

RED RIVER DIVERSION

FARGO – MOORHEAD METRO FLOOD RISK MANAGEMENT PROJECT, FEASIBILITY STUDY, PHASE 4

APPENDIX E –BRIDGE STRUCTURES

**Report for the US Army Corps of Engineers, and the cities of Fargo, ND &
Moorhead, MN**

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E1.0 DISCUSSION OF PROJECT FEATURES

The F-M Metro Flood Risk Management Project Feasibility Study, Phase 4 includes the evaluation of two diversion concepts. These include the Minnesota Diversion alternative (Federally Comparable Plan – FCP) and the North Dakota Diversion alternative (Locally Preferred Plan – LPP). This section documents the preliminary bridge design procedure used to develop cost estimates and preliminary bridge layout drawings for the two diversion alternatives under consideration. The two diversion alternatives require differing amounts of bridges as follows:

<u>Alignment</u>	<u>No. of Highway Bridges</u>	<u>No. of RR Bridges</u>
FCP	20	4
LPP	19	4

(Crossings at divided highways such as I-94 are counted as two bridges)

The following table shows the locations of the bridges for each of the alignments.

E2.0 BRIDGE LOCATIONS

BRIDGE LOCATIONS	
Minnesota Diversion (FCP)	North Dakota Diversion (LPP)
Location	Location
Interstate 29 South Bound	Cass County Road 81
Interstate 29 North Bound	Interstate 29 North Bound
110th Ave. S (C-SAH 8)	Interstate 29 South Bound
US Highway 75	48th St. SE (Cass County Road 16)
BNSF Railway	170th Ave. SE (Cass County Road 17)
80th Ave. S (Clay County Road 67)	RRVW Railway
60th Ave. S (C-SAH 12)	46th St. SE (Cass County Road 14)
County-State Highway 52	44th St. SE (Cass County Road 6)
OTV Railway	41st St. SE (Cass County Road 8)
50th Ave. S (Clay County Road 75)	Interstate 94 East Bound
Interstate 94 East Bound	Interstate 94 West Bound
Interstate 94 West Bound	BNSF Railway
BNSF Railway	36th St. SE (Cass County Road 10)
US Highway 10 East Bound	33rd St. SE (Cass County Road 20)
US Highway 10 West Bound	BNSF Railway
28th Ave. N (C-SAH 18)	31st St. SE (Cass County Road 22)
57th Ave. N (C-SAH 22)	28th St. SE (Cass County Road 32)
40th St. N (Clay County Road 95)	Interstate 29 South Bound
90th Ave. N (Clay County Road 26)	Interstate 29 North Bound
100th Ave. N (C-SAH 5)	BNSF Railway
US Highway 75	County Road 81
BNSF Railway	25th St. SE (Cass County Road 4)
110th Ave. NW (Clay County Road 99)	173rd Ave. SE (Cass County Road 31)
15th St. NW (Clay County Road 100)	

E3.0 DESIGN BASIS

The conceptual bridge designs were developed in accordance with the following specifications and manuals: AASHTO LRFD Bridge Design Specifications, Current Edition; Current MnDOT LRFD Bridge Design Manual ; Current NDDOT LRFD Bridge Design Manual.

The superstructures for all of the bridges are of prestressed concrete girders with cast in place concrete decks. Steel plate girder superstructures were evaluated for comparison, but were found to be more costly than the prestressed concrete bridges, and therefore, are not presented here. The substructures consist of concrete wall piers and concrete abutments supported on steel H-piling. The pile termination elevation was assumed to be approximately 100 feet below existing grade, which is consistent with typical bridges in the area. Adjustments were made in unit prices to reflect the varying heights of the structures thereby accounting for the increased substructure costs based on the height of the bridges.

Approach costs were estimated based on raising the roadways to tie into the proposed bridge elevations. Minimum vertical and horizontal (if applicable) curves were designed and fill quantities were estimated based on the difference between proposed and existing grades. Pavement, guardrail, aggregate base, embankment, and other misc. costs were included in the estimates.

Preliminary designs were performed for each type of bridge (based on roadway classification) for both the FCP and LPP alternatives.

