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Right												

Note: Unfactored live load results computed at 5.00 ft and 0 ft fill depths, per LRFD 3.6.1.2.6

Serviceability Check: Crack Control

Bar Mark	Location	Moment (k-ft)	Thrust (k)	Fss (ksi)	Spacing (in)	Allow (in)
A1	Top Corner Bar	-30.8	10.39	34.47	5.00	9.03
A2	Bot Corner Bar	-34.1	10.39	38.69*	5.00	7.51
A100	Top Slab (int)	23.0	-1.24	29.26	5.00	11.50
A200	Bot Slab (int)	23.7	-0.36	29.79	5.00	11.22
B2	Ext Wall (ext)	-33.3	10.39	37.69	5.00	7.84

Strength Limit State at Critical Sections: Flexure

Member 1: (Exterior Wall), 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
BOT	24.00	-45.65	14.50	48.35	7.56	52.17	1.00	1.44	14.31	1.68	1.68
MID	59.00	0.00	7.18	26.97	7.69	29.40	1.00	0.74	14.31	NC	NC
MID-	59.00	-44.10	14.50	48.35	7.56	52.17	1.00	1.44	14.31	1.92	1.92
TOP	24.00	-42.00	14.50	48.35	7.56	52.17	1.00	1.44	14.31	1.81	1.81

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
LT	24.00	-21.67	6.29	48.35	7.56	50.05	1.00	1.44	14.31	4.42	4.42
MID	125.00	31.74	-1.08	48.35	7.56	48.05	1.00	1.44	14.31	2.51	2.51
MID-	125.00	0.51	6.08	13.89	7.69	16.17	1.00	0.37	14.31	NC	NC
RT	24.00	-21.67	6.29	48.35	7.56	50.05	1.00	1.44	14.31	4.42	4.42

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
LT	24.00	-24.12	10.07	48.35	7.56	51.04	1.00	1.44	14.31	5.49	5.49
MID	125.00	31.83	0.24	48.35	7.56	48.42	1.00	1.44	14.31	3.21	3.21
MID-	125.00	0.79	9.52	13.89	7.69	17.44	1.00	0.37	14.31	NC	NC
RT	24.00	-24.11	10.07	48.35	7.56	51.04	1.00	1.44	14.31	5.50	5.50

Notes: Mu - Resisting moment under pure flexure, Ma - Allowable moment under applied axial load

Strength Limit State at Critical Sections: 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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
BOT	12.20	7.81	46.3	14.50	7.20	10.99	2.000	45.00	12.21 b	0.00	0.00	0.00	4.39	4.39
MID	59.00	1.18	7.8	7.18	7.25	17.46	3.156	33.09	19.40 a	0.00	0.00	0.00	43.20	43.20
MID-	59.00	0.22	43.5	14.50	7.20	11.17	2.033	38.96	12.41 a	0.00	0.00	0.00	21.56	21.56
TOP	12.20	-5.31	41.5	14.50	7.20	11.18	2.035	38.94	12.42 a	0.00	0.00	0.00	4.61	4.61

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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
LT	12.20	13.01	33.2	6.29	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.83	1.83
MID	125.00	1.25	31.7	-1.08	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	12.10	12.10
MID-	125.00	1.25	11.5	6.08	7.69	17.60	n/a	n/a	19.56 c	0.00	0.00	0.00	12.30	12.30
RT	12.20	13.01	33.2	6.29	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.83	1.83

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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
LT	12.20	13.56	37.4	10.07	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	2.01	2.01
MID	125.00	0.10	31.8	0.24	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	NC	NC
MID-	125.00	0.10	0.0	9.52	7.69	23.39	5.083	27.84	25.99 a	0.00	0.00	0.00	NC	NC
RT	12.20	13.56	37.4	10.07	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	2.01	2.01

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

Load Combination Results at Tenth Points: (k-ft, k)(Fill Depth = 5.00 ft)

M-PT	+Moment	-Moment	+Axial	-Axial	+Shear	-Shear
Member 1: (Exterior Wall)						
Bottom						
1- 0	-29.792	-51.168	7.179	14.504	10.066	0.236
1- 1	-21.513	-46.306	7.179	14.504	7.882	0.063
1- 2	-15.305	-45.673	7.179	14.504	5.836	0.186
1- 3	-11.049	-44.928	7.179	14.504	3.930	0.287
1- 4	-8.591	-44.095	7.179	14.504	2.162	0.368
1- 5	-7.803	-43.492	7.179	14.504	1.178	-0.219
1- 6	-8.549	-42.991	7.179	14.504	1.216	-1.709
1- 7	-10.694	-42.473	7.179	14.504	1.233	-3.062
1- 8	-14.108	-41.980	7.179	14.504	1.228	-4.275
1- 9	-18.638	-41.503	7.179	14.504	1.203	-5.350
1-10	-24.166	-45.126	7.179	14.504	1.084	-6.286
Top						
Member 2: (Top Slab)						
Left						
2- 0	-24.246	-45.206	6.081	6.286	14.504	7.179
2- 1	-8.882	-20.685	-1.084	6.286	11.438	5.445
2- 2	7.864	-2.163	-1.084	6.286	8.877	4.078
2- 3	21.109	5.859	-1.084	6.081	6.316	2.719
2- 4	29.050	10.107	-1.084	6.081	3.768	1.176
2- 5	31.741	11.523	-1.084	6.081	1.252	-1.252
2- 6	29.050	10.107	-1.084	6.081	-1.176	-3.768
2- 7	21.119	5.859	-1.084	6.081	-2.719	-6.316
2- 8	7.864	-2.167	-1.084	6.286	-4.078	-8.877
2- 9	-8.882	-20.685	-1.084	6.286	-5.445	-11.438
2-10	-24.246	-45.206	6.081	6.286	-7.179	-14.503
Right						
Member 4: (Bottom Slab)						
Left						
4- 0	-29.792	-51.168	9.520	10.066	15.018	8.286
4- 1	-14.248	-22.989	0.236	10.066	12.033	6.628
4- 2	4.617	-2.173	0.236	9.520	9.048	4.971
4- 3	19.779	6.458	0.236	9.520	6.063	3.314
4- 4	28.914	11.636	0.236	9.520	3.078	1.657
4- 5	31.830	13.363	0.236	9.520	0.099	-0.099
4- 6	28.914	11.636	0.236	9.520	-1.657	-3.078
4- 7	19.781	6.458	0.236	9.520	-3.314	-6.063
4- 8	4.620	-2.173	0.236	9.520	-4.971	-9.047
4- 9	-14.248	-22.983	0.236	10.066	-6.628	-12.032
4-10	-29.792	-51.159	9.520	10.066	-8.286	-15.017
Right						

---------- Analysis Truck, Type 3S2 ----------

Vehicle	Axle No.	Weight (k/ft)	Length (ft)	Dist. From Previous (ft)
Truck	1	0.270	10.58	
	2	0.270	10.58	26.00
	3	0.140	6.58	13.00

***Distributed loads may have been intensified due to axle overlap between lanes

Live Load Parameters:

Traffic Direction is Parallel to Main Reinforcement
Distribution Width : 14.62 ft
Impact Factor : 1.12
Truck MPF : 1.20 Tandem MPF : 0.00
Lane Load Distribution Width : 16.95 ft
Lane Load: 0.000 k/ft

Truck Positions That Cause Maximum Results:

Maximum +Moment in Top Slab

Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)
Truck	1	0.140	6.58	23.08
	2	0.270	10.58	10.08
	3	0.270	10.58	-15.92

Maximum +Moment : 4.90 k-ft
Corresponding Moment at End : -6.29 k-ft

Maximum -Moment in Top Slab

Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)
Truck	1	0.270	10.58	37.79
	2	0.270	10.58	11.79
	3	0.140	6.58	-1.21

Maximum -Moment : -6.37 k-ft
Corresponding Moment at Mid : 4.83 k-ft

Coincident Bottom Slab Load : 0.14 k/ft

Maximum +Shear in Top Slab

Truck			
1	0.140	6.58	18.29
2	0.270	10.58	5.29
3	0.270	10.58	-20.71

Maximum +Shear : 2.28 k
Corresponding Shear at Mid : -0.53 k
Coincident Bottom Slab Load : 0.18 k/ft

Coincident Bottom Slab Load : 0.15 k/ft

Maximum -Shear in Top Slab

Truck			
1	0.270	10.58	41.54
2	0.270	10.58	15.54
3	0.140	6.58	2.54

Maximum -Shear : -2.28 k
Corresponding Shear at Mid : 0.53 k
Coincident Bottom Slab Load : 0.18 k/ft

Unfactored Moments and Shears due to Truck Loads: (k-ft, k)

	Truck				Tandem				Lane			
M-PT	Mll+	Mll-	Vll+	Vll-	Mll+	Mll-	Vll+	Vll-	Mll+	Mll-	Vll+	Vll-
Member 1: (Exterior Wall)												
Bottom												
1- 0	0.00	-5.97	0.19	-0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 1	0.00	-5.93	0.19	-0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 2	0.00	-5.88	0.19	-0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 3	0.00	-5.83	0.19	-0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 4	0.00	-5.80	0.19	-0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 5	0.00	-5.82	0.19	-0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 6	0.00	-5.88	0.19	-0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 7	0.00	-5.97	0.19	-0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 8	0.00	-6.09	0.19	-0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 9	0.00	-6.22	0.19	-0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-10	0.01	-6.36	0.19	-0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Top												
Member 2: (Top Slab)												
Left												
2- 0	0.01	-6.36	2.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 1	0.66	-3.35	1.93	-0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 2	1.96	-1.11	1.58	-0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 3	3.55	0.00	1.26	-0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 4	4.61	0.00	0.95	-0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 5	4.90	0.00	0.65	-0.65	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 6	4.61	0.00	0.40	-0.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 7	3.56	0.00	0.22	-1.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 8	1.96	-1.11	0.09	-1.58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 9	0.66	-3.35	0.02	-1.93	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-10	0.01	-6.37	0.00	-2.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Right												
Member 4: (Bottom Slab)												
Left												
4- 0	0.00	-5.97	1.87	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 1	0.00	-2.45	1.51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 2	0.85	-0.07	1.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 3	2.58	0.00	0.77	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 4	3.66	0.00	0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 5	3.97	0.00	0.05	-0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 6	3.66	0.00	0.00	-0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 7	2.58	0.00	0.00	-0.77	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 8	0.85	-0.07	0.00	-1.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 9	0.00	-2.45	0.00	-1.51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4-10	0.00	-5.97	0.00	-1.87	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Right												

Note: Unfactored live load results computed at 5.00 ft and 0 ft fill depths, per LRFD 3.6.1.2.6

Serviceability Check: Crack Control

Bar Mark	Location	Moment (k-ft)	Thrust (k)	Fss (ksi)	Spacing (in)	Allow (in)
A1	Top Corner Bar	-30.4	10.26	34.01	5.00	9.22
A2	Bot Corner Bar	-34.1	10.26	38.75*	5.00	7.49
A100	Top Slab (int)	22.6	-1.24	28.71	5.00	11.82
A200	Bot Slab (int)	23.9	-0.34	29.97	5.00	11.12
B2	Ext Wall (ext)	-33.4	10.26	37.80	5.00	7.81

Strength Limit State at Critical Sections: Flexure

Member 1: (Exterior Wall), 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
BOT	24.00	-45.67	14.28	48.35	7.56	52.12	1.00	1.44	14.31	1.67	1.67
MID	59.00	0.00	7.18	26.97	7.69	29.40	1.00	0.74	14.31	NC	NC
MID-	59.00	-44.18	14.28	48.35	7.56	52.12	1.00	1.44	14.31	1.94	1.94
TOP	24.00	-41.29	14.28	48.35	7.56	52.12	1.00	1.44	14.31	1.93	1.93

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
LT	24.00	-21.08	6.25	48.35	7.56	50.04	1.00	1.44	14.31	4.80	4.80
MID	125.00	30.97	-1.08	48.35	7.56	48.05	1.00	1.44	14.31	2.74	2.74
MID-	125.00	0.51	6.08	13.89	7.69	16.17	1.00	0.37	14.31	NC	NC
RT	24.00	-21.08	6.25	48.35	7.56	50.04	1.00	1.44	14.31	4.80	4.80

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
LT	24.00	-23.97	10.07	48.35	7.56	51.04	1.00	1.44	14.31	5.65	5.65
MID	125.00	32.09	0.27	48.35	7.56	48.43	1.00	1.44	14.31	3.09	3.09
MID-	125.00	0.79	9.52	13.89	7.69	17.44	1.00	0.37	14.31	NC	NC
RT	24.00	-23.97	10.07	48.35	7.56	51.04	1.00	1.44	14.31	5.65	5.65

Notes: Mu - Resisting moment under pure flexure, Ma - Allowable moment under applied axial load

Strength Limit State at Critical Sections: 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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
BOT	12.20	7.81	46.3	14.28	7.20	10.99	2.000	45.00	12.21 b	0.00	0.00	0.00	4.39	4.39
MID	59.00	1.18	7.8	7.18	7.25	17.46	3.156	33.09	19.40 a	0.00	0.00	0.00	43.06	43.06
MID-	59.00	0.18	43.4	14.28	7.20	11.18	2.034	38.95	12.42 a	0.00	0.00	0.00	23.65	23.65
TOP	12.20	-5.28	40.6	14.28	7.20	11.27	2.050	38.83	12.52 a	0.00	0.00	0.00	4.78	4.78

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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
LT	12.20	12.77	32.4	6.25	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.95	1.95
MID	125.00	1.14	31.0	-1.08	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	13.27	13.27
MID-	125.00	1.14	11.5	6.08	7.69	17.60	n/a	n/a	19.56 c	0.00	0.00	0.00	13.49	13.49
RT	12.20	12.77	32.4	6.25	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.95	1.95

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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
LT	12.20	13.63	37.3	10.07	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.96	1.96
MID	125.00	0.09	32.1	0.27	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	NC	NC
MID-	125.00	0.09	0.0	9.52	7.69	23.39	5.083	27.84	25.99 a	0.00	0.00	0.00	NC	NC
RT	12.20	13.63	37.3	10.07	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.96	1.96

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

Filename: Bothell Culvert Analysis 043025.etcx

Load Combination Results at Tenth Points: (k-ft, k)(Fill Depth = 5.00 ft)

M-PT	+Moment	-Moment	+Axial	-Axial	+Shear	-Shear
Member 1: (Exterior Wall)						
Bottom						
1- 0	-29.792	-51.159	7.179	14.279	10.067	0.273
1- 1	-21.513	-46.313	7.179	14.279	7.883	0.100
1- 2	-15.305	-45.695	7.179	14.279	5.837	0.223
1- 3	-11.049	-44.965	7.179	14.279	3.931	0.324
1- 4	-8.591	-44.175	7.179	14.279	2.163	0.405
1- 5	-7.803	-43.407	7.179	14.279	1.179	-0.182
1- 6	-8.549	-42.664	7.179	14.279	1.217	-1.672
1- 7	-10.694	-41.945	7.179	14.279	1.234	-3.025
1- 8	-14.108	-41.262	7.179	14.279	1.230	-4.238
1- 9	-18.638	-40.622	7.179	14.279	1.204	-5.313
1-10	-24.166	-44.109	7.179	14.279	1.085	-6.249
Top						
Member 2: (Top Slab)						
Left						
2- 0	-24.246	-44.189	6.081	6.249	14.279	7.179
2- 1	-8.958	-20.118	-1.085	6.249	11.187	5.445
2- 2	7.532	-1.975	-1.085	6.249	8.624	4.078
2- 3	20.487	5.859	-1.085	6.081	6.103	2.719
2- 4	28.427	10.107	-1.085	6.081	3.608	1.245
2- 5	30.968	11.523	-1.085	6.081	1.142	-1.142
2- 6	28.427	10.107	-1.085	6.081	-1.245	-3.607
2- 7	20.499	5.859	-1.085	6.081	-2.719	-6.103
2- 8	7.532	-1.978	-1.085	6.249	-4.078	-8.623
2- 9	-8.958	-20.118	-1.085	6.249	-5.445	-11.186
2-10	-24.246	-44.190	6.081	6.249	-7.179	-14.279
Right						
Member 4: (Bottom Slab)						
Left						
4- 0	-29.792	-51.159	9.520	10.067	15.099	8.286
4- 1	-14.248	-22.835	0.273	10.067	12.092	6.628
4- 2	4.473	-2.173	0.273	9.520	9.084	4.971
4- 3	19.816	6.458	0.273	9.520	6.076	3.314
4- 4	29.087	11.636	0.273	9.520	3.069	1.657
4- 5	32.093	13.363	0.273	9.520	0.090	-0.090
4- 6	29.087	11.636	0.273	9.520	-1.657	-3.069
4- 7	19.816	6.458	0.273	9.520	-3.314	-6.076
4- 8	4.476	-2.173	0.273	9.520	-4.971	-9.084
4- 9	-14.248	-22.835	0.273	10.067	-6.628	-12.092
4-10	-29.792	-51.159	9.520	10.067	-8.286	-15.099
Right						

---------- Analysis Truck, Type 3-3 ----------

Vehicle	Axle No.	Weight (k/ft)	Length (ft)	Dist. From Previous (ft)
Truck	1	0.244	10.58	
	2	0.224	6.58	18.00
	3	0.209	10.58	17.00
	4	0.168	6.58	17.00

***Distributed loads may have been intensified due to axle overlap between lanes

Live Load Parameters:

Traffic Direction is Parallel to Main Reinforcement
Distribution Width : 14.62 ft
Impact Factor : 1.12
Truck MPF : 1.20 Tandem MPF : 0.00
Lane Load Distribution Width : 16.95 ft
Lane Load: 0.000 k/ft

Truck Positions That Cause Maximum Results:

Maximum +Moment in Top Slab

Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)
Truck	1	0.244	10.58	10.42
	2	0.224	6.58	-7.58
	3	0.209	10.58	-24.58
	4	0.168	6.58	-41.58

Maximum -Moment in Top Slab

Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)
Truck	1	0.244	10.58	9.38
	2	0.224	6.58	-8.63
	3	0.209	10.58	-25.63
	4	0.168	6.58	-42.63

Maximum +Moment : 4.40 k-ft
Corresponding Moment at End : -5.64 k-ft
Coincident Bottom Slab Load : 0.12 k/ft

Maximum -Moment : -5.72 k-ft
Corresponding Moment at Mid : 4.34 k-ft
Coincident Bottom Slab Load : 0.12 k/ft

Maximum +Shear in Top Slab

Truck	1	0.168	6.58	57.29
	2	0.209	10.58	40.29
	3	0.224	6.58	23.29
	4	0.244	10.58	5.29

Maximum +Shear : 1.98 k
Corresponding Shear at Mid : -0.57 k
Coincident Bottom Slab Load : 0.13 k/ft

Maximum -Shear in Top Slab

Truck	1	0.244	10.58	15.54
	2	0.224	6.58	-2.46
	3	0.209	10.58	-19.46
	4	0.168	6.58	-36.46

Maximum -Shear : -1.98 k
Corresponding Shear at Mid : 0.57 k
Coincident Bottom Slab Load : 0.13 k/ft

Unfactored Moments and Shears due to Truck Loads: (k-ft, k)

	Truck				Tandem				Lane			
M-PT	Mll+	Mll-	Vll+	Vll-	Mll+	Mll-	Vll+	Vll-	Mll+	Mll-	Vll+	Vll-
Member 1: (Exterior Wall)												
Bottom												
1- 0	0.00	-4.70	0.18	-0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 1	0.00	-4.67	0.18	-0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 2	0.00	-4.64	0.18	-0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 3	0.00	-4.61	0.18	-0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 4	0.00	-4.67	0.18	-0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 5	0.00	-4.83	0.18	-0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 6	0.00	-5.00	0.18	-0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 7	0.00	-5.17	0.18	-0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 8	0.00	-5.35	0.18	-0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 9	0.00	-5.54	0.18	-0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-10	0.01	-5.72	0.18	-0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Top												
Member 2: (Top Slab)												
Left												
2- 0	0.01	-5.72	1.98	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 1	0.58	-3.03	1.71	-0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 2	1.77	-1.00	1.42	-0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 3	3.19	0.00	1.14	-0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 4	4.09	0.00	0.86	-0.36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 5	4.40	0.00	0.59	-0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 6	4.09	0.00	0.36	-0.86	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 7	3.19	0.00	0.20	-1.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 8	1.77	-1.01	0.08	-1.42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 9	0.58	-3.03	0.02	-1.71	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-10	0.01	-5.72	0.00	-1.98	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Right												
Member 4: (Bottom Slab)												
Left												
4- 0	0.00	-4.70	1.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 1	0.00	-2.02	1.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 2	0.77	-0.06	0.88	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 3	2.03	0.00	0.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 4	2.80	0.00	0.32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 5	3.03	0.00	0.05	-0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 6	2.80	0.00	0.00	-0.32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 7	2.03	0.00	0.00	-0.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 8	0.77	-0.06	0.00	-0.88	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 9	0.00	-2.02	0.00	-1.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4-10	0.00	-4.70	0.00	-1.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Right												

Note: Unfactored live load results computed at 5.00 ft and 0 ft fill depths, per LRFD 3.6.1.2.6

Serviceability Check: Crack Control

Bar Mark	Location	Moment (k-ft)	Thrust (k)	Fss (ksi)	Spacing (in)	Allow (in)
A1	Top Corner Bar	-29.6	9.95	33.20	5.00	9.56
A2	Bot Corner Bar	-32.9	9.95	37.32*	5.00	7.97
A100	Top Slab (int)	22.1	-1.23	28.08	5.00	12.19
A200	Bot Slab (int)	22.9	-0.31	28.78	5.00	11.78
B2	Ext Wall (ext)	-32.3	9.95	36.51	5.00	8.25

Strength Limit State at Critical Sections: Flexure

Member 1: (Exterior Wall), 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
BOT	24.00	-43.50	13.74	48.35	7.56	51.98	1.00	1.44	14.31	2.10	2.10
MID	59.00	0.00	7.18	26.97	7.69	29.40	1.00	0.74	14.31	NC	NC
MID-	59.00	-42.21	13.74	48.35	7.56	51.98	1.00	1.44	14.31	2.32	2.32
TOP	24.00	-40.00	13.74	48.35	7.56	51.98	1.00	1.44	14.31	2.19	2.19

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
LT	24.00	-20.49	6.21	48.35	7.56	50.03	1.00	1.44	14.31	5.26	5.26
MID	125.00	30.09	-1.07	48.35	7.56	48.06	1.00	1.44	14.31	3.05	3.05
MID-	125.00	0.51	6.08	13.89	7.69	16.17	1.00	0.37	14.31	NC	NC
RT	24.00	-20.49	6.21	48.35	7.56	50.03	1.00	1.44	14.31	5.26	5.26

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
LT	24.00	-23.15	10.05	48.35	7.56	51.04	1.00	1.44	14.31	6.70	6.70
MID	125.00	30.45	0.31	48.35	7.56	48.44	1.00	1.44	14.31	4.05	4.05
MID-	125.00	0.79	9.52	13.89	7.69	17.44	1.00	0.37	14.31	NC	NC
RT	24.00	-23.15	10.05	48.35	7.56	51.04	1.00	1.44	14.31	6.71	6.71

Notes: Mu - Resisting moment under pure flexure, Ma - Allowable moment under applied axial load

Strength Limit State at Critical Sections: 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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
BOT	12.20	7.80	44.1	13.74	7.20	10.99	2.000	45.00	12.21 b	0.00	0.00	0.00	4.45	4.45
MID	59.00	1.16	7.8	7.18	7.25	17.47	3.157	33.08	19.41 a	0.00	0.00	0.00	45.52	45.52
MID-	59.00	0.14	41.7	13.74	7.20	11.34	2.064	38.73	12.60 a	0.00	0.00	0.00	26.61	26.61
TOP	12.20	-5.24	39.4	13.74	7.20	11.39	2.073	38.67	12.66 a	0.00	0.00	0.00	5.00	5.00

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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
LT	12.20	12.31	31.6	6.21	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	2.23	2.23
MID	125.00	1.03	30.1	-1.07	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	14.69	14.69
MID-	125.00	1.03	11.5	6.08	7.69	17.60	n/a	n/a	19.56 c	0.00	0.00	0.00	14.94	14.94
RT	12.20	12.31	31.6	6.21	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	2.23	2.23

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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
LT	12.20	12.93	35.8	10.05	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	2.57	2.57
MID	125.00	0.08	30.4	0.31	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	NC	NC
MID-	125.00	0.08	0.0	9.52	7.69	23.39	5.083	27.84	25.99 a	0.00	0.00	0.00	NC	NC
RT	12.20	12.93	35.8	10.05	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	2.57	2.57

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

Load Combination Results at Tenth Points: (k-ft, k)(Fill Depth = 5.00 ft)

M-PT	+Moment	-Moment	+Axial	-Axial	+Shear	-Shear
Member 1: (Exterior Wall)						
Bottom						
1- 0	-29.792	-48.925	7.179	13.743	10.049	0.310
1- 1	-21.513	-44.108	7.179	13.743	7.865	0.137
1- 2	-15.305	-43.524	7.179	13.743	5.820	0.260
1- 3	-11.049	-42.829	7.179	13.743	3.913	0.361
1- 4	-8.591	-42.203	7.179	13.743	2.145	0.442
1- 5	-7.803	-41.680	7.179	13.743	1.161	-0.145
1- 6	-8.549	-41.117	7.179	13.743	1.199	-1.635
1- 7	-10.694	-40.535	7.179	13.743	1.216	-2.988
1- 8	-14.108	-39.973	7.179	13.743	1.212	-4.201
1- 9	-18.638	-39.427	7.179	13.743	1.186	-5.276
1-10	-24.166	-42.981	7.179	13.743	1.067	-6.212
Top						
Member 2: (Top Slab)						
Left						
2- 0	-24.246	-43.061	6.081	6.212	13.743	7.179
2- 1	-9.099	-19.550	-1.067	6.212	10.798	5.445
2- 2	7.216	-1.787	-1.067	6.212	8.343	4.078
2- 3	19.849	5.859	-1.067	6.081	5.890	2.719
2- 4	27.517	10.107	-1.067	6.081	3.447	1.313
2- 5	30.092	11.523	-1.067	6.081	1.031	-1.031
2- 6	27.517	10.107	-1.067	6.081	-1.313	-3.447
2- 7	19.860	5.859	-1.067	6.081	-2.719	-5.890
2- 8	7.212	-1.790	-1.067	6.212	-4.078	-8.343
2- 9	-9.099	-19.550	-1.067	6.212	-5.445	-10.798
2-10	-24.246	-43.061	6.081	6.212	-7.179	-13.743
Right						
Member 4: (Bottom Slab)						
Left						
4- 0	-29.792	-48.925	9.520	10.049	14.324	8.286
4- 1	-14.248	-22.079	0.310	10.049	11.475	6.628
4- 2	4.330	-2.173	0.310	9.520	8.627	4.971
4- 3	18.861	6.458	0.310	9.520	5.778	3.314
4- 4	27.595	11.636	0.310	9.520	2.929	1.657
4- 5	30.450	13.363	0.310	9.520	0.081	-0.081
4- 6	27.595	11.636	0.310	9.520	-1.657	-2.929
4- 7	18.862	6.458	0.310	9.520	-3.314	-5.778
4- 8	4.332	-2.173	0.310	9.520	-4.971	-8.627
4- 9	-14.248	-22.072	0.310	10.049	-6.628	-11.475
4-10	-29.792	-48.922	9.520	10.049	-8.286	-14.324
Right						

---------- Analysis Truck, Overload 1 ----------

Vehicle	Axle No.	Weight (k/ft)	Length (ft)	Dist. From Previous (ft)
Truck	1	0.375	10.58	
	2	0.375	10.58	16.00
	3	0.140	6.58	12.00

***Distributed loads may have been intensified due to axle overlap between lanes

Live Load Parameters:

Traffic Direction is Parallel to Main Reinforcement
Distribution Width : 14.62 ft
Impact Factor : 1.12
Truck MPF : 1.20 Tandem MPF : 0.00
Lane Load Distribution Width : 16.95 ft
Lane Load: 0.000 k/ft

Truck Positions That Cause Maximum Results:

Maximum +Moment in Top Slab

Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)
Truck	1	0.140	6.58	22.04
	2	0.375	10.58	10.04
	3	0.375	10.58	-5.96

Maximum +Moment : 6.83 k-ft
Corresponding Moment at End : -8.77 k-ft

Maximum -Moment in Top Slab

Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)
Truck	1	0.375	10.58	28.00
	2	0.375	10.58	12.00
	3	0.140	6.58	0.00

Maximum -Moment : -8.91 k-ft
Corresponding Moment at Mid : 6.70 k-ft

Coincident Bottom Slab Load : 0.20 k/ft

Maximum +Shear in Top Slab

Truck				
	1	0.375	10.58	21.29
	2	0.375	10.58	5.29
	3	0.140	6.58	-6.71

Maximum +Shear : 3.21 k
Corresponding Shear at Mid : -0.70 k
Coincident Bottom Slab Load : 0.28 k/ft

Coincident Bottom Slab Load : 0.21 k/ft

Maximum -Shear in Top Slab

Truck				
	1	0.375	10.58	15.54
	2	0.375	10.58	-0.46
	3	0.140	6.58	-12.46

Maximum -Shear : -3.21 k
Corresponding Shear at Mid : 0.70 k
Coincident Bottom Slab Load : 0.28 k/ft

Unfactored Moments and Shears due to Truck Loads: (k-ft, k)

	Truck				Tandem				Lane			
M-PT	Mll+	Mll-	Vll+	Vll-	Mll+	Mll-	Vll+	Vll-	Mll+	Mll-	Vll+	Vll-
Member 1: (Exterior Wall)												
Bottom												
1- 0	0.00	-9.29	0.19	-0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 1	0.00	-9.14	0.19	-0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 2	0.00	-9.00	0.19	-0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 3	0.00	-8.85	0.19	-0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 4	0.00	-8.71	0.19	-0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 5	0.00	-8.56	0.19	-0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 6	0.00	-8.45	0.19	-0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 7	0.00	-8.41	0.19	-0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 8	0.00	-8.50	0.19	-0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 9	0.00	-8.69	0.19	-0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-10	0.01	-8.91	0.19	-0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Top												
Member 2: (Top Slab)												
Left												
2- 0	0.01	-8.91	3.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 1	0.89	-4.65	2.68	-0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 2	2.71	-1.54	2.21	-0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 3	4.98	0.00	1.75	-0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 4	6.43	0.00	1.31	-0.56	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 5	6.83	0.00	0.90	-0.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 6	6.42	0.00	0.56	-1.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 7	4.99	0.00	0.30	-1.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 8	2.71	-1.54	0.13	-2.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 9	0.89	-4.65	0.03	-2.68	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-10	0.01	-8.91	0.00	-3.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Right												
Member 4: (Bottom Slab)												
Left												
4- 0	0.00	-9.29	2.93	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 1	0.00	-3.79	2.35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 2	1.18	-0.09	1.77	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 3	3.91	0.00	1.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 4	5.64	0.00	0.62	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 5	6.16	0.00	0.07	-0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 6	5.64	0.00	0.00	-0.62	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 7	3.91	0.00	0.00	-1.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 8	1.18	-0.09	0.00	-1.77	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 9	0.00	-3.79	0.00	-2.35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4-10	0.00	-9.29	0.00	-2.93	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Right												

Note: Unfactored live load results computed at 5.00 ft and 0 ft fill depths, per LRFD 3.6.1.2.6

Serviceability Check: Crack Control

Bar Mark	Location	Moment (k-ft)	Thrust (k)	Fss (ksi)	Spacing (in)	Allow (in)
A1	Top Corner Bar	-32.8	11.18	36.67*	5.00	8.19
A2	Bot Corner Bar	-37.3	11.18	42.29*	5.00	6.46
A100	Top Slab (int)	24.5	-1.24	31.13	5.00	10.52
A200	Bot Slab (int)	26.0	-0.42	32.74	5.00	9.76
B2	Ext Wall (ext)	-36.3	11.18	41.08	5.00	6.79

Strength Limit State at Critical Sections: Flexure

Member 1: (Exterior Wall), 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
BOT	24.00	-47.53	14.61	48.35	7.56	52.20	1.00	1.44	14.31	1.82	1.82
MID	59.00	0.00	7.18	26.97	7.69	29.40	1.00	0.74	14.31	NC	NC
MID-	59.00	-45.79	14.61	48.35	7.56	52.20	1.00	1.44	14.31	2.16	2.16
TOP	24.00	-42.11	14.61	48.35	7.56	52.20	1.00	1.44	14.31	2.31	2.31

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
LT	24.00	-21.36	5.99	48.35	7.56	49.97	1.00	1.44	14.31	5.92	5.92
MID	125.00	31.61	-1.02	48.35	7.56	48.07	1.00	1.44	14.31	3.28	3.28
MID-	125.00	0.48	5.79	13.89	7.69	16.07	1.00	0.37	14.31	NC	NC
RT	24.00	-21.36	5.99	48.35	7.56	49.97	1.00	1.44	14.31	5.92	5.92

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
LT	24.00	-24.69	9.71	48.35	7.56	50.95	1.00	1.44	14.31	6.36	6.36
MID	125.00	33.47	0.25	48.35	7.56	48.42	1.00	1.44	14.31	3.31	3.31
MID-	125.00	0.77	9.23	13.89	7.69	17.33	1.00	0.37	14.31	NC	NC
RT	24.00	-24.69	9.71	48.35	7.56	50.95	1.00	1.44	14.31	6.36	6.36

Notes: Mu - Resisting moment under pure flexure, Ma - Allowable moment under applied axial load

Strength Limit State at Critical Sections: 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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
BOT	12.20	7.52	48.3	14.61	7.20	10.99	2.000	45.00	12.21 b	0.00	0.00	0.00	7.26	7.26
MID	59.00	1.11	8.4	7.18	7.25	16.97	3.068	33.43	18.86 a	0.00	0.00	0.00	67.96	67.96
MID-	59.00	0.21	44.8	14.61	7.20	11.04	2.009	39.13	12.27 a	0.00	0.00	0.00	28.04	28.04
TOP	12.20	-5.08	41.5	14.61	7.20	11.20	2.038	38.92	12.44 a	0.00	0.00	0.00	7.13	7.13

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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
LT	12.20	13.06	32.9	5.99	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	2.33	2.33
MID	125.00	1.22	31.6	-1.02	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	15.95	15.95
MID-	125.00	1.22	11.7	5.79	7.69	17.60	n/a	n/a	19.56 c	0.00	0.00	0.00	16.21	16.21
RT	12.20	13.06	32.9	5.99	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	2.33	2.33

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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
LT	12.20	14.24	38.7	9.71	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	2.09	2.09
MID	125.00	0.10	33.5	0.25	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	NC	NC
MID-	125.00	0.10	0.0	9.23	7.69	23.39	5.080	27.84	25.99 a	0.00	0.00	0.00	NC	NC
RT	12.20	14.24	38.7	9.71	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	2.09	2.09

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

Load Combination Results at Tenth Points: (k-ft, k)(Fill Depth = 5.00 ft)

M-PT	+Moment	-Moment	+Axial	-Axial	+Shear	-Shear
Member 1: (Exterior Wall)						
Bottom						
1- 0	-29.641	-53.088	7.179	14.614	9.710	0.246
1- 1	-21.616	-48.282	7.179	14.614	7.583	0.073
1- 2	-15.606	-47.552	7.179	14.614	5.595	0.196
1- 3	-11.491	-46.711	7.179	14.614	3.746	0.297
1- 4	-9.117	-45.782	7.179	14.614	2.035	0.378
1- 5	-8.358	-44.784	7.179	14.614	1.109	-0.208
1- 6	-9.076	-43.775	7.179	14.614	1.147	-1.642
1- 7	-11.136	-42.851	7.179	14.614	1.164	-2.936
1- 8	-14.409	-42.083	7.179	14.614	1.160	-4.092
1- 9	-18.741	-41.478	7.179	14.614	1.134	-5.110
1-10	-24.015	-44.845	7.179	14.614	1.015	-5.988
Top						
Member 2: (Top Slab)						
Left						
2- 0	-24.095	-44.925	5.794	5.988	14.614	7.179
2- 1	-8.912	-20.377	-1.015	5.988	11.436	5.445
2- 2	7.772	-1.960	-1.015	5.988	8.830	4.078
2- 3	20.993	6.010	-1.015	5.794	6.257	2.719
2- 4	29.044	10.258	-1.015	5.794	3.724	1.195
2- 5	31.614	11.674	-1.015	5.794	1.221	-1.221
2- 6	29.035	10.258	-1.015	5.794	-1.195	-3.723
2- 7	21.005	6.010	-1.015	5.794	-2.719	-6.257
2- 8	7.772	-1.964	-1.015	5.988	-4.078	-8.830
2- 9	-8.912	-20.377	-1.015	5.988	-5.445	-11.435
2-10	-24.095	-44.925	5.794	5.988	-7.179	-14.614
Right						
Member 4: (Bottom Slab)						
Left						
4- 0	-29.641	-53.088	9.233	9.710	15.772	8.286
4- 1	-14.105	-23.504	9.233	9.710	12.628	6.628
4- 2	4.577	-2.022	0.246	9.233	9.484	4.971
4- 3	20.580	6.609	0.246	9.233	6.340	3.314
4- 4	30.299	11.787	0.246	9.233	3.195	1.657
4- 5	33.467	13.513	0.246	9.233	0.096	-0.096
4- 6	30.299	11.787	0.246	9.233	-1.657	-3.195
4- 7	20.580	6.609	0.246	9.233	-3.314	-6.340
4- 8	4.580	-2.022	0.246	9.233	-4.971	-9.484
4- 9	-14.105	-23.504	9.233	9.710	-6.628	-12.628
4-10	-29.641	-53.088	9.233	9.710	-8.286	-15.772
Right						

---------- Analysis Truck, Overload 2 ----------

Vehicle	Axle No.	Weight (k/ft)	Length (ft)	Dist. From Previous (ft)
Truck	1	0.168	6.58	
	2	0.375	10.58	12.00
	3	0.308	6.58	8.00
	4	0.375	10.58	18.00
	5	0.308	6.58	8.00
	6	0.375	10.58	16.00
	7	0.308	6.58	8.00

***Distributed loads may have been intensified due to axle overlap between lanes

Live Load Parameters:

Traffic Direction is Parallel to Main Reinforcement
Distribution Width : 14.62 ft
Impact Factor : 1.12
Truck MPF : 1.20 Tandem MPF : 0.00
Lane Load Distribution Width : 16.95 ft
Lane Load: 0.000 k/ft

Truck Positions That Cause Maximum Results:

Maximum +Moment in Top Slab

Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)
Truck	1	0.308	6.58	15.63

Maximum -Moment in Top Slab

Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)
Truck	1	0.308	6.58	15.63

	2	0.375	10.58	7.63		2	0.375	10.58	7.21
	3	0.308	6.58	-8.37		3	0.308	6.58	-8.79
	4	0.375	10.58	-16.37		4	0.375	10.58	-16.79
	5	0.308	6.58	-34.37		5	0.308	6.58	-34.79
	6	0.375	10.58	-42.37		6	0.375	10.58	-42.79
	7	0.168	6.58	-54.37		7	0.168	6.58	-54.79

Maximum +Moment : 8.04 k-ft
Corresponding Moment at End : -11.25 k-ft
Coincident Bottom Slab Load : 0.29 k/ft

Maximum -Moment : -11.28 k-ft
Corresponding Moment at Mid : 8.02 k-ft
Coincident Bottom Slab Load : 0.29 k/ft

Maximum +Shear in Top Slab

Truck	1	0.308	6.58	13.29
	2	0.375	10.58	5.29
	3	0.308	6.58	-10.71
	4	0.375	10.58	-18.71
	5	0.308	6.58	-36.71
	6	0.375	10.58	-44.71
	7	0.168	6.58	-56.71

Maximum +Shear : 3.73 k
Corresponding Shear at Mid : -0.30 k
Coincident Bottom Slab Load : 0.29 k/ft

Maximum -Shear in Top Slab

Truck	1	0.168	6.58	27.54
	2	0.375	10.58	15.54
	3	0.308	6.58	7.54
	4	0.375	10.58	-10.46
	5	0.308	6.58	-18.46
	6	0.375	10.58	-34.46
	7	0.308	6.58	-42.46

Maximum -Shear : -3.73 k
Corresponding Shear at Mid : 0.30 k
Coincident Bottom Slab Load : 0.29 k/ft

Unfactored Moments and Shears due to Truck Loads: (k-ft, k)

	Truck				Tandem				Lane			
M-PT	Mll+	Mll-	Vll+	Vll-	Mll+	Mll-	Vll+	Vll-	Mll+	Mll-	Vll+	Vll-
Member 1: (Exterior Wall)												
Bottom												
1- 0	0.00	-9.35	0.30	-0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 1	0.00	-9.51	0.30	-0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 2	0.00	-9.67	0.30	-0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 3	0.00	-9.83	0.30	-0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 4	0.00	-9.99	0.30	-0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 5	0.00	-10.16	0.30	-0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 6	0.00	-10.36	0.30	-0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 7	0.00	-10.58	0.30	-0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 8	0.00	-10.81	0.30	-0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 9	0.00	-11.04	0.30	-0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-10	0.01	-11.28	0.30	-0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Top												
Member 2: (Top Slab)												
Left												
2- 0	0.01	-11.28	3.73	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 1	0.73	-5.39	3.10	-0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 2	2.76	-1.53	2.47	-0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 3	5.34	0.00	1.88	-0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 4	7.38	0.00	1.35	-0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 5	8.04	0.00	0.90	-0.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 6	7.38	0.00	0.50	-1.35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 7	5.34	0.00	0.25	-1.88	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 8	2.76	-1.53	0.11	-2.47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 9	0.73	-5.39	0.03	-3.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-10	0.01	-11.27	0.00	-3.73	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Right												
Member 4: (Bottom Slab)												
Left												
4- 0	0.00	-9.35	3.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 1	0.00	-3.63	2.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 2	1.31	-0.07	1.86	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 3	4.41	0.00	1.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 4	6.28	0.00	0.64	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 5	6.87	0.00	0.07	-0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 6	6.28	0.00	0.00	-0.64	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 7	4.41	0.00	0.00	-1.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 8	1.31	-0.07	0.00	-1.86	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 9	0.00	-3.63	0.00	-2.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4-10	0.00	-9.35	0.00	-3.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Right												

Note: Unfactored live load results computed at 5.00 ft and 0 ft fill depths, per LRFD 3.6.1.2.6

Serviceability Check: Crack Control

Bar Mark	Location	Moment (k-ft)	Thrust (k)	Fss (ksi)	Spacing (in)	Allow (in)
A1	Top Corner Bar	-35.1	11.71	39.35*	5.00	7.30
A2	Bot Corner Bar	-37.9	11.71	42.95*	5.00	6.28
A100	Top Slab (int)	25.7	-1.35	32.68	5.00	9.79
A200	Bot Slab (int)	26.8	-0.36	33.61	5.00	9.38
B2	Ext Wall (ext)	-37.6	11.71	42.49	5.00	6.41

Strength Limit State at Critical Sections: Flexure

Member 1: (Exterior Wall), 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
BOT	24.00	-48.45	15.32	48.35	7.56	52.38	1.00	1.44	14.31	1.71	1.71
MID	59.00	0.00	7.18	26.97	7.69	29.40	1.00	0.74	14.31	NC	NC
MID-	59.00	-47.52	15.32	48.35	7.56	52.38	1.00	1.44	14.31	1.87	1.87
TOP	24.00	-45.23	15.32	48.35	7.56	52.38	1.00	1.44	14.31	1.83	1.83

