STRUCTURAL DESIGN DOCUMENTATION for

Winsome Filing No. 3

El Paso County, Colorado

Prepared for:

Winsome LLC

1864 Woodmoor Drive, Suite 100

Monument, CO 80132

Prepared by:

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Colorado Springs, Colorado 80903

Prepared: August 31, 2022

PCD File No. CDR-21-012

COLORADO REGISTERED
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2022-0831

Project #: 196106001

Kimley»Horn

STRUCTURAL DESIGN DOCUMENTATION
Winsome Filing No. 3
El Paso County, Colorado

The following calculations have been prepared to analyze a CDOT Standard Box Culvert for a three-cell 12-ft span (S) by 7-ft rise (R) culvert. The member thicknesses and the reinforcing steel are based on the details provided in Standard Plan No. M-601-3 for a 12-ft span by 8-ft rise culvert. Culvert #1 has a max fill height of 3.83-ft and uses the details for a fill height for 2-4-ft of fill. Culvert #2 has a max fill height of 4.21-ft and used the details for 4-8-ft of fill.

Spec.: LRFD 7th ed. 2014-2016
Type of Culvert: Cast-in-Place

Physical Dimensions

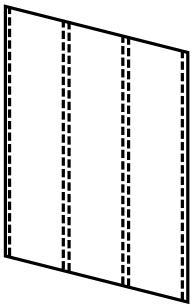
Clear Span:	12'-0"
Clear Height:	7'-0"
Top Slab:	1'- 1/2"
Bottom Slab:	11"
Ext. Wall:	10"
Int. Wall:	10"
Fill Depth:	3.30 ft
Length:	54'-0"
Skew Angle:	14.80 deg
Left Skew Angle:	75.20 deg
Right Skew Angle:	75.20 deg
Bottom Slab Support:	Full Slab
Top Haunch, Width:	0"
Top Haunch, Height:	0"
Bottom Haunch, Width:	0"
Bottom Haunch, Height:	0"

Loads

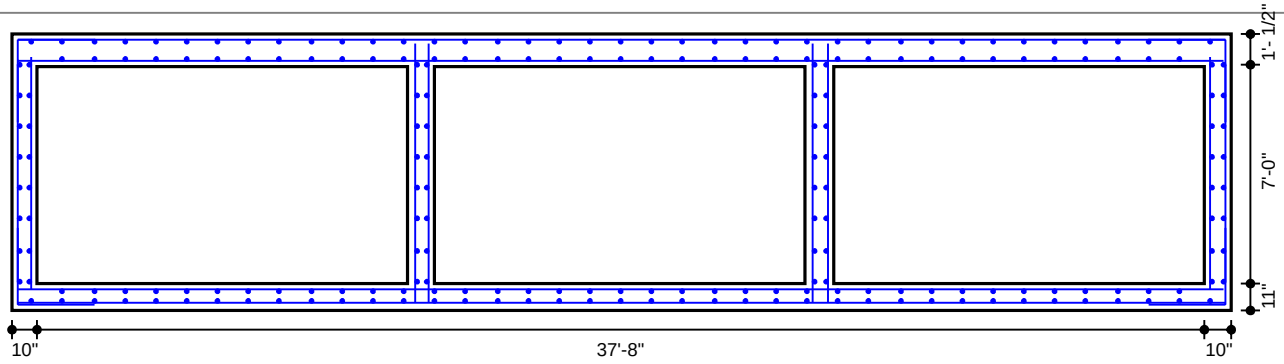
Live Load	
Vehicle Names:	HL-93
Traffic Direction:	Parallel
Eq. Height of Soil:	2.77 ft (Calc'd)
Max No. of Lanes:	1
Dead Load	
Future Wearing Surface:	0.037 klf
Additional Dead Load:	0.000 klf
Concentrated Loads:	none
Lateral Soil Loads	
Eq. Fluid Press. Max:	60.00 pcf
Eq. Fluid Press. Min:	30.00 pcf
Consider Int. Water Press.:	no

Material Properties

Concrete	
Strength, f'c:	4.500 ksi
Density:	0.150 kcf
Elasticity, Ec:	4435 ksi
Type:	Normal wt
Steel	
Yield, fy:	60 ksi
Allow Stress:	36 ksi
Elasticity, Es:	29000 ksi
Soil	
Density:	0.120 kcf
Exposure Factor	
Class 1 Exposure	
Reinforcement Covers	
Ext. Cover Top Slab:	2 1/2"
Ext. Cover Bottom Slab	3"
Ext. Cover Walls	2"
Int. Cover Walls	2"
Int. Cover Top Slab	2"
Int. Cover Bottom Slab	2"



Plan View



Typical Section

Concrete Summary
Volume of Concrete: 3.717 cy/ft Total Volume of Concrete: 200.722 cy

Reinforcing Steel Bar Schedule (lb)

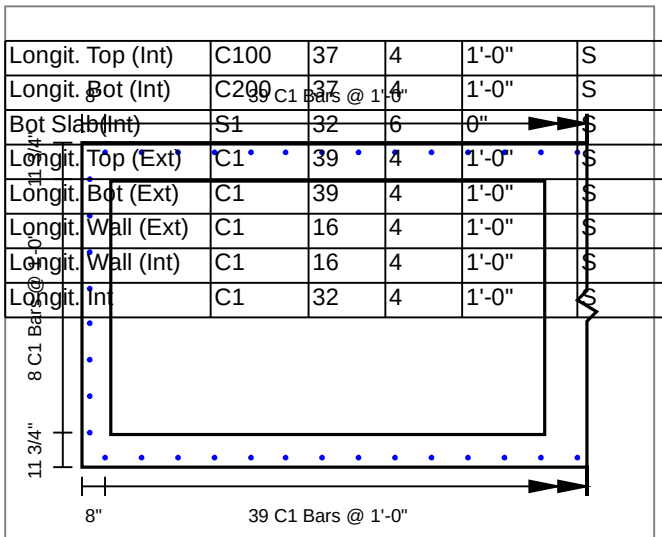
Location	Mark	Qty	Size	Spacing	Type	Length	Hor.Leg	Ver.Leg	Tot.Weight
Top Slab(Int)	A100 (AS2)	88	7	6"	S	38'-11"	--	--	7000.0
Top Slab(Int)	A101	4	7	6"	S	34'-9"	--	--	284.0
Top Slab(Int)	A102	4	7	6"	S	30'-11"	--	--	253.0
Top Slab(Int)	A103	4	7	6"	S	27'-2"	--	--	222.0
Top Slab(Int)	A104	4	7	6"	S	23'-4"	--	--	191.0
Top Slab(Int)	A105	4	7	6"	S	19'-7"	--	--	160.0
Top Slab(Int)	A106	4	7	6"	S	15'-10"	--	--	129.0
Top Slab(Int)	A107	4	7	6"	S	12'-0"	--	--	98.0
Top Slab(Int)	A108	4	7	6"	S	8'-3"	--	--	67.0
Top Slab(Int)	A109	4	7	6"	S	4'-5"	--	--	36.0
Bot Slab(Int)	A200 (AS3)	88	6	6"	S	38'-11"	--	--	5144.0
Bot Slab(Int)	A201	4	6	6"	S	34'-9"	--	--	209.0
Bot Slab(Int)	A202	4	6	6"	S	30'-11"	--	--	186.0
Bot Slab(Int)	A203	4	6	6"	S	27'-2"	--	--	163.0
Bot Slab(Int)	A204	4	6	6"	S	23'-4"	--	--	140.0
Bot Slab(Int)	A205	4	6	6"	S	19'-7"	--	--	118.0
Bot Slab(Int)	A206	4	6	6"	S	15'-10"	--	--	95.0
Bot Slab(Int)	A207	4	6	6"	S	12'-0"	--	--	72.0
Bot Slab(Int)	A208	4	6	6"	S	8'-3"	--	--	50.0
Bot Slab(Int)	A209	4	6	6"	S	4'-5"	--	--	27.0
Top Slab(Ext)	A300 (AS7)	88	6	6"	S	38'-11"	--	--	5144.0
Top Slab(Ext)	A301	4	6	6"	S	34'-9"	--	--	209.0
Top Slab(Ext)	A302	4	6	6"	S	30'-11"	--	--	186.0
Top Slab(Ext)	A303	4	6	6"	S	27'-2"	--	--	163.0
Top Slab(Ext)	A304	4	6	6"	S	23'-4"	--	--	140.0
Top Slab(Ext)	A305	4	6	6"	S	19'-7"	--	--	118.0
Top Slab(Ext)	A306	4	6	6"	S	15'-10"	--	--	95.0
Top Slab(Ext)	A307	4	6	6"	S	12'-0"	--	--	72.0
Top Slab(Ext)	A308	4	6	6"	S	8'-3"	--	--	50.0
Top Slab(Ext)	A309	4	6	6"	S	4'-5"	--	--	27.0
Bot Slab(Ext)	A400 (AS8)	88	6	6"	S	38'-11"	--	--	5144.0
Bot Slab(Ext)	A401	4	6	6"	S	34'-9"	--	--	209.0
Bot Slab(Ext)	A402	4	6	6"	S	30'-11"	--	--	186.0
Bot Slab(Ext)	A403	4	6	6"	S	27'-2"	--	--	163.0
Bot Slab(Ext)	A404	4	6	6"	S	23'-4"	--	--	140.0
Bot Slab(Ext)	A405	4	6	6"	S	19'-7"	--	--	118.0
Bot Slab(Ext)	A406	4	6	6"	S	15'-10"	--	--	95.0
Bot Slab(Ext)	A407	4	6	6"	S	12'-0"	--	--	72.0
Bot Slab(Ext)	A408	4	6	6"	S	8'-3"	--	--	50.0
Bot Slab(Ext)	A409	4	6	6"	S	4'-5"	--	--	27.0
Corner(Top)	A1 (AS1)	216	5	6"	L	5'-2"	2'-6"	2'-8"	1164.0
Corner(Bot)	A2 (AS1)	216	5	6"	L	5'-0"	2'-6"	2'-6"	1126.0
Wall(Int)	B1 (AS4)	108	5	1'-0"	S	7'-6"	--	--	845.0
Wall(Ext)	B2 (AS1)	108	5	1'-0"	S	7'-0"	--	--	789.0
Int Wall	B3	216	5	1'-0"	S	8'-5"	--	--	1896.0

KIMLEY-HORN

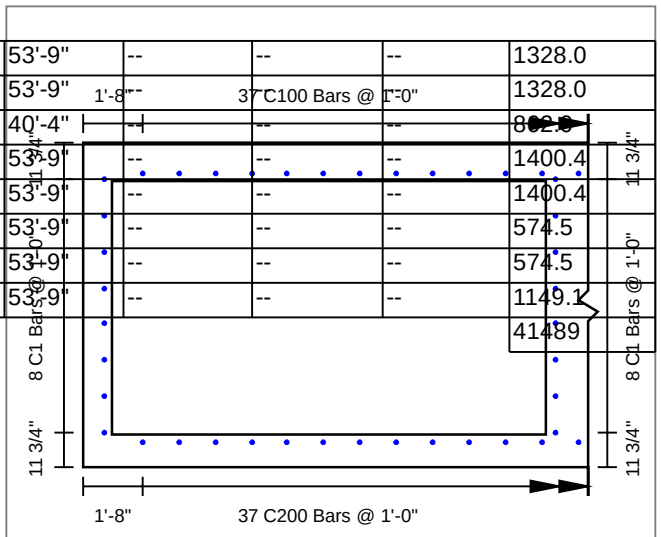
Project : Winsome Filing No. 3 Culvert #1
Task : 3-12-ft x 7-ft_skewed Client:
Job No. : 196106001 File: 3 cell 7x12 skew.etcx

Sht_____of_____
By:DJL
Ck:_____
8/25/2022 5:32:26 AM
p. 3 of 3

Longit. Top (Int)	C100	37	4	1'-0"	S	53'-9"	--	--	--	1328.0
Longit. Bot (Int)	C200	37	4	1'-0"	S	53'-9"	--	--	--	1328.0
Bot Slab(Int)	S1	32	6	0"	S	40'-4"	--	--	--	862.9
Longit. Top (Ext)	C1	39	4	1'-0"	S	53'-9"	--	--	--	1400.4
Longit. Bot (Ext)	C1	39	4	1'-0"	S	53'-9"	--	--	--	1400.4
Longit. Wall (Ext)	C1	16	4	1'-0"	S	53'-9"	--	--	--	574.5
Longit. Wall (Int)	C1	16	4	1'-0"	S	53'-9"	--	--	--	574.5
Longit. Int	C1	32	4	1'-0"	S	53'-9"	--	--	--	1149.1
										41489



Section Ext. Longit. Reinf.



Section Int. Longit. Reinf.

Culvert #1

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

	Flexure					Shear				
Truck	Fill	Member	Location	IR	OR	Fill	Member	Location	IR	OR
(AA) HL-93	3.30	3	TOP	1.70	2.20	3.30	2	RT	1.14	1.47

Eriksson Culvert v5.0.0

Filename: 3 cell 7x12 skew.etcx

Culvert #1

REINFORCEMENT SUMMARY

M dimension = 1.66 ft (method of equivalent capacity)
= 3.94 ft (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)	88	7	STR	6.00	1.200	38-11	7000		
	A101	4	7	STR	6.00	---	34- 9	284		
	A102	4	7	STR	6.00	---	30-11	253		
	A103	4	7	STR	6.00	---	27- 2	222		
	A104	4	7	STR	6.00	---	23- 4	191		
	A105	4	7	STR	6.00	---	19- 7	160		
	A106	4	7	STR	6.00	---	15-10	129		
	A107	4	7	STR	6.00	---	12- 0	98		
	A108	4	7	STR	6.00	---	8- 3	67		
	A109	4	7	STR	6.00	---	4- 5	36		
Bot Slab (int)	A200 (AS3)	88	6	STR	6.00	0.880	38-11	5144		
	A201	4	6	STR	6.00	---	34- 9	209		
	A202	4	6	STR	6.00	---	30-11	186		
	A203	4	6	STR	6.00	---	27- 2	163		
	A204	4	6	STR	6.00	---	23- 4	140		
	A205	4	6	STR	6.00	---	19- 7	118		
	A206	4	6	STR	6.00	---	15-10	95		
	A207	4	6	STR	6.00	---	12- 0	72		
	A208	4	6	STR	6.00	---	8- 3	50		
	A209	4	6	STR	6.00	---	4- 5	27		
Top Slab (ext)	A300 (AS7)	88	6	STR	6.00	0.880	38-11	5144		
	A301	4	6	STR	6.00	---	34- 9	209		
	A302	4	6	STR	6.00	---	30-11	186		
	A303	4	6	STR	6.00	---	27- 2	163		
	A304	4	6	STR	6.00	---	23- 4	140		
	A305	4	6	STR	6.00	---	19- 7	118		
	A306	4	6	STR	6.00	---	15-10	95		
	A307	4	6	STR	6.00	---	12- 0	72		
	A308	4	6	STR	6.00	---	8- 3	50		
	A309	4	6	STR	6.00	---	4- 5	27		
Bot Slab (ext)	A400 (AS8)	88	6	STR	6.00	0.880	38-11	5144		
	A401	4	6	STR	6.00	---	34- 9	209		
	A402	4	6	STR	6.00	---	30-11	186		
	A403	4	6	STR	6.00	---	27- 2	163		
	A404	4	6	STR	6.00	---	23- 4	140		
	A405	4	6	STR	6.00	---	19- 7	118		
	A406	4	6	STR	6.00	---	15-10	95		
	A407	4	6	STR	6.00	---	12- 0	72		
	A408	4	6	STR	6.00	---	8- 3	50		
	A409	4	6	STR	6.00	---	4- 5	27		
Corner (Top)	A1 (AS1)	216	5	L-BAR	6.00	0.620	5- 2	1164	2- 6	2- 8
Corner (Bottom)	A2 (AS1)	216	5	L-BAR	6.00	0.620	5- 0	1126	2- 6	2- 6
Ext Wall (int)	B1 (AS4)	108	5	STR	12.00	0.310	7- 6	845		
Ext Wall (ext)	B2 (AS1)	108	5	STR	12.00	0.310	7- 0	789		
Int Wall	B3	216	5	STR	12.00	0.310	8- 5	1896		
Top Slab (int- 1)	C100 (AS5)	37	4	STR	12.00	0.200	53- 9	1328		
Bot Slab (int- 1)	C200	37	4	STR	12.00	0.200	53- 9	1328		
Edge Beam(1)	S1	32	6	STR	0.00	---	40- 4	862		
Temperature (1)	C1 (AS6)	39	4	STR	12.00	0.200	53- 9	1400		
Temperature (1)	C1 (AS6)	39	4	STR	12.00	0.200	53- 9	1400		
Temperature (1)	C1 (AS6)	16	4	STR	12.00	0.200	53- 9	575		
Temperature (1)	C1 (AS6)	16	4	STR	12.00	0.200	53- 9	575		
Temperature (1)	C1 (AS6)	32	4	STR	12.00	0.200	53- 9	1149		
							Total	41489		