The bridge types and associated width are as follows:

MN Divided Highway (I-94 and US 10)	42' clear roadway
MN State Highway	48' clear roadway
MN Local Roads	32' clear roadway
ND Divided Highway (I-29 and I-94)	40' clear roadway
ND Local Roads	28' to 36' clear roadway

E4.0 BRIDGE LENGTH DETERMINATION

Bridge lengths were calculated for each bridge location for each of the alternatives using Excel spreadsheets. The bridge lengths were based on the channel bottom width and elevation, channel slopes consistent with the rest of the channel geometrics (7:1 slopes, bench, then 7:1 slopes), and the estimated deck elevation. The deck elevation was computed by taking the 500-year water surface elevation at the structure and adding freeboard and the superstructure depth. The freeboard was assumed to be 3'-0" and the superstructure depth was approximately 5'-5". The water surface elevations, channel

bottom elevations, and existing ground elevations were taken from the HEC-RAS models provided by Moore Engineering, Inc.

For some bridge locations, the calculated deck elevation was lower than the existing ground elevation. In those cases, the bridge length was based on matching the bridge deck elevation to the existing ground elevation.

Exhibit A shows the Bridge Length Determination spreadsheets for the Minnesota Diversion (FCP) and North Dakota Diversion (LPP) alternatives. The calculated bridge lengths were averaged and rounded to the nearest 20 feet.

E5.0 COST BASIS

A detailed cost estimate was performed for two bridges of varying length and span counts to establish an average superstructure unit cost per square foot of bridge deck. The superstructure unit cost for each bridge type was then applied to the bridge widths and lengths determined for each bridge location. Site specific pier costs were calculated and added to the superstructure cost to account for the various pier heights and span counts found at each bridge. Pier heights for each bridge were assumed to be the same independent of channel slope to be conservative for estimating. The quantities used in the detailed cost estimates were estimated using an Excel spreadsheet, with estimated dimensions of all of the bridge components. The unit prices used in the detailed cost estimates were based on recent average bid prices obtained from websites of the Minnesota and North Dakota Departments of Transportation. See Exhibit B for a Detailed Cost Estimate example spreadsheet.

In addition to the bridge costs, the detailed cost estimates also include costs to construct a temporary bypass or crossover for the road so that traffic can be maintained during construction of the bridge. The bypass cost estimates assumed that the bypass would be constructed along the existing grade.

The last element included in the cost estimates was the approximate costs for grade raises for the bridge sites that would require building the bridge above the existing ground elevation. The quantities for these estimates were based on a maximum grade of 2.5% for highways. See Exhibit C for an example MN Grade Raise Cost Estimate Spreadsheet.

The results of all of the cost estimates are summarized in Exhibit D.

E6.0 RAILROAD BRIDGE COST ESTIMATES

The railroad bridge locations for both the Minnesota Diversion (FCP) and North Dakota Diversion (LPP) Alternatives are listed in the above table for reference only. The costs estimates associated with these structures were developed separately and are included in Appendix G.