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
LT	24.00	-22.44	5.91	48.35	7.56	49.95	1.00	1.44	14.31	5.12	5.12
MID	125.00	33.25	-1.16	48.35	7.56	48.03	1.00	1.44	14.31	2.78	2.78
MID-	125.00	0.48	5.79	13.89	7.69	16.07	1.00	0.37	14.31	NC	NC
RT	24.00	-22.44	5.91	48.35	7.56	49.95	1.00	1.44	14.31	5.12	5.12

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
LT	24.00	-24.49	9.85	48.35	7.56	50.99	1.00	1.44	14.31	6.59	6.59
MID	125.00	34.43	0.33	48.35	7.56	48.44	1.00	1.44	14.31	2.97	2.97
MID-	125.00	0.77	9.23	13.89	7.69	17.33	1.00	0.37	14.31	NC	NC
RT	24.00	-24.49	9.85	48.35	7.56	50.99	1.00	1.44	14.31	6.59	6.59

Notes: Mu - Resisting moment under pure flexure, Ma - Allowable moment under applied axial load

Strength Limit State at Critical Sections: 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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
BOT	12.20	7.66	48.8	15.32	7.20	10.99	2.000	45.00	12.21 b	0.00	0.00	0.00	6.40	6.40
MID	59.00	1.25	8.4	7.18	7.25	16.93	3.060	33.46	18.81 a	0.00	0.00	0.00	44.25	44.25
MID-	59.00	0.13	46.9	15.32	7.20	10.99	2.000	45.00	12.21 b	0.00	0.00	0.00	34.73	34.73
TOP	12.20	-4.99	44.7	15.32	7.20	10.99	2.000	45.00	12.21 b	0.00	0.00	0.00	12.55	12.55

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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
LT	12.20	13.70	35.1	5.91	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	2.01	2.01
MID	125.00	1.21	33.2	-1.16	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	16.03	16.03
MID-	125.00	1.21	11.7	5.79	7.69	17.60	n/a	n/a	19.56 c	0.00	0.00	0.00	16.30	16.30
RT	12.20	13.70	35.1	5.91	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	2.01	2.01

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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
LT	12.20	14.44	38.6	9.85	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.98	1.98
MID	125.00	0.10	34.4	0.33	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	NC	NC
MID-	125.00	0.10	0.0	9.23	7.69	23.39	5.080	27.84	25.99 a	0.00	0.00	0.00	NC	NC
RT	12.20	14.44	38.6	9.85	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.98	1.98

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

Load Combination Results at Tenth Points: (k-ft, k)(Fill Depth = 5.00 ft)

M-PT	+Moment	-Moment	+Axial	-Axial	+Shear	-Shear
Member 1: (Exterior Wall)						
Bottom						
1- 0	-29.641	-53.172	7.179	15.318	9.850	0.327
1- 1	-21.616	-48.779	7.179	15.318	7.723	0.153
1- 2	-15.606	-48.462	7.179	15.318	5.735	0.276
1- 3	-11.491	-48.034	7.179	15.318	3.886	0.378
1- 4	-9.117	-47.518	7.179	15.318	2.175	0.458
1- 5	-8.358	-46.933	7.179	15.318	1.249	-0.128
1- 6	-9.076	-46.353	7.179	15.318	1.287	-1.561
1- 7	-11.136	-45.778	7.179	15.318	1.304	-2.856
1- 8	-14.409	-45.202	7.179	15.318	1.300	-4.012
1- 9	-18.741	-44.650	7.179	15.318	1.274	-5.029
1-10	-24.015	-48.047	7.179	15.318	1.155	-5.908
Top						
Member 2: (Top Slab)						
Left						
2- 0	-24.095	-48.127	5.794	5.908	15.318	7.179
2- 1	-9.125	-21.374	-1.155	5.908	12.001	5.445
2- 2	7.841	-1.950	-1.155	5.908	9.189	4.078
2- 3	21.479	6.010	-1.155	5.794	6.433	2.719
2- 4	30.332	10.258	-1.155	5.794	3.775	1.273
2- 5	33.246	11.674	-1.155	5.794	1.215	-1.215
2- 6	30.332	10.258	-1.155	5.794	-1.273	-3.775
2- 7	21.479	6.010	-1.155	5.794	-2.719	-6.433
2- 8	7.840	-1.952	-1.155	5.908	-4.078	-9.189
2- 9	-9.125	-21.374	-1.155	5.908	-5.445	-12.001
2-10	-24.095	-48.119	5.794	5.908	-7.179	-15.318
Right						
Member 4: (Bottom Slab)						
Left						
4- 0	-29.641	-53.172	9.233	9.850	15.994	8.286
4- 1	-14.105	-23.294	9.233	9.850	12.801	6.628
4- 2	4.756	-2.022	0.327	9.233	9.609	4.971
4- 3	21.260	6.609	0.327	9.233	6.416	3.314
4- 4	31.172	11.787	0.327	9.233	3.224	1.657
4- 5	34.433	13.513	0.327	9.233	0.097	-0.097
4- 6	31.172	11.787	0.327	9.233	-1.657	-3.224
4- 7	21.260	6.609	0.327	9.233	-3.314	-6.416
4- 8	4.756	-2.022	0.327	9.233	-4.971	-9.609
4- 9	-14.105	-23.294	9.233	9.850	-6.628	-12.801
4-10	-29.641	-53.171	9.233	9.850	-8.286	-15.994
Right						

---------- Analysis Truck, EV 2 ----------

Vehicle	Axle No.	Weight (k/ft)	Length (ft)	Dist. From Previous (ft)
Truck	1	0.469	6.58	
	2	0.336	6.58	15.00

***Distributed loads may have been intensified due to axle overlap between lanes

Live Load Parameters:

Traffic Direction is Parallel to Main Reinforcement
Distribution Width : 14.62 ft
Impact Factor : 1.12
Truck MPF : 1.20 Tandem MPF : 0.00
Lane Load Distribution Width : 16.95 ft
Lane Load: 0.000 k/ft

Truck Positions That Cause Maximum Results:

Maximum +Moment in Top Slab

Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)
Truck	1	0.336	6.58	25.42
	2	0.469	6.58	10.42

Maximum +Moment : 6.36 k-ft
Corresponding Moment at End : -7.20 k-ft
Coincident Bottom Slab Load : 0.15 k/ft

Maximum -Moment in Top Slab

Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)
Truck	1	0.336	6.58	24.13
	2	0.469	6.58	9.13

Maximum -Moment : -7.35 k-ft
Corresponding Moment at Mid : 6.10 k-ft
Coincident Bottom Slab Load : 0.15 k/ft

Maximum +Shear in Top Slab

Truck	1	0.336	6.58	18.29
	2	0.469	6.58	3.29

Maximum +Shear : 2.90 k
Corresponding Shear at Mid : -0.19 k
Coincident Bottom Slab Load : 0.24 k/ft

Maximum -Shear in Top Slab

Truck	1	0.469	6.58	17.54
	2	0.336	6.58	2.54

Maximum -Shear : -2.90 k
Corresponding Shear at Mid : 0.19 k
Coincident Bottom Slab Load : 0.24 k/ft

Unfactored Moments and Shears due to Truck Loads: (k-ft, k)

	Truck				Tandem				Lane			
M-PT	Mll+	Mll-	Vll+	Vll-	Mll+	Mll-	Vll+	Vll-	Mll+	Mll-	Vll+	Vll-
Member 1: (Exterior Wall)												
Bottom												
1- 0	0.00	-8.20	0.29	-0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 1	0.00	-7.92	0.29	-0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 2	0.00	-7.63	0.29	-0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 3	0.00	-7.35	0.29	-0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 4	0.00	-7.07	0.29	-0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 5	0.00	-6.89	0.29	-0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 6	0.00	-6.80	0.29	-0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 7	0.00	-6.80	0.29	-0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 8	0.00	-6.90	0.29	-0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 9	0.00	-7.08	0.29	-0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-10	0.02	-7.35	0.29	-0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Top												
Member 2: (Top Slab)												
Left												
2- 0	0.02	-7.35	2.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 1	1.11	-4.03	2.46	-0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 2	3.16	-1.56	2.06	-0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 3	4.94	0.00	1.69	-0.38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 4	6.02	0.00	1.34	-0.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 5	6.36	0.00	1.00	-1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 6	6.02	0.00	0.67	-1.34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 7	4.94	0.00	0.38	-1.69	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 8	3.17	-1.56	0.16	-2.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 9	1.11	-4.03	0.04	-2.46	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-10	0.02	-7.35	0.00	-2.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Right												
Member 4: (Bottom Slab)												
Left												
4- 0	0.00	-8.20	2.55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 1	0.00	-3.41	2.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 2	1.06	-0.11	1.54	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 3	3.22	0.00	1.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 4	4.74	0.00	0.53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 5	5.22	0.00	0.08	-0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 6	4.74	0.00	0.00	-0.53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 7	3.22	0.00	0.00	-1.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 8	1.06	-0.11	0.00	-1.54	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 9	0.00	-3.41	0.00	-2.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4-10	0.00	-8.20	0.00	-2.55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Right												

Note: Unfactored live load results computed at 5.00 ft and 0 ft fill depths, per LRFD 3.6.1.2.6

Serviceability Check: Crack Control

Bar Mark	Location	Moment (k-ft)	Thrust (k)	Fss (ksi)	Spacing (in)	Allow (in)
A1	Top Corner Bar	-31.2	10.88	34.79	5.00	8.90
A2	Bot Corner Bar	-35.9	10.88	40.70*	5.00	6.90
A100	Top Slab (int)	24.0	-1.34	30.58	5.00	10.80
A200	Bot Slab (int)	25.1	-0.40	31.56	5.00	10.31
B2	Ext Wall (ext)	-34.7	10.88	39.15	5.00	7.37

Strength Limit State at Critical Sections: Flexure

Member 1: (Exterior Wall), 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
BOT	24.00	-45.68	14.20	48.35	7.56	52.10	1.00	1.44	14.31	1.98	1.98
MID	59.00	0.00	7.18	26.97	7.69	29.40	1.00	0.74	14.31	NC	NC
MID-	59.00	-43.58	14.20	48.35	7.56	52.10	1.00	1.44	14.31	2.45	2.45
TOP	24.00	-39.95	14.20	48.35	7.56	52.10	1.00	1.44	14.31	2.62	2.62

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
LT	24.00	-20.48	5.97	48.35	7.56	49.97	1.00	1.44	14.31	6.24	6.24
MID	125.00	30.98	-1.15	48.35	7.56	48.03	1.00	1.44	14.31	3.24	3.24
MID-	125.00	0.48	5.79	13.89	7.69	16.07	1.00	0.37	14.31	NC	NC
RT	24.00	-20.48	5.97	48.35	7.56	49.97	1.00	1.44	14.31	6.24	6.24

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
LT	24.00	-24.14	9.84	48.35	7.56	50.98	1.00	1.44	14.31	6.48	6.48
MID	125.00	32.20	0.27	48.35	7.56	48.42	1.00	1.44	14.31	3.61	3.61
MID-	125.00	0.77	9.23	13.89	7.69	17.33	1.00	0.37	14.31	NC	NC
RT	24.00	-24.14	9.84	48.35	7.56	50.98	1.00	1.44	14.31	6.48	6.48

Notes: Mu - Resisting moment under pure flexure, Ma - Allowable moment under applied axial load

Strength Limit State at Critical Sections: 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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
BOT	12.20	7.65	46.6	14.20	7.20	10.99	2.000	45.00	12.21 b	0.00	0.00	0.00	5.94	5.94
MID	59.00	1.24	8.4	7.18	7.25	16.93	3.060	33.46	18.81 a	0.00	0.00	0.00	41.49	41.49
MID-	59.00	0.19	42.5	14.20	7.20	11.27	2.050	38.83	12.52 a	0.00	0.00	0.00	27.92	27.92
TOP	12.20	-5.05	39.3	14.20	7.20	11.44	2.083	38.61	12.72 a	0.00	0.00	0.00	12.20	12.20

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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
LT	12.20	12.71	31.5	5.97	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	2.36	2.36
MID	125.00	1.34	31.0	-1.15	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	13.37	13.37
MID-	125.00	1.34	11.7	5.79	7.69	17.60	n/a	n/a	19.56 c	0.00	0.00	0.00	13.60	13.60
RT	12.20	12.71	31.5	5.97	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	2.36	2.36

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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
LT	12.20	13.78	37.7	9.84	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	2.22	2.22
MID	125.00	0.10	32.2	0.27	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	NC	NC
MID-	125.00	0.10	0.0	9.23	7.69	23.39	5.080	27.84	25.99 a	0.00	0.00	0.00	NC	NC
RT	12.20	13.78	37.7	9.84	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	2.22	2.22

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

Load Combination Results at Tenth Points: (k-ft, k)(Fill Depth = 5.00 ft)

M-PT	+Moment	-Moment	+Axial	-Axial	+Shear	-Shear
Member 1: (Exterior Wall)						
Bottom						
1- 0	-29.641	-51.623	7.179	14.202	9.843	0.268
1- 1	-21.616	-46.628	7.179	14.202	7.717	0.094
1- 2	-15.606	-45.711	7.179	14.202	5.729	0.217
1- 3	-11.491	-44.682	7.179	14.202	3.880	0.319
1- 4	-9.117	-43.572	7.179	14.202	2.169	0.399
1- 5	-8.358	-42.523	7.179	14.202	1.243	-0.187
1- 6	-9.076	-41.553	7.179	14.202	1.281	-1.620
1- 7	-11.136	-40.680	7.179	14.202	1.298	-2.915
1- 8	-14.409	-39.922	7.179	14.202	1.293	-4.071
1- 9	-18.741	-39.301	7.179	14.202	1.268	-5.088
1-10	-24.015	-42.739	7.179	14.202	1.149	-5.967
Top						
Member 2: (Top Slab)						
Left						
2- 0	-24.095	-42.819	5.794	5.967	14.202	7.179
2- 1	-8.609	-19.550	-1.149	5.967	11.137	5.445
2- 2	8.376	-1.985	-1.149	5.967	8.632	4.078
2- 3	20.936	6.010	-1.149	5.794	6.187	2.719
2- 4	28.498	10.258	-1.149	5.794	3.761	1.043
2- 5	30.979	11.674	-1.149	5.794	1.344	-1.344
2- 6	28.497	10.258	-1.149	5.794	-1.042	-3.761
2- 7	20.936	6.010	-1.149	5.794	-2.719	-6.187
2- 8	8.391	-1.985	-1.149	5.967	-4.078	-8.631
2- 9	-8.609	-19.550	-1.149	5.967	-5.445	-11.137
2-10	-24.095	-42.819	5.794	5.967	-7.179	-14.202
Right						
Member 4: (Bottom Slab)						
Left						
4- 0	-29.641	-51.623	9.233	9.843	15.265	8.286
4- 1	-14.105	-22.994	9.233	9.843	12.218	6.628
4- 2	4.421	-2.022	0.268	9.233	9.172	4.971
4- 3	19.646	6.609	0.268	9.233	6.126	3.314
4- 4	29.094	11.787	0.268	9.233	3.080	1.657
4- 5	32.197	13.513	0.268	9.233	0.102	-0.102
4- 6	29.094	11.787	0.268	9.233	-1.657	-3.080
4- 7	19.646	6.609	0.268	9.233	-3.314	-6.126
4- 8	4.421	-2.022	0.268	9.233	-4.971	-9.172
4- 9	-14.105	-22.994	9.233	9.843	-6.628	-12.218
4-10	-29.641	-51.623	9.233	9.843	-8.286	-15.265
Right						

---------- Analysis Truck, EV 3 ----------

Vehicle	Axle No.	Weight (k/ft)	Length (ft)	Dist. From Previous (ft)
Truck	1	0.540	10.58	
	2	0.336	6.58	17.00

***Distributed loads may have been intensified due to axle overlap between lanes

Live Load Parameters:

Traffic Direction is Parallel to Main Reinforcement
Distribution Width : 14.62 ft
Impact Factor : 1.12
Truck MPF : 1.20 Tandem MPF : 0.00
Lane Load Distribution Width : 16.95 ft
Lane Load: 0.000 k/ft

Truck Positions That Cause Maximum Results:

Maximum +Moment in Top Slab

Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)
Truck	1	0.336	6.58	27.42
	2	0.540	10.58	10.42

Maximum +Moment : 9.74 k-ft
Corresponding Moment at End : -12.49 k-ft
Coincident Bottom Slab Load : 0.27 k/ft

Maximum -Moment in Top Slab

Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)
Truck	1	0.336	6.58	26.38
	2	0.540	10.58	9.38

Maximum -Moment : -12.67 k-ft
Corresponding Moment at Mid : 9.60 k-ft
Coincident Bottom Slab Load : 0.27 k/ft

Maximum +Shear in Top Slab

Truck	1	0.336	6.58	22.29
	2	0.540	10.58	5.29

Maximum +Shear : 4.39 k
Corresponding Shear at Mid : -1.24 k
Coincident Bottom Slab Load : 0.30 k/ft

Maximum -Shear in Top Slab

Truck	1	0.540	10.58	15.54
	2	0.336	6.58	-1.46

Maximum -Shear : -4.39 k
Corresponding Shear at Mid : 1.24 k
Coincident Bottom Slab Load : 0.30 k/ft

Unfactored Moments and Shears due to Truck Loads: (k-ft, k)

	Truck				Tandem				Lane			
M-PT	Mll+	Mll-	Vll+	Vll-	Mll+	Mll-	Vll+	Vll-	Mll+	Mll-	Vll+	Vll-
Member 1: (Exterior Wall)												
Bottom												
1- 0	0.00	-10.69	0.32	-0.44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 1	0.00	-10.61	0.32	-0.44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 2	0.00	-10.53	0.32	-0.44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 3	0.00	-10.44	0.32	-0.44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 4	0.00	-10.41	0.32	-0.44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 5	0.00	-10.70	0.32	-0.44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 6	0.00	-11.06	0.32	-0.44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 7	0.00	-11.44	0.32	-0.44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 8	0.00	-11.85	0.32	-0.44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 9	0.00	-12.26	0.32	-0.44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-10	0.02	-12.67	0.32	-0.44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Top												
Member 2: (Top Slab)												
Left												
2- 0	0.02	-12.67	4.39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 1	1.28	-6.70	3.78	-0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 2	3.91	-2.22	3.15	-0.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 3	7.11	0.00	2.52	-0.44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 4	9.05	0.00	1.89	-0.81	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 5	9.74	0.00	1.30	-1.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 6	9.05	0.00	0.81	-1.89	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 7	7.12	0.00	0.44	-2.52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 8	3.91	-2.23	0.19	-3.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 9	1.28	-6.70	0.05	-3.78	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-10	0.02	-12.67	0.00	-4.39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Right												
Member 4: (Bottom Slab)												
Left												
4- 0	0.00	-10.69	3.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 1	0.00	-4.55	2.63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 2	1.70	-0.13	2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 3	4.60	0.00	1.37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 4	6.38	0.00	0.73	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 5	6.83	0.00	0.10	-0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 6	6.38	0.00	0.00	-0.73	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 7	4.60	0.00	0.00	-1.36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 8	1.70	-0.13	0.00	-2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 9	0.00	-4.54	0.00	-2.63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4-10	0.00	-10.69	0.00	-3.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Right												

Note: Unfactored live load results computed at 5.00 ft and 0 ft fill depths, per LRFD 3.6.1.2.6

Serviceability Check: Crack Control

Bar Mark	Location	Moment (k-ft)	Thrust (k)	Fss (ksi)	Spacing (in)	Allow (in)
A1	Top Corner Bar	-36.1	12.37	40.39*	5.00	6.99
A2	Bot Corner Bar	-38.8	12.37	43.75*	5.00	6.08
A100	Top Slab (int)	27.4	-1.37	34.81	5.00	8.89
A200	Bot Slab (int)	26.7	-0.55	33.64	5.00	9.37
B2	Ext Wall (ext)	-38.0	12.37	42.75	5.00	6.34

Strength Limit State at Critical Sections: Flexure

Member 1: (Exterior Wall), 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
BOT	24.00	-49.60	16.21	48.35	7.56	52.60	1.00	1.44	14.31	1.47	1.47
MID	59.00	0.00	7.18	26.97	7.69	29.40	1.00	0.74	14.31	NC	NC
MID-	59.00	-48.08	16.21	48.35	7.56	52.60	1.00	1.44	14.31	1.65	1.65
TOP	24.00	-46.62	16.21	48.35	7.56	52.60	1.00	1.44	14.31	1.56	1.56

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
LT	24.00	-24.22	6.17	48.35	7.56	50.02	1.00	1.44	14.31	3.88	3.88
MID	125.00	35.54	-1.19	48.35	7.56	48.02	1.00	1.44	14.31	2.12	2.12
MID-	125.00	0.48	5.79	13.89	7.69	16.07	1.00	0.37	14.31	NC	NC
RT	24.00	-24.22	6.17	48.35	7.56	50.02	1.00	1.44	14.31	3.88	3.88

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
LT	24.00	-25.75	9.88	48.35	7.56	50.99	1.00	1.44	14.31	4.99	4.99
MID	125.00	34.38	0.07	48.35	7.56	48.37	1.00	1.44	14.31	2.75	2.75
MID-	125.00	0.77	9.23	13.89	7.69	17.33	1.00	0.37	14.31	NC	NC
RT	24.00	-25.74	9.88	48.35	7.56	50.99	1.00	1.44	14.31	5.00	5.00

Notes: Mu - Resisting moment under pure flexure, Ma - Allowable moment under applied axial load

Strength Limit State at Critical Sections: 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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
BOT	12.20	7.69	50.2	16.21	7.20	10.99	2.000	45.00	12.21 b	0.00	0.00	0.00	5.76	5.76
MID	59.00	1.28	8.4	7.18	7.25	16.92	3.058	33.47	18.80 a	0.00	0.00	0.00	37.97	37.97
MID-	59.00	0.39	47.7	16.21	7.20	10.99	2.000	45.00	12.21 b	0.00	0.00	0.00	17.86	17.86
TOP	12.20	-5.26	46.3	16.21	7.20	10.99	2.000	45.00	12.21 b	0.00	0.00	0.00	5.55	5.55

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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
LT	12.20	14.60	36.9	6.17	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.55	1.55
MID	125.00	1.76	35.5	-1.19	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	10.21	10.21
MID-	125.00	1.76	11.7	5.79	7.69	17.60	n/a	n/a	19.56 c	0.00	0.00	0.00	10.38	10.38
RT	12.20	14.60	36.9	6.17	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.55	1.55

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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
LT	12.20	14.66	40.1	9.88	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.73	1.73
MID	125.00	0.14	34.4	0.07	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	NC	NC
MID-	125.00	0.14	0.0	9.23	7.69	23.39	5.079	27.84	25.99 a	0.00	0.00	0.00	NC	NC
RT	12.20	14.66	40.1	9.88	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.73	1.73

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

Filename: Bothell Culvert Analysis 043025.etcx

Load Combination Results at Tenth Points: (k-ft, k)(Fill Depth = 5.00 ft)

M-PT	+Moment	-Moment	+Axial	-Axial	+Shear	-Shear
Member 1: (Exterior Wall)						
Bottom						
1- 0	-29.641	-54.987	7.179	16.214	9.880	0.066
1- 1	-21.616	-50.263	7.179	16.214	7.753	-0.108
1- 2	-15.606	-49.616	7.179	16.214	5.765	0.015
1- 3	-11.491	-48.858	7.179	16.214	3.916	0.117
1- 4	-9.117	-48.077	7.179	16.214	2.206	0.197
1- 5	-8.358	-47.669	7.179	16.214	1.279	-0.389
1- 6	-9.076	-47.310	7.179	16.214	1.317	-1.822
1- 7	-11.136	-46.937	7.179	16.214	1.334	-3.117
1- 8	-14.409	-46.604	7.179	16.214	1.330	-4.273
1- 9	-18.741	-46.287	7.179	16.214	1.304	-5.290
1-10	-24.015	-49.919	7.179	16.214	1.185	-6.169
Top						
Member 2: (Top Slab)						
Left						
2- 0	-24.095	-49.999	5.794	6.169	16.214	7.179
2- 1	-8.381	-23.149	-1.185	6.169	12.912	5.445
2- 2	9.390	-2.880	-1.185	6.169	10.108	4.078
2- 3	23.873	6.010	-1.185	5.794	7.298	2.719
2- 4	32.582	10.258	-1.185	5.794	4.507	0.861
2- 5	35.541	11.674	-1.185	5.794	1.761	-1.761
2- 6	32.582	10.258	-1.185	5.794	-0.861	-4.507
2- 7	23.888	6.010	-1.185	5.794	-2.719	-7.298
2- 8	9.390	-2.885	-1.185	6.169	-4.078	-10.108
2- 9	-8.381	-23.149	-1.185	6.169	-5.445	-12.912
2-10	-24.095	-49.999	5.794	6.169	-7.179	-16.213
Right						
Member 4: (Bottom Slab)						
Left						
4- 0	-29.641	-54.987	9.233	9.880	16.230	8.286
4- 1	-14.105	-24.527	9.233	9.880	13.011	6.628
4- 2	5.279	-2.022	0.066	9.233	9.791	4.971
4- 3	21.513	6.609	0.066	9.233	6.572	3.314
4- 4	31.299	11.787	0.066	9.233	3.352	1.657
4- 5	34.378	13.513	0.066	9.233	0.139	-0.139
4- 6	31.300	11.787	0.066	9.233	-1.657	-3.351
4- 7	21.515	6.609	0.066	9.233	-3.314	-6.571
4- 8	5.283	-2.022	0.066	9.233	-4.971	-9.790
4- 9	-14.105	-24.520	9.233	9.880	-6.628	-13.010
4-10	-29.641	-54.977	9.233	9.880	-8.286	-16.229
Right						

---------- Analysis Truck, NRL - Legal Lane ----------

Vehicle	Axle No.	Weight (k/ft)	Length (ft)	Dist. From Previous (ft)
Truck	1	0.183	10.58	
	2	0.168	6.58	18.00
	3	0.157	10.58	17.00
	4	0.126	6.58	17.00

***Distributed loads may have been intensified due to axle overlap between lanes

Live Load Parameters:

Traffic Direction is Parallel to Main Reinforcement
Distribution Width : 14.62 ft
Impact Factor : 1.12
Truck MPF : 1.20 Tandem MPF : 0.00
Lane Load Distribution Width : 16.95 ft
Lane Load: 0.014 k/ft

Truck Positions That Cause Maximum Results:

Maximum +Moment in Top Slab

Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)
Truck	1	0.183	10.58	10.42
	2	0.168	6.58	-7.58
	3	0.157	10.58	-24.58
	4	0.126	6.58	-41.58

Maximum -Moment in Top Slab

Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)
Truck	1	0.183	10.58	9.38
	2	0.168	6.58	-8.63
	3	0.157	10.58	-25.63
	4	0.126	6.58	-42.63

Maximum +Moment : 3.30 k-ft
Corresponding Moment at End : -4.23 k-ft
Coincident Bottom Slab Load : 0.09 k/ft

Maximum -Moment : -4.29 k-ft
Corresponding Moment at Mid : 3.25 k-ft
Coincident Bottom Slab Load : 0.09 k/ft

Maximum +Shear in Top Slab

Truck	1	0.126	6.58	57.29
	2	0.157	10.58	40.29
	3	0.168	6.58	23.29
	4	0.183	10.58	5.29

Maximum +Shear : 1.48 k
Corresponding Shear at Mid : -0.42 k
Coincident Bottom Slab Load : 0.10 k/ft

Maximum -Shear in Top Slab

Truck	1	0.183	10.58	15.54
	2	0.168	6.58	-2.46
	3	0.157	10.58	-19.46
	4	0.126	6.58	-36.46

Maximum -Shear : -1.48 k
Corresponding Shear at Mid : 0.42 k
Coincident Bottom Slab Load : 0.10 k/ft

Unfactored Moments and Shears due to Truck Loads: (k-ft, k)

	Truck				Tandem				Lane			
M-PT	Mll+	Mll-	Vll+	Vll-	Mll+	Mll-	Vll+	Vll-	Mll+	Mll-	Vll+	Vll-
Member 1: (Exterior Wall)												
Bottom												
1- 0	0.00	-3.52	0.13	-0.15	0.00	0.00	0.00	0.00	0.00	-0.45	0.01	-0.01
1- 1	0.00	-3.50	0.13	-0.15	0.00	0.00	0.00	0.00	0.00	-0.45	0.01	-0.01
1- 2	0.00	-3.48	0.13	-0.15	0.00	0.00	0.00	0.00	0.00	-0.45	0.01	-0.01
1- 3	0.00	-3.46	0.13	-0.15	0.00	0.00	0.00	0.00	0.00	-0.45	0.01	-0.01
1- 4	0.00	-3.50	0.13	-0.15	0.00	0.00	0.00	0.00	0.00	-0.45	0.01	-0.01
1- 5	0.00	-3.62	0.13	-0.15	0.00	0.00	0.00	0.00	0.00	-0.45	0.01	-0.01
1- 6	0.00	-3.75	0.13	-0.15	0.00	0.00	0.00	0.00	0.00	-0.45	0.01	-0.01
1- 7	0.00	-3.87	0.13	-0.15	0.00	0.00	0.00	0.00	0.00	-0.45	0.01	-0.01
1- 8	0.00	-4.01	0.13	-0.15	0.00	0.00	0.00	0.00	0.00	-0.45	0.01	-0.01
1- 9	0.00	-4.15	0.13	-0.15	0.00	0.00	0.00	0.00	0.00	-0.45	0.01	-0.01
1-10	0.01	-4.29	0.13	-0.15	0.00	0.00	0.00	0.00	0.00	-0.45	0.01	-0.01
Top												
Member 2: (Top Slab)												
Left												
2- 0	0.01	-4.29	1.48	0.00	0.00	0.00	0.00	0.00	0.00	-0.45	0.15	0.00
2- 1	0.43	-2.27	1.28	-0.02	0.00	0.00	0.00	0.00	0.03	-0.20	0.12	0.00
2- 2	1.33	-0.75	1.07	-0.06	0.00	0.00	0.00	0.00	0.10	-0.06	0.09	0.00
2- 3	2.39	0.00	0.85	-0.15	0.00	0.00	0.00	0.00	0.20	0.00	0.07	-0.01
2- 4	3.06	0.00	0.64	-0.27	0.00	0.00	0.00	0.00	0.29	0.00	0.05	-0.02
2- 5	3.30	0.00	0.44	-0.44	0.00	0.00	0.00	0.00	0.32	0.00	0.03	-0.03
2- 6	3.06	0.00	0.27	-0.64	0.00	0.00	0.00	0.00	0.29	0.00	0.02	-0.05
2- 7	2.40	0.00	0.15	-0.85	0.00	0.00	0.00	0.00	0.20	0.00	0.01	-0.07
2- 8	1.33	-0.75	0.06	-1.07	0.00	0.00	0.00	0.00	0.10	-0.06	0.00	-0.09
2- 9	0.43	-2.27	0.02	-1.28	0.00	0.00	0.00	0.00	0.03	-0.20	0.00	-0.12
2-10	0.01	-4.29	0.00	-1.48	0.00	0.00	0.00	0.00	0.00	-0.45	0.00	-0.15
Right												
Member 4: (Bottom Slab)												
Left												
4- 0	0.00	-3.52	1.07	0.00	0.00	0.00	0.00	0.00	0.00	-0.45	0.15	0.00
4- 1	0.00	-1.52	0.87	0.00	0.00	0.00	0.00	0.00	0.00	-0.17	0.12	0.00
4- 2	0.57	-0.04	0.66	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.09	0.00
4- 3	1.53	0.00	0.45	0.00	0.00	0.00	0.00	0.00	0.20	0.00	0.06	0.00
4- 4	2.10	0.00	0.24	0.00	0.00	0.00	0.00	0.00	0.29	0.00	0.03	0.00
4- 5	2.27	0.00	0.03	-0.03	0.00	0.00	0.00	0.00	0.32	0.00	0.00	0.00
4- 6	2.10	0.00	0.00	-0.24	0.00	0.00	0.00	0.00	0.29	0.00	0.00	-0.03
4- 7	1.53	0.00	0.00	-0.45	0.00	0.00	0.00	0.00	0.20	0.00	0.00	-0.06
4- 8	0.58	-0.04	0.00	-0.66	0.00	0.00	0.00	0.00	0.05	0.00	0.00	-0.09
4- 9	0.00	-1.51	0.00	-0.87	0.00	0.00	0.00	0.00	0.00	-0.17	0.00	-0.12
4-10	0.00	-3.52	0.00	-1.07	0.00	0.00	0.00	0.00	0.00	-0.45	0.00	-0.15
Right												

Note: Unfactored live load results computed at 5.00 ft and 0 ft fill depths, per LRFD 3.6.1.2.6

Serviceability Check: Crack Control

Bar Mark	Location	Moment (k-ft)	Thrust (k)	Fss (ksi)	Spacing (in)	Allow (in)
A1	Top Corner Bar	-28.7	9.61	32.23	5.00	10.00
A2	Bot Corner Bar	-32.2	9.61	36.56*	5.00	8.23
A100	Top Slab (int)	21.3	-1.19	27.10	5.00	12.81
A200	Bot Slab (int)	22.5	-0.28	28.23	5.00	12.11
B2	Ext Wall (ext)	-31.5	9.61	35.74	5.00	8.54

Strength Limit State at Critical Sections: Flexure

Member 1: (Exterior Wall), 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
BOT	24.00	-42.26	13.14	48.35	7.56	51.83	1.00	1.44	14.31	2.46	2.46
MID	59.00	0.00	7.18	26.97	7.69	29.40	1.00	0.74	14.31	NC	NC
MID-	59.00	-40.94	13.14	48.35	7.56	51.83	1.00	1.44	14.31	2.73	2.73
TOP	24.00	-38.44	13.14	48.35	7.56	51.83	1.00	1.44	14.31	2.60	2.60

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
LT	24.00	-19.49	6.15	48.35	7.56	50.01	1.00	1.44	14.31	6.28	6.28
MID	125.00	28.73	-1.01	48.35	7.56	48.07	1.00	1.44	14.31	3.71	3.71
MID-	125.00	0.51	6.08	13.89	7.69	16.17	1.00	0.37	14.31	NC	NC
RT	24.00	-19.49	6.15	48.35	7.56	50.01	1.00	1.44	14.31	6.28	6.28

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
LT	24.00	-22.54	9.99	48.35	7.56	51.02	1.00	1.44	14.31	7.79	7.79
MID	125.00	29.69	0.38	48.35	7.56	48.45	1.00	1.44	14.31	4.73	4.73
MID-	125.00	0.79	9.52	13.89	7.69	17.44	1.00	0.37	14.31	NC	NC
RT	24.00	-22.53	9.99	48.35	7.56	51.02	1.00	1.44	14.31	7.80	7.80

Notes: Mu - Resisting moment under pure flexure, Ma - Allowable moment under applied axial load

Strength Limit State at Critical Sections: 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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
BOT	12.20	7.74	42.8	13.14	7.20	10.99	2.000	45.00	12.21 b	0.00	0.00	0.00	4.65	4.65
MID	59.00	1.10	7.8	7.18	7.25	17.50	3.163	33.06	19.44 a	0.00	0.00	0.00	55.98	55.98
MID-	59.00	0.08	40.3	13.14	7.20	11.53	2.098	38.52	12.81 a	0.00	0.00	0.00	33.47	33.47
TOP	12.20	-5.17	37.8	13.14	7.20	11.62	2.116	38.41	12.92 a	0.00	0.00	0.00	5.41	5.41

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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
LT	12.20	11.73	30.2	6.15	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	2.71	2.71
MID	125.00	0.83	28.7	-1.01	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	18.18	18.18
MID-	125.00	0.83	11.5	6.08	7.69	17.60	n/a	n/a	19.56 c	0.00	0.00	0.00	18.49	18.49
RT	12.20	11.73	30.2	6.15	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	2.71	2.71

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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
LT	12.20	12.60	34.9	9.99	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	3.01	3.01
MID	125.00	0.07	29.7	0.38	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	NC	NC
MID-	125.00	0.07	0.0	9.52	7.69	23.39	5.084	27.83	25.99 a	0.00	0.00	0.00	NC	NC
RT	12.20	12.60	34.9	9.99	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	3.01	3.01

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

Load Combination Results at Tenth Points: (k-ft, k)(Fill Depth = 5.00 ft)

M-PT	+Moment	-Moment	+Axial	-Axial	+Shear	-Shear
Member 1: (Exterior Wall)						
Bottom						
1- 0	-29.792	-47.650	7.179	13.136	9.991	0.376
1- 1	-21.513	-42.847	7.179	13.136	7.807	0.203
1- 2	-15.305	-42.276	7.179	13.136	5.761	0.326
1- 3	-11.049	-41.593	7.179	13.136	3.854	0.427
1- 4	-8.591	-40.940	7.179	13.136	2.086	0.508
1- 5	-7.803	-40.347	7.179	13.136	1.103	-0.079
1- 6	-8.549	-39.712	7.179	13.136	1.141	-1.570
1- 7	-10.694	-39.057	7.179	13.136	1.158	-2.922
1- 8	-14.108	-38.414	7.179	13.136	1.153	-4.135
1- 9	-18.638	-37.787	7.179	13.136	1.128	-5.210
1-10	-24.166	-41.260	7.179	13.136	1.009	-6.146
Top						
Member 2: (Top Slab)						
Left						
2- 0	-24.246	-41.340	6.081	6.146	13.136	7.179
2- 1	-9.293	-18.584	-1.009	6.146	10.260	5.445
2- 2	6.622	-1.450	-1.009	6.146	7.884	4.078
2- 3	18.806	5.859	-1.009	6.081	5.516	2.719
2- 4	26.239	10.107	-1.009	6.081	3.162	1.359
2- 5	28.732	11.523	-1.009	6.081	0.833	-0.833
2- 6	26.239	10.107	-1.009	6.081	-1.359	-3.161
2- 7	18.814	5.859	-1.009	6.081	-2.719	-5.516
2- 8	6.620	-1.452	-1.009	6.146	-4.078	-7.884
2- 9	-9.292	-18.584	-1.009	6.146	-5.445	-10.260
2-10	-24.246	-41.339	6.081	6.146	-7.179	-13.136
Right						
Member 4: (Bottom Slab)						
Left						
4- 0	-29.792	-47.650	9.520	9.991	13.956	8.286
4- 1	-14.248	-21.492	0.376	9.991	11.177	6.628
4- 2	4.080	-2.173	0.376	9.520	8.398	4.971
4- 3	18.320	6.458	0.376	9.520	5.619	3.314
4- 4	26.879	11.636	0.376	9.520	2.839	1.657
4- 5	29.689	13.363	0.376	9.520	0.066	-0.066
4- 6	26.879	11.636	0.376	9.520	-1.657	-2.839
4- 7	18.321	6.458	0.376	9.520	-3.314	-5.618
4- 8	4.083	-2.173	0.376	9.520	-4.971	-8.398
4- 9	-14.248	-21.485	0.376	9.991	-6.628	-11.177
4-10	-29.792	-47.647	9.520	9.991	-8.286	-13.956
Right						

---------- Analysis Truck, WA-105 ----------

Vehicle	Axle No.	Weight (k/ft)	Length (ft)	Dist. From Previous (ft)
Truck	1	0.244	10.58	
	2	0.238	6.58	12.00
	3	0.296	10.58	34.00
	4	0.122	10.58	8.00
	5	0.175	6.58	13.00

***Distributed loads may have been intensified due to axle overlap between lanes

Live Load Parameters:

Traffic Direction is Parallel to Main Reinforcement
Distribution Width : 14.62 ft
Impact Factor : 1.12
Truck MPF : 1.20 Tandem MPF : 0.00
Lane Load Distribution Width : 16.95 ft
Lane Load: 0.000 k/ft

Truck Positions That Cause Maximum Results:

Maximum +Moment in Top Slab

Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)
Truck	1	0.244	10.58	58.58
	2	0.238	6.58	46.58
	3	0.296	10.58	12.58

Maximum -Moment in Top Slab

Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)
Truck	1	0.244	10.58	59.13
	2	0.238	6.58	47.13
	3	0.296	10.58	13.13

	4	0.122	10.58	4.58		4	0.122	10.58	5.13
	5	0.175	6.58	-8.42		5	0.175	6.58	-7.87
Maximum +Moment :				6.23 k-ft	Maximum -Moment :				-8.38 k-ft
Corresponding Moment at End :				-8.12 k-ft	Corresponding Moment at Mid :				6.23 k-ft
Coincident Bottom Slab Load :				0.21 k/ft	Coincident Bottom Slab Load :				0.21 k/ft

Maximum +Shear in Top Slab					Maximum -Shear in Top Slab				
Truck	1	0.175	6.58	26.29	Truck	1	0.244	10.58	61.54
	2	0.122	10.58	13.29		2	0.238	6.58	49.54
	3	0.296	10.58	5.29		3	0.296	10.58	15.54
	4	0.238	6.58	-28.71		4	0.122	10.58	7.54
	5	0.244	10.58	-40.71		5	0.175	6.58	-5.46
Maximum +Shear :				2.85 k	Maximum -Shear :				-2.85 k
Corresponding Shear at Mid :				-0.54 k	Corresponding Shear at Mid :				0.54 k
Coincident Bottom Slab Load :				0.21 k/ft	Coincident Bottom Slab Load :				0.21 k/ft

Unfactored Moments and Shears due to Truck Loads: (k-ft, k)

	Truck				Tandem				Lane			
M-PT	Mll+	Mll-	Vll+	Vll-	Mll+	Mll-	Vll+	Vll-	Mll+	Mll-	Vll+	Vll-
Member 1: (Exterior Wall)												
Bottom												
1- 0	0.00	-7.02	0.17	-0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 1	0.00	-7.09	0.17	-0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 2	0.00	-7.17	0.17	-0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 3	0.00	-7.28	0.17	-0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 4	0.00	-7.42	0.17	-0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 5	0.00	-7.57	0.17	-0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 6	0.00	-7.72	0.17	-0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 7	0.00	-7.88	0.17	-0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 8	0.00	-8.04	0.17	-0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 9	0.00	-8.21	0.17	-0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-10	0.01	-8.38	0.17	-0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Top												
Member 2: (Top Slab)												
Left												
2- 0	0.01	-8.38	2.85	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 1	0.70	-4.20	2.39	-0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 2	2.24	-1.29	1.93	-0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 3	4.27	0.00	1.49	-0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 4	5.76	0.00	1.09	-0.44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 5	6.23	0.00	0.73	-0.73	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 6	5.76	0.00	0.44	-1.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 7	4.27	0.00	0.24	-1.49	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 8	2.24	-1.30	0.10	-1.93	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 9	0.70	-4.20	0.03	-2.39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-10	0.01	-8.38	0.00	-2.85	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Right												
Member 4: (Bottom Slab)												
Left												
4- 0	0.00	-7.02	2.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 1	0.00	-2.79	1.81	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 2	1.05	-0.07	1.37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 3	3.26	0.00	0.92	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 4	4.59	0.00	0.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 5	5.01	0.00	0.06	-0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 6	4.59	0.00	0.00	-0.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 7	3.26	0.00	0.00	-0.92	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 8	1.05	-0.07	0.00	-1.37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 9	0.00	-2.79	0.00	-1.81	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4-10	0.00	-7.02	0.00	-2.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Right												

Note: Unfactored live load results computed at 5.00 ft and 0 ft fill depths, per LRFD 3.6.1.2.6

Serviceability Check: Crack Control

Bar Mark	Location	Moment (k-ft)	Thrust (k)	Fss (ksi)	Spacing (in)	Allow (in)
A1	Top Corner Bar	-32.3	10.82	36.24*	5.00	8.35
A2	Bot Corner Bar	-35.4	10.82	40.15*	5.00	7.06
A100	Top Slab (int)	23.9	-1.21	30.37	5.00	10.91
A200	Bot Slab (int)	24.9	-0.33	31.27	5.00	10.45
B2	Ext Wall (ext)	-35.0	10.82	39.61	5.00	7.23

