ATTACHMENT 23 – LETTER TO THE NATIONAL TRANSPORTATION SAFETY BOARD FROM THE MINNESOTA DEPARTMENT OF TRANSPORTATION DATED JANUARY 8, 2008

(43 pages)

Minnesota Department of Transportation

Office of Bridges & Structures
MS 610, 3485 Hadley Ave. No.
Oakdale, MN 55128

January 8, 2008

Daniel Walsh P.E.
Highway Accident Investigator
National Transportation Safety Board
Office of Highway Safety
624 Six Flags Drive Suite 150
Arlington, TX 76011

Dear Mr. Walsh,

In response to your email inquiry dated December 18th 2007, we have reviewed our records, and AASHTO and Minnesota Department of Transportation policies. We offer the following responses to your questions:

Question 1: Immediately identify 5 truss bridge designs (out of a total of 25 truss bridge designs in Minnesota) to determine if calculations for the gusset plates are available. Preferably, the 5 truss bridge designs should be on a major artery (NHS system or state route). Please determine if calculations for the gusset plates are available at the time of original design and at a later date when additional weight (dead load) was added to the bridge.

We selected the eight bridges shown on Attachment 1-A. For each of these we examined all bridge files found both in our office and at the Mn/DOT storage facility. Two bridges are on the border with Wisconsin, and Wisconsin DOT supplied additional information to us.

Only two of these bridge files contained any calculations related to gusset plate design. Files for Bridge No. 79000, the Mississippi River Bridge at Wabasha, contained four pages of original calculations for the design of one of the joints in that bridge. Files for bridge 6347 contained calculations for gusset plates, chord to plate calculations only. Copies of these calculations are enclosed as Attachment 1-B and 1-C.

Bridge 9030 was rated by a consultant for Wisconsin DOT in 1996. That rating of the suspended span covered truss chord, and the floor system, but not gusset plates. This bridge was rehabilitated in 1993. Calculations from the 1993 work can be found for truss chords, and the floor system, but not gusset plates

Question 2: Identify the specific language in Mn/DOT standards or NBIS standards requiring a bridge load rating and recalculation of the connections (i.e. gusset plates) to be performed when additional weight is added to the bridge

The policy for load rating existing bridges is addressed by both AASHTO Specifications and Mn/DOT. The 2003 AASHTO Manual for Condition Evaluation of Bridges (MCE) Section 6.1 states, "As part of every inspection cycle, bridge load ratings should be reviewed and updated to reflect any relevant changes in condition or dead load noted during the inspection." Also in the MCE Section 7.2 states "At each inspection, any deterioration or distress which has occurred which will materially affect the load-carrying capacity of the structure should be evaluated."

The Mn/DOT Bridge Maintenance Manual states the bridge conditions that warrant recalculations in Section 5-399.006 Posting of Bridges. A copy is enclosed as Attachment 2-A. In addition the July 2007 draft Load Rating section of Mn/DOT LRFD Bridge Design Manual specifies when new load ratings are required. See Attachment 2-B for the draft section out of the Mn/DOT LRFD Bridge Design Manual on load ratings.

The Bridge Office at the required annual bridge inspection classes has stressed the importance of load rating to inspectors and team leaders. In four of the past five years there have been presentations to inspectors from the Districts and Counties on various load rating topics. When to rerate a bridge was discussed at each of the presentations.

Regarding review of connections, we only have found one reference to connections in the AASHTO MCE. That reference pertained to compression members, not to truss gusset plates. The AASHTO MCE Section 6.5.4 states to "Also, examine the connections of compression members carefully to see if they are detailed such that eccentricities are introduced which must be considered in the structural analysis." Connections are conservatively designed per the AASHTO Standard Specifications 10.18.1.1. Similar language is in Section 6.13.1 of AASHTO LRFD Bridge Design Specifications. The connections shall be designed to a minimum of either the average of the required strength and capacity of section or 75% of capacity of section. Neither BARS nor Virtis rating software include an analysis of connections.

Question 3: What was your procedure in reviewing the Sverdrup bridge design plans in the early 1960's? What specific items did MnDOT review and check as part of the approval process of the bridge design plans? Did the specific items include review and check of the calculations to the gusset plates?

We have reviewed our files and located a March 19, 1974, update of our Bridge Design Manual which includes instructions regarding review of consultant plans in Section 5-392.420(x) on page 13. A copy is enclosed as Attachment 3-A. As noted in the transmittal letter, this is an update of a portion of the Bridge Design Manual. Truss gusset plates are not mentioned in this section, however one must also realize that the era of truss bridges was over by 1974. See the response to Question 5 for that data.

We assume the version prior to 1974 also included a section on Checking Consultant Plans, but we do not have copies of those records. We do know the practice was to review consultant plans prior to 1974 since there was a unit specifically responsible for these reviews in the 1960s. We did find two 1965 letters from the Minnesota Department of Highways to Sverdrup and Parcel transmitting checking prints or review comments. Those are enclosed as Attachment 3-B. We also found hand calculations by a reviewer. The review calculations we have located to not include gusset plate checks.

Question 4: What is the difference in Mn/DOT's procedure for reviewing bridge design plans today versus the early 1960's?

Attachment 4-A is the current copy of Section 1.3.2 Checking of Consultant Prepared Bridge Plans from our LRFD Bridge Design Manual. These pages were last updated in July of 2003. The process today is fairly similar to the 1974 procedures with the instructions noting areas for review or for checking. Truss gusset plates are not mentioned in this current section since that is a structure type no longer in use for Minnesota.

Question 5: Can you please confirm that truss type bridges are no longer being built in Minnesota? All of the truss type bridges were built in the 1960's, with the lone exception of a truss type bridge built in the mid-1980's (the local jurisdiction requested the bridge look historic).

Attached is a list from our Bridge database of the truss bridges on the State Trunk Highway system. This is Attachment 5-A. As we discussed previously, the last truss was built in 1987. The next truss is 1963, since Bridge 9340 I35W is no longer in the inventory.

Please let me know if you need additional information.

Sincerely,

[redacted]

Daniel L. Dorgan
State Bridge Engineer

DLD:lmg

Attachment 1-A

Gusset design review

Bridge No.	Route	Main span length, feet	AADT	Year built	Additional deck, thickness, year	Original design calcs found	Comments
09001	MN 210	214	1350	1961	1.5 inch 1993	No	No gusset calculations found, original or rerating.
6748	MN 23	290	31000	1957	1.5 inch 1978	Yes	No gusset calculations found, original or rerating.
6347	MN 243	162	7600	1953	0 1979	Yes	Ten original pages gusset calculations found. (Deck was replaced with same thickness)
5895	US 61	514	32500	1950	2.5 inch 1987	Yes	No gusset calculations found, original or rerating.
5900	MN 43	450	11900	1941	1 inch 1985	Yes	No gusset calculations found, original or rerating. A letter was found indicating that the fabricator increased the number of rivets in a connection.
6690	MN 11	249	1400	1954	none	Yes	No gusset calculations found, original or rerating.
9030	I 535	600	28000	1961	1.5 inch 1993	No	No gusset calculations found, original or rerating.
79000	MN 60	470	4750	1987	none	Yes	Four original pages gusset calculations found.

SVERDRUP & PARCEL

JOB 9561 MISSISSIPPI RIVER BR. AT WABASHA SHEET NO. 309. OF

COMPUTATIONS FOR TRUSS – DETAILING DATE MARCH 1986

BY [redacted] CHKD [redacted]

JOINT:

LO–UI CONNECTION:

D+L+I; SHT. 5^D REQUIRES 1903/9.62 = 198$^{\pm}$ – ⅞"ϕ BOLTS OR 99/GUSSET

WIND + DL: 2435^K @ 1.46 = 1668^K

PORTAL MOMENT @ 4 FT. FROM LO = 980^{1K} @ 1.60 = 613^{1K}

TOTAL SHEAR TO GUSSET (EA. SIDE)

N_B = 1668/(2×9.62) + 613/(1.6667×9.62) = 125$^{\pm}$ – ⅞"ϕ @ 125% N.U.S.

REQ'D. NO. OF BOLTS TO EA. GUSSET = 125×0.8 ≅ 100 MIN.

USE 105 BOLTS @ EACH SIDE

LO–L2 CONNECTION:

D+L+I; SHT. 5^D REQUIRES 1236/9.62 = 129$^{\pm}$ – ⅞"ϕ BOLTS OR 65/GUSSET

WIND + DL:

[(613^{1K}/1.6667)×(39.17/60.36) + 1653^K/(2×1.46)]/9.62 =

= 84 – ⅞"ϕ BOLTS PER GUSSET @ 125% N.U.S.

REQ'D. NO. OF BOLTS TO EA. GUSSET = 84×0.8 ≅ 68 MIN.

USE 70 BOLTS @ EACH SIDE

MOMENT CONN. BETWEEN END FB & TRUSS JOINT:

(WIND ONLY)

MAX M = 1210^{1K} × 45.94/60.36 = 920^{1K} (@ 1.60) @ N.A. OF END FB (@ JOINT LO)

FORCE IN UPPER TIE PL. = 920/(1.60×2×3.33) ≅ 87^K

FORCE IN LOWER TIE PL. = 920/(1.60×2×2.79) ≅ 104^K

REQ'D. TIE PL. THICKNESS:

b = 18 – 4×1 = 14"

REQ'D. t = 104/(14×27.0 KSI) = 0.275"

USE MIN t = ⅜"

REQ'D. NO. OF ⅞"ϕ H.S. BOLTS

REQ'D N_B = 104/9.62 = 11 ⟶ USE 14 BOLTS (BOTT.)

N_T = 87/9.62 = 9 ⟶ USE 10 BOLTS (TOP)

OR @ BEARINGS:

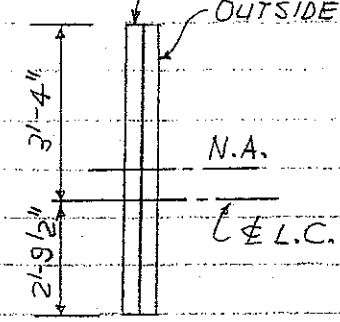
8 – 1¼"ϕ H.S. BOLTS ⟶ CAP = 157^K > 104^K (O.K.)

CHECK GUSSET PL'S FOR BENDING & SHEAR:

VERTICAL SECTION:

INSIDE GUSSET PL'S 1½" × 73½"

OUTSIDE GUSSET PL'S 1" × 73½"



$\Sigma A = 2.5 \times 73.5 = 183.75 \ \square''$

$I_{NA} = 2.5(73.5)^3/12 = 82722 \ IN^4$

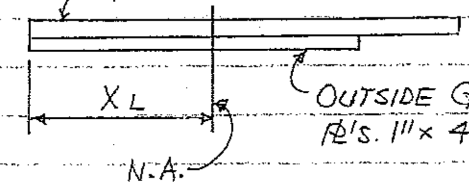
$SM = 82722/36.75 = 2250.9 \ IN^3$

$f_b = 1548 \times (29.22 - 9)/2250.9 = \underline{13.9 \ KSI < F_b}$

$f_v = 1548/183.75 = \underline{8.4 \ KSI < F_v}$

HORIZONTAL SECTION:

INSIDE GUSSET PL'S 1½" × 64"



OUTSIDE GUSSET PL'S. 1" × 47"

LOCATION OF N.A.:

$1.5 \times 64.0 = 96.00 \ \square'' \times 32.0 = 3072 \ IN^3$

$1.0 \times 47. = 47.00 \ \square'' \times 23.5 = 1105 \ IN^3$

$\Sigma A = 143.00 \ \square'' \quad = 4177 \ IN^3$

$X_L = 4177.0/143.0 = \underline{29.22 \ IN.}, \quad X_R = 64.0 - 29.22 = 34.78 \ IN$

$I_{N.A.} = 1.5(64.0)^3/12 + 96.00(2.78)^2 = 33497 \ IN^4$

$1.0(47.0)^3/12 + 47.00(5.72)^2 = 10195 \ IN^4$

$I_{N.A.} = 43692 \ IN^4$

$MIN \ SM = 43692/34.78 = 1256.2 \ IN^3$

$f_b = 1215 \times (36.75 - 33.5)/1256.2 = \underline{3.1 \ KSI < F_b}$

$f_v = 1215/143.00 = \underline{8.5 \ KSI < F_v}$

CHECK DEVELOPMENT OF COV. PL'S INSIDE GUSSET PL'S.:

MEMBER L0-L2:

AGE OF ONE COV. PL = $(19 - 9) \times 0.5 = 5.0 \ IN^2$

CAPACITY OF COV. PL = $5.0 \times 27.0 \ KSI = 135.0^K$

FOR MIN. SIZE OF FILLET WELDS $W = 5/16''$

REQ'D $L = 135.0/(0.27 \times 70.0 \times 0.707 \times 0.3125 \times 2) \cong \underline{16\frac{1}{4}'' \ MIN.}$

MEMBER L0-U1:

TOP COV. ℔ AGE = $19 \times 0.625 = 11.875\ IN^2$

CAPACITY = 11.875×19.06 KSI = 227.0^K

FOR MIN SIZE OF FILLET WELDS $W = \frac{3}{8}''$

REQ'D $L = 227.0/(0.27 \times 70.0 \times 0.707 \times 0.375 \times 2) \cong 22\frac{3}{4}''$ MIN.

BOTT. COV. ℔ AGE = $(19.0 - 9.0) \times 0.625 = 6.25\ IN^2$

CAPACITY = 6.25×19.06 KSI $\cong 120.0^K$

FOR $W = \frac{3}{8}''$

REQ'D $L = 120.0/(0.27 \times 70.0 \times 0.707 \times 0.375 \times 2) \cong 12''$ MIN.