Exhibit - A
Bridge Length Determination

Minnesota Diversion (FCP) Alignment

Station:	0+00	0+00	131+52	1286+89	1060+72	1035+21	977+56	960+10	854+06	853+15	743+21	742+27	635+18	515+72	444+11	299+74	245+18	195+22	90+36	6+90		
Feature Carried:	Interstate 29 South Bound	Interstate 29 North Bound	110th Ave. S	US Highway 75	80th Ave. S	60th Ave. S	County-State Highway 52	50th Ave. S	Interstate 94 East Bound	Interstate 94 West Bound	US Highway 10 East Bound	US Highway 10 West Bound	28th Ave. N	57th Ave. N	40th St. N	90th Ave. N	100th Ave. N	US Highway 75	110th Ave. NW	15th St. NW		
A	Invert Elevation:	898.09	898.09	898.09	889.60	891.66	889.15	887.99	887.65	885.50	885.50	883.40	883.40	882.33	877.13	876.42	874.98	874.43	873.92	872.88	872.04	
B	Q 500 WS Elevation	914.87	914.87	914.87	914.02	910.29	908.02	907.04	906.75	905.1	905.1	903.58	903.58	902.12	900.36	899.32	897.12	896.24	895.38	893.24	890.96	
C	Approximate Ground Elevation:	912.64	916.03	916.79	913.22	913.2	918.26	917.01	918.4	914.64	914.76	914.23	913.5	913.45	902.11	903.39	895.85	892.52	892.45	888.86	887.37	
D	Q 500 Depth (ft):	15.40	15.40	15.40	21.35	16.87	16.70	17.90	18.60	17.72	17.72	19.93	19.93	18.80	22.48	21.80	20.91	20.64	20.38	19.62	17.73	
E	Required Freeboard (ft):	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	
F	Abutment Setback (ft):	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	
G	Abutment Thickness (ft):	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	
H	* Skew Angle (degrees):	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
I	Skew Direction:																					
J	Girder Depth (in):	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	
K	Deck Thickness plus Riser (in):	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	
L	Grade Raise Needed (ft):	10.6	7.3	6.5	9.2	5.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.7	4.3	9.7	12.1	13.9	12.8	12.0	
M	Channel Dimensions at Crossing	Bottom Width (ft):	100	100	215	225	400	400	400	400	400	400	400	400	225	225	225	225	225	225	225	
N		Side Slope Below Bench (_H:1V):	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
O		Bench Width (ft):	0	0	0	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70
P		Bench Height (ft):	0	0	0	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
Q	Side slope Above Bench (_H:1V):	7	7	7	7	7	7	7	7	10	10	10	10	10	7	7	7	7	7	7	7	
R	Estimated Bridge Length (EWS to EWS) (ft):	300.6	300.6	415.6	690.9	803.2	800.8	817.6	827.4	867.4	867.4	911.6	911.6	889.0	706.7	697.2	684.7	681.0	677.3	666.7	640.2	
See Sheet S-201 for details	Bridge Length to Use for Design (ft):	300	300	420	680	800	800	820	820	860	860	900	900	880	700	700	680	680	680	660	640	
	Bridge Deck Width (ft):	44.5	44.5	34.5	50.5	34.5	34.5	34.5	34.5	44.5	44.5	44.5	44.5	34.5	34.5	34.5	34.5	34.5	50.5	34.5	34.5	
	Deck Surface Area (ft ²):	13350	13350	14490	34340	27600	27600	28290	28290	38270	38270	40050	40050	30360	24150	24150	23460	23460	34340	22770	22080	

* Skew Angles are measured for estimating bridge lengths at specific crossings. Actual skews used for final design shall follow MN DOT Design Manual guidelines.



Exhibit - A
Bridge Length Determination

North Dakota Diversion (LPP) Alignment

Station:		1885+15.00	1806+15.00	1805+05.00	1640+45.00	1587+20.00	1461+20.00	1347+45.00	1188+70.00	917+55.00	916+65.00	863+75.00	702+75.00	595+15.00	425+75.00	316+35.00	315+30.00	311+75.00	167+55.00	25+10
Feature Carried:		County Road 81	Interstate 29 North Bound	Interstate 29 South Bound	48th St. SE	170th Ave. SE	46th St. SE	44th St. SE	41st St. SE	Interstate 94 East Bound	Interstate 94 West Bound	36th St. SE	33rd St. SE	31st St. SE	28th St. SE	Interstate 29 South Bound	Interstate 29 North Bound	County Road 81	25th St. SE	173rd Ave. SE
A	Invert Elevation:	898.30	899.88	899.90	900.75	883.98	882.31	880.66	878.37	874.44	874.43	873.67	871.34	869.78	867.33	865.74	865.73	865.68	863.59	861.53
B	Q 500 WS Elevation:	921.73	921.72	921.72	920.58	904.45	901.51	900.19	898.58	896.42	896.42	896.09	893.16	891.61	889.34	887.81	887.81	887.81	885.83	884.08
C	Approximate Ground Elevation:	915.32	915.99	916.03	916.98	918.41	915.52	913.30	903.74	908.50	908.50	902.16	897.06	894.44	890.89	888.42	888.29	887.34	885.87	883.21
D	Q 500 Depth (ft):	23.43	21.84	21.82	19.83	20.47	19.20	19.53	20.21	21.98	21.99	22.42	21.82	21.83	22.01	22.07	22.08	22.13	22.24	22.55
E	Required Freeboard (ft):	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
F	Abutment Setback (ft):	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
G	Abutment Thickness (ft):	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
H	* Skew Angle (degrees):	0	0	0	20	0	21	7	0	5	5	13	0	0	0	0	0	0	0	0
I	Skew Direction:				L		L	R		L	L	L								
J	Girder Depth (in):	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54
K	Deck Thickness plus Riser (in):	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11
L	Grade Raise Needed (ft):	14.8	14.1	14.1	12.0	0.0	0.0	0.0	3.3	0.0	0.0	2.3	4.5	5.6	6.9	7.8	7.9	8.9	8.4	9.3
M	Bottom Width (ft):	250	250	250	100	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250
N	Side Slope Below Bench (H:1V):	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
O	Bench Width (ft):	0	0	0	0	0	40	40	40	25	25	25	25	15	15	0	0	0	0	0
P	Bench Height (ft):	0	0	0	0	0	8	8	8	8	8	8	8	8	8	0	0	0	0	0
Q	Side slope Above Bench (H:1V):	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
R	Estimated Bridge Length (EWS to EWS) (ft):	605	583	582	431	641	752	702	640	689	689	659	632	613	615	586	586	587	588	593
See Sheet S-201 for details	Bridge Length to Use for Design (ft):	600	580	580	440	640	760	700	640	680	680	660	640	620	620	580	580	580	580	600
	Bridge Deck Width (ft):	38.5	42.5	42.5	32.5	30.5	32.5	30.5	38.5	42.5	42.5	38.5	38.5	30.5	30.5	42.5	42.5	38.5	32.5	30.5
	Deck Surface Area (ft ²):	23100	24650	24650	14300	19520	24700	21350	24640	28900	28900	25410	24640	18910	18910	24650	24650	22330	18850	18300