Strength Limit State at Critical Sections: Flexure

Member 1: (Exterior Wall), 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
BOT	24.00	-47.94	15.26	48.35	7.56	52.37	1.00	1.44	14.31	1.38	1.38
MID	59.00	0.00	7.18	26.97	7.69	29.40	1.00	0.74	14.31	NC	NC
MID-	59.00	-47.01	15.26	48.35	7.56	52.37	1.00	1.44	14.31	1.51	1.51
TOP	24.00	-44.71	15.26	48.35	7.56	52.37	1.00	1.44	14.31	1.48	1.48

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
LT	24.00	-22.64	6.24	48.35	7.56	50.04	1.00	1.44	14.31	3.90	3.90
MID	125.00	33.30	-1.04	48.35	7.56	48.06	1.00	1.44	14.31	2.15	2.15
MID-	125.00	0.51	6.08	13.89	7.69	16.17	1.00	0.37	14.31	NC	NC
RT	24.00	-22.64	6.24	48.35	7.56	50.04	1.00	1.44	14.31	3.90	3.90

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
LT	24.00	-24.60	10.03	48.35	7.56	51.03	1.00	1.44	14.31	5.03	5.03
MID	125.00	33.92	0.29	48.35	7.56	48.43	1.00	1.44	14.31	2.45	2.45
MID-	125.00	0.79	9.52	13.89	7.69	17.44	1.00	0.37	14.31	NC	NC
RT	24.00	-24.60	10.03	48.35	7.56	51.03	1.00	1.44	14.31	5.03	5.03

Notes: Mu - Resisting moment under pure flexure, Ma - Allowable moment under applied axial load

Strength Limit State at Critical Sections: 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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
BOT	12.20	7.77	48.3	15.26	7.20	10.99	2.000	45.00	12.21 b	0.00	0.00	0.00	4.52	4.52
MID	59.00	1.14	7.8	7.18	7.25	17.48	3.159	33.07	19.42 a	0.00	0.00	0.00	49.01	49.01
MID-	59.00	0.17	46.5	15.26	7.20	10.99	2.000	45.00	12.21 b	0.00	0.00	0.00	24.06	24.06
TOP	12.20	-5.26	44.1	15.26	7.20	10.99	2.000	45.00	12.21 b	0.00	0.00	0.00	4.65	4.65

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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
LT	12.20	13.67	35.0	6.24	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.57	1.57
MID	125.00	1.28	33.3	-1.04	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	11.87	11.87
MID-	125.00	1.28	11.5	6.08	7.69	17.60	n/a	n/a	19.56 c	0.00	0.00	0.00	12.06	12.06
RT	12.20	13.67	35.0	6.24	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.57	1.57

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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
LT	12.20	14.23	38.6	10.03	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.63	1.63
MID	125.00	0.11	33.9	0.29	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	NC	NC
MID-	125.00	0.11	0.0	9.52	7.69	23.39	5.082	27.84	25.99 a	0.00	0.00	0.00	NC	NC
RT	12.20	14.23	38.6	10.03	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.63	1.63

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

Load Combination Results at Tenth Points: (k-ft, k)(Fill Depth = 5.00 ft)

M-PT	+Moment	-Moment	+Axial	-Axial	+Shear	-Shear
Member 1: (Exterior Wall)						
Bottom						
1- 0	-29.792	-52.989	7.179	15.265	10.027	0.287
1- 1	-21.513	-48.352	7.179	15.265	7.843	0.113
1- 2	-15.305	-47.946	7.179	15.265	5.797	0.236
1- 3	-11.049	-47.503	7.179	15.265	3.891	0.338
1- 4	-8.591	-47.009	7.179	15.265	2.123	0.418
1- 5	-7.803	-46.464	7.179	15.265	1.139	-0.168
1- 6	-8.549	-45.890	7.179	15.265	1.177	-1.659
1- 7	-10.694	-45.290	7.179	15.265	1.194	-3.011
1- 8	-14.108	-44.687	7.179	15.265	1.190	-4.225
1- 9	-18.638	-44.105	7.179	15.265	1.164	-5.299
1-10	-24.166	-47.629	7.179	15.265	1.045	-6.235
Top						
Member 2: (Top Slab)						
Left						
2- 0	-24.246	-47.709	6.081	6.235	15.265	7.179
2- 1	-8.882	-21.597	-1.045	6.235	11.990	5.445
2- 2	8.025	-2.295	-1.045	6.235	9.226	4.078
2- 3	21.749	5.859	-1.045	6.081	6.509	2.719
2- 4	30.445	10.107	-1.045	6.081	3.855	1.176
2- 5	33.301	11.523	-1.045	6.081	1.277	-1.277
2- 6	30.452	10.107	-1.045	6.081	-1.176	-3.854
2- 7	21.749	5.859	-1.045	6.081	-2.719	-6.509
2- 8	8.025	-2.297	-1.045	6.235	-4.078	-9.226
2- 9	-8.882	-21.597	-1.045	6.235	-5.445	-11.989
2-10	-24.246	-47.709	6.081	6.235	-7.179	-15.264
Right						
Member 4: (Bottom Slab)						
Left						
4- 0	-29.792	-52.989	9.520	10.027	15.763	8.286
4- 1	-14.248	-23.420	0.287	10.027	12.624	6.628
4- 2	4.819	-2.173	0.287	9.520	9.484	4.971
4- 3	21.010	6.458	0.287	9.520	6.345	3.314
4- 4	30.726	11.636	0.287	9.520	3.206	1.657
4- 5	33.921	13.363	0.287	9.520	0.106	-0.106
4- 6	30.727	11.636	0.287	9.520	-1.657	-3.206
4- 7	21.015	6.458	0.287	9.520	-3.314	-6.345
4- 8	4.819	-2.173	0.287	9.520	-4.971	-9.484
4- 9	-14.248	-23.420	0.287	10.027	-6.628	-12.623
4-10	-29.792	-52.989	9.520	10.027	-8.286	-15.763
Right						

Analysis Results: Fill Depth = 5.50 ft

Load Parameters:

Fe = 1.00 Surcharge Depth : 2.38 ft

Applied Horizontal Loads: (k/ft)

Load Description	Bottom of Wall	Top of Wall
Live Load Surcharge	0.143	0.143
Internal Water Pressure	-0.749(5.0in)	-0.187(-5.0in)
External Water Pressure	0.801(0.0in)	0.187(0.0in)
Horizontal Earth Load	0.945	0.355

Applied Uniform Bottom Slab Loads: (k/ft)

Load Description	
Dead Load	0.284
Vertical Earth	0.660
Wearing Surface	0.000

Unfactored Moments due to All Loads: (k-ft) / Unfactored Shears due to All Loads: (k)

M-PT	Mdc	Mev	Mdw	Meh	Mls	Mwa	Mgw	Vdc	Vev	Vdw	Veh	Vls	Vwa	Vgw
Member 1: (Exterior Wall)														
Bottom														
1- 0	-9.58	-20.79	0.00	-1.71	-0.37	1.23	-1.30	0.61	0.00	0.00	3.68	0.70	-2.50	2.94
1- 1	-8.97	-20.79	0.00	1.47	0.25	-1.11	1.21	0.61	0.00	0.00	2.78	0.56	-2.08	2.18
1- 2	-8.37	-20.79	0.00	3.79	0.74	-2.83	3.01	0.61	0.00	0.00	1.94	0.42	-1.41	1.48
1- 3	-7.77	-20.79	0.00	5.32	1.08	-3.91	4.15	0.61	0.00	0.00	1.16	0.28	-0.80	0.85
1- 4	-7.17	-20.79	0.00	6.10	1.29	-4.43	4.70	0.61	0.00	0.00	0.43	0.14	-0.25	0.27
1- 5	-6.57	-20.79	0.00	6.19	1.36	-4.43	4.71	0.61	0.00	0.00	-0.24	0.00	0.24	-0.25
1- 6	-5.97	-20.79	0.00	5.66	1.29	-3.99	4.25	0.61	0.00	0.00	-0.85	-0.14	0.67	-0.70
1- 7	-5.36	-20.79	0.00	4.56	1.08	-3.15	3.36	0.61	0.00	0.00	-1.40	-0.28	1.04	-1.10
1- 8	-4.76	-20.79	0.00	2.94	0.74	-1.97	2.12	0.61	0.00	0.00	-1.89	-0.42	1.35	-1.43
1- 9	-4.16	-20.79	0.00	0.86	0.25	-0.52	0.57	0.61	0.00	0.00	-2.33	-0.56	1.60	-1.71
1-10	-3.56	-20.79	0.00	-1.62	-0.37	1.14	-1.21	0.61	0.00	0.00	-2.71	-0.70	1.71	-1.92
Top														
Member 2: (Top Slab)														
Left														
2- 0	-3.56	-20.79	0.00	-1.65	-0.37	1.17	-1.25	1.73	6.88	0.00	0.00	0.00	0.00	0.00
2- 1	-0.71	-7.90	0.00	-1.65	-0.37	1.17	-1.25	1.05	5.50	0.00	0.00	0.00	0.00	0.00
2- 2	1.19	2.13	0.00	-1.65	-0.37	1.17	-1.25	0.78	4.13	0.00	0.00	0.00	0.00	0.00
2- 3	2.55	9.29	0.00	-1.65	-0.37	1.17	-1.25	0.52	2.75	0.00	0.00	0.00	0.00	0.00
2- 4	3.36	13.59	0.00	-1.65	-0.37	1.17	-1.25	0.26	1.38	0.00	0.00	0.00	0.00	0.00
2- 5	3.63	15.02	0.00	-1.65	-0.37	1.17	-1.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 6	3.36	13.59	0.00	-1.65	-0.37	1.17	-1.25	-0.26	-1.38	0.00	0.00	0.00	0.00	0.00
2- 7	2.55	9.29	0.00	-1.65	-0.37	1.17	-1.25	-0.52	-2.75	0.00	0.00	0.00	0.00	0.00
2- 8	1.19	2.13	0.00	-1.65	-0.37	1.17	-1.25	-0.78	-4.13	0.00	0.00	0.00	0.00	0.00
2- 9	-0.71	-7.90	0.00	-1.65	-0.37	1.17	-1.25	-1.05	-5.50	0.00	0.00	0.00	0.00	0.00
2-10	-3.56	-20.79	0.00	-1.65	-0.37	1.17	-1.25	-1.73	-6.88	0.00	0.00	0.00	0.00	0.00
Right														
Member 4: (Bottom Slab)														
Left														
4- 0	-9.58	-20.79	0.00	-1.71	-0.37	1.23	-1.30	2.96	6.88	0.00	0.00	0.00	0.00	0.00
4- 1	-4.03	-7.90	0.00	-1.71	-0.37	1.23	-1.30	2.37	5.50	0.00	0.00	0.00	0.00	0.00
4- 2	0.28	2.13	0.00	-1.71	-0.37	1.23	-1.30	1.77	4.13	0.00	0.00	0.00	0.00	0.00
4- 3	3.36	9.29	0.00	-1.71	-0.37	1.23	-1.30	1.18	2.75	0.00	0.00	0.00	0.00	0.00
4- 4	5.20	13.59	0.00	-1.71	-0.37	1.23	-1.30	0.59	1.38	0.00	0.00	0.00	0.00	0.00
4- 5	5.82	15.02	0.00	-1.71	-0.37	1.23	-1.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 6	5.20	13.59	0.00	-1.71	-0.37	1.23	-1.30	-0.59	-1.38	0.00	0.00	0.00	0.00	0.00
4- 7	3.36	9.29	0.00	-1.71	-0.37	1.23	-1.30	-1.18	-2.75	0.00	0.00	0.00	0.00	0.00
4- 8	0.28	2.13	0.00	-1.71	-0.37	1.23	-1.30	-1.77	-4.13	0.00	0.00	0.00	0.00	0.00
4- 9	-4.03	-7.90	0.00	-1.71	-0.37	1.23	-1.30	-2.37	-5.50	0.00	0.00	0.00	0.00	0.00
4-10	-9.58	-20.79	0.00	-1.71	-0.37	1.23	-1.30	-2.96	-6.88	0.00	0.00	0.00	0.00	0.00
Right														

Unfactored Thrusts due to All Loads: (k) (Fill Depth = 5.50 ft)

Member	Pdc	Pev	Pdw	Peh	Pls	Pwa
1	1.73	6.88	0.00	0.00	0.00	0.00
2	-0.61	0.00	0.00	2.71	0.70	-1.71
4	0.61	0.00	0.00	3.68	0.70	-2.50

Analysis Truck, HL-93

Vehicle	Axle No.	Weight (k/ft)	Length (ft)	Dist. From Previous (ft)
Truck	1	0.097	7.16	
	2	0.390	7.16	14.00
	3	0.390	7.16	14.00

Tandem 1 0.390 11.16

***Distributed loads may have been intensified due to axle overlap between lanes

Live Load Parameters:

Traffic Direction is Parallel to Main Reinforcement
Distribution Width : 15.19 ft
Impact Factor : 1.10
Truck MPF : 1.20 Tandem MPF : 1.20
Lane Load Distribution Width : 17.52 ft
Lane Load: 0.000 k/ft

Truck Positions That Cause Maximum Results:

Maximum +Moment in Top Slab

Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)
Truck	1	0.097	7.16	24.87
	2	0.390	7.16	10.87
	3	0.390	7.16	-3.13

Maximum +Moment : 5.59 k-ft
Corresponding Moment at End : -6.33 k-ft
Coincident Bottom Slab Load : 0.14 k/ft

Maximum -Moment in Top Slab

Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)
Truck	1	0.097	7.16	27.55
	2	0.390	7.16	13.55
	3	0.390	7.16	-0.45

Maximum -Moment : -6.66 k-ft
Corresponding Moment at Mid : 4.78 k-ft
Coincident Bottom Slab Load : 0.19 k/ft

Maximum +Shear in Top Slab

Truck	1	0.097	7.16	31.58
	2	0.390	7.16	17.58
	3	0.390	7.16	3.58

Maximum +Shear : 2.75 k
Corresponding Shear at Mid : -0.04 k
Coincident Bottom Slab Load : 0.26 k/ft

Maximum -Shear in Top Slab

Truck	1	0.097	7.16	31.25
	2	0.390	7.16	17.25
	3	0.390	7.16	3.25

Maximum -Shear : -2.75 k
Corresponding Shear at Mid : 0.04 k
Coincident Bottom Slab Load : 0.26 k/ft

Maximum +Moment in Top Slab

Tandem	1	0.390	11.16	10.42

Maximum +Moment : 7.22 k-ft
Corresponding Moment at End : -9.40 k-ft
Coincident Bottom Slab Load : 0.21 k/ft

Maximum -Moment in Top Slab

Tandem	1	0.390	11.16	9.38

Maximum -Moment : -9.52 k-ft
Corresponding Moment at Mid : 7.13 k-ft
Coincident Bottom Slab Load : 0.21 k/ft

Maximum +Shear in Top Slab

Tandem	1	0.390	11.16	5.58

Maximum +Shear : 3.26 k
Corresponding Shear at Mid : -0.80 k
Coincident Bottom Slab Load : 0.21 k/ft

Maximum -Shear in Top Slab

Tandem	1	0.390	11.16	15.25

Maximum -Shear : -3.26 k
Corresponding Shear at Mid : 0.80 k
Coincident Bottom Slab Load : 0.21 k/ft

Unfactored Moments and Shears due to Truck Loads: (k-ft, k)

	Truck				Tandem				Lane			
M-PT	Mll+	Mll-	Vll+	Vll-	Mll+	Mll-	Vll+	Vll-	Mll+	Mll-	Vll+	Vll-
Member 1: (Exterior Wall)												
Bottom												
1- 0	0.00	-8.53	0.25	-0.25	0.00	-7.32	0.16	-0.32	0.00	0.00	0.00	0.00
1- 1	0.00	-8.29	0.25	-0.25	0.00	-7.35	0.16	-0.32	0.00	0.00	0.00	0.00
1- 2	0.00	-8.04	0.25	-0.25	0.00	-7.43	0.16	-0.32	0.00	0.00	0.00	0.00
1- 3	0.00	-7.80	0.25	-0.25	0.00	-7.60	0.16	-0.32	0.00	0.00	0.00	0.00
1- 4	0.00	-7.56	0.25	-0.25	0.00	-7.82	0.16	-0.32	0.00	0.00	0.00	0.00
1- 5	0.00	-7.32	0.25	-0.25	0.00	-8.07	0.16	-0.32	0.00	0.00	0.00	0.00
1- 6	0.00	-7.08	0.25	-0.25	0.00	-8.35	0.16	-0.32	0.00	0.00	0.00	0.00
1- 7	0.00	-6.88	0.25	-0.25	0.00	-8.63	0.16	-0.32	0.00	0.00	0.00	0.00
1- 8	0.00	-6.74	0.25	-0.25	0.00	-8.92	0.16	-0.32	0.00	0.00	0.00	0.00
1- 9	0.00	-6.67	0.25	-0.25	0.00	-9.22	0.16	-0.32	0.00	0.00	0.00	0.00
1-10	0.01	-6.66	0.25	-0.25	0.01	-9.52	0.16	-0.32	0.00	0.00	0.00	0.00
Top												
Member 2: (Top Slab)												
Left												
2- 0	0.01	-6.66	2.75	0.00	0.01	-9.52	3.26	0.00	0.00	0.00	0.00	0.00
2- 1	0.92	-3.59	2.27	-0.03	0.93	-5.00	2.81	-0.03	0.00	0.00	0.00	0.00
2- 2	2.71	-1.37	1.85	-0.14	2.83	-1.62	2.33	-0.14	0.00	0.00	0.00	0.00
2- 3	4.31	0.00	1.49	-0.31	5.19	0.00	1.85	-0.32	0.00	0.00	0.00	0.00
2- 4	5.40	0.00	1.17	-0.57	6.70	0.00	1.38	-0.58	0.00	0.00	0.00	0.00
2- 5	5.59	0.00	0.86	-0.86	7.22	0.00	0.94	-0.94	0.00	0.00	0.00	0.00
2- 6	5.40	0.00	0.57	-1.17	6.70	0.00	0.58	-1.38	0.00	0.00	0.00	0.00
2- 7	4.31	0.00	0.31	-1.49	5.20	0.00	0.32	-1.85	0.00	0.00	0.00	0.00
2- 8	2.71	-1.37	0.14	-1.85	2.83	-1.62	0.14	-2.33	0.00	0.00	0.00	0.00
2- 9	0.92	-3.59	0.03	-2.27	0.93	-5.00	0.03	-2.81	0.00	0.00	0.00	0.00

2-10	0.01	-6.66	0.00	-2.75	0.01	-9.52	0.00	-3.26	0.00	0.00	0.00	0.00
Right												

Member 4: (Bottom Slab)

Left												
4- 0	0.00	-8.53	2.73	0.00	0.00	-7.32	2.25	0.00	0.00	0.00	0.00	0.00
4- 1	0.00	-3.41	2.18	0.00	0.00	-3.08	1.82	0.00	0.00	0.00	0.00	0.00
4- 2	0.94	-0.09	1.64	0.00	1.26	-0.09	1.38	0.00	0.00	0.00	0.00	0.00
4- 3	3.44	0.00	1.09	0.00	3.41	0.00	0.94	0.00	0.00	0.00	0.00	0.00
4- 4	5.14	0.00	0.55	0.00	4.68	0.00	0.51	0.00	0.00	0.00	0.00	0.00
4- 5	5.70	0.00	0.07	-0.07	5.09	0.00	0.07	-0.07	0.00	0.00	0.00	0.00
4- 6	5.14	0.00	0.00	-0.55	4.68	0.00	0.00	-0.51	0.00	0.00	0.00	0.00
4- 7	3.44	0.00	0.00	-1.09	3.41	0.00	0.00	-0.94	0.00	0.00	0.00	0.00
4- 8	0.94	-0.09	0.00	-1.64	1.26	-0.09	0.00	-1.38	0.00	0.00	0.00	0.00
4- 9	0.00	-3.41	0.00	-2.18	0.00	-3.08	0.00	-1.82	0.00	0.00	0.00	0.00
4-10	0.00	-8.53	0.00	-2.73	0.00	-7.32	0.00	-2.25	0.00	0.00	0.00	0.00
Right												

Note: Unfactored live load results computed at 5.50 ft and 0 ft fill depths, per LRFD 3.6.1.2.6

Serviceability Check: Crack Control

Bar Mark	Location	Moment (k-ft)	Thrust (k)	Fss (ksi)	Spacing (in)	Allow (in)
A1	Top Corner Bar	-35.0	11.87	39.20*	5.00	7.35
A2	Bot Corner Bar	-38.1	11.87	43.10*	5.00	6.25
A100	Top Slab (int)	26.2	-1.22	33.27	5.00	9.53
A200	Bot Slab (int)	26.9	-0.36	33.80	5.00	9.30
B2	Ext Wall (ext)	-37.2	11.87	41.90	5.00	6.56

Strength Limit State at Critical Sections: Flexure

Member 1: (Exterior Wall), 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
BOT	24.00	-51.80	16.81	48.35	7.56	52.75	1.00	1.44	14.31	1.27	1.65
MID	59.00	0.00	7.74	26.97	7.69	29.58	1.00	0.74	14.31	NC	NC
MID-	59.00	-49.99	16.81	48.35	7.56	52.75	1.00	1.44	14.31	1.48	1.92
TOP	24.00	-48.59	16.81	48.35	7.56	52.75	1.00	1.44	14.31	1.40	1.81

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
LT	24.00	-25.15	6.60	48.35	7.56	50.13	1.00	1.44	14.31	3.70	4.80
MID	125.00	36.75	-1.08	48.35	7.56	48.05	1.00	1.44	14.31	1.99	2.58
MID-	125.00	0.52	6.25	13.89	7.69	16.24	1.00	0.37	14.31	NC	NC
RT	24.00	-25.15	6.60	48.35	7.56	50.13	1.00	1.44	14.31	3.70	4.80

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
LT	24.00	-26.84	10.34	48.35	7.56	51.11	1.00	1.44	14.31	4.67	6.05
MID	125.00	36.85	0.20	48.35	7.56	48.41	1.00	1.44	14.31	2.28	2.96
MID-	125.00	0.81	9.69	13.89	7.69	17.50	1.00	0.37	14.31	NC	NC
RT	24.00	-26.84	10.34	48.35	7.56	51.11	1.00	1.44	14.31	4.67	6.05

Notes: Mu - Resisting moment under pure flexure, Ma - Allowable moment under applied axial load

Strength Limit State at Critical Sections: 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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
BOT	12.20	8.05	52.8	16.81	7.20	10.99	2.000	45.00	12.21 b	0.00	0.00	0.00	4.63	6.00
MID	59.00	1.28	9.2	7.74	7.25	16.50	2.982	33.81	18.33 a	0.00	0.00	0.00	35.94	46.58
MID-	59.00	0.36	49.6	16.81	7.20	10.99	2.000	45.00	12.21 b	0.00	0.00	0.00	18.14	23.51
TOP	12.20	-5.59	48.3	16.81	7.20	10.99	2.000	45.00	12.21 b	0.00	0.00	0.00	4.63	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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
LT	12.20	15.13	38.5	6.60	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.41	1.83
MID	125.00	1.65	36.8	-1.08	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	10.50	13.61
MID-	125.00	1.65	12.7	6.25	7.69	17.60	n/a	n/a	19.56 c	0.00	0.00	0.00	10.67	13.83
RT	12.20	15.13	38.5	6.60	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.41	1.83

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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
LT	12.20	15.71	42.2	10.34	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.37	1.78
MID	125.00	0.13	36.8	0.20	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	NC	NC
MID-	125.00	0.13	0.0	9.69	7.69	23.39	5.083	27.84	25.99 a	0.00	0.00	0.00	NC	NC
RT	12.20	15.71	42.2	10.34	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.37	1.78

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

Filename: Bothell Culvert Analysis 043025.etcx

Load Combination Results at Tenth Points: (k-ft, k)(Fill Depth = 5.50 ft)

M-PT	+Moment	-Moment	+Axial	-Axial	+Shear	-Shear
Member 1: (Exterior Wall)						
Bottom						
1- 0	-31.584	-58.172	7.742	16.808	10.336	0.196
1- 1	-23.151	-52.861	7.742	16.808	8.118	0.002
1- 2	-16.824	-51.836	7.742	16.808	6.038	0.105
1- 3	-12.483	-50.720	7.742	16.808	4.096	0.187
1- 4	-9.974	-49.986	7.742	16.808	2.294	0.247
1- 5	-9.169	-49.619	7.742	16.808	1.275	-0.359
1- 6	-9.932	-49.257	7.742	16.808	1.293	-1.884
1- 7	-12.128	-48.905	7.742	16.808	1.290	-3.271
1- 8	-15.627	-48.576	7.742	16.808	1.266	-4.519
1- 9	-20.277	-48.295	7.742	16.808	1.221	-5.628
1-10	-25.958	-52.178	7.742	16.808	1.082	-6.599
Top						
Member 2: (Top Slab)						
Left						
2- 0	-26.038	-52.258	6.254	6.599	16.808	7.742
2- 1	-9.477	-24.025	-1.082	6.599	13.380	5.895
2- 2	9.261	-2.700	-1.082	6.599	10.423	4.416
2- 3	24.402	6.528	-1.082	6.254	7.467	2.944
2- 4	33.642	11.128	-1.082	6.254	4.533	1.093
2- 5	36.752	12.661	-1.082	6.254	1.649	-1.649
2- 6	33.642	11.128	-1.082	6.254	-1.093	-4.532
2- 7	24.415	6.528	-1.082	6.254	-2.944	-7.467
2- 8	9.261	-2.705	-1.082	6.599	-4.416	-10.423
2- 9	-9.477	-24.025	-1.082	6.599	-5.895	-13.380
2-10	-26.038	-52.258	6.254	6.599	-7.742	-16.808
Right						
Member 4: (Bottom Slab)						
Left						
4- 0	-31.584	-58.172	9.693	10.336	17.407	8.848
4- 1	-14.994	-25.533	9.693	10.336	13.927	7.078
4- 2	5.388	-2.090	0.196	9.693	10.446	5.309
4- 3	22.366	7.127	0.196	9.693	6.966	3.539
4- 4	33.232	12.657	0.196	9.693	3.486	1.770
4- 5	36.846	14.500	0.196	9.693	0.130	-0.130
4- 6	33.232	12.657	0.196	9.693	-1.770	-3.486
4- 7	22.366	7.127	0.196	9.693	-3.539	-6.966
4- 8	5.393	-2.090	0.196	9.693	-5.309	-10.446
4- 9	-14.994	-25.533	9.693	10.336	-7.078	-13.927
4-10	-31.584	-58.172	9.693	10.336	-8.848	-17.407
Right						

---------- Analysis Truck, NRL ----------

Vehicle	Axle No.	Weight (k/ft)	Length (ft)	Dist. From Previous (ft)
Truck	1	0.097	7.16	
	2	0.125	11.16	6.00
	3	0.266	11.16	8.00
	4	0.125	11.16	8.00
	5	0.073	7.16	8.00

***Distributed loads may have been intensified due to axle overlap between lanes

Live Load Parameters:

Traffic Direction is Parallel to Main Reinforcement
Distribution Width : 15.19 ft
Impact Factor : 1.10
Truck MPF : 1.20 Tandem MPF : 0.00
Lane Load Distribution Width : 17.52 ft
Lane Load: 0.000 k/ft

Truck Positions That Cause Maximum Results:

Maximum +Moment in Top Slab

Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)
Truck	1	0.097	7.16	22.70
	2	0.125	11.16	16.70
	3	0.266	11.16	8.70

Maximum -Moment in Top Slab

Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)
Truck	1	0.097	7.16	25.46
	2	0.125	11.16	19.46
	3	0.266	11.16	11.46

	4	0.125	11.16	0.70		4	0.125	11.16	3.46
	5	0.073	7.16	-7.30		5	0.073	7.16	-4.54

Maximum +Moment : 6.42 k-ft
Corresponding Moment at End : -8.92 k-ft
Coincident Bottom Slab Load : 0.25 k/ft

Maximum -Moment : -8.94 k-ft
Corresponding Moment at Mid : 6.39 k-ft
Coincident Bottom Slab Load : 0.24 k/ft

Maximum +Shear in Top Slab

Truck	1	0.097	7.16	19.58
	2	0.125	11.16	13.58
	3	0.266	11.16	5.58
	4	0.125	11.16	-2.42
	5	0.073	7.16	-10.42

Maximum +Shear : 3.10 k
Corresponding Shear at Mid : -0.36 k
Coincident Bottom Slab Load : 0.25 k/ft

Maximum -Shear in Top Slab

Truck	1	0.097	7.16	29.25
	2	0.125	11.16	23.25
	3	0.266	11.16	15.25
	4	0.125	11.16	7.25
	5	0.073	7.16	-0.75

Maximum -Shear : -3.07 k
Corresponding Shear at Mid : 0.40 k
Coincident Bottom Slab Load : 0.24 k/ft

Unfactored Moments and Shears due to Truck Loads: (k-ft, k)

	Truck				Tandem				Lane			
M-PT	Mll+	Mll-	Vll+	Vll-	Mll+	Mll-	Vll+	Vll-	Mll+	Mll-	Vll+	Vll-
Member 1: (Exterior Wall)												
Bottom												
1- 0	0.00	-8.18	0.08	-0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 1	0.00	-8.22	0.08	-0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 2	0.00	-8.28	0.08	-0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 3	0.00	-8.33	0.08	-0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 4	0.00	-8.38	0.08	-0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 5	0.00	-8.43	0.08	-0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 6	0.00	-8.50	0.08	-0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 7	0.00	-8.59	0.08	-0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 8	0.00	-8.69	0.08	-0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 9	0.00	-8.81	0.08	-0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-10	0.00	-8.94	0.08	-0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Top												
Member 2: (Top Slab)												
Left												
2- 0	0.00	-8.94	3.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 1	0.35	-4.08	2.57	-0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 2	1.70	-0.71	2.04	-0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 3	4.25	0.00	1.52	-0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 4	5.90	0.00	1.01	-0.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 5	6.42	0.00	0.51	-0.47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 6	5.86	0.00	0.19	-0.99	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 7	4.25	0.00	0.10	-1.52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 8	1.85	-0.63	0.04	-2.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 9	0.30	-4.04	0.01	-2.56	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-10	0.00	-8.94	0.00	-3.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Right												
Member 4: (Bottom Slab)												
Left												
4- 0	0.00	-8.18	2.66	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 1	0.00	-3.23	2.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 2	1.04	-0.04	1.61	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 3	3.61	0.00	1.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 4	5.22	0.00	0.55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 5	5.81	0.00	0.03	-0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 6	5.31	0.00	0.00	-0.53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 7	3.72	0.00	0.00	-1.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 8	1.03	-0.03	0.00	-1.57	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 9	0.00	-3.12	0.00	-2.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4-10	0.00	-7.90	0.00	-2.63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Right												

Note: Unfactored live load results computed at 5.50 ft and 0 ft fill depths, per LRFD 3.6.1.2.6

Serviceability Check: Crack Control

Bar Mark	Location	Moment (k-ft)	Thrust (k)	Fss (ksi)	Spacing (in)	Allow (in)
A1	Top Corner Bar	-34.8	11.70	38.98*	5.00	7.42
A2	Bot Corner Bar	-38.4	11.70	43.47*	5.00	6.15
A100	Top Slab (int)	25.4	-1.05	32.20	5.00	10.01
A200	Bot Slab (int)	27.0	-0.20	33.88	5.00	9.27
B2	Ext Wall (ext)	-37.7	11.70	42.66	5.00	6.36

Strength Limit State at Critical Sections: Flexure

Member 1: (Exterior Wall), 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
BOT	24.00	-52.23	16.52	48.35	7.56	52.68	1.00	1.44	14.31	1.08	1.08
MID	59.00	0.00	7.74	26.97	7.69	29.58	1.00	0.74	14.31	NC	NC
MID-	59.00	-50.97	16.52	48.35	7.56	52.68	1.00	1.44	14.31	1.23	1.23
TOP	24.00	-48.20	16.52	48.35	7.56	52.68	1.00	1.44	14.31	1.25	1.25

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
LT	24.00	-23.58	6.32	48.35	7.56	50.06	1.00	1.44	14.31	3.86	3.86
MID	125.00	35.35	-0.79	48.35	7.56	48.13	1.00	1.44	14.31	1.96	1.96
MID-	125.00	0.52	6.25	13.89	7.69	16.24	1.00	0.37	14.31	NC	NC
RT	24.00	-23.51	6.32	48.35	7.56	50.06	1.00	1.44	14.31	3.89	3.89

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
LT	24.00	-26.51	10.04	48.35	7.56	51.04	1.00	1.44	14.31	4.28	4.28
MID	125.00	37.04	0.48	48.35	7.56	48.48	1.00	1.44	14.31	1.97	1.97
MID-	125.00	0.81	9.69	13.89	7.69	17.50	1.00	0.37	14.31	NC	NC
RT	24.00	-26.30	10.04	48.35	7.56	51.04	1.00	1.44	14.31	4.42	4.42

Notes: Mu - Resisting moment under pure flexure, Ma - Allowable moment under applied axial load

Strength Limit State at Critical Sections: 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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
BOT	12.20	7.75	52.7	16.52	7.20	10.99	2.000	45.00	12.21 b	0.00	0.00	0.00	5.12	5.12
MID	59.00	0.98	9.2	7.74	7.25	16.59	2.998	33.74	18.43 a	0.00	0.00	0.00	NC	NC
MID-	59.00	0.08	50.2	16.52	7.20	10.99	2.000	45.00	12.21 b	0.00	0.00	0.00	32.06	32.06
TOP	12.20	-5.31	47.6	16.52	7.20	10.99	2.000	45.00	12.21 b	0.00	0.00	0.00	4.96	4.96

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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
LT	12.20	14.79	37.2	6.32	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.32	1.32
MID	125.00	0.90	35.4	-0.79	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	16.90	16.90
MID-	125.00	0.82	12.7	6.25	7.69	17.60	n/a	n/a	19.56 c	0.00	0.00	0.00	18.77	18.77
RT	12.20	14.74	37.1	6.32	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.33	1.33

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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
LT	12.20	15.60	41.8	10.04	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.23	1.23
MID	125.00	0.05	37.0	0.48	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	NC	NC
MID-	125.00	0.07	0.0	9.69	7.69	23.39	5.085	27.83	25.99 a	0.00	0.00	0.00	NC	NC
RT	12.20	15.55	41.4	10.04	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.25	1.25

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

Load Combination Results at Tenth Points: (k-ft, k)(Fill Depth = 5.50 ft)

M-PT	+Moment	-Moment	+Axial	-Axial	+Shear	-Shear
Member 1: (Exterior Wall)						
Bottom						
1- 0	-31.584	-57.572	7.742	16.523	10.042	0.478
1- 1	-23.151	-52.755	7.742	16.523	7.824	0.285
1- 2	-16.824	-52.244	7.742	16.523	5.744	0.388
1- 3	-12.483	-51.641	7.742	16.523	3.802	0.469
1- 4	-9.974	-50.969	7.742	16.523	2.000	0.530
1- 5	-9.169	-50.248	7.742	16.523	0.981	-0.076
1- 6	-9.932	-49.520	7.742	16.523	0.999	-1.602
1- 7	-12.128	-48.829	7.742	16.523	0.996	-2.989
1- 8	-15.627	-48.178	7.742	16.523	0.972	-4.237
1- 9	-20.277	-47.584	7.742	16.523	0.927	-5.346
1-10	-25.958	-51.165	7.742	16.523	0.788	-6.317
Top						
Member 2: (Top Slab)						
Left						
2- 0	-26.038	-51.245	6.254	6.317	16.523	7.742
2- 1	-10.489	-22.424	-0.788	6.317	12.965	5.895
2- 2	7.289	-1.138	-0.788	6.254	9.916	4.416
2- 3	22.757	6.528	-0.788	6.254	6.894	2.944
2- 4	32.248	11.128	-0.788	6.254	3.880	1.472
2- 5	35.351	12.661	-0.788	6.254	0.897	-0.821
2- 6	32.173	11.128	-0.788	6.254	-1.472	-3.844
2- 7	22.746	6.528	-0.788	6.254	-2.944	-6.887
2- 8	7.555	-1.138	-0.788	6.254	-4.416	-9.914
2- 9	-10.580	-22.354	-0.788	6.317	-5.895	-12.941
2-10	-26.038	-51.251	6.254	6.317	-7.742	-16.463
Right						
Member 4: (Bottom Slab)						
Left						
4- 0	-31.584	-57.572	9.693	10.042	17.287	8.848
4- 1	-14.994	-25.219	9.693	10.042	13.838	7.078
4- 2	5.011	-2.090	0.478	9.693	10.390	5.309
4- 3	22.660	7.127	0.478	9.693	6.941	3.539
4- 4	33.370	12.657	0.478	9.693	3.493	1.770
4- 5	37.042	14.500	0.478	9.693	0.055	-0.066
4- 6	33.542	12.657	0.478	9.693	-1.770	-3.459
4- 7	22.857	7.127	0.478	9.693	-3.539	-6.890
4- 8	4.992	-2.090	0.478	9.693	-5.309	-10.336
4- 9	-14.994	-25.017	9.693	10.042	-7.078	-13.782
4-10	-31.584	-57.084	9.693	10.042	-8.848	-17.228
Right						

---------- Analysis Truck, Type 3 ----------

Vehicle	Axle No.	Weight (k/ft)	Length (ft)	Dist. From Previous (ft)
Truck	1	0.266	11.16	
	2	0.195	7.16	17.00

***Distributed loads may have been intensified due to axle overlap between lanes

Live Load Parameters:

Traffic Direction is Parallel to Main Reinforcement
Distribution Width : 15.19 ft
Impact Factor : 1.10
Truck MPF : 1.20 Tandem MPF : 0.00
Lane Load Distribution Width : 17.52 ft
Lane Load: 0.000 k/ft

Truck Positions That Cause Maximum Results:

Maximum +Moment in Top Slab

Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)
Truck	1	0.266	11.16	10.42
	2	0.195	7.16	-6.58

Maximum +Moment : 4.91 k-ft
Corresponding Moment at End : -6.39 k-ft
Coincident Bottom Slab Load : 0.14 k/ft

Maximum -Moment in Top Slab

Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)
Truck	1	0.266	11.16	9.38
	2	0.195	7.16	-7.62

Maximum -Moment : -6.47 k-ft
Corresponding Moment at Mid : 4.85 k-ft
Coincident Bottom Slab Load : 0.14 k/ft

Maximum +Shear in Top Slab

Truck	1	0.195	7.16	22.58
	2	0.266	11.16	5.58

Maximum +Shear : 2.23 k
Corresponding Shear at Mid : -0.53 k
Coincident Bottom Slab Load : 0.16 k/ft

Maximum -Shear in Top Slab

Truck	1	0.266	11.16	15.25
	2	0.195	7.16	-1.75

Maximum -Shear : -2.23 k
Corresponding Shear at Mid : 0.53 k
Coincident Bottom Slab Load : 0.16 k/ft

Unfactored Moments and Shears due to Truck Loads: (k-ft, k)

	Truck				Tandem				Lane			
M-PT	Mll+	Mll-	Vll+	Vll-	Mll+	Mll-	Vll+	Vll-	Mll+	Mll-	Vll+	Vll-
Member 1: (Exterior Wall)												
Bottom												
1- 0	0.00	-5.55	0.16	-0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 1	0.00	-5.51	0.16	-0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 2	0.00	-5.48	0.16	-0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 3	0.00	-5.45	0.16	-0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 4	0.00	-5.41	0.16	-0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 5	0.00	-5.49	0.16	-0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 6	0.00	-5.68	0.16	-0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 7	0.00	-5.87	0.16	-0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 8	0.00	-6.07	0.16	-0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 9	0.00	-6.27	0.16	-0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-10	0.01	-6.47	0.16	-0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Top												
Member 2: (Top Slab)												
Left												
2- 0	0.01	-6.47	2.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 1	0.63	-3.40	1.91	-0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 2	1.92	-1.10	1.59	-0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 3	3.57	0.00	1.26	-0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 4	4.56	0.00	0.94	-0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 5	4.91	0.00	0.64	-0.64	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 6	4.56	0.00	0.40	-0.94	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 7	3.57	0.00	0.21	-1.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 8	1.92	-1.10	0.09	-1.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 9	0.63	-3.40	0.02	-1.91	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-10	0.01	-6.47	0.00	-2.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Right												
Member 4: (Bottom Slab)												
Left												
4- 0	0.00	-5.55	1.71	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 1	0.00	-2.34	1.38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 2	0.85	-0.06	1.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 3	2.40	0.00	0.71	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 4	3.34	0.00	0.38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 5	3.59	0.00	0.05	-0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 6	3.34	0.00	0.00	-0.38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 7	2.40	0.00	0.00	-0.71	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 8	0.86	-0.06	0.00	-1.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 9	0.00	-2.33	0.00	-1.37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4-10	0.00	-5.54	0.00	-1.71	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Right												

Note: Unfactored live load results computed at 5.50 ft and 0 ft fill depths, per LRFD 3.6.1.2.6

Serviceability Check: Crack Control

Bar Mark	Location	Moment (k-ft)	Thrust (k)	Fss (ksi)	Spacing (in)	Allow (in)
A1	Top Corner Bar	-32.1	10.83	36.03*	5.00	8.43
A2	Bot Corner Bar	-35.6	10.83	40.30*	5.00	7.02
A100	Top Slab (int)	23.9	-1.13	30.34	5.00	10.92
A200	Bot Slab (int)	24.8	-0.26	31.13	5.00	10.52
B2	Ext Wall (ext)	-34.8	10.83	39.29	5.00	7.32

Strength Limit State at Critical Sections: Flexure

Member 1: (Exterior Wall), 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
BOT	24.00	-47.33	15.00	48.35	7.56	52.30	1.00	1.44	14.31	1.59	1.59
MID	59.00	0.00	7.74	26.97	7.69	29.58	1.00	0.74	14.31	NC	NC
MID-	59.00	-45.78	15.00	48.35	7.56	52.30	1.00	1.44	14.31	1.86	1.86
TOP	24.00	-43.60	15.00	48.35	7.56	52.30	1.00	1.44	14.31	1.76	1.76

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
LT	24.00	-22.25	6.42	48.35	7.56	50.09	1.00	1.44	14.31	4.61	4.61
MID	125.00	32.71	-0.93	48.35	7.56	48.09	1.00	1.44	14.31	2.56	2.56
MID-	125.00	0.52	6.25	13.89	7.69	16.24	1.00	0.37	14.31	NC	NC
RT	24.00	-22.25	6.42	48.35	7.56	50.09	1.00	1.44	14.31	4.61	4.61

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
LT	24.00	-24.83	10.19	48.35	7.56	51.07	1.00	1.44	14.31	5.73	5.73
MID	125.00	33.16	0.37	48.35	7.56	48.45	1.00	1.44	14.31	3.18	3.18
MID-	125.00	0.81	9.69	13.89	7.69	17.50	1.00	0.37	14.31	NC	NC
RT	24.00	-24.82	10.19	48.35	7.56	51.07	1.00	1.44	14.31	5.74	5.74

Notes: Mu - Resisting moment under pure flexure, Ma - Allowable moment under applied axial load

Strength Limit State at Critical Sections: 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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
BOT	12.20	7.90	48.0	15.00	7.20	10.99	2.000	45.00	12.21 b	0.00	0.00	0.00	4.53	4.53
MID	59.00	1.13	9.2	7.74	7.25	16.54	2.990	33.78	18.38 a	0.00	0.00	0.00	48.17	48.17
MID-	59.00	0.18	45.1	15.00	7.20	11.02	2.006	39.16	12.24 a	0.00	0.00	0.00	23.41	23.41
TOP	12.20	-5.41	43.1	15.00	7.20	11.02	2.006	39.16	12.25 a	0.00	0.00	0.00	4.60	4.60

