VEENSTRA & KIMM, INC.
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June 11, 2015 **ENGINEER'S REPORT**

3rd Ave & 5th Ave Reconstruction

Plans were reviewed with City staff on June 11th. We anticipate setting the bid date and public hearing date for the plans, specifications, form of contract and estimate of cost at the June 15th City Council meeting. Permit applications are underway and will be submitted to the necessary agencies. The schedule is to receive bids July 15th and award the project to the low bidder at the July 20th City Council meeting. Construction will begin in August with completion in November.

Lisbon Road Overlay

LL Pelling began work on June 8th and completed the asphalt overlay and pavement markings on June 10th. As previously discussed, the ditch on the south side was cleaned by city crews to remove debris and trees within the right-of-way. There is no edge support for the roadway in this area which increases the potential for settlement of the pavement along the edge of the road. Council has discussed completing drainage calculations and sizing storm sewer for this area so the ditch can be filled and curb & gutter installed. It is recommended that this approach be pursued.

Sewer Rehabilitation/Replacement

Work on the 4th street SE sewer project began on May 21st and is now complete with the exception of a few testing procedures. Work on the Shepley line is progressing with the sewer line bored in place and the manhole at 3rd Street NE installed. The contractor will be working to connect service lines and install the manholes at 2nd Street NE and at the east/west alley at the south end of the project. Street replacement around the 3rd Street NE manhole will begin the week of June 15th.

Prairie Park Water Plant

Plans and specifications are being finalized for replacement of the filter unit at the water plant. We anticipate setting the bid date and public hearing date for the plans, specifications, form of contract and estimate of cost at the June 15th City Council meeting. The schedule is to receive bids in July. It is likely that construction will not begin until the new filter unit is fabricated and ready to ship. Due to fabrication time and other procedural delays, the completion date will be set for early spring of 2016.

Palisades Road Geotechnical Services

Terracon completed the soil borings on Friday, May 29th. They are conducting laboratory tests on the samples and should have a report for review shortly. Preliminary discussions indicate that base stabilization is required prior to constructing improvements on the roadway. The extent of the corrective work and the recommended pavement section will be included in the report.

Wagon Pass

V&K conducted an inspection of the wagon pass on June 4th. A letter is attached with the load rating calculations and recommended action. This issue is included on the Council agenda for discussion and possible action.

VEENSTRA & KIMM, INC.
Dave Schechinger, P.E.

VEENSTRA & KIMM, INC.
3000 Westown Parkway • West Des Moines, Iowa 50266-1320
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June 9, 2015

Mike Beimer
City Administrator
City of Mount Vernon
213 First Street NW
Mount Vernon, IA 52314

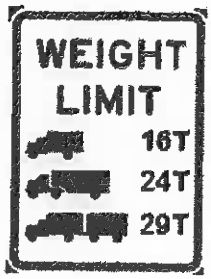
Mount Vernon, Iowa
Wagon Pass RCBC
Structural Evaluation and Rating
Letter / Report

Mr. Beimer,

On June 4, 2015 Veenstra and Kimm, Inc. completed a general inspection of the Wagon Pass reinforced concrete box culvert. The structure is located at the northwest end of town on 1st St. W. and serves as an underpass for a local farmer. The purpose of this inspection was to visually observe the readily accessible portions of the structure and identify the amount and extent of any structural deterioration.

A significant amount of deterioration was identified as shown in the included pictures. The concrete is severely deteriorated, especially throughout the top slab where a significant amount of concrete has spalled away. The concrete that has not spalled off is cracking and leaching and will likely spall away in the future. The exposed reinforcing has lost much of its bond with the concrete and is severely corroded with a significant amount of section loss.

A rating calculation was performed based on the findings of the inspection. It is our recommendation that the City immediately post this structure accordingly: 416, 524, 629. See attached example of posting sign. It is also our recommendation that the City barricade the underside of the structure, blocking anyone from passing through, due to the danger of falling debris. In addition, we recommend that this structure be inspected annually, at a minimum, to monitor future deterioration.



If you have any questions please let us know.

Thank you,

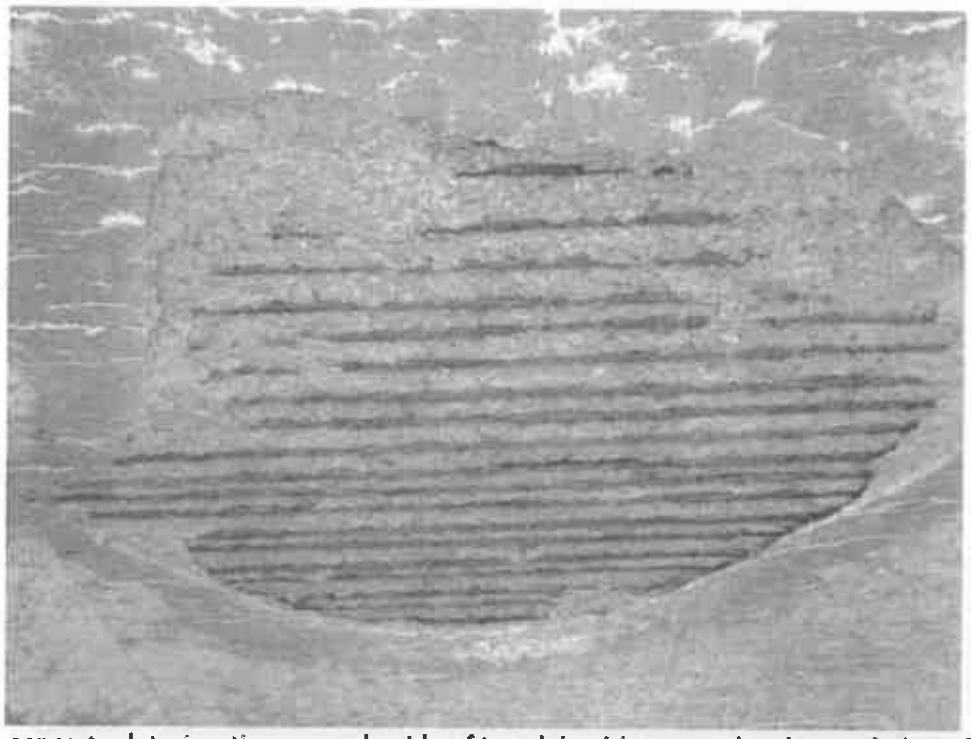
Dallas Schechinger, P.E.
Veenstra & Kimm, Inc.

Site Photos Taken: June 4, 2015

Side view looking west, note concrete deterioration

Under view looking west, note spalling with exposed reinforcing

Site Photos Taken: June 4, 2015



Severe concrete deterioration on underside of top slab with exposed and corroded reinforcing

Severe concrete deterioration at southwest wing (typical)

SUMMARY - SINGLE 14' x 12.5' R.C.B. CULVERT

CALHOUN-BURNS AND ASSOCIATES, INC.
BRIDGE NUMBER : *NONE*
CITY / COUNTY : *MOUNT VERNON*

FILL HEIGHT: *1.9 FT*
DESIGN LOAD: *H15*
YEAR BUILT: *1935*

INIT: *RMJ*
DATE: *6/5/2015*

TRUCK	INVENTORY RATING	OPERATING RATING	
TYPE 4	*9.8 T*	*16.3 T*	
TYPE 3S3A	*14.4 T*	*24.0 T*	
TYPE 3-3	*17.5 T*	*29.2 T*	
TYPE 3S3B	*16.2 T*	*27.0 T*	
TYPE 4S3	*17.2 T*	*28.8 T*	
HS20	*11.0 T*	*18.4 T*	

REMARKS :

CONTROLS RATING AT:
0.5000 POINT OF SLAB,BENDING, NEAR MIDSPAN , 0.5 PT

LOAD FACTOR ANALYSIS

CALHOUN-BURNS AND ASSOCIATES, INC.
BRIDGE NUMBER : *NONE*
CITY / COUNTY : *MOUNT VERNON*

INIT: *RMJ*
DATE: *6/5/2015*

MEMBER : *SLAB, BENDING, NEAR CENTER WALL*
0.9417 POINT

YEAR BUILT : *1935*

GEOMETRY : *SINGLE 14' x 12.5' R.C.B. CULVERT*

LANES : *2*

ULTIMATE MOMENT *0.00 k'*

LATERAL SUPPORT:
FULL

SECTION PROPERTIES :

t	15.000	in.
d	13	in.
As	0.000	$in.^2/ft$
Fy	33	ksi
f'c	1.5	ksi

DEAD LOAD:

FILL HEIGHT=	1.9 FEET
UNIT WEIGHT OF SOIL	120 LBS/CF
LATERAL EARTH LOAD	30 LBS/CF

IMPACT : *1.200*

LL DIST FACTOR:

WH FACTOR

UNFACTORED DL MOMENT *0.00 k'*

FACTORED DL MOMENT *0.00 k'*

TRUCK	UNFACTORED M_{LL+I}	INVENTORY M_{LL+I}	OPERATING M_{LL+I}
TYPE 4	0.00 k'	0.00 k'	0.00 k'
TYPE 3S3A	0.00 k'	0.00 k'	0.00 k'
TYPE 3-3	0.00 k'	0.00 k'	0.00 k'
TYPE 3S3B	0.00 k'	0.00 k'	0.00 k'
TYPE 4S3	0.00 k'	0.00 k'	0.00 k'
HS20	0.00 k'	0.00 k'	0.00 k'

TRUCK	INVENTORY RATING	OPERATING RATING	
TYPE 4	1800.5 T (L)	3005.4 T (L)	
TYPE 3S3A	2761.9 T (L)	4610.3 T (L)	
TYPE 3-3	2889.8 T (L)	4823.8 T (L)	
TYPE 3S3B	2997.5 T (L)	5003.6 T (L)	
TYPE 4S3	3235.8 T (L)	5401.3 T (L)	
HS20	1758.7 T (L)	2935.6 T (L)	

