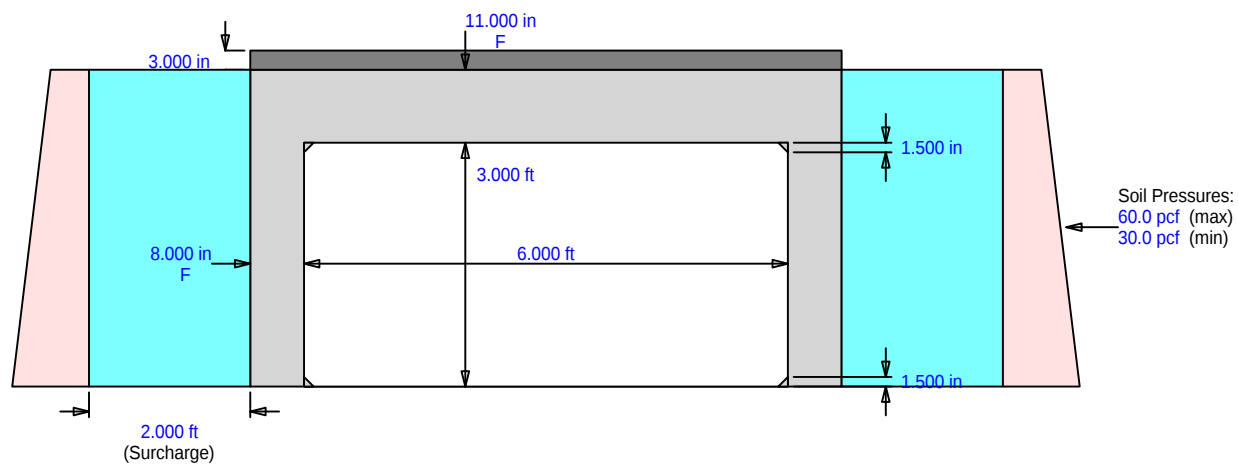


APPENDIX E

Load Rating Calculations



AASHTO LRFD HL-93 Design Truck (US) / No Lane (due to fill depth)	
Controlling Rating Factor	
Action Type	Flexure
Location	Middle of top slab, inside face
Rating Type	Inventory
Rating Factor	0.86
Controlling Rating Factor	
Action Type	Flexure
Location	Middle of top slab, inside face
Rating Type	Operating
Rating Factor	1.11

AASHTO LRFD HL-93 Design Tandem (US) / No Lane (due to fill depth)	
Controlling Rating Factor	
Action Type	Flexure
Location	Middle of top slab, inside face
Rating Type	Inventory
Rating Factor	1.10
Controlling Rating Factor	
Action Type	Flexure
Location	Middle of top slab, inside face
Rating Type	Operating
Rating Factor	1.42

AASHTO Type 3 Rating Truck (US)/ No Lane Specified	
Controlling Rating Factor	
Action Type	Flexure
Location	Middle of top slab, inside face
Rating Type	Legal
Rating Factor	1.42

AASHTO Type 3S2 Rating Truck (US)/ No Lane Specified	
Controlling Rating Factor	
Action Type	Flexure
Location	Middle of top slab, inside face
Rating Type	Legal
Rating Factor	1.56

AASHTO Type 3-3 Rating Truck (US)/ No Lane Specified	
Controlling Rating Factor	
Action Type	Flexure
Location	Middle of top slab, inside face
Rating Type	Legal
Rating Factor	1.51

AASHTO Notional Rating Load (NRL-MIN)/ No Lane Specified	
Controlling Rating Factor	
Action Type	Flexure
Location	Middle of top slab, inside face
Rating Type	Legal
Rating Factor	1.42

AASHTO Notional Rating Load (NRL-MAX)/ No Lane Specified	
Controlling Rating Factor	
Action Type	Flexure
Location	Middle of top slab, inside face
Rating Type	Legal
Rating Factor	1.42