* Skew Angles are measured for estimating bridge lengths at specific crossings. Actual skews used for final design shall follow ND DOT Design Manual guidelines.

Example Bridge 1

Summary of Quantities: 8-span, 760' bridge MN-Rural																
Item:	Excavation		Concrete		Reinforcing Steel		Prestressed Beam	Steel Pile	Bridge Backwall Protection	Abutment Strip Drain	Elastomeric Bearing	Expansion Device	Substructure Water proofing	Approach Pavement (10in)	Approach Pavement Footing	
	Class I (dry)	Class II (wet)	4 ksi	4 ksi	Epoxy	Non										
	CYD	CYD	AE-3	AAE-3	LBS	LBS										LIN FOOT
Substructure	Abut 1	95		64.5	**			630	47	43						
	Pier 1	50	162	130.5		24010		1440								
	Pier 2	40	162	130.5		24010		1440								
	Pier 3	30	162	130.5		24010		1440								
	Pier 4	30	162	130.5		24010		1440			10		24			
	Pier 5	30	162	130.5		24010		1440								
	Pier 6	40	162	130.5		24010		1440								
	Pier 7	50	162	130.5		24010		1440								
	Abut 2	95		64.5	**			630	47	43						
	Totals	460	1134	1042.5			168070		11340	94	86	10		24		
	Unit Price	\$12.50	\$39.00	\$525.00	\$625.00	\$1.15	\$1.10	\$210.00	\$45.00	\$25.00	\$31.00	\$1,880.00	\$940.00	\$58.61	\$150.00	\$287.00
Total	\$5,750	\$44,226	\$547,313			\$184,877		\$510,300	\$2,350	\$2,666	\$18,800		\$1,407			
Superstructure	Girder							3760								
	Deck			1004.9		232300						68		98		
	Totals			1004.9		232300		3760				68		98		
	Unit Price	\$12.50	\$39.00	\$525.00	\$625.00	\$1.15	\$1.10	\$210.00	\$45.00	\$25.00	\$31.00	\$1,880.00	\$940.00	\$58.61	\$150.00	\$287.00
	Total				\$628,063	\$267,145		\$789,600				\$63,920		\$14,700		

Example Bridge 2

Summary of Quantities: 5-span , 450' MN-Rural																
Item:	Excavation		Concrete		Reinforcing Steel		Prestressed Beam	Steel Pile	Bridge Backwall Protection	Abutment Strip Drain	Elastomeric Bearing	Expansion Device	Substructure Water proofing	Approach pavement (10in)	Approach pavement Footing	
	Class I (dry)	Class II (wet)	4 ksi	4 ksi	Epoxy	Non										
	CYD	CYD	AE-3	AAE-3	LBS	LBS										LIN FOOT
Substructure	Abut 1	95		17.6	**			630	47	43						
	Pier 1	50	162	130.5		24010		1260								
	Pier 2	40	162	130.5		24010		1260								
	Pier 3	40	162	130.5		24010		1260								
	Pier 4	50	162	130.5		24010		1260								
	Abut 2	95		17.6	**			630	47	43						
	Totals	370	648	557.2			96040		6300	94	86					
	Unit Price	\$12.50	\$39.00	\$525.00	\$625.00	\$1.15	\$1.10	\$210.00	\$45.00	\$25.00	\$31.00	\$1,880.00	\$940.00	\$58.61	\$150.00	\$287.00
Total	\$4,625	\$25,272	\$292,530			\$105,644		\$283,500	\$2,350	\$2,666						
Superstructure	Girder							2275						250	57	
	Deck			618		162360										
	Totals			618		162360		2275						250	57	
	Unit Price	\$12.50	\$39.00	\$525.00	\$625.00	\$1.15	\$1.10	\$210.00	\$45.00	\$25.00	\$31.00	\$1,880.00	\$940.00	\$58.61	\$150.00	\$287.00
	Total				\$386,250	\$186,714		\$477,750						\$37,500	\$16,359	