REMARKS :

NOT APPLICABLE FOR SINGLE SPAN

LOAD FACTOR ANALYSIS

CALHOUN-BURNS AND ASSOCIATES, INC.
BRIDGE NUMBER : *NONE*
CITY / COUNTY : *MOUNT VERNON*

INIT: *RMJ*
DATE: *6/5/2015*

MEMBER : *SLAB,BENDING, NEAR MIDSPAN , 0.5 PT*
0.5000 POINT

YEAR BUILT : *1935*

GEOMETRY : *SINGLE 14' x 12.5' R.C.B. CULVERT*

LANES : *2*

ULTIMATE MOMENT *17.69 k'*

LATERAL SUPPORT:
FULL

SECTION PROPERTIES :

t	15.000	in.
d	12.5625	in.
As	0.600	in.^{2}/ft
Fy	33	ksi
f'c	1.5	ksi

DEAD LOAD:

FILL HEIGHT=	1.9	FEET
UNIT WEIGHT OF SOIL	120	LBS/CF
LATERAL EARTH LOAD	30	LBS/CF

IMPACT : *1.200*

LL DIST FACTOR:

WH FACTOR

UNFACTORED DL MOMENT *5.88 k'*

FACTORED DL MOMENT *7.64 k'*

TRUCK	UNFACTORED M_{LL+I}	INVENTORY M_{LL+I}	OPERATING M_{LL+I}
TYPE 4	12.91 k'	28.02 k'	16.79 k'
TYPE 3S3A	12.90 k'	27.99 k'	16.77 k'
TYPE 3-3	10.61 k'	23.03 k'	13.80 k'
TYPE 3S3B	12.89 k'	27.97 k'	16.75 k'
TYPE 4S3	12.91 k'	28.02 k'	16.79 k'
HS20	15.18 k'	32.93 k'	19.73 k'

TRUCK	INVENTORY RATING	OPERATING RATING	
TYPE 4	9.8 T	16.3 T	
TYPE 3S3A	14.4 T	24.0 T	
TYPE 3-3	17.5 T	29.2 T	
TYPE 3S3B	16.2 T	27.0 T	
TYPE 4S3	17.2 T	28.8 T	
HS20	11.0 T	18.4 T	

REMARKS :

LOAD FACTOR ANALYSIS

CALHOUN-BURNS AND ASSOCIATES, INC.
BRIDGE NUMBER : *NONE*
CITY / COUNTY : *MOUNT VERNON*

INIT: *RMJ*
DATE: *6/5/2015*

MEMBER : *SLAB, BENDING, NEAR EXTERIOR WALL*
0.0583 POINT

YEAR BUILT : *1935*

GEOMETRY : *SINGLE 14' x 12.5' R.C.B. CULVERT*

LANES : *2*

ULTIMATE MOMENT *-13.23 k'*

LATERAL SUPPORT: *FULL*

SECTION PROPERTIES :

t	15.000	in.
d	12.625	in.
As	0.440	$in.^2/ft$
Fy	33	ksi
f'c	1.5	ksi

DEAD LOAD:

FILL HEIGHT=	1.9	FEET
UNIT WEIGHT OF SOIL	120	LBS/CF
LATERAL EARTH LOAD	60	LBS/CF

IMPACT : *1.200*

LL DIST FACTOR:

WH FACTOR

UNFACTORED DL MOMENT *0.00 k'*

FACTORED DL MOMENT *0.00 k'*

TRUCK	UNFACTORED M_{LL+I}	INVENTORY M_{LL+I}	OPERATING M_{LL+I}
TYPE 4	0.00 k'	0.00 k'	0.00 k'
TYPE 3S3A	0.00 k'	0.00 k'	0.00 k'
TYPE 3-3	0.00 k'	0.00 k'	0.00 k'
TYPE 3S3B	0.00 k'	0.00 k'	0.00 k'
TYPE 4S3	0.00 k'	0.00 k'	0.00 k'
HS20	0.00 k'	0.00 k'	0.00 k'

TRUCK	INVENTORY RATING	OPERATING RATING
TYPE 4	1075947.8 T (L)	###### T (L)
TYPE 3S3A	1569210.7 T (L)	###### T (L)
TYPE 3-3	1911546.6 T (L)	###### T (L)
TYPE 3S3B	1819005.6 T (L)	###### T (L)
TYPE 4S3	1883052.8 T (L)	###### T (L)
HS20	1295582.9 T (L)	###### T (L)

REMARKS :

HINGED AT THIS LOCATION

LOAD FACTOR ANALYSIS

CALHOUN-BURNS AND ASSOCIATES, INC.
BRIDGE NUMBER : *NONE*
CITY / COUNTY : *MOUNT VERNON*

INIT: *RMJ*
DATE: *6/5/2015*

MEMBER : *EXTERIOR WALL, BENDING, NEAR SLAB*
0.0783 POINT

YEAR BUILT : *1935*

GEOMETRY : *SINGLE 14' x 12.5' R.C.B. CULVERT*

LANES : *2*

ULTIMATE MOMENT *9.96 k'*

LATERAL SUPPORT:
FULL

SECTION PROPERTIES :

t	12.000	in.
d	9.625	in.
As	0.440	$in.^2/ft$
Fy	33	ksi
f'c	1.5	ksi

DEAD LOAD:

FILL HEIGHT=	1.9	FEET
UNIT WEIGHT OF SOIL	120	LBS/CF
LATERAL EARTH LOAD	60	LBS/CF

IMPACT : *1.200*

LL DIST FACTOR:

WH FACTOR

UNFACTORED DL MOMENT *0.00 k'*

FACTORED DL MOMENT *0.00 k'*

TRUCK	UNFACTORED M_{LL+I}	INVENTORY M_{LL+I}	OPERATING M_{LL+I}
TYPE 4	0.00 k'	0.00 k'	0.00 k'
TYPE 3S3A	0.00 k'	0.00 k'	0.00 k'
TYPE 3-3	0.00 k'	0.00 k'	0.00 k'
TYPE 3S3B	0.00 k'	0.00 k'	0.00 k'
TYPE 4S3	0.00 k'	0.00 k'	0.00 k'
HS20	0.00 k'	0.00 k'	0.00 k'

TRUCK	INVENTORY RATING	OPERATING RATING
TYPE 4	363777.6 T (L)	###### T (L)
TYPE 3S3A	533648.2 T (L)	###### T (L)
TYPE 3-3	676222.1 T (L)	###### T (L)
TYPE 3S3B	626057.7 T (L)	###### T (L)
TYPE 4S3	640377.9 T (L)	###### T (L)
HS20	488051.8 T (L)	###### T (L)

REMARKS :

HINGED AT THIS LOCATION

LOAD FACTOR ANALYSIS

CALHOUN-BURNS AND ASSOCIATES, INC.
BRIDGE NUMBER : NONE
CITY / COUNTY : MOUNT VERNON

INIT: RMJ
DATE: 6/5/2015

MEMBER : EXTERIOR WALL, BENDING, NEAR FLOOR
0.9478 POINT

YEAR BUILT : 1935

GEOMETRY : SINGLE 14' x 12.5' R.C.B. CULVERT

LANES : 2

ULTIMATE MOMENT 17.23 k'

LATERAL SUPPORT:
FULL

SECTION PROPERTIES :

t	12.000	in.
d	9.5625	in.
As	0.800	in.^{2}/ft
Fy	33	ksi
f'c	1.5	ksi

DEAD LOAD:

FILL HEIGHT=	1.9	FEET
UNIT WEIGHT OF SOIL	120	LBS/CF
LATERAL EARTH LOAD	60	LBS/CF

IMPACT : 1.000

LL DIST FACTOR:

WH FACTOR

UNFACTORED DL MOMENT 0.01 k'

FACTORED DL MOMENT 0.01 k'

TRUCK	UNFACTORED M_{LL+I}	INVENTORY M_{LL+I}	OPERATING M_{LL+I}
TYPE 4	0.00 k'	0.01 k'	0.00 k'
TYPE 3S3A	0.00 k'	0.01 k'	0.00 k'
TYPE 3-3	0.00 k'	0.00 k'	0.00 k'
TYPE 3S3B	0.00 k'	0.01 k'	0.00 k'
TYPE 4S3	0.00 k'	0.01 k'	0.00 k'
HS20	0.00 k'	0.01 k'	0.00 k'

TRUCK	INVENTORY RATING	OPERATING RATING	
TYPE 4	91449.3 T (L)	###### T (L)	
TYPE 3S3A	133541.4 T (L)	###### T (L)	
TYPE 3-3	151834.7 T (L)	###### T (L)	
TYPE 3S3B	137986.4 T (L)	###### T (L)	
TYPE 4S3	159981.3 T (L)	###### T (L)	
HS20	97509.0 T (L)	###### T (L)	

REMARKS :

HINGED AT THIS LOCATION

LOAD FACTOR ANALYSIS

CALHOUN-BURNS AND ASSOCIATES, INC.
BRIDGE NUMBER : *NONE*
CITY / COUNTY : *MOUNT VERNON*

INIT: *RMJ*
DATE: *6/5/2015*

MEMBER : *FLOOR, BENDING, NEAR EXTERIOR WALL*
0.0333 POINT

YEAR BUILT : *1935*

GEOMETRY : *SINGLE 14' x 12.5' R.C.B. CULVERT*

LANES : *2*

ULTIMATE MOMENT *29.11 k'*

LATERAL SUPPORT:
FULL

SECTION PROPERTIES :

t	18.000	in.
d	15.5625	in.
As	0.800	in.^{2}/ft
Fy	33	ksi
f'c	1.5	ksi

DEAD LOAD:

FILL HEIGHT=	1.9	FEET
UNIT WEIGHT OF SOIL	120	LBS/CF
LATERAL EARTH LOAD	60	LBS/CF

IMPACT : *1.000*

LL DIST FACTOR:

WH FACTOR

UNFACTORED DL MOMENT *0.01 k'*

FACTORED DL MOMENT *0.02 k'*

TRUCK	UNFACTORED M_{LL+I}	INVENTORY M_{LL+I}	OPERATING M_{LL+I}
TYPE 4	0.00 k'	0.00 k'	0.00 k'
TYPE 3S3A	0.00 k'	0.00 k'	0.00 k'
TYPE 3-3	0.00 k'	0.00 k'	0.00 k'
TYPE 3S3B	0.00 k'	0.00 k'	0.00 k'
TYPE 4S3	0.00 k'	0.00 k'	0.00 k'
HS20	0.00 k'	0.00 k'	0.00 k'

TRUCK	INVENTORY RATING	OPERATING RATING
TYPE 4	215207.4 T (L)	###### T (L)
TYPE 3S3A	313846.1 T (L)	###### T (L)
TYPE 3-3	341620.1 T (L)	###### T (L)
TYPE 3S3B	316533.9 T (L)	###### T (L)
TYPE 4S3	375394.6 T (L)	###### T (L)
HS20	209799.3 T (L)	###### T (L)

REMARKS :

HINGED AT THIS LOCATION

LOAD FACTOR ANALYSIS

CALHOUN-BURNS AND ASSOCIATES, INC.
BRIDGE NUMBER : *NONE*
CITY / COUNTY : *MOUNT VERNON*

INIT: *RMJ*
DATE: *6/5/2015*

MEMBER : *FLOOR, BENDING, NEAR MIDSPAN , 0.4 PT*
0.4000 POINT

YEAR BUILT : *1935*

GEOMETRY : *SINGLE 14' x 12.5' R.C.B. CULVERT*

LANES : *2*

ULTIMATE MOMENT *-42.38 k'*

LATERAL SUPPORT:
FULL

SECTION PROPERTIES :

t	18.000	in.	
d	15.5625	in.	Reduced 0" for mud mat
As	1.200	in.^{2}/ft	
Fy	33	ksi	
f'c	1.5	ksi	

DEAD LOAD:

FILL HEIGHT=	1.9	FEET
UNIT WEIGHT OF SOIL	120	LBS/CF
LATERAL EARTH LOAD	30	LBS/CF

IMPACT : *1.000*

LL DIST FACTOR:

WH FACTOR

UNFACTORED DL MOMENT *-9.13 k'*

FACTORED DL MOMENT *-11.86 k'*

TRUCK	UNFACTORED M_{LL+I}	INVENTORY M_{LL+I}	OPERATING M_{LL+I}
TYPE 4	-9.57 k'	-20.77 k'	-12.44 k'
TYPE 3S3A	-9.59 k'	-20.82 k'	-12.47 k'
TYPE 3-3	-7.33 k'	-15.91 k'	-9.53 k'
TYPE 3S3B	-9.84 k'	-21.36 k'	-12.80 k'
TYPE 4S3	-9.59 k'	-20.82 k'	-12.47 k'
HS20	-9.20 k'	-19.96 k'	-11.96 k'

TRUCK	INVENTORY RATING	OPERATING RATING	
TYPE 4	40.0 T (L)	66.8 T (L)	
TYPE 3S3A	58.6 T (L)	97.9 T (L)	
TYPE 3-3	76.7 T (L)	128.0 T (L)	
TYPE 3S3B	64.3 T (L)	107.3 T (L)	
TYPE 4S3	70.4 T (L)	117.4 T (L)	
HS20	55.0 T (L)	91.9 T (L)	

REMARKS :

LOAD FACTOR ANALYSIS

CALHOUN-BURNS AND ASSOCIATES, INC.

BRIDGE NUMBER : *NONE*

CITY / COUNTY : *MOUNT VERNON*

INIT: *RMJ*

DATE: *6/5/2015*

MEMBER : *FLOOR, BENDING NEAR CENTER WALL*
0.9667 POINT

YEAR BUILT : *1935*

GEOMETRY : *SINGLE 14' x 12.5' R.C.B. CULVERT*

LANES : *2*

ULTIMATE MOMENT *0.00 k'*

LATERAL SUPPORT:
FULL

SECTION PROPERTIES :

t	18.000	in.
d	16	in.
As	0.000	in.^{2}/ft
Fy	33	ksi
f'c	1.5	ksi

DEAD LOAD:

FILL HEIGHT=	1.9	FEET
UNIT WEIGHT OF SOIL	120	LBS/CF
LATERAL EARTH LOAD	30	LBS/CF

IMPACT : *1.000*

LL DIST FACTOR:

WH FACTOR

UNFACTORED DL MOMENT *0.00 k'*

FACTORED DL MOMENT *0.00 k'*

TRUCK	UNFACTORED M_{LL+I}	INVENTORY M_{LL+I}	OPERATING M_{LL+I}
TYPE 4	0.00 k'	0.00 k'	0.00 k'
TYPE 3S3A	0.00 k'	0.00 k'	0.00 k'
TYPE 3-3	0.00 k'	0.00 k'	0.00 k'
TYPE 3S3B	0.00 k'	0.00 k'	0.00 k'
TYPE 4S3	0.00 k'	0.00 k'	0.00 k'
HS20	0.00 k'	0.00 k'	0.00 k'

TRUCK	INVENTORY RATING	OPERATING RATING	
TYPE 4	2841.2 T (L)	4742.6 T (L)	
TYPE 3S3A	4143.4 T (L)	6916.3 T (L)	
TYPE 3-3	3589.0 T (L)	5990.9 T (L)	
TYPE 3S3B	3718.2 T (L)	6206.5 T (L)	
TYPE 4S3	4002.4 T (L)	6681.0 T (L)	
HS20	2209.4 T (L)	3688.0 T (L)	

REMARKS :

NOT APPLICABLE FOR SINGLE SPAN

LOAD FACTOR ANALYSIS

General Information

Bridge Number	NONE
City/County	MOUNT VERNON
Initials	RMJ
Year Built	1935
Fill Height (ft)	1.9
Number of Cells	SINGLE
Culvert Span (ft)	14
Culvert Height (ft)	12.5
Slab Thickness (in)	15
Floor Thickness (in)	18
Wall Thickness (in)	12

Slab Haunch Vertical (in)	12
Slab Haunch Horz (in)	12
Floor Frost Depth (in)	6
Floor Frost Horz Cons Dist. (in)	11
Floor Frost Horz Slope Dist (in)	1
Mud Mat (in)	0
Design Load	H15

THE TOP AND BOTTOM CORNER BARS OF THE EXTERIOR WALLS WERE HINGED AND THE CULVERT STILL DOES NOT RATE. BECAUSE OF SEVERE CORROSION OF THE SLAB ON THE UNDERSIDE; IT WAS ESTIMATED THAT THE REINFORCING HAS EXPERIENCED 50% SECTION LOSS. CULVERT DOES NOT RATE AT OPERATING.

Material Properties

fy (ksi)	33
f'c (ksi)	1.5

SLAB, BENDING, NEAR CENTER WALL

Area steel (in^2 per ft)	0.0000
Bar diameter (in)	0.0000
Cover (in)	2
d	13.0000
a	0.0000
phi M (in-k)	0.0
impact	1.20
CL Wall to Check Pt (in)	10.5
Check Point	0.9417

Moment Modifier	0.00			
Point	1.0	0.9	0.9417	Pt
Dead Load (DC) in-k	-8.5	15.4	0.0	
Dead Load (DW) in-k	0.0	0.0	0.0	
Earth Vertical (EV) in-k	-18.7	9.7	0.0	
Earth Horz (EH) in-k	25.6	17.8	0.0	
Lateral Surcharge (LS) in-k	4.1	2.9	0.0	Neglect if value is greater than 0
Total DL in-k			0.0	
Type 4 LL Min (LL) in-k	-31.2	-16.5	0.0	
Type 3S3A LL Min (LL) in-k	-31.1	-14.9	0.0	
Type 3-3 LL Min (LL) in-k	-27.4	-15.9	0.0	
Type 3S3B LL Min (LL) in-k	-30.2	-16.9	0.0	
Type 4S3 Min (LL) in-k	-31.1	-15.8	0.0	
Type HS-20 LL Min (LL) in-k	-39.7	-24.1	0.0	

SLAB,BENDING, NEAR MIDSPAN , 0.5 PT

Area steel (in^2 per ft)	0.6000
Bar diameter (in)	0.8750
Cover (in)	2
d	12.5625
a	1.2941
phi M (in-k)	212.3
impact	1.20

Moment Modifier	1.25		
Point	0.5	0.5	
Dead Load (DC) in-k	55.3	69.1	
Dead Load (DW) in-k	0.0	0.0	
Earth Vertical (EV) in-k	57.0	71.3	
Earth Horz (EH) in-k	-55.9	-69.9	
Lateral Surcharge (LS) in-k	-12.7	0.0	Neglect if value is less than 0
Total DL in-k		70.5	
Type 4 LL Max (LL) in-k	103.3	129.1	
Type 3S3A LL Max (LL) in-k	103.2	129.0	
Type 3-3 LL Max (LL) in-k	84.9	106.1	
Type 3S3B LL Max (LL) in-k	103.1	128.9	
Type 4S3 Max (LL) in-k	103.3	129.1	
Type HS-20 LL Max (LL) in-k	121.4	151.8	