AASHTO Spec. Hauling Veh. (SU4 Truck)/ No Lane Specified	
Controlling Rating Factor	
Action Type	Flexure
Location	Middle of top slab, inside face
Rating Type	Legal
Rating Factor	1.42

AASHTO Spec. Hauling Veh. (SU5 Truck)/ No Lane Specified	
Controlling Rating Factor	
Action Type	Flexure
Location	Middle of top slab, inside face
Rating Type	Legal
Rating Factor	1.42

AASHTO Spec. Hauling Veh. (SU6 Truck)/ No Lane Specified	
Controlling Rating Factor	
Action Type	Flexure
Location	Middle of top slab, inside face
Rating Type	Legal
Rating Factor	1.42

AASHTO Spec. Hauling Veh. (SU7 Truck)/ No Lane Specified	
Controlling Rating Factor	
Action Type	Flexure
Location	Middle of top slab, inside face
Rating Type	Legal
Rating Factor	1.42

HI Std. Single Trip Permit Trucks (HP1)/ No Lane Specified	
Controlling Rating Factor	
Action Type	Flexure
Location	Middle of top slab, inside face
Rating Type	Legal
Rating Factor	1.00

HI Std. Single Trip Permit Trucks (HP2)/ No Lane Specified	
Controlling Rating Factor	
Action Type	Flexure
Location	Middle of top slab, inside face
Rating Type	Legal
Rating Factor	0.60

HI Std. Single Trip Permit Trucks (HP3)/ No Lane Specified	
Controlling Rating Factor	
Action Type	Flexure
Location	Middle of top slab, inside face
Rating Type	Legal
Rating Factor	1.19

EXTWALL (Inside)	B1	60	4	STR	3- 6	140
LONGITUD.(1)	C1	20	4	STR	29- 9	398
LONGITUD.(1)	C100	9	4	STR	29- 9	179
	F1	7	4	STR	8- 7	0
Total weight black bars						1793
Total weight all bars						1793

The minimum temperature and shrinkage steel for the:

Top slab(s) = 0.4400 in2
 Bottom slab(s) = 0.0000 in2
 Exterior wall(s) = 0.3200 in2

Splice Lengths Chart

Mark	Size	Splice (Ft-In)	Length (m)
B1	4	1- 9	0.533
C1	4	1- 9	0.533
C100	4	1- 9	0.533

PAGE151
 DATE 03/01/2017
 BRASS-CULVERT(LRFD) Version 2.3.0
 FARRINGTON HWY BOX CULV NO. 1

Factored Actions for Load and Resistance Factor Design at Tenth Points (per unit design width)

M-Pt	+Moment (Kft)	-Moment (Kft)	+A.F. (Kips)	-A.F. (Kips)	+Shear (Kips)	-Shear (Kips)
EXTERIOR WALL BOTTOM						
1- 0	0.000	0.000	-0.510	-11.549	0.643	-1.076
1- 1	0.191	-0.384	-0.331	-11.550	0.465	-1.146
1- 2	0.323	-0.792	-0.331	-11.550	0.297	-1.209
1- 3	0.398	-1.220	-0.331	-11.550	0.139	-1.266
1- 4	0.420	-1.667	-0.331	-11.550	-0.007	-1.319
1- 5	0.393	-2.130	-0.331	-11.550	-0.083	-1.426
1- 6	0.319	-2.607	-0.331	-11.550	-0.121	-1.555
1- 7	0.203	-3.097	-0.331	-11.550	-0.152	-1.674
1- 8	0.046	-3.595	-0.331	-11.550	-0.177	-1.784
1- 9	-0.133	-4.123	-0.332	-11.548	-0.195	-1.884
1-10	-0.232	-4.791	-0.332	-11.548	-0.207	-1.974
EXTERIOR WALL TOP						
TOP SLAB LEFT SIDE						
2- 0	-0.232	-4.791	-0.293	-1.883	11.550	0.331
2- 1	3.211	-1.243	-0.323	-1.853	9.101	-0.434
2- 2	6.427	-0.153	-0.323	-1.853	7.417	-1.275
2- 3	8.864	-0.022	-0.323	-1.853	5.739	-2.196
2- 4	10.152	0.000	-0.323	-1.853	4.717	-3.127
2- 5	10.629	0.000	-0.323	-1.853	3.686	-4.134
2- 6	10.121	0.000	-0.323	-1.853	2.686	-5.166
2- 7	8.878	-0.026	-0.323	-1.853	1.742	-6.492
2- 8	6.385	-0.166	-0.323	-1.853	0.864	-8.174
2- 9	3.144	-1.283	-0.323	-1.853	0.078	-9.860
2-10	-0.231	-4.839	-0.293	-1.883	-0.335	-11.520
TOP SLAB RIGHT SIDE						