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)	0.620
Transverse Top Slab - Inside Face (AS2)	1.200
Transverse Bottom Slab - Inside Face (AS3)	0.880
Transverse Side Wall - Inside Face (AS4)	0.310
Distribution Top Slab - Inside Face (AS5)	0.200
Distribution Top Slab - OutSide Face (AS6)	0.200
Transverse Top Slab - Outside Face (AS7)	0.880
Transverse Bottom Slab - Outside Face (AS8)	0.880

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

Culvert #1

Eriksson Culvert v5.0.0

Filename: 3 cell 7x12 skew.etcx
Splice Lengths Table:

Bar Mark	Size	Splice Length (ft-in)
B1	5	1-10
B3	5	1-10
C1	4	1- 6
C100	4	1- 6
C200	4	1- 6

Culvert #1

Eriksson Culvert v5.0.0

Filename: 3 cell 7x12 skew.etcx

Project: Winsome Filing No. 3
Task : 3-12-ft x 7-ft_skewed
Client :
Job No.: 196106001

CULVERT PROPERTIES
==========
Type of Culvert: Cast-in-Place Specification : LRFD 7th Edition w/ 2015 and 2016 Interims
Operating Mode : Analysis

Physical Dimensions

No. of Boxes: 3 Name: 3Cell CIP 12x7
Clear Span : 12.0000 ft Fill Depth : 3.30 ft
Clear Height: 7.0000 ft Center Skew : 14.80 deg Left Skew: 75.20 deg Right Skew: 75.20 deg
Length : 54.0000 ft Bottom Slab Support: Full Slab
Haunches: Top, Length: 0.0000 in Height: 0.0000 in
Bottom, Length: 0.0000 in Height: 0.0000 in
Member Thicknesses: Top Slab: 12.5000 in Bot Slab: 11.0000 in
Ext Wall: 10.0000 in Int Wall: 10.0000 in
Wall Joint: None

Material Properties

Concrete: Strength,f'c : 4.500 ksi Density : 0.150 kcf Elasticity,Ec: 4435 ksi
Type : Normal Weight Density Modification Factor : 1.00
Fr Factor : 0.24 Gamma1 : 1.60 Gamma3 : 0.75
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 (B1 Installation)
Poisson's : 0.5
Fe Factor : 1.150 (Maximum for Compacted Fill)
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
Include Lane Load : no Max. No. of Lanes: Computed by Program
Traffic Direction** : Lanes Parallel to Main Reinforcement
Neglect Live Load for Large Fill Depths: yes
Apply Surcharge at Fill Depths > 2 ft : yes
Compute Surcharge Depth: yes
Dead Load: Future Wearing Surface : 0.04 klf Add. Dead Load : 0.00 klf
Concentrated Loads : none
Lateral Soil Loads: Max. Equiv. Fluid Press.: 60.00 pcf Min. Equiv. Fluid Press. : 30.00 pcf
Include Additional Uniform Horiz. Load: no
Include Additional Uniform Vert. Load: no
Buoyancy Check : no
Fluid Pressures : Apply Water Press. : no
Foundation Model : Rigid

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
Ductility: 1.000 Importance: 1.000 Redundancy, non-earth: 1.000 Redundancy, earth: 1.050
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

Culvert #1

Eriksson Culvert v5.0.0

Filename: 3 cell 7x12 skew.etcx

```
Reinforcement Covers  :  Exterior      Interior
              Top Slab:  2.5000 in     2.0000 in
              Walls   :  2.0000 in     2.0000 in
              Bot Slab:  3.0000 in     2.0000 in
```

Assigned reinforcement:

Location	Mark	Size	Spacing (in)
Top Slab Inside	A100 (AS2)	7	6.0000
Bottom Slab Inside	A200 (AS3)	6	6.0000
Top Slab Outside	A300 (AS7)	6	6.0000
Bottom Slab Outside	A400 (AS8)	6	6.0000
Top Corner	A1 (AS1)	5	6.0000
Bottom Corner	A2 (AS1)	5	6.0000
Ext. Wall Inside	B1 (AS4)	5	12.0000
Ext. Wall Outside	B2 (AS1)	5	12.0000
Interior Wall	B3	5	12.0000
Longitudinal	C1 (AS6)	4	12.0000
Top Distribution	C100 (AS5)	4	12.0000
Bottom Distribution	C200	4	12.0000

Analysis Options

```
LL Analysis  : Automatically Set Traffic Direction to Account for Skew Effects: yes (**Will override previo
               Limit LL Distribution Width to Culvert Length for: All Fill Depths
               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: no
               Always Distribute Wheel Load: yes
Reinforcement: Always Include Distribution Steel: yes
               Distribution Slab Provided: no
               User Defined Longitudinal Steel: yes
               Max. As used in Vc Calcs: 2.00 in2/ft
               Distribute Minimum Reinforcement per Face: no
               Use individual Member Thicknesses for Min Steel: yes
               Epoxy coat steel: top bars, if fill < 2'
               Use M-dimension for bar length calcs.: no
Slenderness  : Checked       K Factor: 2.00
Analysis Modeling     : Use Haunches in the Structural Analysis Model: no
Crit. Section: Consider Haunches when Selecting Critical Section Locations: no
               Use Max. Moment with Max. Shear at the Critical Section for Shear: yes
Flexure      : Ignore Axial Thrust: yes
               Use Eq. 12.10.4.2.4a-1: no
Shear        : Always Check Iterative Beta Method
Environmental: Apply envirnomental duribility factors: no
```

Culvert #1

Filename: 3 cell 7x12 skew.etcx

ANALYSIS RESULTS
==========

Top Slab Thickness = 12.50 in
Bottom Slab Thickness = 11.00 in
Exterior Wall Thickness = 10.00 in
Interior Wall Thickness = 10.00 in

Modular Ratio (N) = 6.54 Max. Steel Ratio = 0.023
Design Span = 12.83 ft Design Height = 7.98 ft
Design Fill Depth = 3.30 ft

Volume of Concrete: 3.717 cy/ft Weight of Steel: 766 lb/ft

M dimension = 1.66 ft (method of equivalent capacity)
= 3.94 ft (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)	88	7	STR	6.00	1.200	38-11	7000		
	A101	4	7	STR	6.00	---	34- 9	284		
	A102	4	7	STR	6.00	---	30-11	253		
	A103	4	7	STR	6.00	---	27- 2	222		
	A104	4	7	STR	6.00	---	23- 4	191		
	A105	4	7	STR	6.00	---	19- 7	160		
	A106	4	7	STR	6.00	---	15-10	129		
	A107	4	7	STR	6.00	---	12- 0	98		
	A108	4	7	STR	6.00	---	8- 3	67		
	A109	4	7	STR	6.00	---	4- 5	36		
Bot Slab (int)	A200 (AS3)	88	6	STR	6.00	0.880	38-11	5144		
	A201	4	6	STR	6.00	---	34- 9	209		
	A202	4	6	STR	6.00	---	30-11	186		
	A203	4	6	STR	6.00	---	27- 2	163		
	A204	4	6	STR	6.00	---	23- 4	140		
	A205	4	6	STR	6.00	---	19- 7	118		
	A206	4	6	STR	6.00	---	15-10	95		
	A207	4	6	STR	6.00	---	12- 0	72		
	A208	4	6	STR	6.00	---	8- 3	50		
	A209	4	6	STR	6.00	---	4- 5	27		
Top Slab (ext)	A300 (AS7)	88	6	STR	6.00	0.880	38-11	5144		
	A301	4	6	STR	6.00	---	34- 9	209		
	A302	4	6	STR	6.00	---	30-11	186		
	A303	4	6	STR	6.00	---	27- 2	163		
	A304	4	6	STR	6.00	---	23- 4	140		
	A305	4	6	STR	6.00	---	19- 7	118		
	A306	4	6	STR	6.00	---	15-10	95		
	A307	4	6	STR	6.00	---	12- 0	72		
	A308	4	6	STR	6.00	---	8- 3	50		
	A309	4	6	STR	6.00	---	4- 5	27		
Bot Slab (ext)	A400 (AS8)	88	6	STR	6.00	0.880	38-11	5144		
	A401	4	6	STR	6.00	---	34- 9	209		
	A402	4	6	STR	6.00	---	30-11	186		
	A403	4	6	STR	6.00	---	27- 2	163		
	A404	4	6	STR	6.00	---	23- 4	140		
	A405	4	6	STR	6.00	---	19- 7	118		
	A406	4	6	STR	6.00	---	15-10	95		
	A407	4	6	STR	6.00	---	12- 0	72		
	A408	4	6	STR	6.00	---	8- 3	50		
	A409	4	6	STR	6.00	---	4- 5	27		
Corner (Top)	A1 (AS1)	216	5	L-BAR	6.00	0.620	5- 2	1164	2- 6	2- 8
Corner (Bottom)	A2 (AS1)	216	5	L-BAR	6.00	0.620	5- 0	1126	2- 6	2- 6
Ext Wall (int)	B1 (AS4)	108	5	STR	12.00	0.310	7- 6	845		
Ext Wall (ext)	B2 (AS1)	108	5	STR	12.00	0.310	7- 0	789		
Int Wall	B3	216	5	STR	12.00	0.310	8- 5	1896		
Top Slab (int- 1)	C100 (AS5)	37	4	STR	12.00	0.200	53- 9	1328		
Bot Slab (int- 1)	C200	37	4	STR	12.00	0.200	53- 9	1328		
Edge Beam(1)	S1	32	6	STR	0.00	---	40- 4	862		
Temperature (1)	C1 (AS6)	39	4	STR	12.00	0.200	53- 9	1400		
Temperature (1)	C1 (AS6)	39	4	STR	12.00	0.200	53- 9	1400		
Temperature (1)	C1 (AS6)	16	4	STR	12.00	0.200	53- 9	575		
Temperature (1)	C1 (AS6)	16	4	STR	12.00	0.200	53- 9	575		
Temperature (1)	C1 (AS6)	32	4	STR	12.00	0.200	53- 9	1149		
							Total	41489		

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

AS Bar Marks

Location	As prv in2/ft

Eriksson Culvert v5.0.0

Filename: 3 cell 7x12 skew.etcx

Culvert #1

Transverse Side Wall - Outside Face (AS1)	0.620
Transverse Top Slab - Inside Face (AS2)	1.200
Transverse Bottom Slab - Inside Face (AS3)	0.880
Transverse Side Wall - Inside Face (AS4)	0.310
Distribution Top Slab - Inside Face (AS5)	0.200
Distribution Top Slab - OutSide Face (AS6)	0.200
Transverse Top Slab - Outside Face (AS7)	0.880
Transverse Bottom Slab - Outside Face (AS8)	0.880

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

Splice Lengths Table:

Bar Mark	Size	Splice Length (ft-in)
B1	5	1-10
B3	5	1-10
C1	4	1- 6
C100	4	1- 6
C200	4	1- 6

Output for Skewed Ends

End Layout	Total Width (ft)	Skew (deg)	Skew Offset (ft)	Skew Length (ft)
Left	39.333	75.2	10.392	40.683
Right	39.333	75.2	10.392	40.683

>>>Warning: The adequacy of the edge beam reinforcement must be hand checked and increased if necessary.

Summary of Ratings Table:

Truck	Flexure Fill	Flexure Member	Flexure Location	Flexure IR	Flexure OR	Shear Fill	Shear Member	Shear Location	Shear IR	Shear OR
(AA) HL-93	3.30	3	TOP	1.70	2.20	3.30	2	RT	1.14	1.47

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	OR	Truck	Fill Depth (ft)
BOT	5.50	-8.85	15.32	22.58	7.69	22.58	1.00	0.62	10.18	6.61	8.57	AA	3.30
MID	47.88	1.60	3.12	11.60	7.69	11.60	1.00	0.31	10.18	7.25	9.39	AA	3.30
MID-	47.88	-7.78	15.08	11.60	7.69	11.60	1.00	0.31	10.18	1.74	2.25	AA	3.30
TOP	6.25	-13.66	15.32	22.58	7.69	22.58	1.00	0.62	10.18	1.97	2.55	AA	3.30

Member 2: (Top Slab), Thickness = 12.50 in

Loc	Dist. (in)	Design Moment (k-ft)	Corr. A. F. (k)	Mu (k-ft)	ds (in)	Ma (k-ft)	phi	As (in2)	Mcr (k-ft)	Load Ratings IR	OR	Truck	Fill Depth (ft)
LT	5.00	-11.64	4.20	28.78	9.69	28.78	1.00	0.62	15.91	3.16	4.10	AA	3.30
MID	61.60	26.20	0.14	55.67	10.06	55.67	1.00	1.20	15.91	2.64	3.43	AA	3.30
RT	5.00	-26.71	1.79	39.82	9.63	39.82	1.00	0.88	15.91	1.81	2.35	AA	3.30

Member 3: (Interior 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	Truck	Fill Depth (ft)
BOT	5.50	-1.94	23.30	11.60	7.69	11.60	1.00	0.31	10.18	6.34	8.22	AA	3.30
MID	47.88	3.83	9.89	11.60	7.69	11.60	1.00	0.31	10.18	3.64	4.72	AA	3.30
TOP	6.25	-5.89	23.30	11.60	7.69	11.60	1.00	0.31	10.18	1.70	2.20	AA	3.30

Member 4: (Bottom Slab), Thickness = 11.00 in

Loc	Dist. (in)	Design Moment (k-ft)	Corr. A. F. (k)	Mu (k-ft)	ds (in)	Ma (k-ft)	phi	As (in2)	Mcr (k-ft)	Load Ratings IR	OR	Truck	Fill Depth (ft)
LT	5.00	-8.28	5.07	22.58	7.69	22.58	1.00	0.62	12.32	6.66	8.64	AA	3.30
MID	61.60	11.84	0.61	35.42	8.63	35.42	1.00	0.88	12.32	8.16	10.58	AA	3.30
RT	5.00	-16.67	2.27	31.02	7.63	31.02	1.00	0.88	12.32	4.17	5.40	AA	3.30

Member 5: (Top Slab - Interior Cell), Thickness = 12.50 in

Loc	Dist. (in)	Design Moment (k-ft)	Corr. A. F. (k)	Mu (k-ft)	ds (in)	Ma (k-ft)	phi	As (in2)	Mcr (k-ft)	Load Ratings IR	OR	Truck	Fill Depth (ft)
LT	5.00	-25.57	1.31	39.82	9.63	39.82	1.00	0.88	15.91	1.92	2.49	AA	3.30
MID	77.00	20.58	2.82	55.67	10.06	55.67	1.00	1.20	15.91	3.20	4.15	AA	3.30
RT	5.00	-25.57	1.31	39.82	9.63	39.82	1.00	0.88	15.91	1.92	2.49	AA	3.30

Culvert #1

Member 7: (Bottom Slab - Interior Cell), Thickness = 11.00 in

Loc	Dist. (in)	Design Moment (k-ft)	Corr. A. F. (k)	Mu (k-ft)	ds (in)	Ma (k-ft)	phi	As (in2)	Mcr (k-ft)	Load Ratings IR	OR	Truck	Fill Depth (ft)
LT	5.00	-15.72	1.99	31.02	7.63	31.02	1.00	0.88	12.32	4.48	5.80	AA	3.30
MID	77.00	7.96	3.90	35.42	8.63	35.42	1.00	0.88	12.32	13.37	17.34	AA	3.30
RT	5.00	-15.72	1.99	31.02	7.63	31.02	1.00	0.88	12.32	4.48	5.80	AA	3.30

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	12.70	3.76	-8.8	15.32	7.28	15.93	3.021	17.70a	0.00	0.00	0.00	9.92	12.86	AA	3.30
MID	47.88	0.76	1.6	3.12	7.48	21.62	3.990	24.02a	0.00	0.00	0.00	41.63	53.97	AA	3.30
MID-	47.88	0.76	-7.8	15.08	7.48	15.71	2.900	17.46a	0.00	0.00	0.00	13.92	18.05	AA	3.30
TOP	13.45	-3.45	-13.7	15.32	7.28	13.01	2.468	14.46a	0.00	0.00	0.00	5.62	7.29	AA	3.30

Member 2: (Top Slab), Thickness = 12.50 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	14.00	12.98	-11.6	4.20	9.69	17.32	n/a	19.24c	0.00	0.00	0.00	1.46	1.90	AA	3.30
MID	77.00	2.40	26.2	0.14	10.06	16.72	2.295	18.58a	0.00	0.00	0.00	5.50	7.13	AA	3.30
RT	14.00	15.16	-26.7	1.79	9.63	16.57	n/a	18.41c	0.00	0.00	0.00	1.14	1.47	AA	3.30

Member 3: (Interior 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	12.70	1.21	-1.9	23.30	7.48	27.86	5.142	30.96a	0.00	0.00	0.00	22.29	28.89	AA	3.30
MID	47.88	1.21	3.8	9.89	7.48	20.25	3.737	22.50a	0.00	0.00	0.00	16.19	20.99	AA	3.30
TOP	13.45	1.20	-5.9	23.30	7.48	27.30	5.038	30.33a	0.00	0.00	0.00	23.50	30.47	AA	3.30