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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
LT	12.20	13.44	34.4	6.42	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.81	1.81
MID	125.00	1.12	32.7	-0.93	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	13.51	13.51
MID-	125.00	1.12	12.7	6.25	7.69	17.60	n/a	n/a	19.56 c	0.00	0.00	0.00	13.73	13.73
RT	12.20	13.44	34.4	6.42	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.81	1.81

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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
LT	12.20	14.10	38.7	10.19	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.91	1.91
MID	125.00	0.09	33.2	0.37	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	NC	NC
MID-	125.00	0.09	0.0	9.69	7.69	23.39	5.084	27.83	25.99 a	0.00	0.00	0.00	NC	NC
RT	12.20	14.10	38.7	10.19	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.91	1.91

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

Load Combination Results at Tenth Points: (k-ft, k)(Fill Depth = 5.50 ft)

M-PT	+Moment	-Moment	+Axial	-Axial	+Shear	-Shear
Member 1: (Exterior Wall)						
Bottom						
1- 0	-31.584	-52.960	7.742	15.003	10.188	0.375
1- 1	-23.151	-48.012	7.742	15.003	7.969	0.181
1- 2	-16.824	-47.350	7.742	15.003	5.889	0.284
1- 3	-12.483	-46.597	7.742	15.003	3.948	0.366
1- 4	-9.974	-45.774	7.742	15.003	2.145	0.426
1- 5	-9.169	-45.097	7.742	15.003	1.127	-0.180
1- 6	-9.932	-44.582	7.742	15.003	1.145	-1.705
1- 7	-12.128	-44.071	7.742	15.003	1.142	-3.092
1- 8	-15.627	-43.580	7.742	15.003	1.118	-4.340
1- 9	-20.277	-43.132	7.742	15.003	1.073	-5.449
1-10	-25.958	-46.847	7.742	15.003	0.933	-6.420
Top						
Member 2: (Top Slab)						
Left						
2- 0	-26.038	-46.927	6.254	6.420	15.003	7.742
2- 1	-9.996	-21.226	-0.933	6.420	11.806	5.895
2- 2	7.676	-1.794	-0.933	6.420	9.116	4.416
2- 3	21.562	6.528	-0.933	6.254	6.430	2.944
2- 4	29.891	11.128	-0.933	6.254	3.758	1.419
2- 5	32.710	12.661	-0.933	6.254	1.122	-1.122
2- 6	29.891	11.128	-0.933	6.254	-1.419	-3.758
2- 7	21.564	6.528	-0.933	6.254	-2.944	-6.430
2- 8	7.676	-1.798	-0.933	6.420	-4.416	-9.116
2- 9	-9.996	-21.226	-0.933	6.420	-5.895	-11.806
2-10	-26.038	-46.927	6.254	6.420	-7.742	-15.002
Right						
Member 4: (Bottom Slab)						
Left						
4- 0	-31.584	-52.960	9.693	10.188	15.620	8.848
4- 1	-14.994	-23.654	9.693	10.188	12.513	7.078
4- 2	4.684	-2.090	0.375	9.693	9.405	5.309
4- 3	20.554	7.127	0.375	9.693	6.298	3.539
4- 4	30.094	12.657	0.375	9.693	3.190	1.770
4- 5	33.159	14.500	0.375	9.693	0.088	-0.088
4- 6	30.094	12.657	0.375	9.693	-1.770	-3.190
4- 7	20.556	7.127	0.375	9.693	-3.539	-6.297
4- 8	4.688	-2.090	0.375	9.693	-5.309	-9.405
4- 9	-14.994	-23.648	9.693	10.188	-7.078	-12.512
4-10	-31.584	-52.953	9.693	10.188	-8.848	-15.620
Right						

---------- Analysis Truck, Type 3S2 ----------

Vehicle	Axle No.	Weight (k/ft)	Length (ft)	Dist. From Previous (ft)
Truck	1	0.242	11.16	
	2	0.242	11.16	26.00
	3	0.122	7.16	13.00

***Distributed loads may have been intensified due to axle overlap between lanes

Live Load Parameters:

Traffic Direction is Parallel to Main Reinforcement
Distribution Width : 15.19 ft
Impact Factor : 1.10
Truck MPF : 1.20 Tandem MPF : 0.00
Lane Load Distribution Width : 17.52 ft
Lane Load: 0.000 k/ft

Truck Positions That Cause Maximum Results:

Maximum +Moment in Top Slab

Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)
Truck	1	0.122	7.16	23.05
	2	0.242	11.16	10.05
	3	0.242	11.16	-15.95

Maximum +Moment : 4.51 k-ft
Corresponding Moment at End : -5.87 k-ft

Maximum -Moment in Top Slab

Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)
Truck	1	0.242	11.16	37.83
	2	0.242	11.16	11.83
	3	0.122	7.16	-1.17

Maximum -Moment : -5.95 k-ft
Corresponding Moment at Mid : 4.46 k-ft

Coincident Bottom Slab Load : 0.14 k/ft

Maximum +Shear in Top Slab

Truck			
1	0.122	7.16	18.58
2	0.242	11.16	5.58
3	0.242	11.16	-20.42

Maximum +Shear : 2.11 k
Corresponding Shear at Mid : -0.41 k
Coincident Bottom Slab Load : 0.16 k/ft

Coincident Bottom Slab Load : 0.14 k/ft

Maximum -Shear in Top Slab

Truck			
1	0.242	11.16	41.25
2	0.242	11.16	15.25
3	0.122	7.16	2.25

Maximum -Shear : -2.11 k
Corresponding Shear at Mid : 0.41 k
Coincident Bottom Slab Load : 0.16 k/ft

Unfactored Moments and Shears due to Truck Loads: (k-ft, k)

	Truck				Tandem				Lane			
M-PT	Mll+	Mll-	Vll+	Vll-	Mll+	Mll-	Vll+	Vll-	Mll+	Mll-	Vll+	Vll-
Member 1: (Exterior Wall)												
Bottom												
1- 0	0.00	-5.51	0.18	-0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 1	0.00	-5.48	0.18	-0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 2	0.00	-5.46	0.18	-0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 3	0.00	-5.43	0.18	-0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 4	0.00	-5.41	0.18	-0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 5	0.00	-5.44	0.18	-0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 6	0.00	-5.50	0.18	-0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 7	0.00	-5.59	0.18	-0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 8	0.00	-5.69	0.18	-0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 9	0.00	-5.81	0.18	-0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-10	0.01	-5.95	0.18	-0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Top												
Member 2: (Top Slab)												
Left												
2- 0	0.01	-5.95	2.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 1	0.57	-3.10	1.78	-0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 2	1.75	-1.00	1.45	-0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 3	3.24	0.00	1.15	-0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 4	4.23	0.00	0.86	-0.36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 5	4.51	0.00	0.58	-0.58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 6	4.23	0.00	0.36	-0.86	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 7	3.24	0.00	0.20	-1.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 8	1.75	-1.00	0.08	-1.45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 9	0.57	-3.10	0.02	-1.78	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-10	0.01	-5.95	0.00	-2.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Right												
Member 4: (Bottom Slab)												
Left												
4- 0	0.00	-5.51	1.74	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 1	0.00	-2.25	1.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 2	0.78	-0.06	1.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 3	2.41	0.00	0.71	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 4	3.41	0.00	0.37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 5	3.70	0.00	0.05	-0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 6	3.41	0.00	0.00	-0.37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 7	2.41	0.00	0.00	-0.71	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 8	0.78	-0.06	0.00	-1.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 9	0.00	-2.25	0.00	-1.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4-10	0.00	-5.51	0.00	-1.74	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Right												

Note: Unfactored live load results computed at 5.50 ft and 0 ft fill depths, per LRFD 3.6.1.2.6

Serviceability Check: Crack Control

Bar Mark	Location	Moment (k-ft)	Thrust (k)	Fss (ksi)	Spacing (in)	Allow (in)
A1	Top Corner Bar	-31.8	10.71	35.61	5.00	8.58
A2	Bot Corner Bar	-35.5	10.71	40.32*	5.00	7.01
A100	Top Slab (int)	23.5	-1.15	29.85	5.00	11.18
A200	Bot Slab (int)	24.9	-0.24	31.25	5.00	10.46
B2	Ext Wall (ext)	-34.8	10.71	39.33	5.00	7.31

Strength Limit State at Critical Sections: Flexure

Member 1: (Exterior Wall), 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
BOT	24.00	-47.29	14.79	48.35	7.56	52.25	1.00	1.44	14.31	1.59	1.59
MID	59.00	0.00	7.74	26.97	7.69	29.58	1.00	0.74	14.31	NC	NC
MID-	59.00	-45.78	14.79	48.35	7.56	52.25	1.00	1.44	14.31	1.87	1.87
TOP	24.00	-42.95	14.79	48.35	7.56	52.25	1.00	1.44	14.31	1.87	1.87

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
LT	24.00	-21.71	6.39	48.35	7.56	50.08	1.00	1.44	14.31	5.01	5.01
MID	125.00	32.02	-0.97	48.35	7.56	48.08	1.00	1.44	14.31	2.79	2.79
MID-	125.00	0.52	6.25	13.89	7.69	16.24	1.00	0.37	14.31	NC	NC
RT	24.00	-21.71	6.39	48.35	7.56	50.08	1.00	1.44	14.31	5.01	5.01

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
LT	24.00	-24.68	10.22	48.35	7.56	51.08	1.00	1.44	14.31	5.92	5.92
MID	125.00	33.34	0.41	48.35	7.56	48.46	1.00	1.44	14.31	3.09	3.09
MID-	125.00	0.81	9.69	13.89	7.69	17.50	1.00	0.37	14.31	NC	NC
RT	24.00	-24.68	10.22	48.35	7.56	51.08	1.00	1.44	14.31	5.92	5.92

Notes: Mu - Resisting moment under pure flexure, Ma - Allowable moment under applied axial load

Strength Limit State at Critical Sections: 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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
BOT	12.20	7.93	47.9	14.79	7.20	10.99	2.000	45.00	12.21 b	0.00	0.00	0.00	4.41	4.41
MID	59.00	1.16	9.2	7.74	7.25	16.53	2.989	33.78	18.37 a	0.00	0.00	0.00	42.81	42.81
MID-	59.00	0.15	45.0	14.79	7.20	11.02	2.006	39.16	12.25 a	0.00	0.00	0.00	25.68	25.68
TOP	12.20	-5.38	42.4	14.79	7.20	11.10	2.020	39.05	12.33 a	0.00	0.00	0.00	4.77	4.77

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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
LT	12.20	13.22	33.7	6.39	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.93	1.93
MID	125.00	1.02	32.0	-0.97	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	14.81	14.81
MID-	125.00	1.02	12.7	6.25	7.69	17.60	n/a	n/a	19.56 c	0.00	0.00	0.00	15.06	15.06
RT	12.20	13.22	33.7	6.39	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.93	1.93

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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
LT	12.20	14.15	38.6	10.22	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.88	1.88
MID	125.00	0.08	33.3	0.41	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	NC	NC
MID-	125.00	0.08	0.0	9.69	7.69	23.39	5.084	27.83	25.99 a	0.00	0.00	0.00	NC	NC
RT	12.20	14.15	38.6	10.22	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.88	1.88

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

Load Combination Results at Tenth Points: (k-ft, k)(Fill Depth = 5.50 ft)

M-PT	+Moment	-Moment	+Axial	-Axial	+Shear	-Shear
Member 1: (Exterior Wall)						
Bottom						
1- 0	-31.584	-52.897	7.742	14.786	10.223	0.408
1- 1	-23.151	-47.960	7.742	14.786	8.004	0.215
1- 2	-16.824	-47.309	7.742	14.786	5.924	0.318
1- 3	-12.483	-46.567	7.742	14.786	3.983	0.399
1- 4	-9.974	-45.771	7.742	14.786	2.180	0.460
1- 5	-9.169	-45.008	7.742	14.786	1.162	-0.146
1- 6	-9.932	-44.273	7.742	14.786	1.180	-1.672
1- 7	-12.128	-43.575	7.742	14.786	1.177	-3.058
1- 8	-15.627	-42.926	7.742	14.786	1.153	-4.306
1- 9	-20.277	-42.336	7.742	14.786	1.108	-5.416
1-10	-25.958	-45.924	7.742	14.786	0.968	-6.387
Top						
Member 2: (Top Slab)						
Left						
2- 0	-26.038	-46.004	6.254	6.387	14.786	7.742
2- 1	-10.093	-20.701	-0.968	6.387	11.571	5.895
2- 2	7.379	-1.624	-0.968	6.387	8.883	4.416
2- 3	20.981	6.528	-0.968	6.254	6.235	2.944
2- 4	29.327	11.128	-0.968	6.254	3.613	1.472
2- 5	32.016	12.661	-0.968	6.254	1.023	-1.023
2- 6	29.327	11.128	-0.968	6.254	-1.472	-3.612
2- 7	20.989	6.528	-0.968	6.254	-2.944	-6.235
2- 8	7.379	-1.628	-0.968	6.387	-4.416	-8.883
2- 9	-10.093	-20.701	-0.968	6.387	-5.895	-11.571
2-10	-26.038	-46.004	6.254	6.387	-7.742	-14.786
Right						
Member 4: (Bottom Slab)						
Left						
4- 0	-31.584	-52.897	9.693	10.223	15.672	8.848
4- 1	-14.994	-23.500	9.693	10.223	12.549	7.078
4- 2	4.552	-2.090	0.408	9.693	9.425	5.309
4- 3	20.558	7.127	0.408	9.693	6.302	3.539
4- 4	30.205	12.657	0.408	9.693	3.178	1.770
4- 5	33.345	14.500	0.408	9.693	0.081	-0.081
4- 6	30.205	12.657	0.408	9.693	-1.770	-3.178
4- 7	20.558	7.127	0.408	9.693	-3.539	-6.302
4- 8	4.556	-2.090	0.408	9.693	-5.309	-9.425
4- 9	-14.994	-23.500	9.693	10.223	-7.078	-12.549
4-10	-31.584	-52.897	9.693	10.223	-8.848	-15.672
Right						

---------- Analysis Truck, Type 3-3 ----------

Vehicle	Axle No.	Weight (k/ft)	Length (ft)	Dist. From Previous (ft)
Truck	1	0.219	11.16	
	2	0.195	7.16	18.00
	3	0.187	11.16	17.00
	4	0.146	7.16	17.00

***Distributed loads may have been intensified due to axle overlap between lanes

Live Load Parameters:

Traffic Direction is Parallel to Main Reinforcement
Distribution Width : 15.19 ft
Impact Factor : 1.10
Truck MPF : 1.20 Tandem MPF : 0.00
Lane Load Distribution Width : 17.52 ft
Lane Load: 0.000 k/ft

Truck Positions That Cause Maximum Results:

Maximum +Moment in Top Slab

Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)
Truck	1	0.219	11.16	10.42
	2	0.195	7.16	-7.58
	3	0.187	11.16	-24.58
	4	0.146	7.16	-41.58

Maximum -Moment in Top Slab

Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)
Truck	1	0.219	11.16	9.38
	2	0.195	7.16	-8.63
	3	0.187	11.16	-25.63
	4	0.146	7.16	-42.63

Maximum +Moment : 4.04 k-ft
Corresponding Moment at End : -5.26 k-ft
Coincident Bottom Slab Load : 0.12 k/ft

Maximum -Moment : -5.33 k-ft
Corresponding Moment at Mid : 3.99 k-ft
Coincident Bottom Slab Load : 0.12 k/ft

Maximum +Shear in Top Slab

Truck	1	0.146	7.16	57.58
	2	0.187	11.16	40.58
	3	0.195	7.16	23.58
	4	0.219	11.16	5.58

Maximum +Shear : 1.83 k
Corresponding Shear at Mid : -0.45 k
Coincident Bottom Slab Load : 0.12 k/ft

Maximum -Shear in Top Slab

Truck	1	0.219	11.16	15.25
	2	0.195	7.16	-2.75
	3	0.187	11.16	-19.75
	4	0.146	7.16	-36.75

Maximum -Shear : -1.83 k
Corresponding Shear at Mid : 0.45 k
Coincident Bottom Slab Load : 0.12 k/ft

Unfactored Moments and Shears due to Truck Loads: (k-ft, k)

	Truck				Tandem				Lane			
M-PT	Mll+	Mll-	Vll+	Vll-	Mll+	Mll-	Vll+	Vll-	Mll+	Mll-	Vll+	Vll-
Member 1: (Exterior Wall)												
Bottom												
1- 0	0.00	-4.37	0.15	-0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 1	0.00	-4.36	0.15	-0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 2	0.00	-4.35	0.15	-0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 3	0.00	-4.33	0.15	-0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 4	0.00	-4.38	0.15	-0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 5	0.00	-4.52	0.15	-0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 6	0.00	-4.68	0.15	-0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 7	0.00	-4.83	0.15	-0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 8	0.00	-5.00	0.15	-0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 9	0.00	-5.16	0.15	-0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-10	0.01	-5.33	0.15	-0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Top												
Member 2: (Top Slab)												
Left												
2- 0	0.01	-5.33	1.83	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 1	0.52	-2.80	1.57	-0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 2	1.58	-0.91	1.31	-0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 3	2.92	0.00	1.04	-0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 4	3.75	0.00	0.77	-0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 5	4.04	0.00	0.53	-0.53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 6	3.75	0.00	0.33	-0.77	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 7	2.92	0.00	0.18	-1.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 8	1.58	-0.91	0.08	-1.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 9	0.52	-2.80	0.02	-1.57	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-10	0.01	-5.33	0.00	-1.83	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Right												
Member 4: (Bottom Slab)												
Left												
4- 0	0.00	-4.37	1.34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 1	0.00	-1.87	1.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 2	0.70	-0.05	0.82	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 3	1.91	0.00	0.56	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 4	2.64	0.00	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 5	2.85	0.00	0.04	-0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 6	2.64	0.00	0.00	-0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 7	1.91	0.00	0.00	-0.56	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 8	0.71	-0.05	0.00	-0.82	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 9	0.00	-1.86	0.00	-1.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4-10	0.00	-4.37	0.00	-1.34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Right												

Note: Unfactored live load results computed at 5.50 ft and 0 ft fill depths, per LRFD 3.6.1.2.6

Serviceability Check: Crack Control

Bar Mark	Location	Moment (k-ft)	Thrust (k)	Fss (ksi)	Spacing (in)	Allow (in)
A1	Top Corner Bar	-31.1	10.43	34.84	5.00	8.88
A2	Bot Corner Bar	-34.4	10.43	39.04*	5.00	7.40
A100	Top Slab (int)	23.0	-1.13	29.26	5.00	11.51
A200	Bot Slab (int)	24.1	-0.22	30.19	5.00	11.00
B2	Ext Wall (ext)	-33.7	10.43	38.15	5.00	7.69

Strength Limit State at Critical Sections: Flexure

Member 1: (Exterior Wall), 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
BOT	24.00	-45.34	14.30	48.35	7.56	52.12	1.00	1.44	14.31	1.99	1.99
MID	59.00	0.00	7.74	26.97	7.69	29.58	1.00	0.74	14.31	NC	NC
MID-	59.00	-43.97	14.30	48.35	7.56	52.12	1.00	1.44	14.31	2.24	2.24
TOP	24.00	-41.73	14.30	48.35	7.56	52.12	1.00	1.44	14.31	2.12	2.12

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
LT	24.00	-21.17	6.35	48.35	7.56	50.07	1.00	1.44	14.31	5.49	5.49
MID	125.00	31.19	-0.92	48.35	7.56	48.10	1.00	1.44	14.31	3.11	3.11
MID-	125.00	0.52	6.25	13.89	7.69	16.24	1.00	0.37	14.31	NC	NC
RT	24.00	-21.17	6.35	48.35	7.56	50.07	1.00	1.44	14.31	5.49	5.49

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
LT	24.00	-23.96	10.18	48.35	7.56	51.07	1.00	1.44	14.31	6.96	6.96
MID	125.00	31.86	0.44	48.35	7.56	48.47	1.00	1.44	14.31	4.00	4.00
MID-	125.00	0.81	9.69	13.89	7.69	17.50	1.00	0.37	14.31	NC	NC
RT	24.00	-23.95	10.18	48.35	7.56	51.07	1.00	1.44	14.31	6.97	6.97

Notes: Mu - Resisting moment under pure flexure, Ma - Allowable moment under applied axial load

Strength Limit State at Critical Sections: 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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
BOT	12.20	7.89	46.0	14.30	7.20	10.99	2.000	45.00	12.21 b	0.00	0.00	0.00	4.57	4.57
MID	59.00	1.12	9.2	7.74	7.25	16.55	2.991	33.77	18.39 a	0.00	0.00	0.00	50.08	50.08
MID-	59.00	0.11	43.4	14.30	7.20	11.18	2.035	38.95	12.42 a	0.00	0.00	0.00	28.87	28.87
TOP	12.20	-5.34	41.2	14.30	7.20	11.20	2.039	38.91	12.45 a	0.00	0.00	0.00	4.97	4.97

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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
LT	12.20	12.79	32.8	6.35	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	2.20	2.20
MID	125.00	0.92	31.2	-0.92	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	16.40	16.40
MID-	125.00	0.92	12.7	6.25	7.69	17.60	n/a	n/a	19.56 c	0.00	0.00	0.00	16.67	16.67
RT	12.20	12.79	32.8	6.35	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	2.20	2.20

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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
LT	12.20	13.53	37.2	10.18	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	2.43	2.43
MID	125.00	0.07	31.9	0.44	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	NC	NC
MID-	125.00	0.07	0.0	9.69	7.69	23.39	5.085	27.83	25.99 a	0.00	0.00	0.00	NC	NC
RT	12.20	13.53	37.2	10.18	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	2.43	2.43

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

Load Combination Results at Tenth Points: (k-ft, k)(Fill Depth = 5.50 ft)

M-PT	+Moment	-Moment	+Axial	-Axial	+Shear	-Shear
Member 1: (Exterior Wall)						
Bottom						
1- 0	-31.584	-50.904	7.742	14.299	10.177	0.442
1- 1	-23.151	-45.988	7.742	14.299	7.959	0.248
1- 2	-16.824	-45.365	7.742	14.299	5.879	0.351
1- 3	-12.483	-44.650	7.742	14.299	3.937	0.433
1- 4	-9.974	-43.964	7.742	14.299	2.135	0.494
1- 5	-9.169	-43.402	7.742	14.299	1.116	-0.113
1- 6	-9.932	-42.829	7.742	14.299	1.134	-1.638
1- 7	-12.128	-42.259	7.742	14.299	1.131	-3.025
1- 8	-15.627	-41.706	7.742	14.299	1.107	-4.273
1- 9	-20.277	-41.196	7.742	14.299	1.062	-5.382
1-10	-25.958	-44.848	7.742	14.299	0.923	-6.353
Top						
Member 2: (Top Slab)						
Left						
2- 0	-26.038	-44.928	6.254	6.353	14.299	7.742
2- 1	-10.191	-20.177	-0.923	6.353	11.216	5.895
2- 2	7.082	-1.455	-0.923	6.353	8.626	4.416
2- 3	20.430	6.528	-0.923	6.254	6.041	2.944
2- 4	28.484	11.128	-0.923	6.254	3.468	1.472
2- 5	31.194	12.661	-0.923	6.254	0.924	-0.924
2- 6	28.484	11.128	-0.923	6.254	-1.472	-3.467
2- 7	20.430	6.528	-0.923	6.254	-2.944	-6.041
2- 8	7.082	-1.457	-0.923	6.353	-4.416	-8.626
2- 9	-10.191	-20.177	-0.923	6.353	-5.895	-11.216
2-10	-26.038	-44.928	6.254	6.353	-7.742	-14.299
Right						
Member 4: (Bottom Slab)						
Left						
4- 0	-31.584	-50.904	9.693	10.177	14.981	8.848
4- 1	-14.994	-22.833	9.693	10.177	11.999	7.078
4- 2	4.420	-2.090	0.442	9.693	9.017	5.309
4- 3	19.699	7.127	0.442	9.693	6.035	3.539
4- 4	28.869	12.657	0.442	9.693	3.053	1.770
4- 5	31.865	14.500	0.442	9.693	0.073	-0.073
4- 6	28.869	12.657	0.442	9.693	-1.770	-3.053
4- 7	19.699	7.127	0.442	9.693	-3.539	-6.035
4- 8	4.423	-2.090	0.442	9.693	-5.309	-9.017
4- 9	-14.994	-22.827	9.693	10.177	-7.078	-11.999
4-10	-31.584	-50.901	9.693	10.177	-8.848	-14.981
Right						

---------- Analysis Truck, Overload 1 ----------

Vehicle	Axle No.	Weight (k/ft)	Length (ft)	Dist. From Previous (ft)
Truck	1	0.336	11.16	
	2	0.336	11.16	16.00
	3	0.122	7.16	12.00

***Distributed loads may have been intensified due to axle overlap between lanes

Live Load Parameters:

Traffic Direction is Parallel to Main Reinforcement
Distribution Width : 15.19 ft
Impact Factor : 1.10
Truck MPF : 1.20 Tandem MPF : 0.00
Lane Load Distribution Width : 17.52 ft
Lane Load: 0.000 k/ft

Truck Positions That Cause Maximum Results:

Maximum +Moment in Top Slab

Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)
Truck	1	0.122	7.16	22.05
	2	0.336	11.16	10.05
	3	0.336	11.16	-5.95

Maximum +Moment : 6.29 k-ft
Corresponding Moment at End : -8.20 k-ft

Maximum -Moment in Top Slab

Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)
Truck	1	0.336	11.16	28.00
	2	0.336	11.16	12.00
	3	0.122	7.16	0.00

Maximum -Moment : -8.32 k-ft
Corresponding Moment at Mid : 6.18 k-ft

Coincident Bottom Slab Load : 0.19 k/ft

Maximum +Shear in Top Slab

Truck				
	1	0.336	11.16	21.58
	2	0.336	11.16	5.58
	3	0.122	7.16	-6.42

Maximum +Shear : 2.97 k
Corresponding Shear at Mid : -0.53 k
Coincident Bottom Slab Load : 0.26 k/ft

Coincident Bottom Slab Load : 0.20 k/ft

Maximum -Shear in Top Slab

Truck				
	1	0.336	11.16	15.25
	2	0.336	11.16	-0.75
	3	0.122	7.16	-12.75

Maximum -Shear : -2.97 k
Corresponding Shear at Mid : 0.53 k
Coincident Bottom Slab Load : 0.26 k/ft

Unfactored Moments and Shears due to Truck Loads: (k-ft, k)

	Truck				Tandem				Lane			
M-PT	Mll+	Mll-	Vll+	Vll-	Mll+	Mll-	Vll+	Vll-	Mll+	Mll-	Vll+	Vll-
Member 1: (Exterior Wall)												
Bottom												
1- 0	0.00	-8.58	0.16	-0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 1	0.00	-8.47	0.16	-0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 2	0.00	-8.36	0.16	-0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 3	0.00	-8.25	0.16	-0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 4	0.00	-8.14	0.16	-0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 5	0.00	-8.03	0.16	-0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 6	0.00	-7.93	0.16	-0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 7	0.00	-7.91	0.16	-0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 8	0.00	-7.94	0.16	-0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 9	0.00	-8.12	0.16	-0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-10	0.01	-8.32	0.16	-0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Top												
Member 2: (Top Slab)												
Left												
2- 0	0.01	-8.32	2.97	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 1	0.80	-4.30	2.47	-0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 2	2.43	-1.39	2.02	-0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 3	4.53	0.00	1.59	-0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 4	5.92	0.00	1.19	-0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 5	6.29	0.00	0.81	-0.81	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 6	5.92	0.00	0.50	-1.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 7	4.54	0.00	0.27	-1.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 8	2.43	-1.39	0.12	-2.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 9	0.80	-4.30	0.03	-2.47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-10	0.01	-8.32	0.00	-2.97	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Right												
Member 4: (Bottom Slab)												
Left												
4- 0	0.00	-8.58	2.72	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 1	0.00	-3.48	2.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 2	1.08	-0.08	1.64	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 3	3.65	0.00	1.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 4	5.26	0.00	0.57	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 5	5.75	0.00	0.06	-0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 6	5.26	0.00	0.00	-0.57	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 7	3.65	0.00	0.00	-1.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 8	1.08	-0.08	0.00	-1.64	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 9	0.00	-3.48	0.00	-2.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4-10	0.00	-8.58	0.00	-2.72	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Right												

Note: Unfactored live load results computed at 5.50 ft and 0 ft fill depths, per LRFD 3.6.1.2.6

Serviceability Check: Crack Control

Bar Mark	Location	Moment (k-ft)	Thrust (k)	Fss (ksi)	Spacing (in)	Allow (in)
A1	Top Corner Bar	-34.0	11.57	38.10*	5.00	7.71
A2	Bot Corner Bar	-38.4	11.57	43.62*	5.00	6.11
A100	Top Slab (int)	25.3	-1.13	32.06	5.00	10.07
A200	Bot Slab (int)	27.0	-0.32	33.85	5.00	9.29
B2	Ext Wall (ext)	-37.5	11.57	42.42	5.00	6.42

Strength Limit State at Critical Sections: Flexure

Member 1: (Exterior Wall), 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
BOT	24.00	-49.02	15.10	48.35	7.56	52.32	1.00	1.44	14.31	1.74	1.74
MID	59.00	0.00	7.74	26.97	7.69	29.58	1.00	0.74	14.31	NC	NC
MID-	59.00	-47.30	15.10	48.35	7.56	52.32	1.00	1.44	14.31	2.09	2.09
TOP	24.00	-43.71	15.10	48.35	7.56	52.32	1.00	1.44	14.31	2.24	2.24

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
LT	24.00	-21.96	6.13	48.35	7.56	50.01	1.00	1.44	14.31	6.18	6.18
MID	125.00	32.61	-0.87	48.35	7.56	48.11	1.00	1.44	14.31	3.34	3.34
MID-	125.00	0.50	5.97	13.89	7.69	16.13	1.00	0.37	14.31	NC	NC
RT	24.00	-21.96	6.13	48.35	7.56	50.01	1.00	1.44	14.31	6.18	6.18

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
LT	24.00	-25.34	9.84	48.35	7.56	50.98	1.00	1.44	14.31	6.67	6.67
MID	125.00	34.64	0.38	48.35	7.56	48.46	1.00	1.44	14.31	3.31	3.31
MID-	125.00	0.78	9.41	13.89	7.69	17.40	1.00	0.37	14.31	NC	NC
RT	24.00	-25.34	9.84	48.35	7.56	50.98	1.00	1.44	14.31	6.67	6.67

Notes: Mu - Resisting moment under pure flexure, Ma - Allowable moment under applied axial load

Strength Limit State at Critical Sections: 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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
BOT	12.20	7.61	49.8	15.10	7.20	10.99	2.000	45.00	12.21 b	0.00	0.00	0.00	7.57	7.57
MID	59.00	1.06	9.7	7.74	7.25	16.21	2.929	34.05	18.01 a	0.00	0.00	0.00	79.61	79.61
MID-	59.00	0.17	46.3	15.10	7.20	10.99	2.000	45.00	12.21 b	0.00	0.00	0.00	30.76	30.76
TOP	12.20	-5.18	43.1	15.10	7.20	11.03	2.008	39.14	12.26 a	0.00	0.00	0.00	7.15	7.15

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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
LT	12.20	13.49	34.1	6.13	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	2.30	2.30
MID	125.00	1.09	32.6	-0.87	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	17.80	17.80
MID-	125.00	1.09	12.8	5.97	7.69	17.60	n/a	n/a	19.56 c	0.00	0.00	0.00	18.10	18.10
RT	12.20	13.49	34.1	6.13	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	2.30	2.30

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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
LT	12.20	14.72	39.8	9.84	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	2.01	2.01
MID	125.00	0.09	34.6	0.38	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	NC	NC
MID-	125.00	0.09	0.0	9.41	7.69	23.39	5.082	27.84	25.99 a	0.00	0.00	0.00	NC	NC
RT	12.20	14.72	39.8	9.84	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	2.01	2.01

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

Load Combination Results at Tenth Points: (k-ft, k)(Fill Depth = 5.50 ft)

M-PT	+Moment	-Moment	+Axial	-Axial	+Shear	-Shear
Member 1: (Exterior Wall)						
Bottom						
1- 0	-31.436	-54.690	7.742	15.099	9.840	0.384
1- 1	-23.252	-49.800	7.742	15.099	7.677	0.191
1- 2	-17.119	-49.049	7.742	15.099	5.654	0.293
1- 3	-12.916	-48.206	7.742	15.099	3.768	0.375
1- 4	-10.490	-47.294	7.742	15.099	2.022	0.436
1- 5	-9.713	-46.333	7.742	15.099	1.060	-0.171
1- 6	-10.448	-45.358	7.742	15.099	1.078	-1.640
1- 7	-12.561	-44.473	7.742	15.099	1.075	-2.970
1- 8	-15.922	-43.684	7.742	15.099	1.051	-4.162
1- 9	-20.378	-43.130	7.742	15.099	1.005	-5.215
1-10	-25.810	-46.600	7.742	15.099	0.866	-6.130
Top						
Member 2: (Top Slab)						
Left						
2- 0	-25.890	-46.680	5.973	6.130	15.099	7.742
2- 1	-10.023	-20.933	-0.866	6.130	11.800	5.895
2- 2	7.594	-1.600	-0.866	6.130	9.072	4.416
2- 3	21.437	6.676	-0.866	5.973	6.376	2.944
2- 4	29.907	11.275	-0.866	5.973	3.718	1.436
2- 5	32.605	12.809	-0.866	5.973	1.094	-1.094
2- 6	29.907	11.275	-0.866	5.973	-1.436	-3.718
2- 7	21.445	6.676	-0.866	5.973	-2.944	-6.376
2- 8	7.594	-1.603	-0.866	6.130	-4.416	-9.072
2- 9	-10.023	-20.933	-0.866	6.130	-5.895	-11.799
2-10	-25.890	-46.680	5.973	6.130	-7.742	-15.099
Right						
Member 4: (Bottom Slab)						
Left						
4- 0	-31.436	-54.690	9.412	9.840	16.302	8.848
4- 1	-14.846	-24.113	9.412	9.840	13.051	7.078
4- 2	4.648	-1.942	0.384	9.412	9.800	5.309
4- 3	21.276	7.275	0.384	9.412	6.548	3.539
4- 4	31.343	12.805	0.384	9.412	3.297	1.770
4- 5	34.636	14.648	0.384	9.412	0.086	-0.086
4- 6	31.343	12.805	0.384	9.412	-1.770	-3.297
4- 7	21.276	7.275	0.384	9.412	-3.539	-6.548
4- 8	4.651	-1.942	0.384	9.412	-5.309	-9.800
4- 9	-14.846	-24.113	9.412	9.840	-7.078	-13.051
4-10	-31.436	-54.690	9.412	9.840	-8.848	-16.302
Right						

---------- Analysis Truck, Overload 2 ----------

Vehicle	Axle No.	Weight (k/ft)	Length (ft)	Dist. From Previous (ft)
Truck	1	0.146	7.16	
	2	0.336	11.16	12.00
	3	0.268	7.16	8.00
	4	0.336	11.16	18.00
	5	0.268	7.16	8.00
	6	0.336	11.16	16.00
	7	0.268	7.16	8.00

***Distributed loads may have been intensified due to axle overlap between lanes

Live Load Parameters:

Traffic Direction is Parallel to Main Reinforcement
Distribution Width : 15.19 ft
Impact Factor : 1.10
Truck MPF : 1.20 Tandem MPF : 0.00
Lane Load Distribution Width : 17.52 ft
Lane Load: 0.000 k/ft

Truck Positions That Cause Maximum Results:

Maximum +Moment in Top Slab					Maximum -Moment in Top Slab				
Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)	Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)
Truck	1	0.146	7.16	25.91	Truck	1	0.268	7.16	15.17

	2	0.336	11.16	13.91	2	0.336	11.16	7.17
	3	0.268	7.16	5.91	3	0.268	7.16	-8.83
	4	0.336	11.16	-12.09	4	0.336	11.16	-16.83
	5	0.268	7.16	-20.09	5	0.268	7.16	-34.83
	6	0.336	11.16	-36.09	6	0.336	11.16	-42.83
	7	0.268	7.16	-44.09	7	0.146	7.16	-54.83

Maximum +Moment : 7.54 k-ft
Corresponding Moment at End : -10.24 k-ft
Coincident Bottom Slab Load : 0.27 k/ft

Maximum -Moment : -10.51 k-ft
Corresponding Moment at Mid : 7.53 k-ft
Coincident Bottom Slab Load : 0.27 k/ft

Maximum +Shear in Top Slab

Truck	1	0.268	7.16	13.58
	2	0.336	11.16	5.58
	3	0.268	7.16	-10.42
	4	0.336	11.16	-18.42
	5	0.268	7.16	-36.42
	6	0.336	11.16	-44.42
	7	0.146	7.16	-56.42

Maximum +Shear : 3.44 k
Corresponding Shear at Mid : -0.17 k
Coincident Bottom Slab Load : 0.27 k/ft

Maximum -Shear in Top Slab

Truck	1	0.146	7.16	27.25
	2	0.336	11.16	15.25
	3	0.268	7.16	7.25
	4	0.336	11.16	-10.75
	5	0.268	7.16	-18.75
	6	0.336	11.16	-34.75
	7	0.268	7.16	-42.75

Maximum -Shear : -3.44 k
Corresponding Shear at Mid : 0.17 k
Coincident Bottom Slab Load : 0.27 k/ft

Unfactored Moments and Shears due to Truck Loads: (k-ft, k)

	Truck				Tandem				Lane			
M-PT	Mll+	Mll-	Vll+	Vll-	Mll+	Mll-	Vll+	Vll-	Mll+	Mll-	Vll+	Vll-
Member 1: (Exterior Wall)												
Bottom												
1- 0	0.00	-8.77	0.28	-0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 1	0.00	-8.92	0.28	-0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 2	0.00	-9.08	0.28	-0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 3	0.00	-9.23	0.28	-0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 4	0.00	-9.39	0.28	-0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 5	0.00	-9.54	0.28	-0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 6	0.00	-9.70	0.28	-0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 7	0.00	-9.89	0.28	-0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 8	0.00	-10.10	0.28	-0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 9	0.00	-10.30	0.28	-0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-10	0.01	-10.51	0.28	-0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Top												
Member 2: (Top Slab)												
Left												
2- 0	0.01	-10.51	3.44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 1	0.64	-4.99	2.85	-0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 2	2.68	-1.39	2.26	-0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 3	5.02	0.00	1.71	-0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 4	6.93	0.00	1.22	-0.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 5	7.54	0.00	0.80	-0.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 6	6.93	0.00	0.43	-1.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 7	5.01	0.00	0.22	-1.71	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 8	2.68	-1.39	0.09	-2.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 9	0.64	-4.99	0.02	-2.85	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-10	0.01	-10.50	0.00	-3.44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Right												
Member 4: (Bottom Slab)												
Left												
4- 0	0.00	-8.77	2.91	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 1	0.00	-3.41	2.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 2	1.23	-0.06	1.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 3	4.15	0.00	1.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 4	5.92	0.00	0.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 5	6.48	0.00	0.07	-0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 6	5.92	0.00	0.00	-0.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 7	4.15	0.00	0.00	-1.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 8	1.23	-0.06	0.00	-1.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 9	0.00	-3.41	0.00	-2.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4-10	0.00	-8.77	0.00	-2.91	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Right												

Note: Unfactored live load results computed at 5.50 ft and 0 ft fill depths, per LRFD 3.6.1.2.6

Serviceability Check: Crack Control

Bar Mark	Location	Moment (k-ft)	Thrust (k)	Fss (ksi)	Spacing (in)	Allow (in)
A1	Top Corner Bar	-36.2	12.04	40.60*	5.00	6.93
A2	Bot Corner Bar	-39.2	12.04	44.34*	5.00	5.93
A100	Top Slab (int)	26.5	-1.26	33.68	5.00	9.35
A200	Bot Slab (int)	27.7	-0.26	34.74	5.00	8.92
B2	Ext Wall (ext)	-38.7	12.04	43.79	5.00	6.07

Strength Limit State at Critical Sections: Flexure

Member 1: (Exterior Wall), 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
BOT	24.00	-50.00	15.74	48.35	7.56	52.48	1.00	1.44	14.31	1.62	1.62
MID	59.00	0.00	7.74	26.97	7.69	29.58	1.00	0.74	14.31	NC	NC
MID-	59.00	-48.98	15.74	48.35	7.56	52.48	1.00	1.44	14.31	1.80	1.80
TOP	24.00	-46.62	15.74	48.35	7.56	52.48	1.00	1.44	14.31	1.78	1.78

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
LT	24.00	-22.98	6.05	48.35	7.56	49.99	1.00	1.44	14.31	5.34	5.34
MID	125.00	34.30	-1.04	48.35	7.56	48.06	1.00	1.44	14.31	2.78	2.78
MID-	125.00	0.50	5.97	13.89	7.69	16.13	1.00	0.37	14.31	NC	NC
RT	24.00	-22.98	6.05	48.35	7.56	49.99	1.00	1.44	14.31	5.34	5.34

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
LT	24.00	-25.26	10.01	48.35	7.56	51.03	1.00	1.44	14.31	6.77	6.77
MID	125.00	35.63	0.46	48.35	7.56	48.48	1.00	1.44	14.31	2.94	2.94
MID-	125.00	0.78	9.41	13.89	7.69	17.40	1.00	0.37	14.31	NC	NC
RT	24.00	-25.26	10.01	48.35	7.56	51.03	1.00	1.44	14.31	6.77	6.77

Notes: Mu - Resisting moment under pure flexure, Ma - Allowable moment under applied axial load

Strength Limit State at Critical Sections: 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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
BOT	12.20	7.78	50.4	15.74	7.20	10.99	2.000	45.00	12.21 b	0.00	0.00	0.00	6.44	6.44
MID	59.00	1.23	9.7	7.74	7.25	16.16	2.920	34.09	17.95 a	0.00	0.00	0.00	44.23	44.23
MID-	59.00	0.09	48.4	15.74	7.20	10.99	2.000	45.00	12.21 b	0.00	0.00	0.00	39.29	39.29
TOP	12.20	-5.10	46.1	15.74	7.20	10.99	2.000	45.00	12.21 b	0.00	0.00	0.00	12.58	12.58

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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
LT	12.20	14.06	36.1	6.05	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.99	1.99
MID	125.00	1.08	34.3	-1.04	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	18.07	18.07
MID-	125.00	1.08	12.8	5.97	7.69	17.60	n/a	n/a	19.56 c	0.00	0.00	0.00	18.38	18.38
RT	12.20	14.06	36.1	6.05	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.99	1.99

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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
LT	12.20	14.95	39.9	10.01	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.88	1.88
MID	125.00	0.09	35.6	0.46	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	NC	NC
MID-	125.00	0.09	0.0	9.41	7.69	23.39	5.082	27.84	25.99 a	0.00	0.00	0.00	NC	NC
RT	12.20	14.95	39.9	10.01	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.88	1.88

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

Load Combination Results at Tenth Points: (k-ft, k)(Fill Depth = 5.50 ft)