SLAB, BENDING, NEAR EXTERIOR WALL

Area steel (in^2 per ft)	0.4400
Bar diameter (in)	0.7500
Cover (in)	2
d	12.6250
a	0.9490
phi M (in-k)	-158.8
impact	1.20
CL Wall to Check Pt (in)	10.5
Check Point	0.0583

Moment Modifier	0.00			
Point	0.0	0.1	0.0583	
Dead Load (DC) in-k	-8.5	15.4	0.0	
Dead Load (DW) in-k	0.0	0.0	0.0	
Earth Vertical (EV) in-k	-18.7	9.7	0.0	
Earth Horz (EH) in-k	-55.9	-55.9	0.0	Includes 2 times EH for 60 lbs/cf
Lateral Surcharge (LS) in-k	-12.7	-12.7	0.0	Neglect if value is greater than 0
Total DL in-k			0.0	
Type 4 LL Min (LL) in-k	-35.1	-1.4	0.0	
Type 3S3A LL Min (LL) in-k	-35.2	-1.5	0.0	
Type 3-3 LL Min (LL) in-k	-28.1	-1.8	0.0	
Type 3S3B LL Min (LL) in-k	-34.1	-1.5	0.0	
Type 4S3 Min (LL) in-k	-35.2	-1.5	0.0	
Type HS-20 LL Min (LL) in-k	-35.2	-3.9	0.0	

EXTERIOR WALL, BENDING, NEAR SLAB

Area steel (in^2 per ft)	0.4400
Bar diameter (in)	0.7500
Cover (in)	2
d	9.6250
a	0.9490
phi M (in-k)	119.6
impact	1.20
CL Slab to Check Pt (in)	13.5
Check Point	0.0783

Moment Modifier	0.00			
Point	0.0	0.1	0.0783	
Dead Load (DC) in-k	8.5	11.7	0.0	
Dead Load (DW) in-k	0.0	0.0	0.0	
Earth Vertical (EV) in-k	18.7	18.5	0.0	
Earth Horz (EH) in-k	55.9	16.2	0.0	Includes 2 times EH for 60 lbs/cf
Lateral Surcharge (LS) in-k	12.7	2.1	0.0	Neglect if value is less than 0
Total DL in-k			0.0	
Type 4 LL Max (LL) in-k	35.1	34.2	0.0	
Type 3S3A LL Max (LL) in-k	35.2	34.2	0.0	
Type 3-3 LL Max (LL) in-k	28.1	26.9	0.0	
Type 3S3B LL Max (LL) in-k	34.1	32.7	0.0	
Type 4S3 Max (LL) in-k	35.2	34.2	0.0	
Type HS-20 LL Max (LL) in-k	35.2	33.5	0.0	

EXTERIOR WALL, BENDING, NEAR FLOOR

Area steel (in^2 per ft)	0.8000
Bar diameter (in)	0.8750
Cover (in)	2
d	9.5625
a	1.7255
phi M (in-k)	206.7
impact	1.00
CL Floor to Check Pt (in)	9
Check Point	0.9478

Moment Modifier	0.00			
Point	1.0	0.9	0.9478	
Dead Load (DC) in-k	41.0	37.7	0.0	
Dead Load (DW) in-k	0.0	0.0	0.0	
Earth Vertical (EV) in-k	17.4	17.5	0.0	
Earth Horz (EH) in-k	66.2	4.5	0.1	Includes 2 times EH for 60 lbs/cf
Lateral Surcharge (LS) in-k	12.7	2.1	0.0	Neglect if value is less than 0
Total DL in-k			0.1	
Type 4 LL Max (LL) in-k	28.1	28.6	0.0	
Type 3S3A LL Max (LL) in-k	28.3	28.7	0.0	
Type 3-3 LL Max (LL) in-k	25.7	24.5	0.0	
Type 3S3B LL Max (LL) in-k	31.3	30.8	0.0	
Type 4S3 Max (LL) in-k	28.4	28.7	0.0	
Type HS-20 LL Max (LL) in-k	36.6	33.8	0.0	

FLOOR, BENDING, NEAR EXTERIOR WALL

Area steel (in^2 per ft)	0.8000
Bar diameter (in)	0.8750
Cover (in)	2
d	15.5625
a	1.7255
phi M (in-k)	349.3
impact	1.00
CL Wall to Check Pt (in)	6
Check Point	0.0333

Moment Modifier	0.00			
Point	0.0	0.1	0.0333	
Dead Load (DC) in-k	41.0	-11.4	0.0	
Dead Load (DW) in-k	0.0	0.0	0.0	
Earth Vertical (EV) in-k	17.4	-9.8	0.0	
Earth Horz (EH) in-k	66.2	66.2	0.1	Includes 2 times EH for 60 lbs/cf
Lateral Surcharge (LS) in-k	12.7	12.7	0.0	Neglect if value is less than 0
Total DL in-k			0.2	
Type 4 LL Max (LL) in-k	28.1	4.9	0.0	
Type 3S3A LL Max (LL) in-k	28.3	4.9	0.0	
Type 3-3 LL Max (LL) in-k	25.7	5.1	0.0	
Type 3S3B LL Max (LL) in-k	31.3	6.0	0.0	
Type 4S3 Max (LL) in-k	28.4	4.9	0.0	
Type HS-20 LL Max (LL) in-k	36.6	9.6	0.0	

FLOOR, BENDING, NEAR MIDSPAN , 0.4 PT

Area steel (in^2 per ft)	1.2000
Bar diameter (in)	0.8750
Cover (in)	2
d	15.5625
a	2.5882
phi M (in-k)	-508.5
impact	1.00

Moment Modifier	1.25		
Point	0.4	0.4	
Dead Load (DC) in-k	-98.6	-123.3	
Dead Load (DW) in-k	0.0	0.0	
Earth Vertical (EV) in-k	-55.2	-69.0	
Earth Horz (EH) in-k	66.2	82.8	
Lateral Surcharge (LS) in-k	12.7	0.0	Neglect if value is greater than 0
Total DL in-k		-109.5	
Type 4 LL Min (LL) in-k	-91.9	-114.9	
Type 3S3A LL Min (LL) in-k	-92.1	-115.1	
Type 3-3 LL Min (LL) in-k	-70.4	-88.0	
Type 3S3B LL Min (LL) in-k	-94.5	-118.1	
Type 4S3 Min (LL) in-k	-92.1	-115.1	
Type HS-20 LL Min (LL) in-k	-88.3	-110.4	

FLOOR, BENDING NEAR CENTER WALL

Area steel (in^2 per ft)	0.0000
Bar diameter (in)	0.0000
Cover (in)	2
d	16.0000
a	0.0000
phi M (in-k)	0.0
impact	1.00
CL Wall to Check Pt (in)	6
Check Point	0.9667

Moment Modifier	0.00			
Point	1.0	0.9	0.9667	Pt
Dead Load (DC) in-k	41.0	-11.4	0.0	
Dead Load (DW) in-k	0.0	0.0	0.0	
Earth Vertical (EV) in-k	17.4	-9.8	0.0	
Earth Horz (EH) in-k	66.2	66.2	0.0	
Lateral Surcharge (LS) in-k	12.7	12.7	0.0	Neglect if value is less than 0
Total DL in-k			0.0	
Type 4 LL Min (LL) in-k	28.1	4.9	0.0	
Type 3S3A LL Min (LL) in-k	28.3	4.9	0.0	
Type 3-3 LL Min (LL) in-k	27.6	15.8	0.0	
Type 3S3B LL Min (LL) in-k	29.8	17.5	0.0	
Type 4S3 Min (LL) in-k	29.4	17.6	0.0	
Type HS-20 LL Min (LL) in-k	40.9	22.0	0.0	

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*******************************************************************************
*                                                                             *
* CulvertCalc IA - Version 1.0                                                *
*                                                                             *
* Release History:                                                            *
* Version 1.0 - Released 05-01-2012 - Original Version                        *
*                                                                             *
* Reinforced concrete box culvert analysis and design based on the            *
* AASHTO LRFD Bridge Design Specifications, 5th Edition, 2010                 *
* with Interims through 2010.                                                 *
*                                                                             *
* Developed for:      Iowa Department of Transportation                       *
*                     Office of Bridges and Structures                        *
*                                                                             *
* Developed by:       Foth Infrastructure & Environment                       *
*                     8191 Birchwood Ct., Suite L                             *
*                     Johnston, IA 50131                                      *
*                                                                             *
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********** Auto Design Report **********

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*** INPUT DATA ECHO ***
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*** Project Information ***

Project Number:
County Name: CITY OF MOUNT VERNON
Design Number:
Route Number:
Feature Crossed:
Designed By:

Comments:

*** Culvert Geometry ***
Design is for a 14 ft x 12.5 ft Single Barrel RCB Culvert
Barrel length is 38 ft.
Minimum member thicknesses are:
Slab - 15 in.
Exterior Wall - 12 in.
Floor - 15 in
Integral wearing surface thickness is 0 in.
Mud mat thickness is 0 in.
Haunch length and width is 12 in.
Frost trough dimensions are:
Height - 6 in.
Width of constant depth portion - 6 in.
Width of tapered portion - 1 in.
Floor extends beyond outside face of exterior wall 4 in.

*** Fill Properties ***
Design fill depth is 1.9 ft.
Pavement thickness is 0 in.
Embankment installation condition with compacted backfill along sides of culvert.
Soil-structure interaction factor is 1.02.
Depth of water above bottom of slab is 2.00 ft.