Output complete for a HFD9 / No Lane vehicle

PAGE152
 DATE 03/01/2017
 BRASS-CULVERT(LRFD) Version 2.3.0
 FARRINGTON HWY BOX CULV NO. 1

1991-1993 SEAGRAVE (HFD1)/ No Lane Specified	
Controlling Rating Factor	
Action Type	Flexure
Location	Middle of top slab, inside face
Rating Type	Legal
Rating Factor	1.00

1992-2002 PIERCE (HFD2)/ No Lane Specified	
Controlling Rating Factor	
Action Type	Flexure
Location	Middle of top slab, inside face
Rating Type	Legal
Rating Factor	1.00

2006 PIERCE (HFD3)/ No Lane Specified	
Controlling Rating Factor	
Action Type	Flexure
Location	Middle of top slab, inside face
Rating Type	Legal
Rating Factor	1.00

2008 PIERCE (HFD4)/ No Lane Specified	
Controlling Rating Factor	
Action Type	Flexure
Location	Middle of top slab, inside face
Rating Type	Legal
Rating Factor	0.89

2009 PIERCE (HFD5)/ No Lane Specified	
Controlling Rating Factor	
Action Type	Flexure
Location	Middle of top slab, inside face
Rating Type	Legal
Rating Factor	0.89

2010 PIERCE (HFD6)/ No Lane Specified	
Controlling Rating Factor	
Action Type	Flexure
Location	Middle of top slab, inside face
Rating Type	Legal
Rating Factor	0.89

QUINT 85' SINGLE AXLE (HFD7)/ No Lane Specified	
Controlling Rating Factor	
Action Type	Flexure
Location	Middle of top slab, inside face
Rating Type	Legal
Rating Factor	0.76

QUINT 100' TANDEM AXEL (HFD8)/ No Lane Specified	
Controlling Rating Factor	
Action Type	Flexure
Location	Middle of top slab, inside face
Rating Type	Legal
Rating Factor	1.09

TOWER APPARATUS (HFD9)/ No Lane Specified	
Controlling Rating Factor	
Action Type	Flexure
Location	Middle of top slab, inside face
Rating Type	Legal
Rating Factor	0.92

Reinforcing Steel Bar Schedule

Location	Mark	Qty	Size	Type	Length (Ft-In)	Wgt (Lbs)	H Leg (Ft-In)	V Leg (Ft-In)
TOP SLAB (Inside)	A100	52	5	STR	7- 0	380		
CORNER (Top)	A1	90	5	L-BAR	6- 9	634	3- 8	3- 1
EXTWALL (Inside)	B1	60	4	STR	3- 6	140		
LONGITUD.(1)	C1	20	4	STR	29- 9	398		
LONGITUD.(1)	C100	9	4	STR	29- 9	179		
	F1	7	4	STR	8- 7	0		
Total weight black bars						1731		
Total weight all bars						1731		

The minimum temperature and shrinkage steel for the:

Top slab(s) = 0.4400 in2

Bottom slab(s) = 0.0000 in2

Exterior wall(s) = 0.3200 in2

Splice Lengths Chart

Mark	Size	Splice (Ft-In)	Length (m)
B1	4	1- 9	0.533
C1	4	1- 9	0.533
C100	4	1- 9	0.533