SVERDRUP & PARCEL

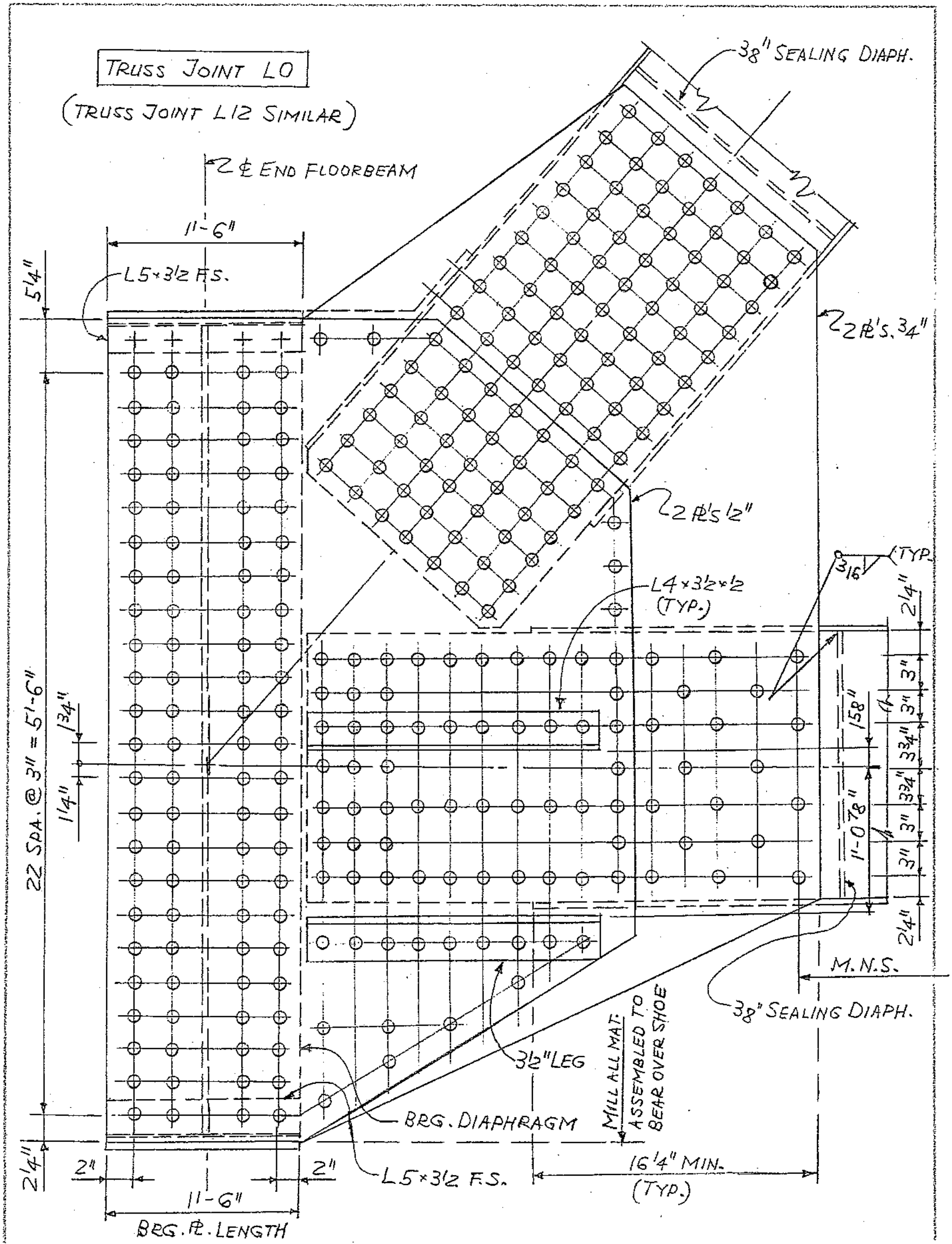
JOB 9561 MISSISSIPPI RIVER BR. AT WABASHA

SHEET NO. 312 OF

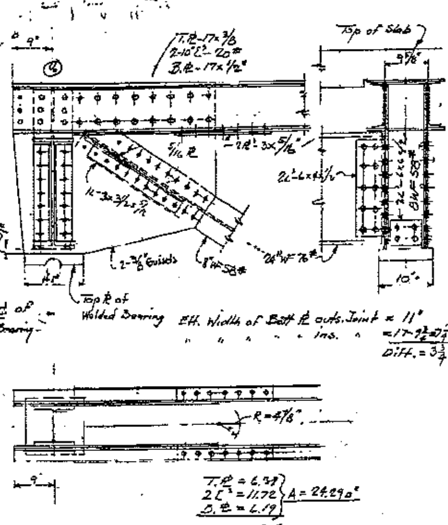
DATE MARCH 1986

COMPUTATIONS FOR TRUSS - FINAL DESIGN

BY [redacted] CHKD [redacted]



DESIGN — Sheet 18



Eff. Width of Bott. Pl. outs. Joint = 11"
" " " " " ins. " = 17 - 9 3/4 = 7 1/4
Diff. = 3 3/4

T.Pl. = 6.39
2 [= 11.72
B.Pl. = 6.19
A = 24.29 □"

U_0U_1 Connect. Load:

$T + \frac{M \cdot c}{I} = 189.6 + \frac{33.06 \times 5.957}{4.545} = 198.0^K$

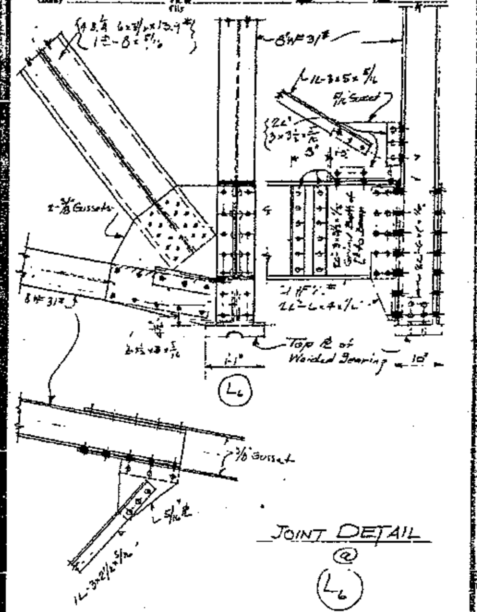
189.6 x .0177 = 3.36
DL + Equiv. LL = 29.70
33.06K

3/4" Riv.s in S.S. = $\frac{198.0}{5.964}$ = 34

Connect. Load to Bott. Pl. = (198.0) x $\frac{6.19}{24.29}$ = (50.5K)

DESIGN — Sheet 20

Checked by JFF



JOINT DETAIL
@
L_6

DESIGN — Sheet 19

Joint U_0

U_0U_1 Bott. Pl. reduced in effective Width from 11" to 7 1/4". Use Reinf. Pl.s to carry the Difference:

Connect. Load to Reinf. Pl.s = 50.5 x $\frac{3.75}{11}$ = 17.2K

Thickness req'd of 2-3" wide Pl.s:

$\frac{17.2}{18 \times 2 \times 3}$ = 0.16" say 5/16. Use 2-Reinf. Pl.s 3 x 5/16

3/4" Riv.s req'd in Reinf. Pl.s = $\frac{17.2}{5.964}$ = 2.9 say 6

Joint L_6

U_6L_6 50% Capacity = $\frac{9.12}{2}$ x 11.78 = 53.7K

3/4" Riv.s in S.S. = $\frac{53.7}{5.964}$ = 9 say 12

U_5L_6 50% Capacity = $\frac{18.74}{2}$ x 12.9 = 120.8K < 188.3K

3/4" Riv.s in S.S. = $\frac{188.3}{5.964}$ = 31.6 say 32

L_6L_6 3/4" Riv.s req'd = $\frac{118.7}{5.964}$ = 19.9 say 20

Beam for Jacking

M = 100.0 x 2 = 200.0'K $S_{req'd} = \frac{200 \times 12}{18}$ = 106.7

Use 21" WF 62# (S = 126.4)

Bear. on 0.4" Web → 3/4 x .40 x 27 = 8.1K

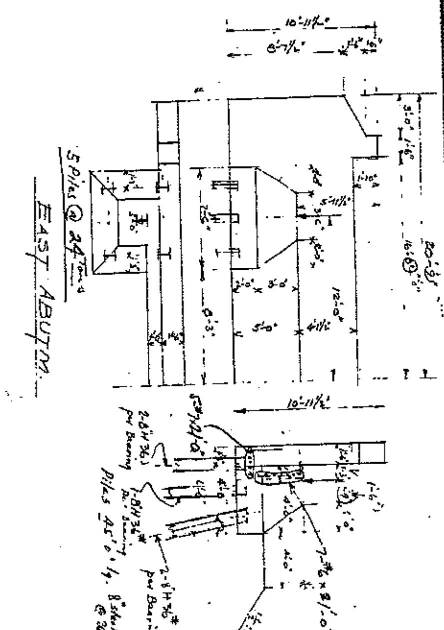
3/4" Riv.s in Beam = $\frac{100}{1.25 \times 8.1}$ = 9.9 say 10

" " " S.S. = $\frac{100}{1.25 \times 5.964}$ = 13.4 say 14

DESIGN — Sheet 1 of 4

48.2-7040-22.1

Structure B-48-224 Computed by UG 8/6 1952 Checked by JFF
County Polk Vil. of Osceola Span 1951 Load H15



B-48-224
1951

DESIGN — Sheet 14

Structure ______ Computed by ______ 19__ Checked by ______
County ______ Tn. Vil. of City ______ Spec. ______ Load ______

Wind Loads

Ro'l. 3 × 2½" = 7½"
Conc. 18 - 1/8" = 17⅞"
25⅜" → Floor + Rails = 2.09 × 92.0 = 192.30'
(2-1⅛")

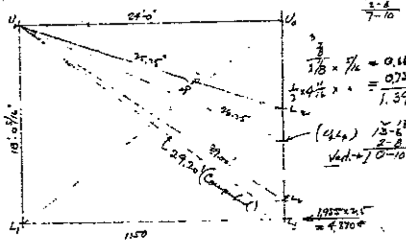
1 Truss

10¾"	Top Chord	= 0.90 × 91.0 =	81.90
8¼"	Bott. —	= 0.69 × 48.17 =	33.23
8⅛"	—	= 0.68 × 15.01 =	10.21
8"	—	= 0.67 × 30.50 =	20.43
8⅛"	Diag.s	= 0.68 × 38.49 =	26.17
8"	—	= 0.67 × 38.49 =	25.78
12 5/16	—	= 1.026 × 24.21 =	24.83
8"	Vert.s	= 0.67 × 81.25 =	54.45

277.00
Σ = 277.00 □' Wind Area = 469.3 □'

50# Wind on unloaded Struct. = 469.3 × 1.5 × 50 = 35,200#

Per Panel of Lower Chord = 35,200 / (6 × 3) = 1,955#



3/8 × 5/16 = 0.165
½ × 4½ × ⅜ = 0.732
1.397□

Left End Panel

U_0L_1 = 4,870 × 30/24 = 1,115# Area req'd = 6,115/18,000 = 0.340□
r_1 = (30 × 12)/140 = 1.5, r_2 = 1.5/2 = 0.75 L - 3 × 3 × 5/16 (r_{min} = .74) (5.6#) A_1 = 1.62□

DESIGN — Sheet 16

Wt. of Lower Lat.s

Lat. Diag. U_0L_1 = 29.20
" " L_1L_2 = 28.35
L_2L_4 = 28.30
L_3L_4 = 28.30
L_4L_5 = 28.35 L-3 × 2½ × 5/16
" " L_5L_6 = 28.35
170.75 × 1.15 × 5.6 = 1,100#

Sway Diag. U_2L_2 = 25.25
U_4L_4 = 26.25
U_6L_6 = 29.00 L-5 × 3 × 5/16
81.50 × 1.15 × 8.2 = 768

Struts ST4WF15.5# = 15.5 × 24.0 × 1.15 × 5 = 2,140
— " — (2-3 × 2½ × 5/16) = 5.6 × 7.5 × 1.15 × 5 = 241
4,249 Say 4250#
Truss = 24,450
Σ = 28,700#

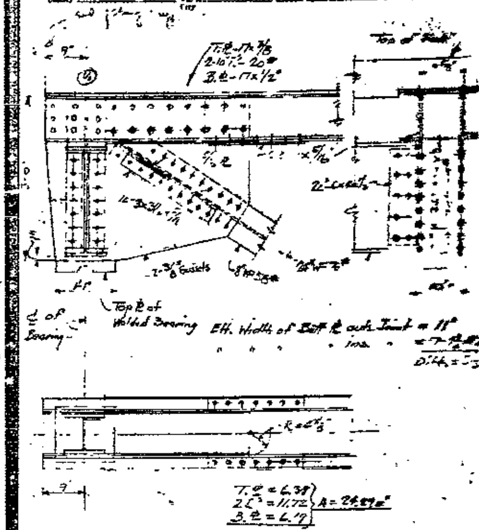
Truss + Bracing per Panel = 28,700/6 = 4,790 say 4.8
Transf. to Sh. #4

Connection Loads

For Symmetr. Members Connect. Loads are the Same as Design Loads for Members.
For Unsymmetr. Members Connect. Loads are as follows:

U_0U_1 → -190.7 - (190.7 × .179 + 29.3 × 12) 5.579 / 4.57 = -280.7k
U_1U_3 → -290.6 - (290.6 × .014 + 51.0 × 12) 5.577 / 4.29 = -476.4k
U_3U_5 → -226.0 - (-226 × .0177 + 51.0 × 12) 5.58 / 4.54 = -390.2k
U_5U_6 → { 0 - 36.85 × 12 × 5.7835 / 4.35 = 192.8k
{ 50% Capacity = 20.51/2 × 14.529 = 149.0k ← U_{5a}

DESIGN — Sheet 18



Connect. Load: 3?
U_0U_1 Connect. Load: T + M/C = 187.6 + 33.06 × 5.757 / 4.54 = 198.2k
189.6 × .0177 = 3.36
DL + Equiv. LL = 29.70
33.06k
¾"φ Riv.s in S.S. = 198.2/5.9 = 34

Connect. Load to Bott. ℄ = (198.2) × 6.39/24.9 = 50.5k

DESIGN — Sheet 15

Sway Diag.s @ U_4L_4

Diag. U_4L_4 = 1955/2 × 25.25/24 = 1,038# r_1 = (26.25 × 12)/240 = 1.312
Area req'd = 1,038/18,000 = 0.060□ r_2 = 1.31/2 = 0.655
L - 5 × 3 × 5/16

Portal Diag.s U_6L_6

Diag U_6L_6 = 35,200/3 × 29.0/24 = 14,200# r_1 = (29 × 12)/240 = 1.45
Area req'd = 14,200/18,000 = 0.790□ r_2 = 1.45/2 = 0.725
1-0, 2-8, 16-4
L - 5 × 3 × 5/16
A_1 = 1.400□ r_1 = 1.61 r_2 = .815

Lower Laterals

L_5 — 15'-3" — L_6
r_1 → Diag. L_5L_6 = (28.35 × 12)/(240 × 2) = 0.709
r_1 = r_2 = 0.709
Diag. L_5L_6 = 35,200/(3 × 2) × 28.35/24 = 6,930#
Area req'd = 6,930/18,000 = 0.390□
L - 3 × 2½ × 5/16 (5.6#)
r_{min} = 0.74