*** Live Load Details ***
Live load vehicles used for design:
Truck Name - Type 4
Number of Axles - 4
Axle Weights (kip) - 12.5, 14.0, 14.0, 14.0
Axle Spacings (ft) - 11.0, 4.0, 4.0
Fill interaction factor is 1.00.
Tire patch length is 5.30000019073486 in.
Tire patch width is 13.1999998092651 in.
Maximum live load step distance is 12 in.
Distribution pattern for soil pressure acting on floor is rigid body.
Live load is neglected for fill depths greater than 14.0 ft.
Design will account for Disappearing Axle Effect.
Overlapping distributed axle loads will be merged.
Variable axle spacing will be accounted for in design.
Variable axle spacing increment is 4.0 ft.
Live load will be distributed parallel to span for fill depths less than 2 ft.
HL93 Lane Load will not be included in design.
Dynamic load allowance will not be included in design.

Constant equivalent height of soil for live load surcharge is 2.00 ft.

*** Material Properties ***

Concrete unit weight -	0.150 kcf
Concrete compressive strength -	3.5 ksi
Maximum aggregate size -	0.75 in.
Reinforcing yield strength -	60 ksi
Soil unit weight -	0.120 kcf
Effective friction angle of soil -	36.9 degrees
Pavement unit weight -	0.150 kcf
Water unit weight -	0.062 kcf

*** Concrete Cover Dimensions ***

Typical edge clearance -	2 in.
Top of slab edge clearance -	2 in.
Top of floor edge clearance -	2.25 in.
Bottom of floor edge clearance -	3.5 in.
End clearance at top of vertical bars -	2 in.
End clearance at bottom of vertical bars -	3 in.
End clearance for transverse bars -	2 in.

*** Sign Convention ***

Slab and Floor-

Sections increase from left to right. Positive moments cause tension on bottom face. Positive shear forces act up on left side of section and down on right side of section. Positive axial forces are tensile.

Walls-

Sections increase from top to bottom. Positive moments cause tension on left face. Positive shear forces act right on top side of section and left on bottom side of section. Positive axial forces are tensile.

****

*** STRUCTURAL ANALYSIS OF CULVERT ***

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--> Actual member thicknesses used for analysis are:

Slab - 15.00 in

Exterior Wall - 12.00 in

Floor - 15.00 in

*** Structural Model Properties ***

Member	Thickness (in)	Length (in)	Area (in^2)	Mom. of I. (in^4)
Slab	15.00	180.00	180.00	3375.00
Wall	12.00	171.00	144.00	1728.00
Floor	15.00	180.00	180.00	3375.00

*** Analysis Results - Section Forces ***

Load Case DC

Member	Section	Moment (in-kip)	Shear (kip)	Axial Force (kip)
Slab	0.0	-8.5	1.48	0.19
	0.1	15.4	1.18	0.19
	0.2	34.0	0.89	0.19
	0.3	47.3	0.59	0.19
	0.4	55.3	0.30	0.19
	0.5	58.0	0.00	0.19
	0.6	55.3	-0.30	0.19
	0.7	47.3	-0.59	0.19
	0.8	34.0	-0.89	0.19
	0.9	15.4	-1.18	0.19
	1.0	-8.5	-1.48	0.19
Wall	0.0	8.5	0.19	-1.48
	0.1	11.7	0.19	-1.69
	0.2	15.0	0.19	-1.90
	0.3	18.2	0.19	-2.12
	0.4	21.5	0.19	-2.33
	0.5	24.7	0.19	-2.55
	0.6	28.0	0.19	-2.76
	0.7	31.2	0.19	-2.97
	0.8	34.5	0.19	-3.19
	0.9	37.7	0.19	-3.40
	1.0	41.0	0.19	-3.61
Floor	0.0	41.0	-3.23	-0.19
	0.1	-11.4	-2.59	-0.19
	0.2	-52.1	-1.94	-0.19
	0.3	-81.2	-1.29	-0.19
	0.4	-98.6	-0.65	-0.19
	0.5	-104.4	0.00	-0.19
	0.6	-98.6	0.65	-0.19
	0.7	-81.2	1.29	-0.19
	0.8	-52.1	1.94	-0.19

	0.9	-11.4	2.59	-0.19
	1.0	41.0	3.23	-0.19

Load Case	DW			
Member	Section	Moment (in-kip)	Shear (kip)	Axial Force (kip)
Slab	0.0	0.0	0.00	0.00
	0.1	0.0	0.00	0.00
	0.2	0.0	0.00	0.00
	0.3	0.0	0.00	0.00
	0.4	0.0	0.00	0.00
	0.5	0.0	0.00	0.00
	0.6	0.0	0.00	0.00
	0.7	0.0	0.00	0.00
	0.8	0.0	0.00	0.00
	0.9	0.0	0.00	0.00
	1.0	0.0	0.00	0.00
Wall	0.0	0.0	0.00	0.00
	0.1	0.0	0.00	0.00
	0.2	0.0	0.00	0.00
	0.3	0.0	0.00	0.00
	0.4	0.0	0.00	0.00
	0.5	0.0	0.00	0.00
	0.6	0.0	0.00	0.00
	0.7	0.0	0.00	0.00
	0.8	0.0	0.00	0.00
	0.9	0.0	0.00	0.00
	1.0	0.0	0.00	0.00
Floor	0.0	0.0	0.00	0.00
	0.1	0.0	0.00	0.00
	0.2	0.0	0.00	0.00
	0.3	0.0	0.00	0.00
	0.4	0.0	0.00	0.00
	0.5	0.0	0.00	0.00
	0.6	0.0	0.00	0.00
	0.7	0.0	0.00	0.00
	0.8	0.0	0.00	0.00
	0.9	0.0	0.00	0.00
	1.0	0.0	0.00	0.00

Load Case	EV			
Member	Section	Moment (in-kip)	Shear (kip)	Axial Force (kip)
Slab	0.0	-18.7	1.75	-0.01
	0.1	9.7	1.40	-0.01
	0.2	31.7	1.05	-0.01
	0.3	47.5	0.70	-0.01
	0.4	57.0	0.35	-0.01
	0.5	60.1	0.00	-0.01
	0.6	57.0	-0.35	-0.01
	0.7	47.5	-0.70	-0.01
	0.8	31.7	-1.05	-0.01
	0.9	9.7	-1.40	-0.01
	1.0	-18.7	-1.75	-0.01
Wall	0.0	18.7	-0.01	-1.75
	0.1	18.5	-0.01	-1.75
	0.2	18.4	-0.01	-1.75
	0.3	18.3	-0.01	-1.75
	0.4	18.2	-0.01	-1.75
	0.5	18.0	-0.01	-1.75
	0.6	17.9	-0.01	-1.75
	0.7	17.8	-0.01	-1.75
	0.8	17.6	-0.01	-1.75
	0.9	17.5	-0.01	-1.75
	1.0	17.4	-0.01	-1.75
Floor	0.0	17.4	-1.68	0.01
	0.1	-9.8	-1.34	0.01
	0.2	-31.0	-1.01	0.01
	0.3	-46.1	-0.67	0.01
	0.4	-55.2	-0.34	0.01
	0.5	-58.3	0.00	0.01
	0.6	-55.2	0.34	0.01
	0.7	-46.1	0.67	0.01
	0.8	-31.0	1.01	0.01
	0.9	-9.8	1.34	0.01
	1.0	17.4	1.68	0.01

Load Case	EH			
Member	Section	Moment (in-kip)	Shear (kip)	Axial Force (kip)
Slab	0.0	-55.9	0.00	-2.42
	0.1	-55.9	0.00	-2.42

	0.2	-55.9	0.00	-2.42
	0.3	-55.9	0.00	-2.42
	0.4	-55.9	0.00	-2.42
	0.5	-55.9	0.00	-2.42
	0.6	-55.9	0.00	-2.42
	0.7	-55.9	0.00	-2.42
	0.8	-55.9	0.00	-2.42
	0.9	-55.9	0.00	-2.42
	1.0	-55.9	0.00	-2.42
Wall	0.0	55.9	-2.42	0.00
	0.1	16.2	-2.20	0.00
	0.2	-18.9	-1.89	0.00
	0.3	-47.8	-1.47	0.00
	0.4	-68.6	-0.96	0.00
	0.5	-79.9	-0.35	0.00
	0.6	-79.9	0.36	0.00
	0.7	-66.9	1.17	0.00
	0.8	-39.4	2.07	0.00
	0.9	4.5	3.07	0.00
	1.0	66.2	4.17	0.00
Floor	0.0	66.2	0.00	-4.17
	0.1	66.2	0.00	-4.17
	0.2	66.2	0.00	-4.17
	0.3	66.2	0.00	-4.17
	0.4	66.2	0.00	-4.17
	0.5	66.2	0.00	-4.17
	0.6	66.2	0.00	-4.17
	0.7	66.2	0.00	-4.17
	0.8	66.2	0.00	-4.17
	0.9	66.2	0.00	-4.17
	1.0	66.2	0.00	-4.17

Load Case	WA			
Member	Section	Moment (in-kip)	Shear (kip)	Axial Force (kip)
Slab	0.0	0.0	0.00	0.00
	0.1	0.0	0.00	0.00
	0.2	0.0	0.00	0.00
	0.3	0.0	0.00	0.00
	0.4	0.0	0.00	0.00
	0.5	0.0	0.00	0.00