Member 4: (Bottom Slab), Thickness = 11.00 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	12.92	5.79	-8.3	5.07	7.69	14.53	2.611	16.15a	0.00	0.00	0.00	7.55	9.78	AA	3.30
MID	77.00	0.17	11.8	0.61	8.63	17.31	2.772	19.23a	0.00	0.00	0.00	NC	NC	AA	3.30
RT	12.92	7.37	-16.7	2.27	7.63	12.83	n/a	14.26c	0.00	0.00	0.00	4.06	5.26	AA	3.30

Member 5: (Top Slab - Interior Cell), Thickness = 12.50 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	14.00	14.10	-25.6	1.31	9.63	16.52	n/a	18.35c	0.00	0.00	0.00	1.24	1.61	AA	3.30
MID	77.00	4.00	20.6	2.82	10.06	18.33	2.516	20.36a	0.00	0.00	0.00	4.58	5.94	AA	3.30
RT	14.00	14.10	-25.6	1.31	9.63	16.52	n/a	18.35c	0.00	0.00	0.00	1.24	1.61	AA	3.30

Member 7: (Bottom Slab - Interior Cell), Thickness = 11.00 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	12.92	6.54	-15.7	1.99	7.63	12.84	2.326	14.27a	0.00	0.00	0.00	5.02	6.50	AA	3.30
MID	77.00	0.20	8.0	3.90	8.63	20.82	3.335	23.14a	0.00	0.00	0.00	99.99	99.99	AA	3.30
RT	12.92	6.54	-15.7	1.99	7.63	12.84	2.326	14.27a	0.00	0.00	0.00	5.02	6.50	AA	3.30

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

Analysis Results: Fill Depth = 3.30 ft

Load Parameters:

Fe = 1.02 Surcharge Depth : 2.77 ft

Applied Horizontal Loads: (k/ft)

Load Description	Bottom of Wall	Top of Wall
Horizontal Earth Load	0.708	0.229
Live Load Surcharge	0.166	0.166
Internal Water Pressure	0.000	0.000

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

M-PT	Mdc	Mev	Mdw	Meh	Mls	Mwa
Member 1: (Exterior Wall)						
Bottom						
1- 0	-1.69	-2.39	-0.22	-1.47	-0.50	0.00
1- 1	-1.56	-2.32	-0.21	0.04	-0.03	0.00
1- 2	-1.44	-2.24	-0.21	1.12	0.32	0.00
1- 3	-1.31	-2.17	-0.20	1.82	0.58	0.00
1- 4	-1.18	-2.09	-0.19	2.15	0.72	0.00
1- 5	-1.06	-2.01	-0.19	2.16	0.76	0.00
1- 6	-0.93	-1.94	-0.18	1.87	0.70	0.00
1- 7	-0.80	-1.86	-0.17	1.31	0.52	0.00
1- 8	-0.68	-1.79	-0.16	0.51	0.25	0.00
1- 9	-0.55	-1.71	-0.16	-0.49	-0.14	0.00
1-10	-0.43	-1.64	-0.15	-1.67	-0.63	0.00
Top						
Member 2: (Top Slab)						
Left						
2- 0	-0.43	-1.64	-0.15	-1.70	-0.63	0.00
2- 1	0.52	0.85	0.08	-1.48	-0.55	0.00
2- 2	1.20	2.69	0.25	-1.26	-0.47	0.00
2- 3	1.63	3.85	0.35	-1.05	-0.39	0.00
2- 4	1.80	4.36	0.40	-0.83	-0.31	0.00
2- 5	1.72	4.20	0.39	-0.62	-0.23	0.00
2- 6	1.37	3.37	0.31	-0.40	-0.15	0.00
2- 7	0.77	1.89	0.17	-0.19	-0.07	0.00
2- 8	-0.09	-0.26	-0.02	0.03	0.01	0.00
2- 9	-1.20	-3.07	-0.28	0.24	0.09	0.00
2-10	-2.57	-6.55	-0.60	0.46	0.17	0.00
Right						
Member 3: (Interior Wall)						
Bottom						
3- 0	0.35	0.53	0.05	-0.24	-0.08	0.00
3- 1	0.33	0.52	0.05	-0.24	-0.08	0.00
3- 2	0.31	0.51	0.05	-0.23	-0.08	0.00
3- 3	0.29	0.51	0.05	-0.23	-0.08	0.00
3- 4	0.27	0.50	0.05	-0.23	-0.08	0.00
3- 5	0.25	0.49	0.04	-0.22	-0.08	0.00
3- 6	0.23	0.48	0.04	-0.22	-0.08	0.00
3- 7	0.22	0.47	0.04	-0.22	-0.08	0.00
3- 8	0.20	0.46	0.04	-0.21	-0.08	0.00
3- 9	0.18	0.45	0.04	-0.21	-0.08	0.00
3-10	0.16	0.45	0.04	-0.21	-0.08	0.00
Top						
Member 4: (Bottom Slab)						
Left						
4- 0	-1.69	-2.39	-0.22	-1.47	-0.50	0.00
4- 1	-0.01	0.19	0.02	-1.28	-0.43	0.00
4- 2	1.24	2.10	0.19	-1.08	-0.37	0.00
4- 3	2.07	3.35	0.31	-0.89	-0.30	0.00
4- 4	2.46	3.94	0.36	-0.70	-0.24	0.00
4- 5	2.43	3.86	0.35	-0.51	-0.17	0.00
4- 6	1.97	3.12	0.29	-0.32	-0.11	0.00
4- 7	1.08	1.72	0.16	-0.13	-0.05	0.00
4- 8	-0.24	-0.35	-0.03	0.06	0.02	0.00
4- 9	-1.98	-3.08	-0.28	0.25	0.08	0.00
4-10	-4.15	-6.47	-0.59	0.44	0.15	0.00
Right						
Member 5: (Top Slab - Interior Cell)						

Unfactored Shears due to All Loads: (k)

M-PT	Vdc	Vev	Vdw	Veh	Vls	Vwa
Member 1: (Exterior Wall)						
Bottom						
1- 0	0.16	0.09	0.01	2.16	0.65	0.00
1- 1	0.16	0.09	0.01	1.61	0.51	0.00
1- 2	0.16	0.09	0.01	1.11	0.38	0.00
1- 3	0.16	0.09	0.01	0.64	0.25	0.00
1- 4	0.16	0.09	0.01	0.21	0.12	0.00
1- 5	0.16	0.09	0.01	-0.19	-0.02	0.00
1- 6	0.16	0.09	0.01	-0.54	-0.15	0.00
1- 7	0.16	0.09	0.01	-0.86	-0.28	0.00
1- 8	0.16	0.09	0.01	-1.14	-0.42	0.00
1- 9	0.16	0.09	0.01	-1.38	-0.55	0.00
1-10	0.16	0.09	0.01	-1.58	-0.68	0.00
Top						
Member 2: (Top Slab)						
Left						
2- 0	0.84	2.20	0.20	0.17	0.06	0.00
2- 1	0.63	1.68	0.15	0.17	0.06	0.00
2- 2	0.43	1.17	0.11	0.17	0.06	0.00
2- 3	0.23	0.65	0.06	0.17	0.06	0.00
2- 4	0.03	0.13	0.01	0.17	0.06	0.00
2- 5	-0.17	-0.38	-0.04	0.17	0.06	0.00
2- 6	-0.37	-0.90	-0.08	0.17	0.06	0.00
2- 7	-0.57	-1.42	-0.13	0.17	0.06	0.00
2- 8	-0.77	-1.93	-0.18	0.17	0.06	0.00
2- 9	-0.97	-2.45	-0.23	0.17	0.06	0.00
2-10	-1.17	-2.97	-0.27	0.17	0.06	0.00
Right						
Member 3: (Interior Wall)						
Bottom						
3- 0	-0.02	-0.01	0.00	0.00	0.00	0.00
3- 1	-0.02	-0.01	0.00	0.00	0.00	0.00
3- 2	-0.02	-0.01	0.00	0.00	0.00	0.00
3- 3	-0.02	-0.01	0.00	0.00	0.00	0.00
3- 4	-0.02	-0.01	0.00	0.00	0.00	0.00
3- 5	-0.02	-0.01	0.00	0.00	0.00	0.00
3- 6	-0.02	-0.01	0.00	0.00	0.00	0.00
3- 7	-0.02	-0.01	0.00	0.00	0.00	0.00
3- 8	-0.02	-0.01	0.00	0.00	0.00	0.00
3- 9	-0.02	-0.01	0.00	0.00	0.00	0.00
3-10	-0.02	-0.01	0.00	0.00	0.00	0.00
Top						
Member 4: (Bottom Slab)						
Left						
4- 0	1.48	2.27	0.21	0.15	0.05	0.00
4- 1	1.14	1.75	0.16	0.15	0.05	0.00
4- 2	0.81	1.23	0.11	0.15	0.05	0.00
4- 3	0.47	0.72	0.07	0.15	0.05	0.00
4- 4	0.14	0.20	0.02	0.15	0.05	0.00
4- 5	-0.19	-0.32	-0.03	0.15	0.05	0.00
4- 6	-0.53	-0.84	-0.08	0.15	0.05	0.00
4- 7	-0.86	-1.35	-0.12	0.15	0.05	0.00
4- 8	-1.19	-1.87	-0.17	0.15	0.05	0.00
4- 9	-1.53	-2.39	-0.22	0.15	0.05	0.00
4-10	-1.86	-2.90	-0.27	0.15	0.05	0.00
Right						
Member 5: (Top Slab - Interior Cell)						

Bottom

5- 0	-2.42	-6.11	-0.56	0.25	0.09	0.00
5- 1	-1.26	-3.12	-0.29	0.25	0.09	0.00
5- 2	-0.36	-0.80	-0.07	0.25	0.09	0.00
5- 3	0.29	0.86	0.08	0.25	0.09	0.00
5- 4	0.67	1.85	0.17	0.25	0.09	0.00
5- 5	0.80	2.19	0.20	0.25	0.09	0.00
5- 6	0.67	1.85	0.17	0.25	0.09	0.00
5- 7	0.29	0.86	0.08	0.25	0.09	0.00
5- 8	-0.36	-0.80	-0.07	0.25	0.09	0.00
5- 9	-1.26	-3.12	-0.29	0.25	0.09	0.00
5-10	-2.42	-6.11	-0.56	0.25	0.09	0.00

Top

Bottom

5- 0	1.00	2.58	0.24	0.00	0.00	0.00
5- 1	0.80	2.07	0.19	0.00	0.00	0.00
5- 2	0.60	1.55	0.14	0.00	0.00	0.00
5- 3	0.40	1.03	0.09	0.00	0.00	0.00
5- 4	0.20	0.52	0.05	0.00	0.00	0.00
5- 5	0.00	0.00	0.00	0.00	0.00	0.00
5- 6	-0.20	-0.52	-0.05	0.00	0.00	0.00
5- 7	-0.40	-1.03	-0.09	0.00	0.00	0.00
5- 8	-0.60	-1.55	-0.14	0.00	0.00	0.00
5- 9	-0.80	-2.07	-0.19	0.00	0.00	0.00
5-10	-1.00	-2.58	-0.24	0.00	0.00	0.00

Top

Member 7: (Bottom Slab - Interior Cell)

Left

7- 0	-3.80	-5.94	-0.55	0.20	0.07	0.00
7- 1	-1.88	-2.96	-0.27	0.20	0.07	0.00
7- 2	-0.38	-0.64	-0.06	0.20	0.07	0.00
7- 3	0.69	1.02	0.09	0.20	0.07	0.00
7- 4	1.33	2.02	0.19	0.20	0.07	0.00
7- 5	1.55	2.35	0.22	0.20	0.07	0.00
7- 6	1.33	2.02	0.19	0.20	0.07	0.00
7- 7	0.69	1.02	0.09	0.20	0.07	0.00
7- 8	-0.38	-0.64	-0.06	0.20	0.07	0.00
7- 9	-1.88	-2.96	-0.27	0.20	0.07	0.00
7-10	-3.80	-5.94	-0.55	0.20	0.07	0.00

Right

Member 7: (Bottom Slab - Interior Cell

Left

7- 0	1.67	2.58	0.24	0.00	0.00	0.00
7- 1	1.33	2.07	0.19	0.00	0.00	0.00
7- 2	1.00	1.55	0.14	0.00	0.00	0.00
7- 3	0.67	1.03	0.09	0.00	0.00	0.00
7- 4	0.33	0.52	0.05	0.00	0.00	0.00
7- 5	0.00	0.00	0.00	0.00	0.00	0.00
7- 6	-0.33	-0.52	-0.05	0.00	0.00	0.00
7- 7	-0.67	-1.03	-0.09	0.00	0.00	0.00
7- 8	-1.00	-1.55	-0.14	0.00	0.00	0.00
7- 9	-1.33	-2.07	-0.19	0.00	0.00	0.00
7-10	-1.67	-2.58	-0.24	0.00	0.00	0.00

Right

Unfactored Thrusts due to All Loads: (k)

Member	Pdc	Pev	Pdw	Peh	Pls	Pwa
1	0.84	2.20	0.20	0.17	0.06	0.00
2	-0.16	-0.09	-0.01	1.58	0.68	0.00
3	2.17	5.55	0.51	-0.17	-0.06	0.00
4	0.16	0.09	0.01	2.16	0.65	0.00
5	-0.13	-0.08	-0.01	1.58	0.68	0.00
7	0.13	0.08	0.01	2.16	0.65	0.00

---------- Analysis Truck, HL-93 ----------

Vehicle	Axle No.	Weight (k/ft)	Length (ft)	Dist. From Previous (ft)
Truck	1	1.355	4.63	
	2	1.355	4.63	14.00
	3	0.339	4.63	14.00
Tandem	1	1.136	8.63	

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

Live Load Parameters:

Traffic Direction is Parallel to Main Reinforcement
Distribution Width : 12.18 ft
Impact Factor : 1.19
Distribution Width : 0.00 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	1.355	4.63	6.42
	2	1.355	4.63	-7.58
	3	0.339	4.63	-21.58

Maximum +Moment : 10.03 k-ft
Corresponding Moment at End : -4.62 k-ft
Coincident Bottom Slab Load : 0.07 k/ft

Maximum -Moment in Top Slab

Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)
Truck	1	1.355	4.63	20.28
	2	1.355	4.63	6.28
	3	0.339	4.63	-7.72

Maximum -Moment : -11.63 k-ft
Corresponding Moment at Mid : 8.75 k-ft
Coincident Bottom Slab Load : 0.14 k/ft

Maximum +Shear in Top Slab

Truck	1	1.355	4.63	15.15
	2	1.355	4.63	1.15
	3	0.339	4.63	-12.85

Maximum +Shear : 5.43 k
Corresponding Shear at Mid : -0.94 k
Coincident Bottom Slab Load : 0.12 k/ft

Maximum -Shear in Top Slab

Truck	1	1.355	4.63	24.52
	2	1.355	4.63	10.52
	3	0.339	4.63	-3.48

Maximum -Shear : -5.53 k
Corresponding Shear at Mid : 0.74 k
Coincident Bottom Slab Load : 0.14 k/ft

Eriksson Culvert v5.0.0

Culvert #1
Filename: 3 cell 7x12 skew.etcx

Maximum +Moment in Top Slab
Tandem 1 1.136 8.63 6.24
Maximum +Moment : 11.93 k-ft
Corresponding Moment at End : -6.44 k-ft
Coincident Bottom Slab Load : 0.11 k/ft

Maximum -Moment in Top Slab
Tandem 1 1.136 8.63 7.06
Maximum -Moment : -11.70 k-ft
Corresponding Moment at Mid : 11.75 k-ft
Coincident Bottom Slab Load : 0.11 k/ft

Maximum +Shear in Top Slab
Tandem 1 1.136 8.63 17.15
Maximum +Shear : 6.66 k
Corresponding Shear at Mid : -0.54 k
Coincident Bottom Slab Load : 0.11 k/ft