24'-0"

Strut with Vert. Support @ ℄

ST4"WF15.5# r_x = .97, r_y = 2.01

Struts
(Vert.) r = (22.5 × 12)/140 = (1.90)
(Hor.) r = 1.90/2 = (0.95)

DESIGN — Sheet 17

DL Deflection

Member	S Kips	L inches	A □"	SL/A	U_3	SL/A · U_3	(U_3)
L_0L_2	+121.2	180.1	14.11	+1,546	+.7505	+1,160	½ × 15/…
L_2L_4	+183.6	361.75	19.70	+3,352	+1.885	+6,320	½ × … × 3 × …
L_4L_6	+75.8	366.0	9.12	+3,062	+.4690	+1,437	½ × …
U_0U_1	-121.1	180.0	21.41	-1,018	-.750	+763	½ × 15/70
U_1U_3	-184.6	360.0	25.10	-2,650	-1.429	+3,785	½ × 15/10.5 × 2
U_3U_5	-143.6	360.0	21.41	-2,413	-1.112	+2,680	½ × 15/13.5 × 2
U_0L_1	+145.6	216.31	17.06	+1,846	+.9013	+1,663	½ × 18.034/70
U_1L_2	+72.4	219.69	11.76	+1,446	+.824	+1,192	½ × .090676 × 18.3073
L_2U_3	-3.5	219.69	9.12	-844	-.545	+46	½ × .05752 × 18.3073
U_3L_4	-51.3	247.19	9.12	-1,362	-1.028	+1,400	½ × .1085 × 20.193
L_4U_5	+92.9	247.19	11.76	+1,915	+.874	+1,673	½ × .0856 × 20.18
U_5L_6	-120.3	290.50	18.74	-1,866	-.745	+1,391	½ × 24.3… / 16.23
U_1L_1	-76.7	120.0	9.12	-1,010	-.475	+480	½ - .7505 × …/15.01

Σ = 23,993

$\Delta_3 = \frac{23,993}{29,000} = .827$ say ⅞"

Max. End React.
DL = 100.0
ULL = 8.4 × 3.09 = 26.0
CLL = 19.3
(45.3) 23.35% Imp. = 10.6
R = 155.9

End Bearing @ U_0

DL React. = 32.4 × 3.09 = ~100k

⅞"φ Riv.s in Bear. on End Fl. Beam. (Web = .44")
¾ × .44 × 27.0 = 8.92k
⅞"φ Riv.s in Bear. = 100/8.92 = 9.0 Say 10 } Req'd for
" " " S.S. = 100/(1.25 × 5.964) = 13.4 Say 14 } Jacking

U_0U_1 → No. of ⅞"φ Riv.s = 187.6/5.9 = 31.8 say 32

U_0L_1 → No. of ⅞"φ Riv.s = 237.9/5.964 = 39.2 say 40

DESIGN — Sheet 19

Joint U_0

U_0U_1 Bott. ℄ reduced in effective Width from 11" to 7¼". Use Reinf. ℄s to carry the Difference:
Connect. Load to Reinf. ℄s = 50.5 × 3.75/11 = 17.2k
Thickness req'd at 2-3 wide ℄s:
17.2/(18 × 2 × 3) = 0.16" say 5/16. Use 2-Reinf. ℄s 3 × 5/16
⅞"φ Riv.s req'd in Reinf. ℄s = 17.2/5.964 = 2.9 say 3

Joint L_6

U_6L_6 50% Capacity = 9.12/2 × 11.78 = 53.7k
⅞"φ Riv.s in S.S. = 53.7/5.964 = 9 Say 12

U_5L_6 50% Capacity = 18.74/2 × 12.7 = 118.8k < 187.3k
⅞"φ Riv.s in S.S. = 187.3/5.964 = 31.6 Say 32

L_6L_6 ⅞"φ Riv.s req'd = 118.7/5.964 = 19.9 say 20

Beam for Jacking
M = 100.0 × 2 = 200.0'k S req'd = (200 × 12)/18.0 = 133.3
Use 21"WF62# (S = 126.4)

Bear. on 0.4" Web → ¾ × .40 × 27 = 8.1k
⅞"φ Riv.s in Bear. = 100/(1.25 × 8.1) = 9.9 say 10
" " " S.S. = 100/(1.25 × 5.964) = 13.4 Say 14

Attachment 2-A (Mn/DOT Bridge Maintenance Manual - February 23, 1996)

5-399.06 Posting of Bridges

The Office of Bridges and Structures calculates the safe live load capacity of every structure on the truck highway system based on the original plans and as modified by information from inspection reports. Calculations are made in accordance with procedures given in the latest issue of the AASTHO "Manual for Maintenance Inspection of Bridges". Rating vehicles used in the analysis are typical Minnesota legal loads as shown on pages 5-392.530 and 5-392.530(2) of the Bridge Design Manual. Structures which have insufficient strength to safely support Minnesota rating vehicles must be posted to restrict loads passing over the bridge. Ratings and load posting limits are recorded on summary sheet Mn/DOT 22107. (See Fig. 1 5-399.006). Copies of the current summary sheet are filed in the District Office and the Bridge Office. Calculations are available from the Bridge Office on request. The capacity of the structure is recalculated whenever requested by the District. Appropriate times to make this request include the following:

1. Before an overlay is placed on the structure.
2. When significant changes are noticed during inspection of the structure such as measurable loss of section due to corrosion on the primary support members.
3. When structural members of the bridge are damaged by traffic.

If the analysis of the structure shows that the bridge cannot safely support legal loads, the Office of Bridges and Structures will notify the District Engineer. This notification will include a specific recommendation regarding the type of signs that must be erected to control future loads passing over the bridge. When signs are inplace the District notifies the Office of Bridge and Structures and Emergency Operations Section. The recommended posting values are entered in the bridge log which is periodically distributed to the District.

All appropriate signs must be installed and maintained for each bridge which is designed for posting of less than legal load. Deficiencies in signing should be referred to the appropriate Sub area Supervisor or Sign Supervisor.

If an emergency load restriction is necessary (such as during a flood or due to impact damage) the Area Maintenance Engineer will notify the Emergency Operations Section, all other Districts, and the Office of Bridge and Structures. The Office of Bridges and Structures will provide recommendations for emergency load posting or lane restrictions for damaged structures.

Attachment 2-B (Draft Load Rating Section of Mn/DOT LRFD Manual)

RATING NEW BRIDGES

New bridges are to be rated anytime after the plan is completed and before the bridge is opened to traffic. The results are then turned in to the Bridge Management Unit for entering in Pontis.

For MnDOT bridges, the records remain inactive until Bridge Management is informed that the bridge has been opened to traffic.

If any changes are made to the bridge during construction that would affect the rating, these changes should be reported to the Bridge Ratings Unit (or the person who did the original rating), and also be recorded on the as built plans. This includes strand pattern changes for prestressed beams. The bridge rating is then recalculated.

RERATING EXISTING BRIDGES

A new bridge rating should be calculated whenever a change occurs that would affect the rating. The most commonly encountered types of changes are:

- A modification that changes the dead load on the bridge (For example: a deck overlay)
- Damage that alters the structural capacity of the bridge. (For example: being hit by an oversize load)
- Deterioration that alters the structural capacity of the bridge. (For example: rust, corrosion or rot.) (Scheduled inspections are usually the source of this information.)
- Settlement or movement of a pier or abutment.
- Repairs or remodeling.
- A change in the AASHTO Rating Specification
- An upgrading of the rating software.
- A change in laws regulating truck weights

The new rating should be completed, signed, dated, and filed, as outlined in the Forms and Documentation Section of this chapter. This most recent rating then supersedes any and all preceding ratings.

Distribution: Bridge Design Manual

MINNESOTA HIGHWAY DEPARTMENT Developed by: Office of Bridge Design and Bridge Standards Section Issued by: Office of Engineering Standards	TRANSMITTAL LETTER NO. 5-392 (74-2) MANUAL: Bridge Design DATED: March 19, 1974
SUBJECT: 5-392.400 Final Plans	

The attached sheets are an update of the .400 series of the Bridge Design Manual. This portion of the manual primarily contains the Standard Plan Notes and Design and Detailing Instructions.

INSTRUCTIONS:

1. Remove entire .400 series
2. Insert attached sheets
3. Record transmittal letter no., date and subject on the transmittal record sheet in the front of the manual.

[redacted]
E. E. Ofstead
Bridge Standards Engineer

FINAL PLANS
5-392.400

5-392.400 GENERAL

A. An accurate set of construction plans is necessary for the Contractor to build the desired structure. As an aid to assure accuracy in the plans, this chapter includes the Standard Plan Notes and Design and Detailing Instructions.

B. The Standard Notes list is to insure that the plans contain all the pertinent notes to describe the work to be done. This list contains notes for all plans, so the applicable ones should be selected.

C. The Design and Detailing Instructions aid in the preparation and review of all plans. It contains, in the general sequence of plan sheets, the items to look for in order to put out the most complete and consistent plan. This list contains notes and instructions for all plans and only those that apply should be used.

5-392.410 STANDARD PLAN NOTES

A. DESIGN DATA

(Use notes that apply)

1973 A.A.S.H.O. Design Specifications

*HS20 Loading (or H20)

**Includes 30 p.s.f. Dead Load allowance for future wearing course.

Maximum allowable Design Stresses:

fc = 1,600 p.s.i. n = 8

fc = 2,000 p.s.i. n = 6 (For precast channels only)

fs = 24,000 p.s.i. reinforcement (For Grade 60 reinf.)

fs = 20,000 p.s.i. Structural Steel M.H.S. 3306

fs = 27,000 p.s.i. Structural Steel M.H.D. 3309

Deck Area________Sq. Ft.
_________Projected ADT for____(Year)______

*For bridges carrying interstate highway add "and alternate loading designated in PPM 20-4 Section 4C."

**Use only on bridges with no wearing course included on original plan.

B. CONSTRUCTION NOTES

The Minnesota Highway Department "Standard Specifications for Highway Construction" dated January 1, 1972 shall govern as amended by "Supplemental Specifications" dated January 1, 1974.

Bridge seat reinforcement shall be carefully placed to avoid interference with drilling holes for anchor rods. The superstructure (beams or girders) shall be erected in final position prior to drilling holes for and placing anchor rods.

The first digit or the first two digits of each bar mark indicate the bar size.

The signature titles in the title block on the General Plan and Elevation sheet shall be as follows:

____________________	____________________
Bridge Engineer	Assistant Commissioner

C. DRAINAGE AND EROSION CONTROL

(Use notes that apply)

3" o x______non-metallic drains. Cover inside end with 1/4" galv. mesh and approximately 1 cu. ft. of coarse gravel. (Where pipe is below ground, cover both ends with coarse gravel.) (Use this note for weep holes in high wall abutments. Place at about 10' centers.)

Contractor shall dress slopes and place riprap in approximate areas shown, as directed by the Engineer. Random riprap Class B average thickness 1' 6".

The State reserves the right to eliminate all or part of the filter blanket. (Use when there is no pay item for mobilization)

Restore side ditches after placement of slope paving to provide drainage as directed by Engineer. Restoration costs shall be included in price bid for Structure Excavation. (Use on railroad underpasses.)

_______pipe to be placed under grading portion of contract. (Combined Br. & Grading contracts only. Modify to suit job requirements.)

D. EXCAVATION AND EARTHWORK

(Use notes that apply)

Quantity of Structure Excavation for payment is computed with the elevations shown for each substructure unit as the upper limit. Excavation above these elevations will be paid for under grading portion of contract. (Use only portions of note which apply. Modify note for rock. For example specify an elevation for top of exposed or buried rock and add note: "assumed average elevation of top of rock for estimated plan quantities.") (Do not use when lump sum payment for structure excavation is used.)

Construction of each abutment shall not be started until the approach fill at that abutment has been constructed to the (bottom of the approach fill treatment) (top of subgrade) (use appropriate note).

Roadway (or channel) excavation will be made by others in advance of bridge construction. (Not applicable on combined projects).

The lower limits of structure excavation Class E shall be the same as the upper limits of structure excavation Class WE.

Footings shall be keyed into sound bedrock as directed by the Engineer. Top of footing shall have a minimum 1' 0" of cover.

E. REINFORCEMENT

A tolerance of ±1/4" will be permitted (for vertical dimension of trussed slab bars.)

Spiral Data

Outside Diam.____________

Height____________

Pitch____________

Spiral Rod Size ______Plain round

Weight______each

Outside diameter of dowel circle to be 2-1/4" less than inside diameter of spiral. (Increase the 2-1/4" dimension where required for fit where large sized column verticals are used.)

F. PILING AND FOOTINGS

Pile Note (for Timber Piles)
(Use only second line when no test piles are required)

_____Treated (or Untreated) Timber Test Piles__ft. long.
_____Treated (or Untreated) Timber Piles est. length__ft.
_____Treated (or Untreated Timber Piles req'd for__.

Estimated penetration 2 ft. less than length given.

Piles marked thus θ→ to be battered __per ft. in direction shown.
Pile spacing shown is at bottom of footing.

Pile Note (For Steel Piles)
(Use only second line when no test piles are required)
_____Steel Test Piles __ft. long.
_____Steel Piles est. length __ ft.
_____Steel Piles req'd for_____

All piles to be (pile size)

Piles marked thus H→ to be battered __per ft. in direction shown.
Pile spacing shown is at bottom of footing.
For splices see Bridge Detail B202.

Pile Note (For Cast-In-Place Piles)
(Use only second line when no test piles are required)
_____Cast-in-Place Conc. Test Piles__ft. long.
_____Cast-in-Place Conc. Piles est. length__ft.
_____Cast-in-Place Conc. Piles req'd. for ____.

Piles to have a nominal diameter of_____
Piles marked thus θ→ to be battered ____per ft. in direction shown.
Pile spacing shown is at bottom of footing.

12" nominal diameter piles may be used as an alternate to 10" nominal diameter piles with no additional compensation.

ABUTMENTS

Computed Soil Pressure K/Sq. Ft.	
D.L. + Earth Pressure	______
Live Load	______
Total	______

ABUTMENTS

Computed Pile Loads - Tons/Pile	
D.L. + Earth Pressure	______
Live Load	______
Total	______

PIERS

Computed Pile Loads - Tons/Pile		
	Pier	Pier
Dead Load	____	____
Live Load	____	____
Overturning	____	____ if Req'd
Total	____	____

——— = ____ Reduction per AASHO 1.2.22

PIERS

Computed Soil Pressure K/Sq. Ft		
	Pier	Pier
Dead Load	____	____
Live Load	____	____
Overturning	____	____ if Req'd
Total	____	____

——— = ____ Reduction per AASHO 1.2.22

G. CONSTRUCTION NOTES FOR STEEL SPANS

(Use only notes that apply)

All structural sheet shall conform to M.H.D. (3306) (3309) unless otherwise noted.