	0.6	0.0	0.00	0.00
	0.7	0.0	0.00	0.00
	0.8	0.0	0.00	0.00
	0.9	0.0	0.00	0.00
	1.0	0.0	0.00	0.00
Wall	0.0	0.0	0.00	0.00
	0.1	0.0	0.00	0.00
	0.2	0.0	0.00	0.00
	0.3	0.0	0.00	0.00
	0.4	0.0	0.00	0.00
	0.5	0.0	0.00	0.00
	0.6	0.0	0.00	0.00
	0.7	0.0	0.00	0.00
	0.8	0.0	0.00	0.00
	0.9	0.0	0.00	0.00
	1.0	0.0	0.00	0.00
Floor	0.0	0.0	0.00	0.00
	0.1	0.0	0.00	0.00
	0.2	0.0	0.00	0.00
	0.3	0.0	0.00	0.00
	0.4	0.0	0.00	0.00
	0.5	0.0	0.00	0.00
	0.6	0.0	0.00	0.00
	0.7	0.0	0.00	0.00
	0.8	0.0	0.00	0.00
	0.9	0.0	0.00	0.00
	1.0	0.0	0.00	0.00

Load Case	LS			
Member	Section	Moment (in-kip)	Shear (kip)	Axial Force (kip)
Slab	0.0	-12.7	0.00	-0.68
	0.1	-12.7	0.00	-0.68
	0.2	-12.7	0.00	-0.68
	0.3	-12.7	0.00	-0.68
	0.4	-12.7	0.00	-0.68
	0.5	-12.7	0.00	-0.68
	0.6	-12.7	0.00	-0.68
	0.7	-12.7	0.00	-0.68
	0.8	-12.7	0.00	-0.68
	0.9	-12.7	0.00	-0.68

	1.0	-12.7	0.00	-0.68
Wall	0.0	12.7	-0.68	0.00
	0.1	2.1	-0.55	0.00
	0.2	-6.0	-0.41	0.00
	0.3	-11.9	-0.27	0.00
	0.4	-15.4	-0.14	0.00
	0.5	-16.6	0.00	0.00
	0.6	-15.4	0.14	0.00
	0.7	-11.9	0.27	0.00
	0.8	-6.0	0.41	0.00
	0.9	2.1	0.55	0.00
	1.0	12.7	0.68	0.00
Floor	0.0	12.7	0.00	-0.68
	0.1	12.7	0.00	-0.68
	0.2	12.7	0.00	-0.68
	0.3	12.7	0.00	-0.68
	0.4	12.7	0.00	-0.68
	0.5	12.7	0.00	-0.68
	0.6	12.7	0.00	-0.68
	0.7	12.7	0.00	-0.68
	0.8	12.7	0.00	-0.68
	0.9	12.7	0.00	-0.68
	1.0	12.7	0.00	-0.68

Load Case LL+IM - Owner-Defined Vehicles TYPE 4

		Moment (in-kip)		Shear (kip)		Axial Force (kip)	
Member	Section	Min.	Max.	Min.	Max.	Min.	Max.
Slab	0.0	-35.1	1.0	0.00	3.34	-0.06	0.06
	0.1	-1.6	22.6	-0.02	2.88	-0.06	0.06
	0.2	0.0	59.3	-0.19	2.29	-0.06	0.06
	0.3	0.0	84.6	-0.30	1.79	-0.06	0.06
	0.4	0.0	103.3	-0.61	1.31	-0.06	0.06
	0.5	0.0	109.8	-0.89	0.83	-0.06	0.06
	0.6	0.0	103.3	-1.31	0.61	-0.06	0.06
	0.7	0.0	84.6	-1.79	0.30	-0.06	0.06
	0.8	0.0	59.3	-2.29	0.19	-0.06	0.06
	0.9	-1.6	22.6	-2.88	0.02	-0.06	0.06
	1.0	-35.1	1.0	-3.34	0.00	-0.06	0.06
Wall	0.0	-1.0	35.1	-0.06	0.06	-3.34	0.00

	0.1	-0.5	34.2	-0.06	0.06	-3.34	0.00
	0.2	0.0	33.3	-0.06	0.06	-3.34	0.00
	0.3	0.0	32.4	-0.06	0.06	-3.34	0.00
	0.4	0.0	31.5	-0.06	0.06	-3.34	0.00
	0.5	0.0	30.7	-0.06	0.06	-3.34	0.00
	0.6	0.0	29.9	-0.06	0.06	-3.34	0.00
	0.7	0.0	29.4	-0.06	0.06	-3.34	0.00
	0.8	0.0	29.0	-0.06	0.06	-3.34	0.00
	0.9	0.0	28.6	-0.06	0.06	-3.34	0.00
	1.0	0.0	28.1	-0.06	0.06	-3.34	0.00
Floor	0.0	0.0	28.1	-3.34	0.00	-0.06	0.06
	0.1	-23.7	4.9	-2.43	0.00	-0.06	0.06
	0.2	-59.9	0.1	-1.61	0.00	-0.06	0.06
	0.3	-82.1	0.0	-1.21	0.00	-0.06	0.06
	0.4	-91.9	0.0	-0.82	0.12	-0.06	0.06
	0.5	-91.9	0.0	-0.44	0.43	-0.06	0.06
	0.6	-91.9	0.0	-0.12	0.82	-0.06	0.06
	0.7	-82.1	0.0	0.00	1.21	-0.06	0.06
	0.8	-59.9	0.1	0.00	1.61	-0.06	0.06
	0.9	-23.7	4.9	0.00	2.43	-0.06	0.06
	1.0	0.0	28.1	0.00	3.34	-0.06	0.06

Load Case LL+IM - Owner-Defined Vehicles TYPE 3S3A

		Moment (in-kip)		Shear (kip)		Axial Force (kip)	
Member	Section	Min.	Max.	Min.	Max.	Min.	Max.
Slab	0.0	-35.2	1.0	0.00	3.38	-0.07	0.06
	0.1	-1.5	22.6	-0.02	2.89	-0.07	0.06
	0.2	0.0	59.3	-0.19	2.32	-0.07	0.06
	0.3	0.0	84.6	-0.33	1.83	-0.07	0.06
	0.4	0.0	103.2	-0.62	1.32	-0.07	0.06
	0.5	0.0	109.7	-0.85	0.96	-0.07	0.06
	0.6	0.0	103.2	-1.32	0.62	-0.07	0.06
	0.7	0.0	84.6	-1.83	0.33	-0.07	0.06
	0.8	0.0	59.3	-2.32	0.19	-0.07	0.06
	0.9	-1.5	22.6	-2.89	0.02	-0.07	0.06
	1.0	-35.2	1.0	-3.38	0.00	-0.07	0.06
Wall	0.0	-1.0	35.2	-0.07	0.06	-3.38	0.00
	0.1	-0.5	34.2	-0.07	0.06	-3.38	0.00
	0.2	-0.1	33.3	-0.07	0.06	-3.38	0.00
	0.3	0.0	32.4	-0.07	0.06	-3.38	0.00

	0.4	0.0	31.5	-0.07	0.06	-3.38	0.00
	0.5	0.0	30.7	-0.07	0.06	-3.38	0.00
	0.6	0.0	29.9	-0.07	0.06	-3.38	0.00
	0.7	0.0	29.4	-0.07	0.06	-3.38	0.00
	0.8	0.0	29.1	-0.07	0.06	-3.38	0.00
	0.9	0.0	28.7	-0.07	0.06	-3.38	0.00
	1.0	0.0	28.3	-0.07	0.06	-3.38	0.00
Floor	0.0	0.0	28.3	-3.38	0.00	-0.06	0.07
	0.1	-24.0	4.9	-2.45	0.00	-0.06	0.07
	0.2	-60.4	0.2	-1.61	0.00	-0.06	0.07
	0.3	-82.5	0.0	-1.22	0.00	-0.06	0.07
	0.4	-92.1	0.0	-0.83	0.12	-0.06	0.07
	0.5	-91.9	0.0	-0.45	0.44	-0.06	0.07
	0.6	-92.1	0.0	-0.12	0.83	-0.06	0.07
	0.7	-82.5	0.0	0.00	1.22	-0.06	0.07
	0.8	-60.4	0.2	0.00	1.61	-0.06	0.07
	0.9	-24.0	4.9	0.00	2.45	-0.06	0.07
	1.0	0.0	28.3	0.00	3.38	-0.06	0.07

Load Case LL+IM - Owner-Defined Vehicles TYPE 3-3

		Moment (in-kip)		Shear (kip)		Axial Force (kip)	
Member	Section	Min.	Max.	Min.	Max.	Min.	Max.
Slab	0.0	-28.1	1.1	0.00	2.74	-0.07	0.07
	0.1	-1.8	23.5	-0.03	2.40	-0.07	0.07
	0.2	0.0	52.4	-0.20	2.02	-0.07	0.07
	0.3	0.0	73.1	-0.38	1.68	-0.07	0.07
	0.4	0.0	84.9	-0.62	1.31	-0.07	0.07
	0.5	0.0	87.1	-0.84	0.97	-0.07	0.07
	0.6	0.0	84.9	-1.31	0.62	-0.07	0.07
	0.7	0.0	73.1	-1.68	0.38	-0.07	0.07
	0.8	0.0	52.4	-2.02	0.20	-0.07	0.07
	0.9	-1.8	23.5	-2.40	0.03	-0.07	0.07
	1.0	-28.1	1.1	-2.74	0.00	-0.07	0.07
Wall	0.0	-1.1	28.1	-0.07	0.07	-2.74	0.00
	0.1	-0.5	26.9	-0.07	0.07	-2.74	0.00
	0.2	0.0	25.8	-0.07	0.07	-2.74	0.00
	0.3	0.0	24.6	-0.07	0.07	-2.74	0.00
	0.4	0.0	23.5	-0.07	0.07	-2.74	0.00
	0.5	0.0	22.5	-0.07	0.07	-2.74	0.00
	0.6	0.0	22.3	-0.07	0.07	-2.74	0.00