Maximum -Shear in Top Slab
Tandem 1 1.136 8.63 8.52
Maximum -Shear : -6.97 k
Corresponding Shear at Mid : 0.32 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	0.02	-1.27	0.29	-0.55	0.00	-0.96	0.31	-0.64	0.00	0.00	0.00	0.00
1- 1	0.00	-1.09	0.29	-0.55	0.00	-0.72	0.31	-0.64	0.00	0.00	0.00	0.00
1- 2	0.00	-1.06	0.29	-0.55	0.00	-0.97	0.31	-0.64	0.00	0.00	0.00	0.00
1- 3	0.00	-1.36	0.29	-0.55	0.00	-1.66	0.31	-0.64	0.00	0.00	0.00	0.00
1- 4	0.00	-1.72	0.29	-0.55	0.00	-2.25	0.31	-0.64	0.00	0.00	0.00	0.00
1- 5	0.00	-2.17	0.29	-0.55	0.05	-2.75	0.31	-0.64	0.00	0.00	0.00	0.00
1- 6	0.03	-2.60	0.29	-0.55	0.33	-3.26	0.31	-0.64	0.00	0.00	0.00	0.00
1- 7	0.32	-3.04	0.29	-0.55	0.61	-3.77	0.31	-0.64	0.00	0.00	0.00	0.00
1- 8	0.62	-3.48	0.29	-0.55	0.90	-4.27	0.31	-0.64	0.00	0.00	0.00	0.00
1- 9	0.85	-3.91	0.29	-0.55	1.18	-4.78	0.31	-0.64	0.00	0.00	0.00	0.00
1-10	1.07	-4.35	0.29	-0.55	1.46	-5.29	0.31	-0.64	0.00	0.00	0.00	0.00
Top												
Member 2: (Top Slab)												
Left												
2- 0	1.07	-4.35	5.12	-0.33	1.46	-5.29	6.07	-0.49	0.00	0.00	0.00	0.00
2- 1	2.72	-1.11	4.44	-0.34	1.75	-1.09	5.19	-0.49	0.00	0.00	0.00	0.00
2- 2	5.94	-0.06	3.72	-0.54	6.21	-0.03	4.12	-0.56	0.00	0.00	0.00	0.00
2- 3	8.45	-0.27	2.99	-1.13	9.12	-0.43	3.10	-0.66	0.00	0.00	0.00	0.00
2- 4	9.87	-0.62	2.28	-1.83	10.25	-1.04	2.17	-1.20	0.00	0.00	0.00	0.00
2- 5	10.03	-1.01	1.62	-2.54	10.14	-1.66	1.36	-1.91	0.00	0.00	0.00	0.00
2- 6	8.99	-1.43	1.02	-3.22	9.46	-2.29	0.69	-2.79	0.00	0.00	0.00	0.00
2- 7	6.85	-1.85	0.52	-3.87	7.27	-2.91	0.17	-3.83	0.00	0.00	0.00	0.00
2- 8	3.83	-3.72	0.13	-4.48	3.29	-3.53	0.13	-4.91	0.00	0.00	0.00	0.00
2- 9	0.83	-6.68	0.10	-5.01	0.94	-4.30	0.09	-5.82	0.00	0.00	0.00	0.00
2-10	0.85	-10.46	0.08	-5.34	1.06	-9.73	0.09	-6.48	0.00	0.00	0.00	0.00
Right												
Member 3: (Interior Wall)												
Bottom												
3- 0	1.60	-0.99	0.57	-0.57	1.33	-1.20	0.71	-0.66	0.00	0.00	0.00	0.00
3- 1	1.13	-0.55	0.57	-0.57	0.81	-0.65	0.71	-0.66	0.00	0.00	0.00	0.00
3- 2	0.67	-0.16	0.57	-0.57	0.55	-0.12	0.71	-0.66	0.00	0.00	0.00	0.00
3- 3	0.48	-0.16	0.57	-0.57	0.57	-0.29	0.71	-0.66	0.00	0.00	0.00	0.00
3- 4	0.88	-0.38	0.57	-0.57	1.11	-0.81	0.71	-0.66	0.00	0.00	0.00	0.00
3- 5	1.33	-0.78	0.57	-0.57	1.67	-1.33	0.71	-0.66	0.00	0.00	0.00	0.00
3- 6	1.78	-1.21	0.57	-0.57	2.24	-1.86	0.71	-0.66	0.00	0.00	0.00	0.00
3- 7	2.23	-1.65	0.57	-0.57	2.80	-2.39	0.71	-0.66	0.00	0.00	0.00	0.00
3- 8	2.68	-2.10	0.57	-0.57	3.37	-2.92	0.71	-0.66	0.00	0.00	0.00	0.00
3- 9	3.13	-2.55	0.57	-0.57	3.94	-3.44	0.71	-0.66	0.00	0.00	0.00	0.00
3-10	3.58	-3.00	0.57	-0.57	4.51	-3.97	0.71	-0.66	0.00	0.00	0.00	0.00
Top												
Member 4: (Bottom Slab)												
Left												
4- 0	0.02	-1.27	0.88	0.00	0.00	-0.96	0.63	0.00	0.00	0.00	0.00	0.00
4- 1	0.67	-0.34	0.68	0.00	0.81	-0.30	0.49	0.00	0.00	0.00	0.00	0.00
4- 2	1.38	0.00	0.49	0.00	1.50	0.00	0.36	0.00	0.00	0.00	0.00	0.00
4- 3	1.76	0.00	0.30	0.00	1.78	0.00	0.22	0.00	0.00	0.00	0.00	0.00
4- 4	1.88	0.00	0.11	0.00	1.87	0.00	0.08	0.00	0.00	0.00	0.00	0.00
4- 5	1.76	0.00	0.00	-0.20	1.80	0.00	0.00	-0.13	0.00	0.00	0.00	0.00
4- 6	1.38	0.00	0.00	-0.40	1.54	0.00	0.00	-0.27	0.00	0.00	0.00	0.00
4- 7	0.77	0.00	0.00	-0.59	1.11	0.00	0.00	-0.41	0.00	0.00	0.00	0.00
4- 8	0.29	-0.61	0.00	-0.79	0.34	-0.69	0.00	-0.54	0.00	0.00	0.00	0.00
4- 9	0.00	-1.65	0.00	-0.99	0.00	-1.53	0.00	-0.68	0.00	0.00	0.00	0.00
4-10	0.00	-3.04	0.00	-1.18	0.00	-2.48	0.00	-0.82	0.00	0.00	0.00	0.00
Right												
Member 5: (Top Slab - Interior Cell)												
Bottom												
5- 0	1.30	-9.99	5.29	-0.44	1.53	-8.74	6.32	-0.53	0.00	0.00	0.00	0.00
5- 1	1.22	-6.44	4.89	-0.47	0.85	-4.58	5.59	-0.53	0.00	0.00	0.00	0.00

5- 2	4.16	-3.79	4.29	-0.47	3.52	-3.90	4.50	-0.53	0.00	0.00	0.00	0.00
5- 3	6.35	-2.62	3.64	-0.98	7.09	-3.22	3.42	-0.63	0.00	0.00	0.00	0.00
5- 4	7.60	-2.06	2.97	-1.62	8.80	-2.55	2.42	-0.80	0.00	0.00	0.00	0.00
5- 5	7.83	-1.50	2.29	-2.29	9.01	-1.87	1.54	-1.54	0.00	0.00	0.00	0.00
5- 6	7.60	-2.06	1.62	-2.97	8.80	-2.55	0.80	-2.42	0.00	0.00	0.00	0.00
5- 7	6.35	-2.62	0.98	-3.64	7.09	-3.22	0.63	-3.42	0.00	0.00	0.00	0.00
5- 8	4.16	-3.79	0.47	-4.29	3.52	-3.90	0.53	-4.50	0.00	0.00	0.00	0.00
5- 9	1.22	-6.44	0.47	-4.89	0.85	-4.58	0.53	-5.59	0.00	0.00	0.00	0.00
5-10	1.30	-9.99	0.44	-5.29	1.53	-8.74	0.53	-6.32	0.00	0.00	0.00	0.00

Top

Member 7: (Bottom Slab - Interior Cell)

Left

7- 0	0.00	-2.70	1.06	0.00	0.00	-2.83	0.82	0.00	0.00	0.00	0.00	0.00
7- 1	0.00	-1.47	0.87	0.00	0.00	-1.86	0.68	0.00	0.00	0.00	0.00	0.00
7- 2	0.19	-0.75	0.67	0.00	0.25	-0.98	0.55	0.00	0.00	0.00	0.00	0.00
7- 3	0.77	-0.20	0.47	0.00	0.85	-0.16	0.41	0.00	0.00	0.00	0.00	0.00
7- 4	0.98	0.00	0.28	0.00	1.11	0.00	0.27	0.00	0.00	0.00	0.00	0.00
7- 5	1.02	0.00	0.09	-0.09	1.20	0.00	0.11	-0.11	0.00	0.00	0.00	0.00
7- 6	0.98	0.00	0.00	-0.28	1.11	0.00	0.00	-0.27	0.00	0.00	0.00	0.00
7- 7	0.77	-0.20	0.00	-0.47	0.85	-0.16	0.00	-0.41	0.00	0.00	0.00	0.00
7- 8	0.19	-0.75	0.00	-0.67	0.25	-0.98	0.00	-0.55	0.00	0.00	0.00	0.00
7- 9	0.00	-1.47	0.00	-0.87	0.00	-1.86	0.00	-0.68	0.00	0.00	0.00	0.00
7-10	0.00	-2.70	0.00	-1.06	0.00	-2.83	0.00	-0.82	0.00	0.00	0.00	0.00

Right

Note: Unfactored live load results computed at 3.30 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	-8.5	9.54	14.90	6.00	28.24
A2	Bot Corner Bar	-6.2	9.54	8.65	6.00	51.98
A100	Top Slab (int)	12.5	1.85	13.04	6.00	34.99
A300	Top Slab (ext)	-16.4	0.90	24.88	6.00	16.33
A200	Bot Slab (int)	5.6	2.70	8.06	6.00	57.58
A400	Bot Slab (ext)	-11.0	1.48	20.80	6.00	19.41
B2	Ext Wall (ext)	-4.9	9.39	9.71	12.00	45.80

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	5.50	-8.85	15.32	22.58	7.69	22.58	1.00	0.62	10.18	6.61	8.57
MID	47.88	1.60	3.12	11.60	7.69	11.60	1.00	0.31	10.18	7.25	9.39
MID-	47.88	-7.78	15.08	11.60	7.69	11.60	1.00	0.31	10.18	1.74	2.25
TOP	6.25	-13.66	15.32	22.58	7.69	22.58	1.00	0.62	10.18	1.97	2.55

Member 2: (Top Slab), Thickness = 12.50 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	5.00	-11.64	4.20	28.78	9.69	28.78	1.00	0.62	15.91	3.16	4.10
MID	61.60	26.20	0.14	55.67	10.06	55.67	1.00	1.20	15.91	2.64	3.43
RT	5.00	-26.71	1.79	39.82	9.63	39.82	1.00	0.88	15.91	1.81	2.35

Member 3: (Interior 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	5.50	-1.94	23.30	11.60	7.69	11.60	1.00	0.31	10.18	6.34	8.22
MID	47.88	3.83	9.89	11.60	7.69	11.60	1.00	0.31	10.18	3.64	4.72
TOP	6.25	-5.89	23.30	11.60	7.69	11.60	1.00	0.31	10.18	1.70	2.20

Member 4: (Bottom Slab), Thickness = 11.00 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	5.00	-8.28	5.07	22.58	7.69	22.58	1.00	0.62	12.32	6.66	8.64
MID	61.60	11.84	0.61	35.42	8.63	35.42	1.00	0.88	12.32	8.16	10.58
RT	5.00	-16.67	2.27	31.02	7.63	31.02	1.00	0.88	12.32	4.17	5.40

Member 5: (Top Slab - Interior Cell), Thickness = 12.50 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	5.00	-25.57	1.31	39.82	9.63	39.82	1.00	0.88	15.91	1.92	2.49
MID	77.00	20.58	2.82	55.67	10.06	55.67	1.00	1.20	15.91	3.20	4.15
RT	5.00	-25.57	1.31	39.82	9.63	39.82	1.00	0.88	15.91	1.92	2.49

Member 7: (Bottom Slab - Interior Cell), Thickness = 11.00 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	5.00	-15.72	1.99	31.02	7.63	31.02	1.00	0.88	12.32	4.48	5.80
MID	77.00	7.96	3.90	35.42	8.63	35.42	1.00	0.88	12.32	13.37	17.34
RT	5.00	-15.72	1.99	31.02	7.63	31.02	1.00	0.88	12.32	4.48	5.80

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)	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	12.70	3.76	-8.8	15.32	7.28	15.93	3.021	33.66	17.70a	0.00	0.00	0.00	9.92	12.86
MID	47.88	0.76	1.6	3.12	7.48	21.62	3.990	30.36	24.02a	0.00	0.00	0.00	41.63	53.97
MID-	47.88	0.76	-7.8	15.08	7.48	15.71	2.900	34.37	17.46a	0.00	0.00	0.00	13.92	18.05
TOP	13.45	-3.45	-13.7	15.32	7.28	13.01	2.468	36.37	14.46a	0.00	0.00	0.00	5.62	7.29

Member 2: (Top Slab), Thickness = 12.50 in

Loc	Dist.	Design Shear	Moment	Corr. A. F.	Dv	phi*Vn	Beta	Theta	Vc	Vs	Av	Max. Spac	Load Ratings IR	OR

	(in)	(k)	(k-ft)	(k)	(in)	(k)			(k)	(k)	(in2)	(in)		
LT	14.00	12.98	-11.6	4.20	9.69	17.32	n/a	n/a	19.24c	0.00	0.00	0.00	1.46	1.90
MID	77.00	2.40	26.2	0.14	10.06	16.72	2.295	39.73	18.58a	0.00	0.00	0.00	5.50	7.13
RT	14.00	15.16	-26.7	1.79	9.63	16.57	n/a	n/a	18.41c	0.00	0.00	0.00	1.14	1.47

Member 3: (Interior 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	12.70	1.21	-1.9	23.30	7.48	27.86	5.142	27.64	30.96a	0.00	0.00	0.00	22.29	28.89
MID	47.88	1.21	3.8	9.89	7.48	20.25	3.737	31.12	22.50a	0.00	0.00	0.00	16.19	20.99
TOP	13.45	1.20	-5.9	23.30	7.48	27.30	5.038	27.81	30.33a	0.00	0.00	0.00	23.50	30.47

Member 4: (Bottom Slab), Thickness = 11.00 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	12.92	5.79	-8.3	5.07	7.69	14.53	2.611	35.93	16.15a	0.00	0.00	0.00	7.55	9.78
MID	77.00	0.17	11.8	0.61	8.63	17.31	2.772	35.88	19.23a	0.00	0.00	0.00	NC	NC
RT	12.92	7.37	-16.7	2.27	7.63	12.83	n/a	n/a	14.26c	0.00	0.00	0.00	4.06	5.26

Member 5: (Top Slab - Interior Cell), Thickness = 12.50 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	14.00	14.10	-25.6	1.31	9.63	16.52	n/a	n/a	18.35c	0.00	0.00	0.00	1.24	1.61
MID	77.00	4.00	20.6	2.82	10.06	18.33	2.516	38.35	20.36a	0.00	0.00	0.00	4.58	5.94
RT	14.00	14.10	-25.6	1.31	9.63	16.52	n/a	n/a	18.35c	0.00	0.00	0.00	1.24	1.61

Member 7: (Bottom Slab - Interior Cell), Thickness = 11.00 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	12.92	6.54	-15.7	1.99	7.63	12.84	2.326	37.50	14.27a	0.00	0.00	0.00	5.02	6.50
MID	77.00	0.20	8.0	3.90	8.63	20.82	3.335	33.41	23.14a	0.00	0.00	0.00	99.99	99.99
RT	12.92	6.54	-15.7	1.99	7.63	12.84	2.326	37.50	14.27a	0.00	0.00	0.00	5.02	6.50

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

Load Combination Results at Tenth Points: (k-ft, k)