Field connections shall be made with 7/8" high strength bolts or 7/8" pin bolts, except as noted.

Rows of shear connectors shall be aligned parallel to the transverse slab reinforcement bars. (For skew bridges with reinf. parallel to skew.)

Shear connectors to be included in weight of Structural Steel M.H.D. (3306) (3309).

Special reaming as per M.H.D. 2471.3E1b will be required for the beam splices. The section to be assembled for reaming shall be from_____to _____.

Full assembly reaming will be required as per M.H.D. 2471.3E1d. (Use full assembly reaming only for complicated structures such as curved, superelevated, etc.)

Web plates shall be furnished in available mill lengths. Location of splices shall be subject to the approval of the Engineer and shall be a minimum of 1' 0" from stiffeners or flange splices.

All butt splices shall be full butt welds using low hydrogen process and shall be ground flush.

Start cover plate welds at center of plate and proceed simultaneously on both sides of the plate toward either end.

Bearing stiffeners shall be perpendicular to flange. (for usual highway bridges).

Bearing stiffeners shall be vertical. (for pedestrian bridges)

End of beams shall be vertical.

Flange plates for beams shall be heat curved before webs are attached. (Use for curved welded beams with less than about 10° curve).

Flange plates for beams shall be cut to proper curvature. (Use when degree of curvature is about 10° or greater and beam cannot be heat curved. Check with Structural Metals Section).

The weight of curved flange plates for payment will be based on the required finished dimensions.

Fill plates are to be included in price bid for bearing assemblies.

H. CAMBER NOTES

Deflections shown are for weight of slab, wearing course, railing, median, and sidewalk. (Include diaphragms for prestressed concrete girder.)

Camber diagram shown is for beam camber without any dead load deflection. Dead load deflections due to weight of steel are_____% of deflections shown on deflection diagram.

I. CONCRETE POURS

Cast counter weight at least 48 hrs., in advance of placing deck slab.

J. JOINTS AND JOINT SEALER

Finish top of all sidewalk, median, and construction joints with small radius edger, and vertical edges with 1/2" V strips. Break bond at joint by approved method. No reinforcement thru joint.

Make saw cut in roadway slab over center line of piers as soon as the cutting can be done without raveling the concrete. (Use on prestressed concrete beam bridges with double diaphragms and slab continuous over piers, where there is no bituminous wearing course.) (Modify for Latex mortar overlays.)

Place 1/2" bit felt on face of shear lug.

Place 1-1/2" Type A Polystyrene behind bearing assembly and 3/4" polystyrene on each side of bearing assembly.

1" Type A Polystyrene on bridge seat. Cut out for bearing assemblies. (Use polystyrene only at single line pile bent contraction type abuts.)

Form opening in web over bearing.

Bridge seat steps shall be parallel to beams. Place 1/2" bit. felt on vertical faces on bridge seat steps. (Use where concrete diaphragm extends to bridge seat).

Place protective coating on bridge seat and 3" up on parapet walls. (Use on bridge seats where expansion devices are used. Modify if used at pier.)

K. CAST STEEL BEARING ASSEMBLIES

(Use only notes that apply)

All castings shall be Carbon Steel M.H.D. 3322 Grade 70-36.

All castings shall be Alloy Steel M.H.D. 3323 Class 90.

Pins and nuts shall conform to M.H.D. 2471.3D8.

Pins shall be cold finished alloy bar steel M.H.D. 3314 Type II (for pins 5" or less).

Pins shall be hot rolled alloy bar steel M.H.D. 3313 Type II (for pins over 5").

Pintles shall be cold finished alloy bar steel M.H.D. 3314 Type II.

Structural steel shall conform to M.H.D. (3306) (3309) except as noted.

Lubricated bronze bushings shall conform to M.H.D. 3329.

All fillets on casting shall be 3/4" radius unless otherwise noted.

Paint cast bearing assemblies same as structural steel except pins, pin holes, and bushings. (Modify note when unpainted weathering steel is used.)

Pins and pin holes shall be coated, in the shop, with a heavy protective grease. Prior to erection, the pins and pin holes shall be cleaned and coated with an approved grease.

The price bid for bearing assembly shall include all materials (anchor rods, sheet lead, bearing, and bolts for attaching bearing to beam) for each type as shown.

L. WELDED STEEL BEARING ASSEMBLIES

Structural steel shall conform to M.H.D. 3309 except as noted.

Pins and nuts shall conform to M.H.D. 2471.3D8.

Pins shall be cold finished alloy bar steel M.H.D. 3314 Type II (for pins 5" or less).

Pins shall be hot rolled alloy bar steel M.H.D. 3313 Type II (for pins over 5").

Pintles shall be cold finished alloy bar steel M.H.D. 3314 Type II.

Lubricated bronze bushings shall conform to M.H.D. 3329.

All welded bearing assemblies shall be annealed after welding. Pin holes and top and bottom plates shall be finished after annealing. (For welded rockers and bolsters).

Paint welded bearing assemblies same as structural steel except pins, pin holes, and bushings. (Use only where painting is required, as at leaking type expansion devices.)

Pins and pin holes shall be coated, in the shop, with a heavy protective grease. Prior to erection, the pins and pin holes shall be cleaned and coated with an approved grease.

The price bid for bearing assembly shall include all materials (anchor rods, sheet lead, bearing, and bolts for attaching bearing to beam) for each type as shown.

M. CUTTING AND REMOVAL OF OLD CONCRETE

Shaded areas indicates concrete to be removed.

No cutting will be permitted until the cutting limits have been outlined by the Contractor and approved by the Engineer. Removal and reconstruction shall conform to M.H.D. 2433.

N. MISCELLANEOUS NOTES

The contractor shall make field measurements as necessary prior to fabrication of the ______ to assure proper fit in the final work. (Use when not tied to M.H.D. 2433.)

Beam length dimensions are slope lengths. (Use where necessary for proper fit.)

The volume of deck concrete for payment shall be computed using an average stool height of ______ inches. (The average stool height should be realistic.)

The quantity of concrete for splash blocks will be computed and paid for as concrete mix No. 3Y43. Reinforcement bars are incidential and will not be measured for payment.

O. SUMMARY OF QUANTITIES NOTES

1. Bridge No.______Project No._________Date

2. State will furnish disk. Payment for placing to be included in price bid for other items. See Std. Plate No. 9301 for placing.

3. To be included in price bid for other items.

4. Included in weight of Structural Steel M.H.D. (3306) (3309).

5. Does not include test piles.

WHEN TO USE NOTES:

1. When bridge name plate is required.

2. When bench mark disk is required.

3. For incidental quantities not listed in pay items (joint filler, waterproofing, etc.)

4. Miscellaneous steel quantities. (Protection angle, exp. device, etc.)

5. When piling quantities are listed.

P. PAY ITEMS (1972 SPECS., 1974 SUPPLEMENTAL SPECS., AND SPECIAL PROVISIONS)

(P) denotes plan quantity pay items as per M.H.D. 1901.

ITEM NO.	ITEM	UNIT	QUANTITY	
2021.501	Mobilization	Lump Sum	________	
2031.501	Field Office, Type_______	Each	________	
2031.503	Field Laboratory, Type________	Each	________	
2104.503	Remove Slab, Type (1 or 2)	Sq. Ft.	________	
2361.504	Asphalt Cement	Ton	________	
2361.508	Wearing Course Mixture	Ton	________	
2401.501	Concrete, Mix No.________	Cu. Yd.	________	(P)
2401.511	Concrete, Mix No.________	Sq. Ft.	________	(P)
2401.521	Structure Excavation, Class________	Cu. Yd.	________	(P)*
2401.541	Reinforcement Bars	Pound	________	(P)
2401.543	Spiral Reinforcement	Pound	________	(P)
2402.521	Structural Steel, (Spec. No.)	Pound	________	
2402.546	Floor Drains, Type________	Each	________	
2402.583	Ornamental Metal Railing	Lin. Ft.	________	(P)
2402.593	Fixed Bearing Assemblies, Type_______	Each	________	
2402.594	Exp. Bearing Assemblies, Type_______	Each	________	
2405.501	Prestressed Concrete Girders, Type_______	Each	________	
2405.511	Elastomeric Bearing Pad, Type_______	Each	________	
2433.501	Lump Sum Removal	Lump Sum	________	
2433.502	Remove Concrete or Masonry	Cu. Yd.	________	
2433.516	Anchorage in Place	Each	________	
2442.501	Remove Old Bridge	Lump Sum	________	
2451.503	Granular Backfill (CV)	Cu. Yd.	________	(P)
2451.505	Aggregate Backfill (CV)	Cu. Yd.	________	(P)
2451.515	Soil Bearing Tests	Each	________	
2452.503	Treated Timber Piling Delivered	Lin. Ft.	________	
2452.504	Treated Timber Piling Driven	Lin. Ft.	________	
2452.507	Cast-In-Place Concrete Piling Delivered	Lin. Ft.	________	
2452.508	Cast-In-Place Concrete Piling Driven	Lin. Ft.	________	
2452.510	Steel H-Piling Driven	Lin. Ft.	________	
2452.511	Steel H-Piling Delivered	Lin. Ft.	________	

*Do not use (P) for rock excavation.

2452.517	Treated Timber Test Piles,___feet long	Each	________	
2452.519	Cast-In-Place Concrete Test Piles,____feet long	Each	________	
2452.520	Steel H-Test Piles,_____feet long	Each	________	
2452.526	Pile Load Tests	Each	________	
2476.501	Painting Metal Structures	Lump Sum	________	
2477.501	Zinc-Rich Paint System	Lump Sum	________	
** 2551.501	Random Riprap, Class_______	Cu. Yd.	________	
** 2511.504	Filter Blanket, Type _______	Cu. Yd.	________	
2514.501	Concrete Slope Paving	Sq. Yd.	________	(P)
2514.503	Aggregate Slope Paving	Sq. Yd.	________	(P)
2545.501	Electric Lighting System	Lump Sum	________	
2545.509	Conduit System (Lighting, Signals, Telephone, Telegraph, Power)	Lump Sum	________	
2557.501	Wire Fence, Design	Lin. Ft.	________	(P)

** For usual cases specify Class B Riprap and type 1 Filter Blanket

Q. SPECIAL PAY ITEMS (1972 SPECS., 1974 SUPPLEMENTAL SPECS., AND SPECIAL PROVISIONS)

(P) Denotes plan quantity pay items as per M.H.D. 1901.

ITEM NO.	ITEM	UNIT	QUANTITY	
104.601	Remove (Specify Item)	Lump Sum	________	
105.614	Bridge Approach Treatment	Lump Sum	________	
105.637	_______Lane By Pass (________' Lanes)	By Pass	________	
301.603	Bridge Approach Panels	Lump Sum	________	
401.604	Surface Finish of Concrete, Type_______	Sq. Ft.	________	(P)
401.608	Post-tensioning in place	System	________	
401.610	Structure Excavation	Lump Sum	________	
401.618	Reconstruct _______	Lump Sum	________	
401.620	_______Repair	Lump Sum	________	
402.602	Expansion Assembly, Type______	Assembly	________	
402.603	Walkway Grating, Type_______	Sq. Ft.	________	(P)
402.604	Temporary Pedestrian Bridge	Lump Sum	________	
402.606	Install_______	Lump Sum	________	
402.612	Drainage System	System	________	
403.606	Glued Laminated Stringer, Type_______	Stringer	________	
405.605	Prestressed Conc. Slabs, Type_______	Slab	________	
451.606	Soil Borings	Lin. Ft.	________	
451.607	Rock Core Borings	Lin. Ft.	________	
451.612	Soil Sampling Test	Test	________	
451.613	Pressuremeter Test	Test	________	
452.601	Steel Sheet Piling	Sq. Ft.	________	
452.606	______Piling Furnished and Driven	Lin. Ft.	________	
452.608	Caisson ______" Diam.	Lin. Ft.	________	
452.609	Cased Caisson______" Diam.	Lin. Ft.	________	
452.611	Pile Tip Anchorage	Each	________	
452.613	Pile Placement	Each	________	
461.611	Mortar	Cu. Yd.	________	
481.603	(Specify Type) Waterproofing	Sq. Ft.	________	(P)
531.607	Concrete Curb Repair	Lin. Ft.	________	
545.604	Trestle and Conduit System (Power, Telephone, Telegraph, Gas)	System	________	
557.610	Chain Link Enclosure	Lin. Ft.	________	(P)
564.626	Traffic Controls	Each	________	
599.601	Temporary Trestle	Lump Sum	________	
599.604	Railroad Track Sub-Ballast	Cu. Yd.	________	(P)

5-392.420 DESIGN AND DETALING INSTRUCTIONS

A. GENERAL

Check with preliminary plan, Bridge Construction Section's "Preliminary Review and Foundation Recommendations", Utilities Unit's "Utilities Requirements on M.H.D. Bridges", letter file, and preliminary file.

Check grades, stationing, end slopes, berms, roadways, shoulders, and median with grading plans.

Review preliminary plan with Preliminary Plans Section and Bridge Construction Section before beginning final plans.

B. GENERAL PLAN AND ELEVATION

1. Plan:

Show span lengths, working points, width, centerlines, angles, curves, minimum horizontal clearance, point of minimum vertical clearance, extent of slope protection, approach panels and curbs, approach panel drains, utilities, ditch drains, deck drains, lights, roadway elevations, stationing, name plate, distance between twin bridges. Show north arrow. Tie bridge dimensions to working points.

2. Elevation:

Show grade, contraction, expansion and fixed points, label piers, spans and abutments, slope protection, give end slopes, min. vertical and horizontal clearances, existing ground lines, footing elevations, limits of excavation, grading notes, high water elevation, assumed low water elevation, scale. Ditch cleanout along railroad tracks.

Show dimension from centerline of pier to toe of slope paving. If there is no side pier, given dimension to centerline of roadway.

Show straight slope line for slope paving. Do not follow ditch radius curve.

3. Typical Cross-Section:

Show transverse bridge dimensions, lane slopes, beam depth and spacing for all spans, type of railing, profile grade location.