PAGE151
DATE 03/01/2017
BRASS-CULVERT(LRFD) Version 2.3.0
FARRINGTON HWY BOX CULV NO. 1

Factored Actions for Load and Resistance Factor Design at Tenth Points (per unit design width)

M-Pt	+Moment (Kft)	-Moment (Kft)	+A.F. (Kips)	-A.F. (Kips)	+Shear (Kips)	-Shear (Kips)
EXTERIOR WALL BOTTOM						
1- 0	0.000	0.000	-0.510	-10.346	0.655	-1.164
1- 1	0.196	-0.415	-0.331	-10.346	0.477	-1.234
1- 2	0.331	-0.852	-0.331	-10.346	0.310	-1.297
1- 3	0.411	-1.311	-0.331	-10.346	0.151	-1.354
1- 4	0.437	-1.788	-0.331	-10.346	0.005	-1.407
1- 5	0.414	-2.282	-0.331	-10.346	-0.071	-1.513
1- 6	0.344	-2.790	-0.331	-10.346	-0.109	-1.642
1- 7	0.232	-3.309	-0.331	-10.346	-0.140	-1.762
1- 8	0.080	-3.838	-0.331	-10.346	-0.164	-1.872
1- 9	-0.095	-4.397	-0.332	-10.345	-0.183	-1.972
1-10	-0.190	-5.094	-0.332	-10.345	-0.194	-2.062
EXTERIOR WALL TOP						
TOP SLAB LEFT SIDE						
2- 0	-0.190	-5.094	-0.281	-1.970	10.347	0.331
2- 1	3.706	-1.432	-0.311	-1.940	8.984	-0.568
2- 2	7.310	-0.164	-0.311	-1.940	7.905	-1.516
2- 3	10.097	0.000	-0.311	-1.940	6.736	-2.592
2- 4	11.854	0.000	-0.311	-1.940	5.533	-3.735
2- 5	12.498	0.000	-0.311	-1.940	4.319	-4.923
2- 6	11.893	0.000	-0.311	-1.940	3.147	-6.133
2- 7	10.131	-0.040	-0.311	-1.940	2.036	-7.315
2- 8	7.359	-0.178	-0.311	-1.940	1.009	-8.446
2- 9	3.728	-1.478	-0.311	-1.940	0.146	-9.469
2-10	-0.316	-5.156	-0.281	-1.970	-0.335	-10.369
TOP SLAB RIGHT SIDE						

Output complete for a HFD18 / No Lane vehicle

PAGE152
DATE 03/01/2017
BRASS-CULVERT(LRFD) Version 2.3.0
FARRINGTON HWY BOX CULV NO. 1

1992-1993 SEAGRAVE LADDER (HFD10)/ No Lane Specified	
Controlling Rating Factor	
Action Type	Flexure
Location	Middle of top slab, inside face
Rating Type	Legal
Rating Factor	1.00

TANKER 2500 GAL (HFD11)/ No Lane Specified

Controlling Rating Factor	
Action Type	Flexure
Location	Middle of top slab, inside face
Rating Type	Legal
Rating Factor	1.20

(1500 GAL) RET T-412, 339 (HFD12)/ No Lane Specified

Controlling Rating Factor	
Action Type	Flexure
Location	Middle of top slab, inside face
Rating Type	Legal
Rating Factor	1.27

TANKER 26 (HFD13)/ No Lane Specified

Controlling Rating Factor	
Action Type	Flexure
Location	Middle of top slab, inside face
Rating Type	Legal
Rating Factor	1.20

TANKER 12-28 (HFD14)/ No Lane Specified

Controlling Rating Factor	
Action Type	Flexure
Location	Middle of top slab, inside face
Rating Type	Legal
Rating Factor	0.79

2010 TANKER (2000 GAL) (HFD15)/ No Lane Specified

Controlling Rating Factor	
Action Type	Flexure
Location	Middle of top slab, inside face
Rating Type	Legal
Rating Factor	0.80