M-PT	+Moment	-Moment	+Axial	-Axial	+Shear	-Shear
Member 1: (Exterior Wall)						
Bottom						
1- 0	-6.605	-10.867	3.611	15.321	5.073	0.615
1- 1	-3.532	-7.350	3.118	15.321	4.067	0.264
1- 2	-1.185	-6.292	3.118	15.082	3.115	-0.063
1- 3	0.423	-6.635	3.118	15.082	2.217	-0.364
1- 4	1.336	-7.165	3.118	15.082	1.373	-0.642
1- 5	1.598	-7.777	3.118	15.082	0.758	-1.069
1- 6	1.252	-8.581	3.118	15.082	0.530	-1.804
1- 7	0.340	-9.557	3.118	15.082	0.327	-2.486
1- 8	-0.812	-10.686	3.850	15.082	0.148	-3.113
1- 9	-1.520	-12.571	3.611	15.321	-0.007	-3.686
1-10	-1.512	-15.718	3.611	15.321	-0.136	-4.204
Top						
Member 2: (Top Slab)						
Left						
2- 0	-1.528	-15.754	0.136	4.204	15.321	3.118
2- 1	5.738	-3.068	0.136	4.204	12.750	2.463
2- 2	15.593	0.932	0.136	3.202	9.850	1.428
2- 3	23.121	2.833	0.136	3.202	7.040	-0.605
2- 4	26.200	3.895	0.136	3.202	4.585	-2.853
2- 5	25.801	4.117	0.136	3.202	2.396	-5.116
2- 6	23.079	1.957	0.136	4.204	0.328	-7.338
2- 7	16.415	-1.670	0.136	4.204	-1.463	-9.503
2- 8	6.268	-6.997	2.552	1.789	-2.117	-12.355
2- 9	-3.393	-17.654	3.202	1.789	-2.772	-14.965
2-10	-7.370	-31.067	3.202	1.789	-3.426	-17.156
Right						
Member 3: (Interior Wall)						
Bottom						
3- 0	3.882	-1.354	9.892	23.301	1.208	-1.204
3- 1	3.022	-0.413	9.892	23.301	1.208	-1.204
3- 2	2.178	0.280	9.892	6.698	1.208	-1.204
3- 3	1.970	0.155	9.892	23.301	1.208	-1.204
3- 4	2.889	-0.786	9.892	23.301	1.208	-1.204
3- 5	3.834	-1.737	9.892	23.301	1.208	-1.204
3- 6	4.787	-2.690	9.892	23.301	1.208	-1.204
3- 7	5.743	-3.646	9.892	23.301	1.208	-1.204
3- 8	6.699	-4.601	9.892	23.301	1.208	-1.204
3- 9	7.658	-5.557	9.892	23.301	1.208	-1.204
3-10	8.616	-6.514	9.892	23.301	1.208	-1.204
Top						
Member 4: (Bottom Slab)						
Left						
4- 0	-6.605	-10.867	0.615	5.073	7.082	3.704
4- 1	0.866	-2.895	0.615	5.073	5.546	2.930
4- 2	6.642	0.861	0.615	4.423	4.016	2.156
4- 3	10.149	3.131	0.615	4.423	2.489	1.382
4- 4	11.836	4.408	0.615	4.423	0.966	0.571
4- 5	11.647	4.691	0.615	4.423	-0.166	-0.972
4- 6	9.638	3.981	0.615	4.423	-0.940	-2.511
4- 7	5.790	2.277	0.615	4.423	-1.714	-4.049
4- 8	-0.108	-1.990	3.420	2.267	-2.488	-5.588
4- 9	-4.110	-9.834	4.423	2.267	-3.263	-7.126
4-10	-8.793	-19.958	4.423	2.267	-4.037	-8.665
Right						
Member 5: (Top Slab - Interior Cell)						
Bottom						
5- 0	-7.247	-29.521	3.227	1.315	16.197	3.272
5- 1	-3.468	-17.361	3.227	1.315	13.891	2.617
5- 2	6.164	-8.312	2.820	1.315	10.962	1.963
5- 3	14.573	-3.829	2.820	1.315	8.430	0.339
5- 4	19.550	-0.665	2.820	1.315	6.222	-1.804
5- 5	20.583	1.181	2.820	1.315	4.002	-4.002
5- 6	19.550	-0.665	2.820	1.315	1.804	-6.222
5- 7	14.573	-3.829	2.820	1.315	-0.339	-8.430
5- 8	6.164	-8.312	2.820	1.315	-1.963	-10.962
5- 9	-3.468	-17.361	3.227	1.315	-2.617	-13.891
5-10	-7.247	-29.521	3.227	1.315	-3.272	-16.197
Top						
Member 7: (Bottom Slab - Interior Cell)						
Left						

Culvert #1

7- 0	-8.474	-18.505	4.398	1.994	7.827	3.870
7- 1	-4.004	-9.924	4.398	1.994	6.289	3.096
7- 2	-0.527	-3.022	4.398	1.994	4.750	2.322
7- 3	4.289	1.956	3.899	4.398	3.212	1.548
7- 4	7.045	3.446	3.899	4.398	1.679	0.774
7- 5	7.963	3.943	3.899	4.398	0.199	-0.199
7- 6	7.045	3.446	3.899	4.398	-0.774	-1.679
7- 7	4.289	1.956	3.899	4.398	-1.548	-3.212
7- 8	-0.527	-3.022	4.398	1.994	-2.322	-4.750
7- 9	-4.004	-9.924	4.398	1.994	-3.096	-6.289
7-10	-8.474	-18.505	4.398	1.994	-3.870	-7.827

Right

KIMLEY-HORN

Project : Winsome Filing No. 3 Culvert #2
Task : 3 cell 12-ft wide by 7-ft high Client:
Job No. : 196106001 File: 3 cell 7x12_4-8ft.etcx

Sht_____of_____
By:DJL
Ck:_____
8/25/2022 5:36:08 AM

Spec.: LRFD 7th ed. 2014-2016
Type of Culvert: Cast-in-Place

Physical Dimensions

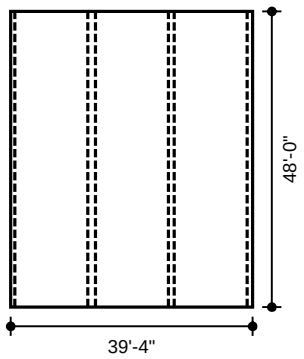
Clear Span:	12'-0"
Clear Height:	7'-0"
Top Slab:	1'-1 1/2"
Bottom Slab:	1'-1"
Ext. Wall:	10"
Int. Wall:	10"
Fill Depth:	4.75 ft
Length:	48'-0"
Skew Angle:	0.00 deg
Left Skew Angle:	90.00 deg
Right Skew Angle:	90.00 deg
Bottom Slab Support:	Full Slab
Top Haunch, Width:	0"
Top Haunch, Height:	0"
Bottom Haunch, Width:	0"
Bottom Haunch, Height:	0"

Loads

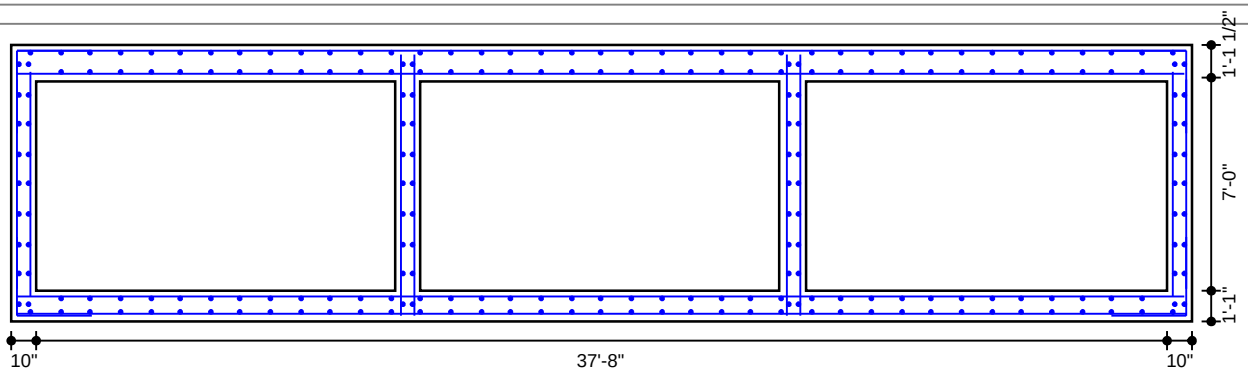
Live Load	
Vehicle Names:	HL-93
Traffic Direction:	Parallel
Eq. Height of Soil:	2.60 ft (Calc'd)
Max No. of Lanes:	1
Dead Load	
Future Wearing Surface:	0.037 klf
Additional Dead Load:	0.000 klf
Concentrated Loads:	none
Lateral Soil Loads	
Eq. Fluid Press. Max:	60.00 pcf
Eq. Fluid Press. Min:	30.00 pcf
Consider Int. Water Press.:	no

Material Properties

Concrete	
Strength, f'c:	4.500 ksi
Density:	0.150 kcf
Elasticity, Ec:	4435 ksi
Type:	Normal wt
Steel	
Yield, fy:	60 ksi
Allow Stress:	36 ksi
Elasticity, Es:	29000 ksi
Soil	
Density:	0.120 kcf
Exposure Factor	
Class 1 Exposure	
Reinforcement Covers	
Ext. Cover Top Slab:	2"
Ext. Cover Bottom Slab	3"
Ext. Cover Walls	2"
Int. Cover Walls	2"
Int. Cover Top Slab	2"
Int. Cover Bottom Slab	2"



Plan View

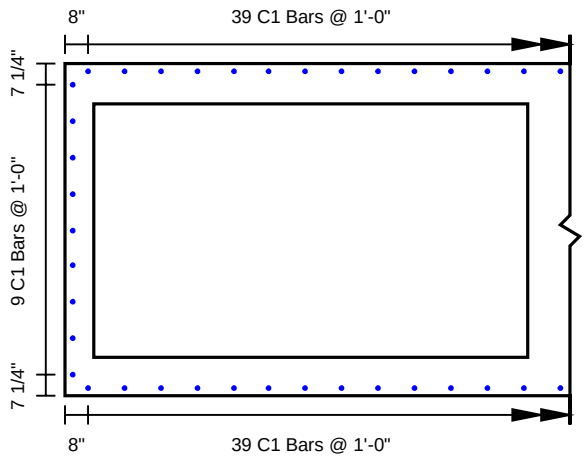


Typical Section

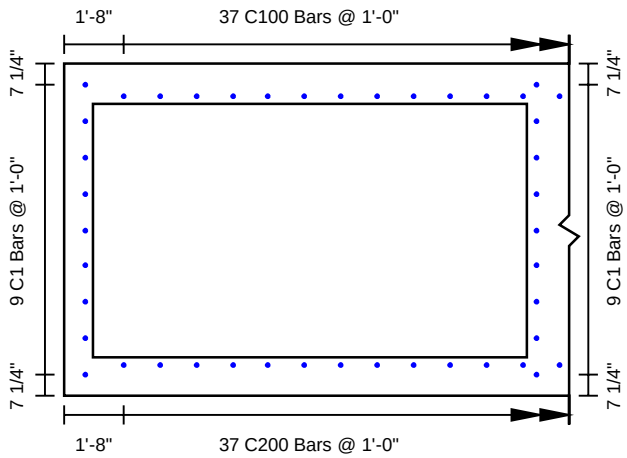
Concrete Summary
Volume of Concrete: 4.081 cy/ft Total Volume of Concrete: 195.901 cy

Reinforcing Steel Bar Schedule (lb)

Location	Mark	Qty	Size	Spacing	Type	Length	Hor.Leg	Ver.Leg	Tot.Weight
Top Slab(Int)	A100 (AS2)	96	5	6"	S	38'-11"	--	--	3897.0
Bot Slab(Int)	A200 (AS3)	96	5	6"	S	38'-11"	--	--	3897.0
Top Slab(Ext)	A300 (AS7)	96	5	6"	S	38'-11"	--	--	3897.0
Bot Slab(Ext)	A400 (AS8)	96	5	6"	S	38'-11"	--	--	3897.0
Corner(Top)	A1 (AS1)	192	5	6"	L	5'-3"	2'-6"	2'-9"	1051.0
Corner(Bot)	A2 (AS1)	192	5	6"	L	5'-2"	2'-6"	2'-8"	1035.0
Wall(Int)	B1 (AS4)	192	5	6"	S	7'-6"	--	--	1502.0
Wall(Ext)	B2 (AS1)	192	5	6"	S	7'-0"	--	--	1402.0
Int Wall	B3	384	5	6"	S	8'-9"	--	--	3504.0
Longit. Top (Int)	C100 (AS5)	37	4	1'-0"	S	47'-9"	--	--	1180.0
Longit. Bot (Int)	C200	37	4	1'-0"	S	47'-9"	--	--	1180.0
Longit. Top (Ext)	C1 (AS6)	39	4	1'-0"	S	47'-9"	--	--	1244.1
Longit. Bot (Ext)	C1 (AS6)	39	4	1'-0"	S	47'-9"	--	--	1244.1
Longit. Wall (Ext)	C1 (AS6)	18	4	1'-0"	S	47'-9"	--	--	574.2
Longit. Wall (Int)	C1 (AS6)	18	4	1'-0"	S	47'-9"	--	--	574.2
Longit. Int	C1 (AS6)	36	4	1'-0"	S	47'-9"	--	--	1148.4
									31227



Section Ext. Longit. Reinf.



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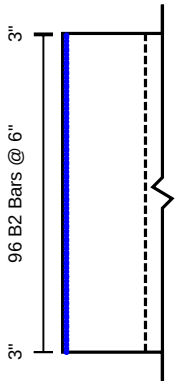
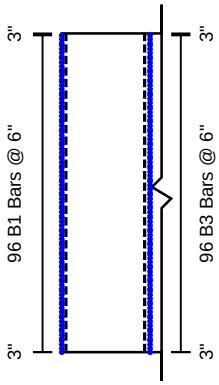
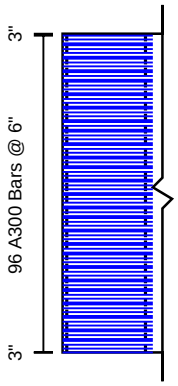


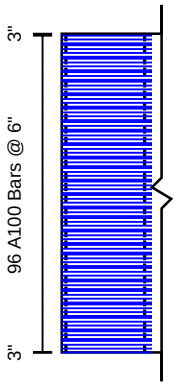
Ext. Wall Reinf.



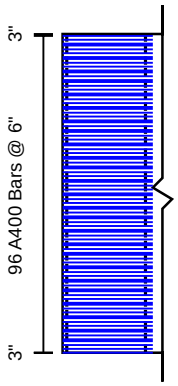
Int. Wall Reinf.



Top Slab Ext. Reinf.

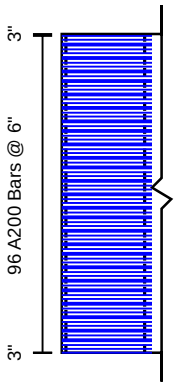


Top Slab Int. Reinf.

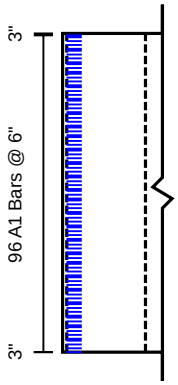


Bottom Slab Ext. Reinf.

31227

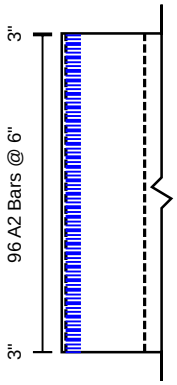


Bottom Slab Int. Reinf.



Top Slab Corner Reinf.

31227



Bottom Slab Corner Reinf.

RATINGS SUMMARY
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	Flexure					Shear				
Truck	Fill	Member	Location	IR	OR	Fill	Member	Location	IR	OR
(AA) HL-93	4.75	2	RT	1.34	1.73	4.75	2	RT	1.55	2.01

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

M dimension = 1.66 ft (method of equivalent capacity)
= 3.65 ft (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)	96	5	STR	6.00	0.620	38-11	3897		
Bot Slab (int)	A200 (AS3)	96	5	STR	6.00	0.620	38-11	3897		
Top Slab (ext)	A300 (AS7)	96	5	STR	6.00	0.620	38-11	3897		
Bot Slab (ext)	A400 (AS8)	96	5	STR	6.00	0.620	38-11	3897		
Corner (Top)	A1 (AS1)	192	5	L-BAR	6.00	0.620	5- 3	1051	2- 6	2- 9
Corner (Bottom)	A2 (AS1)	192	5	L-BAR	6.00	0.620	5- 2	1035	2- 6	2- 8
Ext Wall (int)	B1 (AS4)	192	5	STR	6.00	0.620	7- 6	1502		
Ext Wall (ext)	B2 (AS1)	192	5	STR	6.00	0.620	7- 0	1402		
Int Wall	B3	384	5	STR	6.00	0.620	8- 9	3504		
Top Slab (int- 1)	C100 (AS5)	37	4	STR	12.00	0.200	47- 9	1180		
Bot Slab (int- 1)	C200	37	4	STR	12.00	0.200	47- 9	1180		
Temperature (1)	C1 (AS6)	39	4	STR	12.00	0.200	47- 9	1244		
Temperature (1)	C1 (AS6)	39	4	STR	12.00	0.200	47- 9	1244		
Temperature (1)	C1 (AS6)	18	4	STR	12.00	0.200	47- 9	574		
Temperature (1)	C1 (AS6)	18	4	STR	12.00	0.200	47- 9	574		
Temperature (1)	C1 (AS6)	36	4	STR	12.00	0.200	47- 9	1148		
							Total	31227		

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)	0.620
Transverse Top Slab - Inside Face (AS2)	0.620
Transverse Bottom Slab - Inside Face (AS3)	0.620
Transverse Side Wall - Inside Face (AS4)	0.620
Distribution Top Slab - Inside Face (AS5)	0.200
Distribution Top Slab - OutSide Face (AS6)	0.200
Transverse Top Slab - Outside Face (AS7)	0.620
Transverse Bottom Slab - Outside Face (AS8)	0.620

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

Splice Lengths Table:

Bar Mark	Size	Splice Length (ft-in)
B1	5	1-10
B3	5	1-10
C1	4	1- 6
C100	4	1- 6
C200	4	1- 6

Eriksson Culvert v5.0.0

Filename: 3 cell 7x12_4-8ft.etcx

Project: Winsome Filing No. 3
Task : 3 cell 12-ft wide by 7-ft high
Client :
Job No.: 196106001

CULVERT PROPERTIES

Type of Culvert: Cast-in-Place Specification : LRFD 7th Edition w/ 2015 and 2016 Interims
Operating Mode : Analysis