4. Miscellaneous:

Design data, standard construction notes, list of sheets, engineering certification, north point, project no., schedule of quantities, bench mark. Single bridge name plate on S.E. corner for N & S road & N.E. corner for E & W road. Twin bridges on right hand corner approaching bridge. Omit name plate below except on pedestrian RR and bridges. B.M. disk S.E. corner. Single B.M. disk for twin bridges.

Military loading to be noted for bridges carrying F.A.I. traffic only, but all HS20 bridges will be designed for military loading.

Check for ditch drainage pipe. If needed, locate and note if in grading portion of contract.

Show all utilities which affect the bridge construction and note what is to be done about them.

Concrete or aggregate slope paving is used along a highway or railway. Stream crossings to have random riprap with filter blanket. Preliminary plan will indicate type required.

Check project numbers. Check title block. Give span lengths in title to nearest foot. Use Bridge Description and Identification Number in title block as follows:

BRIDGE SUPERSTRUCTURE IDENTIFICATION TYPE AND NUMBER (3 Digits)

First Digit (Material)	Second & Third Digits (Bridge Type)
1. Concrete	01. Beam Span
2. Concrete Cont.	02. Low Truss
3. Steel	03. High Truss
4. Steel Cont.	04. Deck Truss
5. Prestress	05. Thru Girder
6. Prestress Cont.	06. Deck Girder
7. Timber	07. Box Girder
8. Masonry	08. Rigid Frame
9. Wrought Iron-Cast Iron-Aluminum	09. Slab Span
0. Other	10. Slab Span-Voided
	11. Channel Span
	12. Arch
	13. Box Culvert
	14. Pipe Culvert
	15. Pipe Arch
	16. Pedestrian
	17. Tunnel
	18. Movable
	19. Other

EXAMPLES

Old Designation	New Designation	Type
Prestressed Concrete Girder Span	Prestress Beam Span	501
Continuous Steel Beam Span	Steel Continuous Beam Span	401
Precast Concrete Channel Span	Concrete Channel Span	111

Note: A bridge may have one identification number for main span and another number for approach spans.

C. BRIDGE LAYOUT AND STAKING PLAN

See the Design Aids Section for an example of Working Point Layout.

Identify working line.

Identify control point. Place control point at intersection of survey line and centerline of cross road, track, etc. For river crossings place control point at abutment.

Label centerline of fascia beams.

Label working line throughout plan.

D. SUBSTRUCTURE FOUNDATIONS

1. Determination of type of foundation.

The Bridge Construction Section will review the preliminary plans and will make recommendations as to the type of foundation. If piling is recommended, the type, size, maximum design loads, and estimated lengths will be shown, as well as other pertinent information, on a form that has been prepared for this purpose.

When the designer is ready to start the design of a bridge, he should review the original recommendations made by the Bridge Construction Section, with the reviewer from that section, and discuss any changes that may be desirable.

Where construction of embankments is necessary at substructure units prior to construction of the bridge, a time delay for embankment settlement is occassionally necessary. This determination is normally made by the Soils Engineer prior to development of the bridge Preliminary Plan.

Where this settlement delay is necessary, the Soils Engineer's memo to the Bridge Preliminary Plans Unit will contain a tabulation indicating embankment settlement anticipated for specified periods of time. This memo will be reviewed by the Bridge Construction Unit when preparing the foundation recommendations report. It should also be reviewed by the designer prior to beginning final design.

At the review meeting, prior to final design (see Section A), a determination should be made of the specific time delays necessary for embankment consolidation. Since this information may affect the construction time of the project it is the responsibility of the Bridge Design Group leader to notify the District involved (by memo) of the required settlement delay. This notification should be sent at or before beginning the final bridge plans. A copy of this memo should be retained for the Bridge special provision writer for inclusion in the special provisions.

2. Determination of class of excavation.

See MHD 2451 for the specific definition of the types of excavation (U, E, R, and W). The following guidelines apply:

Class U
May be used when small quantities of two or more type of excavation would otherwise be required, when insufficient information is available for proper classification, or when conglomerates (such as found in a dump area) may be involved. It would not be used when ledge rock is indicated.

Class E
To be used when earth excavation is indicated. May be used by itself, in which case it would cover all conditions or removal and all materials except Class R. When used in conjunction with WE, the lower limits of the Class E should be noted in the Plans as being the same as the upper limits of the WE (the low water elevation shown in the Plans).

Class R
To be used when rock excavation is indicated. May be used by itself, in which case it would cover all conditions of removal. When used in conjunction with WR, the lower limits of the Class R should be noted in the Plans as being the same as the upper limits of the WR (the low water elevation shown in the Plans).

Class WE or Class WR
These classifications should be used whenever significant quantities of excavation below low water are indicated. Minor quantities may be included with Class U, E, or R, since none of these specify conditions or removal under 2451

3. General

More than one type or size of piles may be used in the same bridge (as indicated in the Foundation Recommendations sheet).

Minimum width of pile cap for 12" diameter pile is 2' 6", for 16" diameter piles is 2' 10".

Increase width of cap when using battered piles to provide minimum concrete cover of 9".

Pile spacing to be given at bottom of footing. Label pile cutoff.

Number and locate test piles on the Bridge Survey Plan and Profile sheets.

One test pile plus one additional test pile for every 12 to 15 piles or a maximum test pile spacing of about 40' will be required on ordinary jobs.

On abutments with battered piles, place test pile in front and back row. For pier footings place test piles toward center; use plumb piles when possible.

Check piles for interference with utilities, drains and with other piles when batter piles are (or have been) used.

Batter piles on pier footings 2" per ft. in direction shown.

Battered piles in abutments should be staggered rows a minimum of 2 ft. for driving convenience.

Tie pile spacing to working points.

Include standard pile notes. (See standard notes)

E. ABUTMENTS

1. Abutment Geometrics

Parapet abutments will usually be used for bridges with large skews, for long bridges, and for bridges with possible settlement problems. Single line pile bent abutments with provision for contraction will generally be used for structures not included in the above categories.

The intended type of wing wall will be indicated on the preliminary plan. See Design Aids section of this manual for typical wing wall geometric design.

Bottom of footings, bottom of wall on pile bent abutments, and bottom of wing walls to be 4 feet below ground except on bed rock.

Roadway paving bracket on contraction type abutments to be 8" wide and placed not less than 1' 0" below top of concrete roadway pavement and not less than 1' 3" below pavement with bituminous wearing course.

Sidewalk paving bracket to be 8" wide and placed 6" to 11" below top of sidewalk.

Avoid other projections on back of abutment that do not extend 4 ft. below ground.

Slope bridge seat for drainage. Provide level pedestals under bearings. (For parapet abutments only)

Low abutments (less than 15' high) with footings to have contraction joints at about 32' max. spacing. See Detail B801.

High abutments shall have 1/2" cork doweled exp. joints (no keyways) at about 32' max. spacing. If there is an expansion joint in median, doweled expansion joint may be used in wall under median joint.

Tie abutment dimensions and piles to working points.

2. Abutment Design and Reinforcement

Abutment should generally be designed for 33 lbs/sq. ft. equivalent fluid pressure. A higher pressure may be required based on soil conditions.

Distribute live load over entire length of footing.

Include weight of approach slab in abutment design. Assume about 1/3 of the weight of the approach slab rests on the abutment.

Resultant of vertical and horizontal loads shall be inside center of front piles, or on spread footings, within middle 1/3 of footing, or on rock within middle half of footing for group 1 loads.

If elastomeric (transflex) expansion devices are used, design for force resulting from compressing or stretching of rubber joint material.

Temperature reinforcement No. 5 bars at 1' 6" max. spacing. Heavier reinforcement may be used in long walls or massive sections.

Longitudinal reinforcing in footing No. 6 minimum.

Place No. 4 or No. 5 ties at about 6" to 8" centers under bearing assemblies. 2" clear distance to bridge seat.

Provide generous steel in back at intersection of wing and abutment wall. Develop bars. Do not bend bars around back face corner.

Show end post anchorage reinforcement on abutment sheets (depending on type of railing used).

Provide 2" clear cover on reinforcement bars in walls. (Increase for rustication.)

Give soil bearing loads for spread footings, and pile loads for pile footings.

Railroad underpass abutments shall be designed according to AREA Specifications for the live load specified by the railroad. The D.M. & I.R. Ry. requires a special live load. Construction will be by M.H.D. specifications. Liveload surcharge shall be the axle load distributed over an area equal to axle spacing multiplied by the track spacing, generally 70 sq. ft. Do not reduce surcharge for skew.

3. Miscellaneous

Concrete Mix: Footings No. 1A43, wings and walls (if any) No. 3Y43, sidewalks, and rail post No. 3Y46A.

Check fit with superstructure.

Where steel roadway expansion plates are used, place protective coating on bridge seat and extend coating 3" up on parapet wall.

Joint waterproofing per M.H.D. 2481 on all joints designed for movement above footing and below ground except at top of footing. No waterproofing on contraction joint Detail B801 and construction joints.

Label all construction joints and nominal size of keyways.

Bench mark disk S.E. corner. Use standard note. Use one disk for twin bridges.

Where conduit extends through abutment and projects beyond abutment, place pipe sleeves through parapet and caulk. Use standard pipe instead of mechanical tubing.

Where abutment layouts and details are complicated, detail abutments on separate sheets.

Provide drains for high abutments (over 15' high). 3" drains through wall about 6" above final ground will suffice in most cases. Granular backfills at railroad bridge abutments generally require perforated pipe drains.

F. PIERS

1. Pier Geometrics

For round column piers, column diameter should be in multiples of 2" to permit use of standard fiber forms. Use 2' 6" columns for beams 3' 0" or less in depth, 2' 8" columns for beam 3' 1" to 4' 0", 2' 10" columns for beams 4' 1" to about 5' 0" unless larger columns are required for strength or bearing area.

Omit steps on pier cap if less than 1" high.

On piers with large steps, use concrete pads and slope pier cap in straight line. Concrete pads for bearings should be set back from edge of cap when cap is sloped.

Avoid excessively deep or wide pier caps. Bottom of cap should be approximately parallel to top of cap. Cantilever ends should taper about 1/3 the depth of the cap. Ends of caps to be rounded when round columns are used. For other column types, square ended pier caps may be used.

Bottom of footing to be 4' 6" below finish ground, or 6' 0" below stream bed except on bedrock. 1' 0" minimum cover over footings.

Tie pier footing dimensions and pile locations to working points.

Label end of piers (South end, North end, etc.)

For piers within 25 ft. of railroad tracks provide strut flush with face of column or base. Top of strut should be about 6 ft. above top of tracks, usual depth of strut 4' 0". Strut not required where pier is high up in end slope. Place about 1% steel in strut. Bottom of struts should be at least 8" above ground. C.M. St. P. & P. R.R. requires solid round end pier base extending 10' above rail, and 2' beyond columns and 3 columns or more above, or a solid wall pier.

2. Pier Design and Reinforcement

Space columns to make dead load moment in columns a minimum.

Design columns as tied or spirally reinforced depending on which is most economical. For tied columns use 3/8" dia. spiral at 6" pitch.

Hook bars in bottom of pile footings. In spread footings omit hooks unless required for bond or shear.

Minimum clear distance between anchor rods and reinforcing bars is 2".

Minimum spacing for No. 8 or larger bars is 4".

Where piles project 1' 0" into footings the reinforcement is placed on top of the piles.

Where piles project more than 1' 0" into footing, Place reinforcement between piles, 5" minimum clearance above bottom of footing.

Provide 2" clear cover on reinforcement bars, except that for footings, 3" clear cover should be provided.

Do not show dowel project dimension for bent dowels. Show dowel projection for straight dowels.

Use 90° bend for footing dowels. Horizontal dowel dimension not less than 1' 0". Not less than 40 diameters from top of footing to end of dowel.

Place No. 4 or No. 5 ties under bearing assemblies at 6" to 8" spacing. 2" clear distance from reinforcement to top of pier cap.

Use 90° bend on top longitudinal rebars at ends of pier cap.

Standard dowel circle note and spiral data. (Refer to standard plan notes)

Weight of column spirals to be computed from table in Design Aid Section of this manual.

Maximum size of pier cap stirrups is No. 5.

Use double stirrups if necessary to avoid too close spacing of stirrups.

Give soil bearing loads for spread footings, pile loads for pile footings.

3. Miscellaneous

Concrete Mix: Columns and caps No. 3Y43. Footings No. 1A43.

Call for permissible construction joint at top of columns. Note all keyways and construction joints.

Show 3/4" V strip on bottom of pier cap ends.

Locate name plate on pedestrian bridges and railroad bridges. Use standard note. Show placement detail. Name plate to be located 5 feet above finished ground line at pier.

G. SUPERSTRUCTURE

1. General Design Criteria

All HS20 bridges are to be designed for military loading. Note military loading in design data only for bridges carrying F.A.I. traffic. Space beams so moments in fascia beams will not be larger than moments in intermediate beams where practical. Fascia slab projections shall generally not exceed the depth of beam.

Live load deflection shall preferably be not more than L/1200 for highway bridges, but in no case more than L/800. Do not under stress the beams to obtain greater stiffness than required by AASHO. Live load deflection for pedestrian bridges shall not be more than L/800.

Railroad underpasses shall be designed according to AREA specifications for the live load specified by the railroad. The D.M. & I.R. R.R. requires a special live load. Construction will be according to M.H.D. specifications.

Railroad underpasses will be usually be designed with simple spans to avoid uplift from live load.

2. Slab Overlay Policy

All bridges carrying Interstate traffic, all bridges carrying trunk highway traffic within municipalities, and all additional bridges on highways with projected ADT greater than 5,000 shall be designed with a conventional slab topped with a suitable waterproofing membrane and a separate wearing course. The specific membrane and wearing course will vary from bridge to bridge experimentally until such time as evaluation indicates a superiority of one or more systems. An allowance of 2½" (use 30 lb./s.f. for design) will be used unless otherwise specified in the preliminary plan. The wearing course will normally be bituminous; however, other materials are not excluded. On all bridges not included in the above criteria, allowance shall be made in the design for a future membrane and wearing course. The slab details and grades shall be the same as currently used, but a 30 lb./s.f. wearing course dead load shall be incorporated into the design. The Bridge Engineer shall determine the appropriate action on any individual exceptions to this policy.

3. Slab reinforcement

Use M.H.D. tables and drawings in Design Aids section of this manual for reinforcement in slab, sidewalk, and median. Design for skew length where applicable.

The main transverse slab reinforcement shall consist of a pair of continuous straight bars top and bottom alternate with a crankshaft bar throughout, except as noted below.