SPARTAN RESUE APPARATUS (HFD16)/ No Lane Specified

Controlling Rating Factor	
Action Type	Flexure
Location	Middle of top slab, inside face
Rating Type	Legal
Rating Factor	0.99

SVI HAZMAT APPARATUS (HFD17)/ No Lane Specified

Controlling Rating Factor	
Action Type	Flexure
Location	Middle of top slab, inside face
Rating Type	Legal
Rating Factor	1.00

2010 PIERCE 100' (HFD18)/ No Lane Specified

Controlling Rating Factor	
Action Type	Flexure
Location	Middle of top slab, inside face
Rating Type	Legal
Rating Factor	0.77

USAR TRAILER (HFD19A)/ No Lane Specified

Controlling Rating Factor	
Action Type	Flexure
Location	Middle of top slab, inside face
Rating Type	Legal
Rating Factor	0.90

USAR TRAILER (HFD19B)/ No Lane Specified

Controlling Rating Factor	
Action Type	Flexure
Location	Middle of top slab, inside face
Rating Type	Legal
Rating Factor	0.92

MASS DECON TRAILER (HFD20A)/ No Lane Specified

Controlling Rating Factor	
Action Type	Flexure
Location	Middle of top slab, inside face
Rating Type	Legal
Rating Factor	0.90

MASS DECON TRAILER (HFD20B)/ No Lane Specified

Controlling Rating Factor	
Action Type	Flexure
Location	Middle of top slab, inside face
Rating Type	Legal
Rating Factor	0.92

MOBILE COMMAND CENTER (HFD21)/ No Lane Specified

Controlling Rating Factor	
Action Type	Flexure
Location	Middle of top slab, inside face
Rating Type	Legal
Rating Factor	1.00

COMMUNICATION VEHICLE (HFD22)/ No Lane Specified

Controlling Rating Factor	
Action Type	Flexure
Location	Middle of top slab, inside face
Rating Type	Legal
Rating Factor	1.05

Output complete for a BUS4 / No Lane vehicle

PAGE137
DATE 03/01/2017
BRASS-CULVERT (LRFD) Version 2.3.0
FARRINGTON HWY BOX CULV NO. 1

27 YARD TAPERED AUTOREACH (REF1)/ No Lane Specified	
Controlling Rating Factor	
Action Type	Flexure
Location	Middle of top slab, inside face
Rating Type	Legal
Rating Factor	1.29

25 YARD DURAPACK FORMULA 5000 (REF2)/ No Lane Specified	
Controlling Rating Factor	
Action Type	Flexure
Location	Middle of top slab, inside face
Rating Type	Legal
Rating Factor	1.21

20 YARD HEAVY DUTY RL (REF3)/ No Lane Specified	
Controlling Rating Factor	
Action Type	Flexure
Location	Middle of top slab, inside face
Rating Type	Legal
Rating Factor	1.42

43 YARD PACIFIC 85 (REF4)/ No Lane Specified	
Controlling Rating Factor	
Action Type	Flexure
Location	Middle of top slab, inside face
Rating Type	Legal
Rating Factor	1.23

OPUS 25-29 (BUS1)/ No Lane Specified	
Controlling Rating Factor	
Action Type	Flexure
Location	Middle of top slab, inside face
Rating Type	Legal
Rating Factor	1.18

GILLIG 40-49 (BUS2)/ No Lane Specified	
Controlling Rating Factor	
Action Type	Flexure
Location	Middle of top slab, inside face
Rating Type	Legal
Rating Factor	0.96

GILLIG 50-59 (BUS3)/ No Lane Specified	
Controlling Rating Factor	
Action Type	Flexure
Location	Middle of top slab, inside face
Rating Type	Legal
Rating Factor	0.96

NEW FLYER 110-115 (BUS4)/ No Lane Specified	
Controlling Rating Factor	
Action Type	Flexure
Location	Middle of top slab, inside face
Rating Type	Legal
Rating Factor	0.95