Physical Dimensions

No. of Boxes: 3 Name: 3Cell CIP 12x7
Clear Span : 12.0000 ft Fill Depth : 4.75 ft
Clear Height: 7.0000 ft Center Skew : 0.00 deg Left Skew: 90.00 deg Right Skew: 90.00 deg
Length : 48.0000 ft Bottom Slab Support: Full Slab
Haunches: Top, Length: 0.0000 in Height: 0.0000 in
Bottom, Length: 0.0000 in Height: 0.0000 in
Member Thicknesses: Top Slab: 13.5000 in Bot Slab: 13.0000 in
Ext Wall: 10.0000 in Int Wall: 10.0000 in
Wall Joint: None

Material Properties

Concrete: Strength,f'c : 4.500 ksi Density : 0.150 kcf Elasticity,Ec: 4435 ksi
Type : Normal Weight Density Modification Factor : 1.00
Fr Factor : 0.24 Gamma1 : 1.60 Gamma3 : 0.75
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 (B1 Installation)
Poisson's : 0.5
Fe Factor : 1.150 (Maximum for Compacted Fill)
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
Include Lane Load : no Max. No. of Lanes: Computed by Program
Traffic Direction** : Lanes Parallel to Main Reinforcement
Neglect Live Load for Large Fill Depths: yes
Apply Surcharge at Fill Depths > 2 ft : yes
Compute Surcharge Depth: yes
Dead Load: Future Wearing Surface : 0.04 klf Add. Dead Load : 0.00 klf
Concentrated Loads : none
Lateral Soil Loads: Max. Equiv. Fluid Press.: 60.00 pcf Min. Equiv. Fluid Press. : 30.00 pcf
Include Additional Uniform Horiz. Load: no
Include Additional Uniform Vert. Load: no
Buoyancy Check : no
Fluid Pressures : Apply Water Press. : no
Foundation Model : Rigid

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
Ductility: 1.000 Importance: 1.000 Redundancy, non-earth: 1.000 Redundancy, earth: 1.050
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:	3.0000 in	2.0000 in

Assigned reinforcement:

Location	Mark	Size	Spacing (in)
Top Slab Inside	A100 (AS2)	5	6.0000
Bottom Slab Inside	A200 (AS3)	5	6.0000
Top Slab Outside	A300 (AS7)	5	6.0000
Bottom Slab Outside	A400 (AS8)	5	6.0000
Top Corner	A1 (AS1)	5	6.0000
Bottom Corner	A2 (AS1)	5	6.0000
Ext. Wall Inside	B1 (AS4)	5	6.0000
Ext. Wall Outside	B2 (AS1)	5	6.0000
Interior Wall	B3	5	6.0000
Longitudinal	C1 (AS6)	4	12.0000
Top Distribution	C100 (AS5)	4	12.0000
Bottom Distribution	C200	4	12.0000

Analysis Options

LL Analysis : Automatically Set Traffic Direction to Account for Skew Effects: yes (**Will override previo
Limit LL Distribution Width to Culvert Length for: All Fill Depths
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: no
Always Distribute Wheel Load: yes
Reinforcement: Always Include Distribution Steel: yes
Distribution Slab Provided: no
User Defined Longitudinal Steel: yes
Max. As used in Vc Calcs: 2.00 in2/ft
Distribute Minimum Reinforcement per Face: no
Use individual Member Thicknesses for Min Steel: yes
Epoxy coat steel: top bars, if fill < 2'
Use M-dimension for bar length calcs.: no
Slenderness : Checked K Factor: 2.00
Analysis Modeling : Use Haunches in the Structural Analysis Model: no
Crit. Section: Consider Haunches when Selecting Critical Section Locations: no
Use Max. Moment with Max. Shear at the Critical Section for Shear: yes
Flexure : Ignore Axial Thrust: yes
Use Eq. 12.10.4.2.4a-1: no
Shear : Always Check Iterative Beta Method
Environmental: Apply envirnomental duribility factors: no

ANALYSIS RESULTS
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Top Slab Thickness = 13.50 in
Bottom Slab Thickness = 13.00 in
Exterior Wall Thickness = 10.00 in
Interior Wall Thickness = 10.00 in

Modular Ratio (N) = 6.54 Max. Steel Ratio = 0.023
Design Span = 12.83 ft Design Height = 8.10 ft
Design Fill Depth = 4.75 ft

Volume of Concrete: 4.081 cy/ft Weight of Steel: 656 lb/ft

M dimension = 1.66 ft (method of equivalent capacity)
= 3.65 ft (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)	96	5	STR	6.00	0.620	38-11	3897		
Bot Slab (int)	A200 (AS3)	96	5	STR	6.00	0.620	38-11	3897		
Top Slab (ext)	A300 (AS7)	96	5	STR	6.00	0.620	38-11	3897		
Bot Slab (ext)	A400 (AS8)	96	5	STR	6.00	0.620	38-11	3897		
Corner (Top)	A1 (AS1)	192	5	L-BAR	6.00	0.620	5- 3	1051	2- 6	2- 9
Corner (Bottom)	A2 (AS1)	192	5	L-BAR	6.00	0.620	5- 2	1035	2- 6	2- 8
Ext Wall (int)	B1 (AS4)	192	5	STR	6.00	0.620	7- 6	1502		
Ext Wall (ext)	B2 (AS1)	192	5	STR	6.00	0.620	7- 0	1402		
Int Wall	B3	384	5	STR	6.00	0.620	8- 9	3504		
Top Slab (int- 1)	C100 (AS5)	37	4	STR	12.00	0.200	47- 9	1180		
Bot Slab (int- 1)	C200	37	4	STR	12.00	0.200	47- 9	1180		
Temperature (1)	C1 (AS6)	39	4	STR	12.00	0.200	47- 9	1244		
Temperature (1)	C1 (AS6)	39	4	STR	12.00	0.200	47- 9	1244		
Temperature (1)	C1 (AS6)	18	4	STR	12.00	0.200	47- 9	574		
Temperature (1)	C1 (AS6)	18	4	STR	12.00	0.200	47- 9	574		
Temperature (1)	C1 (AS6)	36	4	STR	12.00	0.200	47- 9	1148		
							Total	31227		

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)	0.620
Transverse Top Slab - Inside Face (AS2)	0.620
Transverse Bottom Slab - Inside Face (AS3)	0.620
Transverse Side Wall - Inside Face (AS4)	0.620
Distribution Top Slab - Inside Face (AS5)	0.200
Distribution Top Slab - OutSide Face (AS6)	0.200
Transverse Top Slab - Outside Face (AS7)	0.620
Transverse Bottom Slab - Outside Face (AS8)	0.620

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

Splice Lengths Table:

Bar Mark	Size	Splice Length (ft-in)
B1	5	1-10
B3	5	1-10
C1	4	1- 6
C100	4	1- 6
C200	4	1- 6

Summary of Ratings Table:

Truck	Flexure Fill	Flexure Member	Flexure Location	Flexure IR	Flexure OR	Shear Fill	Shear Member	Shear Location	Shear IR	Shear OR
(AA) HL-93	4.75	2	RT	1.34	1.73	4.75	2	RT	1.55	2.01

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	Truck	Fill Depth (ft)

BOT	6.50	-8.28	14.25	22.58	7.69	22.58	1.00	0.62	10.18	8.83	11.44	AA	4.75
MID	48.63	1.77	4.08	22.58	7.69	22.58	1.00	0.62	10.18	16.84	21.82	AA	4.75
MID-	48.63	-6.24	13.98	22.58	7.69	22.58	1.00	0.62	10.18	5.79	7.51	AA	4.75
TOP	6.75	-13.09	14.25	22.58	7.69	22.58	1.00	0.62	10.18	2.24	2.90	AA	4.75

Member 2: (Top Slab), Thickness = 13.50 in

Loc	Dist. (in)	Design Moment (k-ft)	Corr. A. F. (k)	Mu (k-ft)	ds (in)	Ma (k-ft)	phi	As (in2)	Mcr (k-ft)	Load Ratings IR	OR	Truck	Fill Depth (ft)
LT	5.00	-11.18	4.69	33.43	11.19	33.43	1.00	0.62	18.56	4.35	5.64	AA	4.75
MID	61.60	26.91	0.69	33.43	11.19	33.43	1.00	0.62	18.56	1.39	1.80	AA	4.75
RT	5.00	-28.53	2.07	33.43	11.19	33.43	1.00	0.62	18.56	1.34	1.73	AA	4.75

Member 3: (Interior 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	Truck	Fill Depth (ft)
BOT	6.50	-2.19	26.25	22.58	7.69	22.58	1.00	0.62	10.18	12.85	16.66	AA	4.75
MID	48.63	3.15	13.50	22.58	7.69	22.58	1.00	0.62	10.18	10.06	13.05	AA	4.75
TOP	6.75	-4.50	26.25	22.58	7.69	22.58	1.00	0.62	10.18	4.22	5.47	AA	4.75

Member 4: (Bottom Slab), Thickness = 13.00 in

Loc	Dist. (in)	Design Moment (k-ft)	Corr. A. F. (k)	Mu (k-ft)	ds (in)	Ma (k-ft)	phi	As (in2)	Mcr (k-ft)	Load Ratings IR	OR	Truck	Fill Depth (ft)
LT	5.00	-8.04	5.36	28.78	9.69	28.78	1.00	0.62	17.21	11.05	14.32	AA	4.75
MID	61.60	15.15	0.85	31.88	10.69	31.88	1.00	0.62	17.21	6.38	8.27	AA	4.75
RT	5.00	-19.68	2.24	28.78	9.69	28.78	1.00	0.62	17.21	3.35	4.34	AA	4.75

Member 5: (Top Slab - Interior Cell), Thickness = 13.50 in

Loc	Dist. (in)	Design Moment (k-ft)	Corr. A. F. (k)	Mu (k-ft)	ds (in)	Ma (k-ft)	phi	As (in2)	Mcr (k-ft)	Load Ratings IR	OR	Truck	Fill Depth (ft)
LT	5.00	-27.49	1.68	33.43	11.19	33.43	1.00	0.62	18.56	1.43	1.85	AA	4.75
MID	77.00	20.43	3.56	33.43	11.19	33.43	1.00	0.62	18.56	1.91	2.47	AA	4.75
RT	5.00	-27.49	1.68	33.43	11.19	33.43	1.00	0.62	18.56	1.43	1.85	AA	4.75

Member 7: (Bottom Slab - Interior Cell), Thickness = 13.00 in

Loc	Dist. (in)	Design Moment (k-ft)	Corr. A. F. (k)	Mu (k-ft)	ds (in)	Ma (k-ft)	phi	As (in2)	Mcr (k-ft)	Load Ratings IR	OR	Truck	Fill Depth (ft)
LT	5.00	-18.84	1.98	28.78	9.69	28.78	1.00	0.62	17.21	3.60	4.67	AA	4.75
MID	77.00	8.89	4.38	31.88	10.69	31.88	1.00	0.62	17.21	13.04	16.91	AA	4.75
RT	5.00	-18.84	1.98	28.78	9.69	28.78	1.00	0.62	17.21	3.60	4.67	AA	4.75

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	13.70	3.81	-8.3	14.25	7.28	16.09	3.051	17.87a	0.00	0.00	0.00	11.53	14.95	AA	4.75
MID	48.63	0.45	1.8	4.08	7.28	24.14	4.579	26.82a	0.00	0.00	0.00	64.38	83.46	AA	4.75
MID-	48.63	0.45	-6.2	13.98	7.28	20.66	3.919	22.96a	0.00	0.00	0.00	20.50	26.57	AA	4.75
TOP	13.95	-3.79	-13.1	14.25	7.28	13.07	2.479	14.52a	0.00	0.00	0.00	6.00	7.78	AA	4.75

Member 2: (Top Slab), Thickness = 13.50 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	14.90	11.45	-11.2	4.69	11.19	19.78	n/a	21.97c	0.00	0.00	0.00	2.24	2.91	AA	4.75
MID	77.00	1.19	26.9	0.69	11.19	17.43	n/a	19.37c	0.00	0.00	0.00	8.59	11.13	AA	4.75
RT	14.90	14.22	-28.5	2.07	11.19	18.52	n/a	20.58c	0.00	0.00	0.00	1.55	2.01	AA	4.75

Member 3: (Interior 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	13.70	1.03	-2.2	26.25	7.28	27.23	5.165	30.26a	0.00	0.00	0.00	25.27	32.75	AA	4.75
MID	48.63	1.03	3.2	13.50	7.28	26.57	5.040	29.53a	0.00	0.00	0.00	24.65	31.96	AA	4.75
TOP	13.95	1.00	-4.5	26.25	7.28	26.92	5.106	29.91a	0.00	0.00	0.00	28.29	36.67	AA	4.75

Member 4: (Bottom Slab), Thickness = 13.00 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	14.36	6.55	-8.0	5.36	9.69	18.80	2.681	20.89a	0.00	0.00	0.00	11.99	15.54	AA	4.75
MID	77.00	0.30	15.1	0.85	10.69	17.58	2.272	19.54a	0.00	0.00	0.00	NC	NC	AA	4.75
RT	14.36	8.78	-19.7	2.24	9.69	15.93	n/a	17.70c	0.00	0.00	0.00	5.55	7.19	AA	4.75

Member 5: (Top Slab - Interior Cell), Thickness = 13.50 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	14.90	12.70	-27.5	1.68	11.19	18.43	n/a	20.48c	0.00	0.00	0.00	1.80	2.33	AA	4.75
MID	77.00	2.77	20.4	3.56	11.19	17.65	n/a	19.61c	0.00	0.00	0.00	6.37	8.25	AA	4.75
RT	14.90	12.70	-27.5	1.68	11.19	18.43	n/a	20.48c	0.00	0.00	0.00	1.80	2.33	AA	4.75

Member 7: (Bottom Slab - Interior Cell), Thickness = 13.00 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	14.36	7.59	-18.8	1.98	9.69	15.84	n/a	17.60c	0.00	0.00	0.00	7.12	9.23	AA	4.75
MID	77.00	0.19	8.9	4.38	10.69	23.20	2.999	25.78a	0.00	0.00	0.00	99.99	99.99	AA	4.75
RT	14.36	7.59	-18.8	1.98	9.69	15.84	n/a	17.60c	0.00	0.00	0.00	7.12	9.23	AA	4.75

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

Analysis Results: Fill Depth = 4.75 ft

Load Parameters:

Fe = 1.02 Surcharge Depth : 2.60 ft

Applied Horizontal Loads: (k/ft)

Load Description	Bottom of Wall	Top of Wall
Horizontal Earth Load	0.805	0.319
Live Load Surcharge	0.156	0.156
Internal Water Pressure	0.000	0.000

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

M-PT	Mdc	Mev	Mdw	Meh	Mls	Mwa
Member 1: (Exterior Wall)						
Bottom						
1- 0	-1.30	-2.41	-0.15	-2.24	-0.60	0.00
1- 1	-1.21	-2.39	-0.15	-0.37	-0.14	0.00
1- 2	-1.13	-2.36	-0.15	0.99	0.22	0.00
1- 3	-1.04	-2.34	-0.15	1.89	0.47	0.00
1- 4	-0.96	-2.31	-0.15	2.36	0.62	0.00
1- 5	-0.87	-2.29	-0.14	2.42	0.67	0.00
1- 6	-0.78	-2.26	-0.14	2.12	0.61	0.00
1- 7	-0.70	-2.24	-0.14	1.48	0.46	0.00
1- 8	-0.61	-2.21	-0.14	0.54	0.20	0.00
1- 9	-0.53	-2.19	-0.14	-0.68	-0.17	0.00
1-10	-0.44	-2.16	-0.14	-2.14	-0.63	0.00
Top						
Member 2: (Top Slab)						
Left						
2- 0	-0.44	-2.16	-0.14	-2.17	-0.63	0.00
2- 1	0.58	1.44	0.09	-1.90	-0.55	0.00
2- 2	1.32	4.07	0.26	-1.62	-0.47	0.00
2- 3	1.78	5.74	0.36	-1.35	-0.39	0.00
2- 4	1.97	6.46	0.41	-1.08	-0.31	0.00
2- 5	1.87	6.20	0.39	-0.81	-0.23	0.00
2- 6	1.50	4.99	0.32	-0.53	-0.15	0.00
2- 7	0.85	2.82	0.18	-0.26	-0.08	0.00
2- 8	-0.07	-0.32	-0.02	0.01	0.00	0.00
2- 9	-1.28	-4.42	-0.28	0.29	0.08	0.00
2-10	-2.76	-9.48	-0.60	0.56	0.16	0.00
Right						
Member 3: (Interior Wall)						
Bottom						
3- 0	0.33	0.65	0.04	-0.26	-0.07	0.00
3- 1	0.31	0.64	0.04	-0.25	-0.07	0.00
3- 2	0.29	0.63	0.04	-0.25	-0.07	0.00
3- 3	0.27	0.62	0.04	-0.24	-0.07	0.00
3- 4	0.25	0.61	0.04	-0.24	-0.07	0.00
3- 5	0.23	0.60	0.04	-0.24	-0.07	0.00
3- 6	0.21	0.59	0.04	-0.23	-0.06	0.00
3- 7	0.19	0.58	0.04	-0.23	-0.06	0.00
3- 8	0.17	0.57	0.04	-0.22	-0.06	0.00
3- 9	0.15	0.56	0.04	-0.22	-0.06	0.00
3-10	0.13	0.55	0.03	-0.21	-0.06	0.00
Top						
Member 4: (Bottom Slab)						
Left						
4- 0	-1.30	-2.41	-0.15	-2.24	-0.60	0.00
4- 1	0.42	1.21	0.08	-1.95	-0.52	0.00
4- 2	1.68	3.86	0.24	-1.67	-0.44	0.00
4- 3	2.49	5.55	0.35	-1.39	-0.37	0.00
4- 4	2.86	6.28	0.40	-1.10	-0.29	0.00
4- 5	2.77	6.05	0.38	-0.82	-0.22	0.00
4- 6	2.23	4.86	0.31	-0.53	-0.14	0.00
4- 7	1.23	2.71	0.17	-0.25	-0.07	0.00
4- 8	-0.21	-0.41	-0.03	0.03	0.01	0.00
4- 9	-2.10	-4.49	-0.28	0.32	0.08	0.00
4-10	-4.45	-9.53	-0.60	0.60	0.16	0.00
Right						
Member 5: (Top Slab - Interior Cell)						