The main transverse slab reinforcement shall consist of pairs of continuous straight bars top and bottom throughout for design span lengths of 6' 0" and less

The main transverse reinforcement shall consist of pairs of continuous straight bars top and bottom throughout for the lengths where the width of the roadway slab varies.

For skews less than 20° slab reinforcing should be parallel to skew. For sharper skews reinforcing should be at right angles to the centerline of roadway.

When the main transverse slab reinforcement is perpendicular to the centerline of roadway, it shall consist of pairs of continuous straight bars top and bottom throughout for the length of the skew at end of slab, hinge expansion joints and pier expansion joints.

When the concrete roadway slab is continuous over skewed piers for prestressed concrete beam spans, and the beams in the adjacent spans have different spacing, and the main transverse reinforcement is perpendicular to the centerline of roadway, the main transverse reinforcement shall consist of pairs of straight bars top and bottom, with slab thickness and reinforcement detailed for the wider beam spacing, throughout the lengths of the skews in the adjacent spans.

Where concrete barrier type median is used without a joint on centerline, provide option for casting dowels in slab or securing dowels in holes drilled in slab. Use No. 4 dowel spaced with every other slab transverse bar.

4. Diaphragms

Use AASHO spacing for all locations.

For skews less than 20° diaphragms should usually be placed parallel to skew. For sharper skews place diaphragms at right angles to centerline of roadway.

Use shallow diaphragms at abutments to facilitate form removal and maintenance. Use deep intermediate diaphragms.

See Design Aids Section of this manual for details and placement of concrete diaphrams for prestressed concrete beams.

5. Superstructure drains

Drains shall not be placed over roadway, shoulders, sidewalks or railroad tracks. Avoid drains over end slopes, if possible. If drains must be placed over riprap, grout the area under the drains, or provide a grouted flume section if erosion of the soil under the riprap is a problem.

Where down spouts or deck drains are not connected to drain pipes, provide splash blocks as necessary.

The materials and gages for corrugated metal (C.M.) drains and semicircle deck drains are given in the special provisions for "Drainage System". Use 16 ga. metal for other C.M. drains.

Drains close to beams or girders shall extend to about 1" below bottom of beam. See Detail B701 or B702.

6. Superstructure Joints (See separate section for expansion joints)

Place deflection joints in barriers, sidewalks and medians along centerline of piers. Omit intermediate joints. For skews less than 20°, slab, sidewalk, and median joints should be parallel to skew. Square railing ends and joints for skews over 20°. Do not let railing or sidewalk overhang back of abutment.

Place construction joints in slab about 5' from end when using finger type expansion device.

No joint seal is required on 1" longitudinal joint at split median barriers.

For single line pile contraction type abutments, with shear lugs, place 1" Type A polystyrene on bridge seat, and 1-1/2" Type A polystyrene behind bearings and openings.

Note to designer: Use Type A polystyrene for compressive loads up to 30 psf. Available in 1", 1-1/2", and 2" thicknesses.

Use Type B polystyrene as joint filler only (for compressive loads less than 10 psf.) Available in 1/2", 3/4", 1", 1-1/2" and 2" thicknesses.

List cork, bituminous felt, butyl rod, elastomeric joint sealer and polystyrene.

7. Concrete for bridge slabs.

Concrete Mix to be used in bridge roadway slabs shall be as follows:

For bridge decks which receive special waterproofing and wearing courses (as per Slab Overlay Policy) use Conc. Mix No. 3Y33.

For bridges carrying U.S. Highways and State Highways with greater than 1000 ADT or 100 TST and which do not receive special waterproofing and wearing courses, use Conc. Mix No. 3Y33A except as follows: Use 3Y33 with low limestone content coarse aggregate (by special provision) in the Southeastern (South and East of line connecting Red Wing, Wanamingo, Claremount, Blooming Prairie and Deer Creek on Iowa Border) and the Northeastern (North and East of a line connecting conflux of Big Fork River at Canadian border, T.H. 1 at Big Fork River East of Effie, Marble, Warba, Comwell, Moose Lake and Cloverton near Wisconsin border) parts of the state.

For all other bridge decks use Conc. Mix No. 3Y33.

8. Miscellaneous

Median on bridge shall conform to median on approaches.

Tie superstructure dimensions to working points.

On curved bridges, rail post and rail joint spacing shall be dimensioned along the outside edge of the slab.

Deflection diagram: Use standard notes; give deflections in decimals of a foot and camber in fractions of an inch; give initial and ultimate deflection for cast-in-place concrete and camber forms for 100% of ultimate deflection; label base line.

Edge of roadway slab to be same thickness in all spans. (8" min.)

Bottom of roadway slab outside of fascia beams to be 1" below top of fascia beams for prestr. concrete bridges. For steel beams, bottom of roadway slab at outside of fascia beam to meet bottom of top flange.

H. BEARINGS

1. Elastomeric Bearings

The use of elastomeric bearings is preferred over other types of bearings. Use wherever practical. See Design Aids Section of this manual for design data. Provide anchor bolts that extend thru elastomeric pad and sole plate (see B301).

2. Standard Steel Bearings

Modify standard bearings as necessary to provide for unusually wide flanges and to provide for movement greater than is permitted by the standard detail.

Where skew distance between beams is more than 45' provide for lateral expansion at bearings.

3. Rocker Bearings

Rocker bearings are normally required for railroad bridges. They should also be considered at locations where there is a combination of large load and large movement.

Provide lubricated bronze brushings around pins wherever possible. Provide grease fittings on shoes to lubricate annular rings in bearings.

Rocker bearings may be either welded or cast, depending on cost. Check with Structural Metals Section.

4. General

Locate bearing anchor rods to permit field drilling of holes in bridge seat.

Make provision for future maintenance of bearing and bridge seat by keeping bearing accessible and removable without major damage to the structure.

Where substructure movement is likely, provide for jacking the superstructure to permit future adjustment of bearings.

I. STEEL BEAM SPANS

Specify kind of material for all structural metals.

For welded beams the minimum flange thickness is 5/8" and the minimum web thickness 3/8" to reduce warping. Thicker webs without stiffeners should be used if economical.

Structural steel MHD 3309 shall not be used for structural purposes (such as light post bases, etc.) in thicknesses less than 1/4".

Change in flange area at welded splices should not exceed 100%. .

Use relatively wide flange plates for lateral stiffness. 16" x 3/4" is preferable to 12" x 1". A 14" minimum width is desirable to permit 4 lines of bolts at splices.

Adjust flange thickness at bolted splices to avoid excessive fills.

Bottom flange should be of uniform width if practical.

Use a wide flange and closer than usual diaphragm spacing on curved bridges to reduce torsion stress.

Wide flange beams are difficult to obtain in lengths over 80'.

Show area "A" on plans. Area "A" is the portion of top beam flange which is in tension due to dead load.

Design bolted splices to develop 100% of net section. Make splice plates same material as beam. For alloy steel beams, increase bolts in standard detail as necessary.

Provide drainage for all steel sections. Avoid sections that trap water.

Structural steel MHD 3309 must be protected with paint at locations where water is likely to drain onto the steel (such as at steel plate expansion joints, etc.)

Avoid sections that are difficult to paint, such as angles separated by ring fills.

At contraction type abutments, provide for field welding longitudinal end web rebars to end of beam (i.e. do not use threaded tie rods.)

Where conduits pass thru steel diaphragms, reinforce hole with section of pipe or curved steel plate welded to diaphragm where diaphragm is significantly weakened. (this does not apply to small openings such as for single conduits).

Use studs for shear transfer. Rows of studs shall be parallel to transverse slab bars. For bridges where studs are not required for composite action, studs should still be provided on compression flange to prevent separation of slab from beam.

Concrete counterweights at abutment end of steel spans shall be detailed to provide access for painting etc.

Provide stools over beams to allow for camber, camber tolerance, splice plates, and cover plates as required. Stools shall be flush with edge of flange. 1" min. stool height is desirable.

For bridges carrying railroad traffic check with railroad on whether to use rivets, high strength bolts, pin bolts, or welding.

J. PRESTRESSED CONCRETE

Use Standard Bridge Detail Sheets for prestressed beams and fill in information required.

Use graphs in Design Aid Section for trial design. Use computer program for final design.

The required minimum concrete strength at time of prestress transfer is 4500 psi and at discontinuance of curing 5000 psi. Show computed minimum concrete strengths where computed values are larger than minimum values. Fill in required minimum values and leave computed values blank where the required minimum value is higher.

Identify beam type on beam sheet and quantity lists by depth and length to the next highest foot. Example: a 45" beam 72' 4" long would be type (45-73); Beams of slightly different lengths should be grouped into one type, using the longest span for type.

Show the following on framing plan: Beam and diaphragm spacing, centerline of piers and abutments, beam marks (B_1, B_2 etc.), "X" end of beam, type and location of bearings and thickness and location of fills.

With double diaphragms over piers and no special slab overlay, make saw cut in slab on centerline of pier and place 3/4" V in bottom of slab under saw cut. Use additional 15 ft. No. 4 longitudinal bars in slab over pier as shown in sketch in slab charts.

When a waterproof membrane and bituminous wearing course is used, omit saw cut in slab. However, if a Dow latex mortar overlay is used, provide for a saw cut in the slab and in the wearing course.

Where slab is not continuous over pier diaphragms, place a watertight expansion joint over pier and add reinforcement for slab cantilever over diaphragms.

Where slab is designed continuous for live load and a single diaphragm is used over the pier, provide a thickened slab at the pier and provide tensile reinforcement as necessary. Do not use saw cut.

At contraction type pile bent abutments, place 1" type A polystyrene between bridge seat and end web, and design end web for wheel loads. Omit tie rods in end web.

Line up beams to follow grade within the following limits: 1/2" difference at ends of fascia beams. 1" difference for interior beams. Provide galvanized steel fill plates or concrete steps to align ends.

Provide about 2" clearance between ends of beams. On sharp horizontal or vertical curves cope beam flanges if necessary. Give slope length of beams where necessary for proper fit.

K. CONCRETE CHANNELS AND CONCRETE SLABS

Use standard detail sheets for concrete channels.

Provide weep holes for sonovoids.

Slope bridge seat to grade. Use bituminous felt or 1/2" masonry mortar under channels.

L. CONCRETE BOX GIRDERS

Depth of box girders should preferably be a minimum of 1/18 of the maximum intermediate span length.

Provide protective coating on bridge seats at expansion joints.

The vertical webs of box girders shall be placed monolithic with the bottom slab.

On continuous box girders some columns may be hinged at the top and bottom to reduce temperature stresses.

The superstructure may be designed to transmit the transverse wind and centrifugal forces to the abutments to reduce stress in piers.

Longitudinal forces may be distributed between the fixed piers and the sliding bearings at abutments.

Bars longer than 60 ft. or larger than No. 11 must be ordered specially from the mill. Use only where there is no other satisfactory solution. Welding of reinforcement is not permitted.

M. PEDESTRIAN BRIDGES

Usual width of pedestrian bridges is 8' 0" face to face of handrail. Maximum grade 10% preferably less. Chain link enclosure on superstructure and 5' 0" wire (Chain link) fence on ramps and stairs. Handrail 3' 0" above concrete on enclosure and fence.

No break in grade at steel expansion device.

Stairs 1' 0" tread, 6" rise. Adjust sidewalk or superstructure elevations to make all risers 6".

14 to 16 risers for each flight of stairs preferred, 19 maximum.

Live load 85 lbs. per sq. ft. on superstructure, ramps and stairs. Maximum live load deflection L/800.

Detail anchorages in piers to prevent uplift from wind on superstructure.

Check need for bicycle ramps on stairs.

Provide additional top longitudinal bars in top of slab over piers, stagger ends.

N. TIMBER BRIDGES

1. General

Longitudinal laminated timber slabs for highway traffic may be used for spans up to 26' long. For longer spans, use stringers and transverse laminated timber floor.

For 3" x 6" laminated floor (1500 Fb) used for transverse decks may be used for stringer spacings up to 5' 0".

The usual live load deflection limits do not apply to timber bridges.

Timber rails shall be pressure treated with Water Borne Preservative in accordance with C2-67 American Wood Preservers Association Standard. All other timber shall be treated in accordance with MHD 3491.

Use timber curb and railing with timber superstructures.

2. Allowable stresses.

The following allowable stresses should generally be used.

Pile caps	-	1200 Fc
Sawed stringers	-	1600 Fb
*Glu Laminated Stringers	-	2200 Fb (Dry condition of use)
	-	2000 Fb (Wet condition of use)
Laminated timber slabs and laminated timber flooring	-	1500 Fb
Rail posts	-	1900 Fb
All other timber	-	1500 Fb

*See AASHO for combination symbol and number of laminations available.

See AASHO for species and commercial grade for the allowable stress Fc or Fb shown.

O. EXPANSION JOINTS

1. General

The following criteria should be considered in selecting the expansion device at a given location.

a. Provisions for the computed movement must be increased by an amount sufficient to provide for fabrication and placement tolerances, anticipated shifting of substructures (when applicable), etc.

b. Provide reasonably smooth rideability by restricting width of expansion recesses to "not more than 4". Any physical openings should be restricted to a size that will not endanger pedestrians, bicyclists, etc.

c. Watertightness. Joints that would drain onto the subgrade (joints at backface of abutment) must be of a water tight design. At other locations the need for watertightness should be based on a review of the ADT, probable extent of winter salting, effect of the runoff (and salt) on underlying bridge elements and the ground, slopes, etc. For example, on a low traffic bridge with a relatively low-level of winter salting, an expensive sealed joint should not be necessary.

d. Resistance to plow and traffic damage. Joints on bridges with high ADT have often been the source of considerable maintenance work. Most future bridges in these locations will receive bituminous overlays. Joints at these locations (with high ADT) should normally have protective concrete headers to buffer the effect of plows and traffic. On lower trafficked roads, simpler details may be justified.

2. Design criteria for expansion joints

Total anticipated movement at expansion joints should normally be based on a temperature range of 150° (plus allowance for substructure movement where necessary).

For anticipated movement of 1/4" and less, liquid seals (conc. joint sealer) may be used against unarmored concrete faces.

The standard steel plate expansion joint is intended for use at locations with up to about 2-1/2" of anticipated movement. These should not be used where a watertight condition is necessary.

Finger joints (toothed steel plates) should not be used for movements less than 2-1/2". They should also be avoided where a watertight condition is considered necessary. Consideration should be given to the use of proprietary joints as well as the finger joints where large movements are anticipated. Where finger joints are selected for use on curved structures, provision must be made for lateral movement of the fingers.