M-Pt	+Moment (Kft)	-Moment (Kft)	+A.F. (Kips)	-A.F. (Kips)	+Shear (Kips)	-Shear (Kips)
EXTERIOR WALL BOTTOM						
1- 0	0.000	0.000	-0.510	-9.147	0.637	-1.026
1- 1	0.189	-0.367	-0.331	-9.147	0.460	-1.096
1- 2	0.319	-0.757	-0.331	-9.147	0.292	-1.160
1- 3	0.392	-1.169	-0.331	-9.147	0.134	-1.217
1- 4	0.413	-1.598	-0.331	-9.147	-0.013	-1.269
1- 5	0.383	-2.044	-0.331	-9.147	-0.089	-1.376
1- 6	0.307	-2.505	-0.331	-9.147	-0.126	-1.505
1- 7	0.189	-2.977	-0.331	-9.147	-0.158	-1.625
1- 8	0.030	-3.458	-0.331	-9.147	-0.182	-1.734
1- 9	-0.151	-3.969	-0.332	-9.146	-0.201	-1.834
1-10	-0.251	-4.619	-0.332	-9.146	-0.212	-1.925
EXTERIOR WALL TOP						

TOP SLAB LEFT SIDE						
2- 0	-0.251	-4.619	-0.314	-1.834	9.320	0.331
2- 1	3.311	-1.308	-0.344	-1.804	8.089	-0.481
2- 2	6.563	-0.157	-0.344	-1.804	7.112	-1.337
2- 3	9.077	0.000	-0.344	-1.804	6.055	-2.308
2- 4	10.657	0.000	-0.344	-1.804	4.967	-3.338
2- 5	11.238	0.000	-0.344	-1.804	3.869	-4.409
2- 6	10.692	0.000	-0.344	-1.804	2.812	-5.503
2- 7	9.104	-0.022	-0.344	-1.804	1.810	-6.572
2- 8	6.604	-0.171	-0.344	-1.804	0.884	-7.596
2- 9	3.327	-1.351	-0.344	-1.804	0.102	-8.523
2-10	-0.316	-4.677	-0.314	-1.834	-0.335	-9.339
TOP SLAB RIGHT SIDE						

Output complete for a BUS11 / No Lane vehicle

PAGE122
DATE 03/01/2017
BRASS-CULVERT(LRFD) Version 2.3.0
FARRINGTON HWY BOX CULV NO. 1

NEW FLYER 132-141 (BUS5)/ No Lane Specified	
Controlling Rating Factor	
Action Type	Flexure
Location	Middle of top slab, inside face
Rating Type	Legal
Rating Factor	0.84

NEW FLYER 151-160 (BUS6)/ No Lane Specified	
Controlling Rating Factor	
Action Type	Flexure
Location	Middle of top slab, inside face
Rating Type	Legal
Rating Factor	0.87

NEW FLYER 161-181 (BUS7)/ No Lane Specified	
Controlling Rating Factor	
Action Type	Flexure
Location	Middle of top slab, inside face
Rating Type	Legal
Rating Factor	0.86

NOVA 201-224 (BUS8)/ No Lane Specified	
Controlling Rating Factor	
Action Type	Flexure
Location	Middle of top slab, inside face
Rating Type	Legal
Rating Factor	0.89

GILLIG 501-555 (BUS9)/ No Lane Specified	
Controlling Rating Factor	
Action Type	Flexure
Location	Middle of top slab, inside face
Rating Type	Legal
Rating Factor	0.96

GILLIG 854-868 (BUS10)/ No Lane Specified	
---	--

Controlling Rating Factor	
Action Type	Flexure
Location	Middle of top slab, inside face
Rating Type	Legal
Rating Factor	0.96

NEW FLYER 901-940 (BUS11)/ No Lane Specified	
Controlling Rating Factor	
Action Type	Flexure
Location	Middle of top slab, inside face
Rating Type	Legal
Rating Factor	0.86