Unfactored Shears due to All Loads: (k)

M-PT	Vdc	Vev	Vdw	Veh	Vls	Vwa
Member 1: (Exterior Wall)						
Bottom						
1- 0	0.11	0.03	0.00	2.61	0.63	0.00
1- 1	0.11	0.03	0.00	1.98	0.50	0.00
1- 2	0.11	0.03	0.00	1.39	0.38	0.00
1- 3	0.11	0.03	0.00	0.83	0.25	0.00
1- 4	0.11	0.03	0.00	0.32	0.12	0.00
1- 5	0.11	0.03	0.00	-0.16	0.00	0.00
1- 6	0.11	0.03	0.00	-0.59	-0.13	0.00
1- 7	0.11	0.03	0.00	-0.99	-0.26	0.00
1- 8	0.11	0.03	0.00	-1.34	-0.38	0.00
1- 9	0.11	0.03	0.00	-1.66	-0.51	0.00
1-10	0.11	0.03	0.00	-1.94	-0.64	0.00
Top						
Member 2: (Top Slab)						
Left						
2- 0	0.90	3.18	0.20	0.21	0.06	0.00
2- 1	0.69	2.43	0.15	0.21	0.06	0.00
2- 2	0.47	1.68	0.11	0.21	0.06	0.00
2- 3	0.25	0.93	0.06	0.21	0.06	0.00
2- 4	0.04	0.18	0.01	0.21	0.06	0.00
2- 5	-0.18	-0.57	-0.04	0.21	0.06	0.00
2- 6	-0.40	-1.32	-0.08	0.21	0.06	0.00
2- 7	-0.61	-2.07	-0.13	0.21	0.06	0.00
2- 8	-0.83	-2.82	-0.18	0.21	0.06	0.00
2- 9	-1.05	-3.57	-0.23	0.21	0.06	0.00
2-10	-1.26	-4.32	-0.27	0.21	0.06	0.00
Right						
Member 3: (Interior Wall)						
Bottom						
3- 0	-0.02	-0.01	0.00	0.01	0.00	0.00
3- 1	-0.02	-0.01	0.00	0.01	0.00	0.00
3- 2	-0.02	-0.01	0.00	0.01	0.00	0.00
3- 3	-0.02	-0.01	0.00	0.01	0.00	0.00
3- 4	-0.02	-0.01	0.00	0.01	0.00	0.00
3- 5	-0.02	-0.01	0.00	0.01	0.00	0.00
3- 6	-0.02	-0.01	0.00	0.01	0.00	0.00
3- 7	-0.02	-0.01	0.00	0.01	0.00	0.00
3- 8	-0.02	-0.01	0.00	0.01	0.00	0.00
3- 9	-0.02	-0.01	0.00	0.01	0.00	0.00
3-10	-0.02	-0.01	0.00	0.01	0.00	0.00
Top						
Member 4: (Bottom Slab)						
Left						
4- 0	1.51	3.19	0.20	0.22	0.06	0.00
4- 1	1.16	2.44	0.15	0.22	0.06	0.00
4- 2	0.81	1.69	0.11	0.22	0.06	0.00
4- 3	0.46	0.94	0.06	0.22	0.06	0.00
4- 4	0.11	0.19	0.01	0.22	0.06	0.00
4- 5	-0.25	-0.55	-0.04	0.22	0.06	0.00
4- 6	-0.60	-1.30	-0.08	0.22	0.06	0.00
4- 7	-0.95	-2.05	-0.13	0.22	0.06	0.00
4- 8	-1.30	-2.80	-0.18	0.22	0.06	0.00
4- 9	-1.65	-3.55	-0.23	0.22	0.06	0.00
4-10	-2.00	-4.30	-0.27	0.22	0.06	0.00
Right						
Member 5: (Top Slab - Interior Cell)						

Bottom

5- 0	-2.63	-8.92	-0.57	0.34	0.10	0.00
5- 1	-1.37	-4.60	-0.29	0.34	0.10	0.00
5- 2	-0.40	-1.23	-0.08	0.34	0.10	0.00
5- 3	0.29	1.17	0.07	0.34	0.10	0.00
5- 4	0.71	2.62	0.17	0.34	0.10	0.00
5- 5	0.85	3.10	0.20	0.34	0.10	0.00
5- 6	0.71	2.62	0.17	0.34	0.10	0.00
5- 7	0.29	1.17	0.07	0.34	0.10	0.00
5- 8	-0.40	-1.23	-0.08	0.34	0.10	0.00
5- 9	-1.37	-4.60	-0.29	0.34	0.10	0.00
5-10	-2.63	-8.92	-0.57	0.34	0.10	0.00

Top

Bottom

5- 0	1.08	3.75	0.24	0.00	0.00	0.00
5- 1	0.87	3.00	0.19	0.00	0.00	0.00
5- 2	0.65	2.25	0.14	0.00	0.00	0.00
5- 3	0.43	1.50	0.09	0.00	0.00	0.00
5- 4	0.22	0.75	0.05	0.00	0.00	0.00
5- 5	0.00	0.00	0.00	0.00	0.00	0.00
5- 6	-0.22	-0.75	-0.05	0.00	0.00	0.00
5- 7	-0.43	-1.50	-0.09	0.00	0.00	0.00
5- 8	-0.65	-2.25	-0.14	0.00	0.00	0.00
5- 9	-0.87	-3.00	-0.19	0.00	0.00	0.00
5-10	-1.08	-3.75	-0.24	0.00	0.00	0.00

Top

Member 7: (Bottom Slab - Interior Cell)

Left

7- 0	-4.12	-8.87	-0.56	0.34	0.09	0.00
7- 1	-2.09	-4.55	-0.29	0.34	0.09	0.00
7- 2	-0.51	-1.18	-0.07	0.34	0.09	0.00
7- 3	0.62	1.22	0.08	0.34	0.09	0.00
7- 4	1.29	2.67	0.17	0.34	0.09	0.00
7- 5	1.52	3.15	0.20	0.34	0.09	0.00
7- 6	1.29	2.67	0.17	0.34	0.09	0.00
7- 7	0.62	1.22	0.08	0.34	0.09	0.00
7- 8	-0.51	-1.18	-0.07	0.34	0.09	0.00
7- 9	-2.09	-4.55	-0.29	0.34	0.09	0.00
7-10	-4.12	-8.87	-0.56	0.34	0.09	0.00

Right

Member 7: (Bottom Slab - Interior Cell

Left

7- 0	1.76	3.75	0.24	0.00	0.00	0.00
7- 1	1.41	3.00	0.19	0.00	0.00	0.00
7- 2	1.05	2.25	0.14	0.00	0.00	0.00
7- 3	0.70	1.50	0.09	0.00	0.00	0.00
7- 4	0.35	0.75	0.05	0.00	0.00	0.00
7- 5	0.00	0.00	0.00	0.00	0.00	0.00
7- 6	-0.35	-0.75	-0.05	0.00	0.00	0.00
7- 7	-0.70	-1.50	-0.09	0.00	0.00	0.00
7- 8	-1.05	-2.25	-0.14	0.00	0.00	0.00
7- 9	-1.41	-3.00	-0.19	0.00	0.00	0.00
7-10	-1.76	-3.75	-0.24	0.00	0.00	0.00

Right

Unfactored Thrusts due to All Loads: (k)

Member	Pdc	Pev	Pdw	Peh	Pls	Pwa
1	0.90	3.18	0.20	0.21	0.06	0.00
2	-0.11	-0.03	0.00	1.94	0.64	0.00
3	2.35	8.06	0.51	-0.21	-0.06	0.00
4	0.11	0.03	0.00	2.61	0.63	0.00
5	-0.08	-0.02	0.00	1.93	0.64	0.00
7	0.08	0.02	0.00	2.62	0.63	0.00

---------- Analysis Truck, HL-93 ----------

Vehicle	Axle No.	Weight (k/ft)	Length (ft)	Dist. From Previous (ft)
Truck	1	0.832	6.30	
	2	0.832	6.30	14.00
	3	0.208	6.30	14.00
Tandem	1	0.795	10.30	

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

Live Load Parameters:

Traffic Direction is Parallel to Main Reinforcement
Distribution Width : 13.85 ft
Impact Factor : 1.13
Distribution Width : 0.00 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	0.832	6.30	6.36
	2	0.832	6.30	-7.64
	3	0.208	6.30	-21.64

Maximum +Moment : 7.75 k-ft
Corresponding Moment at End : -3.32 k-ft
Coincident Bottom Slab Load : 0.06 k/ft

Maximum -Moment in Top Slab

Vehicle	Axle No.	Weight (klf)	Length (ft)	Dist. From Left End (ft)
Truck	1	0.832	6.30	20.36
	2	0.832	6.30	6.36
	3	0.208	6.30	-7.64

Maximum -Moment : -9.48 k-ft
Corresponding Moment at Mid : 6.61 k-ft
Coincident Bottom Slab Load : 0.12 k/ft

Maximum +Shear in Top Slab

Truck	1	0.832	6.30	15.98
	2	0.832	6.30	1.98
	3	0.208	6.30	-12.02

Maximum +Shear : 4.23 k
Corresponding Shear at Mid : -1.19 k
Coincident Bottom Slab Load : 0.11 k/ft

Maximum -Shear in Top Slab

Truck	1	0.832	6.30	23.69
	2	0.832	6.30	9.69
	3	0.208	6.30	-4.31

Maximum -Shear : -4.35 k
Corresponding Shear at Mid : 0.89 k
Coincident Bottom Slab Load : 0.12 k/ft

Maximum +Moment in Top Slab
Tandem 1 0.795 10.30 6.40
Maximum +Moment : 9.15 k-ft
Corresponding Moment at End : -4.39 k-ft
Coincident Bottom Slab Load : 0.09 k/ft

Maximum -Moment in Top Slab
Tandem 1 0.795 10.30 7.04
Maximum -Moment : -8.83 k-ft
Corresponding Moment at Mid : 9.05 k-ft
Coincident Bottom Slab Load : 0.09 k/ft

Maximum +Shear in Top Slab
Tandem 1 0.795 10.30 17.98
Maximum +Shear : 4.96 k
Corresponding Shear at Mid : -0.43 k
Coincident Bottom Slab Load : 0.09 k/ft

Maximum -Shear in Top Slab
Tandem 1 0.795 10.30 7.69
Maximum -Shear : -5.27 k
Corresponding Shear at Mid : -0.16 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	0.35	-0.85	0.19	-0.48	0.19	-0.70	0.22	-0.57	0.00	0.00	0.00	0.00
1- 1	0.00	-0.71	0.19	-0.48	0.00	-0.53	0.22	-0.57	0.00	0.00	0.00	0.00
1- 2	0.00	-0.61	0.19	-0.48	0.00	-0.43	0.22	-0.57	0.00	0.00	0.00	0.00
1- 3	0.00	-0.82	0.19	-0.48	0.00	-0.93	0.22	-0.57	0.00	0.00	0.00	0.00
1- 4	0.00	-1.08	0.19	-0.48	0.00	-1.43	0.22	-0.57	0.00	0.00	0.00	0.00
1- 5	0.00	-1.47	0.19	-0.48	0.06	-1.93	0.22	-0.57	0.00	0.00	0.00	0.00
1- 6	0.06	-1.86	0.19	-0.48	0.30	-2.43	0.22	-0.57	0.00	0.00	0.00	0.00
1- 7	0.27	-2.26	0.19	-0.48	0.54	-2.93	0.22	-0.57	0.00	0.00	0.00	0.00
1- 8	0.42	-2.65	0.19	-0.48	0.71	-3.43	0.22	-0.57	0.00	0.00	0.00	0.00
1- 9	0.57	-3.04	0.19	-0.48	0.88	-3.93	0.22	-0.57	0.00	0.00	0.00	0.00
1-10	0.72	-3.44	0.19	-0.48	1.06	-4.43	0.22	-0.57	0.00	0.00	0.00	0.00
Top												
Member 2: (Top Slab)												
Left												
2- 0	0.72	-3.44	3.87	-0.26	1.06	-4.43	4.61	-0.43	0.00	0.00	0.00	0.00
2- 1	1.90	-0.63	3.28	-0.26	1.44	-0.54	3.74	-0.43	0.00	0.00	0.00	0.00
2- 2	4.49	-0.09	2.69	-0.26	4.88	-0.02	2.90	-0.43	0.00	0.00	0.00	0.00
2- 3	6.55	-0.37	2.10	-0.68	7.56	-0.55	2.13	-0.47	0.00	0.00	0.00	0.00
2- 4	7.63	-0.70	1.55	-1.19	8.98	-1.15	1.44	-0.86	0.00	0.00	0.00	0.00
2- 5	7.75	-1.03	1.05	-1.77	9.15	-1.73	0.86	-1.37	0.00	0.00	0.00	0.00
2- 6	6.89	-1.36	0.61	-2.35	8.06	-2.28	0.39	-1.99	0.00	0.00	0.00	0.00
2- 7	5.15	-1.70	0.25	-2.91	5.76	-2.84	0.11	-2.72	0.00	0.00	0.00	0.00
2- 8	2.66	-3.07	0.08	-3.43	2.31	-3.40	0.11	-3.56	0.00	0.00	0.00	0.00
2- 9	0.74	-5.89	0.08	-3.91	0.98	-3.95	0.10	-4.43	0.00	0.00	0.00	0.00
2-10	0.84	-9.48	0.08	-4.35	1.11	-8.83	0.10	-5.27	0.00	0.00	0.00	0.00
Right												
Member 3: (Interior Wall)												
Bottom												
3- 0	1.24	-0.99	0.47	-0.43	1.20	-1.22	0.61	-0.54	0.00	0.00	0.00	0.00
3- 1	0.89	-0.61	0.47	-0.43	0.76	-0.73	0.61	-0.54	0.00	0.00	0.00	0.00
3- 2	0.55	-0.25	0.47	-0.43	0.35	-0.25	0.61	-0.54	0.00	0.00	0.00	0.00
3- 3	0.27	-0.09	0.47	-0.43	0.33	-0.10	0.61	-0.54	0.00	0.00	0.00	0.00
3- 4	0.56	-0.24	0.47	-0.43	0.72	-0.55	0.61	-0.54	0.00	0.00	0.00	0.00
3- 5	0.93	-0.56	0.47	-0.43	1.22	-1.01	0.61	-0.54	0.00	0.00	0.00	0.00
3- 6	1.30	-0.90	0.47	-0.43	1.72	-1.45	0.61	-0.54	0.00	0.00	0.00	0.00
3- 7	1.68	-1.25	0.47	-0.43	2.22	-1.89	0.61	-0.54	0.00	0.00	0.00	0.00
3- 8	2.06	-1.60	0.47	-0.43	2.72	-2.33	0.61	-0.54	0.00	0.00	0.00	0.00
3- 9	2.44	-1.95	0.47	-0.43	3.23	-2.77	0.61	-0.54	0.00	0.00	0.00	0.00
3-10	2.82	-2.30	0.47	-0.43	3.73	-3.21	0.61	-0.54	0.00	0.00	0.00	0.00
Top												
Member 4: (Bottom Slab)												
Left												
4- 0	0.35	-0.85	0.74	0.00	0.19	-0.70	0.53	0.00	0.00	0.00	0.00	0.00
4- 1	0.85	-0.08	0.57	0.00	1.10	-0.14	0.41	0.00	0.00	0.00	0.00	0.00
4- 2	1.38	0.00	0.40	0.00	1.46	0.00	0.29	0.00	0.00	0.00	0.00	0.00
4- 3	1.69	0.00	0.23	0.00	1.68	0.00	0.17	0.00	0.00	0.00	0.00	0.00
4- 4	1.78	0.00	0.07	0.00	1.73	0.00	0.05	0.00	0.00	0.00	0.00	0.00
4- 5	1.64	0.00	0.00	-0.19	1.64	0.00	0.00	-0.14	0.00	0.00	0.00	0.00
4- 6	1.29	0.00	0.00	-0.37	1.39	0.00	0.00	-0.26	0.00	0.00	0.00	0.00
4- 7	0.71	0.00	0.00	-0.54	0.98	0.00	0.00	-0.38	0.00	0.00	0.00	0.00
4- 8	0.33	-0.46	0.00	-0.71	0.37	-0.60	0.00	-0.50	0.00	0.00	0.00	0.00
4- 9	0.00	-1.38	0.00	-0.89	0.00	-1.29	0.00	-0.62	0.00	0.00	0.00	0.00
4-10	0.00	-2.61	0.00	-1.06	0.00	-2.13	0.00	-0.74	0.00	0.00	0.00	0.00
Right												
Member 5: (Top Slab - Interior Cell)												
Bottom												
5- 0	1.15	-9.07	4.23	-0.40	1.43	-7.72	4.96	-0.51	0.00	0.00	0.00	0.00
5- 1	0.64	-5.70	3.76	-0.40	0.77	-4.46	4.08	-0.51	0.00	0.00	0.00	0.00