Proprietary expansion joints (normally watertight devices such as Transflex, Waboflex, Strip Seal, etc.) are normally manufactured in incremental sizes to provide for a variety of joint movements. Selection must be based on manufactures data.

Elastomeric compression seals as used in the past should not be used without improved technology due to current maintenance experience with this type of joint.

P. WATERPROOF MEMBRANES AND BITUMINOUS WEARING COURSES

1. General

The criteria for determining when to use a waterproof membrane and bituminous wearing course are included in Section G. Superstructure. When these are to be included, the following items should be considered:

- For new bridges the concrete deck surface must be trowed smooth for application of membrane. For restoration work, slurry leveling must be provided.
- Membranes should be in accord with latest field and research information.
- Provide mastic fillet at gutter line. Also provide 3/4" wide joint sealed with concrete joint sealer along gutter lines.
- Provide protective course for membrane and wearing course as per latest information.

2. Quantities

Determination of quantities for Asphaltic Concrete wearing courses (MHD 2361) should be based on the following constants:

a. Wearing course mixture
1 S.Y. of wearing course x 1" thickness = 110 lb.

b. Asphalt cement
Use 8.5% x total weight of W.C. mixture

Determination of volume of emulsion or asphalt for slurry leveling:

a. Compute total volume of material required for leveling. (See Br. Const. Section for estimated thickness, etc.)

b. Gallons of emulsion (or asphalt) = 40% x total volume required for leveling (in gallons)

Q. BRIDGE APPROACH TREATMENT

Include the "Bridge Approach Treatment" sheet (5-397 .305) and appropriate pay item in every plan which has a bridge approach panel unless specific instructions to the contrary are available prior to preparing plan. (See Preliminary Design recommendations provided by Bridge Construction Section.) Complete the standard sheet as follows:

1. Determine and fill in the appropriate elevation for the high end of the perforated pipe based on the 2% slope shown on the sheet and the minimum cover of not less than 4' below top of pavement at any point. Increase pipe gradient on superelevated curves to maintain a constant dimension from pipe flow line to gutter elevation.

2. Fill in note to indicate location of outlet for 6" drain pipe. If necessary show plan view to clarify location of outlets.

3. If the configuration of the wingwalls (or other features such as adjoining retaining walls) prevent placing the pipe outlet as shown in Section A-A for bridges with straight or angled wingwalls, show a plan view of the desired pipe layout at the outlet end.

4. Fill in the appropriate quantities in the "Summary of Quantities."

R. BRIDGE APPROACH PANEL

1. General

The approach panel as detailed on the standard plan sheet (5-397.303) is designed with a 4" pressure relief joint and passive soil pressure keys which are intended to protect the bridge from "pavement growth" pressure. This panel should be basically fixed in position and the end expansion joint at the structure should be designed accordingly.

2. Criteria for use of Bridge Approach Panels

a. Bridge approach panels shall be constructed at all bridges on Trunk Highways.

b. Approach panels shall be constructed at bridges which carry secondary road traffic over a Trunk Highway where the approach roadway on the secondary road has concrete surfacing. In addition, panels shall be constructed at bridges which carry secondary road traffic over a Trunk Highway where the traffic volume on the secondary road is in excess of 750 ADT.

c. When a bridge approach panel is required, it shall be included in the bridge portion of the contract.

d. Plans for bridges which will not incorporate approach panels shall provide for construction of an appropriate length of bituminous curb at each corner of the bridge to reduce erosion at the wing walls.

3. Checklist for detailing

a. Show bridge approach panels on plan view on General Plan and Elevation sheet.

b. Show plan view of all approach panel details on standard Bridge Approach Panel Sheet (See Design Aids Section of this manual).

c. Add pertinent abutment details and dimensions to "longitudinal roadway section" such as type of abutment and location of expansion device, etc.

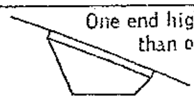
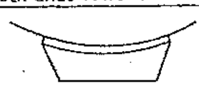
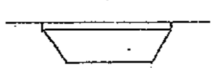
d. If catch basins are required at bridge approaches (See guide for use of Catch Basins on next sheet) give the following information.

- Give elevations of flow line of R.C. pipe at juncture with each catch basin. Provide 6' min. cover to flow line and provide 1% minimum cross slope for drainage.

- Specify type of erosion control at end of flume. For usual grade separations, specify sod. For unusual cases (larger than normal drainage areas, flow concentrations due to superelevation, etc.) check with Hydraulics.

- Indicate locaiton of drainage outlets. On bridges with divided roadways and a common median ditch, drainage should normally flow from the median towards the outside.

GUIDE FOR USE OF CATCH BASIN AT ENDS OF BRIDGE

CASE	GRADE AT BRIDGE	RURAL PAVING (No curbs on approach pavement)	URBAN PAVING (Curbs on approach pavement)
A	 One end higher than other	Use Catch Basins at Low End Only	Use Catch Basins At Both Ends
B	 Both ends lower than center	Use Catch Basins At Both Ends	Use Catch Basins At Both Ends
C	 Deck lower than ends	No Catch Basins	Use Catch Basins At Both Ends
D	 Flat Grade	Use Catch Basins At Both Ends Only When No Drains on Bridge Deck	Use Catch Basins At Both Ends

Note: Check with road design to determine if approach pavement has curbing. Do not place 12' B624 extension when catch basin is not used. Use catch basins only on low side of superelevated roadways.

e. Surfacing on approach panels should conform to the following chart:

APPROACH PANELS - SELECTION OF BIT. OR CONC. SURFACING

CASE	SURFACING ON APPROACH PAVEMENT		SURFACING ON APPROACH PANEL		SURFACING ON BRIDGE	
	BITUMINOUS	CONCRETE	BIT.(OVERLAY)	CONC.	BIT.(OVERLAY)	CONC.
1	X		X		X	
2	X			X		X
3		X		X	X	
4		X		X		X

Note: Designer must contact road design to determine what type pavement will be used.

f. Compute all quantities required for constructing bridge approach panel and enter on summary of quantities on bridge plan sheet 5-397.303.

NOTE: Quantities for the following items should normally be computed and paid for separate from the lump sum item "Bridge Approach Panel":

- Bituminous surfacing on the panel (include with quantity of bituminous surfacing on the bridge)

- Median barrier (Median barriers outside of the abutment can normally be left for construction in the grading and paving poriton of the contract. However, when these extensions are included with the bridge, include concrete volume in concrete pay items.)

- Expansion device at the juncture of bridge slab and approach panel (include with structural steel or in other appropriate items).

g. Standard Plate references

Check against current Standard Plates Manual to assure that the latest Plates are listed.

h. Special cases

- On skew bridges, when long side of approach panel exceed 60' + consider providing a "stepped" panel to reduce length.

- Where city streets intersect at the end of a bridge, significant modificaitons of the panel will be necessary (including possible deletion of the panel).

- Where a median barrier is to be constructed for the roadway crossing the bridge, construct the approach panel for the two roadways separately and provide an opening between these sections for the barrier. Width of opening should be equal to the width of the bottom of barrier as used on the bridge. Construction of median barrier between the bridge approach panels will be included in the grading contract except where special conditions (such as drainage problems) necessitate inclusion of this barrier with the bridge contract.

S. SURVEY

Coordinate with latest grading plan and bridge plan.

Show typical grading sections.

Show utilities

Label abutments and piers.

Show long. section on centerline bridge and horizontal section above footing.

Show profile grade line and data.

Show bridge on plate.

Show test piles to scale in section.

Locate and number test piles in plan.

Show sounding and boring data.

Show north arrow.

Show Hydraulic Engineers recommendations for stream crossings.

T. SUBMISSIONS TO ACCOMPANY FINAL PLANS

Turn in the following data (as applicable) with each completed bridge plan:

1. Bridge Rating and Load Posting Report (for all new jobs and all repair jobs whr

Turn in the following data (as applicable) with each completed bridge plan:

1. Bridge Rating and Load Posting Report (for all new jobs and all repair jobs where the present rating will be affected.)

2. Bridge Rating Sheet (for all new jobs and all repair jobs where the present rating will be affected.)

3. Field Construction Elevation Computer Data (Note: these are not required for District 1, 5, and 9 unless a special request is made by the District.)

4. Structural Steel Quantity Computations (for all bridges with a structural steel pay item.)

5. Prestressed Concrete Beam Quantity Sheet.

U. MISCELLANEOUS

Design for grade 60 reinforcement fs = 24,000 p.s.i. For bent bars, omit last dimension on reinforcement bar derails.

For ease of handling, the preferred maximum length of reinforcement bars is as follows:

No. 3 - 30 ft.; No. 4 - 40 ft.; No. 5 - 45 ft.

Reinforcement bars longer than 60 ft. or larger than No. 11 are available only on special order, and should be avoided if possible, especially if only a few bars are required. Check with supervisor before using special order sizes or lengths.

Round off concrete quantities to the nearest cu. yd., rock excavation quantities to the nearest cu. yd., earth excavation quantities to nearest 5 to 10 cu. yd., reinforcement bars and structural metal to the nearest 10 lbs., metal railings and fencing to the nearest lin. ft.

Deck area shall be computed transversely out to out of bridge and longitudinally from back face to back face of abutments to the nearest square foot. (Do not include bridge approach panels).

If standard sheets are changed, note "modified" under B Detail or Figure Number.

Check standard form from Utilities Unit to determine if provision must be made for lighting, signing, signals, utilities, etc.

Check project numbers.

V. RUSTICATION

High abutment and retaining walls should be rusticated. The type of rustication should conform to the rustication used on adjacent retaining walls. Check with road plans for the type of rustication being used in the area.

One type of rustication consists of horizontal grooves spaced at 4' and vertical grooves spaced at 6' to 8'. Do not stagger vertical grooves. Horizontal grooves should be level, and lined up with grooves on adjacent retaining walls. The copings should line up with the coping and bottom of slab on the superstructure. This type of rustication is awkward to line up with adjacent abutments at different elevations. It is suitable for isolated bridges with U type abutments.

W. PAINTING

1. Zinc Rich System (Organic) (Use with SSPC SP 10 Near-White Blast Cleaning)

With aluminum-clorinated rubber finish coats: use for bridges over heavy traffic, in metro-areas where maximum protection for the steel is essential, and where fast drying of particles is necessary so as to eliminate undue scattering of wet paint particles. Also for bridges over public waters where colors are not a consideration.

With Vinyl Finish Coats:
Use for new bridges over public waters where color is desired, and for other bridges where both maximum protection and color are required.

2. Red Lead - Iron Oxide System (Use with SSPC-SP-6 Commercial Blast Cleaning)

With aluminum finish coats MHD 3527 and 3528: Use for maintenance painting of structures when only spot blasting and priming of steel previously painted with red lead primer is required and where color is not a criteria.

With light green and light blue aluminum same as for B.-1. except use where light green or light blue color is desired.

3. Basic Lead Silico Chromate System (SSPC SP-6 Commercial Blast Cleaning)

Use for maintenance painting on structures where this system was used previously, and on new structures in rural areas where dark color is desired - but not over public waters.

4. General

Color cards showing the available colors for each system can be obtained either from the Bridge Construction Section or the Office of Materials Paint Chemist.

X. CHECKING CONSULTANT PLANS

Consultant prepared plans are to be reviewed and checked for the following major items to insure adequate bridge plans and to assure coordination with the roadway plans:

Note: the following definitions apply -

Review - A comparative analysis for agreement with standard practice, agreement with similar structures, all with application of professional judgement. Mathematical analysis is not specifically required but may be necessary where a discrepency appears likely.

Check - Make a complete mathematical computation and resolve all differences which appear in the plans. Use computer where applicable.

1. Geometrics

Horizontal and vertical clearances are to be checked for compliance with all clearance requirements of MHD, Railroads, or others. Check all stations, elevations and dimensions on the Bridge Layout Sheet. Check all elevations throughout the plan. Review plan for coordination with Bridge Layout Sheet.

2. Design

To assure adequacy in design and conformance with MHD requirements and standards. The following checks and reviews should be performed.

a. Slab - Review for conformance with MHD slab tables.

b. Beams - Design check for strength, shear connector spacing, and diaphragm spacing.

c. Bearings - Review selection for proper types and sizes. (For elastomeric bearings, see Design Aids Section.)

d. Piers and Abutments - Review for strength. Review geometrics.

e. Piling - Review for conformance with Foundations Recommendations Sheet (from Bridge Construction Section.)

f. Bridges carrying railroad traffic will usually be checked for strength by the Railroad Company involved. No design check will be performed on these structures by MHD except when specifically requested to do so.

3. Pay Items and Quantities

Computation of individual check quantities in bridge plan will not be required. Check that consultant has made 2 independent computations for each quantity, and that the results agree with that shown in the plans.

Check the addition of each sheet's quantities with those of the "Schedule of Quantities for Entire Bridge".

Check pay items for conformance with M.H.D. specifications.

4. Plans

Review notes for conformance with standard practice.

Review plan for inclusion of latest B Details.

5. Exceptions

For large and very complex structures, check with Bridge Plans Engineer for special instructions.

Bridge Section

STATE OF MINNESOTA
DEPARTMENT OF HIGHWAYS
St. Paul 1, Minnesota

Date February 3, 1965

To: Sverdrup & Parcel and
Associates, Inc.
915 Olive St.
St. Louis 1, Missouri

Re: Bridge No. 9340
T.H. 35 W. over Mississippi River
S.P. 2783
In Minneapolis

Attention Mr. A. E. Hannes

Gentlemen:

[X] Enclosed
[ ] Under Separate Cover

Via: [X] 1st Class Mail; [ ] Our Messenger; [ ] Express; [ ] Your Messenger

Description of Material:

One (1) set marked up checking prints.

Four (4) sheets (O.Z.T.) of standard details.

We have reviewed the above material and have taken action as checked below:

[X] See our notations and suggestions as shown on the material we are returning to you.

[ ] We consider the above material to be incomplete in the following respects.

Please make the following disposition:

Review suggested changes, revisions and corrections and make necessary changes on final tracings. Advise this office in the event of any disagreement relative to any of the suggested changes before proceeding. Return checking prints with final tracings

Yours very truly,
DEPARTMENT OF HIGHWAYS

P. D. Swensen
Engineer of Bridge Consultant Design

CC: A. E. LaBonte
A. L. Anderson
J. L. Kumpf
P. D. Swensen
R. K. Redin - R.E.T.

LRKR
RRT.