** Included in Superstructure quantities.



Total Structure costs							
Bridge	Super Structure	Substructure	Total Bridge	Length (ft)	Deck width (ft)	Deck area (SQFT)	Unit price (\$/SQFT)
760 ft	\$1,763,428	\$1,317,688	\$3,081,116	760.5	34.5	26237	\$117.43
450 ft	\$1,104,573	\$716,587	\$1,821,160	460.5	34.5	15887	\$114.63

Pier only costs							
Bridge	Class I (dry)	Class II (wet)	4 ksi	Re-Steel 60ksi	Piling	total	per pier
760 ft	\$3,375	\$44,226	\$479,588	\$184,877	\$453,600	\$1,165,666	\$166,524
450 ft	\$2,250	\$25,272	\$274,050	\$105,644	\$226,800	\$634,016	\$158,504

Superstructure Unit cost without Piers					
Bridge	Total Bridge Cost	Pier total	Superstructure only	Deck area (SQFT)	Unit price (\$/SQFT)
760 ft	\$3,081,116	\$1,165,666	\$1,915,450	26237	\$73
450 ft	\$1,821,160	\$634,016	\$1,187,144	15887	\$75



Example Grade Raise Cost Estimate

	Route:	US Highway 75 Over FCP Alignment
Existing Roadway grade Elevation:		892.45
Estimated Grade Raise Needed:		13.9 ft
Existing grade:		0.0 %
Approach grade:		2.40 %
Exit Grade:		-2.40 %
crest	VC K:	312
	Curve Length:	1499.77
	VC K:	206
Sag	Curve Length:	495.12
	Bridge Length:	680 ft
Calculated approach Length:		905 ft

Bid Item Quantities

Estimated Approach Fill per abutment:	19000 CYD	(Estimated using Geopak)
Pavement Base Course per abutment:	530 CYD	
Asphalt per abutment:	710 Ton	
Existing Pavement Removal:	13900 Sq. Yd	
W Beam Guard rail:	480 ft	
Guard Rail End Sections:	4	

Bid Item	Total Quantity	Unit Price	Subtotal
Approach fill	38000	\$10	\$380,000
Pavement Base Course	1060	\$36	\$38,160
Asphalt	1420	\$50	\$71,000
Existing Pavement Removal	13900	\$3	\$41,700
W Beam Guard Rail	480	\$33	\$15,840
Guardrail End Section	4	\$2,250	\$9,000
Total Approach Costs =			\$555,700