5- 2	2.90	-3.14	3.25	-0.40	2.53	-3.80	3.21	-0.51	0.00	0.00	0.00	0.00
5- 3	4.66	-2.43	2.70	-0.52	5.60	-3.15	2.39	-0.51	0.00	0.00	0.00	0.00
5- 4	5.63	-1.92	2.14	-1.04	7.48	-2.50	1.64	-0.51	0.00	0.00	0.00	0.00
5- 5	5.77	-1.41	1.58	-1.58	8.10	-1.84	0.99	-0.99	0.00	0.00	0.00	0.00
5- 6	5.63	-1.92	1.04	-2.14	7.48	-2.50	0.51	-1.64	0.00	0.00	0.00	0.00
5- 7	4.66	-2.43	0.52	-2.70	5.60	-3.15	0.51	-2.39	0.00	0.00	0.00	0.00
5- 8	2.90	-3.14	0.40	-3.25	2.53	-3.80	0.51	-3.21	0.00	0.00	0.00	0.00
5- 9	0.64	-5.70	0.40	-3.76	0.77	-4.46	0.51	-4.08	0.00	0.00	0.00	0.00
5-10	1.15	-9.07	0.40	-4.23	1.43	-7.72	0.51	-4.96	0.00	0.00	0.00	0.00
Top												

Member 7: (Bottom Slab - Interior Cell)

Left												
7- 0	0.00	-2.44	0.93	0.00	0.00	-2.46	0.71	0.00	0.00	0.00	0.00	0.00
7- 1	0.00	-1.36	0.76	0.00	0.00	-1.62	0.59	0.00	0.00	0.00	0.00	0.00
7- 2	0.11	-0.69	0.59	0.00	0.20	-0.94	0.47	0.00	0.00	0.00	0.00	0.00
7- 3	0.59	-0.29	0.41	0.00	0.69	-0.25	0.35	0.00	0.00	0.00	0.00	0.00
7- 4	0.79	0.00	0.24	0.00	0.92	0.00	0.23	0.00	0.00	0.00	0.00	0.00
7- 5	0.83	0.00	0.09	-0.09	1.00	0.00	0.11	-0.11	0.00	0.00	0.00	0.00
7- 6	0.79	0.00	0.00	-0.24	0.92	0.00	0.00	-0.23	0.00	0.00	0.00	0.00
7- 7	0.59	-0.29	0.00	-0.41	0.69	-0.25	0.00	-0.35	0.00	0.00	0.00	0.00
7- 8	0.11	-0.69	0.00	-0.59	0.20	-0.94	0.00	-0.47	0.00	0.00	0.00	0.00
7- 9	0.00	-1.36	0.00	-0.76	0.00	-1.62	0.00	-0.59	0.00	0.00	0.00	0.00
7-10	0.00	-2.44	0.00	-0.93	0.00	-2.46	0.00	-0.71	0.00	0.00	0.00	0.00
Right												

Note: Unfactored live load results computed at 4.75 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	-8.3	9.17	14.72	6.00	28.65
A2	Bot Corner Bar	-5.8	9.17	8.01	6.00	56.49
A100	Top Slab (int)	12.7	2.37	21.63	6.00	20.36
A300	Top Slab (ext)	-18.0	1.19	32.58	6.00	11.96
A200	Bot Slab (int)	6.3	3.03	9.73	6.00	50.33
A400	Bot Slab (ext)	-13.4	1.51	27.55	6.00	14.78
B2	Ext Wall (ext)	-4.0	9.00	3.57	6.00	99.99

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	6.50	-8.28	14.25	22.58	7.69	22.58	1.00	0.62	10.18	8.83	11.44
MID	48.63	1.77	4.08	22.58	7.69	22.58	1.00	0.62	10.18	16.84	21.82
MID-	48.63	-6.24	13.98	22.58	7.69	22.58	1.00	0.62	10.18	5.79	7.51
TOP	6.75	-13.09	14.25	22.58	7.69	22.58	1.00	0.62	10.18	2.24	2.90

Member 2: (Top Slab), Thickness = 13.50 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	5.00	-11.18	4.69	33.43	11.19	33.43	1.00	0.62	18.56	4.35	5.64
MID	61.60	26.91	0.69	33.43	11.19	33.43	1.00	0.62	18.56	1.39	1.80
RT	5.00	-28.53	2.07	33.43	11.19	33.43	1.00	0.62	18.56	1.34	1.73

Member 3: (Interior 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	6.50	-2.19	26.25	22.58	7.69	22.58	1.00	0.62	10.18	12.85	16.66
MID	48.63	3.15	13.50	22.58	7.69	22.58	1.00	0.62	10.18	10.06	13.05
TOP	6.75	-4.50	26.25	22.58	7.69	22.58	1.00	0.62	10.18	4.22	5.47

Member 4: (Bottom Slab), Thickness = 13.00 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	5.00	-8.04	5.36	28.78	9.69	28.78	1.00	0.62	17.21	11.05	14.32
MID	61.60	15.15	0.85	31.88	10.69	31.88	1.00	0.62	17.21	6.38	8.27
RT	5.00	-19.68	2.24	28.78	9.69	28.78	1.00	0.62	17.21	3.35	4.34

Member 5: (Top Slab - Interior Cell), Thickness = 13.50 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	5.00	-27.49	1.68	33.43	11.19	33.43	1.00	0.62	18.56	1.43	1.85
MID	77.00	20.43	3.56	33.43	11.19	33.43	1.00	0.62	18.56	1.91	2.47
RT	5.00	-27.49	1.68	33.43	11.19	33.43	1.00	0.62	18.56	1.43	1.85

Member 7: (Bottom Slab - Interior Cell), Thickness = 13.00 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	5.00	-18.84	1.98	28.78	9.69	28.78	1.00	0.62	17.21	3.60	4.67
MID	77.00	8.89	4.38	31.88	10.69	31.88	1.00	0.62	17.21	13.04	16.91
RT	5.00	-18.84	1.98	28.78	9.69	28.78	1.00	0.62	17.21	3.60	4.67

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	13.70	3.81	-8.3	14.25	7.28	16.09	3.051	33.53	17.87a	0.00	0.00	0.00	11.53	14.95
MID	48.63	0.45	1.8	4.08	7.28	24.14	4.579	28.73	26.82a	0.00	0.00	0.00	64.38	83.46
MID-	48.63	0.45	-6.2	13.98	7.28	20.66	3.919	30.45	22.96a	0.00	0.00	0.00	20.50	26.57
TOP	13.95	-3.79	-13.1	14.25	7.28	13.07	2.479	36.30	14.52a	0.00	0.00	0.00	6.00	7.78

Member 2: (Top Slab), Thickness = 13.50 in

Loc	Dist.	Design Shear	Corr. Moment	Corr. A. F.	Dv	phi*Vn	Beta	Theta	Vc	Vs	Av	Max. Spac	Load Ratings IR	OR

	(in)	(k)	(k-ft)	(k)	(in)	(k)			(k)	(k)	(in2)	(in)		
LT	14.90	11.45	-11.2	4.69	11.19	19.78	n/a	n/a	21.97c	0.00	0.00	0.00	2.24	2.91
MID	77.00	1.19	26.9	0.69	11.19	17.43	n/a	n/a	19.37c	0.00	0.00	0.00	8.59	11.13
RT	14.90	14.22	-28.5	2.07	11.19	18.52	n/a	n/a	20.58c	0.00	0.00	0.00	1.55	2.01

Member 3: (Interior Wall), Thickness = 10.00 in

Loc	Dist.	Design Shear	Corr. Moment	Corr. A. F.	Dv	phi*Vn	Beta	Theta	Vc	Vs	Av	Max. Spac	Load Ratings IR	OR
	(in)	(k)	(k-ft)	(k)	(in)	(k)			(k)	(k)	(in2)	(in)		
BOT	13.70	1.03	-2.2	26.25	7.28	27.23	5.165	27.51	30.26a	0.00	0.00	0.00	25.27	32.75
MID	48.63	1.03	3.2	13.50	7.28	26.57	5.040	27.71	29.53a	0.00	0.00	0.00	24.65	31.96
TOP	13.95	1.00	-4.5	26.25	7.28	26.92	5.106	27.60	29.91a	0.00	0.00	0.00	28.29	36.67

Member 4: (Bottom Slab), Thickness = 13.00 in

Loc	Dist.	Design Shear	Corr. Moment	Corr. A. F.	Dv	phi*Vn	Beta	Theta	Vc	Vs	Av	Max. Spac	Load Ratings IR	OR
	(in)	(k)	(k-ft)	(k)	(in)	(k)			(k)	(k)	(in2)	(in)		
LT	14.36	6.55	-8.0	5.36	9.69	18.80	2.681	37.17	20.89a	0.00	0.00	0.00	11.99	15.54
MID	77.00	0.30	15.1	0.85	10.69	17.58	2.272	40.22	19.54a	0.00	0.00	0.00	NC	NC
RT	14.36	8.78	-19.7	2.24	9.69	15.93	n/a	n/a	17.70c	0.00	0.00	0.00	5.55	7.19

Member 5: (Top Slab - Interior Cell), Thickness = 13.50 in

Loc	Dist.	Design Shear	Corr. Moment	Corr. A. F.	Dv	phi*Vn	Beta	Theta	Vc	Vs	Av	Max. Spac	Load Ratings IR	OR
	(in)	(k)	(k-ft)	(k)	(in)	(k)			(k)	(k)	(in2)	(in)		
LT	14.90	12.70	-27.5	1.68	11.19	18.43	n/a	n/a	20.48c	0.00	0.00	0.00	1.80	2.33
MID	77.00	2.77	20.4	3.56	11.19	17.65	n/a	n/a	19.61c	0.00	0.00	0.00	6.37	8.25
RT	14.90	12.70	-27.5	1.68	11.19	18.43	n/a	n/a	20.48c	0.00	0.00	0.00	1.80	2.33

Member 7: (Bottom Slab - Interior Cell), Thickness = 13.00 in

Loc	Dist.	Design Shear	Corr. Moment	Corr. A. F.	Dv	phi*Vn	Beta	Theta	Vc	Vs	Av	Max. Spac	Load Ratings IR	OR
	(in)	(k)	(k-ft)	(k)	(in)	(k)			(k)	(k)	(in2)	(in)		
LT	14.36	7.59	-18.8	1.98	9.69	15.84	n/a	n/a	17.60c	0.00	0.00	0.00	7.12	9.23
MID	77.00	0.19	8.9	4.38	10.69	23.20	2.999	36.11	25.78a	0.00	0.00	0.00	99.99	99.99
RT	14.36	7.59	-18.8	1.98	9.69	15.84	n/a	n/a	17.60c	0.00	0.00	0.00	7.12	9.23

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

Load Combination Results at Tenth Points: (k-ft, k)

M-PT	+Moment	-Moment	+Axial	-Axial	+Shear	-Shear
Member 1: (Exterior Wall)						
Bottom						
1- 0	-5.971	-10.841	5.144	14.249	5.360	0.853
1- 1	-4.006	-7.010	4.076	14.249	4.242	0.446
1- 2	-1.350	-5.289	4.076	13.976	3.179	0.065
1- 3	0.469	-5.119	4.076	13.976	2.172	-0.291
1- 4	1.494	-5.550	4.076	13.976	1.221	-0.622
1- 5	1.771	-6.239	4.076	13.976	0.455	-1.056
1- 6	1.345	-7.165	4.076	13.976	0.175	-1.895
1- 7	0.262	-8.308	4.076	13.976	-0.080	-2.678
1- 8	-1.433	-9.647	4.076	13.976	-0.309	-3.405
1- 9	-2.744	-11.979	5.144	14.249	-0.513	-4.077
1-10	-3.235	-15.594	5.144	14.249	-0.692	-4.693
Top						
Member 2: (Top Slab)						
Left						
2- 0	-3.252	-15.632	0.692	4.693	14.249	4.076
2- 1	4.927	-1.929	0.692	4.693	11.359	3.208
2- 2	15.093	1.717	0.692	3.743	8.529	2.339
2- 3	22.968	4.162	0.692	3.743	5.811	0.611
2- 4	26.908	5.493	0.692	3.743	3.429	-1.647
2- 5	26.895	5.710	0.692	3.743	1.185	-4.014
2- 6	22.928	4.145	0.692	4.693	-0.939	-6.402
2- 7	15.100	-0.289	0.692	4.693	-2.001	-8.742
2- 8	4.125	-6.492	3.311	2.074	-2.870	-11.238
2- 9	-4.564	-18.166	3.743	2.074	-3.738	-14.129
2-10	-9.918	-33.508	3.743	2.074	-4.606	-16.961
Right						
Member 3: (Interior Wall)						
Bottom						
3- 0	3.367	-1.256	13.503	26.252	1.035	-0.995
3- 1	2.721	-0.428	13.503	26.252	1.035	-0.995
3- 2	2.085	0.360	13.503	8.947	1.035	-0.995
3- 3	1.660	0.340	13.503	8.947	1.035	-0.995
3- 4	2.317	-0.214	13.503	26.252	1.035	-0.995
3- 5	3.154	-1.042	13.503	26.252	1.035	-0.995
3- 6	3.992	-1.844	13.503	26.252	1.035	-0.995
3- 7	4.829	-2.647	13.503	26.252	1.035	-0.995
3- 8	5.672	-3.449	13.503	26.252	1.035	-0.995
3- 9	6.515	-4.252	13.503	26.252	1.035	-0.995
3-10	7.358	-5.054	13.503	26.252	1.035	-0.995
Top						
Member 4: (Bottom Slab)						
Left						
4- 0	-5.971	-10.841	0.853	5.360	8.257	4.646
4- 1	2.943	-2.220	0.853	4.928	6.427	3.656
4- 2	9.225	1.837	0.853	4.928	4.599	2.666
4- 3	13.292	4.624	0.853	4.928	2.774	1.677
4- 4	15.148	6.141	0.853	4.928	0.951	0.553
4- 5	14.647	6.387	0.853	4.928	-0.303	-1.312
4- 6	11.967	5.364	0.853	4.928	-1.293	-3.149
4- 7	7.055	3.070	0.853	4.928	-2.282	-4.986
4- 8	-0.151	-1.894	3.978	2.235	-3.272	-6.823
4- 9	-5.328	-11.398	4.928	2.235	-4.262	-8.660
4-10	-11.432	-23.656	4.928	2.235	-5.251	-10.497
Right						
Member 5: (Top Slab - Interior Cell)						
Bottom						
5- 0	-9.717	-31.960	3.767	1.678	15.497	4.341
5- 1	-4.703	-18.182	3.767	1.678	12.607	3.473
5- 2	3.444	-8.733	3.557	1.678	9.777	2.605
5- 3	12.550	-3.210	3.557	1.678	7.459	1.736
5- 4	18.453	0.562	3.557	1.678	5.115	-0.456
5- 5	20.429	2.581	3.557	1.678	2.772	-2.772
5- 6	18.453	0.562	3.557	1.678	0.456	-5.115
5- 7	12.550	-3.210	3.557	1.678	-1.736	-7.459
5- 8	3.444	-8.733	3.557	1.678	-2.605	-9.777
5- 9	-4.703	-18.182	3.767	1.678	-3.473	-12.607
5-10	-9.717	-31.960	3.767	1.678	-4.341	-15.497
Top						
Member 7: (Bottom Slab - Interior Cell)						
Left						

7- 0	-11.032	-22.184	4.903	1.984	9.300	4.949
7- 1	-5.316	-11.869	4.903	1.984	7.463	3.959
7- 2	-0.871	-3.791	4.903	1.984	5.626	2.969
7- 3	4.415	2.280	4.379	1.984	3.789	1.979
7- 4	7.773	4.210	4.379	4.903	1.953	0.990
7- 5	8.892	4.845	4.379	4.903	0.190	-0.190
7- 6	7.773	4.210	4.379	4.903	-0.990	-1.953
7- 7	4.415	2.280	4.379	1.984	-1.979	-3.789
7- 8	-0.871	-3.791	4.903	1.984	-2.969	-5.626
7- 9	-5.316	-11.869	4.903	1.984	-3.959	-7.463
7-10	-11.032	-22.184	4.903	1.984	-4.949	-9.300

Right