M-PT	+Moment	-Moment	+Axial	-Axial	+Shear	-Shear
Member 1: (Exterior Wall)						
Bottom						
1- 0	-31.436	-54.941	7.742	15.738	10.009	0.465
1- 1	-23.252	-50.409	7.742	15.738	7.847	0.271
1- 2	-17.119	-50.015	7.742	15.738	5.823	0.374
1- 3	-12.916	-49.529	7.742	15.738	3.938	0.456
1- 4	-10.490	-48.975	7.742	15.738	2.192	0.516
1- 5	-9.713	-48.372	7.742	15.738	1.229	-0.090
1- 6	-10.448	-47.740	7.742	15.738	1.248	-1.559
1- 7	-12.561	-47.154	7.742	15.738	1.245	-2.890
1- 8	-15.922	-46.593	7.742	15.738	1.220	-4.081
1- 9	-20.378	-46.070	7.742	15.738	1.175	-5.135
1-10	-25.810	-49.559	7.742	15.738	1.036	-6.049
Top						
Member 2: (Top Slab)						
Left						
2- 0	-25.890	-49.639	5.973	6.049	15.738	7.742
2- 1	-10.241	-21.871	-1.036	6.049	12.306	5.895
2- 2	7.924	-1.593	-1.036	6.049	9.384	4.416
2- 3	22.086	6.676	-1.036	5.973	6.529	2.944
2- 4	31.269	11.275	-1.036	5.973	3.763	1.472
2- 5	34.299	12.809	-1.036	5.973	1.078	-1.078
2- 6	31.269	11.275	-1.036	5.973	-1.472	-3.762
2- 7	22.084	6.676	-1.036	5.973	-2.944	-6.529
2- 8	7.922	-1.596	-1.036	6.049	-4.416	-9.384
2- 9	-10.241	-21.871	-1.036	6.049	-5.895	-12.306
2-10	-25.890	-49.628	5.973	6.049	-7.742	-15.738
Right						
Member 4: (Bottom Slab)						
Left						
4- 0	-31.436	-54.941	9.412	10.009	16.562	8.848
4- 1	-14.846	-24.021	9.412	10.009	13.254	7.078
4- 2	4.843	-1.942	0.465	9.412	9.947	5.309
4- 3	21.946	7.275	0.465	9.412	6.639	3.539
4- 4	32.232	12.805	0.465	9.412	3.332	1.770
4- 5	35.628	14.648	0.465	9.412	0.089	-0.089
4- 6	32.232	12.805	0.465	9.412	-1.770	-3.332
4- 7	21.946	7.275	0.465	9.412	-3.539	-6.639
4- 8	4.843	-1.942	0.465	9.412	-5.309	-9.947
4- 9	-14.846	-24.021	9.412	10.009	-7.078	-13.254
4-10	-31.436	-54.940	9.412	10.009	-8.848	-16.562
Right						

---------- Analysis Truck, EV 2 ----------

Vehicle	Axle No.	Weight (k/ft)	Length (ft)	Dist. From Previous (ft)
Truck	1	0.408	7.16	
	2	0.292	7.16	15.00

***Distributed loads may have been intensified due to axle overlap between lanes

Live Load Parameters:

Traffic Direction is Parallel to Main Reinforcement
Distribution Width : 15.19 ft
Impact Factor : 1.10
Truck MPF : 1.20 Tandem MPF : 0.00
Lane Load Distribution Width : 17.52 ft
Lane Load: 0.000 k/ft

Truck Positions That Cause Maximum Results:

Maximum +Moment in Top Slab

Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)
Truck	1	0.292	7.16	25.42
	2	0.408	7.16	10.42

Maximum +Moment : 5.84 k-ft
Corresponding Moment at End : -6.75 k-ft
Coincident Bottom Slab Load : 0.14 k/ft

Maximum -Moment in Top Slab

Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)
Truck	1	0.292	7.16	26.91
	2	0.408	7.16	11.91

Maximum -Moment : -6.88 k-ft
Corresponding Moment at Mid : 5.55 k-ft
Coincident Bottom Slab Load : 0.14 k/ft

Maximum +Shear in Top Slab

Truck	1	0.292	7.16	18.58
	2	0.408	7.16	3.58

Maximum +Shear : 2.68 k
Corresponding Shear at Mid : -0.24 k
Coincident Bottom Slab Load : 0.22 k/ft

Maximum -Shear in Top Slab

Truck	1	0.408	7.16	17.25
	2	0.292	7.16	2.25

Maximum -Shear : -2.68 k
Corresponding Shear at Mid : 0.24 k
Coincident Bottom Slab Load : 0.22 k/ft

Unfactored Moments and Shears due to Truck Loads: (k-ft, k)

	Truck				Tandem				Lane			
M-PT	Mll+	Mll-	Vll+	Vll-	Mll+	Mll-	Vll+	Vll-	Mll+	Mll-	Vll+	Vll-
Member 1: (Exterior Wall)												
Bottom												
1- 0	0.00	-7.52	0.24	-0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 1	0.00	-7.29	0.24	-0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 2	0.00	-7.06	0.24	-0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 3	0.00	-6.83	0.24	-0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 4	0.00	-6.60	0.24	-0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 5	0.00	-6.46	0.24	-0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 6	0.00	-6.40	0.24	-0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 7	0.00	-6.41	0.24	-0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 8	0.00	-6.50	0.24	-0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 9	0.00	-6.65	0.24	-0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-10	0.01	-6.88	0.24	-0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Top												
Member 2: (Top Slab)												
Left												
2- 0	0.01	-6.88	2.68	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 1	0.97	-3.76	2.28	-0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 2	2.83	-1.44	1.90	-0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 3	4.50	0.00	1.55	-0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 4	5.54	0.00	1.22	-0.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 5	5.84	0.00	0.90	-0.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 6	5.54	0.00	0.60	-1.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 7	4.50	0.00	0.33	-1.55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 8	2.83	-1.44	0.14	-1.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 9	0.97	-3.76	0.04	-2.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-10	0.01	-6.88	0.00	-2.68	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Right												
Member 4: (Bottom Slab)												
Left												
4- 0	0.00	-7.52	2.34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 1	0.00	-3.13	1.88	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 2	0.99	-0.10	1.41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 3	2.99	0.00	0.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 4	4.38	0.00	0.49	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 5	4.81	0.00	0.07	-0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 6	4.38	0.00	0.00	-0.49	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 7	2.99	0.00	0.00	-0.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 8	0.99	-0.10	0.00	-1.41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 9	0.00	-3.13	0.00	-1.88	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4-10	0.00	-7.52	0.00	-2.34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Right												

Note: Unfactored live load results computed at 5.50 ft and 0 ft fill depths, per LRFD 3.6.1.2.6

Serviceability Check: Crack Control

Bar Mark	Location	Moment (k-ft)	Thrust (k)	Fss (ksi)	Spacing (in)	Allow (in)
A1	Top Corner Bar	-32.6	11.29	36.40*	5.00	8.29
A2	Bot Corner Bar	-37.1	11.29	42.09*	5.00	6.51
A100	Top Slab (int)	24.8	-1.22	31.54	5.00	10.32
A200	Bot Slab (int)	26.0	-0.31	32.66	5.00	9.80
B2	Ext Wall (ext)	-35.9	11.29	40.60	5.00	6.93

Strength Limit State at Critical Sections: Flexure

Member 1: (Exterior Wall), 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
BOT	24.00	-47.26	14.72	48.35	7.56	52.23	1.00	1.44	14.31	1.89	1.89
MID	59.00	0.00	7.74	26.97	7.69	29.58	1.00	0.74	14.31	NC	NC
MID-	59.00	-45.22	14.72	48.35	7.56	52.23	1.00	1.44	14.31	2.37	2.37
TOP	24.00	-41.76	14.72	48.35	7.56	52.23	1.00	1.44	14.31	2.52	2.52

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
LT	24.00	-21.19	6.12	48.35	7.56	50.01	1.00	1.44	14.31	6.47	6.47
MID	125.00	32.01	-0.98	48.35	7.56	48.08	1.00	1.44	14.31	3.31	3.31
MID-	125.00	0.50	5.97	13.89	7.69	16.13	1.00	0.37	14.31	NC	NC
RT	24.00	-21.19	6.12	48.35	7.56	50.01	1.00	1.44	14.31	6.47	6.47

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
LT	24.00	-24.82	9.96	48.35	7.56	51.01	1.00	1.44	14.31	6.80	6.80
MID	125.00	33.36	0.40	48.35	7.56	48.46	1.00	1.44	14.31	3.65	3.65
MID-	125.00	0.78	9.41	13.89	7.69	17.40	1.00	0.37	14.31	NC	NC
RT	24.00	-24.82	9.96	48.35	7.56	51.01	1.00	1.44	14.31	6.80	6.80

Notes: Mu - Resisting moment under pure flexure, Ma - Allowable moment under applied axial load

Strength Limit State at Critical Sections: 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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
BOT	12.20	7.72	48.2	14.72	7.20	10.99	2.000	45.00	12.21 b	0.00	0.00	0.00	6.24	6.24
MID	59.00	1.18	9.7	7.74	7.25	16.17	2.923	34.08	17.97 a	0.00	0.00	0.00	47.54	47.54
MID-	59.00	0.16	44.2	14.72	7.20	11.11	2.021	39.04	12.34 a	0.00	0.00	0.00	29.71	29.71
TOP	12.20	-5.17	41.2	14.72	7.20	11.23	2.044	38.88	12.48 a	0.00	0.00	0.00	6.86	6.86

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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
LT	12.20	13.16	32.8	6.12	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	2.32	2.32
MID	125.00	1.21	32.0	-0.98	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	14.82	14.82
MID-	125.00	1.21	12.8	5.97	7.69	17.60	n/a	n/a	19.56 c	0.00	0.00	0.00	15.07	15.07
RT	12.20	13.16	32.8	6.12	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	2.32	2.32

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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
LT	12.20	14.25	38.8	9.96	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	2.15	2.15
MID	125.00	0.09	33.4	0.40	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	NC	NC
MID-	125.00	0.09	0.0	9.41	7.69	23.39	5.082	27.84	25.99 a	0.00	0.00	0.00	NC	NC
RT	12.20	14.25	38.8	9.96	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	2.15	2.15

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

Load Combination Results at Tenth Points: (k-ft, k)(Fill Depth = 5.50 ft)

M-PT	+Moment	-Moment	+Axial	-Axial	+Shear	-Shear
Member 1: (Exterior Wall)						
Bottom						
1- 0	-31.436	-53.255	7.742	14.719	9.956	0.396
1- 1	-23.252	-48.202	7.742	14.719	7.793	0.203
1- 2	-17.119	-47.287	7.742	14.719	5.769	0.306
1- 3	-12.916	-46.280	7.742	14.719	3.884	0.388
1- 4	-10.490	-45.211	7.742	14.719	2.138	0.448
1- 5	-9.713	-44.205	7.742	14.719	1.176	-0.158
1- 6	-10.448	-43.282	7.742	14.719	1.194	-1.627
1- 7	-12.561	-42.457	7.742	14.719	1.191	-2.958
1- 8	-15.922	-41.735	7.742	14.719	1.167	-4.150
1- 9	-20.378	-41.140	7.742	14.719	1.121	-5.203
1-10	-25.810	-44.660	7.742	14.719	0.982	-6.117
Top						
Member 2: (Top Slab)						
Left						
2- 0	-25.890	-44.740	5.973	6.117	14.719	7.742
2- 1	-9.792	-20.213	-0.982	6.117	11.534	5.895
2- 2	8.135	-1.660	-0.982	6.117	8.901	4.416
2- 3	21.394	6.676	-0.982	5.973	6.323	2.944
2- 4	29.399	11.275	-0.982	5.973	3.762	1.307
2- 5	32.008	12.809	-0.982	5.973	1.213	-1.213
2- 6	29.397	11.275	-0.982	5.973	-1.306	-3.762
2- 7	21.394	6.676	-0.982	5.973	-2.944	-6.323
2- 8	8.137	-1.660	-0.982	6.117	-4.416	-8.901
2- 9	-9.792	-20.213	-0.982	6.117	-5.895	-11.534
2-10	-25.890	-44.740	5.973	6.117	-7.742	-14.719
Right						
Member 4: (Bottom Slab)						
Left						
4- 0	-31.436	-53.255	9.412	9.956	15.790	8.848
4- 1	-14.846	-23.640	9.412	9.956	12.640	7.078
4- 2	4.521	-1.942	0.396	9.412	9.489	5.309
4- 3	20.388	7.275	0.396	9.412	6.338	3.539
4- 4	30.157	12.805	0.396	9.412	3.188	1.770
4- 5	33.362	14.648	0.396	9.412	0.093	-0.093
4- 6	30.157	12.805	0.396	9.412	-1.770	-3.188
4- 7	20.388	7.275	0.396	9.412	-3.539	-6.338
4- 8	4.521	-1.942	0.396	9.412	-5.309	-9.489
4- 9	-14.846	-23.640	9.412	9.956	-7.078	-12.640
4-10	-31.436	-53.255	9.412	9.956	-8.848	-15.790
Right						

---------- Analysis Truck, EV 3 ----------

Vehicle	Axle No.	Weight (k/ft)	Length (ft)	Dist. From Previous (ft)
Truck	1	0.484	11.16	
	2	0.292	7.16	17.00

***Distributed loads may have been intensified due to axle overlap between lanes

Live Load Parameters:

Traffic Direction is Parallel to Main Reinforcement
Distribution Width : 15.19 ft
Impact Factor : 1.10
Truck MPF : 1.20 Tandem MPF : 0.00
Lane Load Distribution Width : 17.52 ft
Lane Load: 0.000 k/ft

Truck Positions That Cause Maximum Results:

Maximum +Moment in Top Slab

Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)
Truck	1	0.292	7.16	27.42
	2	0.484	11.16	10.42

Maximum +Moment : 8.95 k-ft
Corresponding Moment at End : -11.65 k-ft
Coincident Bottom Slab Load : 0.26 k/ft

Maximum -Moment in Top Slab

Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)
Truck	1	0.292	7.16	26.38
	2	0.484	11.16	9.38

Maximum -Moment : -11.80 k-ft
Corresponding Moment at Mid : 8.84 k-ft
Coincident Bottom Slab Load : 0.26 k/ft

Maximum +Shear in Top Slab

Truck	1	0.292	7.16	22.58
	2	0.484	11.16	5.58

Maximum +Shear : 4.07 k
Corresponding Shear at Mid : -0.98 k
Coincident Bottom Slab Load : 0.29 k/ft

Maximum -Shear in Top Slab

Truck	1	0.484	11.16	15.25
	2	0.292	7.16	-1.75

Maximum -Shear : -4.07 k
Corresponding Shear at Mid : 0.98 k
Coincident Bottom Slab Load : 0.29 k/ft

Unfactored Moments and Shears due to Truck Loads: (k-ft, k)

	Truck				Tandem				Lane			
M-PT	Mll+	Mll-	Vll+	Vll-	Mll+	Mll-	Vll+	Vll-	Mll+	Mll-	Vll+	Vll-
Member 1: (Exterior Wall)												
Bottom												
1- 0	0.00	-9.93	0.27	-0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 1	0.00	-9.89	0.27	-0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 2	0.00	-9.84	0.27	-0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 3	0.00	-9.80	0.27	-0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 4	0.00	-9.79	0.27	-0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 5	0.00	-10.01	0.27	-0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 6	0.00	-10.35	0.27	-0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 7	0.00	-10.70	0.27	-0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 8	0.00	-11.06	0.27	-0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 9	0.00	-11.43	0.27	-0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-10	0.02	-11.80	0.27	-0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Top												
Member 2: (Top Slab)												
Left												
2- 0	0.02	-11.80	4.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 1	1.15	-6.20	3.48	-0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 2	3.51	-2.01	2.89	-0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 3	6.50	0.00	2.30	-0.39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 4	8.31	0.00	1.71	-0.72	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 5	8.95	0.00	1.17	-1.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 6	8.31	0.00	0.72	-1.71	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 7	6.50	0.00	0.39	-2.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 8	3.51	-2.01	0.17	-2.89	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 9	1.15	-6.20	0.04	-3.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-10	0.02	-11.80	0.00	-4.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Right												
Member 4: (Bottom Slab)												
Left												
4- 0	0.00	-9.93	3.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 1	0.00	-4.18	2.46	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 2	1.56	-0.11	1.87	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 3	4.33	0.00	1.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 4	6.00	0.00	0.68	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 5	6.44	0.00	0.09	-0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 6	6.00	0.00	0.00	-0.68	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 7	4.33	0.00	0.00	-1.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 8	1.56	-0.11	0.00	-1.87	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 9	0.00	-4.18	0.00	-2.46	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4-10	0.00	-9.93	0.00	-3.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Right												

Note: Unfactored live load results computed at 5.50 ft and 0 ft fill depths, per LRFD 3.6.1.2.6

Serviceability Check: Crack Control

Bar Mark	Location	Moment (k-ft)	Thrust (k)	Fss (ksi)	Spacing (in)	Allow (in)
A1	Top Corner Bar	-37.1	12.67	41.56*	5.00	6.66
A2	Bot Corner Bar	-39.9	12.67	45.05*	5.00	5.76
A100	Top Slab (int)	27.9	-1.25	35.44	5.00	8.65
A200	Bot Slab (int)	27.7	-0.44	34.76	5.00	8.91
B2	Ext Wall (ext)	-39.1	12.67	44.05	5.00	6.00

Strength Limit State at Critical Sections: Flexure

Member 1: (Exterior Wall), 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
BOT	24.00	-51.03	16.59	48.35	7.56	52.70	1.00	1.44	14.31	1.39	1.39
MID	59.00	0.00	7.74	26.97	7.69	29.58	1.00	0.74	14.31	NC	NC
MID-	59.00	-49.52	16.59	48.35	7.56	52.70	1.00	1.44	14.31	1.60	1.60
TOP	24.00	-47.91	16.59	48.35	7.56	52.70	1.00	1.44	14.31	1.51	1.51

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
LT	24.00	-24.61	6.29	48.35	7.56	50.05	1.00	1.44	14.31	4.06	4.06
MID	125.00	36.20	-1.02	48.35	7.56	48.07	1.00	1.44	14.31	2.16	2.16
MID-	125.00	0.50	5.97	13.89	7.69	16.13	1.00	0.37	14.31	NC	NC
RT	24.00	-24.61	6.29	48.35	7.56	50.05	1.00	1.44	14.31	4.06	4.06

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
LT	24.00	-26.32	9.99	48.35	7.56	51.02	1.00	1.44	14.31	5.22	5.22
MID	125.00	35.57	0.22	48.35	7.56	48.41	1.00	1.44	14.31	2.72	2.72
MID-	125.00	0.78	9.41	13.89	7.69	17.40	1.00	0.37	14.31	NC	NC
RT	24.00	-26.32	9.99	48.35	7.56	51.02	1.00	1.44	14.31	5.23	5.23

Notes: Mu - Resisting moment under pure flexure, Ma - Allowable moment under applied axial load

Strength Limit State at Critical Sections: 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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
BOT	12.20	7.76	51.7	16.59	7.20	10.99	2.000	45.00	12.21 b	0.00	0.00	0.00	6.02	6.02
MID	59.00	1.21	9.7	7.74	7.25	16.16	2.921	34.09	17.96 a	0.00	0.00	0.00	42.48	42.48
MID-	59.00	0.33	49.0	16.59	7.20	10.99	2.000	45.00	12.21 b	0.00	0.00	0.00	19.69	19.69
TOP	12.20	-5.34	47.6	16.59	7.20	10.99	2.000	45.00	12.21 b	0.00	0.00	0.00	5.73	5.73

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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
LT	12.20	14.92	37.8	6.29	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.53	1.53
MID	125.00	1.58	36.2	-1.02	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	11.40	11.40
MID-	125.00	1.58	12.8	5.97	7.69	17.60	n/a	n/a	19.56 c	0.00	0.00	0.00	11.58	11.58
RT	12.20	14.92	37.8	6.29	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.53	1.53

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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
LT	12.20	15.13	41.2	9.99	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.64	1.64
MID	125.00	0.12	35.6	0.22	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	NC	NC
MID-	125.00	0.12	0.0	9.41	7.69	23.39	5.081	27.84	25.99 a	0.00	0.00	0.00	NC	NC
RT	12.20	15.13	41.2	9.99	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.65	1.65

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

Filename: Bothell Culvert Analysis 043025.etcx

Load Combination Results at Tenth Points: (k-ft, k)(Fill Depth = 5.50 ft)

M-PT	+Moment	-Moment	+Axial	-Axial	+Shear	-Shear
Member 1: (Exterior Wall)						
Bottom						
1- 0	-31.436	-56.512	7.742	16.586	9.995	0.220
1- 1	-23.252	-51.711	7.742	16.586	7.832	0.027
1- 2	-17.119	-51.049	7.742	16.586	5.808	0.130
1- 3	-12.916	-50.295	7.742	16.586	3.923	0.211
1- 4	-10.490	-49.515	7.742	16.586	2.177	0.272
1- 5	-9.713	-49.006	7.742	16.586	1.215	-0.334
1- 6	-10.448	-48.623	7.742	16.586	1.233	-1.804
1- 7	-12.561	-48.249	7.742	16.586	1.230	-3.134
1- 8	-15.922	-47.898	7.742	16.586	1.206	-4.326
1- 9	-20.378	-47.594	7.742	16.586	1.160	-5.379
1-10	-25.810	-51.307	7.742	16.586	1.021	-6.294
Top						
Member 2: (Top Slab)						
Left						
2- 0	-25.890	-51.387	5.973	6.294	16.586	7.742
2- 1	-9.548	-23.497	-1.021	6.294	13.166	5.895
2- 2	9.046	-2.429	-1.021	6.294	10.246	4.416
2- 3	24.084	6.676	-1.021	5.973	7.326	2.944
2- 4	33.133	11.275	-1.021	5.973	4.427	1.137
2- 5	36.203	12.809	-1.021	5.973	1.578	-1.578
2- 6	33.133	11.275	-1.021	5.973	-1.137	-4.426
2- 7	24.090	6.676	-1.021	5.973	-2.944	-7.326
2- 8	9.046	-2.434	-1.021	6.294	-4.416	-10.246
2- 9	-9.548	-23.497	-1.021	6.294	-5.895	-13.166
2-10	-25.890	-51.387	5.973	6.294	-7.742	-16.585
Right						
Member 4: (Bottom Slab)						
Left						
4- 0	-31.436	-56.512	9.412	9.995	16.759	8.848
4- 1	-14.846	-25.065	9.412	9.995	13.430	7.078
4- 2	5.292	-1.942	0.220	9.412	10.102	5.309
4- 3	22.189	7.275	0.220	9.412	6.774	3.539
4- 4	32.346	12.805	0.220	9.412	3.446	1.770
4- 5	35.569	14.648	0.220	9.412	0.124	-0.124
4- 6	32.347	12.805	0.220	9.412	-1.770	-3.445
4- 7	22.191	7.275	0.220	9.412	-3.539	-6.773
4- 8	5.298	-1.942	0.220	9.412	-5.309	-10.102
4- 9	-14.846	-25.058	9.412	9.995	-7.078	-13.430
4-10	-31.436	-56.504	9.412	9.995	-8.848	-16.758
Right						

---------- Analysis Truck, NRL - Legal Lane ----------

Vehicle	Axle No.	Weight (k/ft)	Length (ft)	Dist. From Previous (ft)
Truck	1	0.164	11.16	
	2	0.146	7.16	18.00
	3	0.141	11.16	17.00
	4	0.110	7.16	17.00

***Distributed loads may have been intensified due to axle overlap between lanes

Live Load Parameters:

Traffic Direction is Parallel to Main Reinforcement
Distribution Width : 15.19 ft
Impact Factor : 1.10
Truck MPF : 1.20 Tandem MPF : 0.00
Lane Load Distribution Width : 17.52 ft
Lane Load: 0.014 k/ft

Truck Positions That Cause Maximum Results:

Maximum +Moment in Top Slab

Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)
Truck	1	0.164	11.16	10.42
	2	0.146	7.16	-7.58
	3	0.141	11.16	-24.58
	4	0.110	7.16	-41.58

Maximum -Moment in Top Slab

Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)
Truck	1	0.164	11.16	9.38
	2	0.146	7.16	-8.63
	3	0.141	11.16	-25.63
	4	0.110	7.16	-42.63

Maximum +Moment : 3.03 k-ft
Corresponding Moment at End : -3.95 k-ft
Coincident Bottom Slab Load : 0.09 k/ft

Maximum -Moment : -4.00 k-ft
Corresponding Moment at Mid : 2.99 k-ft
Coincident Bottom Slab Load : 0.09 k/ft

Maximum +Shear in Top Slab

Truck	1	0.110	7.16	57.58
	2	0.141	11.16	40.58
	3	0.146	7.16	23.58
	4	0.164	11.16	5.58

Maximum +Shear : 1.37 k
Corresponding Shear at Mid : -0.34 k
Coincident Bottom Slab Load : 0.09 k/ft

Maximum -Shear in Top Slab

Truck	1	0.164	11.16	15.25
	2	0.146	7.16	-2.75
	3	0.141	11.16	-19.75
	4	0.110	7.16	-36.75

Maximum -Shear : -1.37 k
Corresponding Shear at Mid : 0.34 k
Coincident Bottom Slab Load : 0.09 k/ft

Unfactored Moments and Shears due to Truck Loads: (k-ft, k)

	Truck				Tandem				Lane			
M-PT	Mll+	Mll-	Vll+	Vll-	Mll+	Mll-	Vll+	Vll-	Mll+	Mll-	Vll+	Vll-
Member 1: (Exterior Wall)												
Bottom												
1- 0	0.00	-3.28	0.12	-0.13	0.00	0.00	0.00	0.00	0.00	-0.43	0.01	-0.01
1- 1	0.00	-3.27	0.12	-0.13	0.00	0.00	0.00	0.00	0.00	-0.43	0.01	-0.01
1- 2	0.00	-3.26	0.12	-0.13	0.00	0.00	0.00	0.00	0.00	-0.43	0.01	-0.01
1- 3	0.00	-3.25	0.12	-0.13	0.00	0.00	0.00	0.00	0.00	-0.43	0.01	-0.01
1- 4	0.00	-3.28	0.12	-0.13	0.00	0.00	0.00	0.00	0.00	-0.43	0.01	-0.01
1- 5	0.00	-3.39	0.12	-0.13	0.00	0.00	0.00	0.00	0.00	-0.43	0.01	-0.01
1- 6	0.00	-3.51	0.12	-0.13	0.00	0.00	0.00	0.00	0.00	-0.43	0.01	-0.01
1- 7	0.00	-3.63	0.12	-0.13	0.00	0.00	0.00	0.00	0.00	-0.43	0.01	-0.01
1- 8	0.00	-3.75	0.12	-0.13	0.00	0.00	0.00	0.00	0.00	-0.43	0.01	-0.01
1- 9	0.00	-3.87	0.12	-0.13	0.00	0.00	0.00	0.00	0.00	-0.43	0.01	-0.01
1-10	0.01	-4.00	0.12	-0.13	0.00	0.00	0.00	0.00	0.00	-0.43	0.01	-0.01
Top												
Member 2: (Top Slab)												
Left												
2- 0	0.01	-4.00	1.37	0.00	0.00	0.00	0.00	0.00	0.00	-0.43	0.14	0.00
2- 1	0.39	-2.10	1.18	-0.01	0.00	0.00	0.00	0.00	0.03	-0.20	0.12	0.00
2- 2	1.19	-0.68	0.98	-0.06	0.00	0.00	0.00	0.00	0.10	-0.06	0.09	0.00
2- 3	2.19	0.00	0.78	-0.13	0.00	0.00	0.00	0.00	0.19	0.00	0.07	-0.01
2- 4	2.81	0.00	0.58	-0.24	0.00	0.00	0.00	0.00	0.28	0.00	0.05	-0.02
2- 5	3.03	0.00	0.40	-0.40	0.00	0.00	0.00	0.00	0.31	0.00	0.03	-0.03
2- 6	2.81	0.00	0.24	-0.58	0.00	0.00	0.00	0.00	0.28	0.00	0.02	-0.05
2- 7	2.19	0.00	0.13	-0.78	0.00	0.00	0.00	0.00	0.19	0.00	0.01	-0.07
2- 8	1.19	-0.68	0.06	-0.98	0.00	0.00	0.00	0.00	0.10	-0.06	0.00	-0.09
2- 9	0.39	-2.10	0.01	-1.18	0.00	0.00	0.00	0.00	0.03	-0.20	0.00	-0.12
2-10	0.01	-4.00	0.00	-1.37	0.00	0.00	0.00	0.00	0.00	-0.43	0.00	-0.14
Right												
Member 4: (Bottom Slab)												
Left												
4- 0	0.00	-3.28	1.01	0.00	0.00	0.00	0.00	0.00	0.00	-0.43	0.14	0.00
4- 1	0.00	-1.40	0.81	0.00	0.00	0.00	0.00	0.00	0.00	-0.16	0.11	0.00
4- 2	0.53	-0.04	0.62	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.09	0.00
4- 3	1.44	0.00	0.42	0.00	0.00	0.00	0.00	0.00	0.19	0.00	0.06	0.00
4- 4	1.98	0.00	0.23	0.00	0.00	0.00	0.00	0.00	0.28	0.00	0.03	0.00
4- 5	2.14	0.00	0.03	-0.03	0.00	0.00	0.00	0.00	0.31	0.00	0.00	0.00
4- 6	1.98	0.00	0.00	-0.23	0.00	0.00	0.00	0.00	0.28	0.00	0.00	-0.03
4- 7	1.44	0.00	0.00	-0.42	0.00	0.00	0.00	0.00	0.19	0.00	0.00	-0.06
4- 8	0.53	-0.04	0.00	-0.62	0.00	0.00	0.00	0.00	0.05	0.00	0.00	-0.09
4- 9	0.00	-1.40	0.00	-0.81	0.00	0.00	0.00	0.00	0.00	-0.16	0.00	-0.11
4-10	0.00	-3.28	0.00	-1.01	0.00	0.00	0.00	0.00	0.00	-0.43	0.00	-0.14
Right												

Note: Unfactored live load results computed at 5.50 ft and 0 ft fill depths, per LRFD 3.6.1.2.6

Serviceability Check: Crack Control

Bar Mark	Location	Moment (k-ft)	Thrust (k)	Fss (ksi)	Spacing (in)	Allow (in)
A1	Top Corner Bar	-30.3	10.12	33.94	5.00	9.25
A2	Bot Corner Bar	-33.8	10.12	38.34*	5.00	7.63
A100	Top Slab (int)	22.3	-1.10	28.37	5.00	12.02
A200	Bot Slab (int)	23.7	-0.19	29.67	5.00	11.28
B2	Ext Wall (ext)	-33.1	10.12	37.44	5.00	7.93

Strength Limit State at Critical Sections: Flexure

Member 1: (Exterior Wall), 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
BOT	24.00	-44.20	13.75	48.35	7.56	51.98	1.00	1.44	14.31	2.32	2.32
MID	59.00	0.00	7.74	26.97	7.69	29.58	1.00	0.74	14.31	NC	NC
MID-	59.00	-42.81	13.75	48.35	7.56	51.98	1.00	1.44	14.31	2.63	2.63
TOP	24.00	-40.30	13.75	48.35	7.56	51.98	1.00	1.44	14.31	2.52	2.52

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
LT	24.00	-20.26	6.29	48.35	7.56	50.05	1.00	1.44	14.31	6.52	6.52
MID	125.00	29.97	-0.87	48.35	7.56	48.11	1.00	1.44	14.31	3.76	3.76
MID-	125.00	0.52	6.25	13.89	7.69	16.24	1.00	0.37	14.31	NC	NC
RT	24.00	-20.26	6.29	48.35	7.56	50.05	1.00	1.44	14.31	6.52	6.52

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
LT	24.00	-23.40	10.13	48.35	7.56	51.06	1.00	1.44	14.31	8.04	8.04
MID	125.00	31.16	0.50	48.35	7.56	48.49	1.00	1.44	14.31	4.66	4.66
MID-	125.00	0.81	9.69	13.89	7.69	17.50	1.00	0.37	14.31	NC	NC
RT	24.00	-23.40	10.13	48.35	7.56	51.06	1.00	1.44	14.31	8.06	8.06

Notes: Mu - Resisting moment under pure flexure, Ma - Allowable moment under applied axial load

Strength Limit State at Critical Sections: 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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
BOT	12.20	7.84	44.8	13.75	7.20	10.99	2.000	45.00	12.21 b	0.00	0.00	0.00	4.75	4.75
MID	59.00	1.07	9.2	7.74	7.25	16.56	2.994	33.76	18.40 a	0.00	0.00	0.00	60.92	60.92
MID-	59.00	0.05	42.2	13.75	7.20	11.29	2.055	38.79	12.55 a	0.00	0.00	0.00	35.91	35.91
TOP	12.20	-5.29	39.7	13.75	7.20	11.35	2.065	38.72	12.61 a	0.00	0.00	0.00	5.30	5.30

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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
LT	12.20	12.28	31.6	6.29	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	2.66	2.66
MID	125.00	0.75	30.0	-0.87	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	20.18	20.18
MID-	125.00	0.75	12.7	6.25	7.69	17.60	n/a	n/a	19.56 c	0.00	0.00	0.00	20.52	20.52
RT	12.20	12.27	31.6	6.29	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	2.66	2.66

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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
LT	12.20	13.22	36.4	10.13	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	2.84	2.84
MID	125.00	0.06	31.2	0.50	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	NC	NC
MID-	125.00	0.06	0.0	9.69	7.69	23.39	5.085	27.83	25.99 a	0.00	0.00	0.00	NC	NC
RT	12.20	13.22	36.3	10.13	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	2.84	2.84

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

Filename: Bothell Culvert Analysis 043025.etcx

Load Combination Results at Tenth Points: (k-ft, k)(Fill Depth = 5.50 ft)

M-PT	+Moment	-Moment	+Axial	-Axial	+Shear	-Shear
Member 1: (Exterior Wall)						
Bottom						
1- 0	-31.584	-49.746	7.742	13.748	10.130	0.500
1- 1	-23.151	-44.837	7.742	13.748	7.911	0.307
1- 2	-16.824	-44.219	7.742	13.748	5.831	0.410
1- 3	-12.483	-43.509	7.742	13.748	3.890	0.492
1- 4	-9.974	-42.804	7.742	13.748	2.087	0.552
1- 5	-9.169	-42.179	7.742	13.748	1.068	-0.054
1- 6	-9.932	-41.539	7.742	13.748	1.087	-1.579
1- 7	-12.128	-40.899	7.742	13.748	1.084	-2.966
1- 8	-15.627	-40.276	7.742	13.748	1.059	-4.214
1- 9	-20.277	-39.693	7.742	13.748	1.014	-5.324
1-10	-25.958	-43.272	7.742	13.748	0.875	-6.294
Top						
Member 2: (Top Slab)						
Left						
2- 0	-26.038	-43.352	6.254	6.294	13.748	7.742
2- 1	-10.360	-19.298	-0.875	6.294	10.730	5.895
2- 2	6.565	-1.157	-0.875	6.294	8.213	4.416
2- 3	19.492	6.528	-0.875	6.254	5.706	2.944
2- 4	27.336	11.128	-0.875	6.254	3.215	1.472
2- 5	29.971	12.661	-0.875	6.254	0.751	-0.751
2- 6	27.336	11.128	-0.875	6.254	-1.472	-3.214
2- 7	19.492	6.528	-0.875	6.254	-2.944	-5.706
2- 8	6.566	-1.160	-0.875	6.294	-4.416	-8.213
2- 9	-10.359	-19.298	-0.875	6.294	-5.895	-10.729
2-10	-26.038	-43.351	6.254	6.294	-7.742	-13.748
Right						
Member 4: (Bottom Slab)						
Left						
4- 0	-31.584	-49.746	9.693	10.130	14.643	8.848
4- 1	-14.994	-22.303	9.693	10.130	11.725	7.078
4- 2	4.195	-2.090	0.500	9.693	8.807	5.309
4- 3	19.198	7.127	0.500	9.693	5.889	3.539
4- 4	28.206	12.657	0.500	9.693	2.971	1.770
4- 5	31.163	14.500	0.500	9.693	0.059	-0.059
4- 6	28.206	12.657	0.500	9.693	-1.770	-2.971
4- 7	19.199	7.127	0.500	9.693	-3.539	-5.889
4- 8	4.198	-2.090	0.500	9.693	-5.309	-8.807
4- 9	-14.994	-22.297	9.693	10.130	-7.078	-11.725
4-10	-31.584	-49.743	9.693	10.130	-8.848	-14.643
Right						

---------- Analysis Truck, WA-105 ----------

Vehicle	Axle No.	Weight (k/ft)	Length (ft)	Dist. From Previous (ft)
Truck	1	0.219	11.16	
	2	0.207	7.16	12.00
	3	0.266	11.16	34.00
	4	0.109	11.16	8.00
	5	0.152	7.16	13.00

***Distributed loads may have been intensified due to axle overlap between lanes

Live Load Parameters:

Traffic Direction is Parallel to Main Reinforcement
Distribution Width : 15.19 ft
Impact Factor : 1.10
Truck MPF : 1.20 Tandem MPF : 0.00
Lane Load Distribution Width : 17.52 ft
Lane Load: 0.000 k/ft

Truck Positions That Cause Maximum Results:

Maximum +Moment in Top Slab

Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)
Truck	1	0.219	11.16	58.87
	2	0.207	7.16	46.87
	3	0.266	11.16	12.87

Maximum -Moment in Top Slab

Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)
Truck	1	0.219	11.16	58.87
	2	0.207	7.16	46.87
	3	0.266	11.16	12.87

	4	0.109	11.16	4.87		4	0.109	11.16	4.87
	5	0.152	7.16	-8.13		5	0.152	7.16	-8.13

Maximum +Moment : 5.82 k-ft
Corresponding Moment at End : -7.52 k-ft
Coincident Bottom Slab Load : 0.20 k/ft

Maximum -Moment : -7.81 k-ft
Corresponding Moment at Mid : 5.82 k-ft
Coincident Bottom Slab Load : 0.20 k/ft

Maximum +Shear in Top Slab

Truck	1	0.152	7.16	26.58
	2	0.109	11.16	13.58
	3	0.266	11.16	5.58
	4	0.207	7.16	-28.42
	5	0.219	11.16	-40.42

Maximum +Shear : 2.63 k
Corresponding Shear at Mid : -0.40 k
Coincident Bottom Slab Load : 0.20 k/ft

Maximum -Shear in Top Slab

Truck	1	0.219	11.16	61.25
	2	0.207	7.16	49.25
	3	0.266	11.16	15.25
	4	0.109	11.16	7.25
	5	0.152	7.16	-5.75

Maximum -Shear : -2.63 k
Corresponding Shear at Mid : 0.40 k
Coincident Bottom Slab Load : 0.20 k/ft

Unfactored Moments and Shears due to Truck Loads: (k-ft, k)

	Truck				Tandem				Lane			
M-PT	Mll+	Mll-	Vll+	Vll-	Mll+	Mll-	Vll+	Vll-	Mll+	Mll-	Vll+	Vll-
Member 1: (Exterior Wall)												
Bottom												
1- 0	0.00	-6.59	0.15	-0.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 1	0.00	-6.66	0.15	-0.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 2	0.00	-6.74	0.15	-0.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 3	0.00	-6.84	0.15	-0.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 4	0.00	-6.96	0.15	-0.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 5	0.00	-7.09	0.15	-0.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 6	0.00	-7.23	0.15	-0.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 7	0.00	-7.36	0.15	-0.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 8	0.00	-7.50	0.15	-0.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 9	0.00	-7.65	0.15	-0.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-10	0.01	-7.81	0.15	-0.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Top												
Member 2: (Top Slab)												
Left												
2- 0	0.01	-7.81	2.63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 1	0.63	-3.90	2.19	-0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 2	2.02	-1.17	1.81	-0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 3	3.97	0.00	1.39	-0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 4	5.36	0.00	0.98	-0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 5	5.82	0.00	0.65	-0.65	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 6	5.37	0.00	0.40	-0.98	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 7	3.97	0.00	0.21	-1.39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 8	2.02	-1.17	0.09	-1.81	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 9	0.63	-3.90	0.02	-2.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-10	0.01	-7.81	0.00	-2.63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Right												
Member 4: (Bottom Slab)												
Left												
4- 0	0.00	-6.59	2.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 1	0.00	-2.60	1.71	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 2	0.97	-0.06	1.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 3	3.06	0.00	0.87	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 4	4.32	0.00	0.45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 5	4.71	0.00	0.05	-0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 6	4.32	0.00	0.00	-0.45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 7	3.06	0.00	0.00	-0.87	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 8	0.97	-0.06	0.00	-1.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 9	0.00	-2.60	0.00	-1.71	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4-10	0.00	-6.59	0.00	-2.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Right												

Note: Unfactored live load results computed at 5.50 ft and 0 ft fill depths, per LRFD 3.6.1.2.6

Serviceability Check: Crack Control

Bar Mark	Location	Moment (k-ft)	Thrust (k)	Fss (ksi)	Spacing (in)	Allow (in)
A1	Top Corner Bar	-33.6	11.23	37.67*	5.00	7.85
A2	Bot Corner Bar	-36.8	11.23	41.72*	5.00	6.61
A100	Top Slab (int)	24.8	-1.12	31.47	5.00	10.35
A200	Bot Slab (int)	25.9	-0.24	32.52	5.00	9.86
B2	Ext Wall (ext)	-36.3	11.23	41.07	5.00	6.80

Strength Limit State at Critical Sections: Flexure

Member 1: (Exterior Wall), 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
BOT	24.00	-49.53	15.69	48.35	7.56	52.47	1.00	1.44	14.31	1.31	1.31
MID	59.00	0.00	7.74	26.97	7.69	29.58	1.00	0.74	14.31	NC	NC
MID-	59.00	-48.48	15.69	48.35	7.56	52.47	1.00	1.44	14.31	1.45	1.45
TOP	24.00	-46.12	15.69	48.35	7.56	52.47	1.00	1.44	14.31	1.43	1.43

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
LT	24.00	-23.18	6.38	48.35	7.56	50.08	1.00	1.44	14.31	4.06	4.06
MID	125.00	34.30	-0.92	48.35	7.56	48.10	1.00	1.44	14.31	2.16	2.16
MID-	125.00	0.52	6.25	13.89	7.69	16.24	1.00	0.37	14.31	NC	NC
RT	24.00	-23.18	6.38	48.35	7.56	50.08	1.00	1.44	14.31	4.06	4.06

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
LT	24.00	-25.34	10.17	48.35	7.56	51.07	1.00	1.44	14.31	5.20	5.20
MID	125.00	35.13	0.42	48.35	7.56	48.47	1.00	1.44	14.31	2.42	2.42
MID-	125.00	0.81	9.69	13.89	7.69	17.50	1.00	0.37	14.31	NC	NC
RT	24.00	-25.34	10.17	48.35	7.56	51.07	1.00	1.44	14.31	5.20	5.20

Notes: Mu - Resisting moment under pure flexure, Ma - Allowable moment under applied axial load

Strength Limit State at Critical Sections: 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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
BOT	12.20	7.88	50.0	15.69	7.20	10.99	2.000	45.00	12.21 b	0.00	0.00	0.00	4.59	4.59
MID	59.00	1.11	9.2	7.74	7.25	16.55	2.991	33.77	18.39 a	0.00	0.00	0.00	51.23	51.23
MID-	59.00	0.14	47.9	15.69	7.20	10.99	2.000	45.00	12.21 b	0.00	0.00	0.00	26.11	26.11
TOP	12.20	-5.37	45.6	15.69	7.20	10.99	2.000	45.00	12.21 b	0.00	0.00	0.00	4.72	4.72

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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
LT	12.20	14.04	36.0	6.38	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.55	1.55
MID	125.00	1.14	34.3	-0.92	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	13.25	13.25
MID-	125.00	1.14	12.7	6.25	7.69	17.60	n/a	n/a	19.56 c	0.00	0.00	0.00	13.47	13.47
RT	12.20	14.04	36.0	6.38	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.55	1.55

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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
LT	12.20	14.76	39.8	10.17	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.54	1.54
MID	125.00	0.10	35.1	0.42	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	NC	NC
MID-	125.00	0.10	0.0	9.69	7.69	23.39	5.084	27.83	25.99 a	0.00	0.00	0.00	NC	NC
RT	12.20	14.76	39.8	10.17	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.54	1.54

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

Filename: Bothell Culvert Analysis 043025.etcx

Load Combination Results at Tenth Points: (k-ft, k)(Fill Depth = 5.50 ft)