	0.7	0.0	23.0	-0.07	0.07	-2.74	0.00
	0.8	0.0	23.7	-0.07	0.07	-2.74	0.00
	0.9	0.0	24.5	-0.07	0.07	-2.74	0.00
	1.0	0.0	25.7	-0.07	0.07	-2.74	0.00
Floor	0.0	0.0	25.7	-2.74	0.00	-0.07	0.07
	0.1	-19.1	5.1	-1.97	0.00	-0.07	0.07
	0.2	-46.1	0.1	-1.28	0.00	-0.07	0.07
	0.3	-63.4	0.0	-0.97	0.00	-0.07	0.07
	0.4	-70.4	0.0	-0.70	0.13	-0.07	0.07
	0.5	-69.2	0.0	-0.37	0.44	-0.07	0.07
	0.6	-70.4	0.0	-0.13	0.70	-0.07	0.07
	0.7	-63.4	0.0	0.00	0.97	-0.07	0.07
	0.8	-46.1	0.1	0.00	1.28	-0.07	0.07
	0.9	-19.1	5.1	0.00	1.97	-0.07	0.07
	1.0	0.0	25.7	0.00	2.74	-0.07	0.07

Load Case LL+IM - Owner-Defined Vehicles TYPE 3S3B

		Moment (in-kip)		Shear (kip)		Axial Force (kip)	
Member	Section	Min.	Max.	Min.	Max.	Min.	Max.
Slab	0.0	-34.1	1.3	0.00	3.53	-0.09	0.09
	0.1	-1.5	27.5	-0.02	2.93	-0.09	0.09
	0.2	0.0	65.2	-0.23	2.48	-0.09	0.09
	0.3	0.0	90.1	-0.39	2.04	-0.09	0.09
	0.4	0.0	103.1	-0.75	1.60	-0.09	0.09
	0.5	0.0	107.3	-1.15	1.04	-0.09	0.09
	0.6	0.0	103.1	-1.60	0.75	-0.09	0.09
	0.7	0.0	90.1	-2.04	0.39	-0.09	0.09
	0.8	0.0	65.2	-2.48	0.23	-0.09	0.09
	0.9	-1.5	27.5	-2.93	0.02	-0.09	0.09
	1.0	-34.1	1.3	-3.53	0.00	-0.09	0.09
Wall	0.0	-1.3	34.1	-0.09	0.09	-3.53	0.00
	0.1	-0.6	32.7	-0.09	0.09	-3.53	0.00
	0.2	-0.1	31.3	-0.09	0.09	-3.53	0.00
	0.3	0.0	30.5	-0.09	0.09	-3.53	0.00
	0.4	0.0	30.2	-0.09	0.09	-3.53	0.00
	0.5	0.0	30.2	-0.09	0.09	-3.53	0.00
	0.6	0.0	30.3	-0.09	0.09	-3.53	0.00
	0.7	0.0	30.3	-0.09	0.09	-3.53	0.00
	0.8	0.0	30.8	-0.09	0.09	-3.53	0.00
	0.9	0.0	31.3	-0.09	0.09	-3.53	0.00

	1.0	0.0	31.8	-0.09	0.09	-3.53	0.00
Floor	0.0	0.0	31.8	-3.53	0.00	-0.09	0.09
	0.1	-23.7	6.0	-2.57	0.00	-0.09	0.09
	0.2	-61.2	0.3	-1.69	0.00	-0.09	0.09
	0.3	-84.4	0.0	-1.27	0.00	-0.09	0.09
	0.4	-94.5	0.0	-0.89	0.14	-0.09	0.09
	0.5	-94.0	0.0	-0.53	0.54	-0.09	0.09
	0.6	-94.5	0.0	-0.14	0.89	-0.09	0.09
	0.7	-84.4	0.0	0.00	1.27	-0.09	0.09
	0.8	-61.2	0.3	0.00	1.69	-0.09	0.09
	0.9	-23.7	6.0	0.00	2.57	-0.09	0.09
	1.0	0.0	31.8	0.00	3.53	-0.09	0.09

Load Case LL+IM - Owner-Defined Vehicles TYPE 4S3

		Moment (in-kip)		Shear (kip)		Axial Force (kip)	
Member	Section	Min.	Max.	Min.	Max.	Min.	Max.
Slab	0.0	-35.2	1.0	0.00	3.39	-0.06	0.08
	0.1	-1.5	22.6	-0.02	2.88	-0.06	0.08
	0.2	0.0	59.3	-0.19	2.33	-0.06	0.08
	0.3	0.0	84.7	-0.36	1.82	-0.06	0.08
	0.4	0.0	103.3	-0.62	1.33	-0.06	0.08
	0.5	0.0	109.8	-0.93	0.97	-0.06	0.08
	0.6	0.0	103.3	-1.33	0.62	-0.06	0.08
	0.7	0.0	84.7	-1.82	0.36	-0.06	0.08
	0.8	0.0	59.3	-2.33	0.19	-0.06	0.08
	0.9	-1.5	22.6	-2.88	0.02	-0.06	0.08
	1.0	-35.2	1.0	-3.39	0.00	-0.06	0.08
Wall	0.0	-1.0	35.2	-0.06	0.08	-3.39	0.00
	0.1	-0.5	34.2	-0.06	0.08	-3.39	0.00
	0.2	-0.1	33.3	-0.06	0.08	-3.39	0.00
	0.3	0.0	32.4	-0.06	0.08	-3.39	0.00
	0.4	0.0	31.5	-0.06	0.08	-3.39	0.00
	0.5	0.0	30.7	-0.06	0.08	-3.39	0.00
	0.6	0.0	29.9	-0.06	0.08	-3.39	0.00
	0.7	0.0	29.4	-0.06	0.08	-3.39	0.00
	0.8	0.0	29.1	-0.06	0.08	-3.39	0.00
	0.9	0.0	28.7	-0.06	0.08	-3.39	0.00
	1.0	0.0	28.4	-0.06	0.08	-3.39	0.00
Floor	0.0	0.0	28.4	-3.39	0.00	-0.08	0.06

	0.1	-24.1	4.9	-2.45	0.00	-0.08	0.06
	0.2	-60.5	0.2	-1.61	0.00	-0.08	0.06
	0.3	-82.7	0.0	-1.22	0.00	-0.08	0.06
	0.4	-92.1	0.0	-0.84	0.12	-0.08	0.06
	0.5	-91.9	0.0	-0.45	0.44	-0.08	0.06
	0.6	-92.1	0.0	-0.12	0.84	-0.08	0.06
	0.7	-82.7	0.0	0.00	1.22	-0.08	0.06
	0.8	-60.5	0.2	0.00	1.61	-0.08	0.06
	0.9	-24.1	4.9	0.00	2.45	-0.08	0.06
	1.0	0.0	28.4	0.00	3.39	-0.08	0.06

Load Case LL+IM - Owner-Defined Vehicles TYPE HS20

		Moment (in-kip)		Shear (kip)		Axial Force (kip)	
Member	Section	Min.	Max.	Min.	Max.	Min.	Max.
Slab	0.0	-35.2	2.0	0.00	3.65	-0.10	0.19
	0.1	-3.9	40.5	-0.04	3.10	-0.10	0.19
	0.2	0.0	78.2	-0.38	2.83	-0.10	0.19
	0.3	0.0	105.0	-0.65	2.28	-0.10	0.19
	0.4	0.0	121.4	-1.18	2.01	-0.10	0.19
	0.5	0.0	127.5	-1.45	1.43	-0.10	0.19
	0.6	0.0	121.4	-2.01	1.18	-0.10	0.19
	0.7	0.0	105.0	-2.28	0.65	-0.10	0.19
	0.8	0.0	78.2	-2.83	0.38	-0.10	0.19
	0.9	-3.9	40.5	-3.10	0.04	-0.10	0.19
	1.0	-35.2	2.0	-3.65	0.00	-0.10	0.19
Wall	0.0	-2.0	35.2	-0.10	0.19	-3.65	0.00
	0.1	-0.9	33.5	-0.10	0.19	-3.65	0.00
	0.2	0.0	31.8	-0.10	0.19	-3.65	0.00
	0.3	0.0	30.2	-0.10	0.19	-3.65	0.00
	0.4	0.0	28.5	-0.10	0.19	-3.65	0.00
	0.5	0.0	27.1	-0.10	0.19	-3.65	0.00
	0.6	0.0	25.7	-0.10	0.19	-3.65	0.00
	0.7	0.0	28.2	-0.10	0.19	-3.65	0.00
	0.8	0.0	31.0	-0.10	0.19	-3.65	0.00
	0.9	0.0	33.8	-0.10	0.19	-3.65	0.00
	1.0	0.0	36.6	-0.10	0.19	-3.65	0.00
Floor	0.0	0.0	36.6	-3.65	0.00	-0.19	0.10
	0.1	-24.9	9.6	-2.60	0.00	-0.19	0.10
	0.2	-57.6	0.1	-1.66	0.00	-0.19	0.10
	0.3	-79.8	0.0	-1.28	0.00	-0.19	0.10

0.4	-88.3	0.0	-1.04	0.25	-0.19	0.10
0.5	-86.3	0.0	-0.68	0.74	-0.19	0.10
0.6	-88.3	0.0	-0.25	1.04	-0.19	0.10
0.7	-79.8	0.0	0.00	1.28	-0.19	0.10
0.8	-57.6	0.1	0.00	1.66	-0.19	0.10
0.9	-24.9	9.6	0.00	2.60	-0.19	0.10
1.0	0.0	36.6	0.00	3.65	-0.19	0.10

FED. ROAD DIST. NO.	STATE	PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
5	IOWA	96			