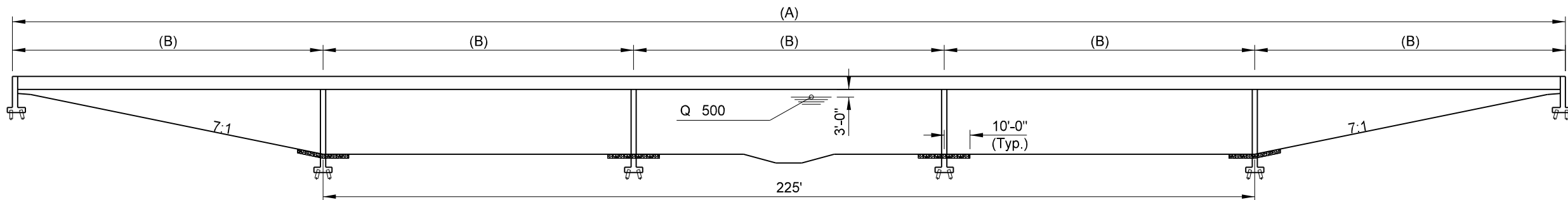
Exhibit - D
 Bridge Cost Summary

Minnesota Diversion (FCP) Bridge Costs Summary								
Location	Bridge Length (ft)	Bridge Deck Area (ft ²)	Cost per ft ² Deck Area	Bridge Structure Cost	Existing Structure Removal	Approach Road Cost	Temporary Bypass Cost	Total Cost per Bridge
Interstate 29 South Bound	300	13,350	125	\$1,670,000	\$0	\$670,000	\$230,000	\$2,570,000
Interstate 29 North Bound	300	13,350	125	\$1,670,000	\$0	\$500,000	\$230,000	\$2,400,000
110th Ave. S	420	14,490	115	\$1,670,000	\$0	\$290,000	\$270,000	\$2,230,000
US Highway 75	680	34,340	110	\$3,780,000	\$0	\$390,000	\$310,000	\$4,480,000
80th Ave. S	800	27,600	110	\$3,040,000	\$0	\$260,000	\$300,000	\$3,600,000
60th Ave. S	800	27,600	115	\$3,170,000	\$0	\$70,000	\$250,000	\$3,490,000
County-State Highway 52	820	28,290	115	\$3,250,000	\$0	\$70,000	\$250,000	\$3,570,000
50th Ave. S	820	28,290	115	\$3,250,000	\$0	\$50,000	\$230,000	\$3,530,000
Interstate 94 East Bound	860	38,270	115	\$4,400,000	\$0	\$160,000	\$230,000	\$4,790,000
Interstate 94 West Bound	860	38,270	115	\$4,400,000	\$0	\$160,000	\$230,000	\$4,790,000
US Highway 10 East Bound	900	40,050	115	\$4,610,000	\$0	\$80,000	\$260,000	\$4,950,000
US Highway 10 West Bound	900	40,050	115	\$4,610,000	\$0	\$80,000	\$260,000	\$4,950,000
28th Ave. N	880	30,360	120	\$3,640,000	\$0	\$70,000	\$260,000	\$3,970,000
57th Ave. N	700	24,150	115	\$2,780,000	\$0	\$300,000	\$300,000	\$3,380,000
40th St. N	700	24,150	115	\$2,780,000	\$0	\$220,000	\$280,000	\$3,280,000
90th Ave. N	680	23,460	110	\$2,580,000	\$0	\$400,000	\$320,000	\$3,300,000
100th Ave. N	680	23,460	110	\$2,580,000	\$0	\$480,000	\$340,000	\$3,400,000
US Highway 75	680	34,340	110	\$3,780,000	\$0	\$560,000	\$350,000	\$4,690,000
110th Ave. NW	660	22,770	110	\$2,500,000	\$0	\$500,000	\$340,000	\$3,340,000
15th St. NW	640	22,080	110	\$2,430,000	\$0	\$480,000	\$330,000	\$3,240,000
							Total	\$73,950,000