M-PT	+Moment	-Moment	+Axial	-Axial	+Shear	-Shear
Member 1: (Exterior Wall)						
Bottom						
1- 0	-31.584	-54.782	7.742	15.694	10.171	0.415
1- 1	-23.151	-50.021	7.742	15.694	7.953	0.222
1- 2	-16.824	-49.546	7.742	15.694	5.873	0.325
1- 3	-12.483	-49.027	7.742	15.694	3.931	0.406
1- 4	-9.974	-48.477	7.742	15.694	2.129	0.467
1- 5	-9.169	-47.893	7.742	15.694	1.110	-0.139
1- 6	-9.932	-47.293	7.742	15.694	1.128	-1.665
1- 7	-12.128	-46.686	7.742	15.694	1.125	-3.052
1- 8	-15.627	-46.093	7.742	15.694	1.101	-4.300
1- 9	-20.277	-45.555	7.742	15.694	1.056	-5.409
1-10	-25.958	-49.185	7.742	15.694	0.917	-6.380
Top						
Member 2: (Top Slab)						
Left						
2- 0	-26.038	-49.265	6.254	6.380	15.694	7.742
2- 1	-9.996	-22.096	-0.917	6.380	12.304	5.895
2- 2	7.839	-1.916	-0.917	6.380	9.504	4.416
2- 3	22.259	6.528	-0.917	6.254	6.663	2.944
2- 4	31.306	11.128	-0.917	6.254	3.836	1.419
2- 5	34.299	12.661	-0.917	6.254	1.144	-1.144
2- 6	31.310	11.128	-0.917	6.254	-1.419	-3.835
2- 7	22.259	6.528	-0.917	6.254	-2.944	-6.663
2- 8	7.839	-1.918	-0.917	6.380	-4.416	-9.504
2- 9	-9.996	-22.096	-0.917	6.380	-5.895	-12.303
2-10	-26.038	-49.265	6.254	6.380	-7.742	-15.693
Right						
Member 4: (Bottom Slab)						
Left						
4- 0	-31.584	-54.782	9.693	10.171	16.350	8.848
4- 1	-14.994	-24.113	9.693	10.171	13.092	7.078
4- 2	4.892	-2.090	0.415	9.693	9.833	5.309
4- 3	21.706	7.127	0.415	9.693	6.575	3.539
4- 4	31.807	12.657	0.415	9.693	3.316	1.770
4- 5	35.126	14.500	0.415	9.693	0.096	-0.096
4- 6	31.809	12.657	0.415	9.693	-1.770	-3.316
4- 7	21.711	7.127	0.415	9.693	-3.539	-6.574
4- 8	4.892	-2.090	0.415	9.693	-5.309	-9.833
4- 9	-14.994	-24.111	9.693	10.171	-7.078	-13.091
4-10	-31.584	-54.779	9.693	10.171	-8.848	-16.350
Right						

Analysis Results: Fill Depth = 6.00 ft

Load Parameters:

Fe = 1.00 Surcharge Depth : 2.33 ft

Applied Horizontal Loads: (k/ft)

Load Description	Bottom of Wall	Top of Wall
Live Load Surcharge	0.140	0.140
Internal Water Pressure	-0.749(5.0in)	-0.187(-5.0in)
External Water Pressure	0.801(0.0in)	0.187(0.0in)
Horizontal Earth Load	0.975	0.385

Applied Uniform Bottom Slab Loads: (k/ft)

Load Description	
Dead Load	0.284
Vertical Earth	0.720
Wearing Surface	0.000

Unfactored Moments due to All Loads: (k-ft) / Unfactored Shears due to All Loads: (k)

M-PT	Mdc	Mev	Mdw	Meh	Mls	Mwa	Mgw	Vdc	Vev	Vdw	Veh	Vls	Vwa	Vgw
Member 1: (Exterior Wall)														
Bottom														
1- 0	-9.58	-22.68	0.00	-1.78	-0.36	1.23	-1.30	0.61	0.00	0.00	3.83	0.69	-2.50	2.94
1- 1	-8.97	-22.68	0.00	1.52	0.25	-1.11	1.21	0.61	0.00	0.00	2.90	0.55	-2.08	2.18
1- 2	-8.37	-22.68	0.00	3.95	0.72	-2.83	3.01	0.61	0.00	0.00	2.03	0.41	-1.41	1.48
1- 3	-7.77	-22.68	0.00	5.54	1.06	-3.91	4.15	0.61	0.00	0.00	1.22	0.28	-0.80	0.85
1- 4	-7.17	-22.68	0.00	6.37	1.26	-4.43	4.70	0.61	0.00	0.00	0.46	0.14	-0.25	0.27
1- 5	-6.57	-22.68	0.00	6.48	1.33	-4.43	4.71	0.61	0.00	0.00	-0.24	0.00	0.24	-0.25
1- 6	-5.97	-22.68	0.00	5.93	1.26	-3.99	4.25	0.61	0.00	0.00	-0.88	-0.14	0.67	-0.70
1- 7	-5.36	-22.68	0.00	4.78	1.06	-3.15	3.36	0.61	0.00	0.00	-1.46	-0.28	1.04	-1.10
1- 8	-4.76	-22.68	0.00	3.09	0.72	-1.97	2.12	0.61	0.00	0.00	-1.98	-0.41	1.35	-1.43
1- 9	-4.16	-22.68	0.00	0.91	0.25	-0.52	0.57	0.61	0.00	0.00	-2.45	-0.55	1.60	-1.71
1-10	-3.56	-22.68	0.00	-1.70	-0.36	1.14	-1.21	0.61	0.00	0.00	-2.85	-0.69	1.71	-1.92
Top														
Member 2: (Top Slab)														
Left														
2- 0	-3.56	-22.68	0.00	-1.73	-0.36	1.17	-1.25	1.73	7.50	0.00	0.00	0.00	0.00	0.00
2- 1	-0.71	-8.62	0.00	-1.73	-0.36	1.17	-1.25	1.05	6.00	0.00	0.00	0.00	0.00	0.00
2- 2	1.19	2.32	0.00	-1.73	-0.36	1.17	-1.25	0.78	4.50	0.00	0.00	0.00	0.00	0.00
2- 3	2.55	10.13	0.00	-1.73	-0.36	1.17	-1.25	0.52	3.00	0.00	0.00	0.00	0.00	0.00
2- 4	3.36	14.82	0.00	-1.73	-0.36	1.17	-1.25	0.26	1.50	0.00	0.00	0.00	0.00	0.00
2- 5	3.63	16.38	0.00	-1.73	-0.36	1.17	-1.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 6	3.36	14.82	0.00	-1.73	-0.36	1.17	-1.25	-0.26	-1.50	0.00	0.00	0.00	0.00	0.00
2- 7	2.55	10.13	0.00	-1.73	-0.36	1.17	-1.25	-0.52	-3.00	0.00	0.00	0.00	0.00	0.00
2- 8	1.19	2.32	0.00	-1.73	-0.36	1.17	-1.25	-0.78	-4.50	0.00	0.00	0.00	0.00	0.00
2- 9	-0.71	-8.62	0.00	-1.73	-0.36	1.17	-1.25	-1.05	-6.00	0.00	0.00	0.00	0.00	0.00
2-10	-3.56	-22.68	0.00	-1.73	-0.36	1.17	-1.25	-1.73	-7.50	0.00	0.00	0.00	0.00	0.00
Right														
Member 4: (Bottom Slab)														
Left														
4- 0	-9.58	-22.68	0.00	-1.78	-0.36	1.23	-1.30	2.96	7.50	0.00	0.00	0.00	0.00	0.00
4- 1	-4.03	-8.62	0.00	-1.78	-0.36	1.23	-1.30	2.37	6.00	0.00	0.00	0.00	0.00	0.00
4- 2	0.28	2.32	0.00	-1.78	-0.36	1.23	-1.30	1.77	4.50	0.00	0.00	0.00	0.00	0.00
4- 3	3.36	10.13	0.00	-1.78	-0.36	1.23	-1.30	1.18	3.00	0.00	0.00	0.00	0.00	0.00
4- 4	5.20	14.82	0.00	-1.78	-0.36	1.23	-1.30	0.59	1.50	0.00	0.00	0.00	0.00	0.00
4- 5	5.82	16.38	0.00	-1.78	-0.36	1.23	-1.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 6	5.20	14.82	0.00	-1.78	-0.36	1.23	-1.30	-0.59	-1.50	0.00	0.00	0.00	0.00	0.00
4- 7	3.36	10.13	0.00	-1.78	-0.36	1.23	-1.30	-1.18	-3.00	0.00	0.00	0.00	0.00	0.00
4- 8	0.28	2.32	0.00	-1.78	-0.36	1.23	-1.30	-1.77	-4.50	0.00	0.00	0.00	0.00	0.00
4- 9	-4.03	-8.62	0.00	-1.78	-0.36	1.23	-1.30	-2.37	-6.00	0.00	0.00	0.00	0.00	0.00
4-10	-9.58	-22.68	0.00	-1.78	-0.36	1.23	-1.30	-2.96	-7.50	0.00	0.00	0.00	0.00	0.00
Right														

Unfactored Thrusts due to All Loads: (k) (Fill Depth = 6.00 ft)

Member	Pdc	Pev	Pdw	Peh	Pls	Pwa
1	1.73	7.50	0.00	0.00	0.00	0.00
2	-0.61	0.00	0.00	2.85	0.69	-1.71
4	0.61	0.00	0.00	3.83	0.69	-2.50

Analysis Truck, HL-93

Vehicle	Axle No.	Weight (k/ft)	Length (ft)	Dist. From Previous (ft)
Truck	1	0.085	7.73	
	2	0.341	7.73	14.00
	3	0.341	7.73	14.00

Tandem	1	0.351	11.73	

***Distributed loads may have been intensified due to axle overlap between lanes

Live Load Parameters:

Traffic Direction is Parallel to Main Reinforcement
Distribution Width : 15.77 ft
Impact Factor : 1.08
Truck MPF : 1.20 Tandem MPF : 1.20
Lane Load Distribution Width : 18.10 ft
Lane Load: 0.000 k/ft

Truck Positions That Cause Maximum Results:

Maximum +Moment in Top Slab

Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)
Truck	1	0.085	7.73	38.12
	2	0.341	7.73	24.12
	3	0.341	7.73	10.12

Maximum +Moment : 5.17 k-ft
Corresponding Moment at End : -6.07 k-ft
Coincident Bottom Slab Load : 0.14 k/ft

Maximum -Moment in Top Slab

Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)
Truck	1	0.085	7.73	35.29
	2	0.341	7.73	21.29
	3	0.341	7.73	7.29

Maximum -Moment : -6.30 k-ft
Corresponding Moment at Mid : 4.54 k-ft
Coincident Bottom Slab Load : 0.18 k/ft

Maximum +Shear in Top Slab

Truck	1	0.085	7.73	31.87
	2	0.341	7.73	17.87
	3	0.341	7.73	3.87

Maximum +Shear : 2.54 k
Corresponding Shear at Mid : -0.10 k
Coincident Bottom Slab Load : 0.24 k/ft

Maximum -Shear in Top Slab

Truck	1	0.085	7.73	30.97
	2	0.341	7.73	16.97
	3	0.341	7.73	2.97

Maximum -Shear : -2.54 k
Corresponding Shear at Mid : 0.10 k
Coincident Bottom Slab Load : 0.24 k/ft

Maximum +Moment in Top Slab

Tandem	1	0.351	11.73	10.42

Maximum +Moment : 6.64 k-ft
Corresponding Moment at End : -8.77 k-ft
Coincident Bottom Slab Load : 0.20 k/ft

Maximum -Moment in Top Slab

Tandem	1	0.351	11.73	9.38

Maximum -Moment : -8.87 k-ft
Corresponding Moment at Mid : 6.57 k-ft
Coincident Bottom Slab Load : 0.20 k/ft

Maximum +Shear in Top Slab

Tandem	1	0.351	11.73	5.87

Maximum +Shear : 3.02 k
Corresponding Shear at Mid : -0.63 k
Coincident Bottom Slab Load : 0.20 k/ft

Maximum -Shear in Top Slab

Tandem	1	0.351	11.73	14.97

Maximum -Shear : -3.02 k
Corresponding Shear at Mid : 0.63 k
Coincident Bottom Slab Load : 0.20 k/ft

Unfactored Moments and Shears due to Truck Loads: (k-ft, k)

	Truck				Tandem				Lane			
M-PT	Mll+	Mll-	Vll+	Vll-	Mll+	Mll-	Vll+	Vll-	Mll+	Mll-	Vll+	Vll-
Member 1: (Exterior Wall)												
Bottom												
1- 0	0.00	-7.79	0.20	-0.23	0.00	-6.85	0.14	-0.29	0.00	0.00	0.00	0.00
1- 1	0.00	-7.59	0.20	-0.23	0.00	-6.90	0.14	-0.29	0.00	0.00	0.00	0.00
1- 2	0.00	-7.39	0.20	-0.23	0.00	-6.97	0.14	-0.29	0.00	0.00	0.00	0.00
1- 3	0.00	-7.20	0.20	-0.23	0.00	-7.13	0.14	-0.29	0.00	0.00	0.00	0.00
1- 4	0.00	-7.00	0.20	-0.23	0.00	-7.33	0.14	-0.29	0.00	0.00	0.00	0.00
1- 5	0.00	-6.81	0.20	-0.23	0.00	-7.56	0.14	-0.29	0.00	0.00	0.00	0.00
1- 6	0.00	-6.61	0.20	-0.23	0.00	-7.81	0.14	-0.29	0.00	0.00	0.00	0.00
1- 7	0.00	-6.45	0.20	-0.23	0.00	-8.07	0.14	-0.29	0.00	0.00	0.00	0.00
1- 8	0.00	-6.35	0.20	-0.23	0.00	-8.33	0.14	-0.29	0.00	0.00	0.00	0.00
1- 9	0.00	-6.29	0.20	-0.23	0.00	-8.60	0.14	-0.29	0.00	0.00	0.00	0.00
1-10	0.01	-6.30	0.20	-0.23	0.01	-8.87	0.14	-0.29	0.00	0.00	0.00	0.00
Top												
Member 2: (Top Slab)												
Left												
2- 0	0.01	-6.30	2.54	0.00	0.01	-8.87	3.02	0.00	0.00	0.00	0.00	0.00
2- 1	0.81	-3.36	2.10	-0.03	0.83	-4.62	2.59	-0.03	0.00	0.00	0.00	0.00
2- 2	2.43	-1.26	1.71	-0.12	2.54	-1.44	2.14	-0.12	0.00	0.00	0.00	0.00
2- 3	3.93	0.00	1.36	-0.28	4.74	0.00	1.69	-0.28	0.00	0.00	0.00	0.00
2- 4	4.98	0.00	1.06	-0.51	6.16	0.00	1.25	-0.52	0.00	0.00	0.00	0.00
2- 5	5.17	0.00	0.77	-0.77	6.64	0.00	0.85	-0.85	0.00	0.00	0.00	0.00
2- 6	4.98	0.00	0.51	-1.06	6.16	0.00	0.52	-1.25	0.00	0.00	0.00	0.00
2- 7	3.93	0.00	0.28	-1.36	4.74	0.00	0.28	-1.69	0.00	0.00	0.00	0.00
2- 8	2.43	-1.26	0.12	-1.71	2.54	-1.45	0.12	-2.14	0.00	0.00	0.00	0.00
2- 9	0.81	-3.36	0.03	-2.10	0.83	-4.62	0.03	-2.59	0.00	0.00	0.00	0.00

2-10	0.01	-6.30	0.00	-2.54	0.01	-8.87	0.00	-3.02	0.00	0.00	0.00	0.00
Right												

Member 4: (Bottom Slab)

Left												
4- 0	0.00	-7.79	2.49	0.00	0.00	-6.85	2.12	0.00	0.00	0.00	0.00	0.00
4- 1	0.00	-3.12	1.99	0.00	0.00	-2.85	1.71	0.00	0.00	0.00	0.00	0.00
4- 2	0.88	-0.08	1.50	0.00	1.15	-0.08	1.30	0.00	0.00	0.00	0.00	0.00
4- 3	3.18	0.00	1.00	0.00	3.20	0.00	0.89	0.00	0.00	0.00	0.00	0.00
4- 4	4.71	0.00	0.50	0.00	4.40	0.00	0.48	0.00	0.00	0.00	0.00	0.00
4- 5	5.22	0.00	0.06	-0.06	4.80	0.00	0.07	-0.07	0.00	0.00	0.00	0.00
4- 6	4.71	0.00	0.00	-0.50	4.40	0.00	0.00	-0.48	0.00	0.00	0.00	0.00
4- 7	3.18	0.00	0.00	-1.00	3.20	0.00	0.00	-0.89	0.00	0.00	0.00	0.00
4- 8	0.88	-0.08	0.00	-1.50	1.16	-0.08	0.00	-1.30	0.00	0.00	0.00	0.00
4- 9	0.00	-3.12	0.00	-1.99	0.00	-2.85	0.00	-1.71	0.00	0.00	0.00	0.00
4-10	0.00	-7.79	0.00	-2.49	0.00	-6.85	0.00	-2.12	0.00	0.00	0.00	0.00
Right												

Note: Unfactored live load results computed at 6.00 ft and 0 ft fill depths, per LRFD 3.6.1.2.6

Serviceability Check: Crack Control

Bar Mark	Location	Moment (k-ft)	Thrust (k)	Fss (ksi)	Spacing (in)	Allow (in)
A1	Top Corner Bar	-36.2	12.25	40.58*	5.00	6.94
A2	Bot Corner Bar	-39.3	12.25	44.41*	5.00	5.92
A100	Top Slab (int)	27.0	-1.10	34.16	5.00	9.16
A200	Bot Slab (int)	27.8	-0.26	34.82	5.00	8.89
B2	Ext Wall (ext)	-38.4	12.25	43.33	5.00	6.19

Strength Limit State at Critical Sections: Flexure

Member 1: (Exterior Wall), 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
BOT	24.00	-53.02	17.20	48.35	7.56	52.85*	1.00	1.44	14.31	1.21	1.57
MID	59.00	0.00	8.30	26.97	7.69	29.77	1.00	0.74	14.31	NC	NC
MID-	59.00	-51.41	17.20	48.35	7.56	52.85	1.00	1.44	14.31	1.41	1.83
TOP	24.00	-49.91	17.20	48.35	7.56	52.85	1.00	1.44	14.31	1.34	1.74

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
LT	24.00	-25.56	6.72	48.35	7.56	50.17	1.00	1.44	14.31	3.87	5.01
MID	125.00	37.47	-0.90	48.35	7.56	48.10	1.00	1.44	14.31	2.02	2.61
MID-	125.00	0.54	6.43	13.89	7.69	16.30	1.00	0.37	14.31	NC	NC
RT	24.00	-25.56	6.72	48.35	7.56	50.17	1.00	1.44	14.31	3.87	5.01

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
LT	24.00	-27.38	10.43	48.35	7.56	51.14	1.00	1.44	14.31	4.91	6.36
MID	125.00	37.73	0.35	48.35	7.56	48.45	1.00	1.44	14.31	2.31	2.99
MID-	125.00	0.82	9.87	13.89	7.69	17.56	1.00	0.37	14.31	NC	NC
RT	24.00	-27.38	10.43	48.35	7.56	51.14	1.00	1.44	14.31	4.91	6.36

Notes: Mu - Resisting moment under pure flexure, Ma - Allowable moment under applied axial load

Strength Limit State at Critical Sections: 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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
BOT	12.20	8.11	54.0	17.20	7.20	10.99	2.000	45.00	12.21 b	0.00	0.00	0.00	4.86	6.30
MID	59.00	1.20	10.5	8.30	7.25	15.74	2.845	34.44	17.49 a	0.00	0.00	0.00	41.75	54.12
MID-	59.00	0.31	51.0	17.20	7.20	10.99	2.000	45.00	12.21 b	0.00	0.00	0.00	20.05	25.99
TOP	12.20	-5.67	49.6	17.20	7.20	10.99	2.000	45.00	12.21 b	0.00	0.00	0.00	4.75	6.16

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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
LT	12.20	15.47	39.4	6.72	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.38	1.78
MID	125.00	1.48	37.5	-0.90	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	11.67	15.13
MID-	125.00	1.48	13.8	6.43	7.69	17.60	n/a	n/a	19.56 c	0.00	0.00	0.00	11.87	15.38
RT	12.20	15.47	39.4	6.72	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.38	1.78

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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
LT	12.20	16.07	43.1	10.43	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.32	1.71
MID	125.00	0.12	37.7	0.35	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	NC	NC
MID-	125.00	0.12	0.0	9.87	7.69	23.39	5.085	27.83	25.99 a	0.00	0.00	0.00	NC	NC
RT	12.20	16.07	43.1	10.43	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.32	1.71

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

Load Combination Results at Tenth Points: (k-ft, k)(Fill Depth = 6.00 ft)

M-PT	+Moment	-Moment	+Axial	-Axial	+Shear	-Shear
Member 1: (Exterior Wall)						
Bottom						
1- 0	-33.376	-59.424	8.304	17.201	10.432	0.349
1- 1	-24.790	-54.065	8.304	17.201	8.178	0.135
1- 2	-18.344	-53.051	8.304	17.201	6.064	0.218
1- 3	-13.917	-51.964	8.304	17.201	4.088	0.280
1- 4	-11.357	-51.402	8.304	17.201	2.250	0.321
1- 5	-10.535	-50.983	8.304	17.201	1.197	-0.305
1- 6	-11.315	-50.590	8.304	17.201	1.195	-1.866
1- 7	-13.562	-50.224	8.304	17.201	1.172	-3.287
1- 8	-17.146	-49.895	8.304	17.201	1.128	-4.570
1- 9	-21.915	-49.638	8.304	17.201	1.063	-5.714
1-10	-27.750	-53.596	8.304	17.201	0.904	-6.719
Top						
Member 2: (Top Slab)						
Left						
2- 0	-27.830	-53.677	6.427	6.719	17.201	8.304
2- 1	-10.626	-24.389	-0.904	6.719	13.650	6.345
2- 2	8.954	-2.235	-0.904	6.719	10.577	4.753
2- 3	24.662	7.197	-0.904	6.427	7.509	3.169
2- 4	34.248	12.148	-0.904	6.427	4.466	1.358
2- 5	37.469	13.798	-0.904	6.427	1.483	-1.483
2- 6	34.248	12.148	-0.904	6.427	-1.358	-4.465
2- 7	24.662	7.197	-0.904	6.427	-3.169	-7.509
2- 8	8.954	-2.239	-0.904	6.719	-4.753	-10.577
2- 9	-10.626	-24.389	-0.904	6.719	-6.345	-13.650
2-10	-27.830	-53.677	6.427	6.719	-8.304	-17.201
Right						
Member 4: (Bottom Slab)						
Left						
4- 0	-33.376	-59.424	9.866	10.432	17.802	9.411
4- 1	-15.731	-26.042	9.866	10.432	14.244	7.528
4- 2	5.407	-2.007	0.349	9.866	10.686	5.646
4- 3	22.989	7.796	0.349	9.866	7.128	3.764
4- 4	34.045	13.677	0.349	9.866	3.570	1.882
4- 5	37.727	15.638	0.349	9.866	0.117	-0.117
4- 6	34.045	13.677	0.349	9.866	-1.882	-3.570
4- 7	22.991	7.796	0.349	9.866	-3.764	-7.128
4- 8	5.414	-2.007	0.349	9.866	-5.646	-10.686
4- 9	-15.731	-26.042	9.866	10.432	-7.528	-14.244
4-10	-33.376	-59.424	9.866	10.432	-9.411	-17.802
Right						

---------- Analysis Truck, NRL ----------

Vehicle	Axle No.	Weight (k/ft)	Length (ft)	Dist. From Previous (ft)
Truck	1	0.085	7.73	
	2	0.112	11.73	6.00
	3	0.239	11.73	8.00
	4	0.112	11.73	8.00
	5	0.064	7.73	8.00

***Distributed loads may have been intensified due to axle overlap between lanes

Live Load Parameters:

Traffic Direction is Parallel to Main Reinforcement
Distribution Width : 15.77 ft
Impact Factor : 1.08
Truck MPF : 1.20 Tandem MPF : 0.00
Lane Load Distribution Width : 18.10 ft
Lane Load: 0.000 k/ft

Truck Positions That Cause Maximum Results:

Maximum +Moment in Top Slab

Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)
Truck	1	0.085	7.73	22.28
	2	0.112	11.73	16.28
	3	0.239	11.73	8.28

Maximum -Moment in Top Slab

Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)
Truck	1	0.085	7.73	23.43
	2	0.112	11.73	17.43
	3	0.239	11.73	9.43

	4	0.112	11.73	0.28		4	0.112	11.73	1.43
	5	0.064	7.73	-7.72		5	0.064	7.73	-6.57

Maximum +Moment : 6.02 k-ft
Corresponding Moment at End : -8.34 k-ft
Coincident Bottom Slab Load : 0.23 k/ft

Maximum -Moment : -8.41 k-ft
Corresponding Moment at Mid : 6.00 k-ft
Coincident Bottom Slab Load : 0.23 k/ft

Maximum +Shear in Top Slab

Truck	1	0.085	7.73	19.87
	2	0.112	11.73	13.87
	3	0.239	11.73	5.87
	4	0.112	11.73	-2.13
	5	0.064	7.73	-10.13

Maximum +Shear : 2.91 k
Corresponding Shear at Mid : -0.27 k
Coincident Bottom Slab Load : 0.24 k/ft

Maximum -Shear in Top Slab

Truck	1	0.085	7.73	28.97
	2	0.112	11.73	22.97
	3	0.239	11.73	14.97
	4	0.112	11.73	6.97
	5	0.064	7.73	-1.03

Maximum -Shear : -2.88 k
Corresponding Shear at Mid : 0.30 k
Coincident Bottom Slab Load : 0.23 k/ft

Unfactored Moments and Shears due to Truck Loads: (k-ft, k)

	Truck				Tandem				Lane			
M-PT	Mll+	Mll-	Vll+	Vll-	Mll+	Mll-	Vll+	Vll-	Mll+	Mll-	Vll+	Vll-
Member 1: (Exterior Wall)												
Bottom												
1- 0	0.00	-7.74	0.07	-0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 1	0.00	-7.78	0.07	-0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 2	0.00	-7.81	0.07	-0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 3	0.00	-7.85	0.07	-0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 4	0.00	-7.88	0.07	-0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 5	0.00	-7.92	0.07	-0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 6	0.00	-7.99	0.07	-0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 7	0.00	-8.08	0.07	-0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 8	0.00	-8.18	0.07	-0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 9	0.00	-8.29	0.07	-0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-10	0.00	-8.41	0.07	-0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Top												
Member 2: (Top Slab)												
Left												
2- 0	0.00	-8.41	2.91	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 1	0.31	-3.84	2.41	-0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 2	1.59	-0.65	1.91	-0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 3	3.96	0.00	1.42	-0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 4	5.52	0.00	0.94	-0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 5	6.02	0.00	0.48	-0.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 6	5.47	0.00	0.17	-0.92	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 7	3.96	0.00	0.09	-1.42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 8	1.73	-0.58	0.04	-1.91	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 9	0.27	-3.79	0.01	-2.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-10	0.00	-8.41	0.00	-2.88	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Right												
Member 4: (Bottom Slab)												
Left												
4- 0	0.00	-7.74	2.51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 1	0.00	-3.05	2.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 2	0.97	-0.03	1.52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 3	3.39	0.00	1.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 4	4.93	0.00	0.52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 5	5.48	0.00	0.03	-0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 6	5.01	0.00	0.00	-0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 7	3.50	0.00	0.00	-0.99	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 8	0.96	-0.03	0.00	-1.49	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 9	0.00	-2.95	0.00	-1.99	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4-10	0.00	-7.49	0.00	-2.49	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Right												

Note: Unfactored live load results computed at 6.00 ft and 0 ft fill depths, per LRFD 3.6.1.2.6

Serviceability Check: Crack Control

Bar Mark	Location	Moment (k-ft)	Thrust (k)	Fss (ksi)	Spacing (in)	Allow (in)
A1	Top Corner Bar	-36.1	12.13	40.44*	5.00	6.98
A2	Bot Corner Bar	-39.7	12.13	44.98*	5.00	5.78
A100	Top Slab (int)	26.3	-0.97	33.33	5.00	9.51
A200	Bot Slab (int)	28.0	-0.12	35.09	5.00	8.78
B2	Ext Wall (ext)	-39.0	12.13	44.07	5.00	6.00

Strength Limit State at Critical Sections: Flexure

Member 1: (Exterior Wall), 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
BOT	24.00	-53.76	17.00	48.35	7.56	52.80*	1.00	1.44	14.31	1.00	1.00
MID	59.00	0.00	8.30	26.97	7.69	29.77	1.00	0.74	14.31	NC	NC
MID-	59.00	-52.37	17.00	48.35	7.56	52.80	1.00	1.44	14.31	1.18	1.18
TOP	24.00	-49.65	17.00	48.35	7.56	52.80	1.00	1.44	14.31	1.19	1.19

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
LT	24.00	-24.22	6.47	48.35	7.56	50.10	1.00	1.44	14.31	3.97	3.97
MID	125.00	36.38	-0.67	48.35	7.56	48.17	1.00	1.44	14.31	1.95	1.95
MID-	125.00	0.54	6.43	13.89	7.69	16.30	1.00	0.37	14.31	NC	NC
RT	24.00	-24.13	6.47	48.35	7.56	50.10	1.00	1.44	14.31	4.02	4.02

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
LT	24.00	-27.26	10.20	48.35	7.56	51.08	1.00	1.44	14.31	4.37	4.37
MID	125.00	38.18	0.59	48.35	7.56	48.51	1.00	1.44	14.31	1.93	1.93
MID-	125.00	0.82	9.87	13.89	7.69	17.56	1.00	0.37	14.31	NC	NC
RT	24.00	-27.07	10.20	48.35	7.56	51.08	1.00	1.44	14.31	4.50	4.50

Notes: Mu - Resisting moment under pure flexure, Ma - Allowable moment under applied axial load

Strength Limit State at Critical Sections: 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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
BOT	12.20	7.88	54.4	17.00	7.20	10.99	2.000	45.00	12.21 b	0.00	0.00	0.00	5.16	5.16
MID	59.00	0.97	10.5	8.30	7.25	15.81	2.857	34.38	17.56 a	0.00	0.00	0.00	NC	NC
MID-	59.00	0.06	51.6	17.00	7.20	10.99	2.000	45.00	12.21 b	0.00	0.00	0.00	34.13	34.13
TOP	12.20	-5.43	49.1	17.00	7.20	10.99	2.000	45.00	12.21 b	0.00	0.00	0.00	5.00	5.00

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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
LT	12.20	15.21	38.3	6.47	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.27	1.27
MID	125.00	0.83	36.4	-0.67	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	18.21	18.21
MID-	125.00	0.75	13.8	6.43	7.69	17.60	n/a	n/a	19.56 c	0.00	0.00	0.00	20.43	20.43
RT	12.20	15.17	38.3	6.47	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.28	1.28

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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
LT	12.20	16.11	43.0	10.20	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.14	1.14
MID	125.00	0.05	38.2	0.59	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	NC	NC
MID-	125.00	0.06	0.0	9.87	7.69	23.39	5.086	27.83	25.99 a	0.00	0.00	0.00	NC	NC
RT	12.20	16.06	42.7	10.20	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.16	1.16

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

Load Combination Results at Tenth Points: (k-ft, k)(Fill Depth = 6.00 ft)

M-PT	+Moment	-Moment	+Axial	-Axial	+Shear	-Shear
Member 1: (Exterior Wall)						
Bottom						
1- 0	-33.376	-59.347	8.304	16.997	10.201	0.594
1- 1	-24.790	-54.390	8.304	16.997	7.948	0.381
1- 2	-18.344	-53.781	8.304	16.997	5.833	0.464
1- 3	-13.917	-53.099	8.304	16.997	3.857	0.526
1- 4	-11.357	-52.367	8.304	16.997	2.019	0.567
1- 5	-10.535	-51.619	8.304	16.997	0.966	-0.060
1- 6	-11.315	-50.905	8.304	16.997	0.965	-1.620
1- 7	-13.562	-50.238	8.304	16.997	0.942	-3.041
1- 8	-17.146	-49.627	8.304	16.997	0.898	-4.324
1- 9	-21.915	-49.089	8.304	16.997	0.832	-5.468
1-10	-27.750	-52.781	8.304	16.997	0.673	-6.473
Top						
Member 2: (Top Slab)						
Left						
2- 0	-27.830	-52.861	6.427	6.473	16.997	8.304
2- 1	-11.543	-23.025	-0.673	6.473	13.326	6.345
2- 2	7.300	-1.055	-0.673	6.427	10.170	4.753
2- 3	23.290	7.197	-0.673	6.427	7.041	3.169
2- 4	33.124	12.148	-0.673	6.427	3.918	1.584
2- 5	36.376	13.798	-0.673	6.427	0.832	-0.754
2- 6	33.052	12.148	-0.673	6.427	-1.584	-3.878
2- 7	23.292	7.197	-0.673	6.427	-3.169	-7.029
2- 8	7.542	-1.055	-0.673	6.427	-4.753	-10.169
2- 9	-11.618	-22.932	-0.673	6.473	-6.345	-13.305
2-10	-27.830	-52.860	6.427	6.473	-8.304	-16.944
Right						
Member 4: (Bottom Slab)						
Left						
4- 0	-33.376	-59.347	9.866	10.201	17.845	9.411
4- 1	-15.731	-25.923	9.866	10.201	14.284	7.528
4- 2	5.092	-2.007	0.594	9.866	10.724	5.646
4- 3	23.332	7.796	0.594	9.866	7.163	3.764
4- 4	34.427	13.677	0.594	9.866	3.602	1.882
4- 5	38.183	15.638	0.594	9.866	0.052	-0.061
4- 6	34.561	13.677	0.594	9.866	-1.882	-3.572
4- 7	23.520	7.796	0.594	9.866	-3.764	-7.117
4- 8	5.076	-2.007	0.594	9.866	-5.646	-10.676
4- 9	-15.731	-25.745	9.866	10.201	-7.528	-14.236
4-10	-33.376	-58.899	9.866	10.201	-9.411	-17.796
Right						

---------- Analysis Truck, Type 3 ----------

Vehicle	Axle No.	Weight (k/ft)	Length (ft)	Dist. From Previous (ft)
Truck	1	0.239	11.73	
	2	0.170	7.73	17.00

***Distributed loads may have been intensified due to axle overlap between lanes

Live Load Parameters:

Traffic Direction is Parallel to Main Reinforcement
Distribution Width : 15.77 ft
Impact Factor : 1.08
Truck MPF : 1.20 Tandem MPF : 0.00
Lane Load Distribution Width : 18.10 ft
Lane Load: 0.000 k/ft

Truck Positions That Cause Maximum Results:

Maximum +Moment in Top Slab

Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)
Truck	1	0.239	11.73	10.42
	2	0.170	7.73	-6.58

Maximum +Moment : 4.52 k-ft
Corresponding Moment at End : -5.96 k-ft
Coincident Bottom Slab Load : 0.13 k/ft

Maximum -Moment in Top Slab

Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)
Truck	1	0.239	11.73	9.38
	2	0.170	7.73	-7.62

Maximum -Moment : -6.03 k-ft
Corresponding Moment at Mid : 4.47 k-ft
Coincident Bottom Slab Load : 0.13 k/ft

Maximum +Shear in Top Slab				Maximum -Shear in Top Slab			
Truck 1	0.170	7.73	22.87	Truck 1	0.239	11.73	14.97
2	0.239	11.73	5.87	2	0.170	7.73	-2.03
Maximum +Shear :	2.07 k			Maximum -Shear :	-2.07 k		
Corresponding Shear at Mid :	-0.42 k			Corresponding Shear at Mid :	0.42 k		
Coincident Bottom Slab Load :	0.15 k/ft			Coincident Bottom Slab Load :	0.15 k/ft		

Unfactored Moments and Shears due to Truck Loads: (k-ft, k)

	Truck				Tandem				Lane			
M-PT	Mll+	Mll-	Vll+	Vll-	Mll+	Mll-	Vll+	Vll-	Mll+	Mll-	Vll+	Vll-
Member 1: (Exterior Wall)												
Bottom												
1- 0	0.00	-5.16	0.14	-0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 1	0.00	-5.14	0.14	-0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 2	0.00	-5.13	0.14	-0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 3	0.00	-5.11	0.14	-0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 4	0.00	-5.10	0.14	-0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 5	0.00	-5.14	0.14	-0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 6	0.00	-5.31	0.14	-0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 7	0.00	-5.49	0.14	-0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 8	0.00	-5.67	0.14	-0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 9	0.00	-5.85	0.14	-0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-10	0.01	-6.03	0.14	-0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Top												
Member 2: (Top Slab)												
Left												
2- 0	0.01	-6.03	2.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 1	0.57	-3.14	1.76	-0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 2	1.73	-0.98	1.46	-0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 3	3.26	0.00	1.15	-0.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 4	4.19	0.00	0.85	-0.36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 5	4.52	0.00	0.58	-0.58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 6	4.19	0.00	0.36	-0.85	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 7	3.26	0.00	0.19	-1.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 8	1.73	-0.98	0.08	-1.46	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 9	0.57	-3.14	0.02	-1.76	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-10	0.01	-6.03	0.00	-2.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Right												
Member 4: (Bottom Slab)												
Left												
4- 0	0.00	-5.16	1.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 1	0.00	-2.15	1.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 2	0.78	-0.06	0.98	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 3	2.26	0.00	0.66	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 4	3.15	0.00	0.35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 5	3.39	0.00	0.05	-0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 6	3.15	0.00	0.00	-0.35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 7	2.26	0.00	0.00	-0.66	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 8	0.79	-0.06	0.00	-0.98	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 9	0.00	-2.15	0.00	-1.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4-10	0.00	-5.15	0.00	-1.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Right												

Note: Unfactored live load results computed at 6.00 ft and 0 ft fill depths, per LRFD 3.6.1.2.6

Serviceability Check: Crack Control

Bar Mark	Location	Moment (k-ft)	Thrust (k)	Fss (ksi)	Spacing (in)	Allow (in)
A1	Top Corner Bar	-33.6	11.29	37.61*	5.00	7.87
A2	Bot Corner Bar	-37.0	11.29	41.95*	5.00	6.55
A100	Top Slab (int)	24.8	-1.04	31.47	5.00	10.35
A200	Bot Slab (int)	25.9	-0.17	32.49	5.00	9.88
B2	Ext Wall (ext)	-36.2	11.29	40.91	5.00	6.84

Strength Limit State at Critical Sections: Flexure

Member 1: (Exterior Wall), 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
BOT	24.00	-49.06	15.53	48.35	7.56	52.43	1.00	1.44	14.31	1.48	1.48
MID	59.00	0.00	8.30	26.97	7.69	29.77	1.00	0.74	14.31	NC	NC
MID-	59.00	-47.50	15.53	48.35	7.56	52.43	1.00	1.44	14.31	1.78	1.78
TOP	24.00	-45.25	15.53	48.35	7.56	52.43	1.00	1.44	14.31	1.69	1.69

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
LT	24.00	-22.88	6.56	48.35	7.56	50.12	1.00	1.44	14.31	4.81	4.81
MID	125.00	33.75	-0.79	48.35	7.56	48.13	1.00	1.44	14.31	2.60	2.60
MID-	125.00	0.54	6.43	13.89	7.69	16.30	1.00	0.37	14.31	NC	NC
RT	24.00	-22.88	6.56	48.35	7.56	50.12	1.00	1.44	14.31	4.81	4.81

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
LT	24.00	-25.57	10.32	48.35	7.56	51.11	1.00	1.44	14.31	5.97	5.97
MID	125.00	34.52	0.51	48.35	7.56	48.49	1.00	1.44	14.31	3.12	3.12
MID-	125.00	0.82	9.87	13.89	7.69	17.56	1.00	0.37	14.31	NC	NC
RT	24.00	-25.57	10.32	48.35	7.56	51.11	1.00	1.44	14.31	5.98	5.98

Notes: Mu - Resisting moment under pure flexure, Ma - Allowable moment under applied axial load

Strength Limit State at Critical Sections: 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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
BOT	12.20	7.99	49.8	15.53	7.20	10.99	2.000	45.00	12.21 b	0.00	0.00	0.00	4.65	4.65
MID	59.00	1.08	10.5	8.30	7.25	15.77	2.851	34.41	17.52 a	0.00	0.00	0.00	54.05	54.05
MID-	59.00	0.14	46.7	15.53	7.20	10.99	2.000	45.00	12.21 b	0.00	0.00	0.00	25.80	25.80
TOP	12.20	-5.51	44.8	15.53	7.20	10.99	2.000	45.00	12.21 b	0.00	0.00	0.00	4.67	4.67

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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
LT	12.20	13.90	35.6	6.56	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.76	1.76
MID	125.00	1.01	33.7	-0.79	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	15.02	15.02
MID-	125.00	1.01	13.8	6.43	7.69	17.60	n/a	n/a	19.56 c	0.00	0.00	0.00	15.27	15.27
RT	12.20	13.90	35.6	6.56	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.76	1.76

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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
LT	12.20	14.66	40.0	10.32	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.79	1.79
MID	125.00	0.08	34.5	0.51	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	NC	NC
MID-	125.00	0.08	0.0	9.87	7.69	23.39	5.086	27.83	25.99 a	0.00	0.00	0.00	NC	NC
RT	12.20	14.66	39.9	10.32	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.79	1.79

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

Load Combination Results at Tenth Points: (k-ft, k)(Fill Depth = 6.00 ft)

M-PT	+Moment	-Moment	+Axial	-Axial	+Shear	-Shear
Member 1: (Exterior Wall)						
Bottom						
1- 0	-33.376	-54.823	8.304	15.527	10.318	0.511
1- 1	-24.790	-49.780	8.304	15.527	8.065	0.297
1- 2	-18.344	-49.082	8.304	15.527	5.950	0.380
1- 3	-13.917	-48.311	8.304	15.527	3.974	0.442
1- 4	-11.357	-47.491	8.304	15.527	2.137	0.483
1- 5	-10.535	-46.749	8.304	15.527	1.084	-0.144
1- 6	-11.315	-46.216	8.304	15.527	1.082	-1.704
1- 7	-13.562	-45.705	8.304	15.527	1.059	-3.125
1- 8	-17.146	-45.229	8.304	15.527	1.015	-4.408
1- 9	-21.915	-44.820	8.304	15.527	0.950	-5.552
1-10	-27.750	-48.627	8.304	15.527	0.791	-6.557
Top						
Member 2: (Top Slab)						
Left						
2- 0	-27.830	-48.707	6.427	6.557	15.527	8.304
2- 1	-11.093	-21.801	-0.791	6.557	12.198	6.345
2- 2	7.532	-1.427	-0.791	6.557	9.377	4.753
2- 3	22.070	7.197	-0.791	6.427	6.563	3.169
2- 4	30.800	12.148	-0.791	6.427	3.765	1.584
2- 5	33.749	13.798	-0.791	6.427	1.008	-1.008
2- 6	30.800	12.148	-0.791	6.427	-1.584	-3.764
2- 7	22.067	7.197	-0.791	6.427	-3.169	-6.563
2- 8	7.532	-1.429	-0.791	6.557	-4.753	-9.377
2- 9	-11.093	-21.801	-0.791	6.557	-6.345	-12.198
2-10	-27.830	-48.707	6.427	6.557	-8.304	-15.527
Right						
Member 4: (Bottom Slab)						
Left						
4- 0	-33.376	-54.823	9.866	10.318	16.243	9.411
4- 1	-15.731	-24.353	9.866	10.318	13.009	7.528
4- 2	4.761	-2.007	0.511	9.866	9.775	5.646
4- 3	21.348	7.796	0.511	9.866	6.541	3.764
4- 4	31.303	13.677	0.511	9.866	3.307	1.882
4- 5	34.522	15.638	0.511	9.866	0.080	-0.080
4- 6	31.304	13.677	0.511	9.866	-1.882	-3.306
4- 7	21.349	7.796	0.511	9.866	-3.764	-6.540
4- 8	4.765	-2.007	0.511	9.866	-5.646	-9.774
4- 9	-15.731	-24.348	9.866	10.318	-7.528	-13.008
4-10	-33.376	-54.817	9.866	10.318	-9.411	-16.242
Right						