STATE OF IOWA

STATE HIGHWAY COMMISSION

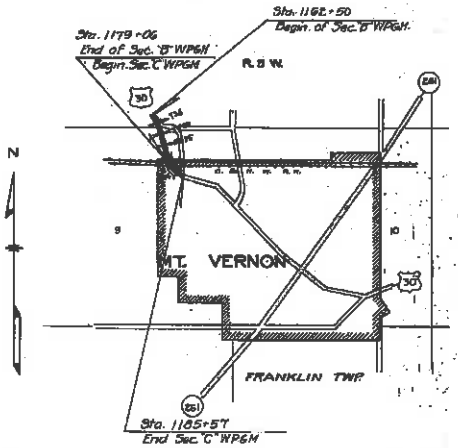
DESIGNS FOR

BRIDGES AND CULVERTS

PRIMARY ROAD SYSTEM U. S. WORKS PROGRAM GRADE CROSSING PROJECT NO. W.P.G.M. 96
NO. W.P.G.H. 96

LINN COUNTY

SEPTEMBER 1935



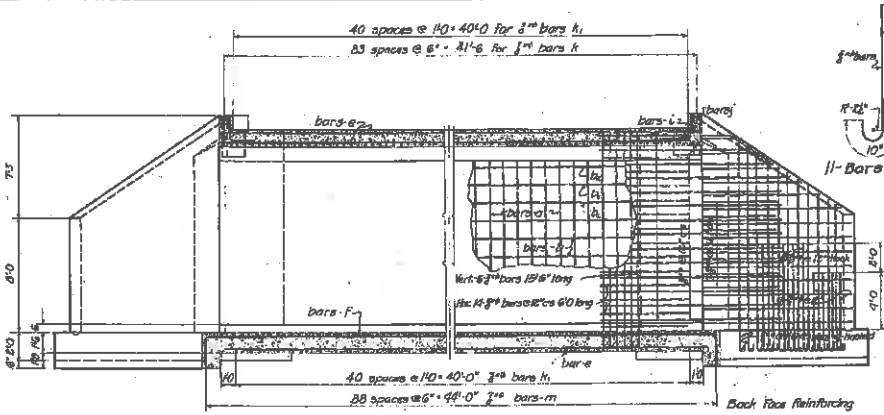
W.P.G.H. & W.P.G.M. 96												
Design	Location			Description	Estimate of Quantities							
	Sec.	Township	Station	Size and Type	Concrete C.Y.	Reinf. Steel #	Struct. Steel #	Piling Creo.	Excava. O.I. Cu.Yd.	Conc. Pipe 24"	Fill C.Y.
634	9	Franklin	1179+156	28' Multiple Span Overhead 4-36'+84' & 1-40'+24' T.B. Spans	406.6	59490	135420	60 @ 30' 30 @ 40' 30 @ 22'	845		
				" W.P.G.H.	349.2	32550	118640	2200 lin.ft.	195		
				" W.P.G.M.	57.4	8940	16780	390 "	50		
736	4	"	1169+00	24" & 54" Conc. Pipe Culv.					10	54	130
5535	9	"	1173+00	4'x5½'x50' " Box Culv.	34.3	3758					315
5635	"	"	1176+20	14'x3'x30' " Under Crossing	184.8	18631					600
				Total	625.7	82279	135420	2400 lin.ft.	1100	54	1045

Standard Specifications of the Iowa State Highway Commission; Series of 1925 for design; Series of 1933 for materials and construction.

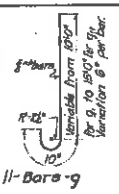
Approved Date
[redacted]
Chief Engineer - Iowa Highway Comm.
Recommended for Approval - Date
[redacted]
District Engineer - District No. 5
Recommended for Approval - Date
[redacted]
Chief Engineer - Bureau of Public Roads
Approved Date
[redacted]
Chief - Bureau of Public Roads

Linn Co. Iowa. Proj. No. W.P.G.M. 96

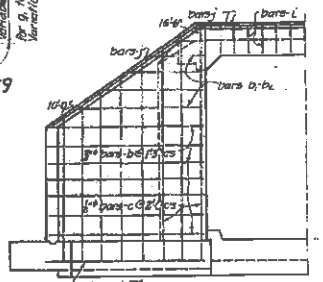
Bench Mark: #15 - Sta. 1169+88 - 60' ℄ Spike in root of 18" Elm - 55' Lt. El. 843.21



LONGITUDINAL SECTION NEAR ℄

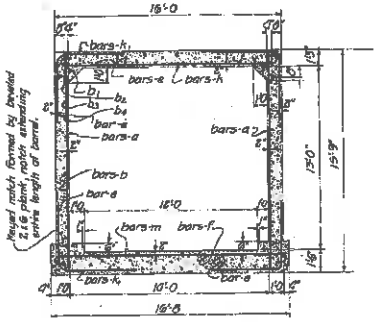


11-Bars-g



HALF END ELEVATION

Front Face Reinforcing

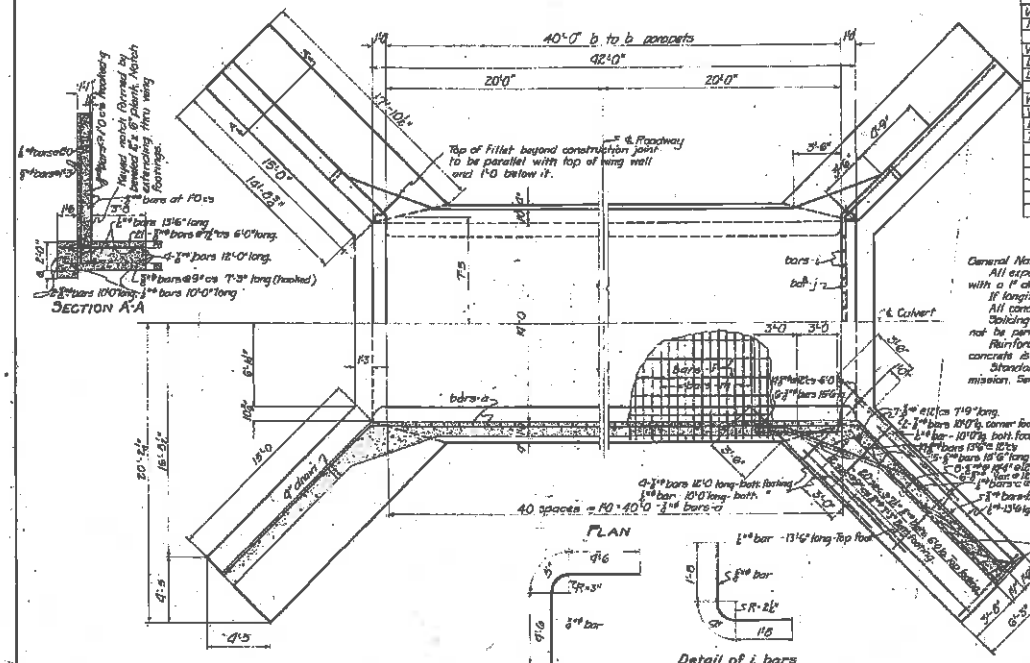


CROSS SECTION OF BARREL

Scale: 1/4" = 1'-0"

Bill of Reinforcing Steel and Quantities

Location of Bars	Mark	No.	Size	Spacing	Length	Weight
Vertical in Walls	a	82	3/4"	1'-0	15'-6	1909
Hor. in Walls and Wings	b	28	3/4"	13	36'-8	1071
" " " "	b_1-b_4	16	3/4"	13	Var.	508
Vertical in Wings Front face	c, c_1-c_4	52	1"	20	Var.	2265
Long. - Footing	d	4	3/4"		15	63
Long. - Slab and corners	e	16	3/4"		41'-9"	609
" - Floor	f	26	3/4"		25'-8"	691
Wing as shown; Back face and footing						9952
Vert. - Parapet	L	26	3/4"	1'-0	3'-6	100
Long. - Parapet	J	8	3/4"		28'-9	215
Trans. - Slab - bottom	h	84	3/4"	6"	17'-8	3005
Trans. - Slab & Floor corners	h_1	154	3/4"	1'-0	9'-8	2316
Trans. - Floor - top	m	87	3/4"	6"	18'-2	3508
Total Weight Reinforcing Steel. Lbs.						19053
" Concrete - Cu. Yds.						1848
Fill Cu. Yds.						600



General Notes:

All exposed corners of 90° or sharper to be filleted with a 1" dressed beveled strip.

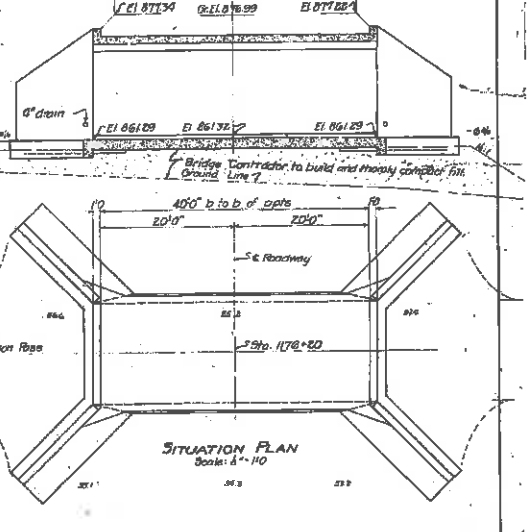
If longitudinal bars are spliced, use a 50 diameter lap.

All concrete to be Class A.

Splicing of bars at junction of barrel and wing wall will not be permitted.

Reinforcing to be securely wired in position before concrete is placed.

Standard Specifications of the Iowa State Highway Commission, Series of 1935



Design for

14' x 8' UNDER CROSSING

Reinforced Concrete

Station 1176+20, Project No. W.P.G.M. 36

LINN COUNTY

Iowa State Highway Commission

June 1935

Scale: 1/4" = 1'-0"

Location
Section 9
Franklin Twp.
Linn County.

Design No. 5635, Linn Co., Iowa.