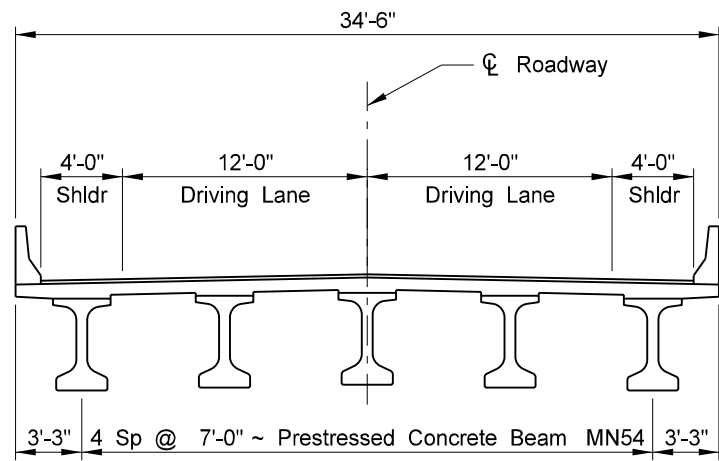


Exhibit - D
 Bridge Cost Summary

North Dakota Diversion (LPP) Bridge Costs Summary								
Location	Bridge Length (ft)	Bridge Deck Area (ft ²)	Cost per ft ² Deck Area	Bridge Structure Cost	Existing Structure Removal	Approach Road Cost	Temporary Bypass Cost	Total Cost per Bridge
County Road 81	600	23,100	120	\$2,770,000	\$0	\$550,000	\$350,000	\$3,670,000
Interstate 29 North Bound	580	24,650	105	\$2,590,000	\$0	\$840,000	\$230,000	\$3,660,000
Interstate 29 South Bound	580	24,650	105	\$2,590,000	\$0	\$830,000	\$230,000	\$3,650,000
48th St. SE	440	14,300	120	\$1,720,000	\$0	\$460,000	\$320,000	\$2,500,000
170th Ave. SE	640	19,520	125	\$2,440,000	\$0	\$70,000	\$240,000	\$2,750,000
46th St. SE	760	24,700	120	\$2,960,000	\$0	\$70,000	\$250,000	\$3,280,000
44th St. SE	700	21,350	125	\$2,670,000	\$20,000	\$70,000	\$250,000	\$3,010,000
41st St. SE	640	24,640	125	\$3,080,000	\$20,000	\$160,000	\$270,000	\$3,530,000
Interstate 94 East Bound	680	28,900	115	\$3,320,000	\$0	\$140,000	\$230,000	\$3,690,000
Interstate 94 West Bound	680	28,900	115	\$3,320,000	\$0	\$140,000	\$230,000	\$3,690,000
36th St. SE	660	25,410	115	\$2,920,000	\$0	\$130,000	\$260,000	\$3,310,000
33rd St. SE	640	24,640	125	\$3,080,000	\$0	\$200,000	\$280,000	\$3,560,000
31st St. SE	620	18,910	125	\$2,360,000	\$0	\$240,000	\$290,000	\$2,890,000
28th St. SE	620	18,910	120	\$2,270,000	\$0	\$280,000	\$290,000	\$2,840,000
Interstate 29 South Bound	580	24,650	120	\$2,960,000	\$10,000	\$520,000	\$230,000	\$3,720,000
Interstate 29 North Bound	580	24,650	120	\$2,960,000	\$10,000	\$530,000	\$230,000	\$3,730,000
County Road 81	580	22,330	120	\$2,680,000	\$10,000	\$360,000	\$310,000	\$3,360,000
25th St. SE	580	18,850	120	\$2,260,000	\$0	\$340,000	\$300,000	\$2,900,000
173rd Ave. SE	600	18,300	120	\$2,200,000	\$0	\$370,000	\$310,000	\$2,880,000
							Total	\$62,620,000

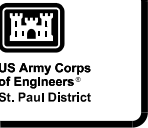


ELEVATION
Minnesota Diversion (FCP)



MN Local Roads Typical Section

Alignment	Bridge Location	Bridge Length (A)	Approximate Span Length (B)	Deck Width	Existing grade Elevation	Proposed Deck Elevation	Channel Elevation
Minnesota Diversion (FCP)	110th Ave. S	420	84.0	34.5	916.79	923.29	898.09



DATE	DESCRIPTION	MARK	DATE	DESCRIPTION	MARK

DESIGNED BY: ARW	DESIGNED BY: ARW	DESIGNED BY: ARW	DESIGNED BY: ARW
DATE: 2011/02/28	DATE: 2011/02/28	DATE: 2011/02/28	DATE: 2011/02/28
FILE NAME: FPM-S-200.dgn	FILE NAME: FPM-S-200.dgn	FILE NAME: FPM-S-200.dgn	FILE NAME: FPM-S-200.dgn
ANSI D	ANSI D	ANSI D	ANSI D
U.S. ARMY CORPS OF ENGINEERS ST. PAUL DISTRICT ST. PAUL, MINNESOTA	U.S. ARMY CORPS OF ENGINEERS ST. PAUL DISTRICT ST. PAUL, MINNESOTA	U.S. ARMY CORPS OF ENGINEERS ST. PAUL DISTRICT ST. PAUL, MINNESOTA	U.S. ARMY CORPS OF ENGINEERS ST. PAUL DISTRICT ST. PAUL, MINNESOTA
HOUSTON ENGINEERING, INC. 1401 21ST AVE. N. FARGO, ND 58102	HOUSTON ENGINEERING, INC. 1401 21ST AVE. N. FARGO, ND 58102	HOUSTON ENGINEERING, INC. 1401 21ST AVE. N. FARGO, ND 58102	HOUSTON ENGINEERING, INC. 1401 21ST AVE. N. FARGO, ND 58102

FARGO-MOORHEAD METRO
FEASIBILITY STUDY, PHASE 4

MINNESOTA DIVERSION (FCP)
TYPICAL BRIDGE DETAILS - 5 SPAN

SHEET
IDENTIFICATION
S-206