---------- Analysis Truck, Type 3S2 ----------

Vehicle	Axle No.	Weight (k/ft)	Length (ft)	Dist. From Previous (ft)
Truck	1	0.218	11.73	
	2	0.218	11.73	26.00
	3	0.107	7.73	13.00

***Distributed loads may have been intensified due to axle overlap between lanes

Live Load Parameters:

Traffic Direction is Parallel to Main Reinforcement
Distribution Width : 15.77 ft
Impact Factor : 1.08
Truck MPF : 1.20 Tandem MPF : 0.00
Lane Load Distribution Width : 18.10 ft
Lane Load: 0.000 k/ft

Truck Positions That Cause Maximum Results:

Maximum +Moment in Top Slab

Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)
Truck	1	0.107	7.73	23.03
	2	0.218	11.73	10.03
	3	0.218	11.73	-15.97

Maximum +Moment : 4.16 k-ft
Corresponding Moment at End : -5.49 k-ft

Maximum -Moment in Top Slab

Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)
Truck	1	0.218	11.73	37.84
	2	0.218	11.73	11.84
	3	0.107	7.73	-1.16

Maximum -Moment : -5.56 k-ft
Corresponding Moment at Mid : 4.12 k-ft

Coincident Bottom Slab Load : 0.13 k/ft

Maximum +Shear in Top Slab

Truck				
	1	0.107	7.73	18.87
	2	0.218	11.73	5.87
	3	0.218	11.73	-20.13

Maximum +Shear : 1.95 k
Corresponding Shear at Mid : -0.32 k
Coincident Bottom Slab Load : 0.15 k/ft

Coincident Bottom Slab Load : 0.14 k/ft

Maximum -Shear in Top Slab

Truck				
	1	0.218	11.73	40.97
	2	0.218	11.73	14.97
	3	0.107	7.73	1.97

Maximum -Shear : -1.95 k
Corresponding Shear at Mid : 0.32 k
Coincident Bottom Slab Load : 0.15 k/ft

Unfactored Moments and Shears due to Truck Loads: (k-ft, k)

	Truck				Tandem				Lane			
M-PT	Mll+	Mll-	Vll+	Vll-	Mll+	Mll-	Vll+	Vll-	Mll+	Mll-	Vll+	Vll-
Member 1: (Exterior Wall)												
Bottom												
1- 0	0.00	-5.10	0.17	-0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 1	0.00	-5.09	0.17	-0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 2	0.00	-5.08	0.17	-0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 3	0.00	-5.07	0.17	-0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 4	0.00	-5.06	0.17	-0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 5	0.00	-5.09	0.17	-0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 6	0.00	-5.15	0.17	-0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 7	0.00	-5.23	0.17	-0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 8	0.00	-5.33	0.17	-0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 9	0.00	-5.44	0.17	-0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-10	0.01	-5.56	0.17	-0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Top												
Member 2: (Top Slab)												
Left												
2- 0	0.01	-5.56	1.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 1	0.52	-2.87	1.64	-0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 2	1.57	-0.89	1.33	-0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 3	2.96	0.00	1.05	-0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 4	3.89	0.00	0.78	-0.32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 5	4.16	0.00	0.53	-0.53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 6	3.90	0.00	0.32	-0.78	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 7	2.96	0.00	0.18	-1.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 8	1.57	-0.90	0.08	-1.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 9	0.52	-2.87	0.02	-1.64	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-10	0.01	-5.56	0.00	-1.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Right												
Member 4: (Bottom Slab)												
Left												
4- 0	0.00	-5.10	1.62	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 1	0.00	-2.06	1.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 2	0.72	-0.05	0.98	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 3	2.25	0.00	0.66	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 4	3.18	0.00	0.35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 5	3.46	0.00	0.04	-0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 6	3.18	0.00	0.00	-0.35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 7	2.25	0.00	0.00	-0.66	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 8	0.72	-0.05	0.00	-0.98	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 9	0.00	-2.06	0.00	-1.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4-10	0.00	-5.10	0.00	-1.62	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Right												

Note: Unfactored live load results computed at 6.00 ft and 0 ft fill depths, per LRFD 3.6.1.2.6

Serviceability Check: Crack Control

Bar Mark	Location	Moment (k-ft)	Thrust (k)	Fss (ksi)	Spacing (in)	Allow (in)
A1	Top Corner Bar	-33.2	11.18	37.24*	5.00	8.00
A2	Bot Corner Bar	-37.0	11.18	41.93*	5.00	6.56
A100	Top Slab (int)	24.5	-1.07	31.04	5.00	10.57
A200	Bot Slab (int)	26.0	-0.15	32.58	5.00	9.84
B2	Ext Wall (ext)	-36.2	11.18	40.90	5.00	6.84

Strength Limit State at Critical Sections: Flexure

Member 1: (Exterior Wall), 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
BOT	24.00	-48.97	15.32	48.35	7.56	52.38	1.00	1.44	14.31	1.49	1.49
MID	59.00	0.00	8.30	26.97	7.69	29.77	1.00	0.74	14.31	NC	NC
MID-	59.00	-47.43	15.32	48.35	7.56	52.38	1.00	1.44	14.31	1.79	1.79
TOP	24.00	-44.66	15.32	48.35	7.56	52.38	1.00	1.44	14.31	1.79	1.79

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
LT	24.00	-22.38	6.53	48.35	7.56	50.11	1.00	1.44	14.31	5.22	5.22
MID	125.00	33.13	-0.85	48.35	7.56	48.12	1.00	1.44	14.31	2.82	2.82
MID-	125.00	0.54	6.43	13.89	7.69	16.30	1.00	0.37	14.31	NC	NC
RT	24.00	-22.38	6.53	48.35	7.56	50.11	1.00	1.44	14.31	5.22	5.22

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
LT	24.00	-25.42	10.38	48.35	7.56	51.12	1.00	1.44	14.31	6.17	6.17
MID	125.00	34.65	0.54	48.35	7.56	48.50	1.00	1.44	14.31	3.06	3.06
MID-	125.00	0.82	9.87	13.89	7.69	17.56	1.00	0.37	14.31	NC	NC
RT	24.00	-25.42	10.38	48.35	7.56	51.12	1.00	1.44	14.31	6.17	6.17

Notes: Mu - Resisting moment under pure flexure, Ma - Allowable moment under applied axial load

Strength Limit State at Critical Sections: 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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
BOT	12.20	8.05	49.7	15.32	7.20	10.99	2.000	45.00	12.21 b	0.00	0.00	0.00	4.44	4.44
MID	59.00	1.14	10.5	8.30	7.25	15.75	2.848	34.42	17.51 a	0.00	0.00	0.00	43.55	43.55
MID-	59.00	0.11	46.7	15.32	7.20	10.99	2.000	45.00	12.21 b	0.00	0.00	0.00	28.30	28.30
TOP	12.20	-5.48	44.1	15.32	7.20	10.99	2.000	45.00	12.21 b	0.00	0.00	0.00	4.79	4.79

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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
LT	12.20	13.69	34.9	6.53	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.88	1.88
MID	125.00	0.92	33.1	-0.85	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	16.48	16.48
MID-	125.00	0.92	13.8	6.43	7.69	17.60	n/a	n/a	19.56 c	0.00	0.00	0.00	16.75	16.75
RT	12.20	13.69	34.9	6.53	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.88	1.88

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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
LT	12.20	14.69	39.8	10.38	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.77	1.77
MID	125.00	0.07	34.6	0.54	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	NC	NC
MID-	125.00	0.07	0.0	9.87	7.69	23.39	5.086	27.83	25.99 a	0.00	0.00	0.00	NC	NC
RT	12.20	14.69	39.8	10.38	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.77	1.77

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

Load Combination Results at Tenth Points: (k-ft, k)(Fill Depth = 6.00 ft)

M-PT	+Moment	-Moment	+Axial	-Axial	+Shear	-Shear
Member 1: (Exterior Wall)						
Bottom						
1- 0	-33.376	-54.722	8.304	15.320	10.375	0.541
1- 1	-24.790	-49.687	8.304	15.320	8.122	0.328
1- 2	-18.344	-48.996	8.304	15.320	6.007	0.411
1- 3	-13.917	-48.232	8.304	15.320	4.031	0.472
1- 4	-11.357	-47.425	8.304	15.320	2.194	0.513
1- 5	-10.535	-46.659	8.304	15.320	1.141	-0.113
1- 6	-11.315	-45.932	8.304	15.320	1.139	-1.673
1- 7	-13.562	-45.254	8.304	15.320	1.116	-3.095
1- 8	-17.146	-44.637	8.304	15.320	1.072	-4.377
1- 9	-21.915	-44.098	8.304	15.320	1.007	-5.521
1-10	-27.750	-47.790	8.304	15.320	0.848	-6.527
Top						
Member 2: (Top Slab)						
Left						
2- 0	-27.830	-47.870	6.427	6.527	15.320	8.304
2- 1	-11.180	-21.319	-0.848	6.527	11.978	6.345
2- 2	7.265	-1.275	-0.848	6.527	9.162	4.753
2- 3	21.533	7.197	-0.848	6.427	6.385	3.169
2- 4	30.288	12.148	-0.848	6.427	3.633	1.584
2- 5	33.126	13.798	-0.848	6.427	0.919	-0.919
2- 6	30.290	12.148	-0.848	6.427	-1.584	-3.633
2- 7	21.533	7.197	-0.848	6.427	-3.169	-6.385
2- 8	7.265	-1.278	-0.848	6.527	-4.753	-9.162
2- 9	-11.180	-21.319	-0.848	6.527	-6.345	-11.978
2-10	-27.830	-47.870	6.427	6.527	-8.304	-15.320
Right						
Member 4: (Bottom Slab)						
Left						
4- 0	-33.376	-54.722	9.866	10.375	16.272	9.411
4- 1	-15.731	-24.202	9.866	10.375	13.027	7.528
4- 2	4.640	-2.007	0.541	9.866	9.782	5.646
4- 3	21.327	7.796	0.541	9.866	6.538	3.764
4- 4	31.367	13.677	0.541	9.866	3.293	1.882
4- 5	34.647	15.638	0.541	9.866	0.073	-0.073
4- 6	31.367	13.677	0.541	9.866	-1.882	-3.293
4- 7	21.327	7.796	0.541	9.866	-3.764	-6.538
4- 8	4.644	-2.007	0.541	9.866	-5.646	-9.782
4- 9	-15.731	-24.202	9.866	10.375	-7.528	-13.027
4-10	-33.376	-54.722	9.866	10.375	-9.411	-16.272
Right						

---------- Analysis Truck, Type 3-3 ----------

Vehicle	Axle No.	Weight (k/ft)	Length (ft)	Dist. From Previous (ft)
Truck	1	0.197	11.73	
	2	0.170	7.73	18.00
	3	0.169	11.73	17.00
	4	0.128	7.73	17.00

***Distributed loads may have been intensified due to axle overlap between lanes

Live Load Parameters:

Traffic Direction is Parallel to Main Reinforcement
Distribution Width : 15.77 ft
Impact Factor : 1.08
Truck MPF : 1.20 Tandem MPF : 0.00
Lane Load Distribution Width : 18.10 ft
Lane Load: 0.000 k/ft

Truck Positions That Cause Maximum Results:

Maximum +Moment in Top Slab

Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)
Truck	1	0.197	11.73	10.42
	2	0.170	7.73	-7.58
	3	0.169	11.73	-24.58
	4	0.128	7.73	-41.58

Maximum -Moment in Top Slab

Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)
Truck	1	0.197	11.73	9.38
	2	0.170	7.73	-8.63
	3	0.169	11.73	-25.63
	4	0.128	7.73	-42.63

Maximum +Moment : 3.72 k-ft
Corresponding Moment at End : -4.91 k-ft
Coincident Bottom Slab Load : 0.11 k/ft

Maximum -Moment : -4.97 k-ft
Corresponding Moment at Mid : 3.68 k-ft
Coincident Bottom Slab Load : 0.11 k/ft

Maximum +Shear in Top Slab

Truck	1	0.128	7.73	57.87
	2	0.169	11.73	40.87
	3	0.170	7.73	23.87
	4	0.197	11.73	5.87

Maximum +Shear : 1.70 k
Corresponding Shear at Mid : -0.35 k
Coincident Bottom Slab Load : 0.12 k/ft

Maximum -Shear in Top Slab

Truck	1	0.197	11.73	14.97
	2	0.170	7.73	-3.03
	3	0.169	11.73	-20.03
	4	0.128	7.73	-37.03

Maximum -Shear : -1.70 k
Corresponding Shear at Mid : 0.35 k
Coincident Bottom Slab Load : 0.12 k/ft

Unfactored Moments and Shears due to Truck Loads: (k-ft, k)

	Truck				Tandem				Lane			
M-PT	Mll+	Mll-	Vll+	Vll-	Mll+	Mll-	Vll+	Vll-	Mll+	Mll-	Vll+	Vll-
Member 1: (Exterior Wall)												
Bottom												
1- 0	0.00	-4.08	0.13	-0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 1	0.00	-4.07	0.13	-0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 2	0.00	-4.07	0.13	-0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 3	0.00	-4.08	0.13	-0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 4	0.00	-4.10	0.13	-0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 5	0.00	-4.23	0.13	-0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 6	0.00	-4.37	0.13	-0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 7	0.00	-4.52	0.13	-0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 8	0.00	-4.67	0.13	-0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 9	0.00	-4.82	0.13	-0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-10	0.01	-4.97	0.13	-0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Top												
Member 2: (Top Slab)												
Left												
2- 0	0.01	-4.97	1.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 1	0.47	-2.59	1.45	-0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 2	1.42	-0.81	1.20	-0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 3	2.67	0.00	0.95	-0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 4	3.45	0.00	0.70	-0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 5	3.72	0.00	0.47	-0.47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 6	3.45	0.00	0.29	-0.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 7	2.67	0.00	0.16	-0.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 8	1.42	-0.81	0.07	-1.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 9	0.47	-2.59	0.02	-1.45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-10	0.01	-4.97	0.00	-1.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Right												
Member 4: (Bottom Slab)												
Left												
4- 0	0.00	-4.08	1.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 1	0.00	-1.73	1.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 2	0.65	-0.05	0.77	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 3	1.80	0.00	0.53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 4	2.50	0.00	0.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 5	2.69	0.00	0.04	-0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 6	2.50	0.00	0.00	-0.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 7	1.80	0.00	0.00	-0.53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 8	0.65	-0.05	0.00	-0.77	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 9	0.00	-1.72	0.00	-1.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4-10	0.00	-4.07	0.00	-1.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Right												

Note: Unfactored live load results computed at 6.00 ft and 0 ft fill depths, per LRFD 3.6.1.2.6

Serviceability Check: Crack Control

Bar Mark	Location	Moment (k-ft)	Thrust (k)	Fss (ksi)	Spacing (in)	Allow (in)
A1	Top Corner Bar	-32.6	10.92	36.51*	5.00	8.25
A2	Bot Corner Bar	-36.0	10.92	40.78*	5.00	6.88
A100	Top Slab (int)	24.0	-1.03	30.48	5.00	10.85
A200	Bot Slab (int)	25.2	-0.13	31.61	5.00	10.29
B2	Ext Wall (ext)	-35.2	10.92	39.81	5.00	7.16

Strength Limit State at Critical Sections: Flexure

Member 1: (Exterior Wall), 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
BOT	24.00	-47.22	14.88	48.35	7.56	52.27	1.00	1.44	14.31	1.85	1.85
MID	59.00	0.00	8.30	26.97	7.69	29.77	1.00	0.74	14.31	NC	NC
MID-	59.00	-45.76	14.88	48.35	7.56	52.27	1.00	1.44	14.31	2.14	2.14
TOP	24.00	-43.50	14.88	48.35	7.56	52.27	1.00	1.44	14.31	2.03	2.03

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
LT	24.00	-21.87	6.50	48.35	7.56	50.11	1.00	1.44	14.31	5.72	5.72
MID	125.00	32.35	-0.78	48.35	7.56	48.13	1.00	1.44	14.31	3.15	3.15
MID-	125.00	0.54	6.43	13.89	7.69	16.30	1.00	0.37	14.31	NC	NC
RT	24.00	-21.87	6.50	48.35	7.56	50.11	1.00	1.44	14.31	5.72	5.72

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
LT	24.00	-24.78	10.31	48.35	7.56	51.10	1.00	1.44	14.31	7.20	7.20
MID	125.00	33.30	0.57	48.35	7.56	48.51	1.00	1.44	14.31	3.93	3.93
MID-	125.00	0.82	9.87	13.89	7.69	17.56	1.00	0.37	14.31	NC	NC
RT	24.00	-24.78	10.31	48.35	7.56	51.10	1.00	1.44	14.31	7.21	7.21

Notes: Mu - Resisting moment under pure flexure, Ma - Allowable moment under applied axial load

Strength Limit State at Critical Sections: 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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
BOT	12.20	7.99	47.9	14.88	7.20	10.99	2.000	45.00	12.21 b	0.00	0.00	0.00	4.68	4.68
MID	59.00	1.08	10.5	8.30	7.25	15.77	2.851	34.41	17.53 a	0.00	0.00	0.00	55.70	55.70
MID-	59.00	0.08	45.2	14.88	7.20	11.01	2.004	39.17	12.24 a	0.00	0.00	0.00	31.40	31.40
TOP	12.20	-5.45	43.0	14.88	7.20	11.03	2.007	39.15	12.25 a	0.00	0.00	0.00	4.93	4.93

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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
LT	12.20	13.30	34.1	6.50	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	2.15	2.15
MID	125.00	0.83	32.4	-0.78	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	18.24	18.24
MID-	125.00	0.83	13.8	6.43	7.69	17.60	n/a	n/a	19.56 c	0.00	0.00	0.00	18.54	18.54
RT	12.20	13.30	34.1	6.50	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	2.15	2.15

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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
LT	12.20	14.13	38.6	10.31	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	2.27	2.27
MID	125.00	0.07	33.3	0.57	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	NC	NC
MID-	125.00	0.07	0.0	9.87	7.69	23.39	5.086	27.83	25.99 a	0.00	0.00	0.00	NC	NC
RT	12.20	14.13	38.6	10.31	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	2.27	2.27

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

Load Combination Results at Tenth Points: (k-ft, k)(Fill Depth = 6.00 ft)

M-PT	+Moment	-Moment	+Axial	-Axial	+Shear	-Shear
Member 1: (Exterior Wall)						
Bottom						
1- 0	-33.376	-52.931	8.304	14.876	10.311	0.571
1- 1	-24.790	-47.912	8.304	14.876	8.058	0.358
1- 2	-18.344	-47.243	8.304	14.876	5.943	0.441
1- 3	-13.917	-46.501	8.304	14.876	3.967	0.503
1- 4	-11.357	-45.758	8.304	14.876	2.130	0.543
1- 5	-10.535	-45.162	8.304	14.876	1.077	-0.083
1- 6	-11.315	-44.576	8.304	14.876	1.075	-1.643
1- 7	-13.562	-44.010	8.304	14.876	1.052	-3.064
1- 8	-17.146	-43.480	8.304	14.876	1.008	-4.347
1- 9	-21.915	-43.013	8.304	14.876	0.943	-5.491
1-10	-27.750	-46.763	8.304	14.876	0.784	-6.497
Top						
Member 2: (Top Slab)						
Left						
2- 0	-27.830	-46.843	6.427	6.497	14.876	8.304
2- 1	-11.268	-20.831	-0.784	6.497	11.654	6.345
2- 2	6.999	-1.124	-0.784	6.497	8.927	4.753
2- 3	21.038	7.197	-0.784	6.427	6.208	3.169
2- 4	29.507	12.148	-0.784	6.427	3.502	1.584
2- 5	32.353	13.798	-0.784	6.427	0.831	-0.831
2- 6	29.507	12.148	-0.784	6.427	-1.584	-3.502
2- 7	21.037	7.197	-0.784	6.427	-3.169	-6.208
2- 8	6.999	-1.126	-0.784	6.497	-4.753	-8.927
2- 9	-11.268	-20.831	-0.784	6.497	-6.345	-11.653
2-10	-27.830	-46.843	6.427	6.497	-8.304	-14.876
Right						
Member 4: (Bottom Slab)						
Left						
4- 0	-33.376	-52.931	9.866	10.311	15.650	9.411
4- 1	-15.731	-23.612	9.866	10.311	12.533	7.528
4- 2	4.519	-2.007	0.571	9.866	9.415	5.646
4- 3	20.551	7.796	0.571	9.866	6.298	3.764
4- 4	30.164	13.677	0.571	9.866	3.180	1.882
4- 5	33.302	15.638	0.571	9.866	0.065	-0.065
4- 6	30.164	13.677	0.571	9.866	-1.882	-3.180
4- 7	20.551	7.796	0.571	9.866	-3.764	-6.298
4- 8	4.522	-2.007	0.571	9.866	-5.646	-9.415
4- 9	-15.731	-23.606	9.866	10.311	-7.528	-12.533
4-10	-33.376	-52.929	9.866	10.311	-9.411	-15.650
Right						

---------- Analysis Truck, Overload 1 ----------

Vehicle	Axle No.	Weight (k/ft)	Length (ft)	Dist. From Previous (ft)
Truck	1	0.302	11.73	
	2	0.302	11.73	16.00
	3	0.107	7.73	12.00

***Distributed loads may have been intensified due to axle overlap between lanes

Live Load Parameters:

Traffic Direction is Parallel to Main Reinforcement
Distribution Width : 15.77 ft
Impact Factor : 1.08
Truck MPF : 1.20 Tandem MPF : 0.00
Lane Load Distribution Width : 18.10 ft
Lane Load: 0.000 k/ft

Truck Positions That Cause Maximum Results:

Maximum +Moment in Top Slab

Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)
Truck	1	0.107	7.73	22.62
	2	0.302	11.73	10.62
	3	0.302	11.73	-5.38

Maximum +Moment : 5.81 k-ft
Corresponding Moment at End : -7.52 k-ft

Maximum -Moment in Top Slab

Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)
Truck	1	0.302	11.73	28.00
	2	0.302	11.73	12.00
	3	0.107	7.73	0.00

Maximum -Moment : -7.77 k-ft
Corresponding Moment at Mid : 5.72 k-ft

Coincident Bottom Slab Load : 0.19 k/ft

Maximum +Shear in Top Slab

Truck				
	1	0.302	11.73	21.87
	2	0.302	11.73	5.87
	3	0.107	7.73	-6.13

Maximum +Shear : 2.74 k
Corresponding Shear at Mid : -0.40 k
Coincident Bottom Slab Load : 0.24 k/ft

Coincident Bottom Slab Load : 0.19 k/ft

Maximum -Shear in Top Slab

Truck				
	1	0.302	11.73	14.97
	2	0.302	11.73	-1.03
	3	0.107	7.73	-13.03

Maximum -Shear : -2.74 k
Corresponding Shear at Mid : 0.40 k
Coincident Bottom Slab Load : 0.24 k/ft

Unfactored Moments and Shears due to Truck Loads: (k-ft, k)

	Truck				Tandem				Lane			
M-PT	Mll+	Mll-	Vll+	Vll-	Mll+	Mll-	Vll+	Vll-	Mll+	Mll-	Vll+	Vll-
Member 1: (Exterior Wall)												
Bottom												
1- 0	0.00	-7.95	0.13	-0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 1	0.00	-7.87	0.13	-0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 2	0.00	-7.78	0.13	-0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 3	0.00	-7.70	0.13	-0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 4	0.00	-7.62	0.13	-0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 5	0.00	-7.54	0.13	-0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 6	0.00	-7.46	0.13	-0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 7	0.00	-7.43	0.13	-0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 8	0.00	-7.46	0.13	-0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 9	0.00	-7.59	0.13	-0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-10	0.01	-7.77	0.13	-0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Top												
Member 2: (Top Slab)												
Left												
2- 0	0.01	-7.77	2.74	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 1	0.72	-3.97	2.28	-0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 2	2.18	-1.24	1.86	-0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 3	4.14	0.00	1.45	-0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 4	5.45	0.00	1.08	-0.45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 5	5.81	0.00	0.73	-0.73	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 6	5.46	0.00	0.45	-1.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 7	4.14	0.00	0.24	-1.45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 8	2.18	-1.24	0.10	-1.86	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 9	0.72	-3.97	0.03	-2.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-10	0.01	-7.77	0.00	-2.74	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Right												
Member 4: (Bottom Slab)												
Left												
4- 0	0.00	-7.95	2.53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 1	0.00	-3.20	2.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 2	0.99	-0.07	1.53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 3	3.41	0.00	1.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 4	4.92	0.00	0.53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 5	5.38	0.00	0.06	-0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 6	4.92	0.00	0.00	-0.53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 7	3.41	0.00	0.00	-1.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 8	1.00	-0.07	0.00	-1.53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 9	0.00	-3.20	0.00	-2.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4-10	0.00	-7.95	0.00	-2.53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Right												

Note: Unfactored live load results computed at 6.00 ft and 0 ft fill depths, per LRFD 3.6.1.2.6

Serviceability Check: Crack Control

Bar Mark	Location	Moment (k-ft)	Thrust (k)	Fss (ksi)	Spacing (in)	Allow (in)
A1	Top Corner Bar	-35.4	11.97	39.61*	5.00	7.23
A2	Bot Corner Bar	-39.7	11.97	45.01*	5.00	5.77
A100	Top Slab (int)	26.1	-1.03	33.09	5.00	9.61
A200	Bot Slab (int)	27.9	-0.22	35.00	5.00	8.82
B2	Ext Wall (ext)	-38.7	11.97	43.80	5.00	6.07

Strength Limit State at Critical Sections: Flexure

Member 1: (Exterior Wall), 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
BOT	24.00	-50.60	15.61	48.35	7.56	52.45	1.00	1.44	14.31	1.63	1.63
MID	59.00	0.00	8.30	26.97	7.69	29.77	1.00	0.74	14.31	NC	NC
MID-	59.00	-48.87	15.61	48.35	7.56	52.45	1.00	1.44	14.31	2.00	2.00
TOP	24.00	-45.42	15.61	48.35	7.56	52.45	1.00	1.44	14.31	2.14	2.14

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
LT	24.00	-22.60	6.27	48.35	7.56	50.05	1.00	1.44	14.31	6.45	6.45
MID	125.00	33.69	-0.73	48.35	7.56	48.15	1.00	1.44	14.31	3.37	3.37
MID-	125.00	0.51	6.15	13.89	7.69	16.20	1.00	0.37	14.31	NC	NC
RT	24.00	-22.60	6.27	48.35	7.56	50.05	1.00	1.44	14.31	6.45	6.45

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
LT	24.00	-26.03	9.98	48.35	7.56	51.02	1.00	1.44	14.31	6.97	6.97
MID	125.00	35.86	0.52	48.35	7.56	48.49	1.00	1.44	14.31	3.27	3.27
MID-	125.00	0.80	9.59	13.89	7.69	17.46	1.00	0.37	14.31	NC	NC
RT	24.00	-26.03	9.98	48.35	7.56	51.02	1.00	1.44	14.31	6.97	6.97

Notes: Mu - Resisting moment under pure flexure, Ma - Allowable moment under applied axial load

Strength Limit State at Critical Sections: 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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
BOT	12.20	7.71	51.4	15.61	7.20	10.99	2.000	45.00	12.21 b	0.00	0.00	0.00	7.85	7.85
MID	59.00	1.02	11.1	8.30	7.25	15.44	2.791	34.68	17.16 a	0.00	0.00	0.00	93.85	93.85
MID-	59.00	0.13	47.9	15.61	7.20	10.99	2.000	45.00	12.21 b	0.00	0.00	0.00	34.11	34.11
TOP	12.20	-5.29	44.9	15.61	7.20	10.99	2.000	45.00	12.21 b	0.00	0.00	0.00	7.29	7.29

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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
LT	12.20	13.94	35.3	6.27	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	2.24	2.24
MID	125.00	0.98	33.7	-0.73	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	19.80	19.80
MID-	125.00	0.98	13.9	6.15	7.69	17.60	n/a	n/a	19.56 c	0.00	0.00	0.00	20.12	20.12
RT	12.20	13.94	35.3	6.27	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	2.24	2.24

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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
LT	12.20	15.22	41.0	9.98	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.89	1.89
MID	125.00	0.08	35.9	0.52	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	NC	NC
MID-	125.00	0.08	0.0	9.59	7.69	23.39	5.084	27.83	25.99 a	0.00	0.00	0.00	NC	NC
RT	12.20	15.22	41.0	9.98	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.89	1.89

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

Filename: Bothell Culvert Analysis 043025.etcx

Load Combination Results at Tenth Points: (k-ft, k)(Fill Depth = 6.00 ft)

M-PT	+Moment	-Moment	+Axial	-Axial	+Shear	-Shear
Member 1: (Exterior Wall)						
Bottom						
1- 0	-33.231	-56.383	8.304	15.612	9.977	0.520
1- 1	-24.889	-51.402	8.304	15.612	7.779	0.307
1- 2	-18.632	-50.620	8.304	15.612	5.719	0.390
1- 3	-14.341	-49.766	8.304	15.612	3.798	0.452
1- 4	-11.862	-48.862	8.304	15.612	2.016	0.492
1- 5	-11.067	-47.930	8.304	15.612	1.018	-0.134
1- 6	-11.821	-46.988	8.304	15.612	1.016	-1.639
1- 7	-13.986	-46.139	8.304	15.612	0.994	-3.005
1- 8	-17.435	-45.387	8.304	15.612	0.949	-4.233
1- 9	-22.014	-44.834	8.304	15.612	0.884	-5.322
1-10	-27.605	-48.410	8.304	15.612	0.725	-6.272
Top						
Member 2: (Top Slab)						
Left						
2- 0	-27.685	-48.490	6.152	6.272	15.612	8.304
2- 1	-11.117	-21.523	-0.725	6.272	12.188	6.345
2- 2	7.458	-1.240	-0.725	6.272	9.335	4.753
2- 3	21.945	7.342	-0.725	6.152	6.514	3.169
2- 4	30.836	12.293	-0.725	6.152	3.729	1.584
2- 5	33.685	13.943	-0.725	6.152	0.984	-0.984
2- 6	30.838	12.293	-0.725	6.152	-1.584	-3.728
2- 7	21.948	7.342	-0.725	6.152	-3.169	-6.514
2- 8	7.458	-1.243	-0.725	6.272	-4.753	-9.335
2- 9	-11.117	-21.523	-0.725	6.272	-6.345	-12.188
2-10	-27.685	-48.490	6.152	6.272	-8.304	-15.612
Right						
Member 4: (Bottom Slab)						
Left						
4- 0	-33.231	-56.383	9.591	9.977	16.860	9.411
4- 1	-15.586	-24.762	9.591	9.977	13.496	7.528
4- 2	4.728	-1.862	0.520	9.591	10.132	5.646
4- 3	22.000	7.940	0.520	9.591	6.767	3.764
4- 4	32.433	13.822	0.520	9.591	3.403	1.882
4- 5	35.857	15.783	0.520	9.591	0.078	-0.078
4- 6	32.433	13.822	0.520	9.591	-1.882	-3.403
4- 7	22.000	7.940	0.520	9.591	-3.764	-6.767
4- 8	4.732	-1.862	0.520	9.591	-5.646	-10.132
4- 9	-15.586	-24.762	9.591	9.977	-7.528	-13.496
4-10	-33.231	-56.383	9.591	9.977	-9.411	-16.860
Right						

---------- Analysis Truck, Overload 2 ----------

Vehicle	Axle No.	Weight (k/ft)	Length (ft)	Dist. From Previous (ft)
Truck	1	0.128	7.73	
	2	0.302	11.73	12.00
	3	0.234	7.73	8.00
	4	0.302	11.73	18.00
	5	0.234	7.73	8.00
	6	0.302	11.73	16.00
	7	0.234	7.73	8.00

***Distributed loads may have been intensified due to axle overlap between lanes

Live Load Parameters:

Traffic Direction is Parallel to Main Reinforcement
Distribution Width : 15.77 ft
Impact Factor : 1.08
Truck MPF : 1.20 Tandem MPF : 0.00
Lane Load Distribution Width : 18.10 ft
Lane Load: 0.000 k/ft

Truck Positions That Cause Maximum Results:

Maximum +Moment in Top Slab					Maximum -Moment in Top Slab				
Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)	Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)
Truck	1	0.234	7.73	14.25	Truck	1	0.234	7.73	15.29

	2	0.302	11.73	6.25		2	0.302	11.73	7.29
	3	0.234	7.73	-9.75		3	0.234	7.73	-8.71
	4	0.302	11.73	-17.75		4	0.302	11.73	-16.71
	5	0.234	7.73	-35.75		5	0.234	7.73	-34.71
	6	0.302	11.73	-43.75		6	0.302	11.73	-42.71
	7	0.128	7.73	-55.75		7	0.128	7.73	-54.71

Maximum +Moment : 7.12 k-ft
Corresponding Moment at End : -9.65 k-ft
Coincident Bottom Slab Load : 0.26 k/ft

Maximum -Moment : -9.79 k-ft
Corresponding Moment at Mid : 7.07 k-ft
Coincident Bottom Slab Load : 0.26 k/ft

Maximum +Shear in Top Slab

Truck	1	0.234	7.73	13.87
	2	0.302	11.73	5.87
	3	0.234	7.73	-10.13
	4	0.302	11.73	-18.13
	5	0.234	7.73	-36.13
	6	0.302	11.73	-44.13
	7	0.128	7.73	-56.13

Maximum +Shear : 3.17 k
Corresponding Shear at Mid : -0.07 k
Coincident Bottom Slab Load : 0.26 k/ft

Maximum -Shear in Top Slab

Truck	1	0.128	7.73	26.97
	2	0.302	11.73	14.97
	3	0.234	7.73	6.97
	4	0.302	11.73	-11.03
	5	0.234	7.73	-19.03
	6	0.302	11.73	-35.03
	7	0.234	7.73	-43.03

Maximum -Shear : -3.17 k
Corresponding Shear at Mid : 0.07 k
Coincident Bottom Slab Load : 0.26 k/ft

Unfactored Moments and Shears due to Truck Loads: (k-ft, k)

	Truck				Tandem				Lane			
M-PT	Mll+	Mll-	Vll+	Vll-	Mll+	Mll-	Vll+	Vll-	Mll+	Mll-	Vll+	Vll-
Member 1: (Exterior Wall)												
Bottom												
1- 0	0.00	-8.24	0.27	-0.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 1	0.00	-8.39	0.27	-0.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 2	0.00	-8.53	0.27	-0.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 3	0.00	-8.68	0.27	-0.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 4	0.00	-8.82	0.27	-0.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 5	0.00	-8.97	0.27	-0.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 6	0.00	-9.11	0.27	-0.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 7	0.00	-9.26	0.27	-0.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 8	0.00	-9.43	0.27	-0.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 9	0.00	-9.61	0.27	-0.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-10	0.01	-9.79	0.27	-0.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Top												
Member 2: (Top Slab)												
Left												
2- 0	0.01	-9.79	3.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 1	0.56	-4.63	2.63	-0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 2	2.57	-1.28	2.10	-0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 3	4.77	0.00	1.55	-0.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 4	6.55	0.00	1.11	-0.38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 5	7.12	0.00	0.71	-0.71	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 6	6.55	0.00	0.38	-1.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 7	4.77	0.00	0.19	-1.55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 8	2.57	-1.28	0.08	-2.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 9	0.56	-4.63	0.02	-2.63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-10	0.01	-9.79	0.00	-3.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Right												
Member 4: (Bottom Slab)												
Left												
4- 0	0.00	-8.24	2.74	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 1	0.00	-3.21	2.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 2	1.15	-0.06	1.65	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 3	3.90	0.00	1.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 4	5.58	0.00	0.56	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 5	6.12	0.00	0.06	-0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 6	5.58	0.00	0.00	-0.56	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 7	3.90	0.00	0.00	-1.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 8	1.15	-0.06	0.00	-1.65	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 9	0.00	-3.21	0.00	-2.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4-10	0.00	-8.24	0.00	-2.74	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Right												

Note: Unfactored live load results computed at 6.00 ft and 0 ft fill depths, per LRFD 3.6.1.2.6

Serviceability Check: Crack Control

Bar Mark	Location	Moment (k-ft)	Thrust (k)	Fss (ksi)	Spacing (in)	Allow (in)
A1	Top Corner Bar	-37.3	12.40	41.89*	5.00	6.57
A2	Bot Corner Bar	-40.4	12.40	45.79*	5.00	5.59
A100	Top Slab (int)	27.4	-1.16	34.78	5.00	8.91
A200	Bot Slab (int)	28.7	-0.16	35.91	5.00	8.47
B2	Ext Wall (ext)	-39.9	12.40	45.14	5.00	5.74

Strength Limit State at Critical Sections: Flexure

Member 1: (Exterior Wall), 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
BOT	24.00	-51.62	16.19	48.35	7.56	52.60	1.00	1.44	14.31	1.50	1.50
MID	59.00	0.00	8.30	26.97	7.69	29.77	1.00	0.74	14.31	NC	NC
MID-	59.00	-50.49	16.19	48.35	7.56	52.60	1.00	1.44	14.31	1.71	1.71
TOP	24.00	-48.07	16.19	48.35	7.56	52.60	1.00	1.44	14.31	1.70	1.70

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
LT	24.00	-23.57	6.19	48.35	7.56	50.03	1.00	1.44	14.31	5.56	5.56
MID	125.00	35.46	-0.91	48.35	7.56	48.10	1.00	1.44	14.31	2.74	2.74
MID-	125.00	0.51	6.15	13.89	7.69	16.20	1.00	0.37	14.31	NC	NC
RT	24.00	-23.57	6.19	48.35	7.56	50.03	1.00	1.44	14.31	5.56	5.56

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
LT	24.00	-26.06	10.16	48.35	7.56	51.07	1.00	1.44	14.31	6.94	6.94
MID	125.00	36.86	0.60	48.35	7.56	48.52	1.00	1.44	14.31	2.88	2.88
MID-	125.00	0.80	9.59	13.89	7.69	17.46	1.00	0.37	14.31	NC	NC
RT	24.00	-26.05	10.16	48.35	7.56	51.07	1.00	1.44	14.31	6.94	6.94

Notes: Mu - Resisting moment under pure flexure, Ma - Allowable moment under applied axial load

Strength Limit State at Critical Sections: 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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
BOT	12.20	7.90	52.1	16.19	7.20	10.99	2.000	45.00	12.21 b	0.00	0.00	0.00	6.52	6.52
MID	59.00	1.20	11.1	8.30	7.25	15.39	2.781	34.72	17.10 a	0.00	0.00	0.00	44.95	44.95
MID-	59.00	0.05	49.9	16.19	7.20	10.99	2.000	45.00	12.21 b	0.00	0.00	0.00	44.79	44.79
TOP	12.20	-5.21	47.6	16.19	7.20	10.99	2.000	45.00	12.21 b	0.00	0.00	0.00	12.60	12.60

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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
LT	12.20	14.47	37.2	6.19	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.94	1.94
MID	125.00	0.96	35.5	-0.91	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	20.36	20.36
MID-	125.00	0.96	13.9	6.15	7.69	17.60	n/a	n/a	19.56 c	0.00	0.00	0.00	20.71	20.71
RT	12.20	14.47	37.2	6.19	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.94	1.94

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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
LT	12.20	15.48	41.2	10.16	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.74	1.74
MID	125.00	0.08	36.9	0.60	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	NC	NC
MID-	125.00	0.08	0.0	9.59	7.69	23.39	5.084	27.83	25.99 a	0.00	0.00	0.00	NC	NC
RT	12.20	15.48	41.2	10.16	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.74	1.74

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

Load Combination Results at Tenth Points: (k-ft, k)(Fill Depth = 6.00 ft)

M-PT	+Moment	-Moment	+Axial	-Axial	+Shear	-Shear
Member 1: (Exterior Wall)						
Bottom						
1- 0	-33.231	-56.782	8.304	16.191	10.163	0.600
1- 1	-24.889	-52.107	8.304	16.191	7.965	0.386
1- 2	-18.632	-51.631	8.304	16.191	5.905	0.469
1- 3	-14.341	-51.084	8.304	16.191	3.984	0.531
1- 4	-11.862	-50.487	8.304	16.191	2.202	0.572
1- 5	-11.067	-49.861	8.304	16.191	1.204	-0.054
1- 6	-11.821	-49.226	8.304	16.191	1.202	-1.559
1- 7	-13.986	-48.604	8.304	16.191	1.179	-2.926
1- 8	-17.435	-48.043	8.304	16.191	1.135	-4.153
1- 9	-22.014	-47.558	8.304	16.191	1.070	-5.242
1-10	-27.605	-51.144	8.304	16.191	0.911	-6.193
Top						
Member 2: (Top Slab)						
Left						
2- 0	-27.685	-51.224	6.152	6.193	16.191	8.304
2- 1	-11.334	-22.415	-0.911	6.193	12.658	6.345
2- 2	7.976	-1.292	-0.911	6.193	9.661	4.753
2- 3	22.800	7.342	-0.911	6.152	6.647	3.169
2- 4	32.312	12.293	-0.911	6.152	3.767	1.584
2- 5	35.456	13.943	-0.911	6.152	0.956	-0.956
2- 6	32.317	12.293	-0.911	6.152	-1.584	-3.767
2- 7	22.798	7.342	-0.911	6.152	-3.169	-6.647
2- 8	7.973	-1.292	-0.911	6.193	-4.753	-9.661
2- 9	-11.334	-22.415	-0.911	6.193	-6.345	-12.658
2-10	-27.685	-51.212	6.152	6.193	-8.304	-16.191
Right						
Member 4: (Bottom Slab)						
Left						
4- 0	-33.231	-56.782	9.591	10.163	17.150	9.411
4- 1	-15.586	-24.776	9.591	10.163	13.724	7.528
4- 2	4.937	-1.862	0.600	9.591	10.297	5.646
4- 3	22.657	7.940	0.600	9.591	6.871	3.764
4- 4	33.327	13.822	0.600	9.591	3.444	1.882
4- 5	36.859	15.783	0.600	9.591	0.084	-0.084
4- 6	33.327	13.822	0.600	9.591	-1.882	-3.444
4- 7	22.657	7.940	0.600	9.591	-3.764	-6.871
4- 8	4.937	-1.862	0.600	9.591	-5.646	-10.297
4- 9	-15.586	-24.773	9.591	10.163	-7.528	-13.724
4-10	-33.231	-56.781	9.591	10.163	-9.411	-17.150
Right						

---------- Analysis Truck, EV 2 ----------

Vehicle	Axle No.	Weight (k/ft)	Length (ft)	Dist. From Previous (ft)
Truck	1	0.357	7.73	
	2	0.256	7.73	15.00

***Distributed loads may have been intensified due to axle overlap between lanes

Live Load Parameters:

Traffic Direction is Parallel to Main Reinforcement
Distribution Width : 15.77 ft
Impact Factor : 1.08
Truck MPF : 1.20 Tandem MPF : 0.00
Lane Load Distribution Width : 18.10 ft
Lane Load: 0.000 k/ft

Truck Positions That Cause Maximum Results:

Maximum +Moment in Top Slab

Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)
Truck	1	0.256	7.73	25.42
	2	0.357	7.73	10.42

Maximum +Moment : 5.38 k-ft
Corresponding Moment at End : -6.33 k-ft
Coincident Bottom Slab Load : 0.13 k/ft

Maximum -Moment in Top Slab

Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)
Truck	1	0.256	7.73	26.76
	2	0.357	7.73	11.76