June 7, 1965

Sverdrup & Parcel and Associates, Inc.
915 Olive Street
St Louis, Missouri

Attn: Mr. A. E. Haunes

Bridge No 9340
Project No 2783-9340A
Fed Proj. No. I-IG 35W-3(50)112
T.H. 35W over Streets,
Mississippi River and
Railroads in Minneapolis

Dear Sir:

We are enclosing a print, sheet 21, of Bridge 9340. We are unable to find anything in your calculations to clarify the Dimensions which we have circled in red. Would you please send us this information so that we may complete the final plan check?

Sincerely,

DEPARTMENT OF HIGHWAYS

P. D. Swenson
Engr. of Br. Consultant Design

PDS:rll

cc: A. E. LaBonte
A. L. W Anderson

9340_P019_003.pdf

1.2.4 Limit States to Consider in Design

Bridge designs shall typically consider Strength, Service, Extreme Event, and Fatigue limit states. The limit state checks will vary with the component under consideration. Not all elements will require consideration of all limit states. For example, the fatigue limit state need not be considered for fully prestressed pretensioned elements.

1.3 Procedures

This section covers the Bridge Office procedures for checking of bridge plans, scheduling of projects, and revising or creating standards.

1.3.1 Checking of Mn/DOT Prepared Bridge Plans

The general practice of most engineering offices is to require that designs they produce be checked before they are reviewed and certified by the "Engineer in Responsible Charge". Although this practice has always been required for structures designed for Mn/DOT, it is recognized that the quality of the checking process often varies according to time restraints, confidence in the designer, and the instructions given to the checker. Therefore, in order to maintain a consistent design checking process the following guidance is given for routine bridge designs.

For more complex or unusual designs, the checker is advised to discuss additional requirements with the design unit leader. Also, the checking process described is not meant to apply to the check or review functions required for Mn/DOT review of consultant plans (see Section 1.3.2.) or for construction false work reviews. (See the Bridge Construction Manual.)

Three types of design checking will apply:
1) An independent analysis of the completed design.
2) A check of original design computations for mathematical accuracy, application of code, and accepted engineering practice.
3) A review of drafted details for constructibility and accepted engineering practice.

Generally, an independent analysis to confirm the adequacy of the complete design is preferred. Significant differences should be discussed and resolved before the plan is certified. The separate set of calculations should be included with the design file as a record of the completed design check.

When circumstances prevent a complete independent analysis, as a minimum, an independent analysis shall be completed for the following:
1) Live and dead loads
2) Critical beam lines
3) A pier cap

4) A pier footing
5) Main reinforcement for high abutments
6) An abutment footing

However, for the elements not independently analyzed, the original computations should be checked for mathematical accuracy of original design computations, applications of code, and accepted engineering practice. Checked computations should be initialed by the checker, and the independent analysis should be included in the design file.

When doing a separate analysis, the checker may make simplifying assumptions to streamline the checking process. However, when major differences are found, results must be discussed and resolved with the designer. For instance, for normal piers, piling might be analyzed for dead and live loads only if lateral loads appear to have been reasonably applied in the original computations or the "AISC Beam Diagram and Formula Tables" may be used to approximate pier cap moment and shear.

Whether the check is a completely independent analysis or a minimal analysis combined with a computations check, some details, such as the reinforcing details in a wall corner, also require review by the checker. Often referencing old bridge plans with similar details allows the checker to compare the current design to details that have performed well in the past.

1.3.2 Checking of Consultant Prepared Bridge Plans

Consultant prepared bridge plans are created by private engineering firms through contracts with the Department. The finished plans are complete to the extent that they can be used for construction.

Since these plans receive final approval of the State Bridge Engineer, there must be assurance that the plans are geometrically accurate and buildable; structural design is adequate and design codes have been correctly applied; proper direction is given to the construction contractor; and all construction costs are accounted for. Plan errors may cause costly construction delays or safety may be compromised by an inadequate design.

To keep consultant plan reviews consistent and timely, a procedure was developed as a guide that assigns priority to specific items in the plans. The overall review includes "a Thorough Check" and "Cursory Review" of various items. The distinction between "Thorough Check" and "Cursory Review" is as follows:

Thorough Check refers to performing complete mathematical computations in order to identify discrepancies in the plans, or conducting careful comparisons of known data and standards of the Project with values given in the plan.

Cursory Review refers to a comparative analysis for agreement with standard practice and consistency with similar structures, all with application of engineering judgment. Mathematical analysis is not required, but may be deemed necessary to identify the extent of a discrepancy.

The review procedure is listed on the CONSULTANT BRIDGE PLAN REVIEW form following this section. Headings on this list are defined as follows:

PARTIAL PLAN: In order to assure that the consultant is proceeding in the right direction, an early submittal of the plan is required. This submittal usually consists of the General Plan and Elevation sheet showing the overall geometry of the structure and the proposed beam type and spacing; the Bridge Layout Sheet; the Framing Plan sheet; and the Bridge Survey sheets. Errors and inconsistencies found in this phase can be corrected before the entire plan is completed. For example, a framing plan, including the proposed beams, must be assured as workable on the partial plan before the consultant gets deep into the design of the remainder of the bridge.

FINAL PLAN: A final plan should be complete in all areas to the extent that it can be certified by the designer, although a certification signature is not required for this phase.

THOROUGH CHECK: Items indicated for checking on the consultant's partial plan must be correct. Given geometry must fit the roadway layout. Most of this information can be checked using data from the approved preliminary plan. Approval of the partial plan will indicate that Mn/DOT is satisfied with the geometry and proposed structure, and the consultant may proceed with further development of the plan. For the final plan, obvious drafting and numerical errors should be marked to point out the errors to the consultant, however, the reviewer should not provide corrections to errors in the consultant's numerical computations.

Checking on the final plan should be thorough to eliminate possible errors that may occur, such as the pay items in the Schedule of Quantities. Plan notes and pay items can be difficult for a consultant to anticipate because of frequent changes by Mn/DOT. Pay items must be correct because these are carried throughout the entire accounting system for the Project. Plan (P) quantities must also be correctly indicated.

CURSORY REVIEW: Normally, a cursory review would not require numerical calculations. This type of review can be conducted by reading and observing the contents of the plan in order to assure the completeness of the work. The reviewer should be observant to recognize what looks right and what doesn't look right. Obvious errors or inconsistencies on any parts of the plan should be marked for correction.

Although structural design is usually the major focus of any plan, most consultants are well versed in design procedures and should need only minimal assistance from our office. A comparison of the consultant's calculations with the plan details should be performed to assure that the plans reflect their design and that the applicable codes are followed. An independent design by our office is time consuming and is not recommended unless there is a reasonable doubt as to the adequacy of the consultant's design.

NO REVIEW: A thorough review of these items would be time-consuming and may not produce corrections that are vital to construction; therefore, it is recommended that little or no time be spent on the listed items. Numerous errors can occur in the Bills of Reinforcement and quantity values. However, checking this information is also time-consuming, hence the burden of providing correct data should be placed on the consultant.

CONSULTANT BRIDGE PLAN REVIEW

Br. No. ________ RTE ____ DATE: PARTIAL PLAN REC'D. _____ DATE FINAL PLAN REC'D. _______

DESIGN GROUP _______________________ CONSULTANT _______________________

No. OF SHEETS IN PLAN ______ DESCRIBE COMPLEXITY_______________________

EST. REVIEW TIME BY DESIGN GROUP ________(hrs.) ACTUAL REVIEW TIME __________(hrs)

PARTIAL PLAN

THOROUGH CHECK

	Horizontal and vertical clearances
	Stations and elevations on survey line
	Deck and seat elevations at working points
	Deck cross-section dimensions
	Working line location and data
	Coordinates at working points and key stations
	Substructure locations by station
	Framing Plan
	Conformance to preliminary plan
	Design loads

CURSORY REVIEW

	Proposed precast beams [per 5-393.509(2)]
	Precast conformance to industry standards
	Proposed steel beam sections

FINAL PLAN

THOROUGH CHECK

	Pay items and plan quantities
	Project numbers
	Design data block & Rating on GP&E sheet
	Job number
	Certification block
	Standard plan notes
	Concrete mix numbers
	Construction joint locations
	Prestressed beam design if inadequate design is suspected
	Bridge seat elevations at working points
	Utilities on bridge
	Existing major utilities near bridge

CURSORY REVIEW

	Steel beam splice locations and diaphragm spacing; flange plate thickness increments (enough to save 800+ # of steel)
	Abutment and Pier design to be checked against consultant's calculations
	Conformance to foundation recommendations.
	Pile loads and earth pressures. Check against consultant's calculations.
	Rebar series increments (min. 3")
	Interior beam seat elevations
	Bottom-of-footing elevations (for adequate cover)
	Railing lengths and metal post spacing (check for fit)
	Use of B-details and standard plan sheets
	Conformance to aesthetic requirements
	Notes – General, construction, reference, etc.
	Quantity items on tabulations
	Precast beam design (Check against consultant's calculations)

NO CHECK OR REVIEW REQUIRED

	Diagonals on Layout sheet
	Figures in Bills of Reinforcement
	Bar shapes and dimensions
	Rebar placement dimensions
	Bar marks on details against listed bars
	Quantity values (including total of tabulations)

1.3.3 Schedule for Processing Construction Lettings

To meet the Department's schedule requirements for construction lettings, the following schedule for processing bridge plans, special provisions and estimates must be followed. This schedule applies to all projects: Federal Aid, State Funds and Maintenance. In general, processing of bridge plans, special provisions and estimates for lettings shall be given priority over all other work, and every effort must be made to complete the processing in advance of the times shown, which are deadlines.

Schedule and Remarks	Deadline Time Before Letting Date	
	Federal Project	State Project
Bridge plans complete to the extent that processing can be completed on schedule.	14 Weeks (Friday)	12 Weeks (Friday)
Preliminary bridge pay items and quantities for estimate (to Estimating Unit – Design Services)	13 Weeks (Friday)	11 Weeks (Friday)
Bridge plan and special provisions review complete (by Bridge Construction Unit)	13 Weeks (Friday)	11 Weeks (Friday)
Bridge special provisions complete, other information or material for inclusion in Roadway Special Provisions complete (to Special Provisions & Final Processing Unit – Design Services)	12 Weeks (Friday)	10 Weeks (Friday)
Bridge plans complete, approved and dated (to Office Management Unit)	12 Weeks (Friday)	10 Weeks (Friday)
Final bridge pay items and quantities for estimate (to estimating Unit – Design Services)	12 Weeks (Friday)	10 Weeks (Friday)
Final computer runs for bridge estimate	during 9th week	during 8th week
Office copy and final bridge plans (Bridge plans to Special & Final Processing Unit – Design Services for submittal to FHWA)	$8^1/_2$ weeks (Tuesday)	7 weeks (Friday)
Federal Project to FHWA	$7^1/_2$ weeks (Tuesday)	7 weeks (Friday)
Preliminary advertisement	$6^1/_2$ weeks (Tuesday)	6 weeks (Friday)
Final advertisement	$5^1/_2$ weeks (Tuesday)	5 weeks (Friday)
Sale of plans and proposals	5 weeks (Friday)	5 weeks (Friday)
Last date for mailing letter addendums by Special Provisions & Final Processing Unit – Design Services	10 days (Wednesday)	10 days (Wednesday)

Attachment 5-A

MINNESOTA DEPARTMENT OF TRANSPORTATION
HIGH TRUSS AND DECK TRUSS BRIDGES
HIGHWAY ON BRIDGE

Date: 12-21-2007

TH BRIDGES

BR NO	OWNER	FACILITY CARRIED / FEATURE CROSSED	MAIN SPAN LENGTH	BRIDGE LENGTH	YEAR BUILT	MAIN SPAN TYPE
79000	STATE	TH 60 OVER MISS R, RR, & STS	470	2,462	1987	STEEL HIGH TRUSS
9090	STATE	US 2 OVER RED RIVER & CITY ST	279	1,261	1963	STEEL HIGH TRUSS
9030	STATE	I 535 OVER ST LOUIS R; RR,STREET	600	7,980	1961	CSTL HIGH TRUSS
09001	STATE	TH 210 OVER ST LOUIS RIVER	214	223	1961	STEEL HIGH TRUSS
9100	STATE	TH 1 OVER RED RIVER OF THE NORTH	220	792	1959	STEEL HIGH TRUSS
9412	STATE	TH 72 OVER RAINY RIVER	193	1,285	1959	STEEL HIGH TRUSS
9040	STATE	US 63 OVER MISS RIVER & CP RAIL	432	1,631	1958	CSTL HIGH TRUSS
6748	STATE	TH 23 OVER MISS R & RIVERSIDE DR	291	890	1957	CSTL DECK TRUSS
6690	STATE	TH 11 OVER RED RIVER OF THE NORTH	249	1,058	1954	CSTL HIGH TRUSS
6347	STATE	TH 243 (OSCEOLA) OVER ST CROIX RIVER	162	674	1953	STEEL DECK TRUSS
5895	STATE	US 61 OVER MISS RIVER, RR, STREET	514	1,857	1950	CSTL HIGH TRUSS
6535	STATE	TH 258 OVER COTTONWOOD RIVER	157	163	1949	STEEL HIGH TRUSS
5718	STATE	TH 123 OVER KETTLE RIVER & ST	200	403	1948	CSTL DECK TRUSS
5900	STATE	TH 43 OVER MISS RVR, RR, STREETS	450	2,289	1941	CSTL HIGH TRUSS
5872	STATE	TH 317 OVER RED RIVER OF THE NORTH	200	412	1939	STEEL HIGH TRUSS
5380	STATE	TH 40 OVER LAC QUI PARLE L	163	221	1938	STEEL HIGH TRUSS
9114	STATE	TH 7 OVER CHIPPEWA RIVER	150	182	1932	STEEL HIGH TRUSS
4930	STATE	TH 99 OVER MINNESOTA RIVER	196	402	1931	CSTL HIGH TRUSS
6975	STATE	TH 250 OVER S BR ROOT RIVER	100	104	1931	STEEL HIGH TRUSS
4700	STATE	US 2B (BUSINESS) OVER RED RIVER	279	603	1929	STEEL HIGH TRUSS
4667	STATE	TH 19 ACCESS RD OVER SULPHER L	117	122	1927	STEEL HIGH TRUSS
6977	STATE	TH 250 OVER N BR ROOT RIVER	140	144	1924	STEEL HIGH TRUSS
90249	OTHER	US 53 SB OVER RAINY RIVER	184	941	1912	STEEL HIGH TRUSS

23 TH BRIDGES