Maximum -Moment : -6.45 k-ft
Corresponding Moment at Mid : 5.18 k-ft
Coincident Bottom Slab Load : 0.13 k/ft

Maximum +Shear in Top Slab

Truck	1	0.256	7.73	18.87
	2	0.357	7.73	3.87

Maximum +Shear : 2.48 k
Corresponding Shear at Mid : -0.28 k
Coincident Bottom Slab Load : 0.20 k/ft

Maximum -Shear in Top Slab

Truck	1	0.357	7.73	16.97
	2	0.256	7.73	1.97

Maximum -Shear : -2.48 k
Corresponding Shear at Mid : 0.28 k
Coincident Bottom Slab Load : 0.20 k/ft

Unfactored Moments and Shears due to Truck Loads: (k-ft, k)

	Truck				Tandem				Lane			
M-PT	Mll+	Mll-	Vll+	Vll-	Mll+	Mll-	Vll+	Vll-	Mll+	Mll-	Vll+	Vll-
Member 1: (Exterior Wall)												
Bottom												
1- 0	0.00	-6.92	0.20	-0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 1	0.00	-6.73	0.20	-0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 2	0.00	-6.55	0.20	-0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 3	0.00	-6.36	0.20	-0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 4	0.00	-6.18	0.20	-0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 5	0.00	-6.07	0.20	-0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 6	0.00	-6.02	0.20	-0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 7	0.00	-6.04	0.20	-0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 8	0.00	-6.12	0.20	-0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 9	0.00	-6.25	0.20	-0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-10	0.01	-6.45	0.20	-0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Top												
Member 2: (Top Slab)												
Left												
2- 0	0.01	-6.45	2.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 1	0.85	-3.51	2.10	-0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 2	2.54	-1.32	1.75	-0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 3	4.11	0.00	1.43	-0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 4	5.11	0.00	1.11	-0.53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 5	5.38	0.00	0.81	-0.81	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 6	5.10	0.00	0.53	-1.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 7	4.11	0.00	0.29	-1.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 8	2.54	-1.32	0.12	-1.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 9	0.85	-3.51	0.03	-2.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-10	0.01	-6.45	0.00	-2.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Right												
Member 4: (Bottom Slab)												
Left												
4- 0	0.00	-6.92	2.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 1	0.00	-2.88	1.73	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 2	0.92	-0.08	1.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 3	2.79	0.00	0.88	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 4	4.06	0.00	0.45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 5	4.45	0.00	0.06	-0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 6	4.06	0.00	0.00	-0.45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 7	2.79	0.00	0.00	-0.88	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 8	0.92	-0.08	0.00	-1.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 9	0.00	-2.88	0.00	-1.73	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4-10	0.00	-6.92	0.00	-2.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Right												

Note: Unfactored live load results computed at 6.00 ft and 0 ft fill depths, per LRFD 3.6.1.2.6

Serviceability Check: Crack Control

Bar Mark	Location	Moment (k-ft)	Thrust (k)	Fss (ksi)	Spacing (in)	Allow (in)
A1	Top Corner Bar	-34.0	11.71	38.03*	5.00	7.73
A2	Bot Corner Bar	-38.4	11.71	43.55*	5.00	6.13
A100	Top Slab (int)	25.7	-1.10	32.58	5.00	9.84
A200	Bot Slab (int)	27.0	-0.21	33.84	5.00	9.29
B2	Ext Wall (ext)	-37.3	11.71	42.10	5.00	6.51

Strength Limit State at Critical Sections: Flexure

Member 1: (Exterior Wall), 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
BOT	24.00	-48.92	15.26	48.35	7.56	52.37	1.00	1.44	14.31	1.78	1.78
MID	59.00	0.00	8.30	26.97	7.69	29.77	1.00	0.74	14.31	NC	NC
MID-	59.00	-46.92	15.26	48.35	7.56	52.37	1.00	1.44	14.31	2.27	2.27
TOP	24.00	-43.61	15.26	48.35	7.56	52.37	1.00	1.44	14.31	2.39	2.39

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
LT	24.00	-21.93	6.27	48.35	7.56	50.05	1.00	1.44	14.31	6.70	6.70
MID	125.00	33.10	-0.83	48.35	7.56	48.12	1.00	1.44	14.31	3.36	3.36
MID-	125.00	0.51	6.15	13.89	7.69	16.20	1.00	0.37	14.31	NC	NC
RT	24.00	-21.93	6.27	48.35	7.56	50.05	1.00	1.44	14.31	6.70	6.70

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
LT	24.00	-25.55	10.08	48.35	7.56	51.05	1.00	1.44	14.31	7.10	7.10
MID	125.00	34.60	0.52	48.35	7.56	48.50	1.00	1.44	14.31	3.66	3.66
MID-	125.00	0.80	9.59	13.89	7.69	17.46	1.00	0.37	14.31	NC	NC
RT	24.00	-25.55	10.08	48.35	7.56	51.05	1.00	1.44	14.31	7.10	7.10

Notes: Mu - Resisting moment under pure flexure, Ma - Allowable moment under applied axial load

Strength Limit State at Critical Sections: 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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
BOT	12.20	7.81	49.8	15.26	7.20	10.99	2.000	45.00	12.21 b	0.00	0.00	0.00	6.51	6.51
MID	59.00	1.12	11.1	8.30	7.25	15.41	2.785	34.70	17.12 a	0.00	0.00	0.00	54.19	54.19
MID-	59.00	0.13	45.9	15.26	7.20	10.99	2.000	45.00	12.21 b	0.00	0.00	0.00	31.79	31.79
TOP	12.20	-5.28	43.0	15.26	7.20	11.05	2.010	39.13	12.27 a	0.00	0.00	0.00	6.80	6.80

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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
LT	12.20	13.65	34.1	6.27	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	2.27	2.27
MID	125.00	1.09	33.1	-0.83	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	16.43	16.43
MID-	125.00	1.09	13.9	6.15	7.69	17.60	n/a	n/a	19.56 c	0.00	0.00	0.00	16.70	16.70
RT	12.20	13.65	34.1	6.27	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	2.27	2.27

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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
LT	12.20	14.76	40.0	10.08	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	2.05	2.05
MID	125.00	0.09	34.6	0.52	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	NC	NC
MID-	125.00	0.08	0.0	9.59	7.69	23.39	5.084	27.83	25.99 a	0.00	0.00	0.00	NC	NC
RT	12.20	14.76	40.0	10.08	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	2.05	2.05

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

Load Combination Results at Tenth Points: (k-ft, k)(Fill Depth = 6.00 ft)

M-PT	+Moment	-Moment	+Axial	-Axial	+Shear	-Shear
Member 1: (Exterior Wall)						
Bottom						
1- 0	-33.231	-54.996	8.304	15.263	10.080	0.523
1- 1	-24.889	-49.873	8.304	15.263	7.882	0.310
1- 2	-18.632	-48.950	8.304	15.263	5.822	0.393
1- 3	-14.341	-47.954	8.304	15.263	3.901	0.455
1- 4	-11.862	-46.912	8.304	15.263	2.119	0.495
1- 5	-11.067	-45.940	8.304	15.263	1.121	-0.131
1- 6	-11.821	-45.051	8.304	15.263	1.119	-1.636
1- 7	-13.986	-44.262	8.304	15.263	1.096	-3.002
1- 8	-17.435	-43.582	8.304	15.263	1.052	-4.230
1- 9	-22.014	-43.026	8.304	15.263	0.987	-5.319
1-10	-27.605	-46.632	8.304	15.263	0.828	-6.269
Top						
Member 2: (Top Slab)						
Left						
2- 0	-27.685	-46.712	6.152	6.269	15.263	8.304
2- 1	-10.941	-20.901	-0.828	6.269	11.953	6.345
2- 2	7.941	-1.344	-0.828	6.269	9.189	4.753
2- 3	21.909	7.342	-0.828	6.152	6.475	3.169
2- 4	30.366	12.293	-0.828	6.152	3.778	1.560
2- 5	33.100	13.943	-0.828	6.152	1.095	-1.095
2- 6	30.361	12.293	-0.828	6.152	-1.560	-3.778
2- 7	21.909	7.342	-0.828	6.152	-3.169	-6.475
2- 8	7.941	-1.344	-0.828	6.269	-4.753	-9.189
2- 9	-10.941	-20.901	-0.828	6.269	-6.345	-11.953
2-10	-27.685	-46.712	6.152	6.269	-8.304	-15.263
Right						
Member 4: (Bottom Slab)						
Left						
4- 0	-33.231	-54.996	9.591	10.080	16.353	9.411
4- 1	-15.586	-24.326	9.591	10.080	13.090	7.528
4- 2	4.625	-1.862	0.523	9.591	9.827	5.646
4- 3	21.163	7.940	0.523	9.591	6.564	3.764
4- 4	31.281	13.822	0.523	9.591	3.301	1.882
4- 5	34.600	15.783	0.523	9.591	0.085	-0.085
4- 6	31.281	13.822	0.523	9.591	-1.882	-3.301
4- 7	21.163	7.940	0.523	9.591	-3.764	-6.564
4- 8	4.625	-1.862	0.523	9.591	-5.646	-9.827
4- 9	-15.586	-24.326	9.591	10.080	-7.528	-13.090
4-10	-33.231	-54.996	9.591	10.080	-9.411	-16.353
Right						

---------- Analysis Truck, EV 3 ----------

Vehicle	Axle No.	Weight (k/ft)	Length (ft)	Dist. From Previous (ft)
Truck	1	0.435	11.73	
	2	0.256	7.73	17.00

***Distributed loads may have been intensified due to axle overlap between lanes

Live Load Parameters:

Traffic Direction is Parallel to Main Reinforcement
Distribution Width : 15.77 ft
Impact Factor : 1.08
Truck MPF : 1.20 Tandem MPF : 0.00
Lane Load Distribution Width : 18.10 ft
Lane Load: 0.000 k/ft

Truck Positions That Cause Maximum Results:

Maximum +Moment in Top Slab

Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)
Truck	1	0.256	7.73	27.42
	2	0.435	11.73	10.42

Maximum +Moment : 8.24 k-ft
Corresponding Moment at End : -10.87 k-ft
Coincident Bottom Slab Load : 0.25 k/ft

Maximum -Moment in Top Slab

Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)
Truck	1	0.256	7.73	26.38
	2	0.435	11.73	9.38

Maximum -Moment : -11.00 k-ft
Corresponding Moment at Mid : 8.14 k-ft
Coincident Bottom Slab Load : 0.25 k/ft

Maximum +Shear in Top Slab

Truck	1	0.256	7.73	22.87
	2	0.435	11.73	5.87

Maximum +Shear : 3.77 k
Corresponding Shear at Mid : -0.77 k
Coincident Bottom Slab Load : 0.27 k/ft

Maximum -Shear in Top Slab

Truck	1	0.435	11.73	14.97
	2	0.256	7.73	-2.03

Maximum -Shear : -3.77 k
Corresponding Shear at Mid : 0.77 k
Coincident Bottom Slab Load : 0.27 k/ft

Unfactored Moments and Shears due to Truck Loads: (k-ft, k)

	Truck				Tandem				Lane			
M-PT	Mll+	Mll-	Vll+	Vll-	Mll+	Mll-	Vll+	Vll-	Mll+	Mll-	Vll+	Vll-
Member 1: (Exterior Wall)												
Bottom												
1- 0	0.00	-9.24	0.23	-0.36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 1	0.00	-9.23	0.23	-0.36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 2	0.00	-9.22	0.23	-0.36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 3	0.00	-9.20	0.23	-0.36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 4	0.00	-9.20	0.23	-0.36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 5	0.00	-9.37	0.23	-0.36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 6	0.00	-9.68	0.23	-0.36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 7	0.00	-10.01	0.23	-0.36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 8	0.00	-10.33	0.23	-0.36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 9	0.00	-10.67	0.23	-0.36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-10	0.01	-11.00	0.23	-0.36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Top												
Member 2: (Top Slab)												
Left												
2- 0	0.01	-11.00	3.77	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 1	1.03	-5.73	3.22	-0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 2	3.15	-1.79	2.66	-0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 3	5.94	0.00	2.10	-0.35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 4	7.64	0.00	1.55	-0.65	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 5	8.24	0.00	1.05	-1.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 6	7.64	0.00	0.65	-1.55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 7	5.93	0.00	0.35	-2.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 8	3.15	-1.79	0.15	-2.66	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 9	1.03	-5.73	0.04	-3.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-10	0.01	-11.00	0.00	-3.77	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Right												
Member 4: (Bottom Slab)												
Left												
4- 0	0.00	-9.24	2.86	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 1	0.00	-3.85	2.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 2	1.43	-0.10	1.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 3	4.07	0.00	1.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 4	5.66	0.00	0.63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 5	6.08	0.00	0.08	-0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 6	5.66	0.00	0.00	-0.63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 7	4.07	0.00	0.00	-1.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 8	1.44	-0.10	0.00	-1.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 9	0.00	-3.85	0.00	-2.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4-10	0.00	-9.24	0.00	-2.86	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Right												

Note: Unfactored live load results computed at 6.00 ft and 0 ft fill depths, per LRFD 3.6.1.2.6

Serviceability Check: Crack Control

Bar Mark	Location	Moment (k-ft)	Thrust (k)	Fss (ksi)	Spacing (in)	Allow (in)
A1	Top Corner Bar	-38.2	12.99	42.79*	5.00	6.33
A2	Bot Corner Bar	-41.1	12.99	46.41*	5.00	5.45
A100	Top Slab (int)	28.6	-1.13	36.17*	5.00	8.38
A200	Bot Slab (int)	28.6	-0.33	35.92	5.00	8.47
B2	Ext Wall (ext)	-40.3	12.99	45.39	5.00	5.68

Strength Limit State at Critical Sections: Flexure

Member 1: (Exterior Wall), 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
BOT	24.00	-52.53	16.99	48.35	7.56	52.80	1.00	1.44	14.31	1.30	1.30
MID	59.00	0.00	8.30	26.97	7.69	29.77	1.00	0.74	14.31	NC	NC
MID-	59.00	-51.01	16.99	48.35	7.56	52.80	1.00	1.44	14.31	1.53	1.53
TOP	24.00	-49.28	16.99	48.35	7.56	52.80	1.00	1.44	14.31	1.45	1.45

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
LT	24.00	-25.05	6.42	48.35	7.56	50.09	1.00	1.44	14.31	4.25	4.25
MID	125.00	36.96	-0.87	48.35	7.56	48.11	1.00	1.44	14.31	2.19	2.19
MID-	125.00	0.51	6.15	13.89	7.69	16.20	1.00	0.37	14.31	NC	NC
RT	24.00	-25.05	6.42	48.35	7.56	50.09	1.00	1.44	14.31	4.25	4.25

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
LT	24.00	-26.95	10.12	48.35	7.56	51.06	1.00	1.44	14.31	5.45	5.45
MID	125.00	36.80	0.37	48.35	7.56	48.45	1.00	1.44	14.31	2.67	2.67
MID-	125.00	0.80	9.59	13.89	7.69	17.46	1.00	0.37	14.31	NC	NC
RT	24.00	-26.94	10.12	48.35	7.56	51.06	1.00	1.44	14.31	5.46	5.46

Notes: Mu - Resisting moment under pure flexure, Ma - Allowable moment under applied axial load

Strength Limit State at Critical Sections: 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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
BOT	12.20	7.85	53.2	16.99	7.20	10.99	2.000	45.00	12.21 b	0.00	0.00	0.00	6.27	6.27
MID	59.00	1.16	11.1	8.30	7.25	15.40	2.783	34.71	17.11 a	0.00	0.00	0.00	47.46	47.46
MID-	59.00	0.28	50.4	16.99	7.20	10.99	2.000	45.00	12.21 b	0.00	0.00	0.00	21.77	21.77
TOP	12.20	-5.43	49.0	16.99	7.20	10.99	2.000	45.00	12.21 b	0.00	0.00	0.00	5.90	5.90

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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
LT	12.20	15.27	38.7	6.42	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.49	1.49
MID	125.00	1.42	37.0	-0.87	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	12.67	12.67
MID-	125.00	1.42	13.9	6.15	7.69	17.60	n/a	n/a	19.56 c	0.00	0.00	0.00	12.88	12.88
RT	12.20	15.27	38.7	6.42	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.49	1.49

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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
LT	12.20	15.63	42.3	10.12	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.54	1.54
MID	125.00	0.11	36.8	0.37	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	NC	NC
MID-	125.00	0.11	0.0	9.59	7.69	23.39	5.083	27.84	25.99 a	0.00	0.00	0.00	NC	NC
RT	12.20	15.63	42.3	10.12	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.54	1.54

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

Load Combination Results at Tenth Points: (k-ft, k)(Fill Depth = 6.00 ft)

M-PT	+Moment	-Moment	+Axial	-Axial	+Shear	-Shear
Member 1: (Exterior Wall)						
Bottom						
1- 0	-33.231	-58.131	8.304	16.994	10.119	0.371
1- 1	-24.889	-53.243	8.304	16.994	7.920	0.157
1- 2	-18.632	-52.554	8.304	16.994	5.861	0.240
1- 3	-14.341	-51.793	8.304	16.994	3.940	0.302
1- 4	-11.862	-51.001	8.304	16.994	2.157	0.343
1- 5	-11.067	-50.408	8.304	16.994	1.159	-0.283
1- 6	-11.821	-49.996	8.304	16.994	1.158	-1.788
1- 7	-13.986	-49.610	8.304	16.994	1.135	-3.155
1- 8	-17.435	-49.261	8.304	16.994	1.091	-4.382
1- 9	-22.014	-48.984	8.304	16.994	1.025	-5.471
1-10	-27.605	-52.777	8.304	16.994	0.866	-6.422
Top						
Member 2: (Top Slab)						
Left						
2- 0	-27.685	-52.857	6.152	6.422	16.994	8.304
2- 1	-10.690	-23.893	-0.866	6.422	13.453	6.345
2- 2	8.761	-1.980	-0.866	6.422	10.415	4.753
2- 3	24.376	7.342	-0.866	6.152	7.381	3.169
2- 4	33.780	12.293	-0.866	6.152	4.371	1.398
2- 5	36.964	13.943	-0.866	6.152	1.419	-1.419
2- 6	33.780	12.293	-0.866	6.152	-1.398	-4.370
2- 7	24.373	7.342	-0.866	6.152	-3.169	-7.381
2- 8	8.761	-1.984	-0.866	6.422	-4.753	-10.415
2- 9	-10.690	-23.893	-0.866	6.422	-6.345	-13.453
2-10	-27.685	-52.857	6.152	6.422	-8.304	-16.993
Right						
Member 4: (Bottom Slab)						
Left						
4- 0	-33.231	-58.131	9.591	10.119	17.313	9.411
4- 1	-15.586	-25.648	9.591	10.119	13.871	7.528
4- 2	5.320	-1.862	0.371	9.591	10.429	5.646
4- 3	22.890	7.940	0.371	9.591	6.987	3.764
4- 4	33.432	13.822	0.371	9.591	3.545	1.882
4- 5	36.803	15.783	0.371	9.591	0.112	-0.112
4- 6	33.432	13.822	0.371	9.591	-1.882	-3.545
4- 7	22.892	7.940	0.371	9.591	-3.764	-6.987
4- 8	5.326	-1.862	0.371	9.591	-5.646	-10.428
4- 9	-15.586	-25.642	9.591	10.119	-7.528	-13.870
4-10	-33.231	-58.124	9.591	10.119	-9.411	-17.312
Right						

---------- Analysis Truck, NRL - Legal Lane ----------

Vehicle	Axle No.	Weight (k/ft)	Length (ft)	Dist. From Previous (ft)
Truck	1	0.147	11.73	
	2	0.128	7.73	18.00
	3	0.126	11.73	17.00
	4	0.096	7.73	17.00

***Distributed loads may have been intensified due to axle overlap between lanes

Live Load Parameters:

Traffic Direction is Parallel to Main Reinforcement
Distribution Width : 15.77 ft
Impact Factor : 1.08
Truck MPF : 1.20 Tandem MPF : 0.00
Lane Load Distribution Width : 18.10 ft
Lane Load: 0.013 k/ft

Truck Positions That Cause Maximum Results:

Maximum +Moment in Top Slab

Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)
Truck	1	0.147	11.73	10.42
	2	0.128	7.73	-7.58
	3	0.126	11.73	-24.58
	4	0.096	7.73	-41.58

Maximum -Moment in Top Slab

Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)
Truck	1	0.147	11.73	9.38
	2	0.128	7.73	-8.63
	3	0.126	11.73	-25.63
	4	0.096	7.73	-42.63

Maximum +Moment : 2.79 k-ft
Corresponding Moment at End : -3.68 k-ft
Coincident Bottom Slab Load : 0.08 k/ft

Maximum -Moment : -3.73 k-ft
Corresponding Moment at Mid : 2.76 k-ft
Coincident Bottom Slab Load : 0.08 k/ft

Maximum +Shear in Top Slab

Truck	1	0.096	7.73	57.87
	2	0.126	11.73	40.87
	3	0.128	7.73	23.87
	4	0.147	11.73	5.87

Maximum +Shear : 1.27 k
Corresponding Shear at Mid : -0.26 k
Coincident Bottom Slab Load : 0.09 k/ft

Maximum -Shear in Top Slab

Truck	1	0.147	11.73	14.97
	2	0.128	7.73	-3.03
	3	0.126	11.73	-20.03
	4	0.096	7.73	-37.03

Maximum -Shear : -1.27 k
Corresponding Shear at Mid : 0.26 k
Coincident Bottom Slab Load : 0.09 k/ft

Unfactored Moments and Shears due to Truck Loads: (k-ft, k)

	Truck				Tandem				Lane			
M-PT	Mll+	Mll-	Vll+	Vll-	Mll+	Mll-	Vll+	Vll-	Mll+	Mll-	Vll+	Vll-
Member 1: (Exterior Wall)												
Bottom												
1- 0	0.00	-3.06	0.10	-0.12	0.00	0.00	0.00	0.00	0.00	-0.42	0.01	-0.01
1- 1	0.00	-3.06	0.10	-0.12	0.00	0.00	0.00	0.00	0.00	-0.42	0.01	-0.01
1- 2	0.00	-3.06	0.10	-0.12	0.00	0.00	0.00	0.00	0.00	-0.42	0.01	-0.01
1- 3	0.00	-3.06	0.10	-0.12	0.00	0.00	0.00	0.00	0.00	-0.42	0.01	-0.01
1- 4	0.00	-3.08	0.10	-0.12	0.00	0.00	0.00	0.00	0.00	-0.42	0.01	-0.01
1- 5	0.00	-3.18	0.10	-0.12	0.00	0.00	0.00	0.00	0.00	-0.42	0.01	-0.01
1- 6	0.00	-3.28	0.10	-0.12	0.00	0.00	0.00	0.00	0.00	-0.42	0.01	-0.01
1- 7	0.00	-3.39	0.10	-0.12	0.00	0.00	0.00	0.00	0.00	-0.42	0.01	-0.01
1- 8	0.00	-3.50	0.10	-0.12	0.00	0.00	0.00	0.00	0.00	-0.42	0.01	-0.01
1- 9	0.00	-3.61	0.10	-0.12	0.00	0.00	0.00	0.00	0.00	-0.42	0.01	-0.01
1-10	0.00	-3.73	0.10	-0.12	0.00	0.00	0.00	0.00	0.00	-0.42	0.01	-0.01
Top												
Member 2: (Top Slab)												
Left												
2- 0	0.00	-3.73	1.27	0.00	0.00	0.00	0.00	0.00	0.00	-0.42	0.14	0.00
2- 1	0.35	-1.94	1.09	-0.01	0.00	0.00	0.00	0.00	0.03	-0.19	0.11	0.00
2- 2	1.07	-0.61	0.90	-0.05	0.00	0.00	0.00	0.00	0.10	-0.05	0.09	0.00
2- 3	2.00	0.00	0.71	-0.12	0.00	0.00	0.00	0.00	0.19	0.00	0.07	-0.01
2- 4	2.59	0.00	0.53	-0.22	0.00	0.00	0.00	0.00	0.27	0.00	0.05	-0.02
2- 5	2.79	0.00	0.36	-0.36	0.00	0.00	0.00	0.00	0.30	0.00	0.03	-0.03
2- 6	2.59	0.00	0.22	-0.53	0.00	0.00	0.00	0.00	0.27	0.00	0.02	-0.05
2- 7	2.00	0.00	0.12	-0.71	0.00	0.00	0.00	0.00	0.19	0.00	0.01	-0.07
2- 8	1.07	-0.61	0.05	-0.90	0.00	0.00	0.00	0.00	0.10	-0.05	0.00	-0.09
2- 9	0.35	-1.94	0.01	-1.09	0.00	0.00	0.00	0.00	0.03	-0.19	0.00	-0.11
2-10	0.00	-3.73	0.00	-1.27	0.00	0.00	0.00	0.00	0.00	-0.42	0.00	-0.14
Right												
Member 4: (Bottom Slab)												
Left												
4- 0	0.00	-3.06	0.95	0.00	0.00	0.00	0.00	0.00	0.00	-0.42	0.14	0.00
4- 1	0.00	-1.30	0.76	0.00	0.00	0.00	0.00	0.00	0.00	-0.16	0.11	0.00
4- 2	0.48	-0.03	0.58	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.08	0.00
4- 3	1.35	0.00	0.39	0.00	0.00	0.00	0.00	0.00	0.19	0.00	0.06	0.00
4- 4	1.87	0.00	0.21	0.00	0.00	0.00	0.00	0.00	0.27	0.00	0.03	0.00
4- 5	2.02	0.00	0.03	-0.03	0.00	0.00	0.00	0.00	0.30	0.00	0.00	0.00
4- 6	1.87	0.00	0.00	-0.21	0.00	0.00	0.00	0.00	0.27	0.00	0.00	-0.03
4- 7	1.35	0.00	0.00	-0.39	0.00	0.00	0.00	0.00	0.19	0.00	0.00	-0.06
4- 8	0.49	-0.03	0.00	-0.58	0.00	0.00	0.00	0.00	0.05	0.00	0.00	-0.08
4- 9	0.00	-1.29	0.00	-0.76	0.00	0.00	0.00	0.00	0.00	-0.16	0.00	-0.11
4-10	0.00	-3.06	0.00	-0.95	0.00	0.00	0.00	0.00	0.00	-0.42	0.00	-0.14
Right												

Note: Unfactored live load results computed at 6.00 ft and 0 ft fill depths, per LRFD 3.6.1.2.6

Serviceability Check: Crack Control

Bar Mark	Location	Moment (k-ft)	Thrust (k)	Fss (ksi)	Spacing (in)	Allow (in)
A1	Top Corner Bar	-31.8	10.64	35.68	5.00	8.56
A2	Bot Corner Bar	-35.4	10.64	40.13*	5.00	7.07
A100	Top Slab (int)	23.4	-1.01	29.68	5.00	11.27
A200	Bot Slab (int)	24.9	-0.10	31.13	5.00	10.52
B2	Ext Wall (ext)	-34.6	10.64	39.16	5.00	7.36

Strength Limit State at Critical Sections: Flexure

Member 1: (Exterior Wall), 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
BOT	24.00	-46.17	14.38	48.35	7.56	52.14	1.00	1.44	14.31	2.15	2.15
MID	59.00	0.00	8.30	26.97	7.69	29.77	1.00	0.74	14.31	NC	NC
MID-	59.00	-44.70	14.38	48.35	7.56	52.14	1.00	1.44	14.31	2.50	2.50
TOP	24.00	-42.19	14.38	48.35	7.56	52.14	1.00	1.44	14.31	2.40	2.40

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
LT	24.00	-21.05	6.44	48.35	7.56	50.09	1.00	1.44	14.31	6.76	6.76
MID	125.00	31.25	-0.75	48.35	7.56	48.15	1.00	1.44	14.31	3.80	3.80
MID-	125.00	0.54	6.43	13.89	7.69	16.30	1.00	0.37	14.31	NC	NC
RT	24.00	-21.05	6.44	48.35	7.56	50.09	1.00	1.44	14.31	6.76	6.76

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
LT	24.00	-24.28	10.27	48.35	7.56	51.09	1.00	1.44	14.31	8.29	8.29
MID	125.00	32.65	0.62	48.35	7.56	48.52	1.00	1.44	14.31	4.56	4.56
MID-	125.00	0.82	9.87	13.89	7.69	17.56	1.00	0.37	14.31	NC	NC
RT	24.00	-24.28	10.27	48.35	7.56	51.09	1.00	1.44	14.31	8.30	8.30

Notes: Mu - Resisting moment under pure flexure, Ma - Allowable moment under applied axial load

Strength Limit State at Critical Sections: 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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
BOT	12.20	7.95	46.8	14.38	7.20	10.99	2.000	45.00	12.21 b	0.00	0.00	0.00	4.84	4.84
MID	59.00	1.04	10.5	8.30	7.25	15.78	2.853	34.40	17.54 a	0.00	0.00	0.00	66.96	66.96
MID-	59.00	0.03	44.0	14.38	7.20	11.12	2.023	39.03	12.35 a	0.00	0.00	0.00	38.82	38.82
TOP	12.20	-5.40	41.7	14.38	7.20	11.16	2.031	38.97	12.40 a	0.00	0.00	0.00	5.24	5.24

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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
LT	12.20	12.83	33.0	6.44	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	2.59	2.59
MID	125.00	0.68	31.3	-0.75	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	22.31	22.31
MID-	125.00	0.68	13.8	6.43	7.69	17.60	n/a	n/a	19.56 c	0.00	0.00	0.00	22.69	22.69
RT	12.20	12.83	33.0	6.44	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	2.59	2.59

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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
LT	12.20	13.85	37.9	10.27	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	2.64	2.64
MID	125.00	0.05	32.7	0.62	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	NC	NC
MID-	125.00	0.05	0.0	9.87	7.69	23.39	5.087	27.83	25.99 a	0.00	0.00	0.00	NC	NC
RT	12.20	13.85	37.8	10.27	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	2.64	2.64

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

Load Combination Results at Tenth Points: (k-ft, k)(Fill Depth = 6.00 ft)

M-PT	+Moment	-Moment	+Axial	-Axial	+Shear	-Shear
Member 1: (Exterior Wall)						
Bottom						
1- 0	-33.376	-51.880	8.304	14.376	10.273	0.623
1- 1	-24.790	-46.861	8.304	14.376	8.019	0.410
1- 2	-18.344	-46.192	8.304	14.376	5.905	0.493
1- 3	-13.917	-45.450	8.304	14.376	3.929	0.554
1- 4	-11.357	-44.694	8.304	14.376	2.091	0.595
1- 5	-10.535	-44.041	8.304	14.376	1.038	-0.031
1- 6	-11.315	-43.394	8.304	14.376	1.036	-1.591
1- 7	-13.562	-42.765	8.304	14.376	1.014	-3.013
1- 8	-17.146	-42.170	8.304	14.376	0.969	-4.295
1- 9	-21.915	-41.637	8.304	14.376	0.904	-5.439
1-10	-27.750	-45.322	8.304	14.376	0.745	-6.445
Top						
Member 2: (Top Slab)						
Left						
2- 0	-27.830	-45.402	6.427	6.445	14.376	8.304
2- 1	-11.416	-20.034	-0.745	6.445	11.214	6.345
2- 2	6.546	-1.055	-0.745	6.427	8.555	4.753
2- 3	20.198	7.197	-0.745	6.427	5.909	3.169
2- 4	28.475	12.148	-0.745	6.427	3.278	1.584
2- 5	31.254	13.798	-0.745	6.427	0.679	-0.679
2- 6	28.476	12.148	-0.745	6.427	-1.584	-3.278
2- 7	20.198	7.197	-0.745	6.427	-3.169	-5.909
2- 8	6.547	-1.055	-0.745	6.427	-4.753	-8.555
2- 9	-11.415	-20.034	-0.745	6.445	-6.345	-11.214
2-10	-27.830	-45.400	6.427	6.445	-8.304	-14.376
Right						
Member 4: (Bottom Slab)						
Left						
4- 0	-33.376	-51.880	9.866	10.273	15.341	9.411
4- 1	-15.731	-23.134	9.866	10.273	12.282	7.528
4- 2	4.316	-2.007	0.623	9.866	9.223	5.646
4- 3	20.088	7.796	0.623	9.866	6.164	3.764
4- 4	29.549	13.677	0.623	9.866	3.106	1.882
4- 5	32.654	15.638	0.623	9.866	0.054	-0.054
4- 6	29.550	13.677	0.623	9.866	-1.882	-3.105
4- 7	20.088	7.796	0.623	9.866	-3.764	-6.164
4- 8	4.319	-2.007	0.623	9.866	-5.646	-9.223
4- 9	-15.731	-23.129	9.866	10.273	-7.528	-12.282
4-10	-33.376	-51.877	9.866	10.273	-9.411	-15.341
Right						

---------- Analysis Truck, WA-105 ----------

Vehicle	Axle No.	Weight (k/ft)	Length (ft)	Dist. From Previous (ft)
Truck	1	0.197	11.73	
	2	0.181	7.73	12.00
	3	0.239	11.73	34.00
	4	0.098	11.73	8.00
	5	0.133	7.73	13.00

***Distributed loads may have been intensified due to axle overlap between lanes

Live Load Parameters:

Traffic Direction is Parallel to Main Reinforcement
Distribution Width : 15.77 ft
Impact Factor : 1.08
Truck MPF : 1.20 Tandem MPF : 0.00
Lane Load Distribution Width : 18.10 ft
Lane Load: 0.000 k/ft

Truck Positions That Cause Maximum Results:

Maximum +Moment in Top Slab

Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)
Truck	1	0.197	11.73	58.88
	2	0.181	7.73	46.88
	3	0.239	11.73	12.88

Maximum -Moment in Top Slab

Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)
Truck	1	0.133	7.73	28.95
	2	0.098	11.73	15.95
	3	0.239	11.73	7.95

	4	0.098	11.73	4.88		4	0.181	7.73	-26.05
	5	0.133	7.73	-8.12		5	0.197	11.73	-38.05

Maximum +Moment : 5.43 k-ft
Corresponding Moment at End : -7.03 k-ft
Coincident Bottom Slab Load : 0.19 k/ft

Maximum -Moment : -7.29 k-ft
Corresponding Moment at Mid : 5.43 k-ft
Coincident Bottom Slab Load : 0.19 k/ft

Maximum +Shear in Top Slab

Truck	1	0.133	7.73	26.87
	2	0.098	11.73	13.87
	3	0.239	11.73	5.87
	4	0.181	7.73	-28.13
	5	0.197	11.73	-40.13

Maximum +Shear : 2.43 k
Corresponding Shear at Mid : -0.30 k
Coincident Bottom Slab Load : 0.19 k/ft

Maximum -Shear in Top Slab

Truck	1	0.197	11.73	60.97
	2	0.181	7.73	48.97
	3	0.239	11.73	14.97
	4	0.098	11.73	6.97
	5	0.133	7.73	-6.03

Maximum -Shear : -2.43 k
Corresponding Shear at Mid : 0.30 k
Coincident Bottom Slab Load : 0.19 k/ft

Unfactored Moments and Shears due to Truck Loads: (k-ft, k)

	Truck				Tandem				Lane			
M-PT	Mll+	Mll-	Vll+	Vll-	Mll+	Mll-	Vll+	Vll-	Mll+	Mll-	Vll+	Vll-
Member 1: (Exterior Wall)												
Bottom												
1- 0	0.00	-6.19	0.13	-0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 1	0.00	-6.26	0.13	-0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 2	0.00	-6.34	0.13	-0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 3	0.00	-6.42	0.13	-0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 4	0.00	-6.53	0.13	-0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 5	0.00	-6.64	0.13	-0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 6	0.00	-6.76	0.13	-0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 7	0.00	-6.87	0.13	-0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 8	0.00	-7.00	0.13	-0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1- 9	0.00	-7.14	0.13	-0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-10	0.01	-7.29	0.13	-0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Top												
Member 2: (Top Slab)												
Left												
2- 0	0.01	-7.29	2.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 1	0.57	-3.62	2.06	-0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 2	1.84	-1.05	1.69	-0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 3	3.70	0.00	1.30	-0.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 4	5.01	0.00	0.89	-0.36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 5	5.43	0.00	0.59	-0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 6	5.01	0.00	0.36	-0.89	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 7	3.70	0.00	0.19	-1.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 8	1.84	-1.06	0.08	-1.69	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2- 9	0.57	-3.62	0.02	-2.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-10	0.01	-7.28	0.00	-2.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Right												
Member 4: (Bottom Slab)												
Left												
4- 0	0.00	-6.19	2.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 1	0.00	-2.43	1.61	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 2	0.91	-0.06	1.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 3	2.88	0.00	0.82	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 4	4.07	0.00	0.42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 5	4.44	0.00	0.05	-0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 6	4.07	0.00	0.00	-0.42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 7	2.88	0.00	0.00	-0.82	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 8	0.91	-0.06	0.00	-1.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4- 9	0.00	-2.43	0.00	-1.61	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4-10	0.00	-6.19	0.00	-2.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Right												

Note: Unfactored live load results computed at 6.00 ft and 0 ft fill depths, per LRFD 3.6.1.2.6

Serviceability Check: Crack Control

Bar Mark	Location	Moment (k-ft)	Thrust (k)	Fss (ksi)	Spacing (in)	Allow (in)
A1	Top Corner Bar	-34.9	11.65	39.15*	5.00	7.37
A2	Bot Corner Bar	-38.2	11.65	43.33*	5.00	6.19
A100	Top Slab (int)	25.8	-1.03	32.62	5.00	9.82
A200	Bot Slab (int)	27.0	-0.15	33.80	5.00	9.30
B2	Ext Wall (ext)	-37.6	11.65	42.56	5.00	6.39

Strength Limit State at Critical Sections: Flexure

Member 1: (Exterior Wall), 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
BOT	24.00	-51.19	16.15	48.35	7.56	52.59	1.00	1.44	14.31	1.21	1.21
MID	59.00	0.00	8.30	26.97	7.69	29.77	1.00	0.74	14.31	NC	NC
MID-	59.00	-50.01	16.15	48.35	7.56	52.59	1.00	1.44	14.31	1.39	1.39
TOP	24.00	-47.59	16.15	48.35	7.56	52.59	1.00	1.44	14.31	1.38	1.38

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
LT	24.00	-23.77	6.53	48.35	7.56	50.11	1.00	1.44	14.31	4.22	4.22
MID	125.00	35.35	-0.79	48.35	7.56	48.13	1.00	1.44	14.31	2.16	2.16
MID-	125.00	0.54	6.43	13.89	7.69	16.30	1.00	0.37	14.31	NC	NC
RT	24.00	-23.77	6.53	48.35	7.56	50.11	1.00	1.44	14.31	4.22	4.22

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
LT	24.00	-26.11	10.31	48.35	7.56	51.11	1.00	1.44	14.31	5.35	5.35
MID	125.00	36.37	0.54	48.35	7.56	48.50	1.00	1.44	14.31	2.38	2.38
MID-	125.00	0.82	9.87	13.89	7.69	17.56	1.00	0.37	14.31	NC	NC
RT	24.00	-26.11	10.31	48.35	7.56	51.11	1.00	1.44	14.31	5.35	5.35

Notes: Mu - Resisting moment under pure flexure, Ma - Allowable moment under applied axial load

Strength Limit State at Critical Sections: 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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
BOT	12.20	7.99	51.7	16.15	7.20	10.99	2.000	45.00	12.21 b	0.00	0.00	0.00	4.67	4.67
MID	59.00	1.08	10.5	8.30	7.25	15.77	2.851	34.41	17.52 a	0.00	0.00	0.00	54.90	54.90
MID-	59.00	0.11	49.4	16.15	7.20	10.99	2.000	45.00	12.21 b	0.00	0.00	0.00	28.43	28.43
TOP	12.20	-5.48	47.1	16.15	7.20	10.99	2.000	45.00	12.21 b	0.00	0.00	0.00	4.79	4.79

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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
LT	12.20	14.48	37.1	6.53	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.51	1.51
MID	125.00	1.03	35.3	-0.79	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	14.73	14.73
MID-	125.00	1.03	13.8	6.43	7.69	17.60	n/a	n/a	19.56 c	0.00	0.00	0.00	14.98	14.98
RT	12.20	14.48	37.1	6.53	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.51	1.51

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 (k)	Beta	Theta	Vc (k)	Vs (k)	Av (in2)	Max. Spac (in)	Load Ratings IR	OR
LT	12.20	15.30	41.1	10.31	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.43	1.43
MID	125.00	0.09	36.4	0.54	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	NC	NC
MID-	125.00	0.09	0.0	9.87	7.69	23.39	5.086	27.83	25.99 a	0.00	0.00	0.00	NC	NC
RT	12.20	15.30	41.1	10.31	7.56	17.31	n/a	n/a	19.24 c	0.00	0.00	0.00	1.43	1.43

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

Load Combination Results at Tenth Points: (k-ft, k)(Fill Depth = 6.00 ft)

M-PT	+Moment	-Moment	+Axial	-Axial	+Shear	-Shear
Member 1: (Exterior Wall)						
Bottom						
1- 0	-33.376	-56.636	8.304	16.154	10.315	0.542
1- 1	-24.790	-51.747	8.304	16.154	8.061	0.329
1- 2	-18.344	-51.202	8.304	16.154	5.947	0.412
1- 3	-13.917	-50.611	8.304	16.154	3.971	0.474
1- 4	-11.357	-50.004	8.304	16.154	2.133	0.514
1- 5	-10.535	-49.378	8.304	16.154	1.080	-0.112
1- 6	-11.315	-48.744	8.304	16.154	1.078	-1.672
1- 7	-13.562	-48.130	8.304	16.154	1.056	-3.093
1- 8	-17.146	-47.568	8.304	16.154	1.011	-4.376
1- 9	-21.915	-47.079	8.304	16.154	0.946	-5.520
1-10	-27.750	-50.819	8.304	16.154	0.787	-6.525
Top						
Member 2: (Top Slab)						
Left						
2- 0	-27.830	-50.899	6.427	6.525	16.154	8.304
2- 1	-11.093	-22.636	-0.787	6.525	12.721	6.345
2- 2	7.737	-1.554	-0.787	6.525	9.790	4.753
2- 3	22.832	7.197	-0.787	6.427	6.826	3.169
2- 4	32.237	12.148	-0.787	6.427	3.837	1.584
2- 5	35.348	13.798	-0.787	6.427	1.028	-1.028
2- 6	32.235	12.148	-0.787	6.427	-1.584	-3.837
2- 7	22.832	7.197	-0.787	6.427	-3.169	-6.826
2- 8	7.737	-1.557	-0.787	6.525	-4.753	-9.790
2- 9	-11.093	-22.636	-0.787	6.525	-6.345	-12.721
2-10	-27.830	-50.895	6.427	6.525	-8.304	-16.154
Right						
Member 4: (Bottom Slab)						
Left						
4- 0	-33.376	-56.636	9.866	10.315	16.954	9.411
4- 1	-15.731	-24.837	9.866	10.315	13.573	7.528
4- 2	4.972	-2.007	0.542	9.866	10.192	5.646
4- 3	22.429	7.796	0.542	9.866	6.811	3.764
4- 4	32.918	13.677	0.542	9.866	3.430	1.882
4- 5	36.365	15.638	0.542	9.866	0.087	-0.087
4- 6	32.921	13.677	0.542	9.866	-1.882	-3.430
4- 7	22.432	7.796	0.542	9.866	-3.764	-6.811
4- 8	4.972	-2.007	0.542	9.866	-5.646	-10.192
4- 9	-15.731	-24.834	9.866	10.315	-7.528	-13.573
4-10	-33.376	-56.633	9.866	10.315	-9.411	-16.954
Right						

Project : Bothell to Swamp Creek
Task : Box Culvert Evaluation
Job No. : Client: Skanska File: Bothell Culvert Analysis 043025.etcx